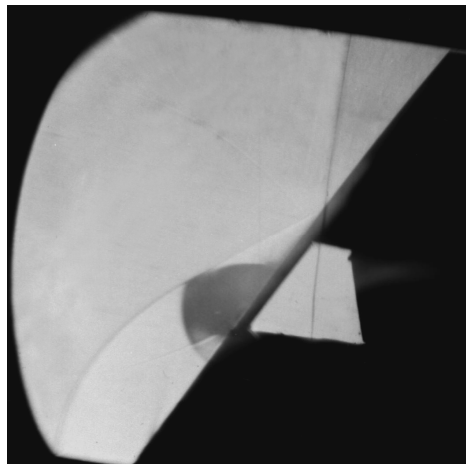
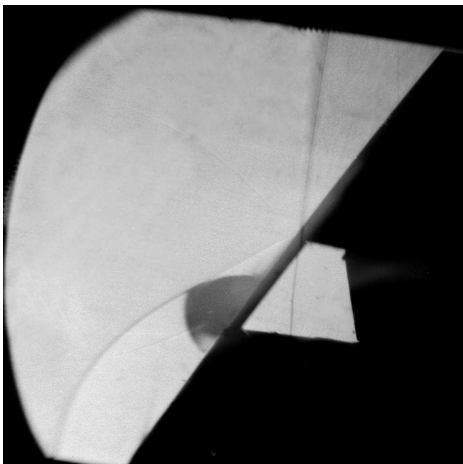
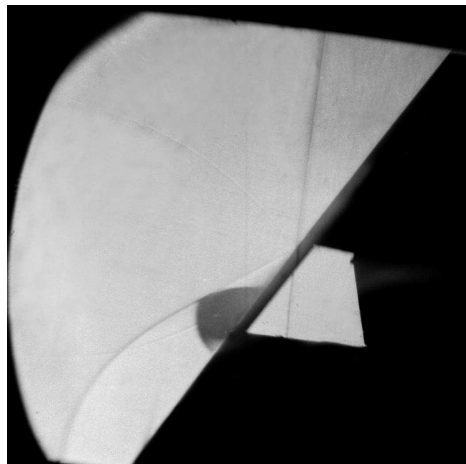
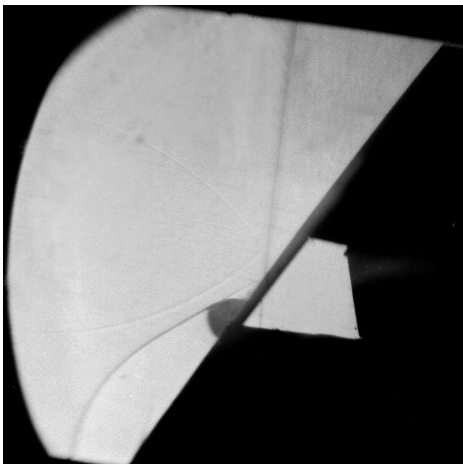
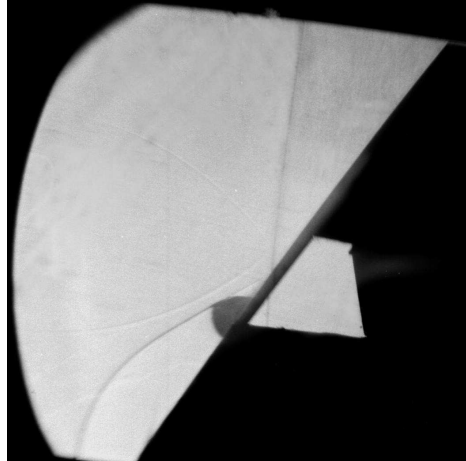
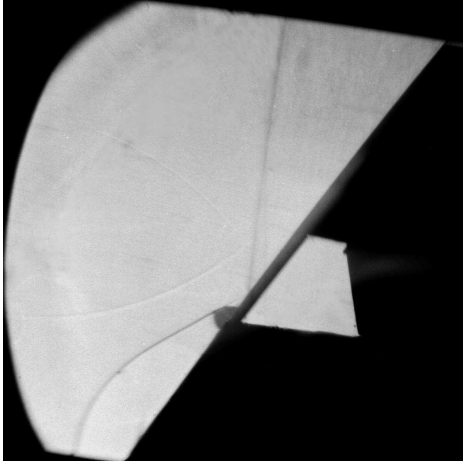


F.1 Rectangular valley results

F.1.1 Rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$



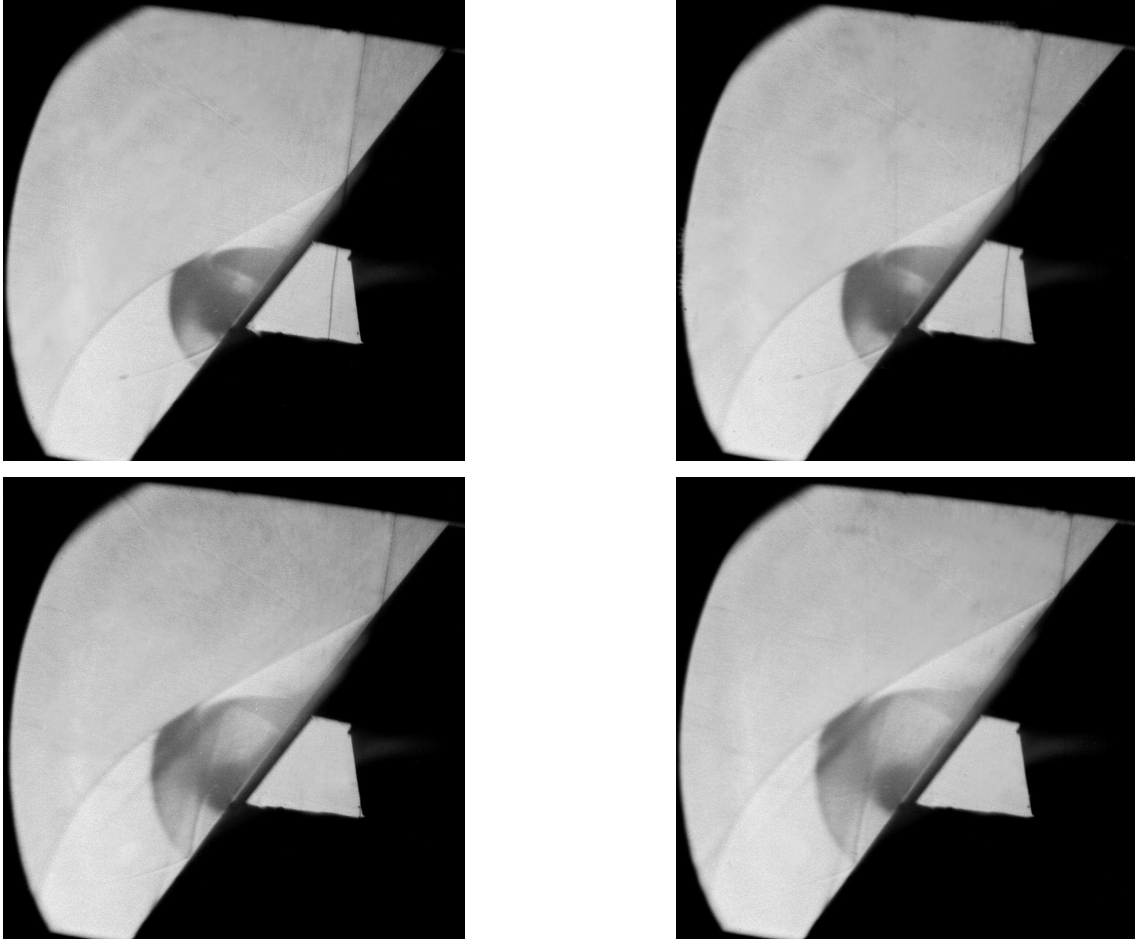


Figure 1: Schlieren images for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, at time delay 1645 μ s, 1655 μ s, 1665 μ s, 1675 μ s, 1685 μ s, 1695 μ s, 1705 μ s, 1715 μ s, 1725 μ s and 1735 μ s respectively.

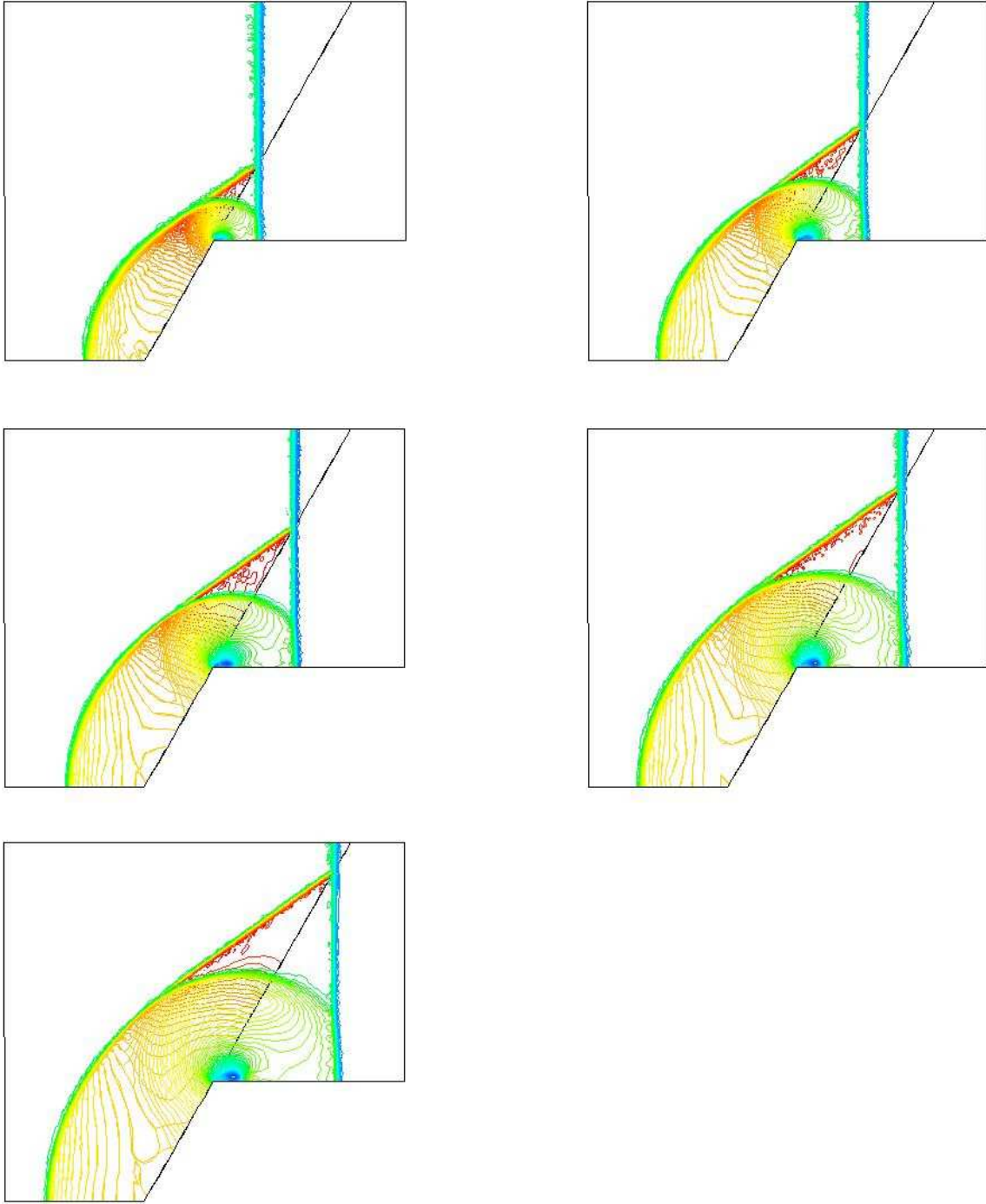


Figure 2: Time sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$.

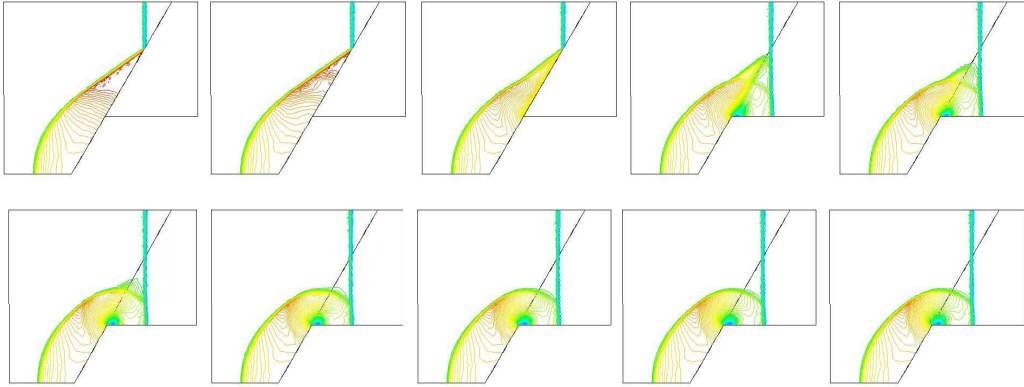


Figure 3: Density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 18.75mm , 37.5mm , 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm , 68.75mm , 75mm respectively.

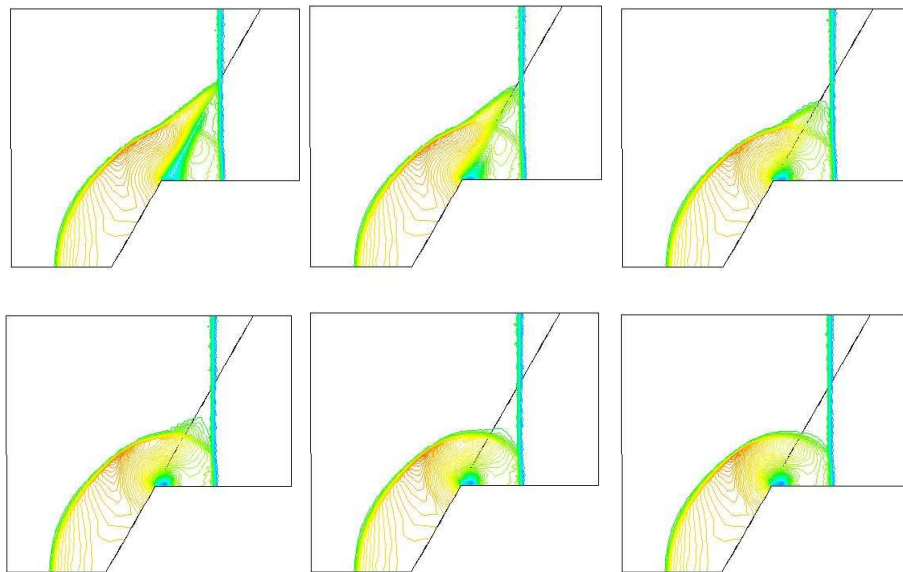


Figure 4: Enlarged density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the y-z plane at $x = 40\text{mm}$, 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm respectively.

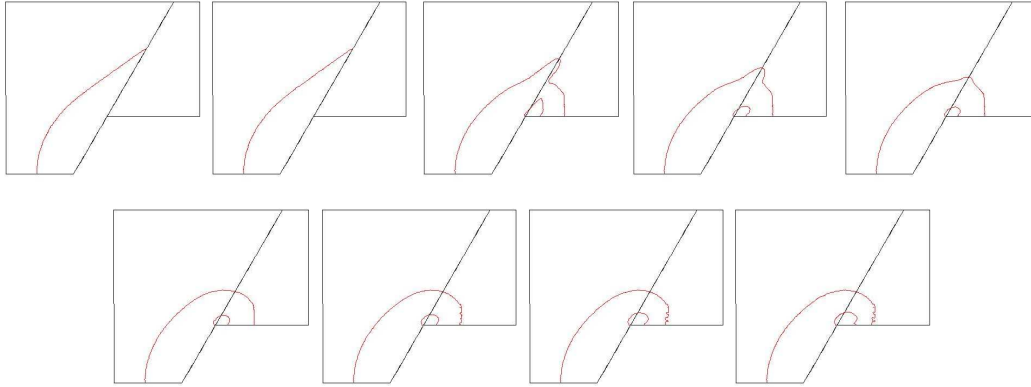


Figure 5: Pressure contour plots (single level) of secondary reflected wave for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 18.75mm , 37.5mm , 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm , 68.75mm , 75mm respectively.

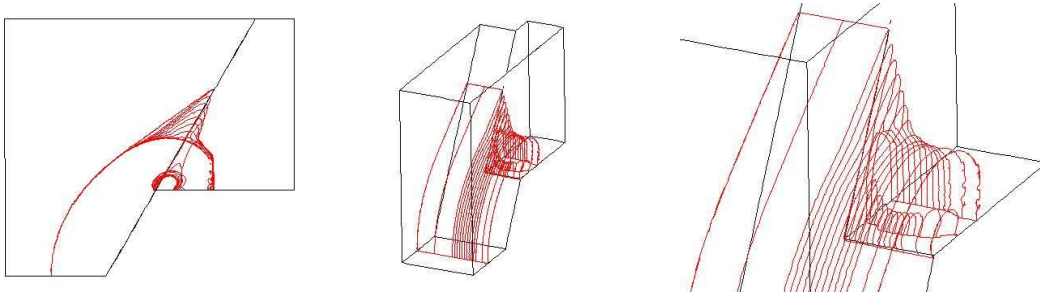


Figure 6: Overlaid pressure contour plots (single level) of secondary reflected wave for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$.

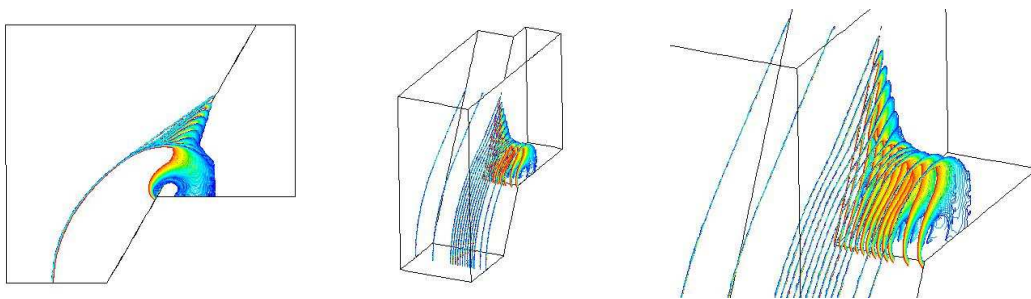


Figure 7: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$.

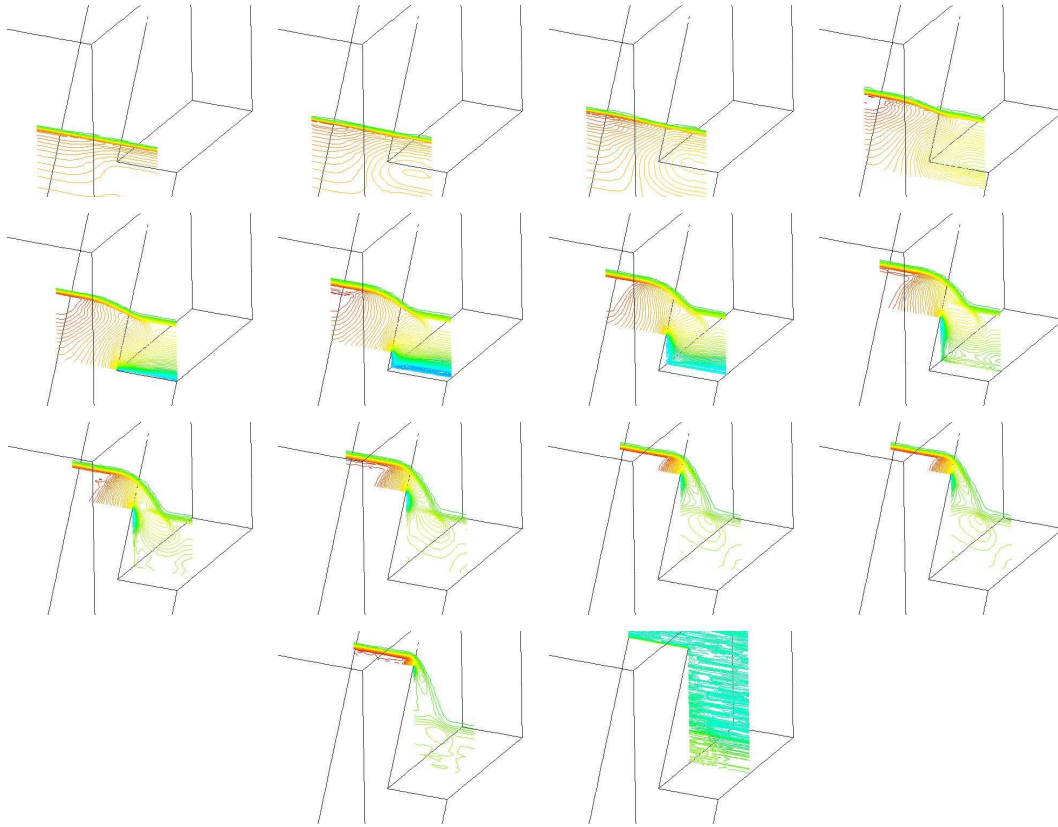


Figure 8: Isometric views of sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 5mm along the z axis.

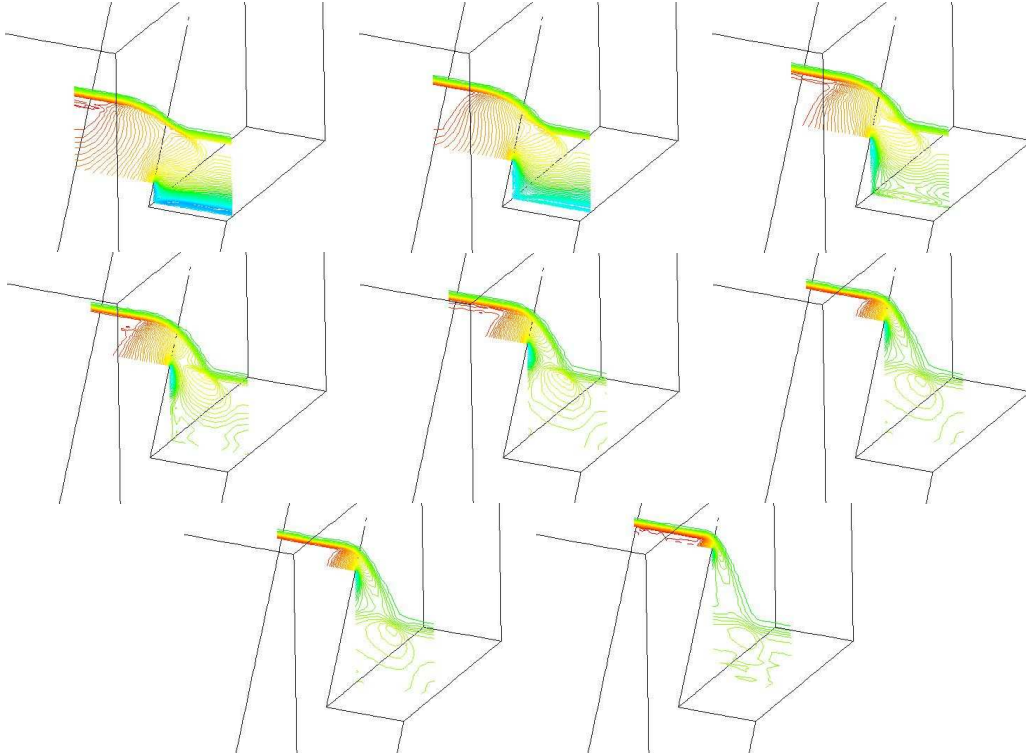


Figure 9: Enlarged isometric views of sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 5mm along the z axis.

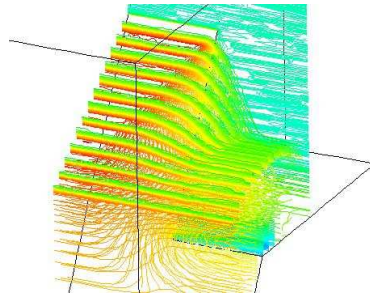


Figure 10: Isometric view of overlaid density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane.

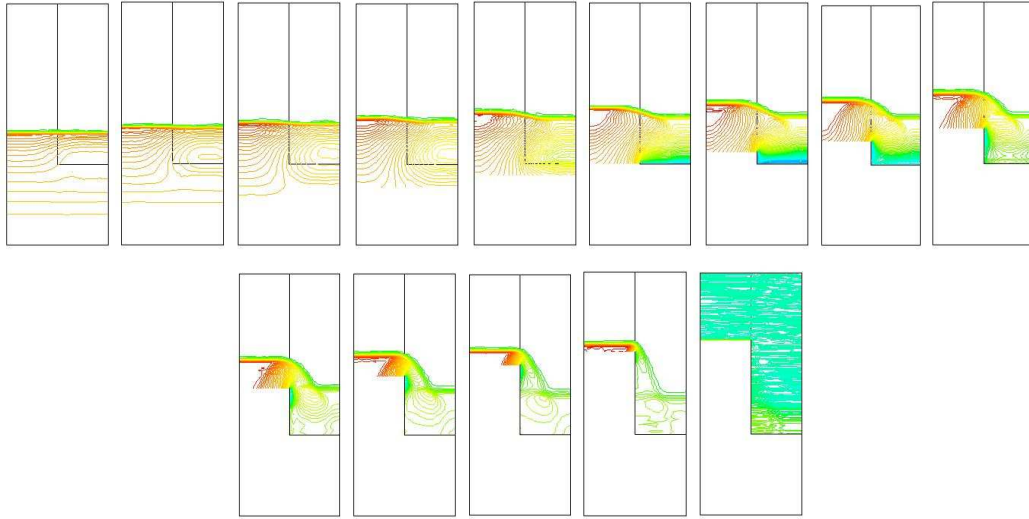


Figure 11: Sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

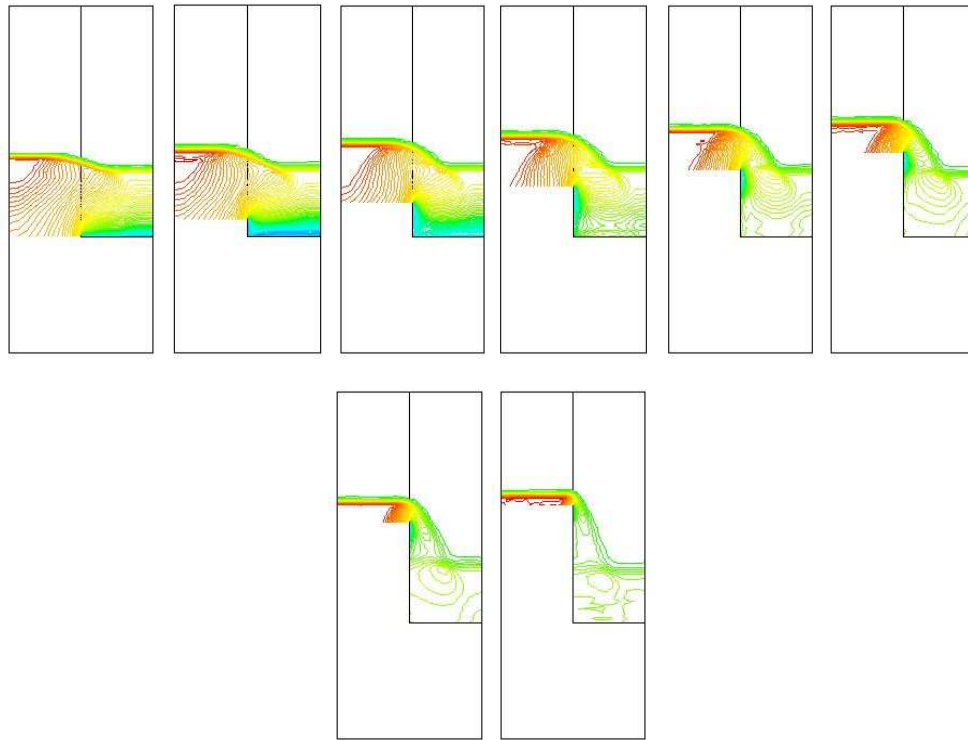


Figure 12: Enlarged sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 5mm along the z axis.

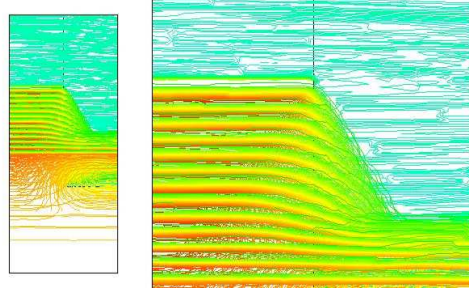


Figure 13: Overlaid density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane.

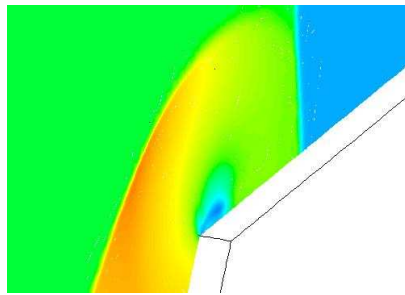


Figure 14: Filled density contour plot of plane in y-z plane for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, illustrating shear layer.

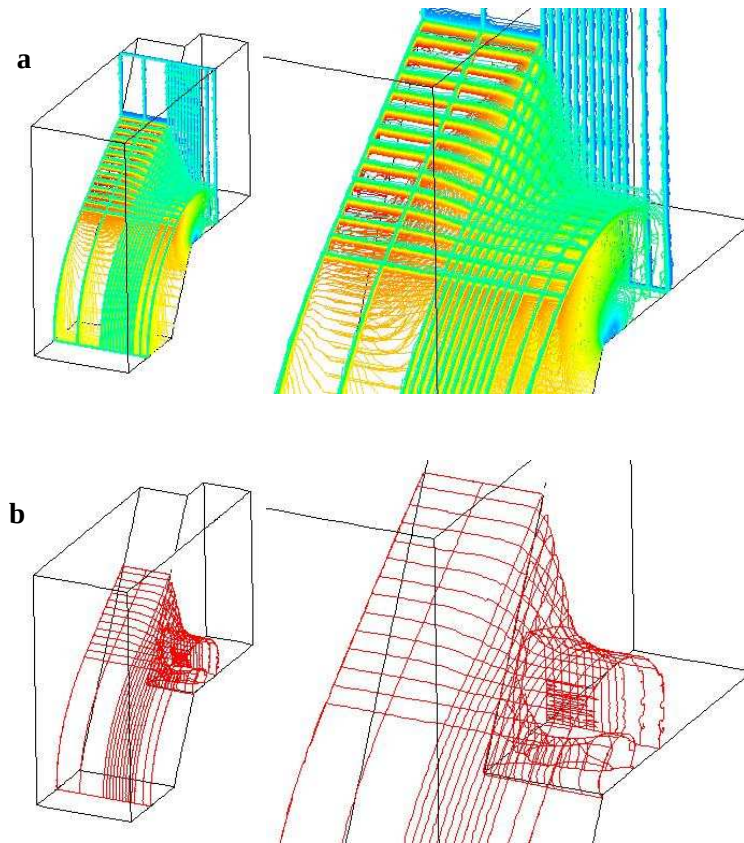


Figure 15: Isometric view of overlaid planes for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$.

a) Entire flow field b) Secondary reflected wave

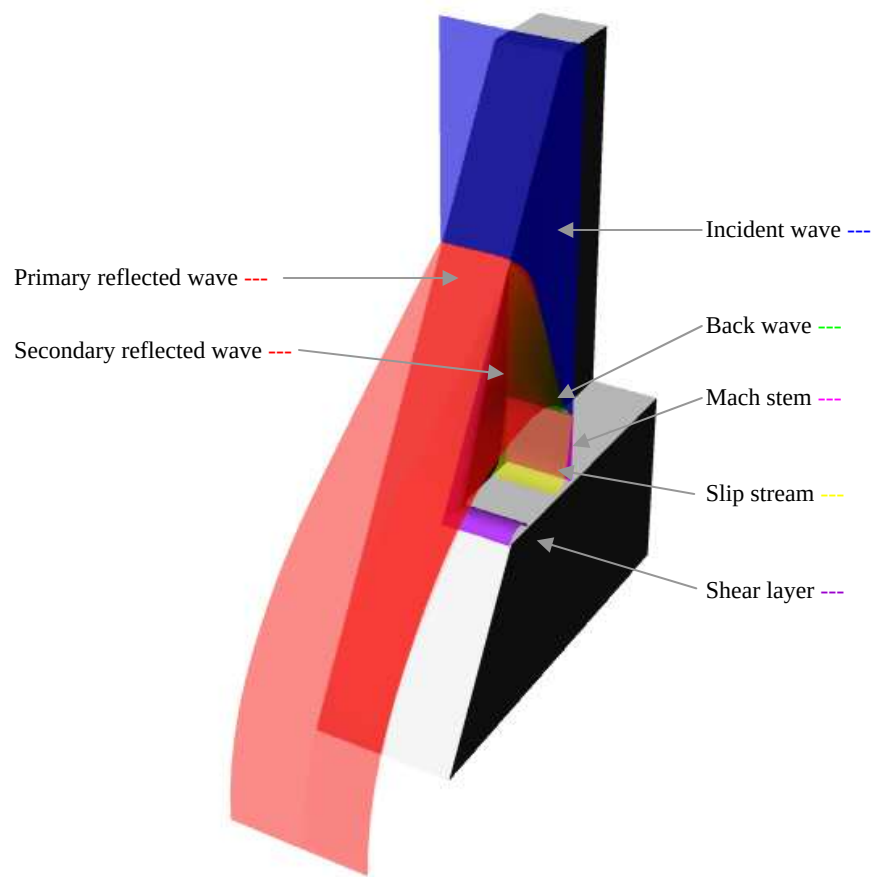
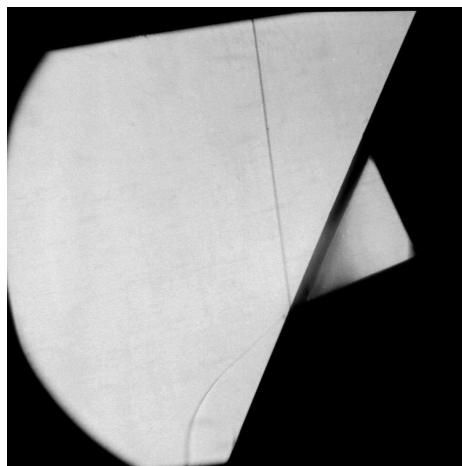
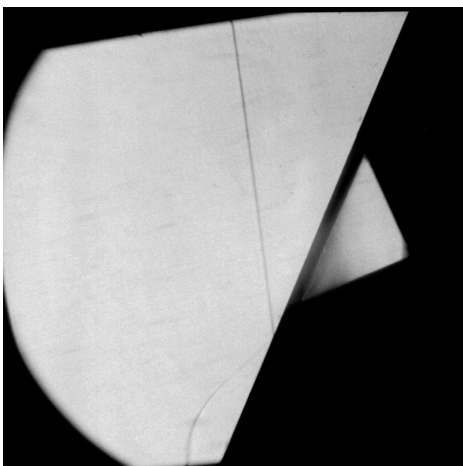
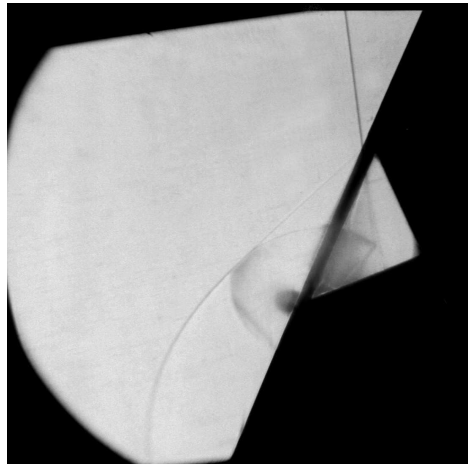
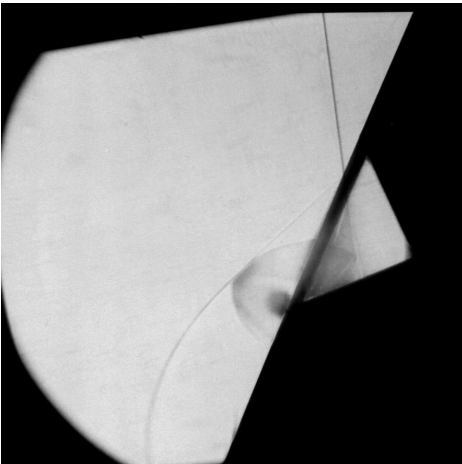
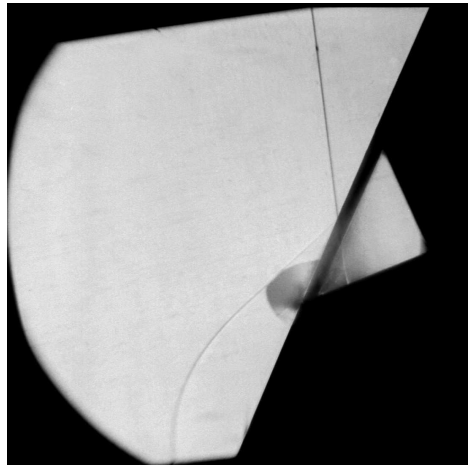
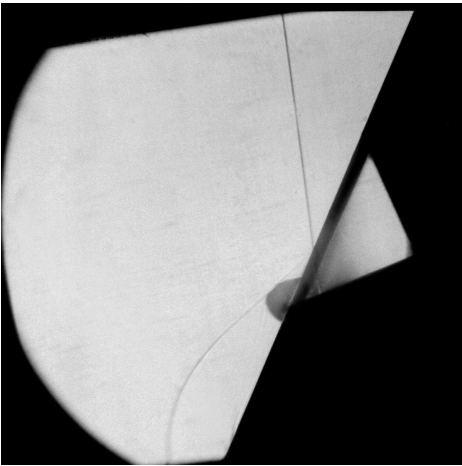
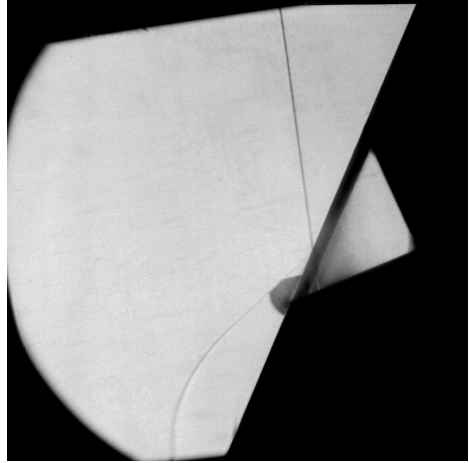
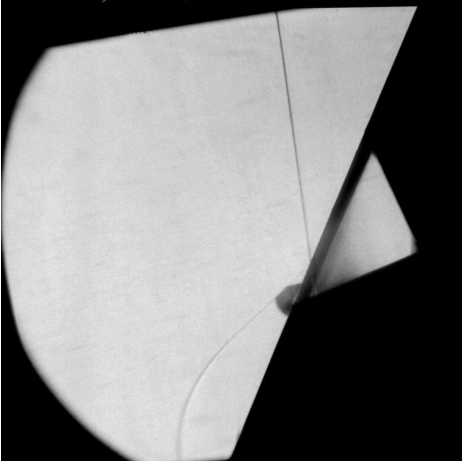


Figure 16: Three-dimensional NURBS model of rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$.

F.1.2 Rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$





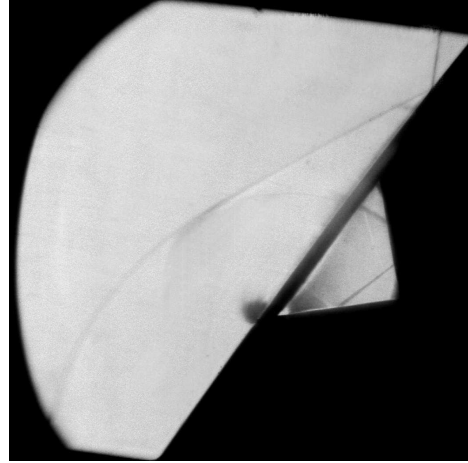
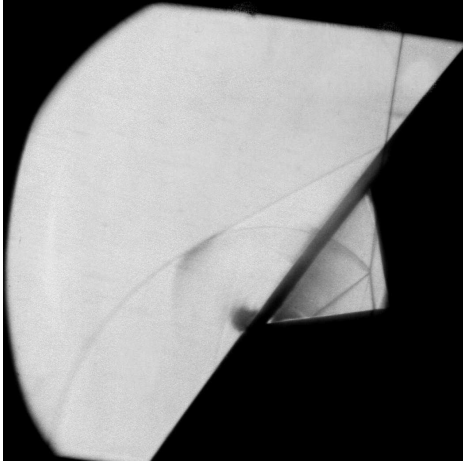
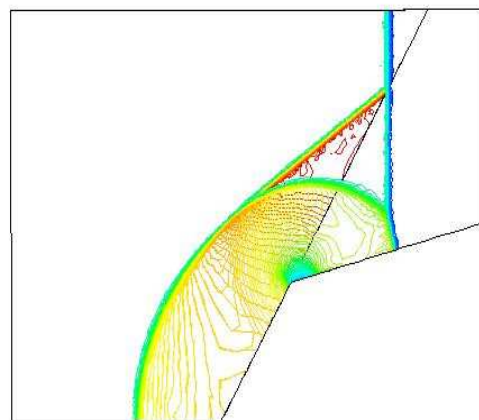
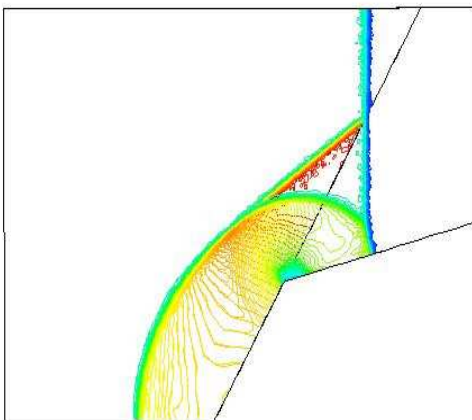
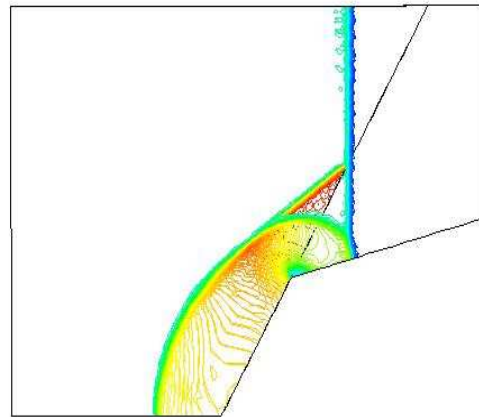
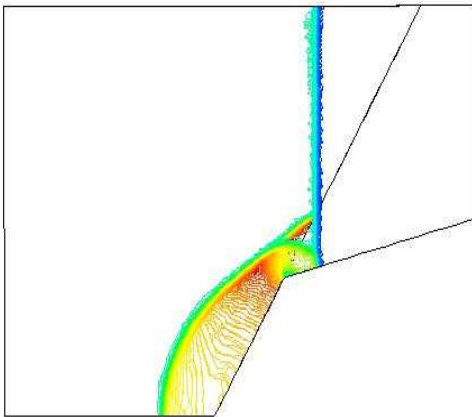


Figure 17: Schlieren images for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, at time delay 1645 μ s, 1655 μ s, 1665 μ s, 1675 μ s, 1685 μ s, 1695 μ s, 1705 μ s, 1715 μ s, 1725 μ s and 1735 μ s respectively.



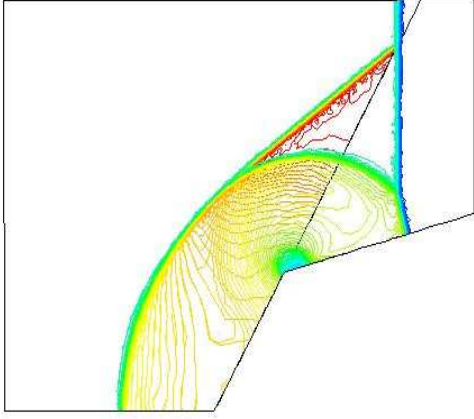


Figure 18: Sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$.

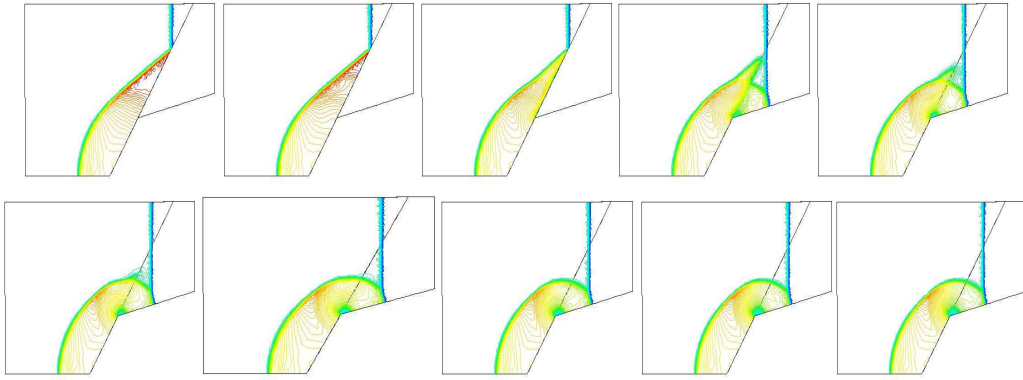


Figure 19: Density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 18.75mm , 37.5mm , 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm , 68.75mm , 75mm respectively.

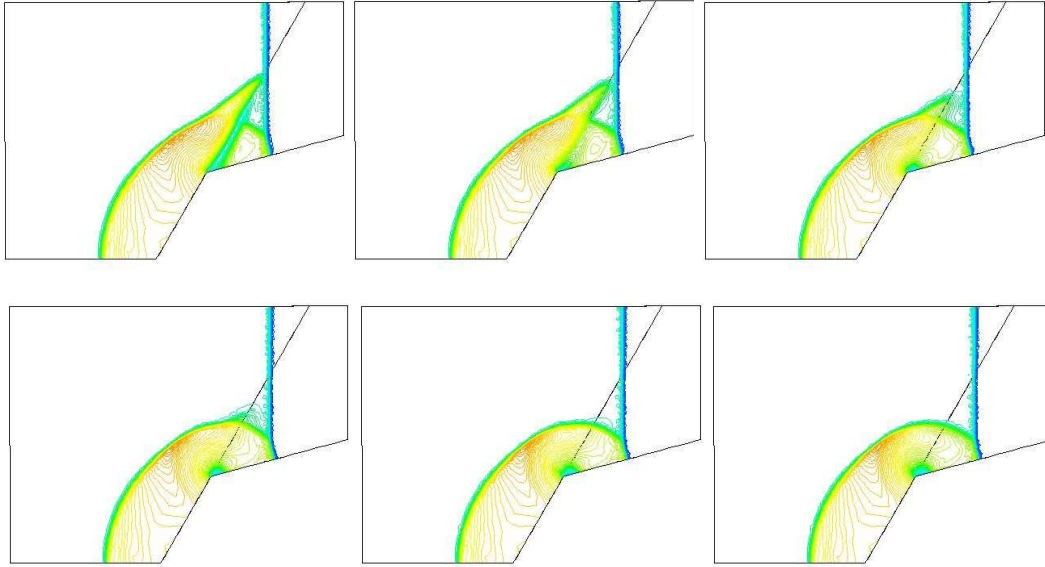


Figure 20: Enlarged density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the y-z plane at $x = 40\text{mm}$, 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm respectively.

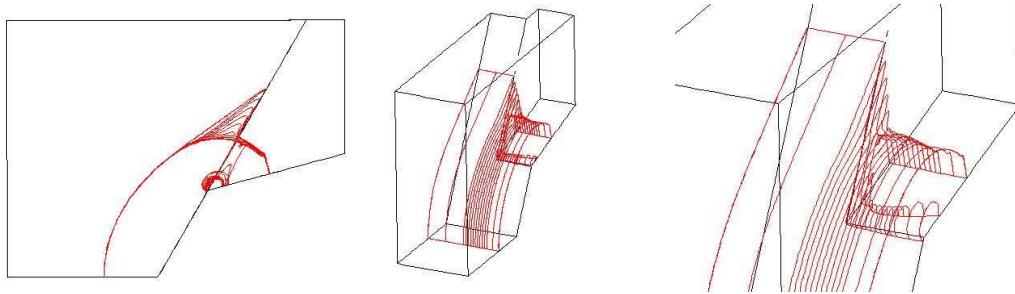


Figure 21: Overlaid pressure contour plots (single level) of secondary reflected wave for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$.

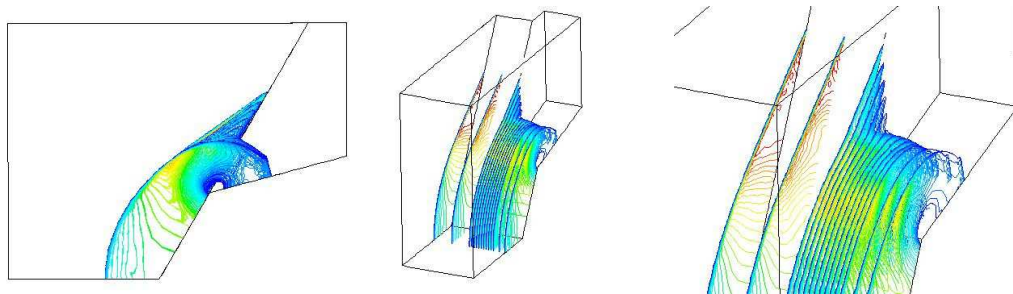


Figure 22: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$.

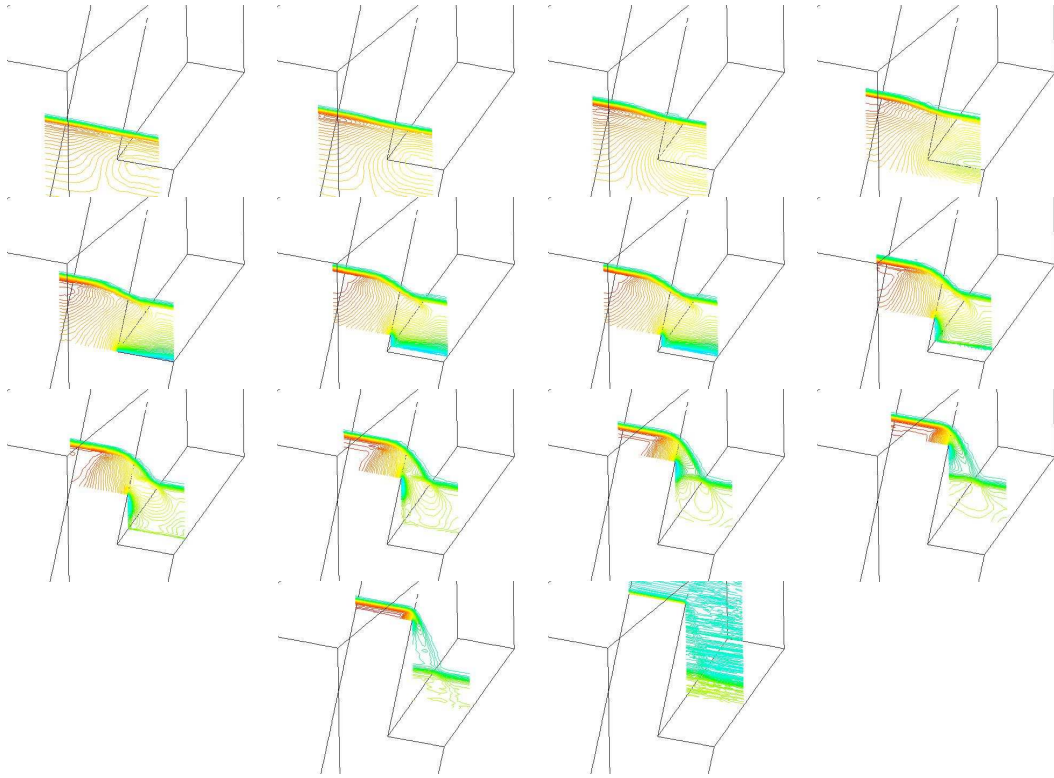


Figure 23: Isometric views of sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 5mm along the z axis.

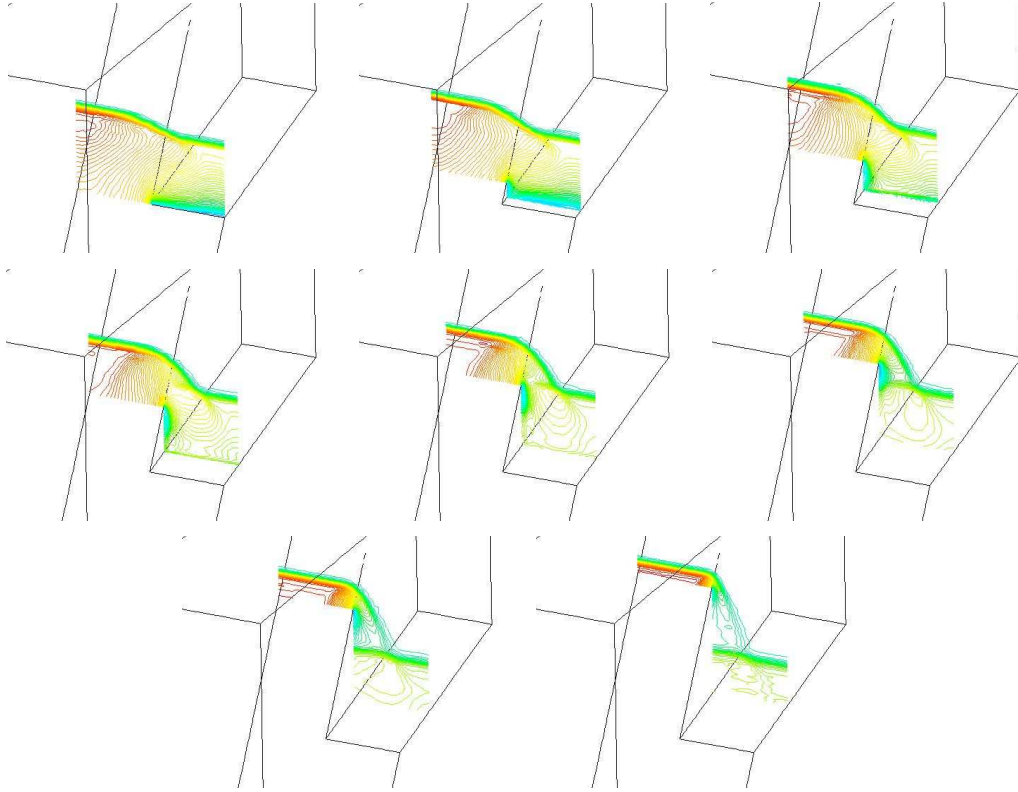


Figure 24: Enlarged isometric views of sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 5mm along the z axis.

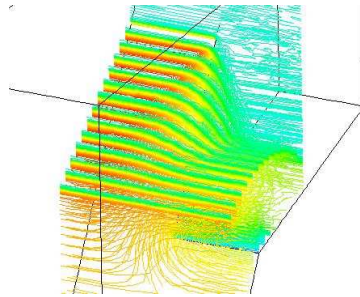


Figure 25: Isometric view of overlaid density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane.

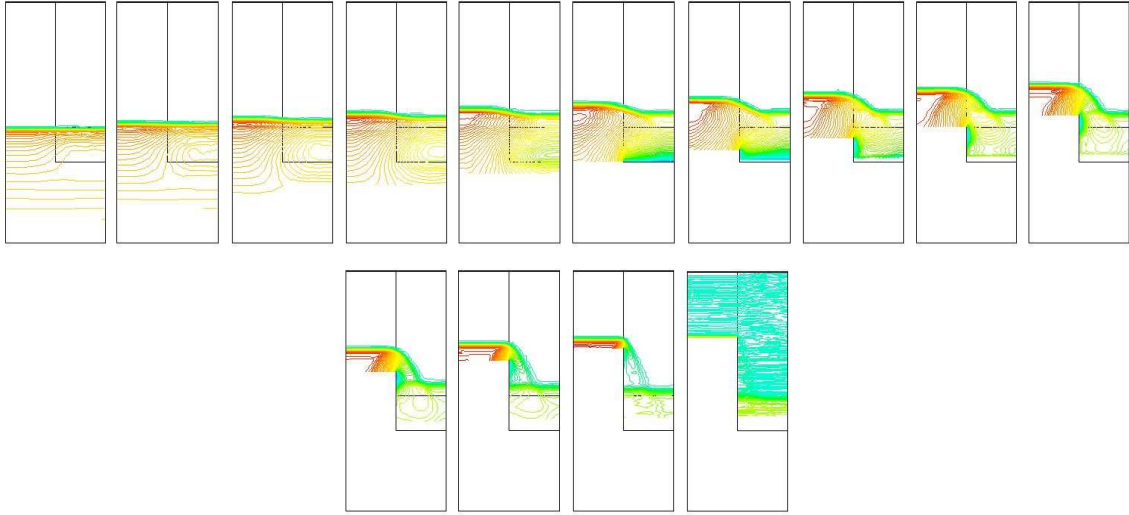


Figure 26: Sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

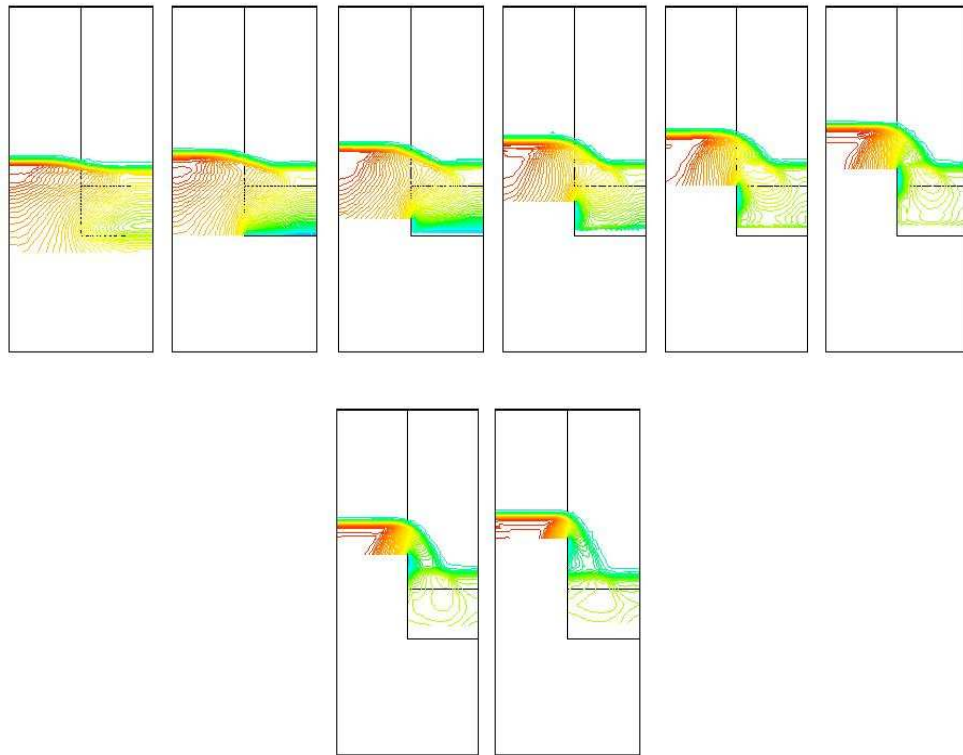


Figure 27: Enlarged sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 5mm along the z axis.

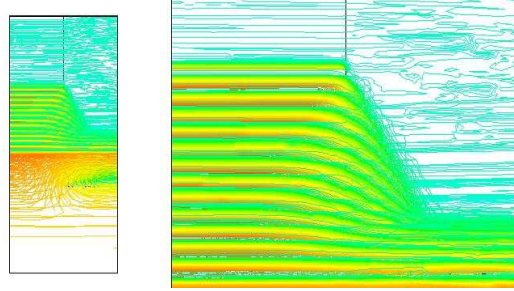


Figure 28: Overlaid density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane.

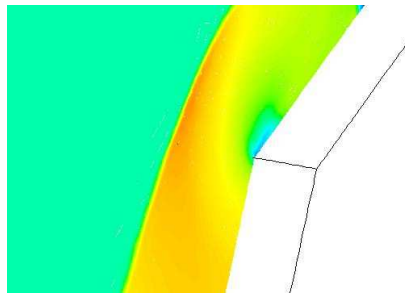


Figure 29: Filled density contour plot of plane in y-z plane for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, illustrating shear layer.

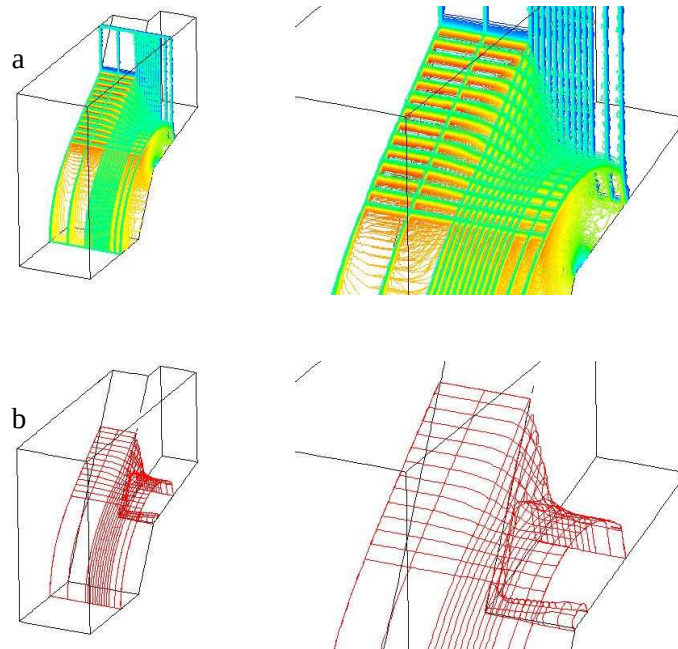
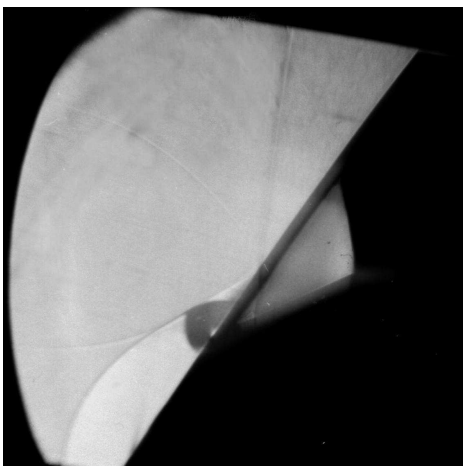
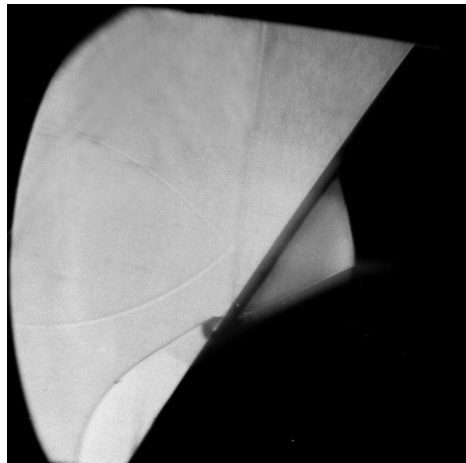
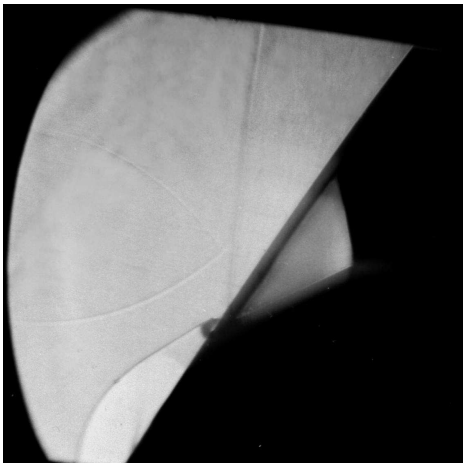
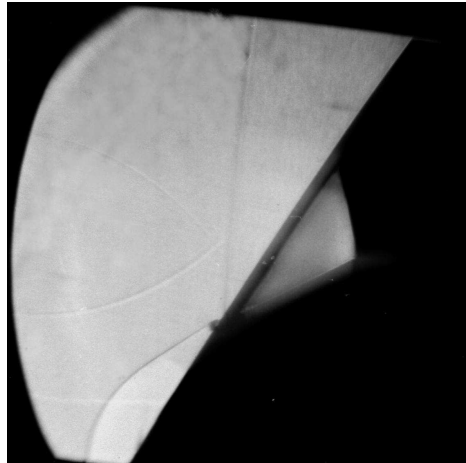
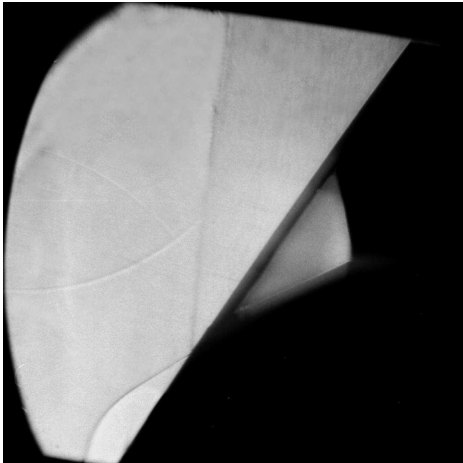


Figure 30: Isometric view of overlaid planes for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$.

a) Entire flow field b) Secondary reflected wave

F.1.3 Rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$



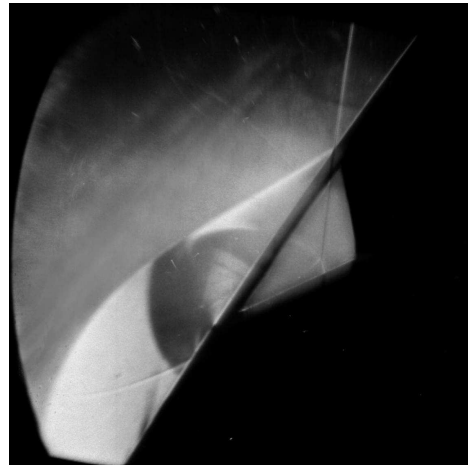
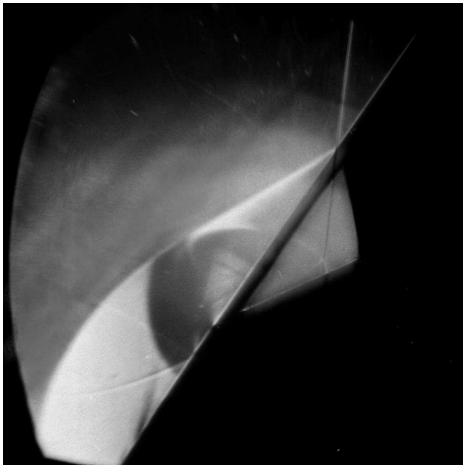
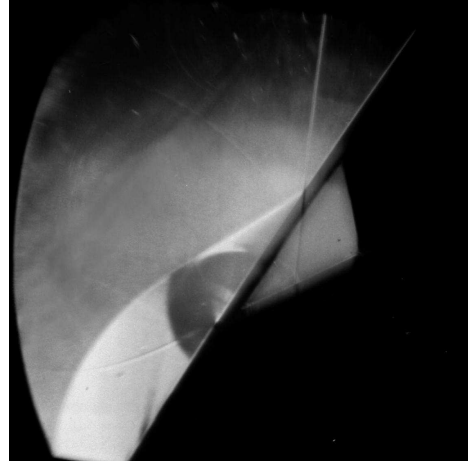
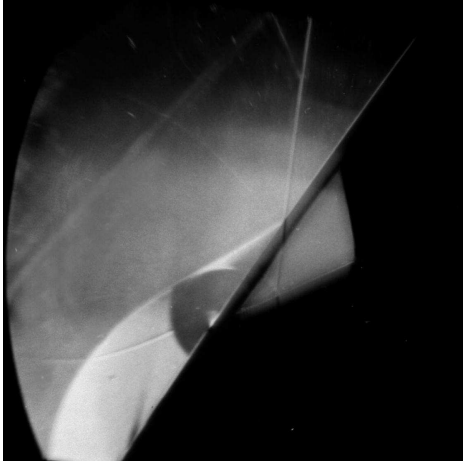
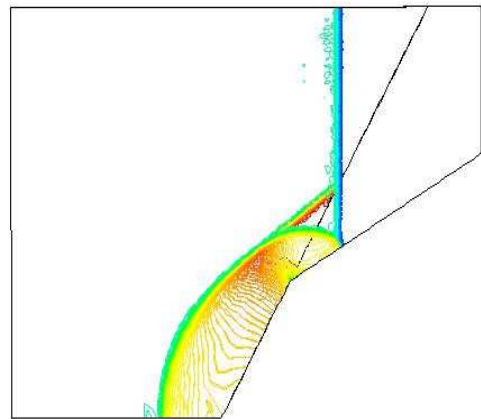
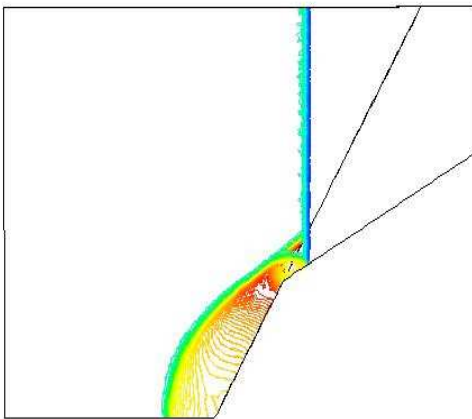


Figure 31: Schlieren images for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, at time delay $1635\mu\text{s}$, $1645\mu\text{s}$, $1655\mu\text{s}$, $1665\mu\text{s}$, $1675\mu\text{s}$, $1685\mu\text{s}$, $1695\mu\text{s}$, $1705\mu\text{s}$, $1715\mu\text{s}$, and $1725\mu\text{s}$ respectively.



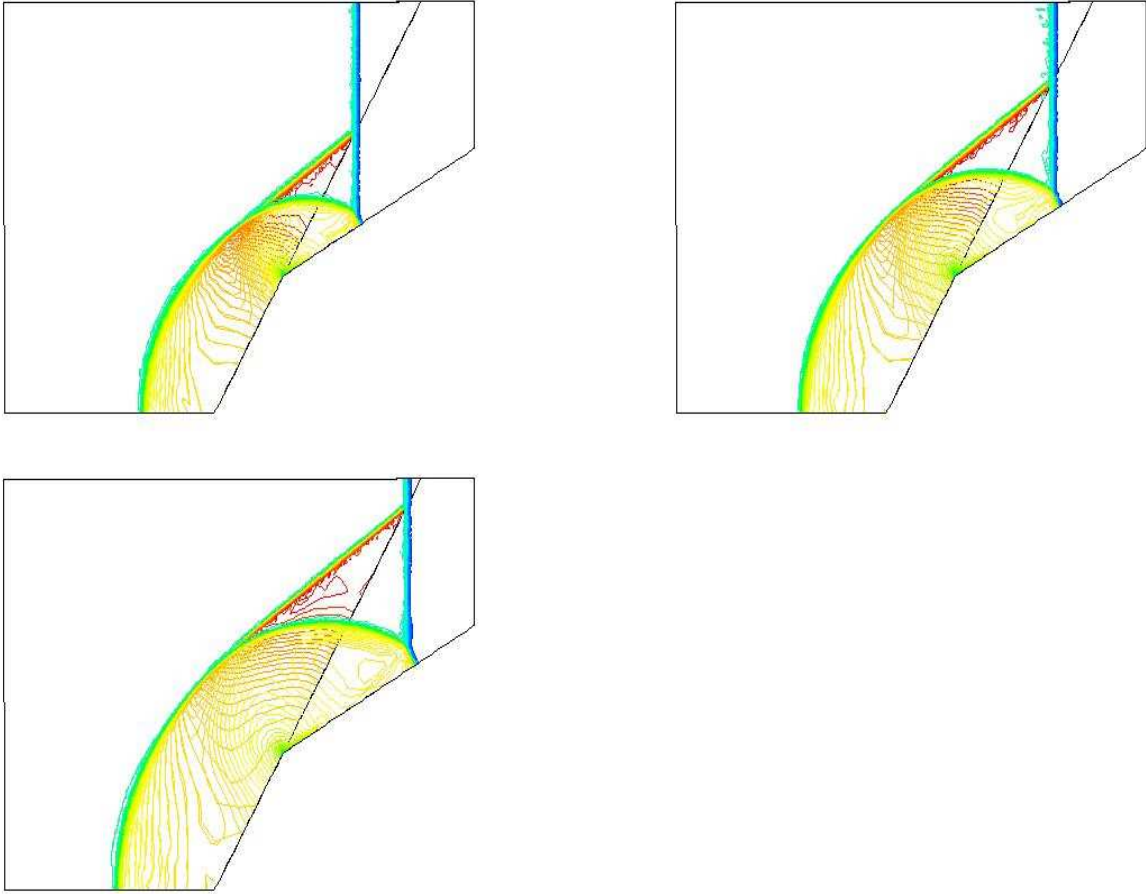


Figure 32: Sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$.

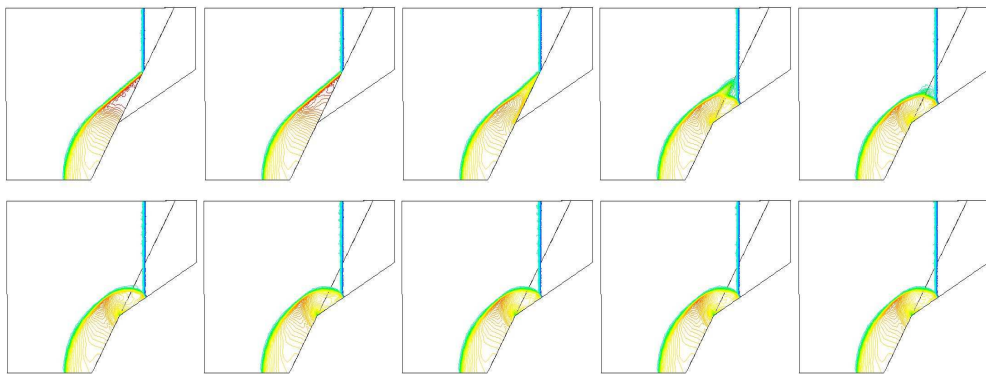


Figure 33: Density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 18.75mm , 37.5mm , 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm , 68.75mm , 75mm respectively.

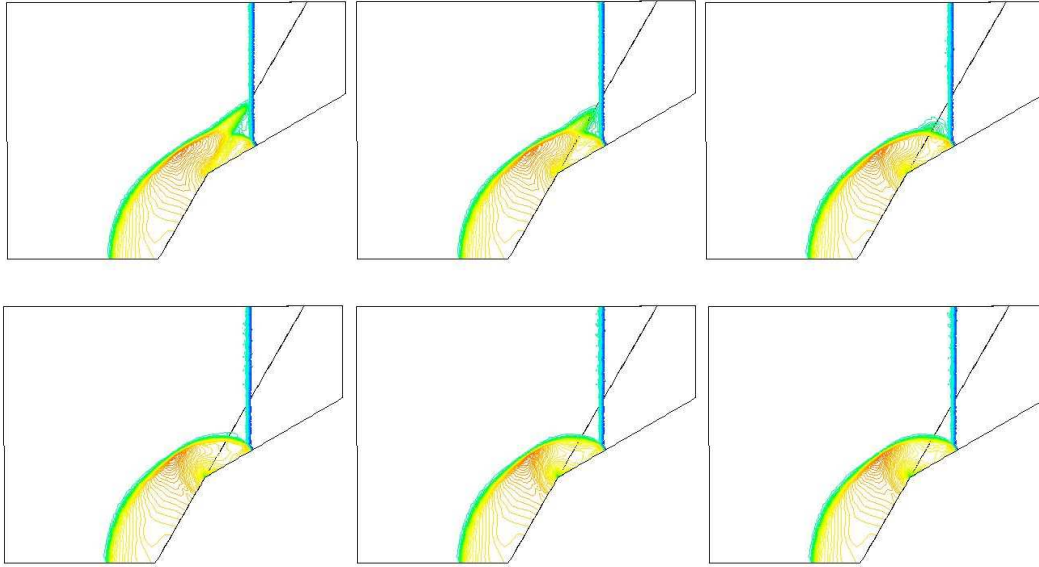


Figure 34: Enlarged density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the y-z plane at $x = 40\text{mm}$, 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm respectively.

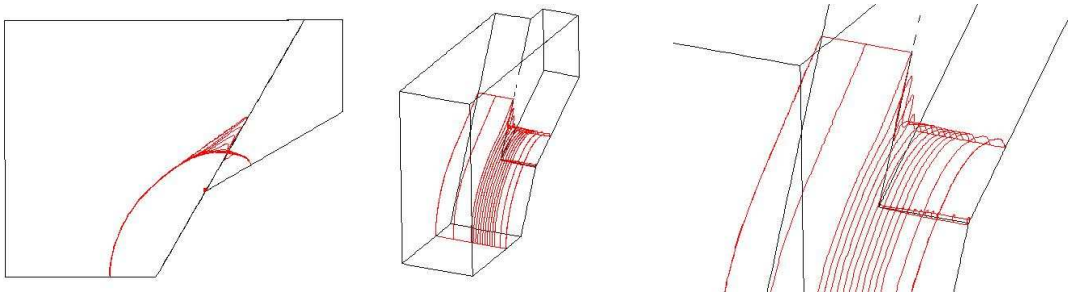


Figure 35: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$.

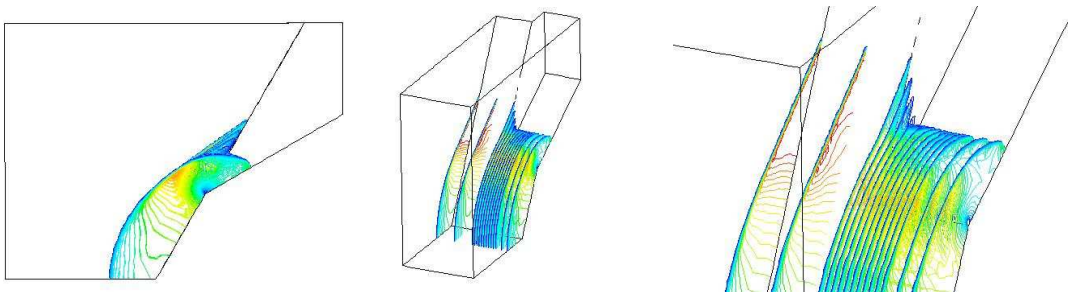


Figure 36: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$.

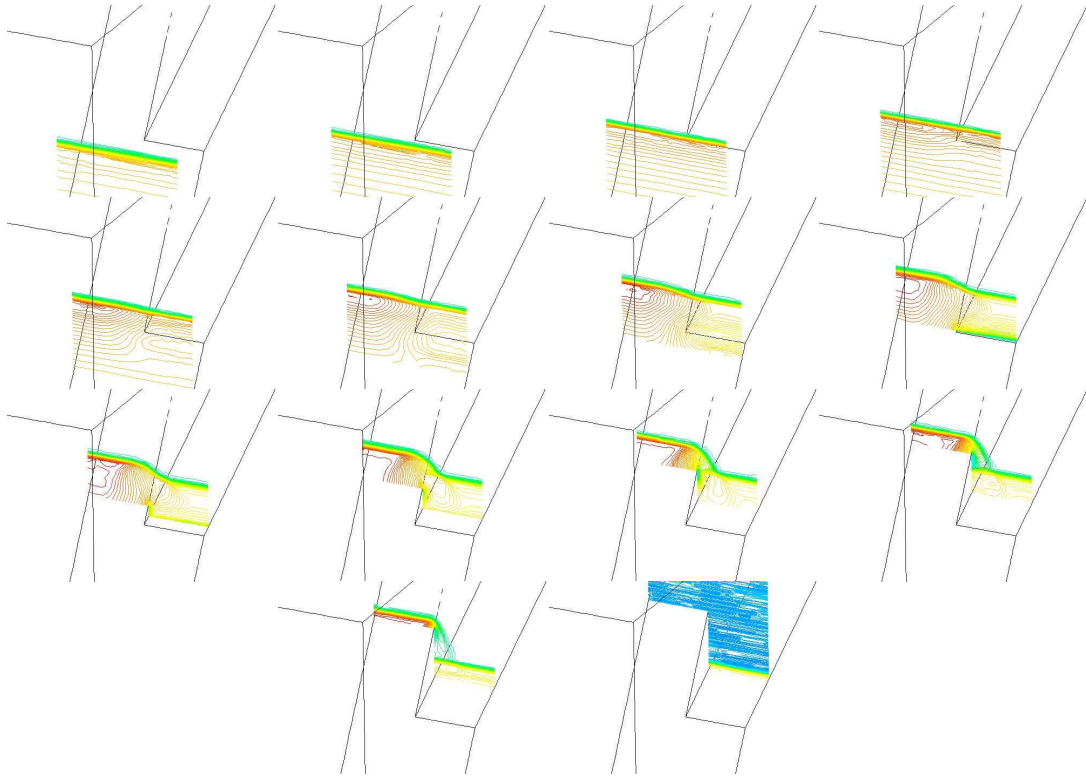


Figure 37: Isometric views of sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 5mm along the z axis.

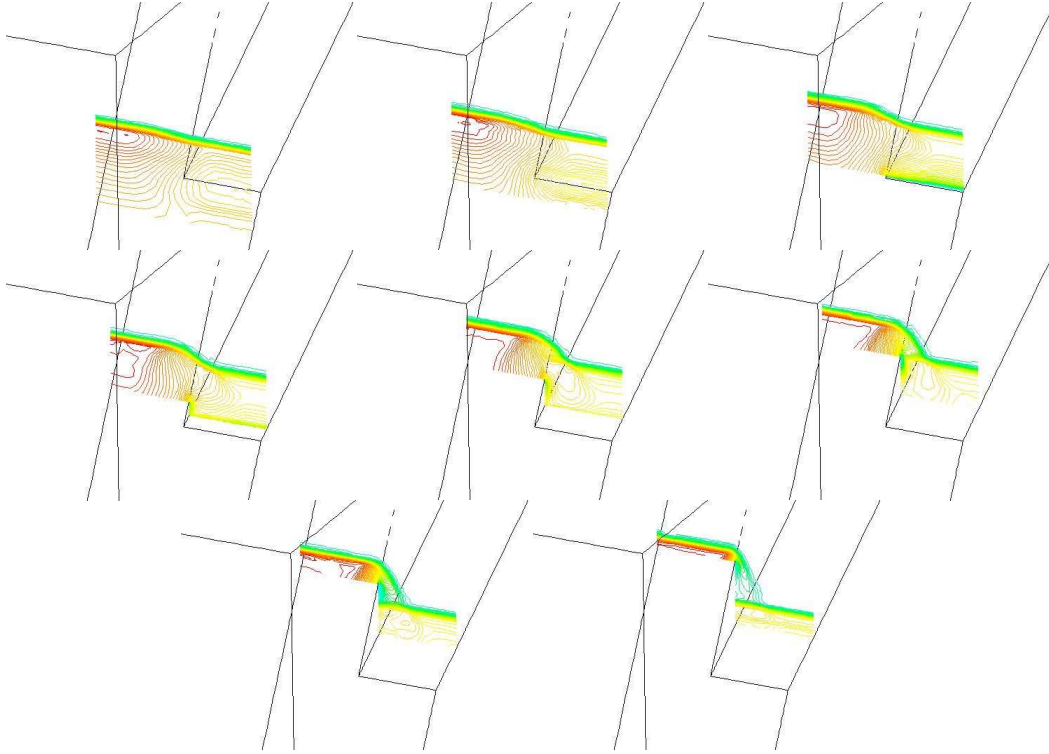


Figure 38: Enlarged isometric views of sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 5mm along the z axis.

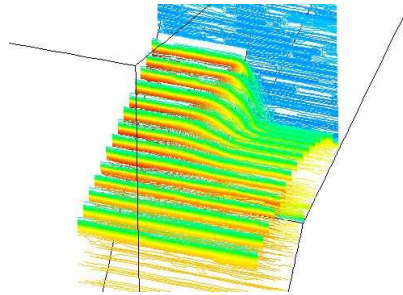


Figure 39: Isometric view of overlaid density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane.

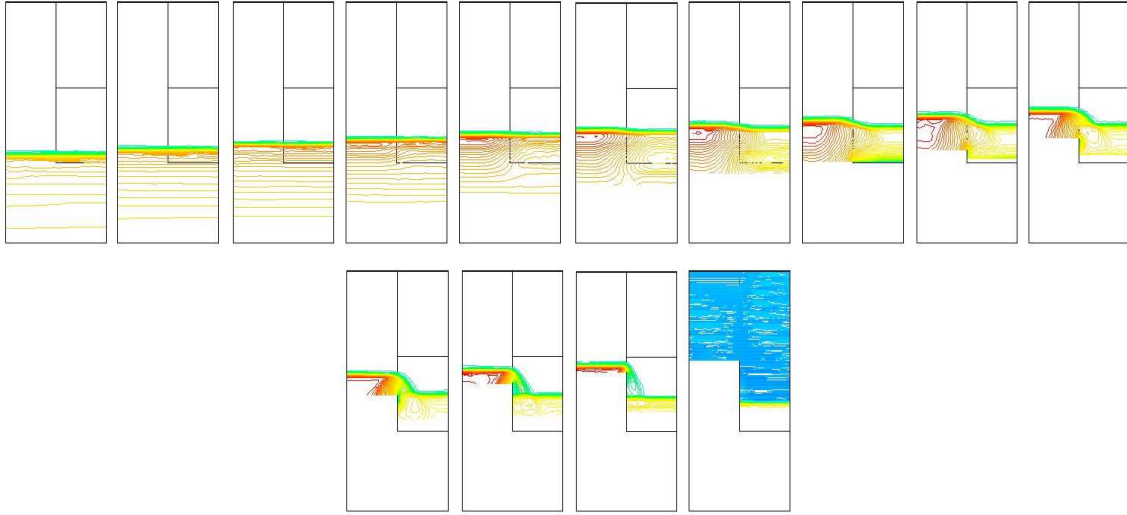


Figure 40: Sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

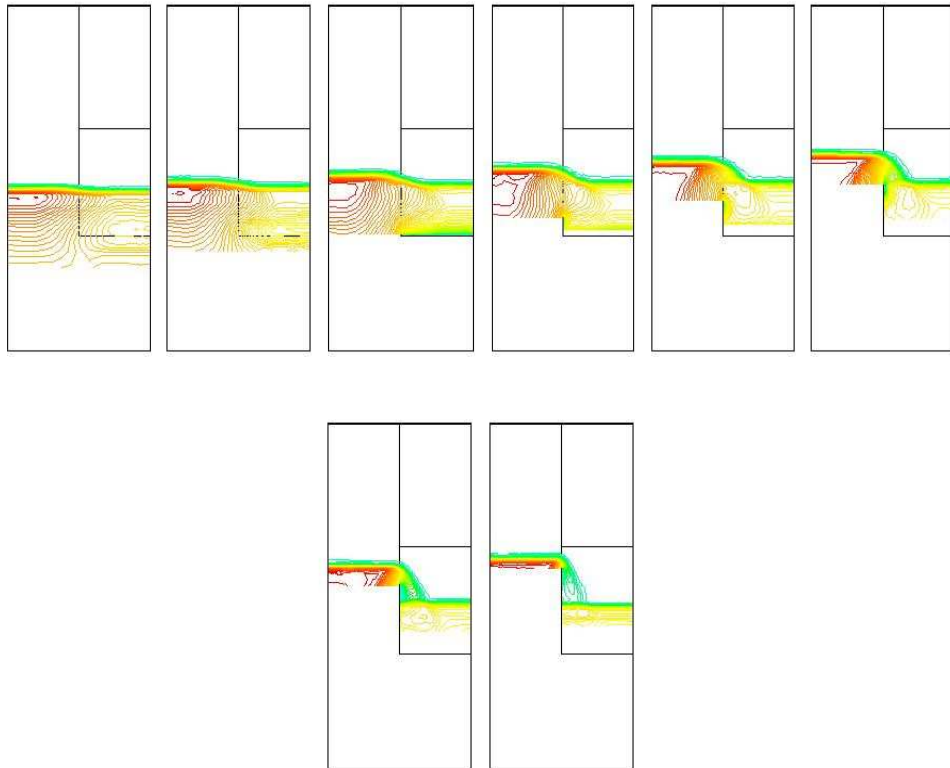


Figure 41: Enlarged sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 5mm along the z axis.

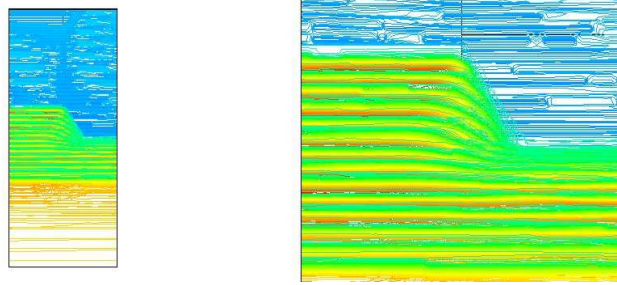


Figure 42: Overlaid density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane.

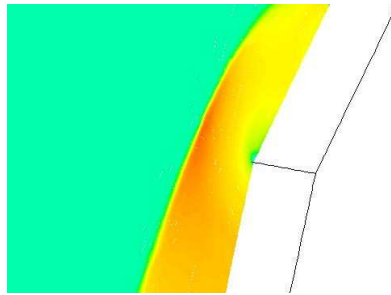


Figure 43: Filled density contour plot of plane in y-z plane for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, illustrating shear layer.

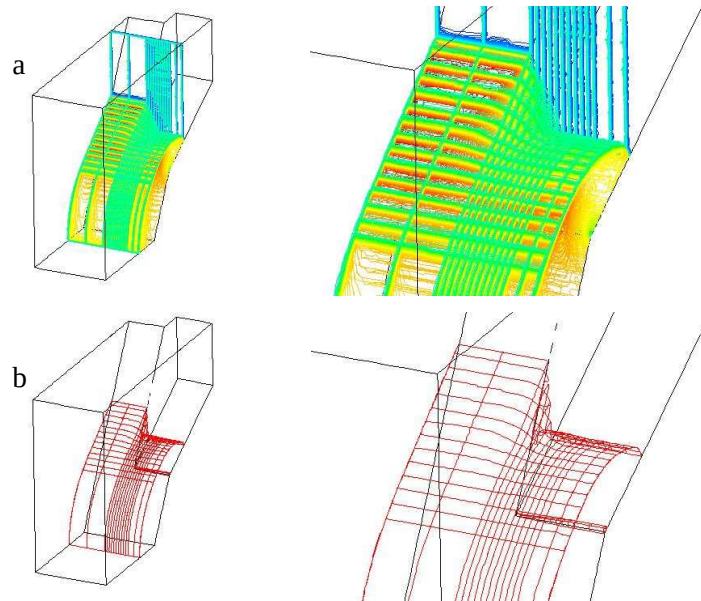
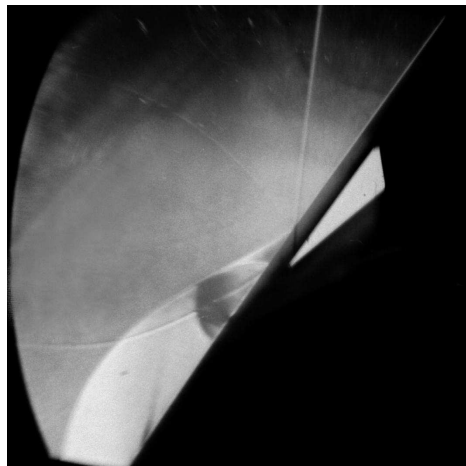
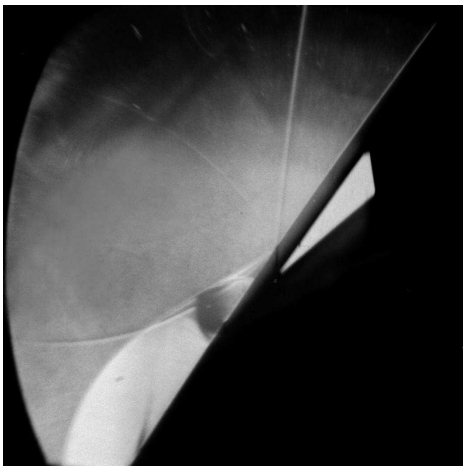
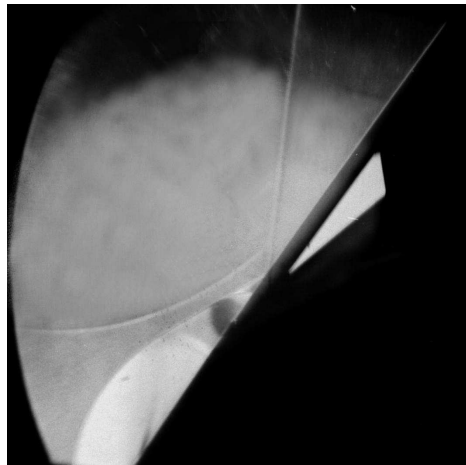
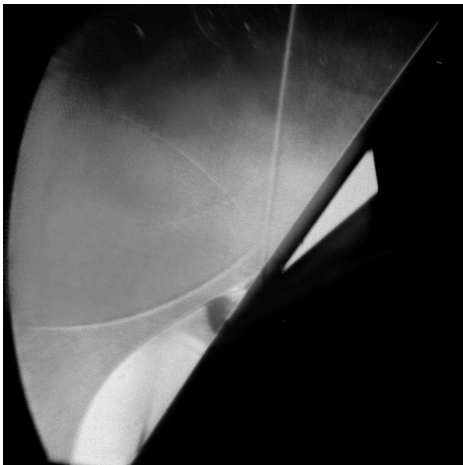


Figure 44: Isometric view of overlaid planes for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$.

a) Entire flow field b) Secondary reflected wave

F.1.4 Rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$



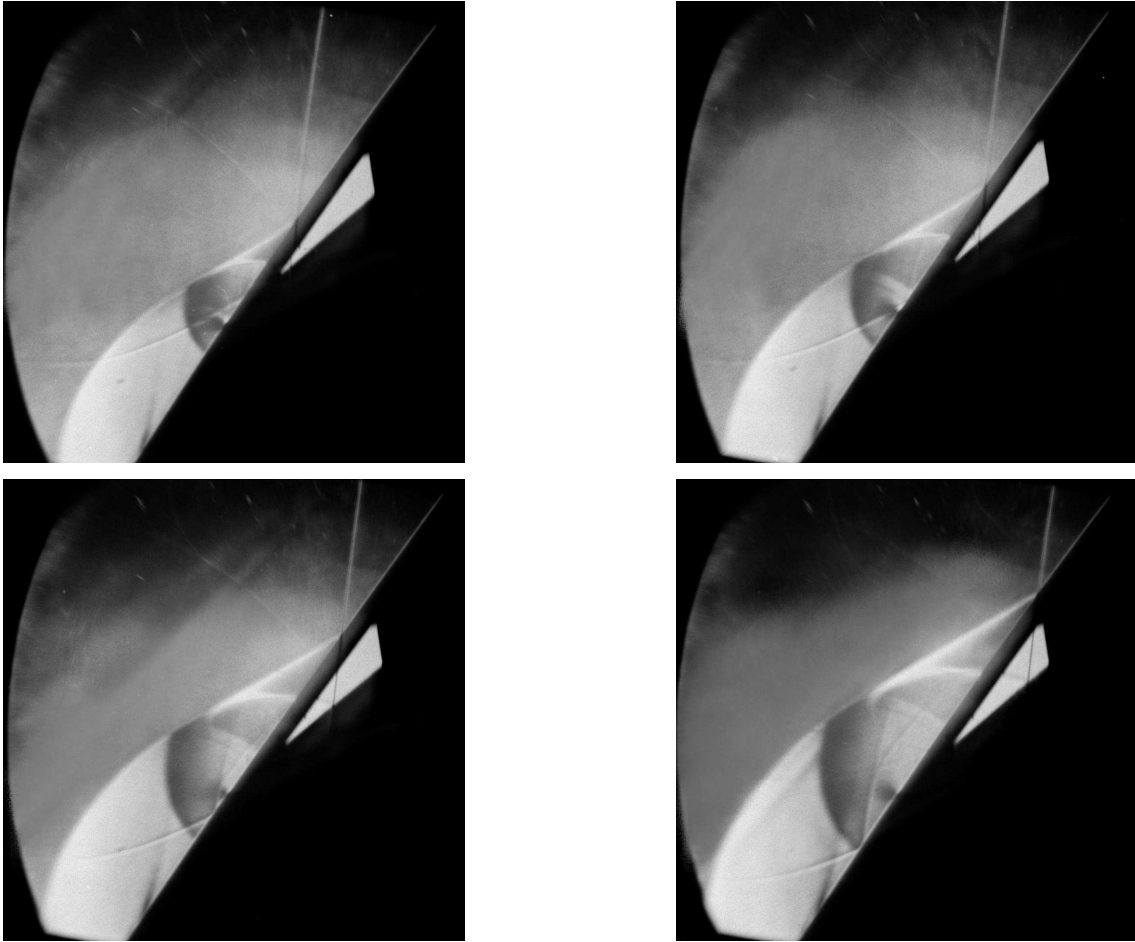
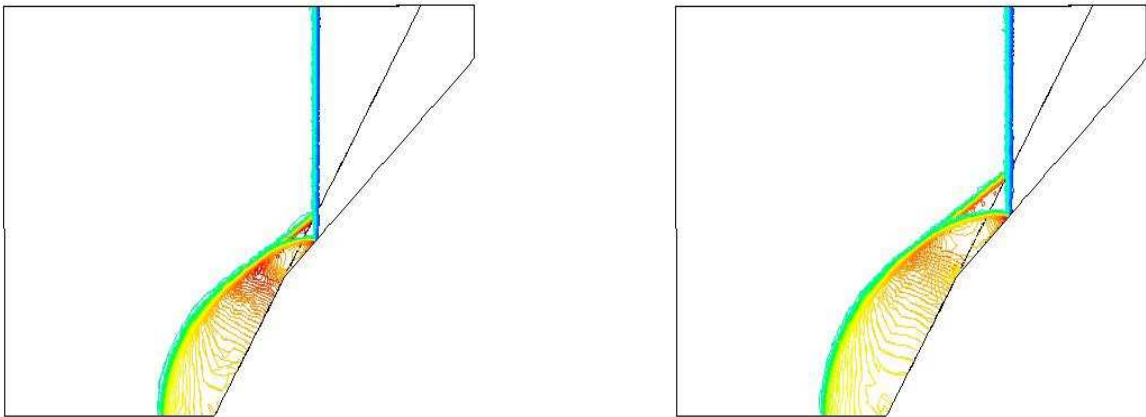


Figure 45: Schlieren images for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, at time delay $1635\mu\text{s}$, $1645\mu\text{s}$, $1655\mu\text{s}$, $1665\mu\text{s}$, $1675\mu\text{s}$, $1685\mu\text{s}$, $1695\mu\text{s}$, $1705\mu\text{s}$, $1715\mu\text{s}$, and $1725\mu\text{s}$ respectively.



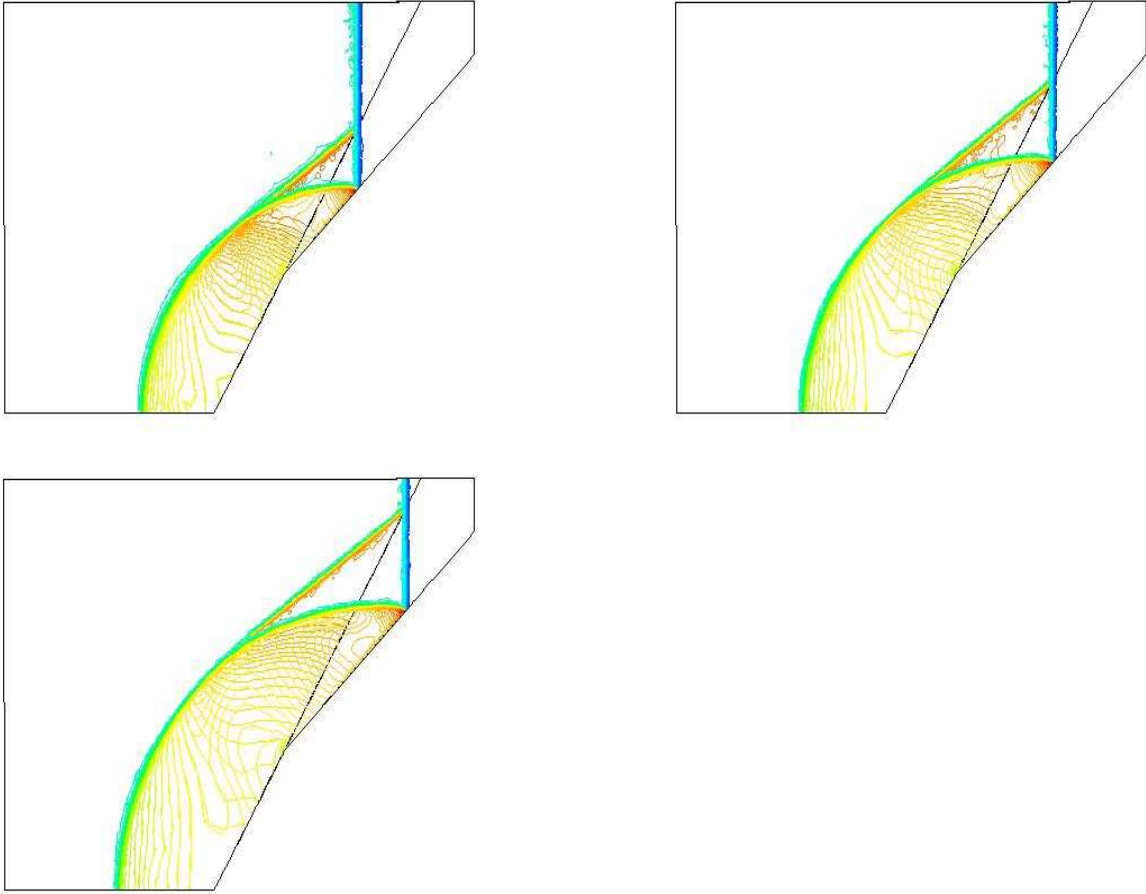


Figure 46: Sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$.

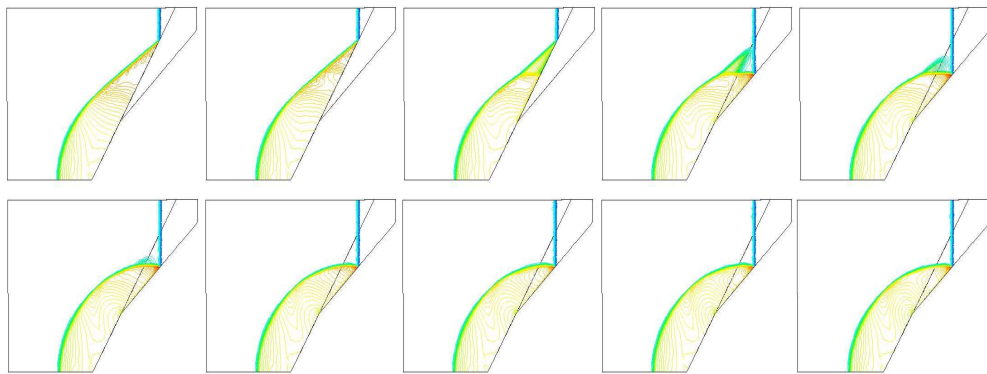


Figure 47: Density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 18.75mm , 37.5mm , 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm , 68.75mm , 75mm respectively.

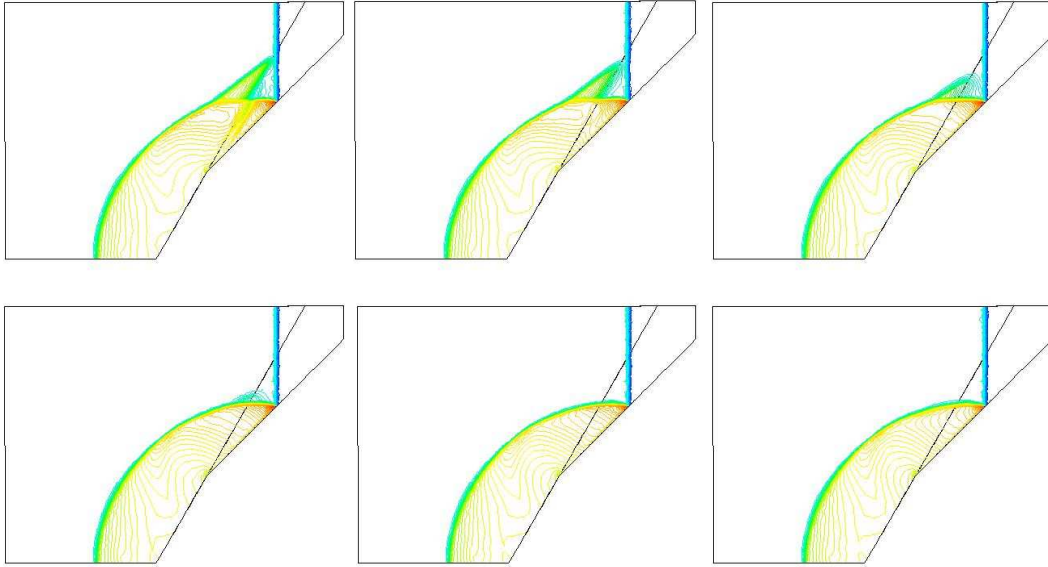


Figure 48: Enlarged density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the y-z plane at $x = 40\text{mm}$, 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm respectively.

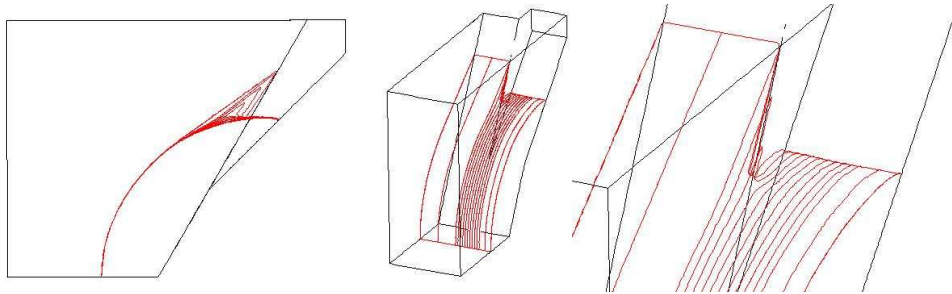


Figure 49: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$.

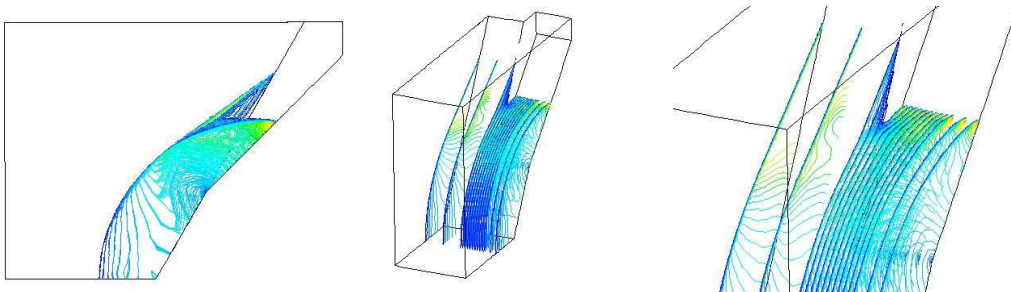


Figure 50: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$.

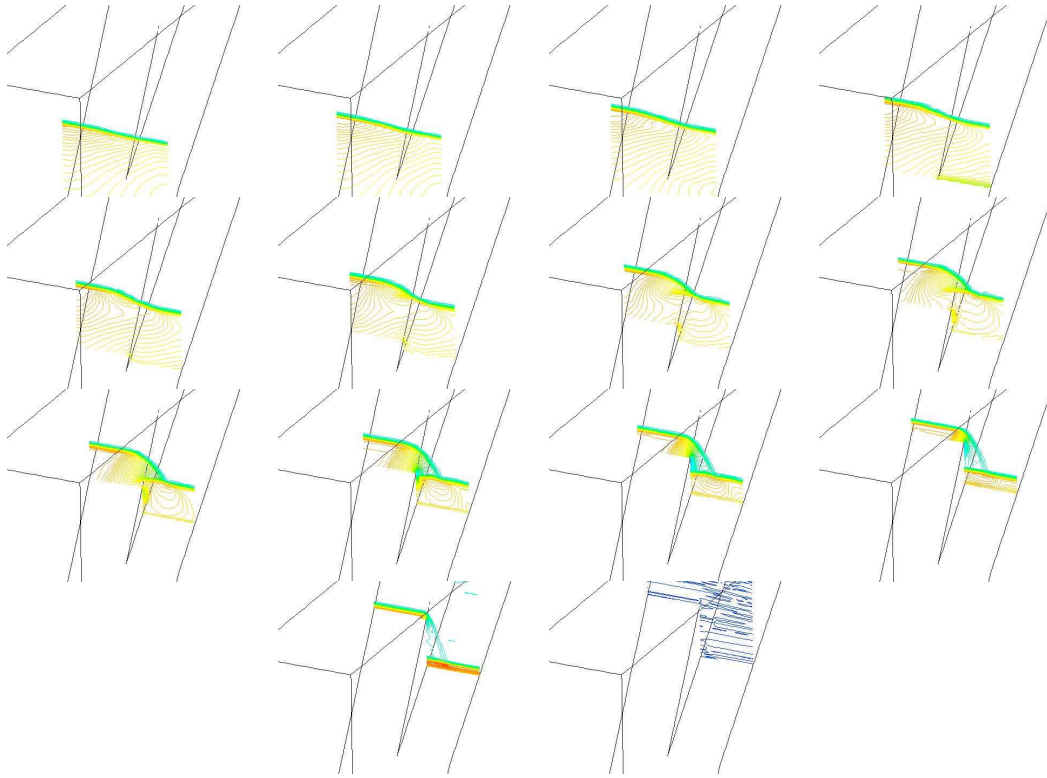


Figure 51: Isometric views of sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y in steps of 5mm along the z axis.

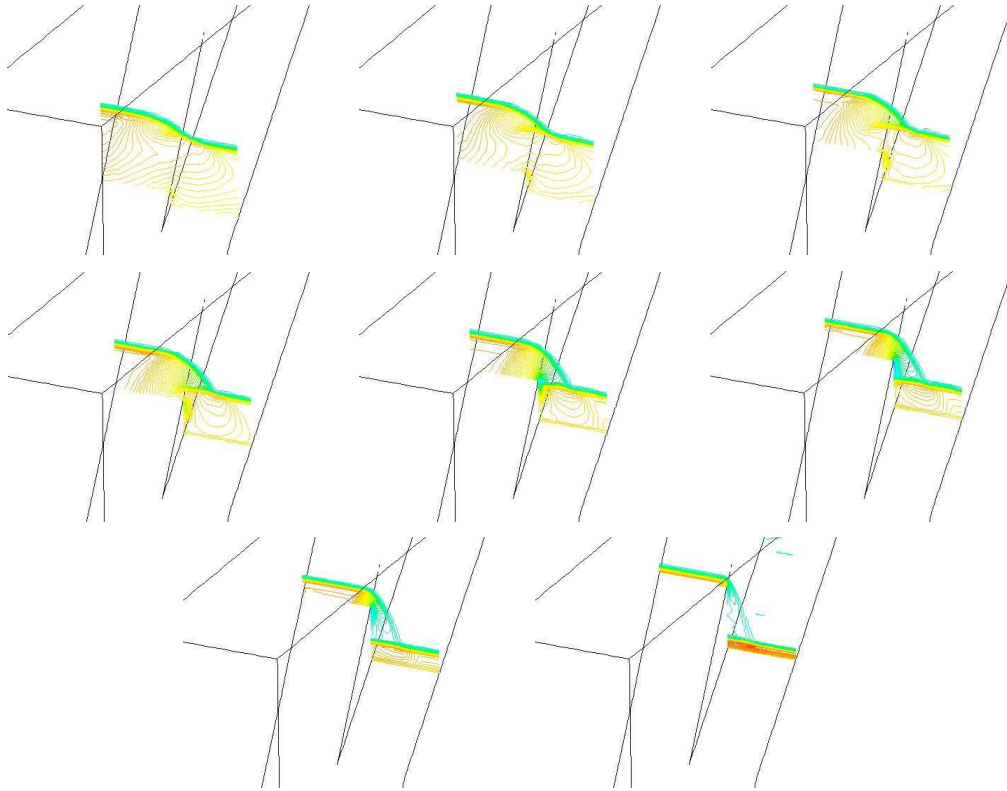


Figure 52: Enlarged isometric views of sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y in steps of 5mm along the z axis.

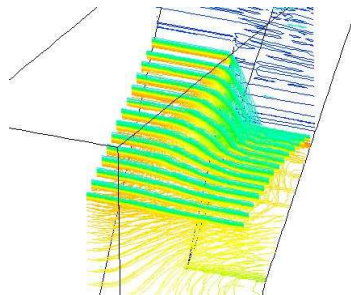


Figure 53: Isometric view of overlaid density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane.

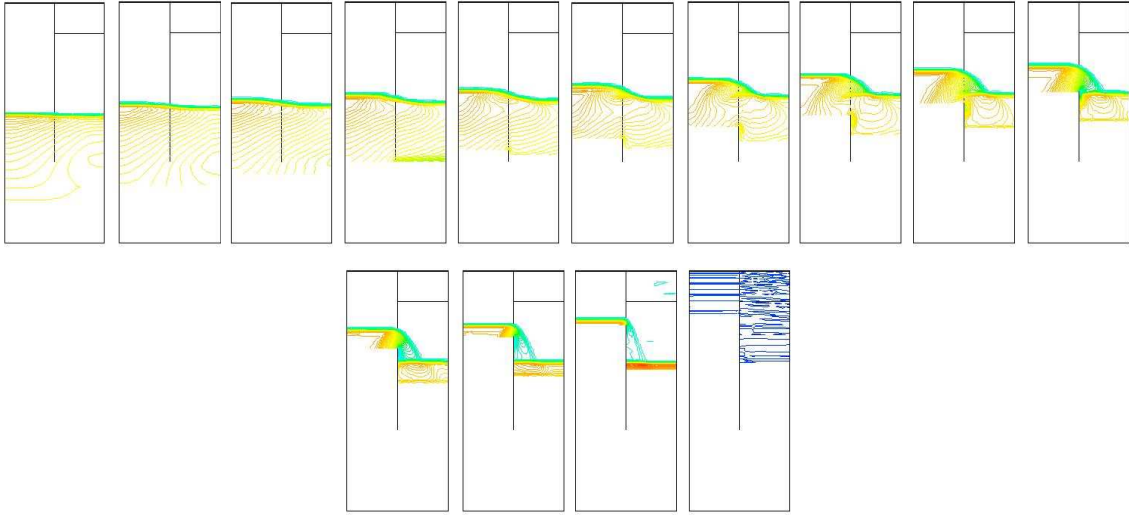


Figure 54: Sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

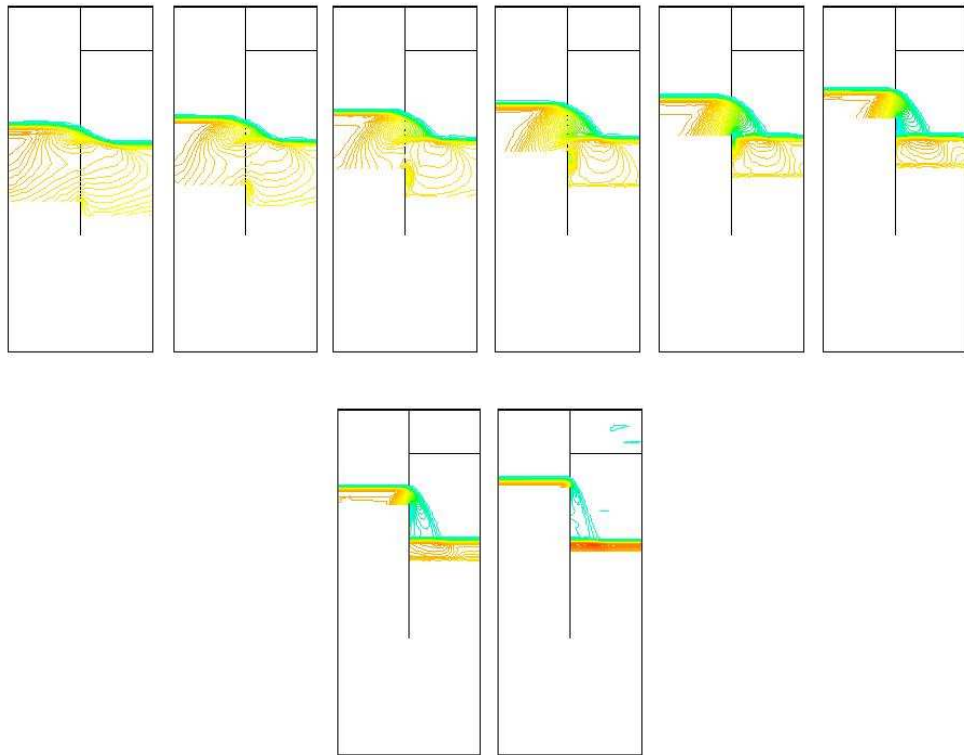


Figure 55: Enlarged sequential density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y in steps of 5mm along the z axis.

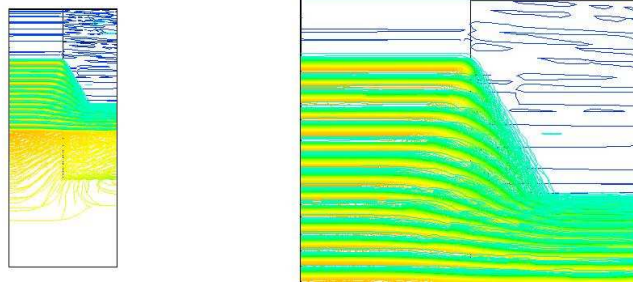


Figure 56: Overlaid density contour plots for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane.

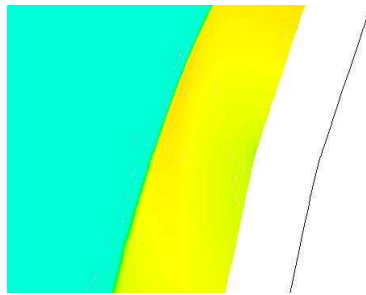


Figure 57: Filled density contour plot of plane in y-z plane for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, illustrating shear layer.

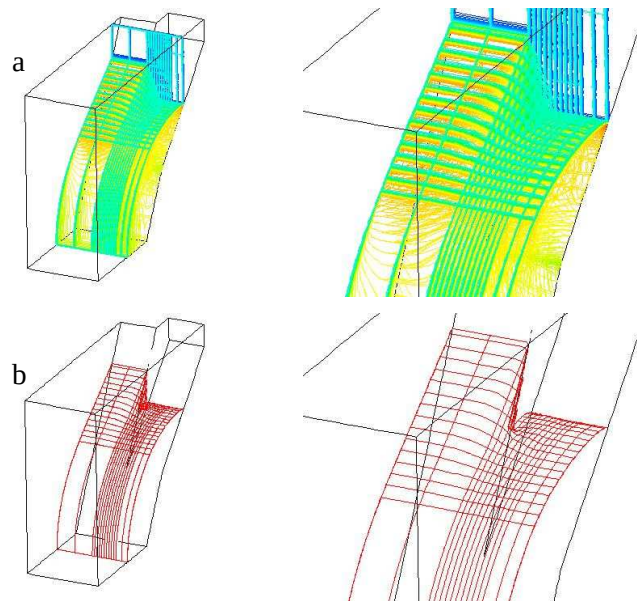


Figure 58: Isometric view of overlaid planes for rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$.

a) Entire flow field b) Secondary reflected wave

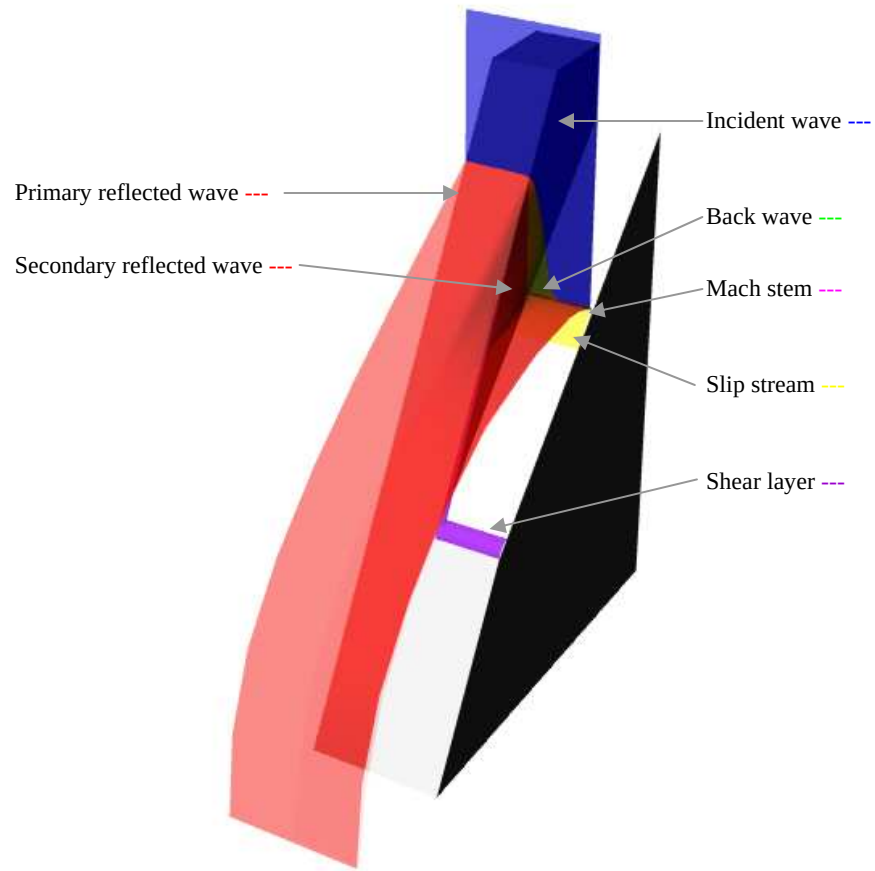
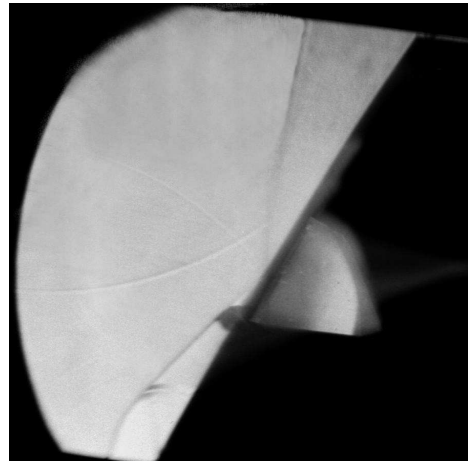
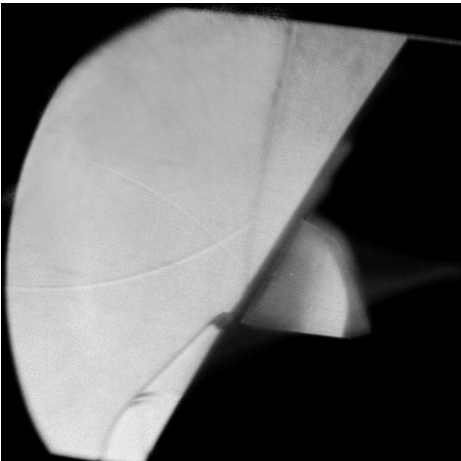
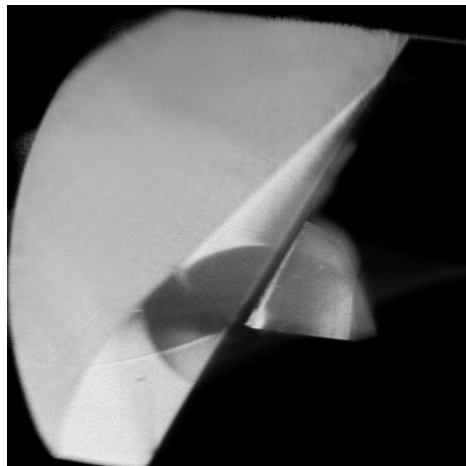
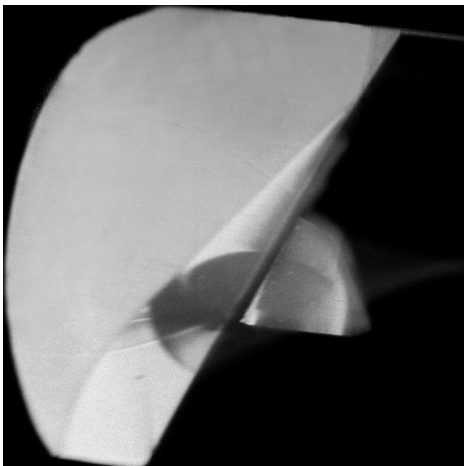
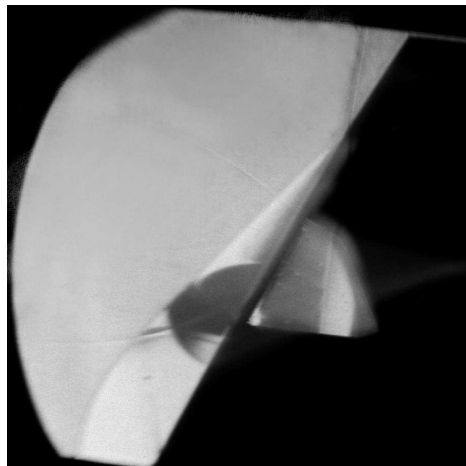
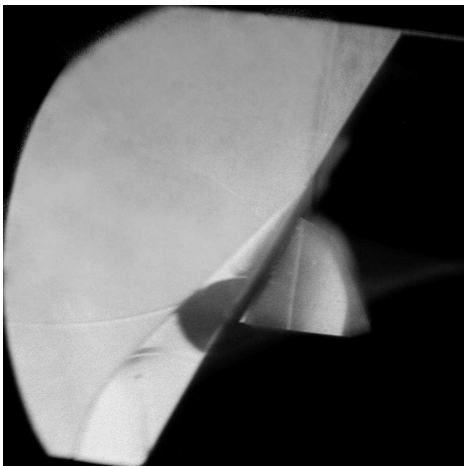
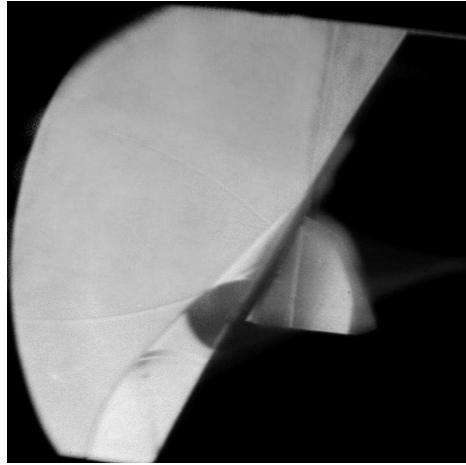
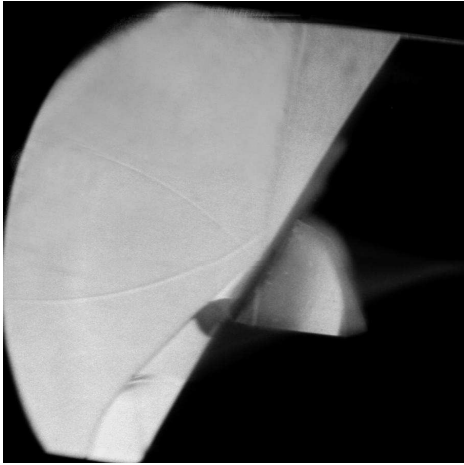


Figure 59: Three-dimensional NURBS model of rectangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$.

F.1.5 Rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$





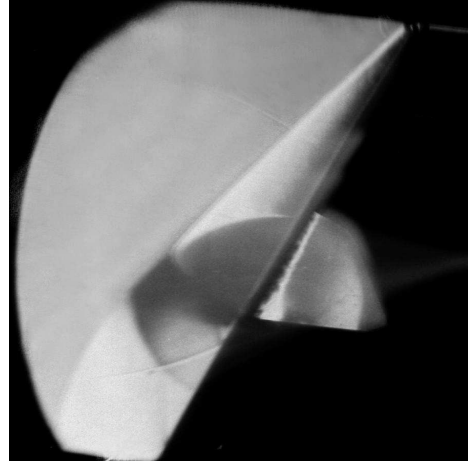
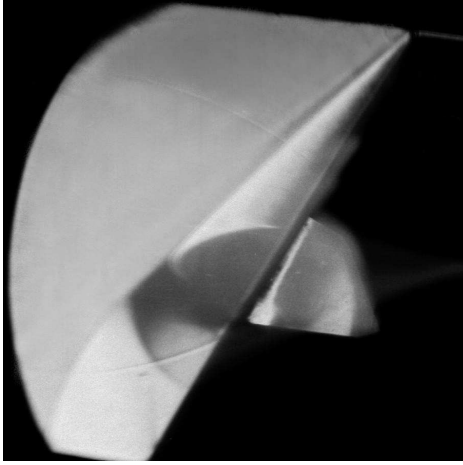
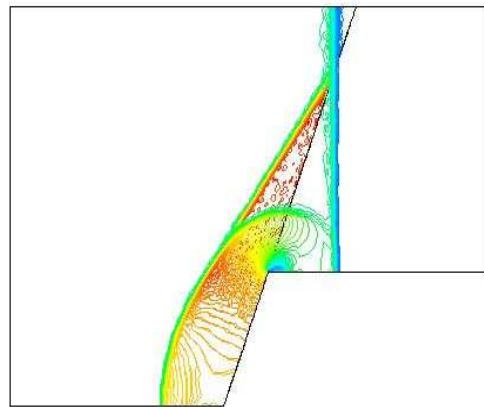
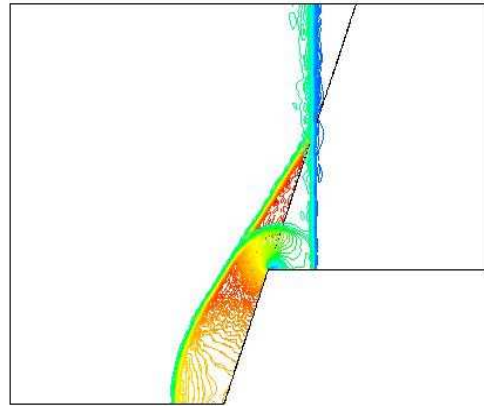
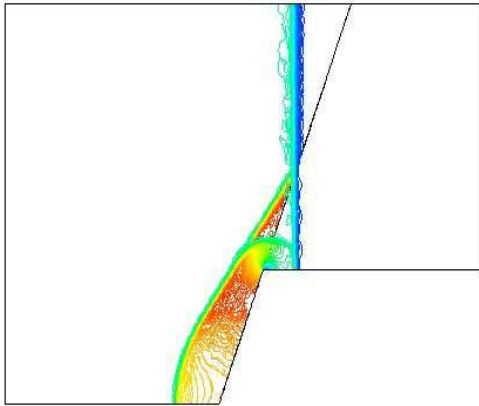


Figure 60: Schlieren images for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, at time delay 1615 μ s, 1625 μ s, 1635 μ s, 1645 μ s, 1655 μ s, 1665 μ s, 1675 μ s, 1685 μ s, 1695 μ s, and 1705 μ s respectively.



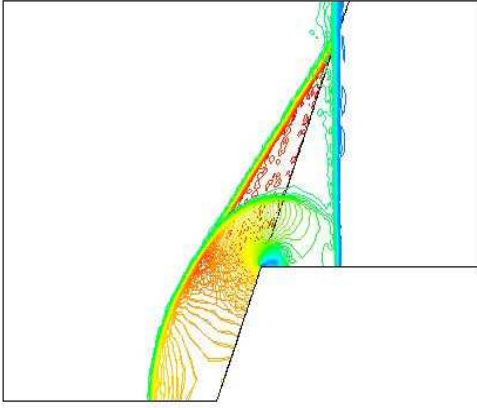


Figure 61: Sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$.

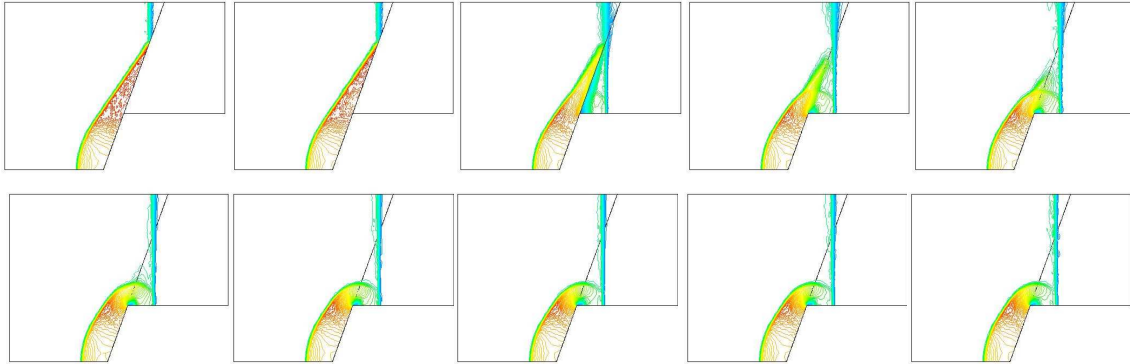


Figure 62: Density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the y-z plane at $x = 0\text{mm}, 18.75\text{mm}, 37.5\text{mm}, 42.5\text{mm}, 47.5\text{mm}, 52.5\text{mm}, 57.5\text{mm}, 62.5\text{mm}, 68.75\text{mm}, 75\text{mm}$ respectively.

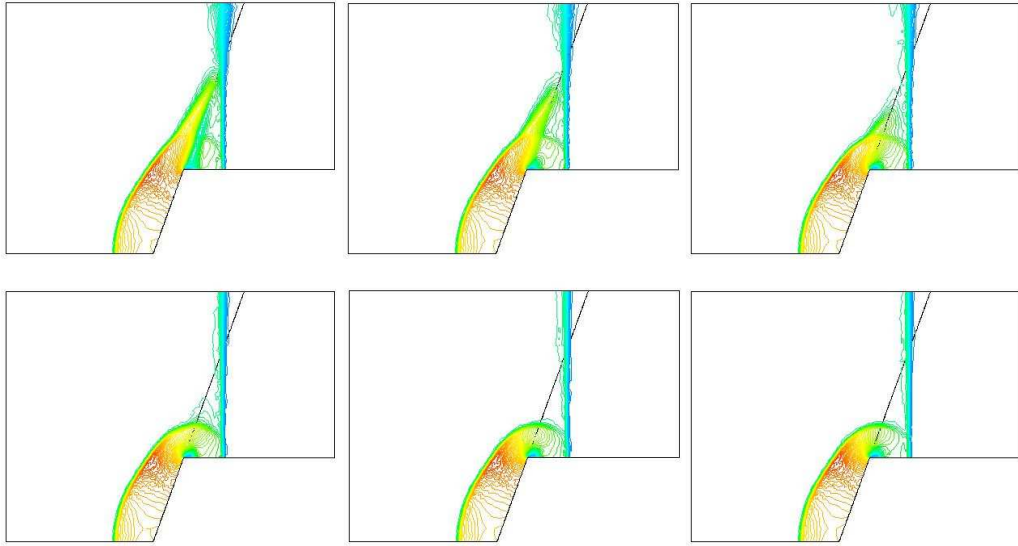


Figure 63: Enlarged density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the y-z plane at $x = 40\text{mm}$, 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm respectively.

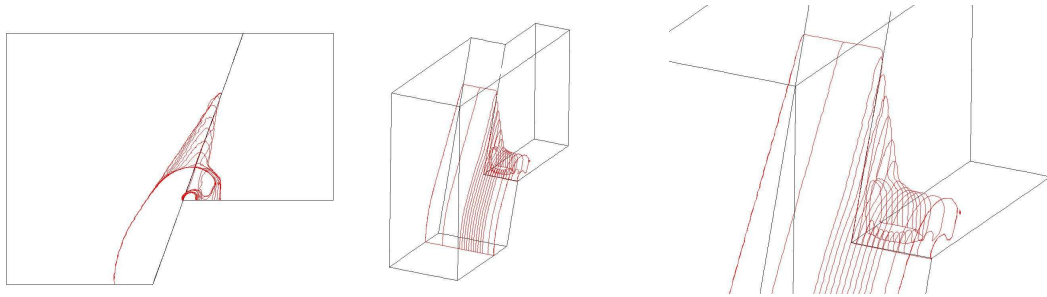


Figure 64: Overlaid pressure contour plots (single level) of secondary reflected wave for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$.

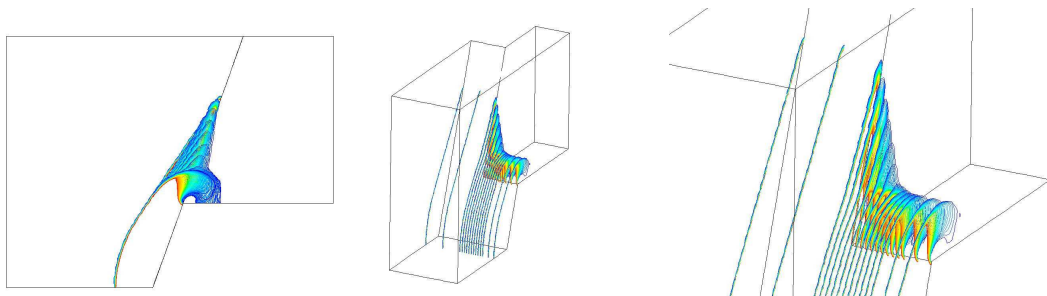


Figure 65: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$.

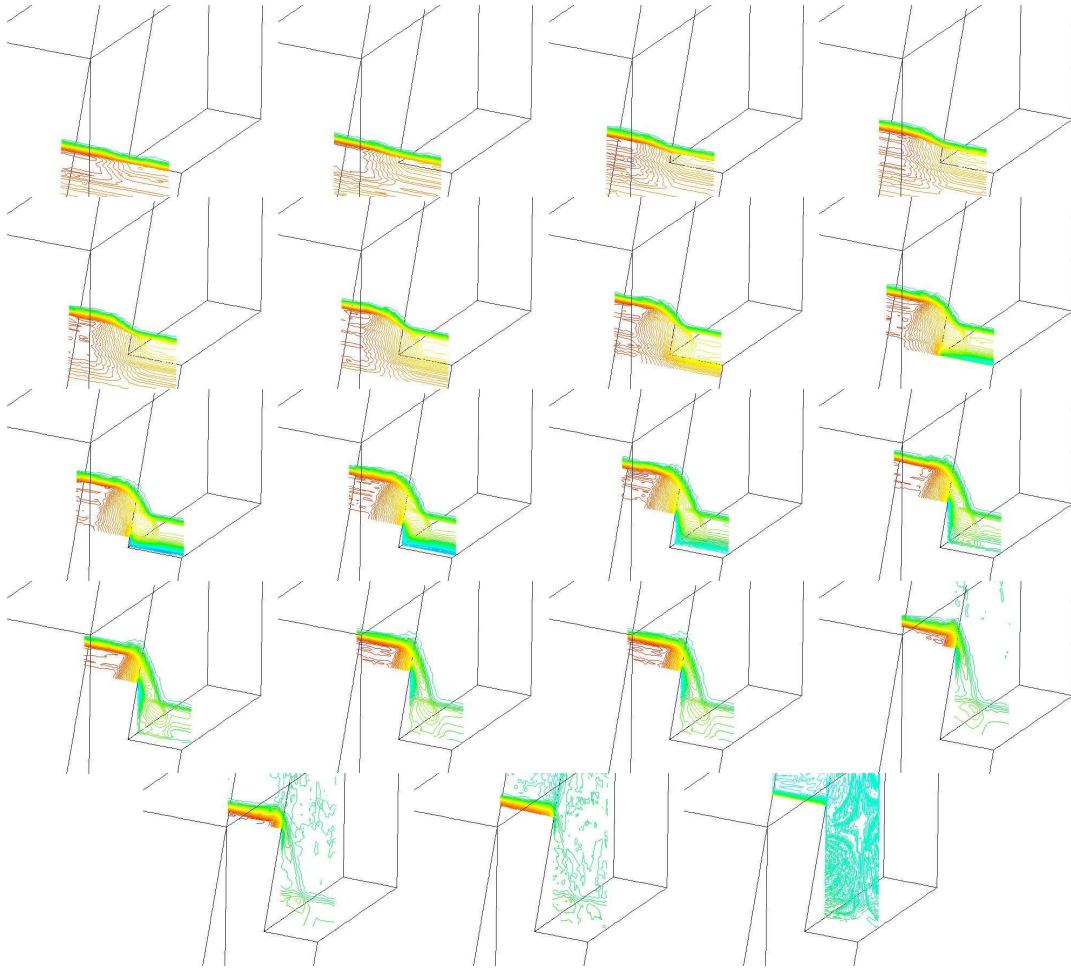


Figure 66: Isometric views of sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

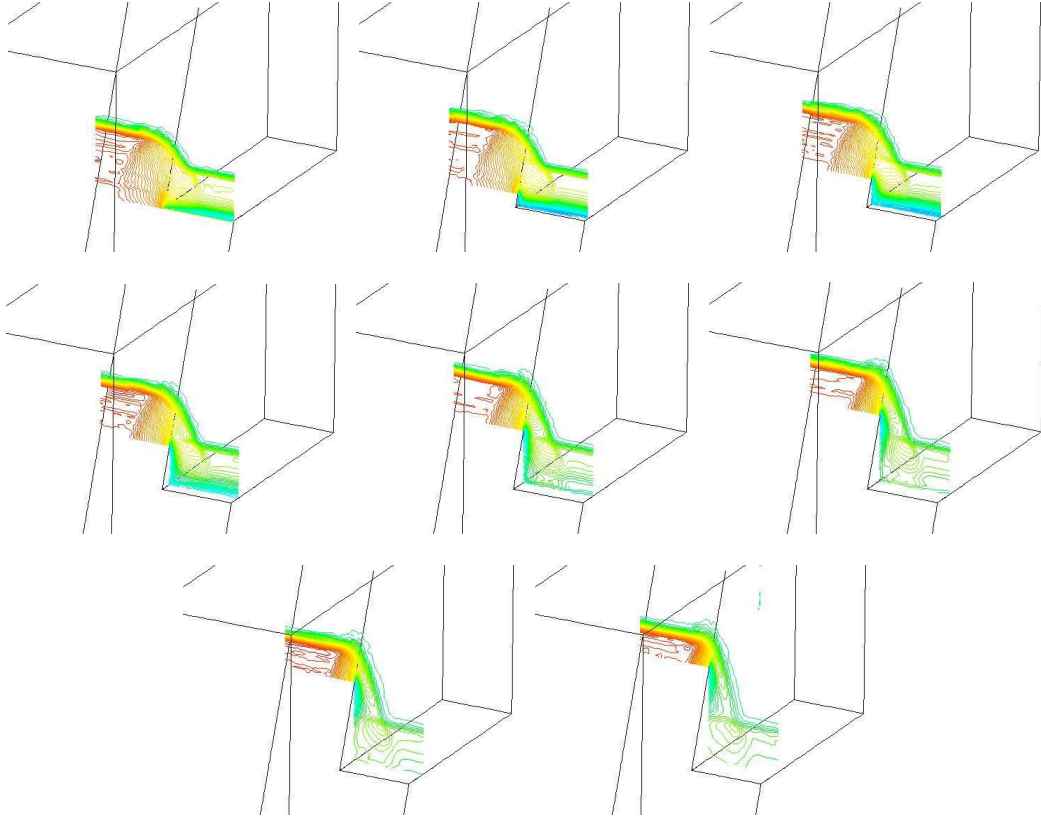


Figure 67: Enlarged isometric views of sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

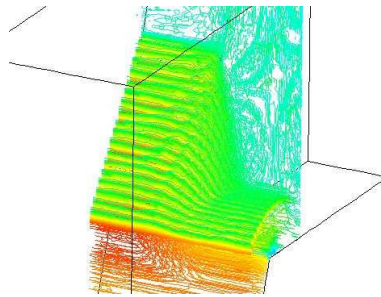


Figure 68: Isometric view of overlaid density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane.

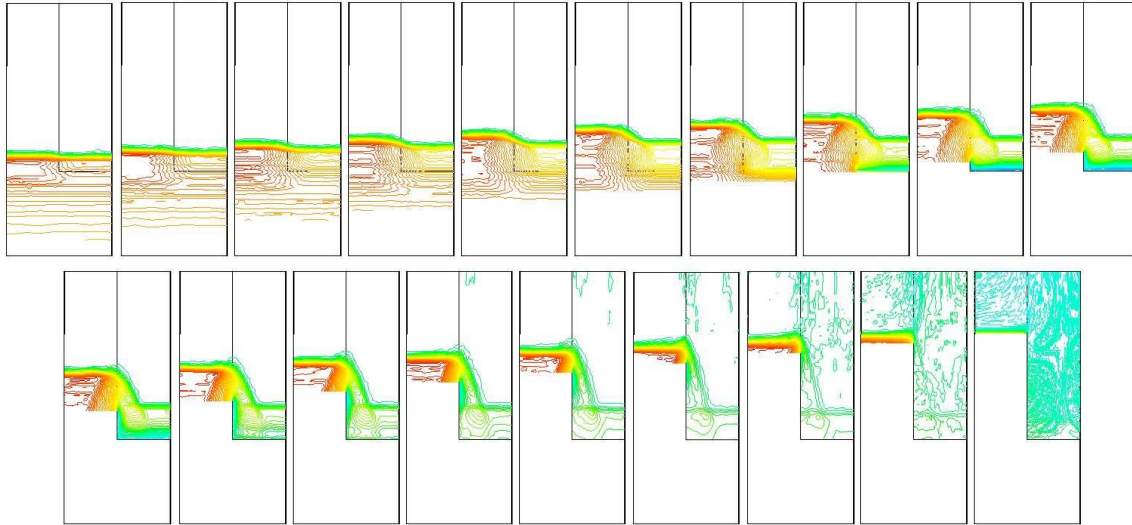


Figure 69: Sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane in steps of 2.5mm along the z axis.

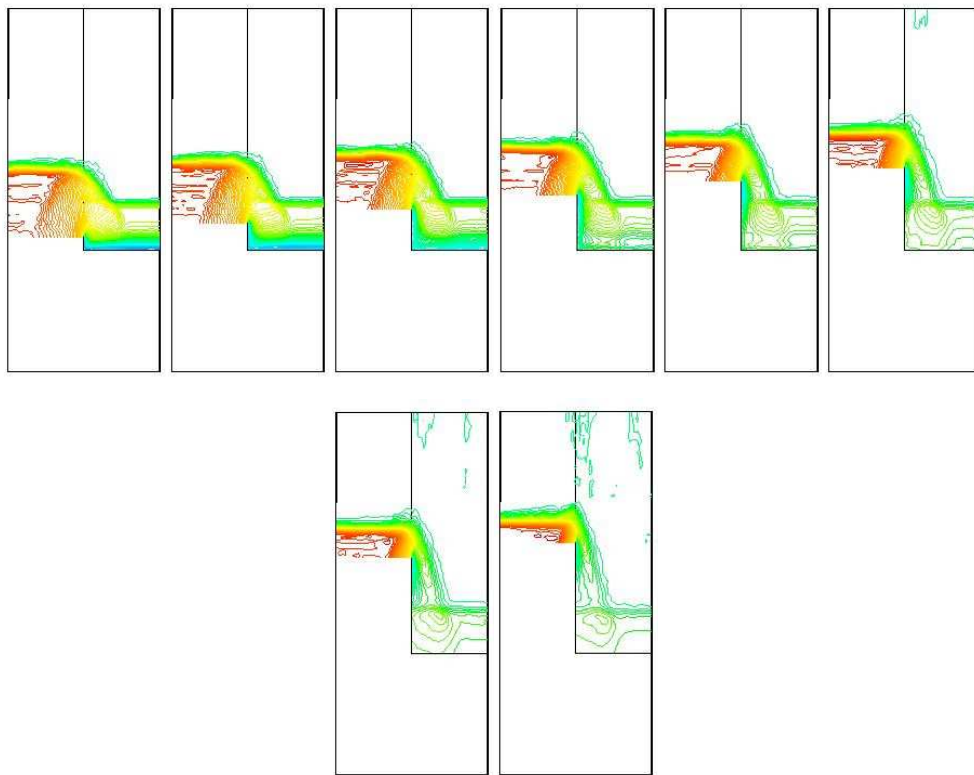


Figure 70: Enlarged sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

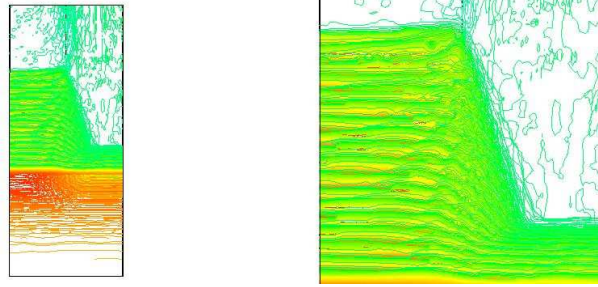


Figure 71: Overlaid density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane.

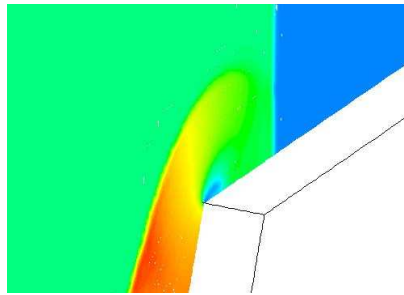


Figure 72: Filled density contour plot of plane in y-z plane for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, illustrating shear layer.

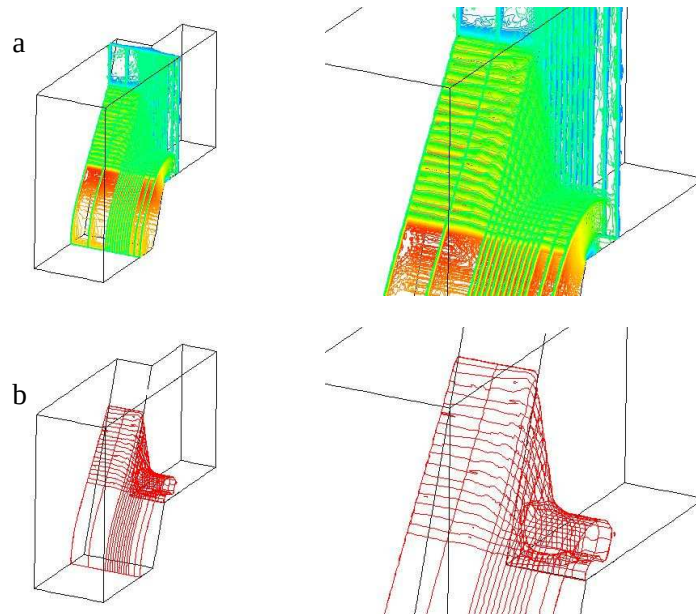


Figure 73: Isometric view of overlaid planes for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$.

a) Entire flow field b) Secondary reflected wave

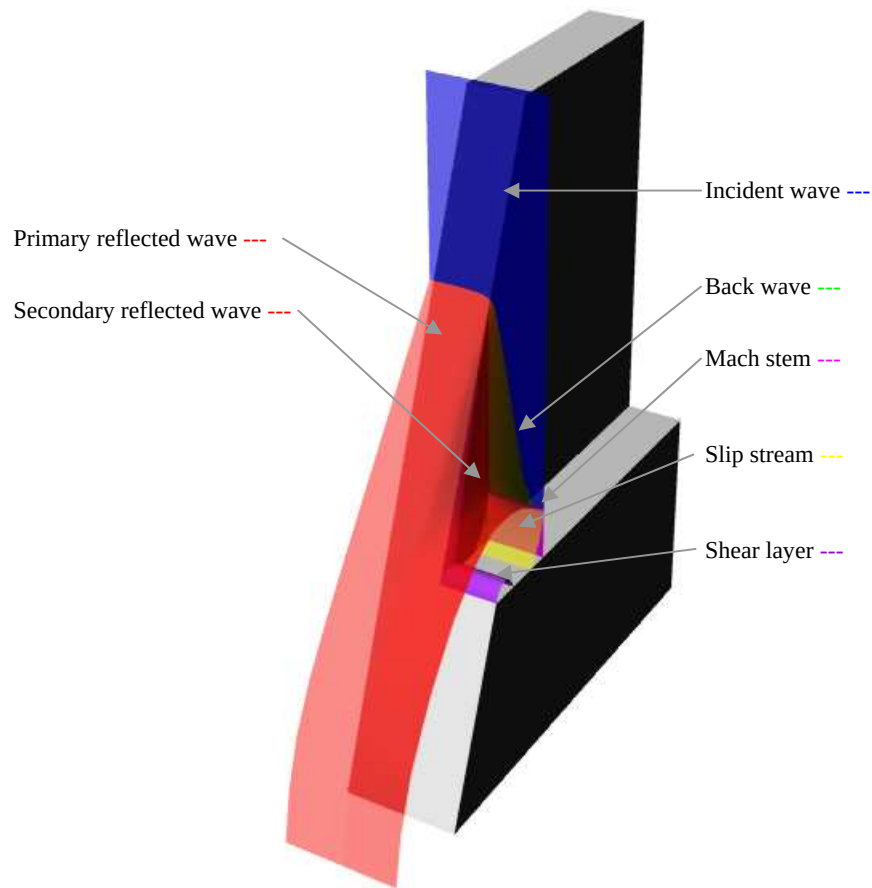
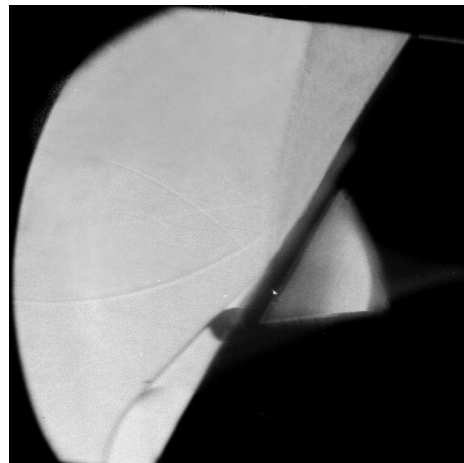
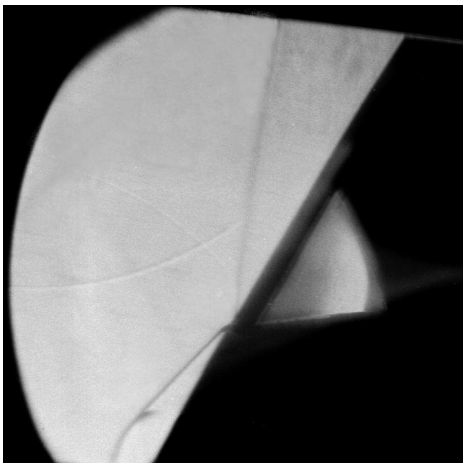
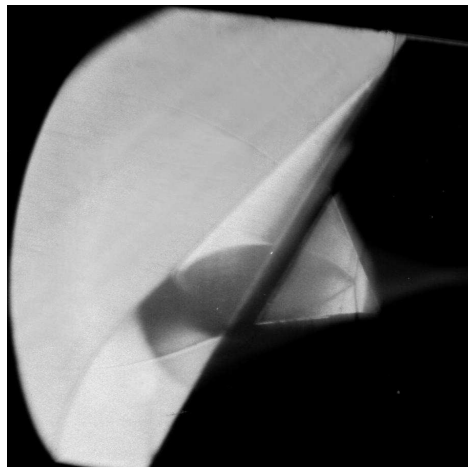
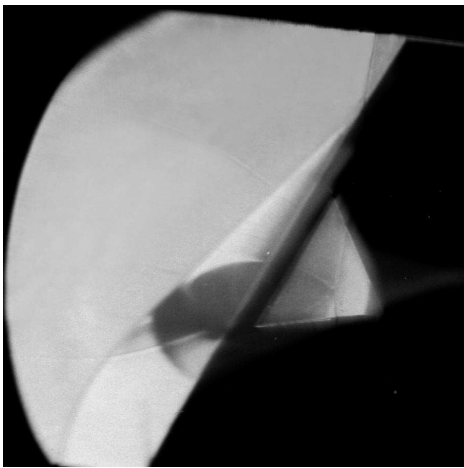
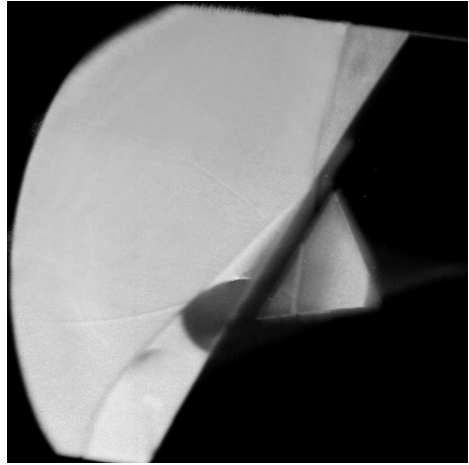


Figure 74: Three-dimensional NURBS model of rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$.

F.1.6 Rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$





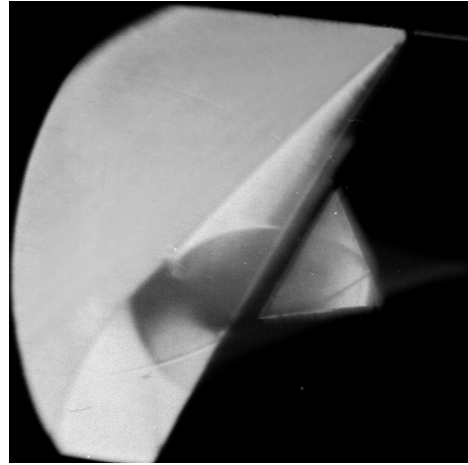
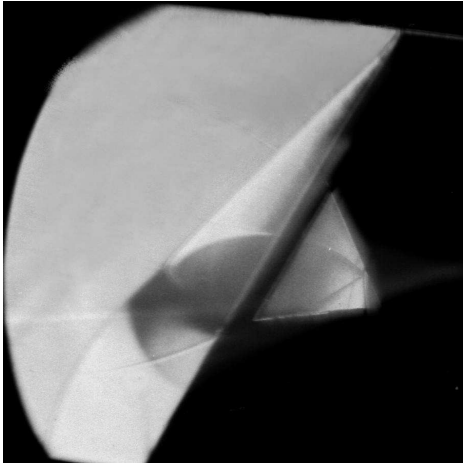
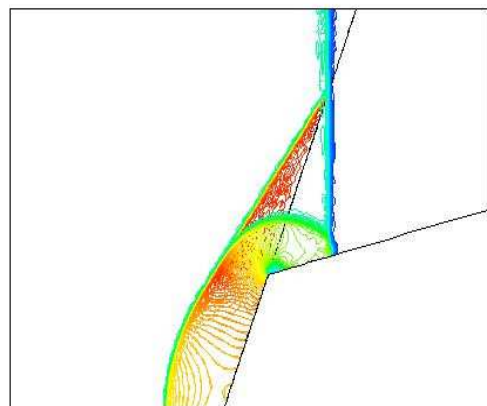
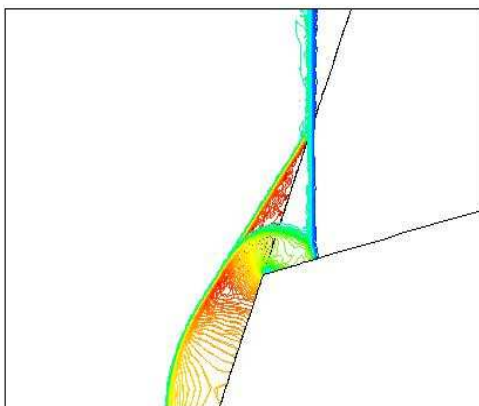
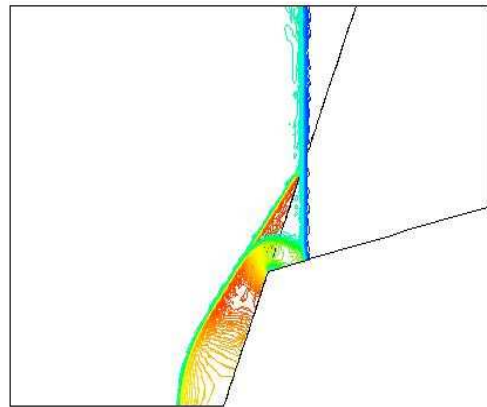
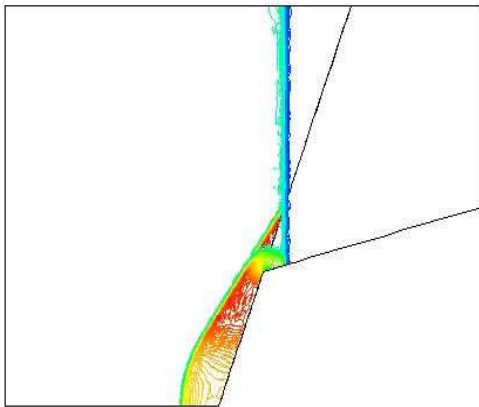


Figure 75: Schlieren images for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, at time delay 1615 μ s, 1625 μ s, 1635 μ s, 1645 μ s, 1655 μ s, 1665 μ s, 1675 μ s, 1685 μ s, 1695 μ s, and 1705 μ s respectively.



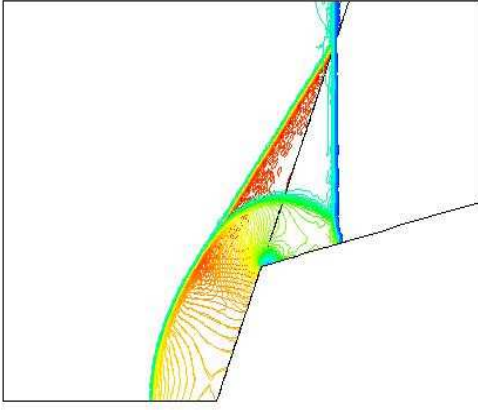


Figure 76: Sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$.

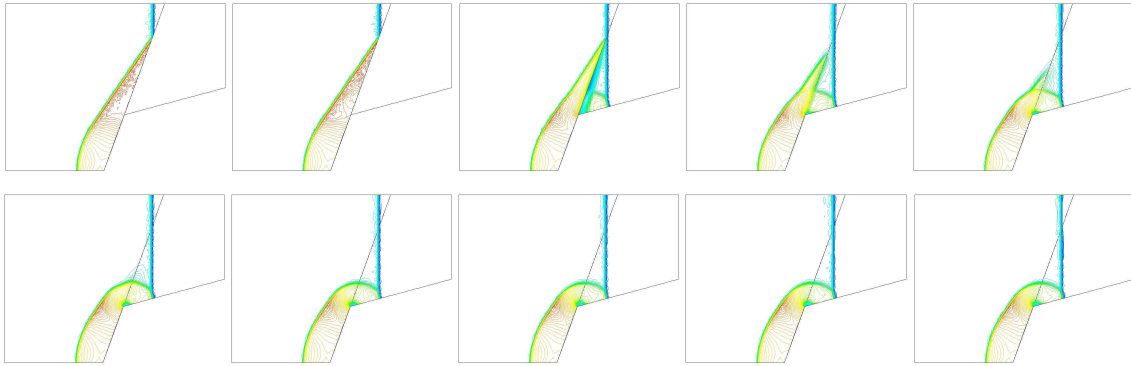


Figure 77: Density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 18.75mm , 37.5mm , 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm , 68.75mm , 75mm respectively.

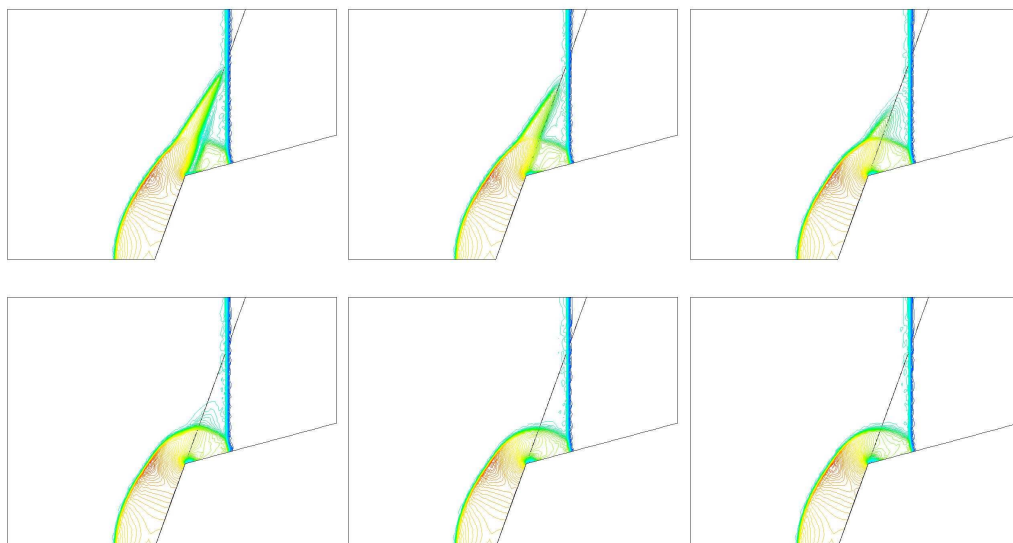


Figure 78: Enlarged density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the y-z plane at $x = 40\text{mm}$, 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm respectively.

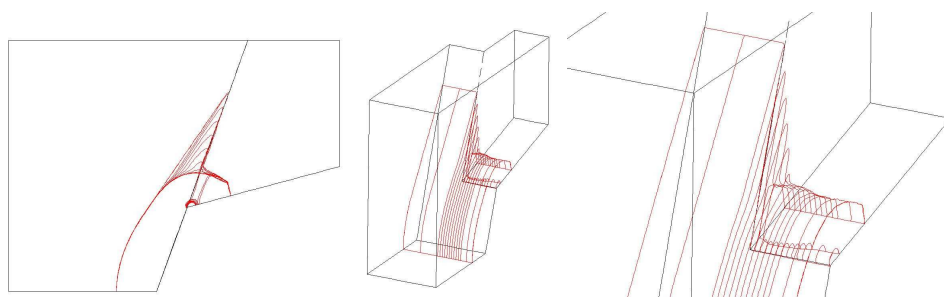


Figure 79: Overlaid pressure contour plots (single level) of secondary reflected wave for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$.

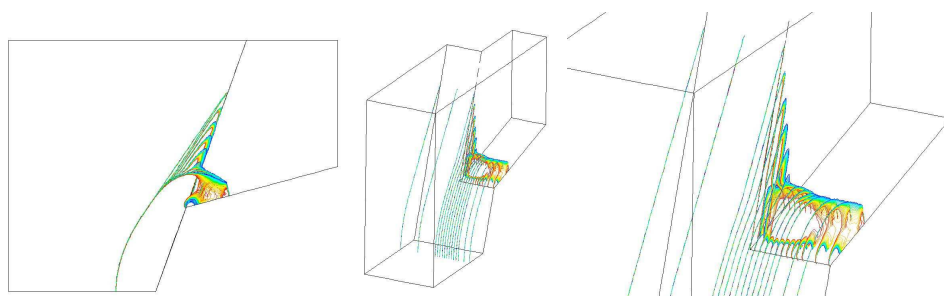


Figure 80: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$.

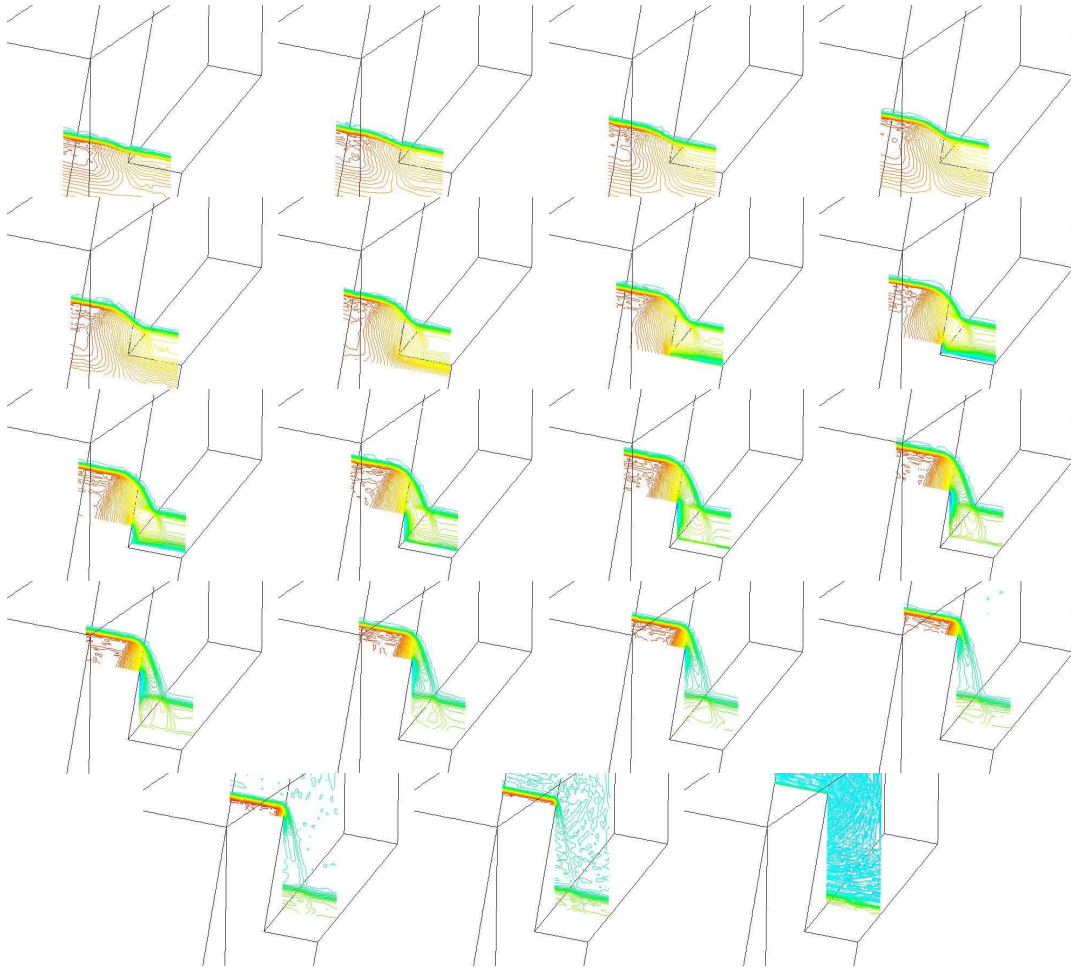


Figure 81: Isometric views of sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

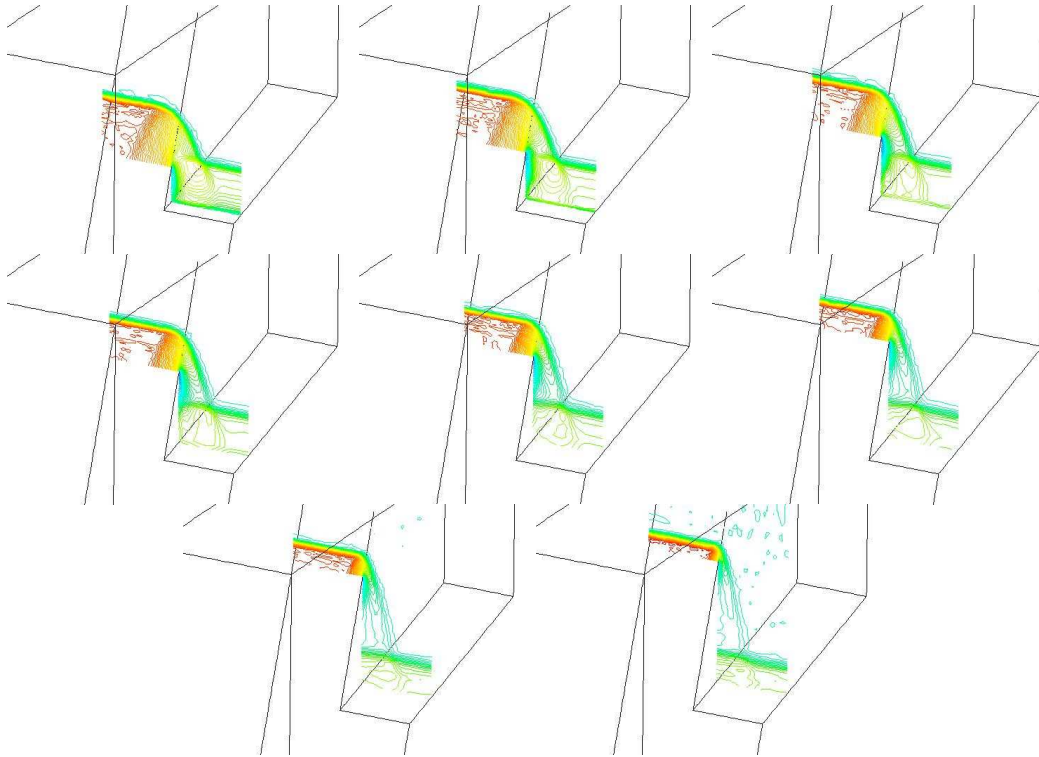


Figure 82: Enlarged isometric views of sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

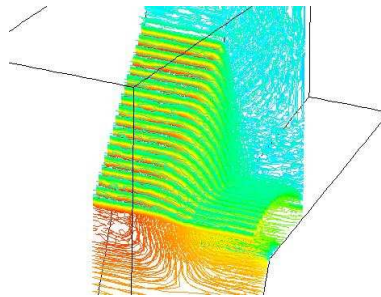


Figure 83: Isometric view of overlaid density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane.

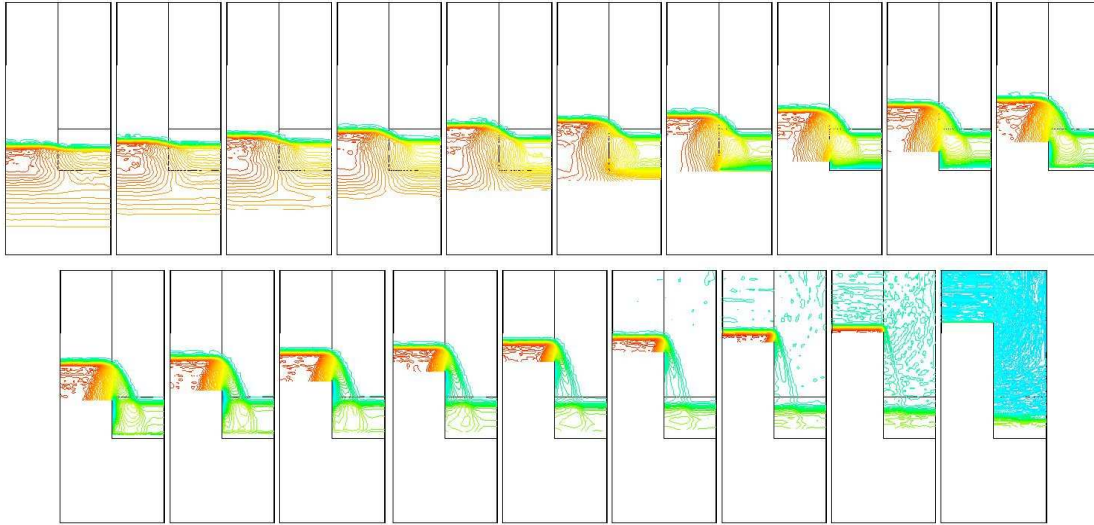


Figure 84: Sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane in steps of 2.5mm along the z axis.

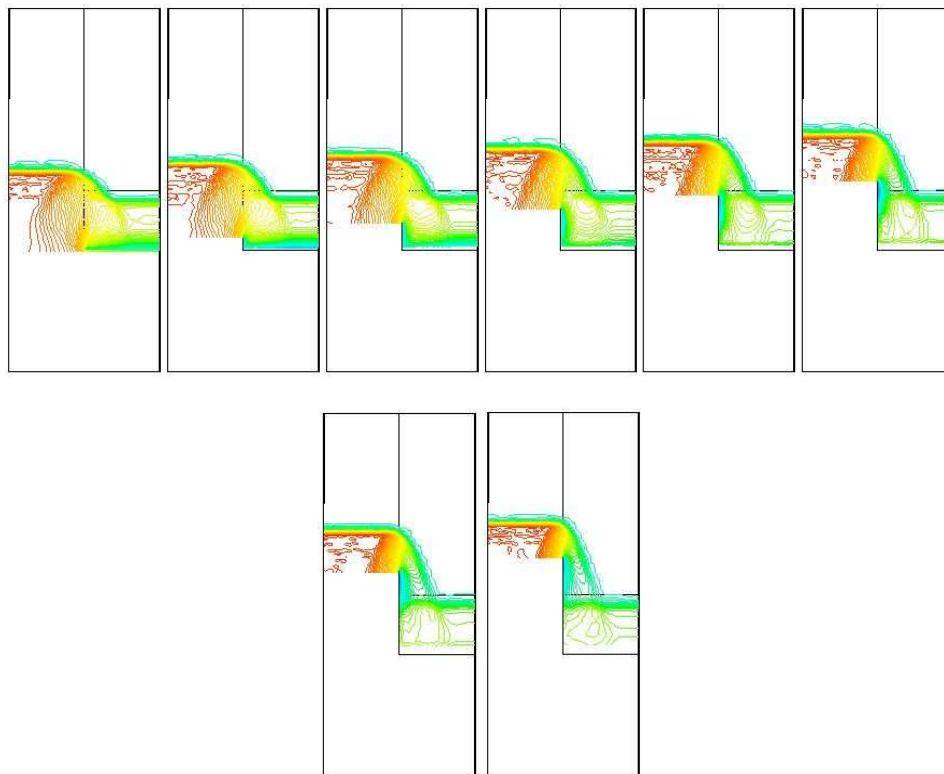


Figure 85: Enlarged sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

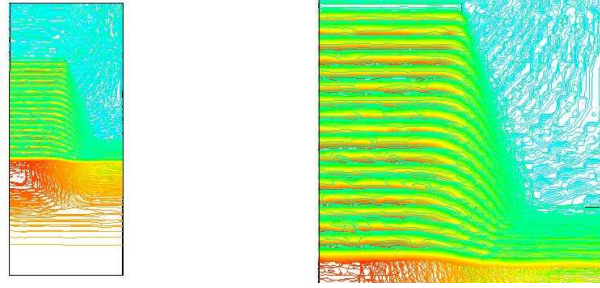


Figure 86: Overlaid density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane.

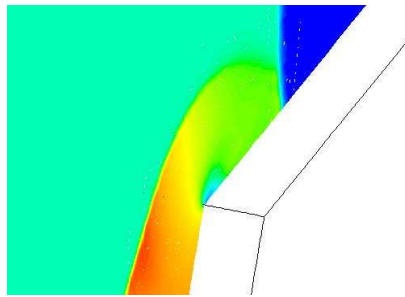


Figure 87: Filled density contour plot of plane in y-z plane for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, illustrating shear layer.

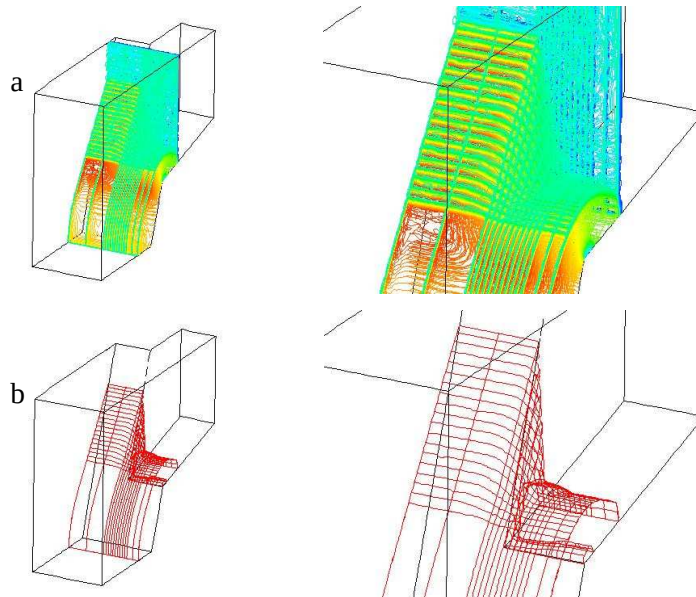
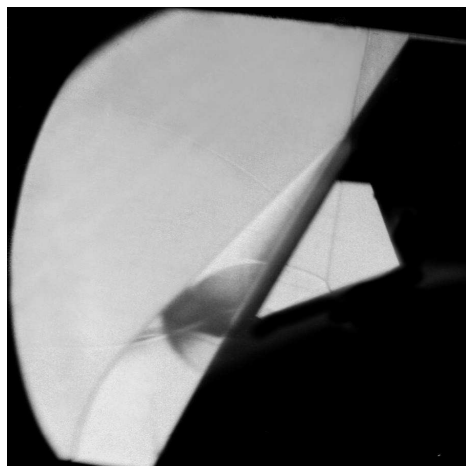
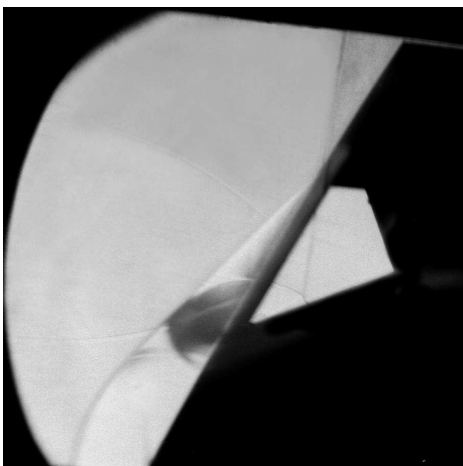


Figure 88: Isometric view of overlaid planes for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$.

a) Entire flow field b) Secondary reflected wave

F.1.7 Rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$



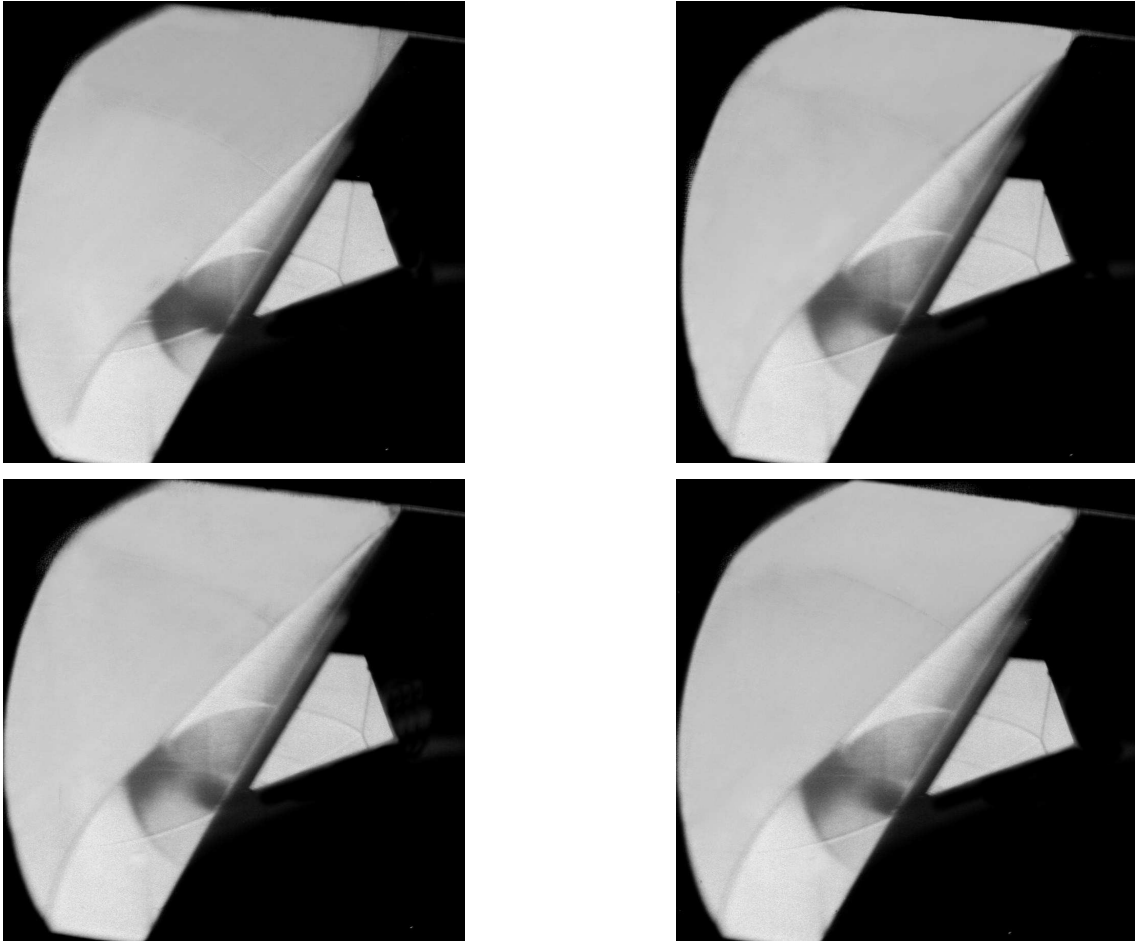
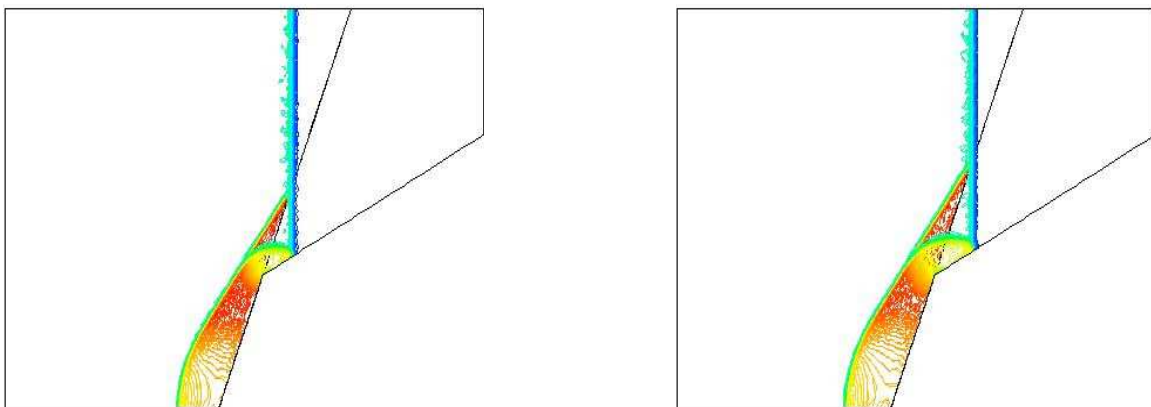


Figure 89: Schlieren images for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, at time delay $1615\mu\text{s}$, $1625\mu\text{s}$, $1635\mu\text{s}$, $1645\mu\text{s}$, $1655\mu\text{s}$, $1665\mu\text{s}$, $1675\mu\text{s}$, $1685\mu\text{s}$, $1695\mu\text{s}$, and $1705\mu\text{s}$ respectively.



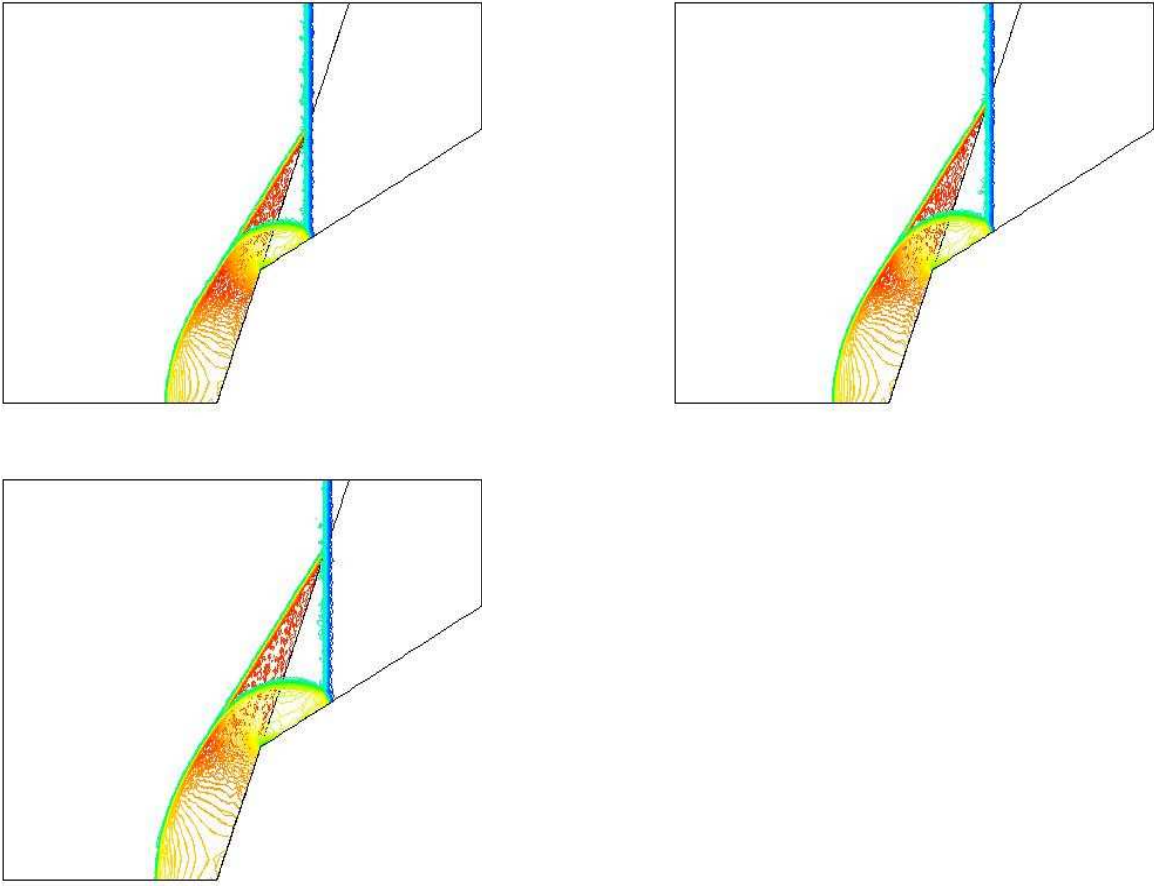


Figure 90: Sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$.

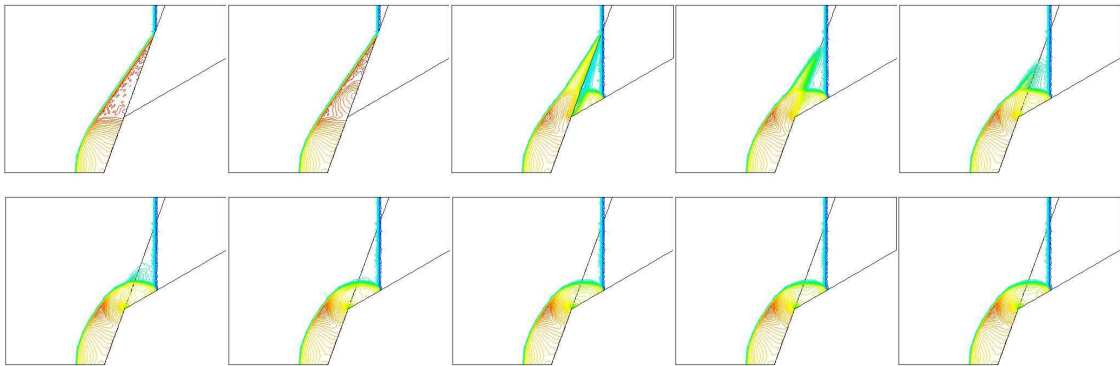


Figure 91: Density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 18.75mm , 37.5mm , 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm , 68.75mm , 75mm respectively.

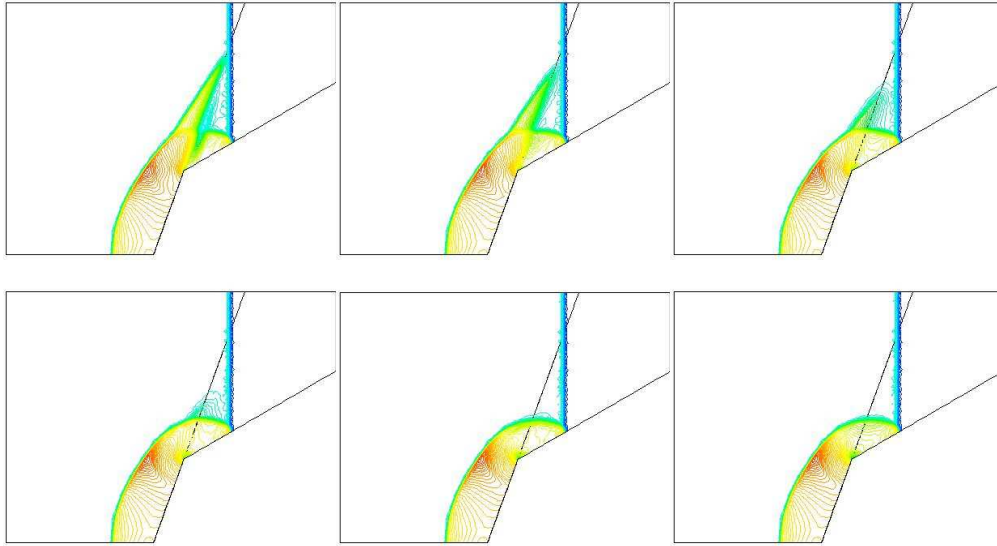


Figure 92: Enlarged density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the y-z plane at $x = 40\text{mm}$, 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm respectively.

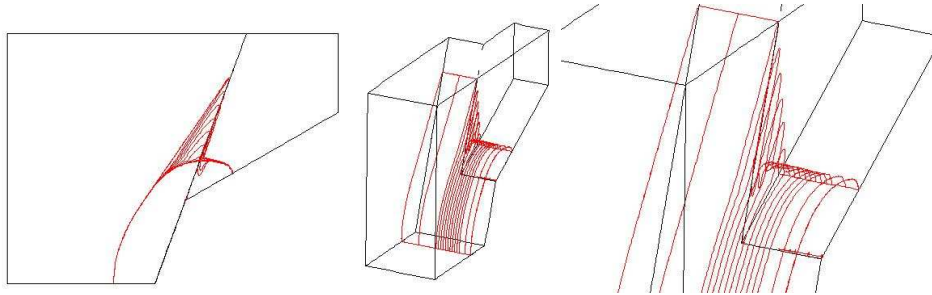


Figure 93: Overlaid pressure contour plots (single level) of secondary reflected wave for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$.

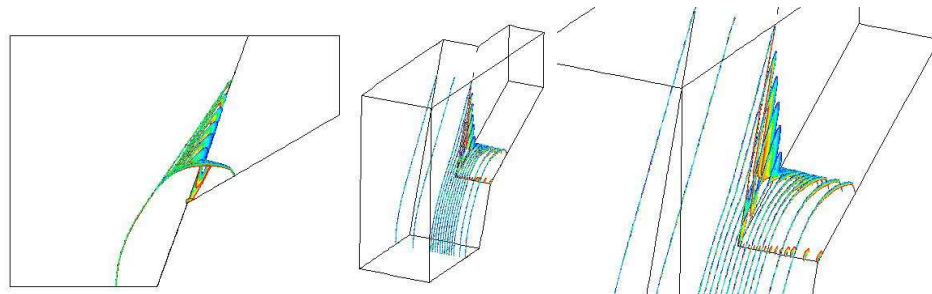


Figure 94: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$.

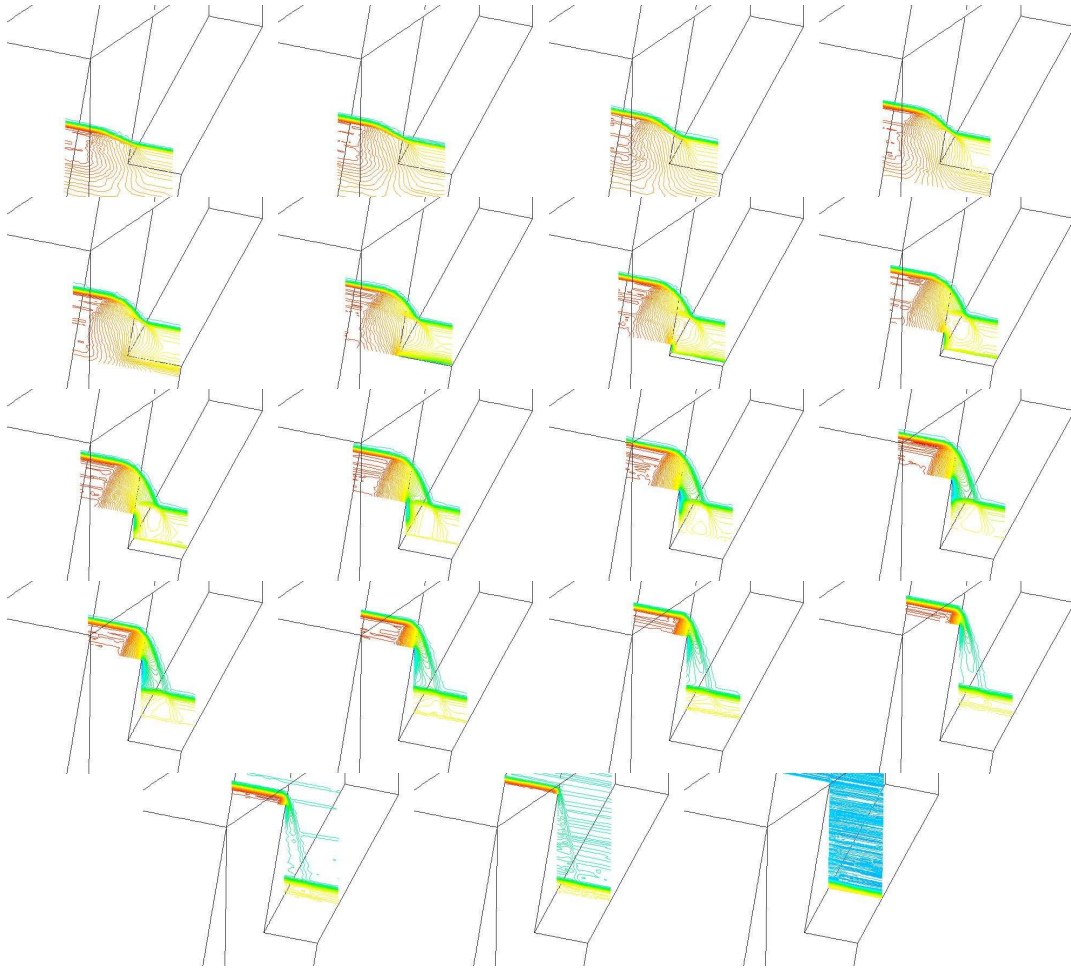


Figure 95: Isometric views of sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

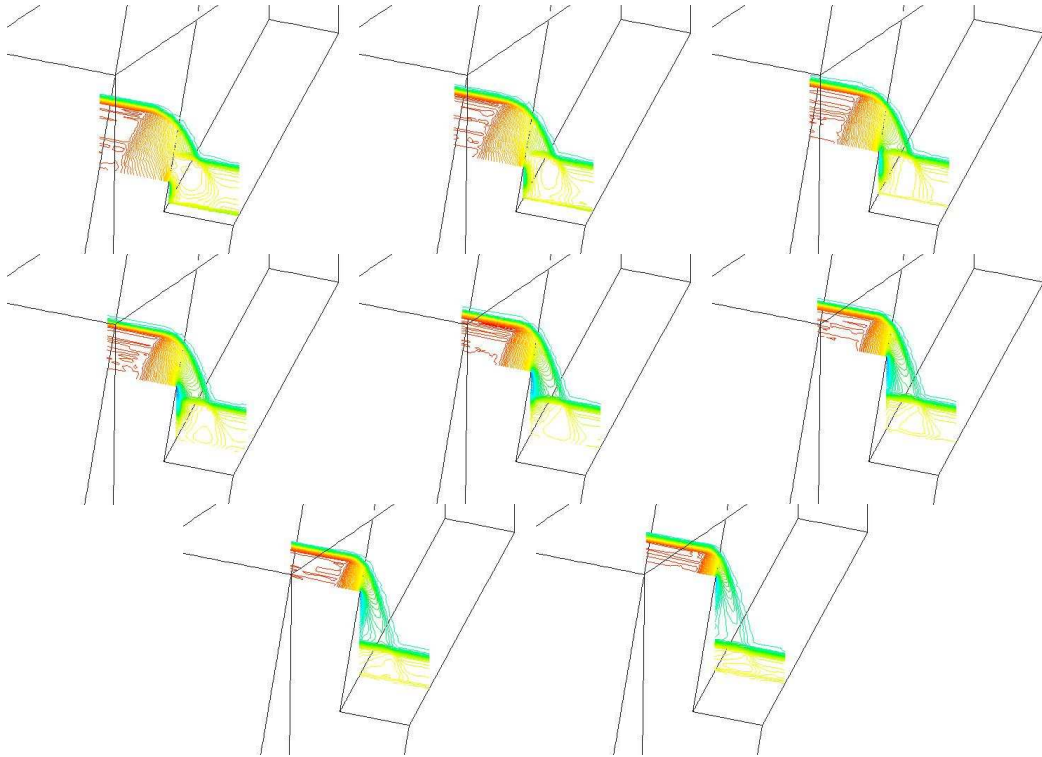


Figure 96: Enlarged isometric views of sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

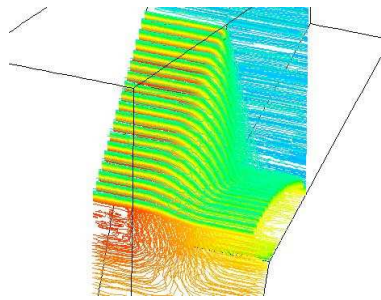


Figure 97: Isometric view of overlaid density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane.

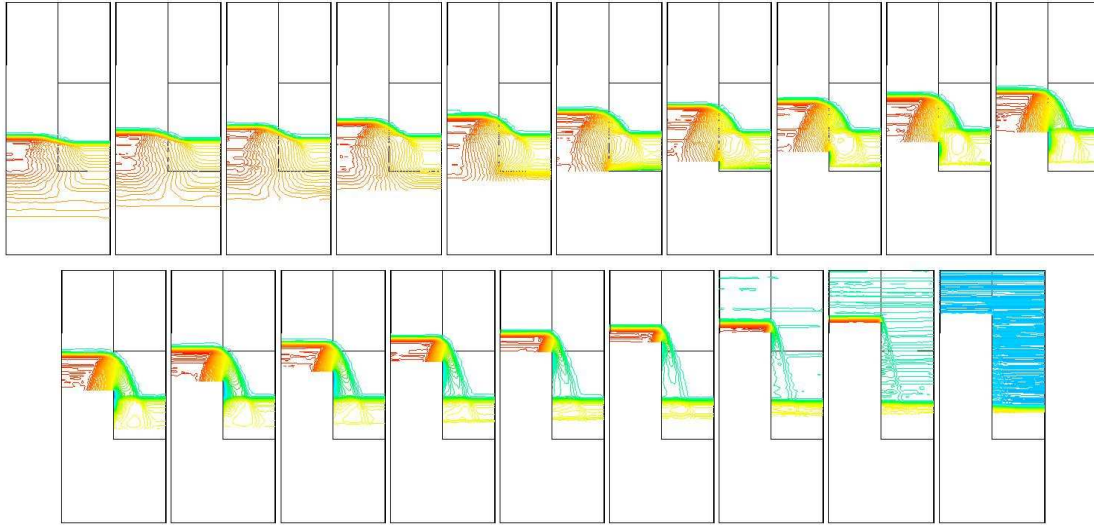


Figure 98: Sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane in steps of 2.5mm along the z axis.

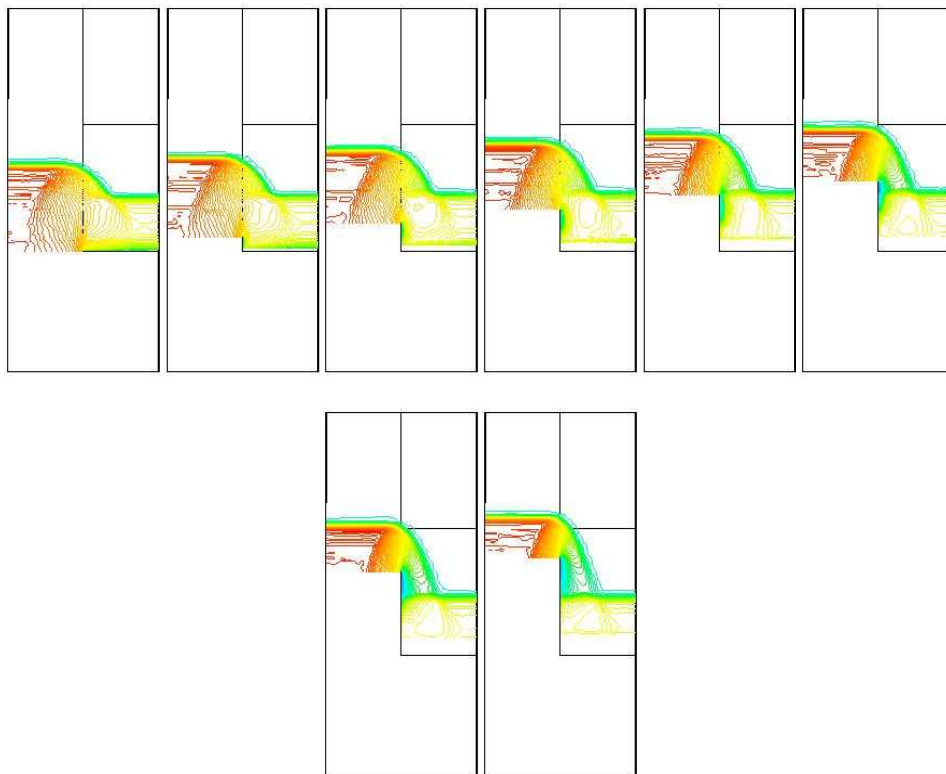


Figure 99: Enlarged sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

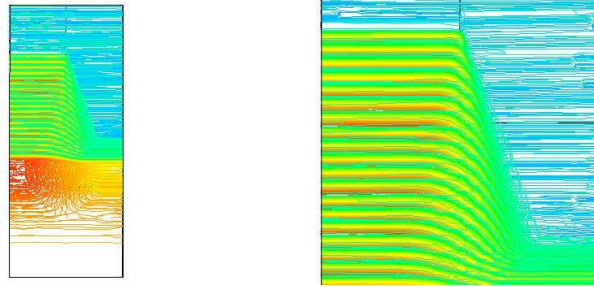


Figure 100: Overlaid density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane.

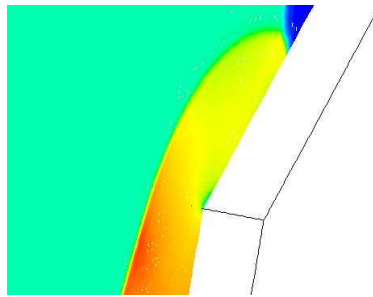


Figure 101: Filled density contour plot of plane in y-z plane for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, illustrating shear layer.

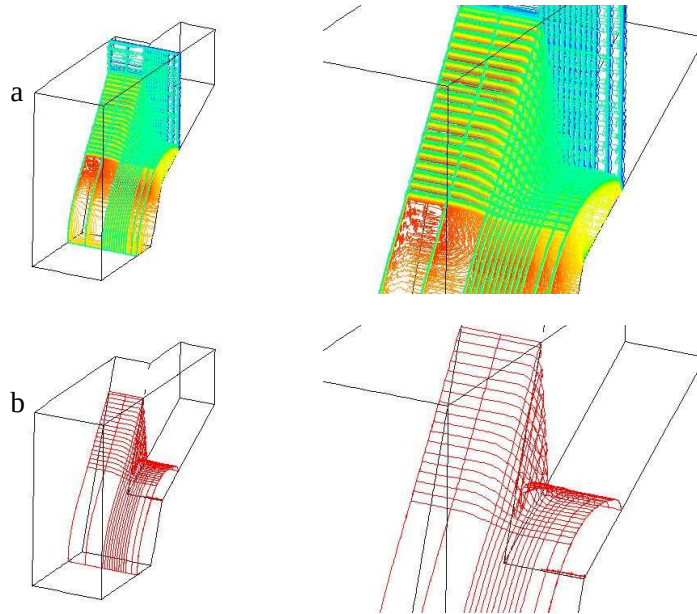
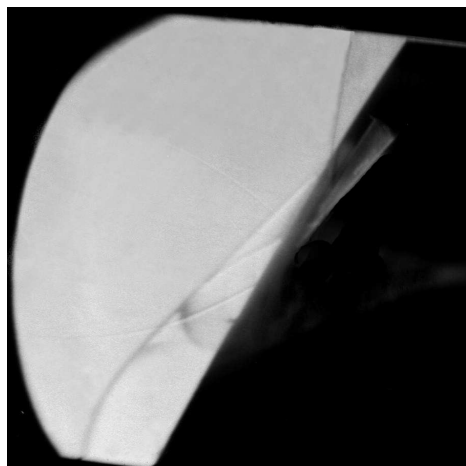
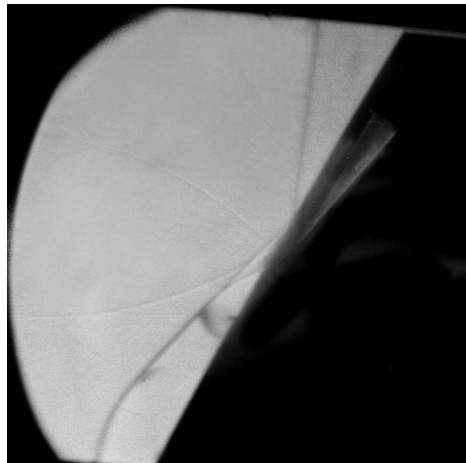
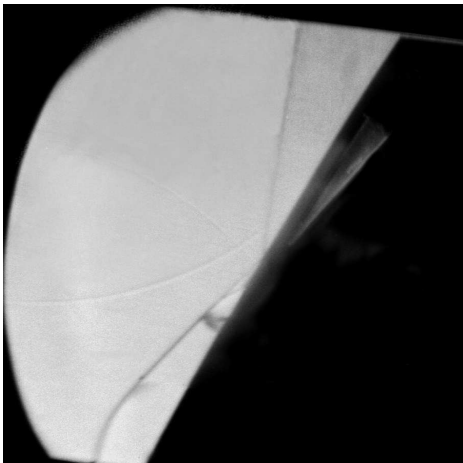
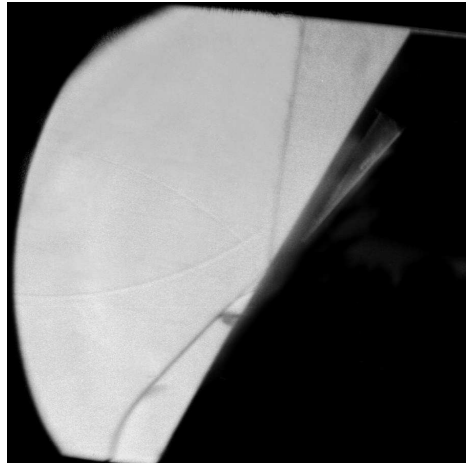
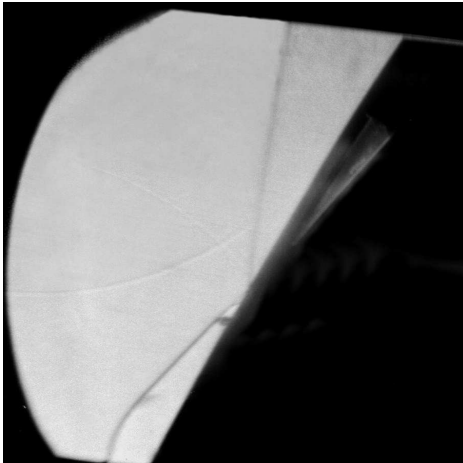


Figure 102: Isometric view of overlaid planes for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$.

a) Entire flow field b) Secondary reflected wave

F.1.8 Rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$



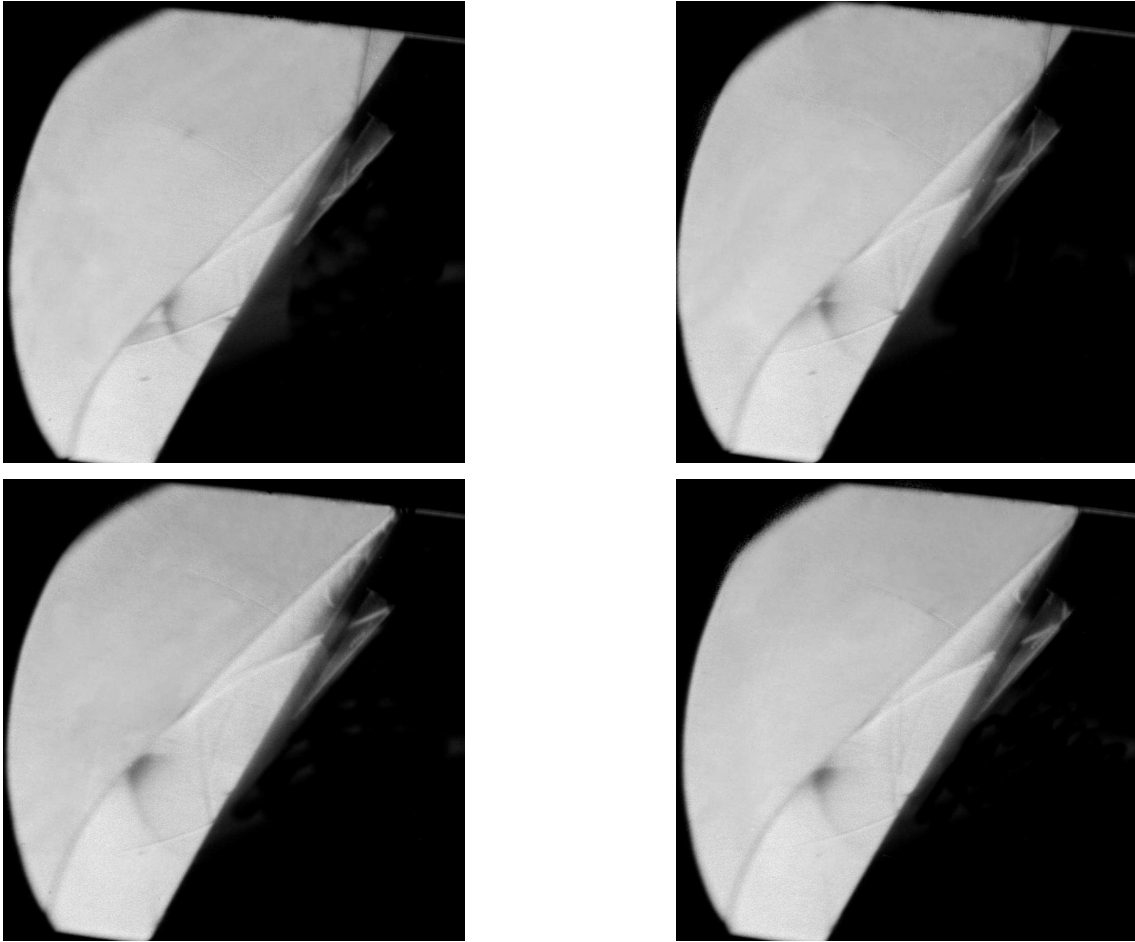
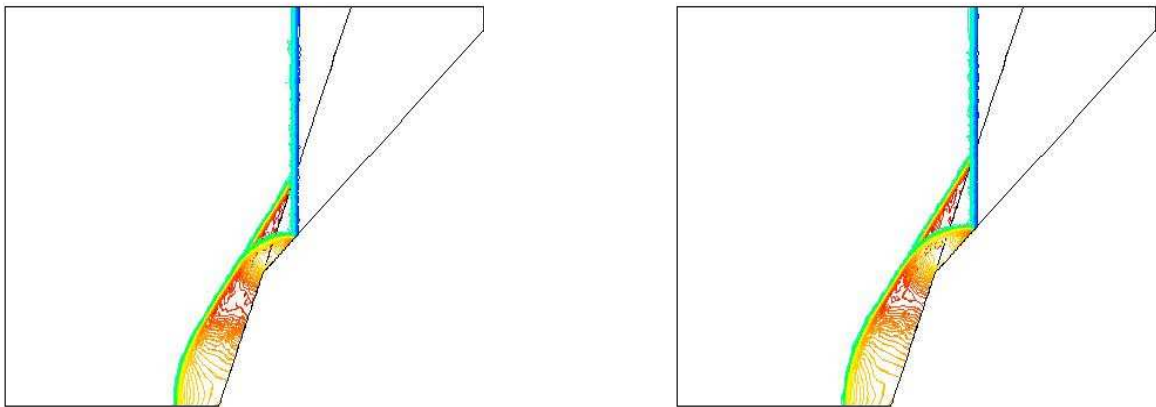


Figure 103: Schlieren images for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, at time delay $1615\mu\text{s}$, $1625\mu\text{s}$, $1635\mu\text{s}$, $1645\mu\text{s}$, $1655\mu\text{s}$, $1665\mu\text{s}$, $1675\mu\text{s}$, $1685\mu\text{s}$, $1695\mu\text{s}$, and $1705\mu\text{s}$ respectively.



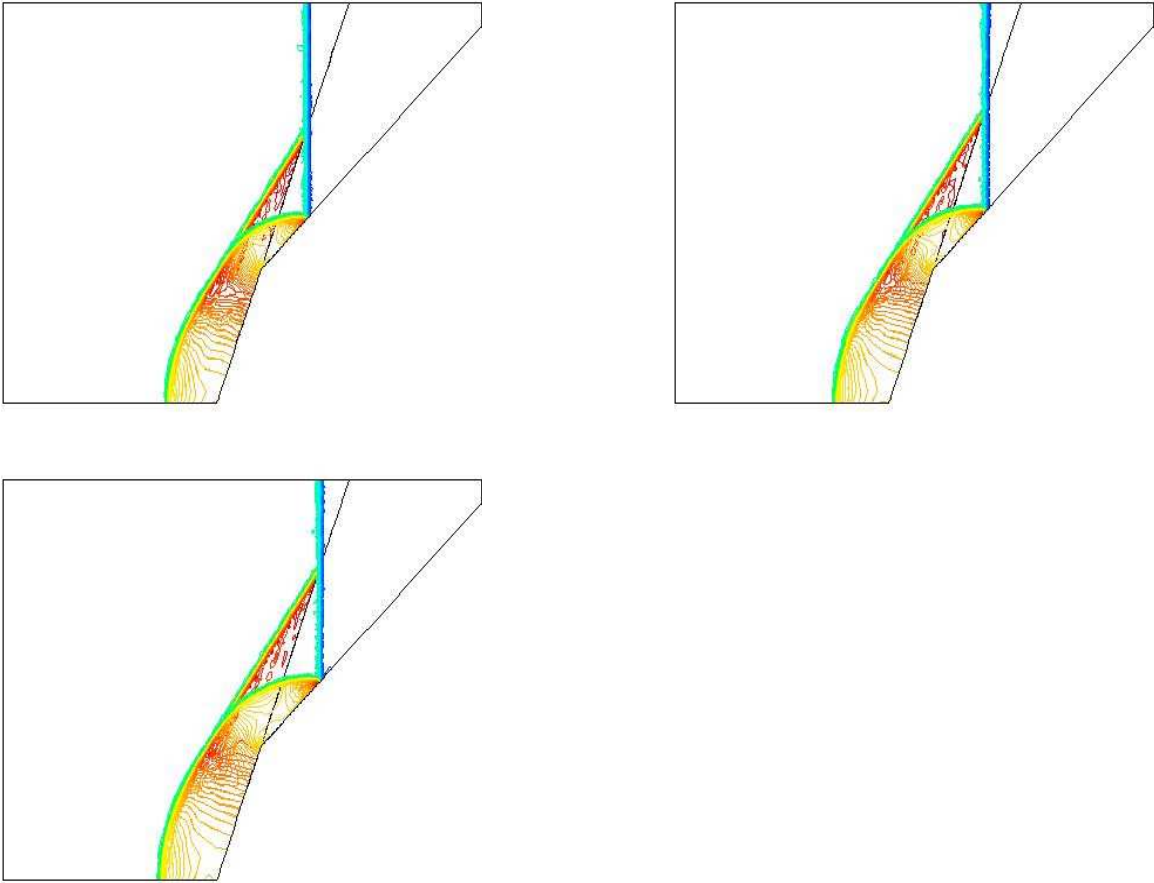


Figure 104: Sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$.

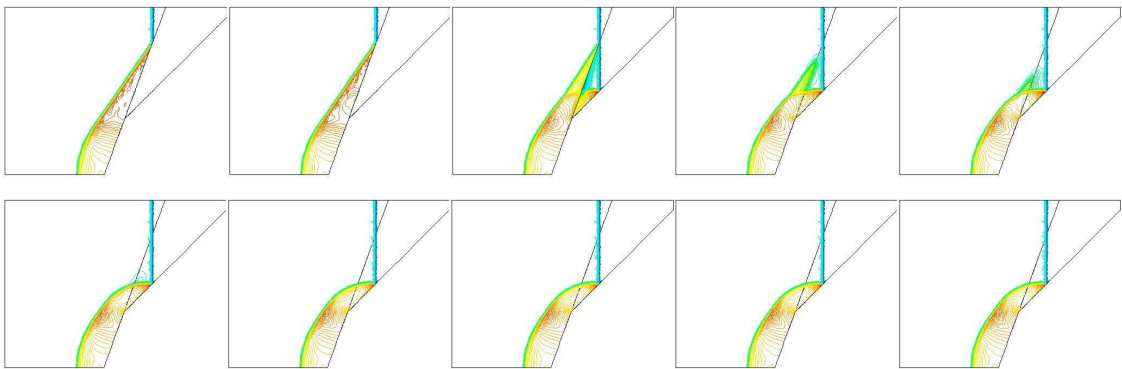


Figure 105: Density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 18.75mm , 37.5mm , 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm , 68.75mm , 75mm respectively.

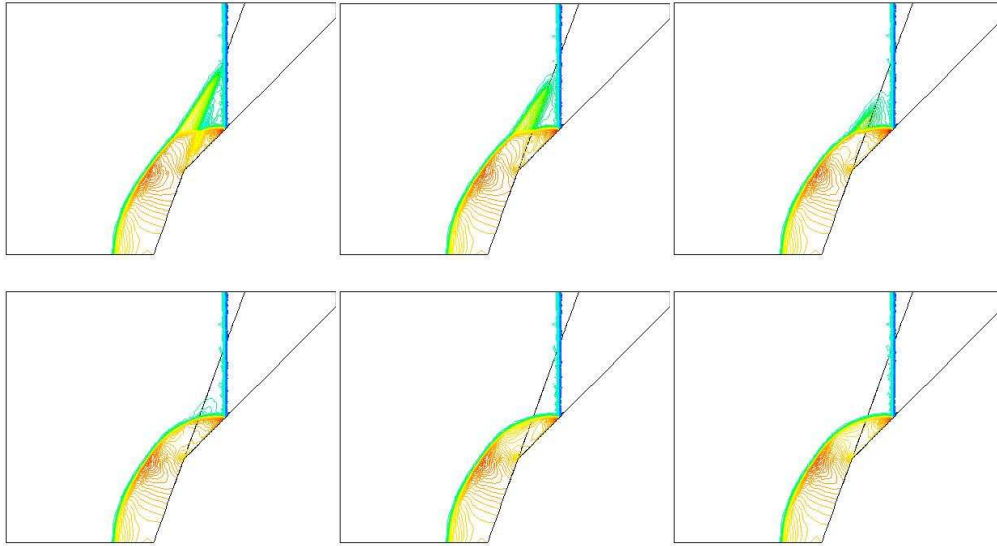


Figure 106: Enlarged density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the y-z plane at $x = 40\text{mm}$, 42.5mm , 47.5mm , 52.5mm , 57.5mm , 62.5mm respectively.

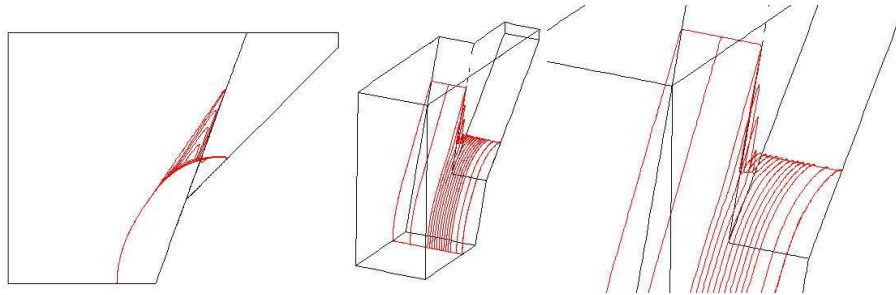


Figure 107: Overlaid pressure contour plots (single level) of secondary reflected wave for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$.

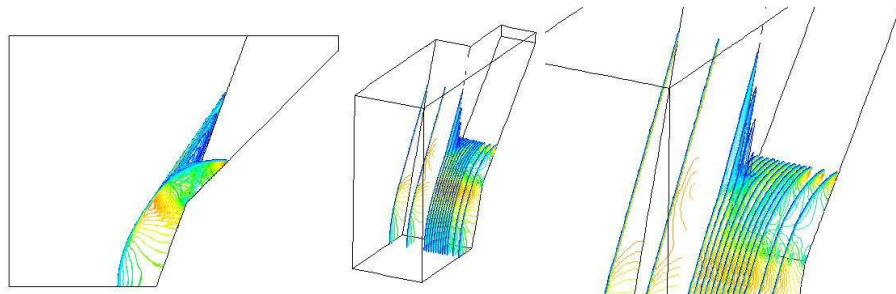


Figure 108: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$.

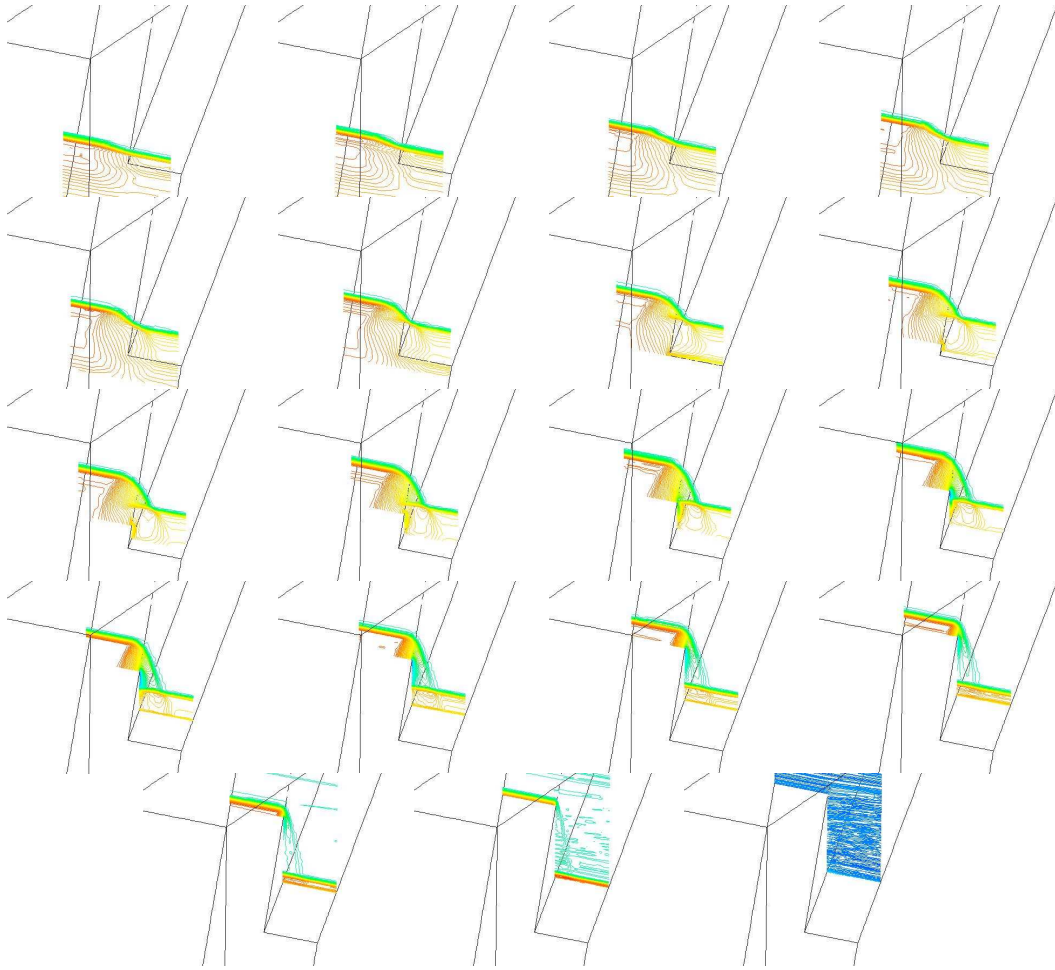


Figure 109: Isometric views of sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

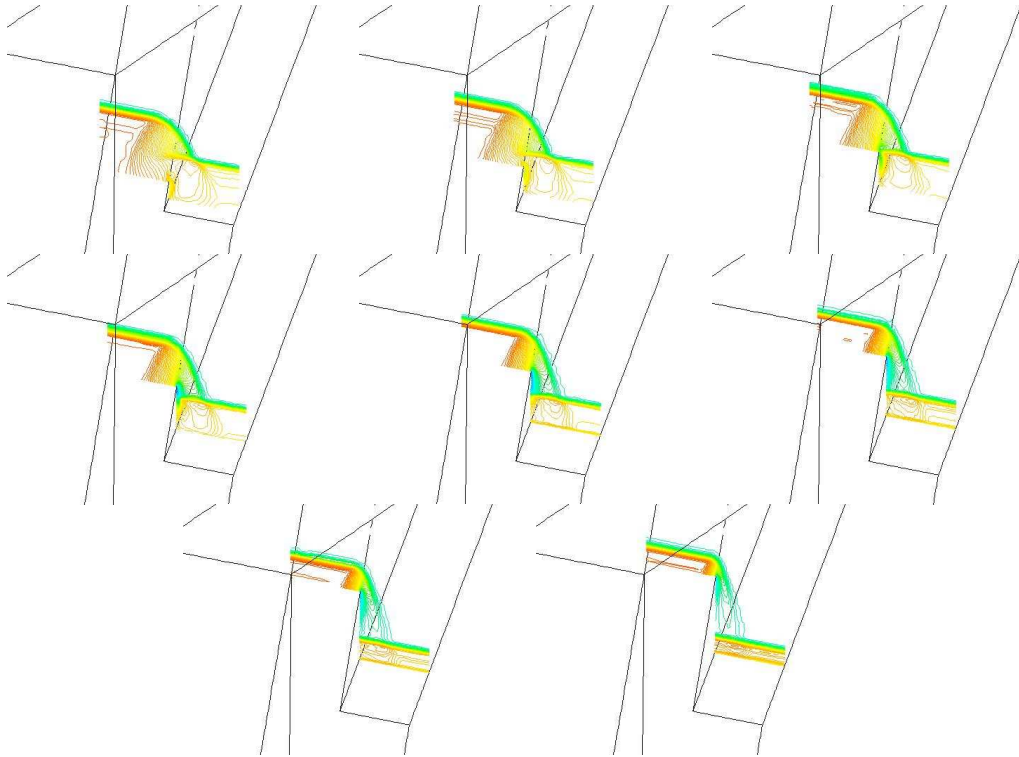


Figure 110: Enlarged isometric views of sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

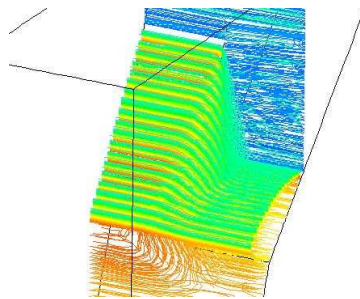


Figure 111: Isometric view of overlaid density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane.

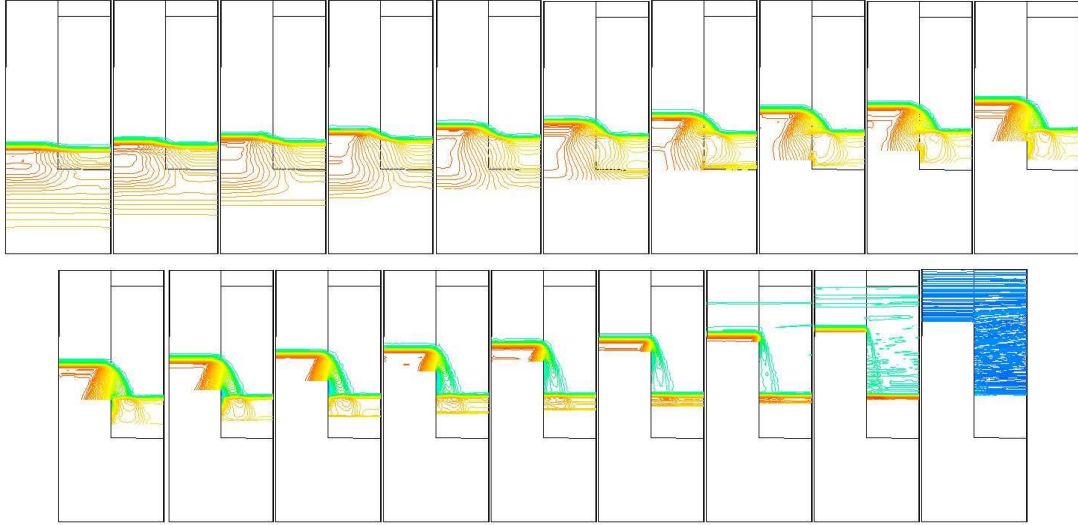


Figure 112: Sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane in steps of 2.5mm along the z axis.

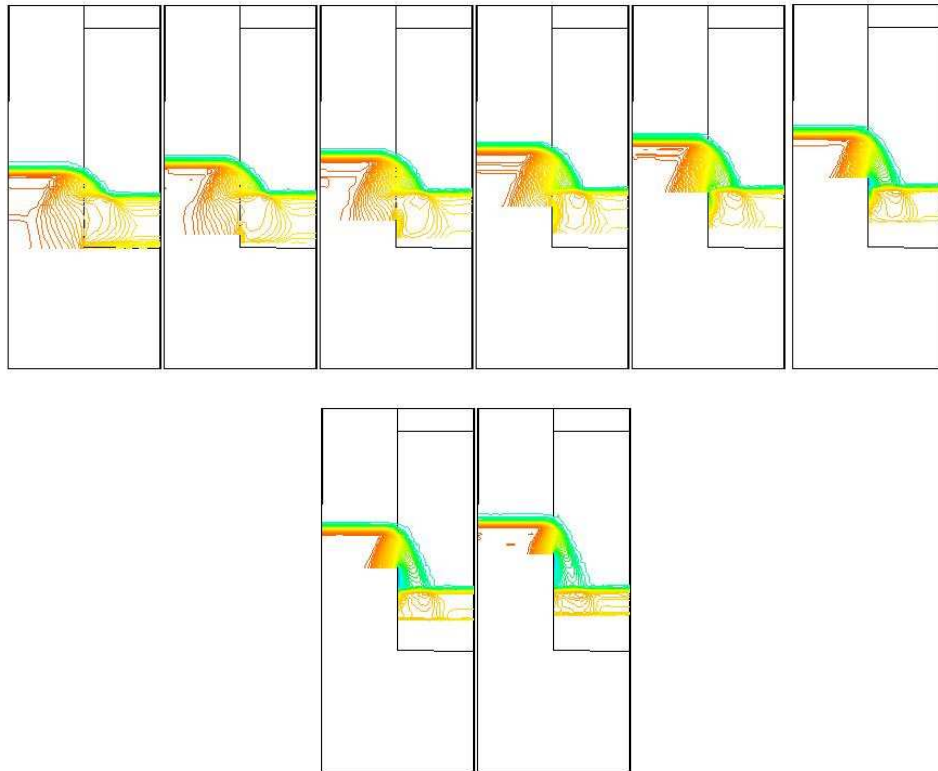


Figure 113: Enlarged sequential density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y in steps of 2.5mm along the z axis.

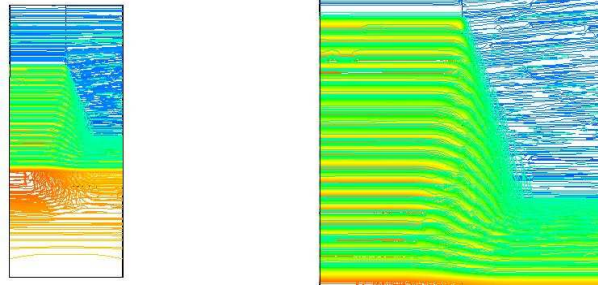


Figure 114: Overlaid density contour plots for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane.

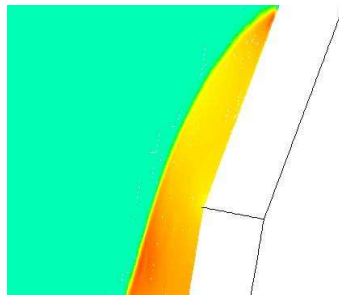


Figure 115: Filled density contour plot of plane in y-z plane for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, illustrating shear layer.

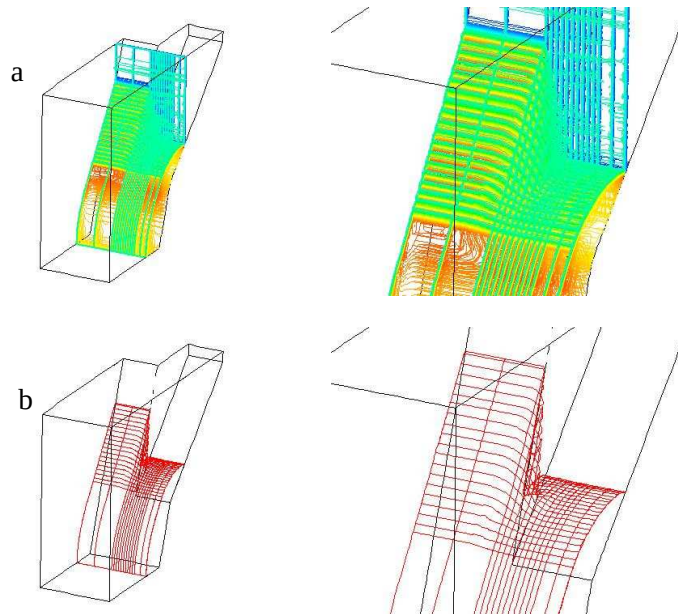


Figure 116: Isometric view of overlaid planes for rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$.

a) Entire flow field b) Secondary reflected wave

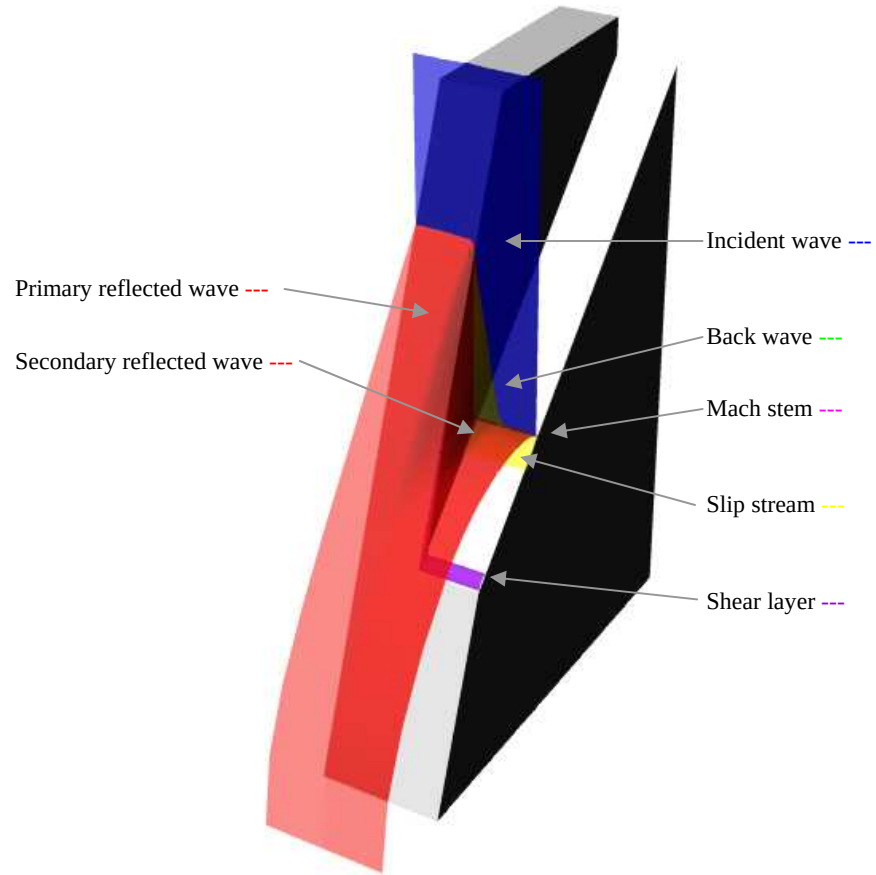


Figure 117: Three-dimensional NURBS model of rectangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$.

F.2 Triangular valley results

F.2.1 Triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$

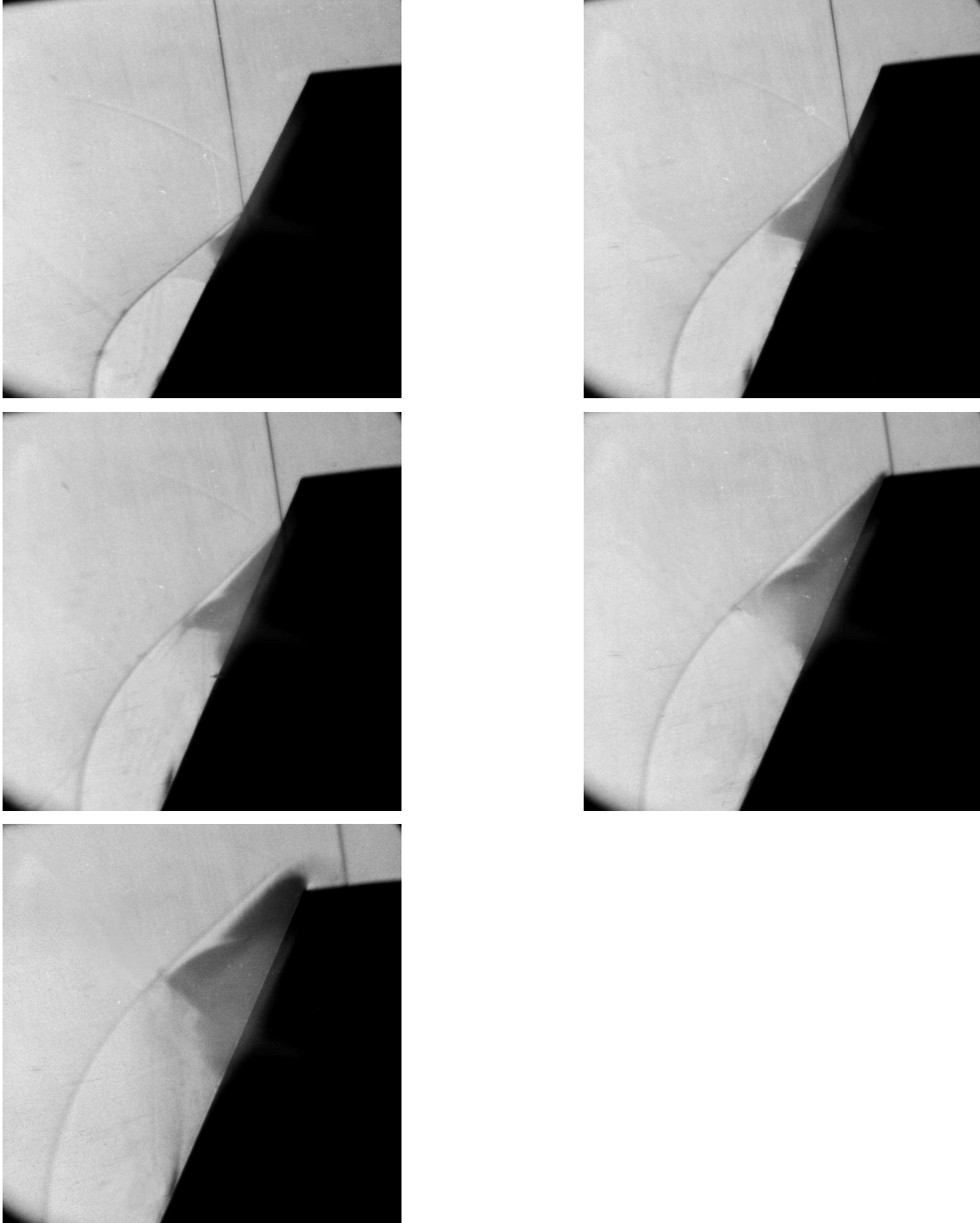


Figure 118: Schlieren images for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, at time delay $1700\mu\text{s}$, $1725\mu\text{s}$, $1750\mu\text{s}$, $1775\mu\text{s}$, and $1800\mu\text{s}$ respectively.

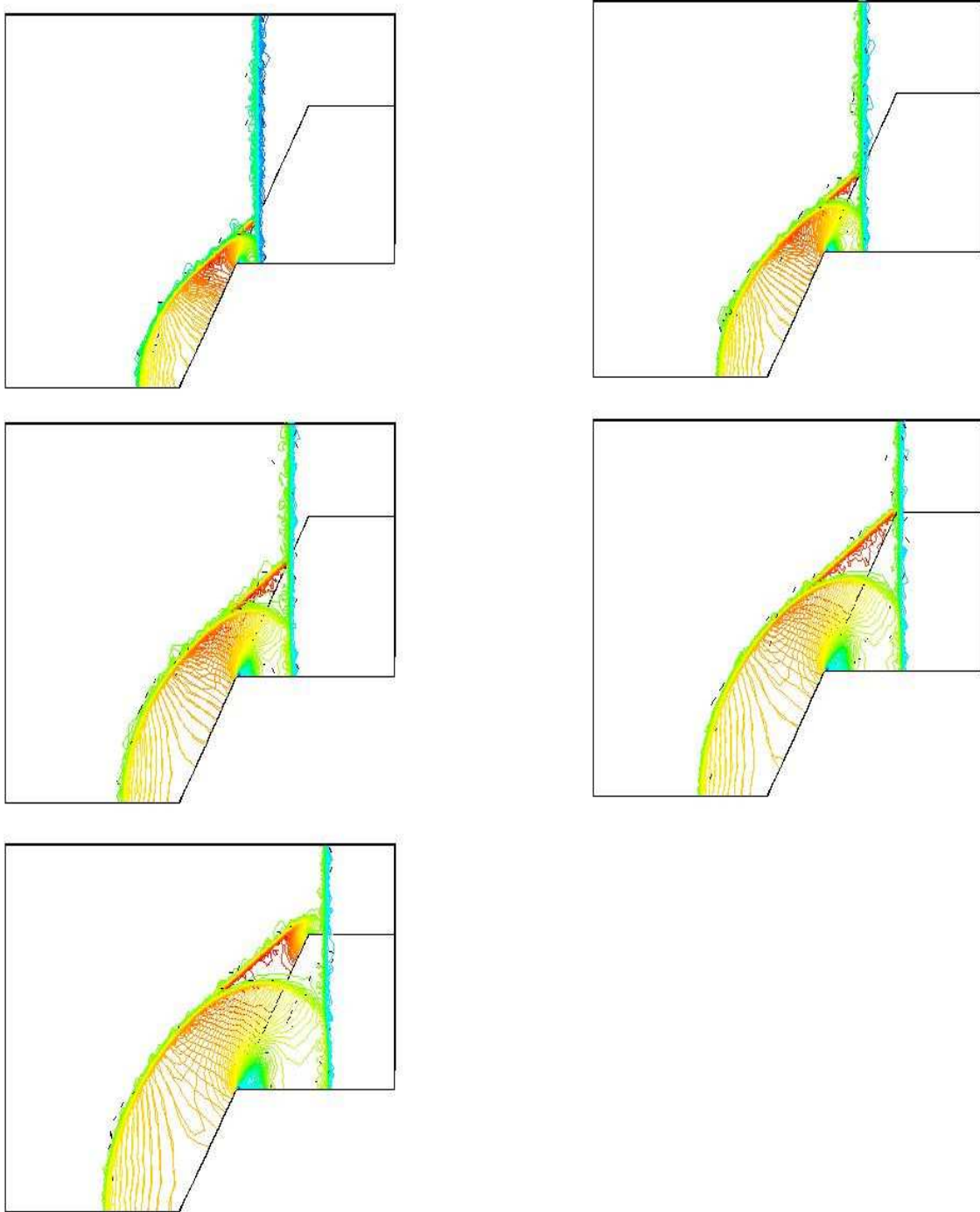


Figure 119: Sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$.

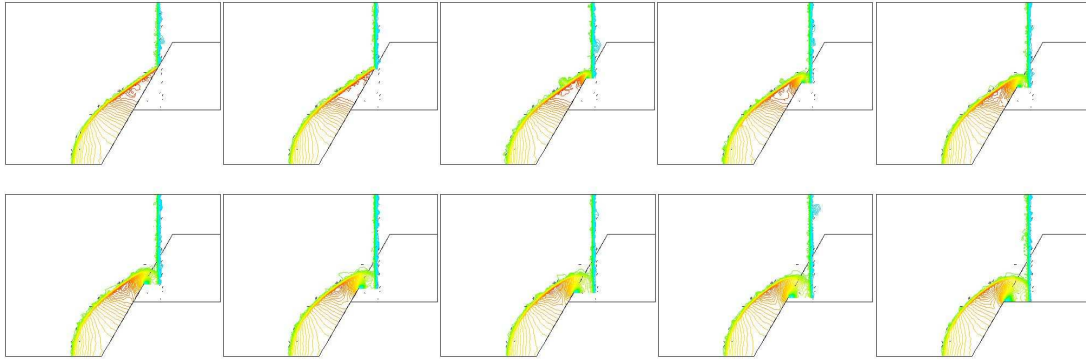


Figure 120: Density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 25mm , 35mm , 45mm , 50mm , 55mm , 60mm , 65mm , 70mm and 75mm respectively.

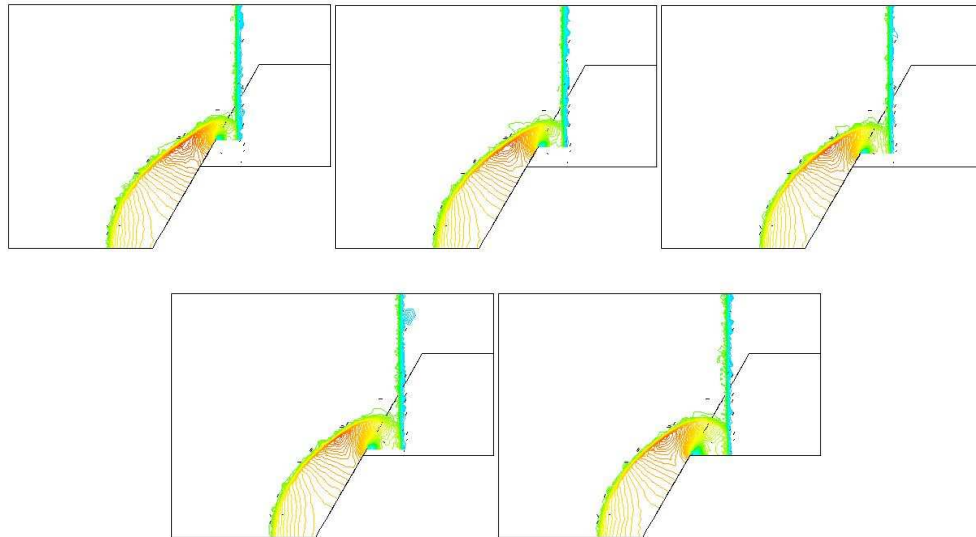


Figure 121: Enlarged density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the y-z plane at $x = 55\text{mm}$, 60mm , 65mm , 70mm , and 75mm respectively.

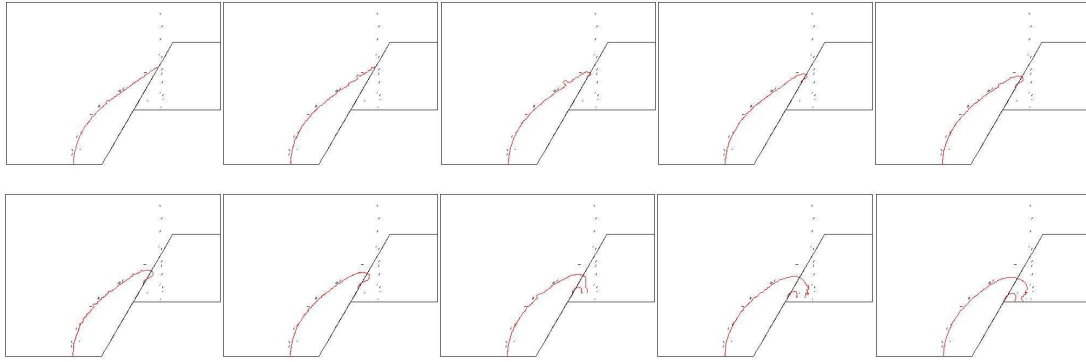


Figure 122: Pressure contour plots (single level) of secondary reflected wave for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 25mm , 35mm , 45mm , 50mm , 55mm , 60mm , 65mm , 70mm and 75mm respectively.

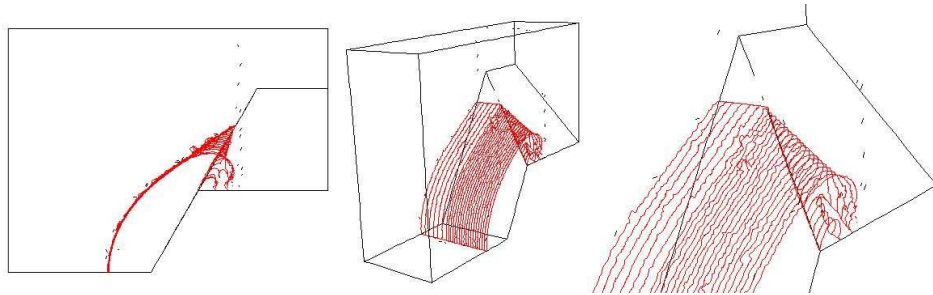


Figure 123: Overlaid pressure contour plots (single level) of secondary reflected wave for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$.

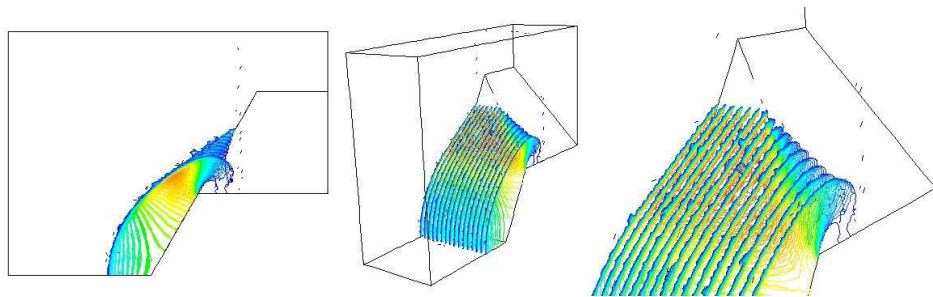


Figure 124: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$.

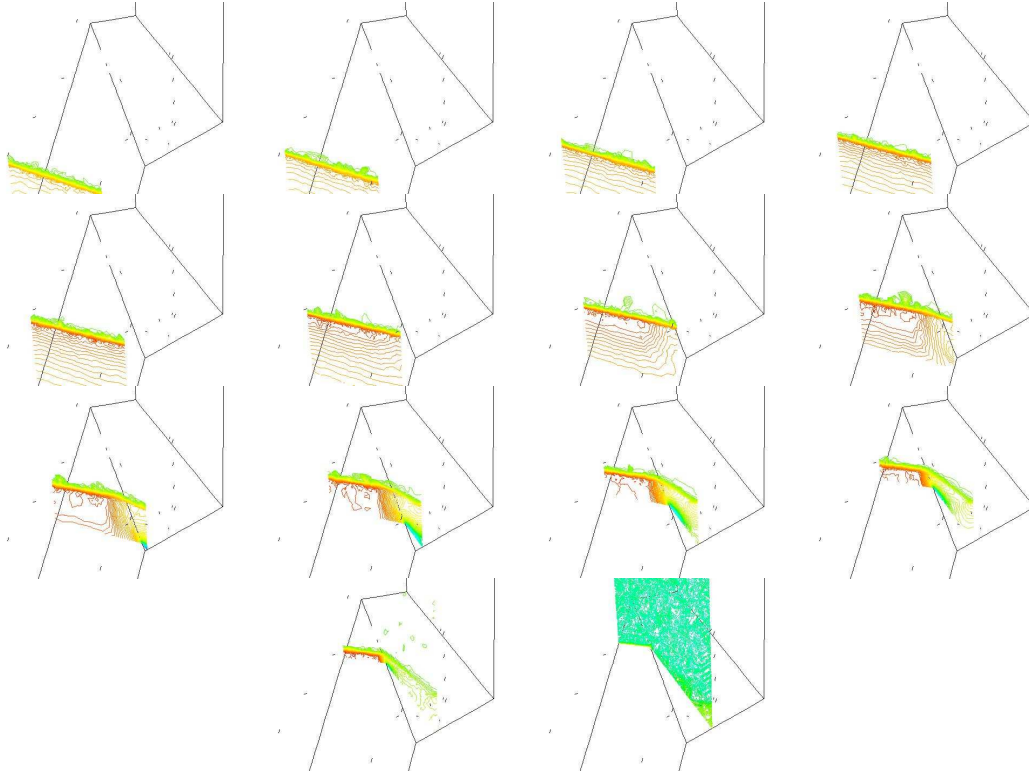


Figure 125: Isometric views of sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 5mm along the z axis.

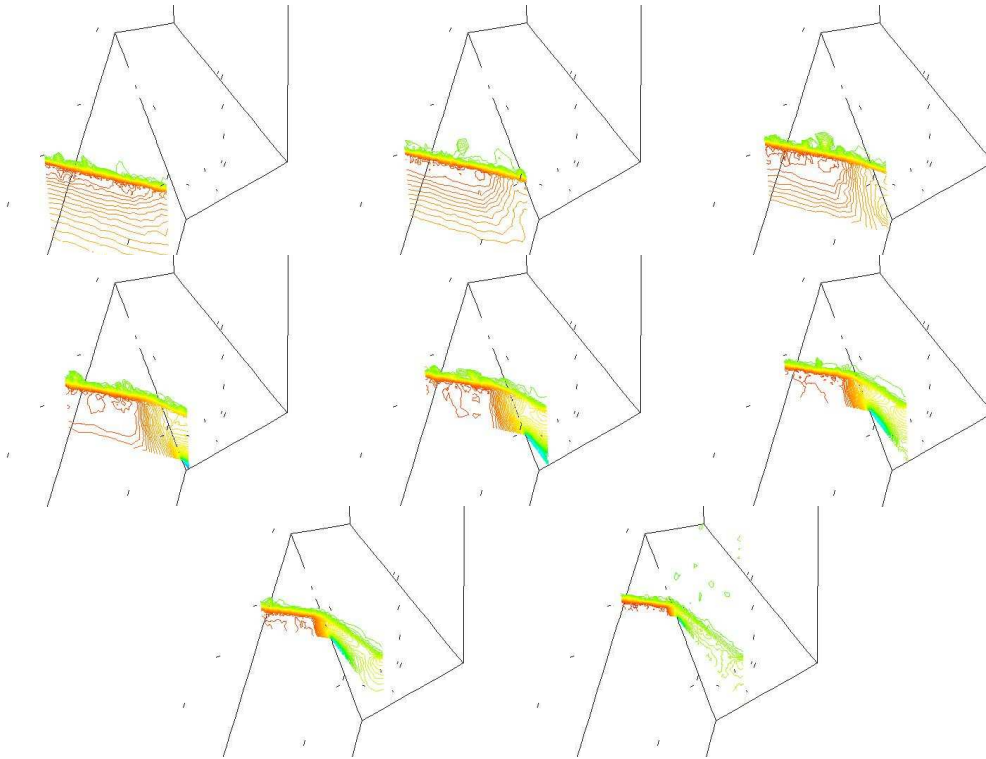


Figure 126: Enlarged isometric views of sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 5mm along the z axis.

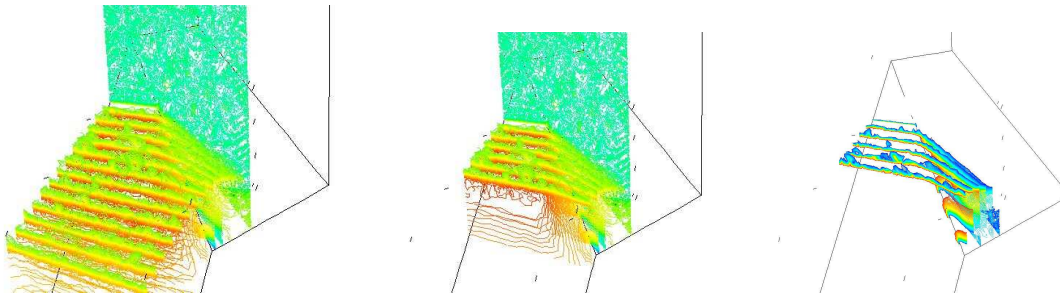


Figure 127: Isometric view of overlaid density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane.

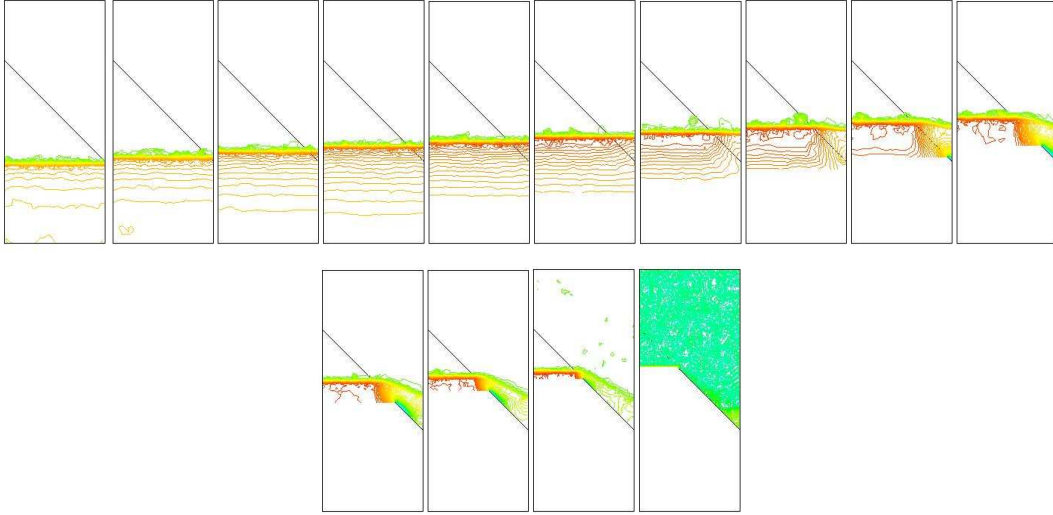


Figure 128: Sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

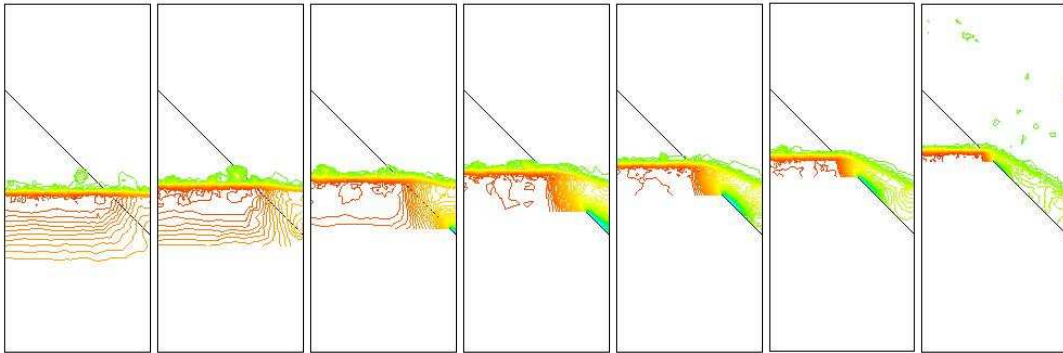


Figure 129: Enlarged sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 5mm along the z axis.

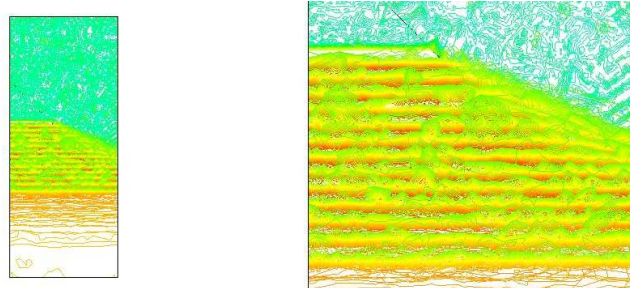


Figure 130: Overlaid density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane.

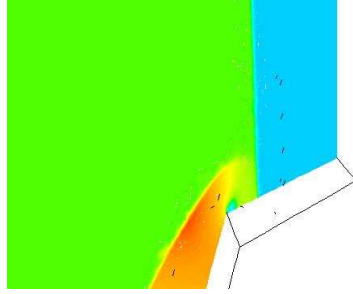


Figure 131: Filled density contour plot of plane in y-z plane for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$, illustrating shear layer.

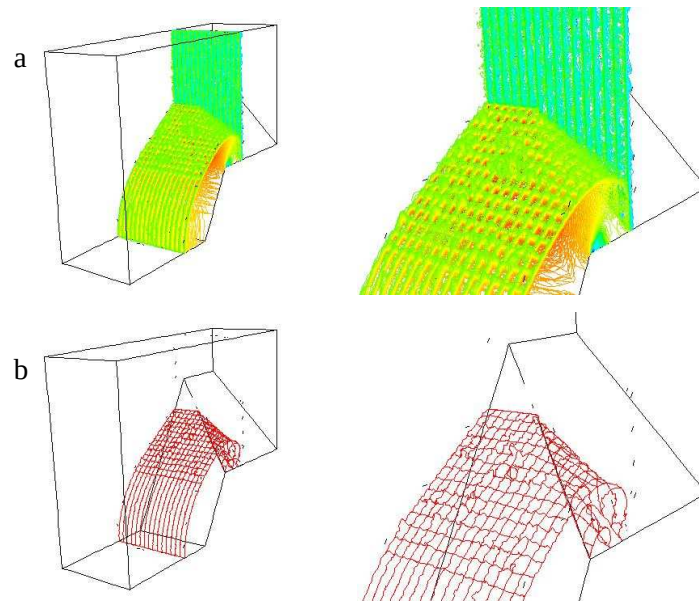


Figure 132: Isometric view of overlaid planes for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$.

a) Entire flow field b) Secondary reflected wave

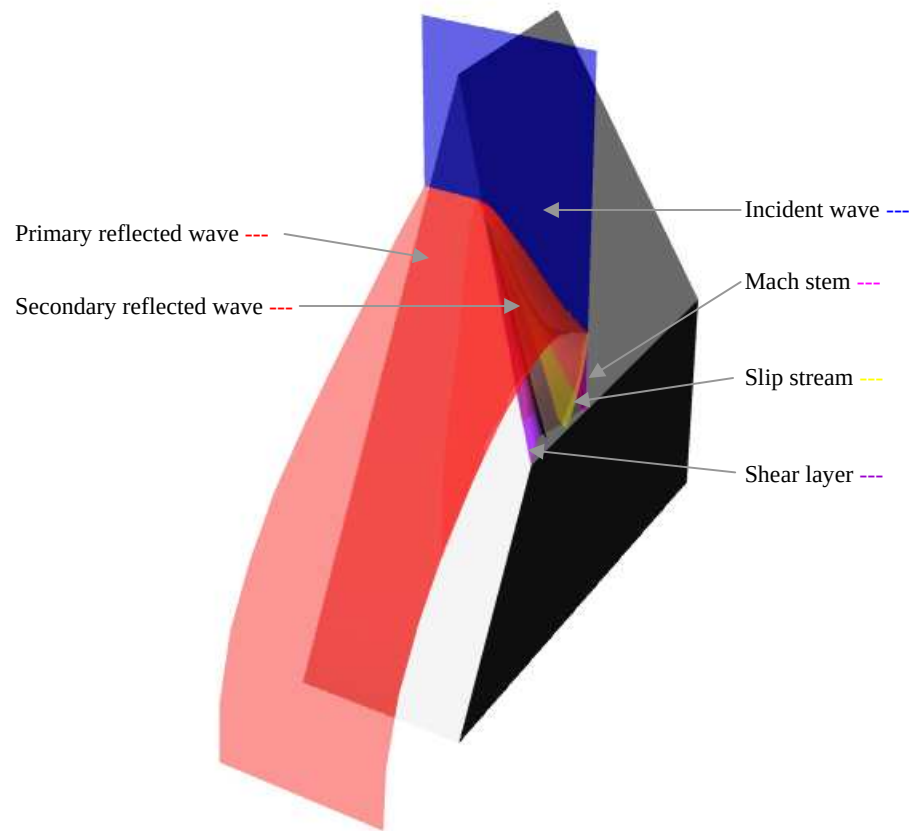
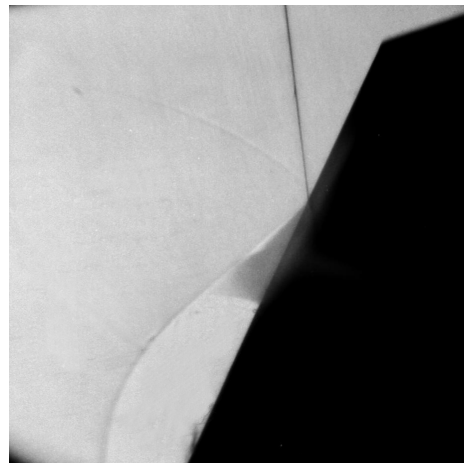
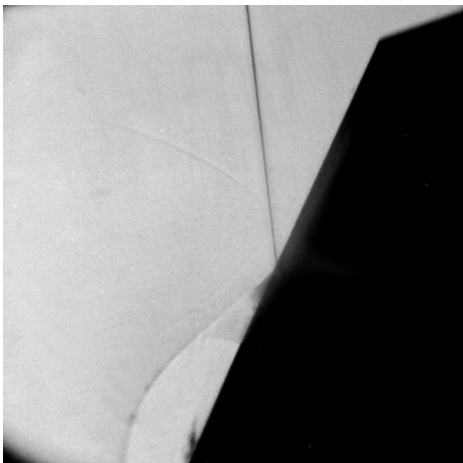


Figure 133: Three-dimensional NURBS model of triangular valley, $\theta_w = 60^\circ$, $\theta_v = 0^\circ$.

F.2.2 Triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$



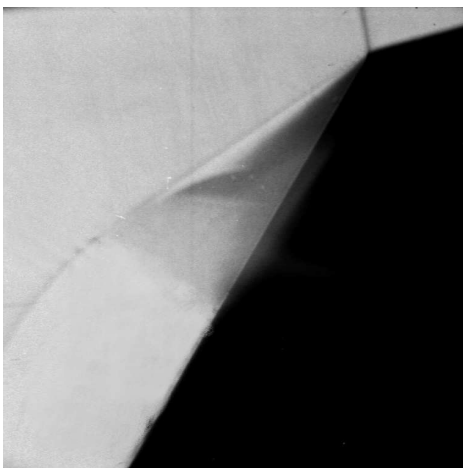
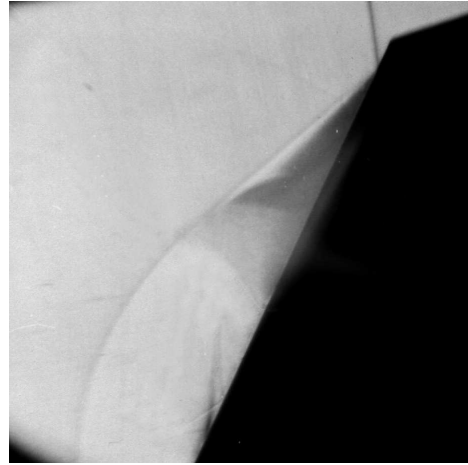
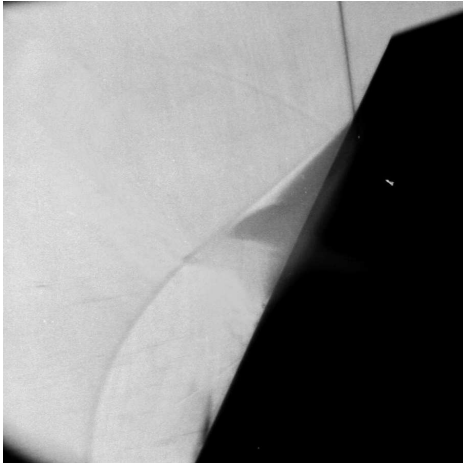
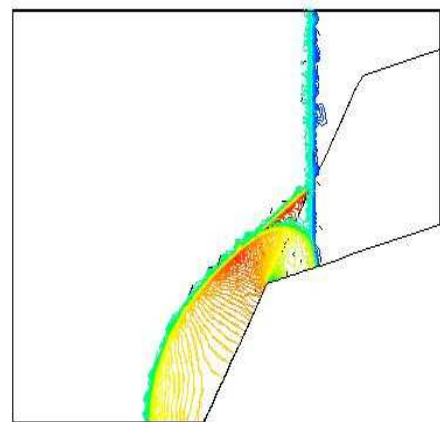
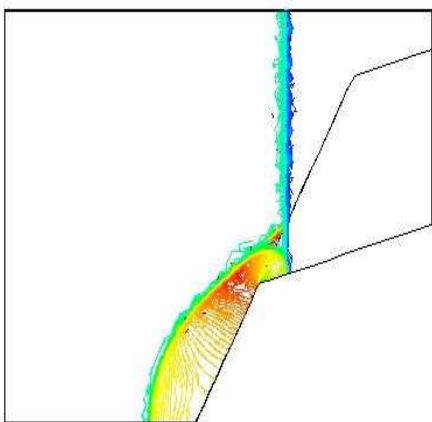


Figure 134: Schlieren images for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, at time delay $1700\mu\text{s}$, $1725\mu\text{s}$, $1750\mu\text{s}$, $1775\mu\text{s}$, and $1800\mu\text{s}$ respectively.



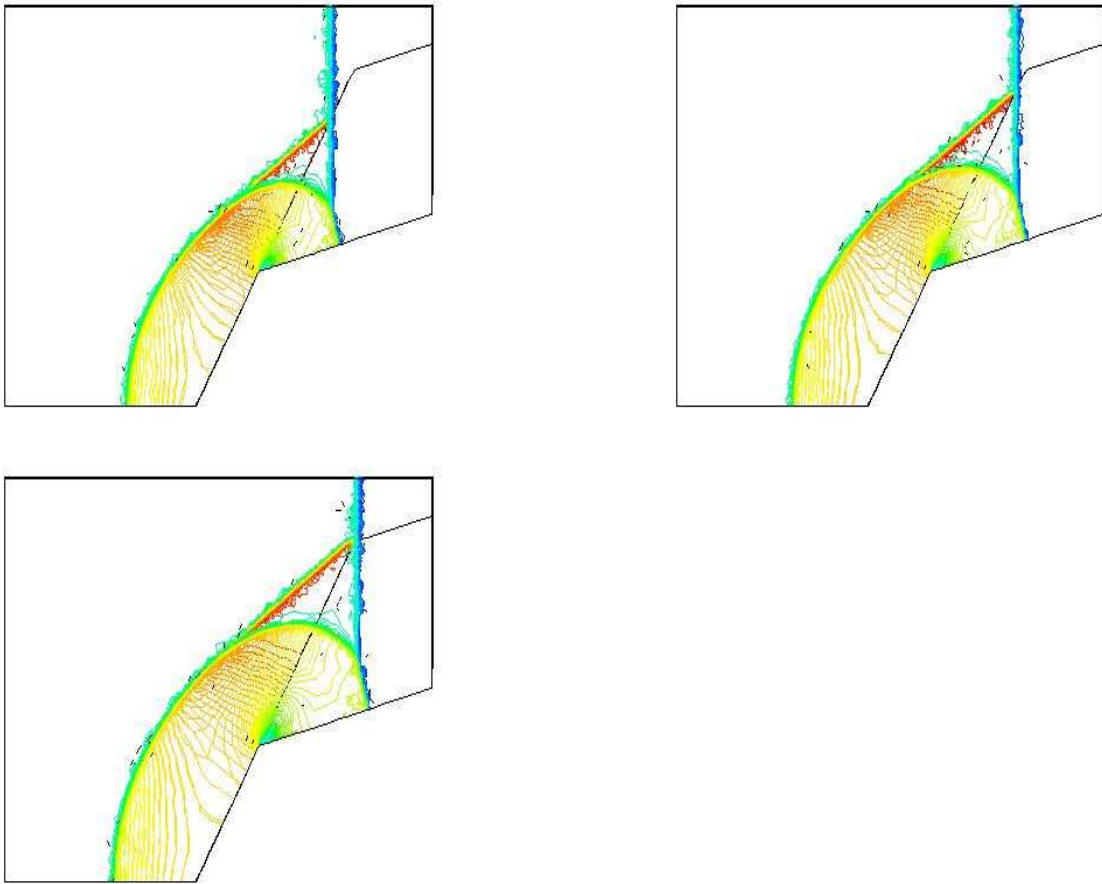


Figure 135: Sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$.

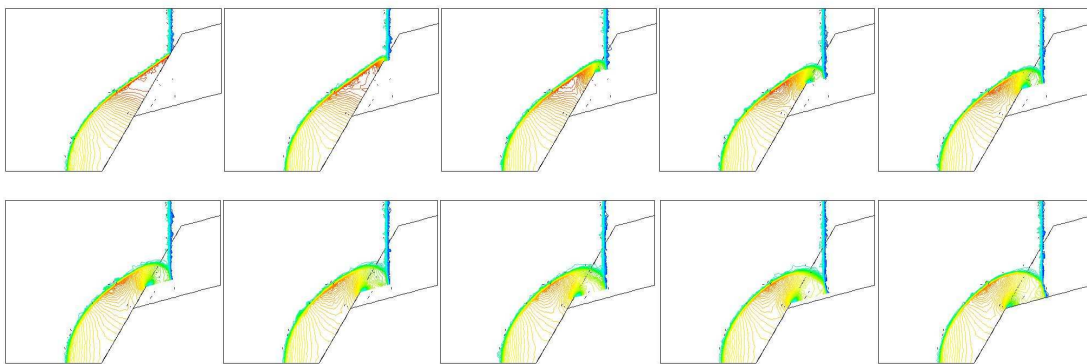


Figure 136: Density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 25mm , 35mm , 45mm , 50mm , 55mm , 60mm , 65mm , 70mm and 75mm respectively.

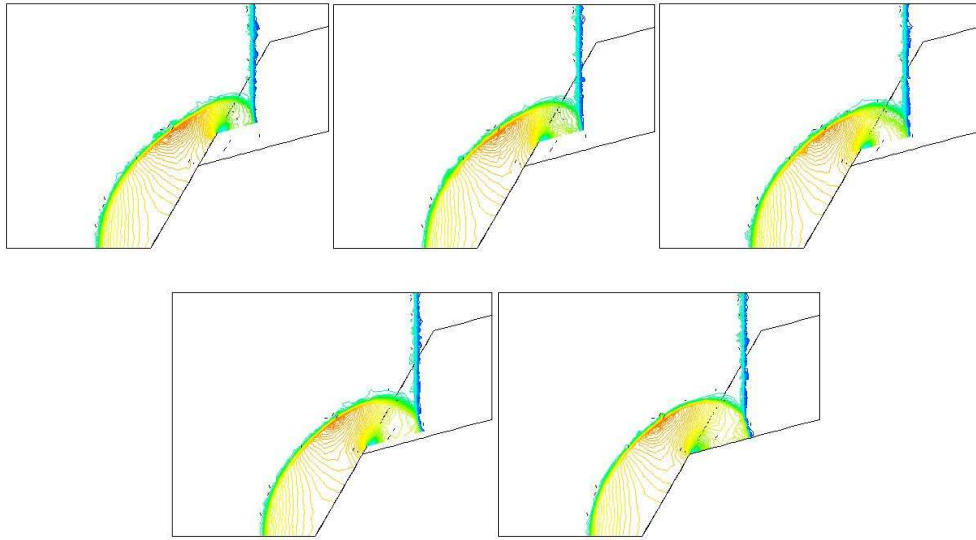


Figure 137: Enlarged density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the y-z plane at $x = 55\text{mm}$, 60mm , 65mm , 70mm , and 75mm respectively.

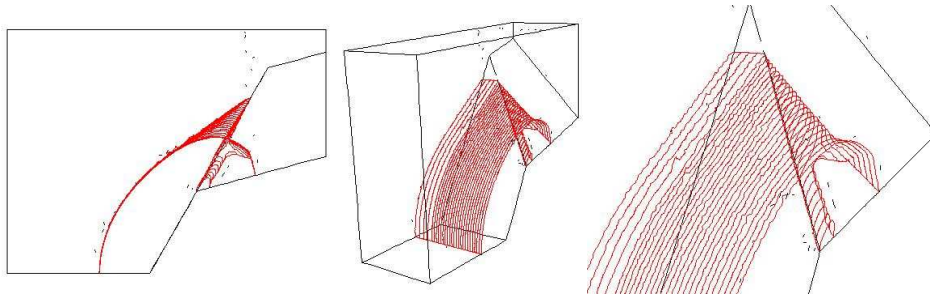


Figure 138: Overlaid pressure contour plots (single level) of secondary reflected wave for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$.

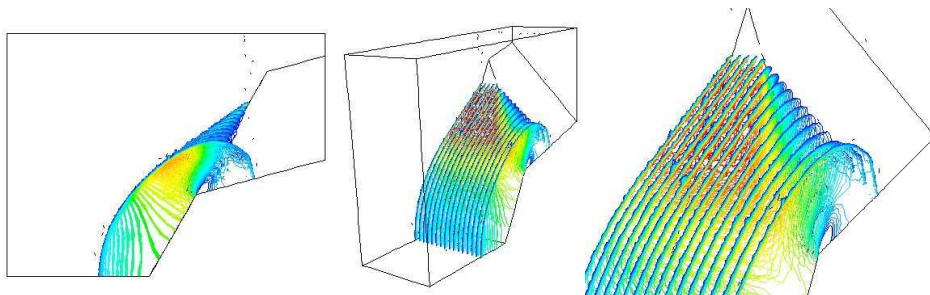


Figure 139: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$.

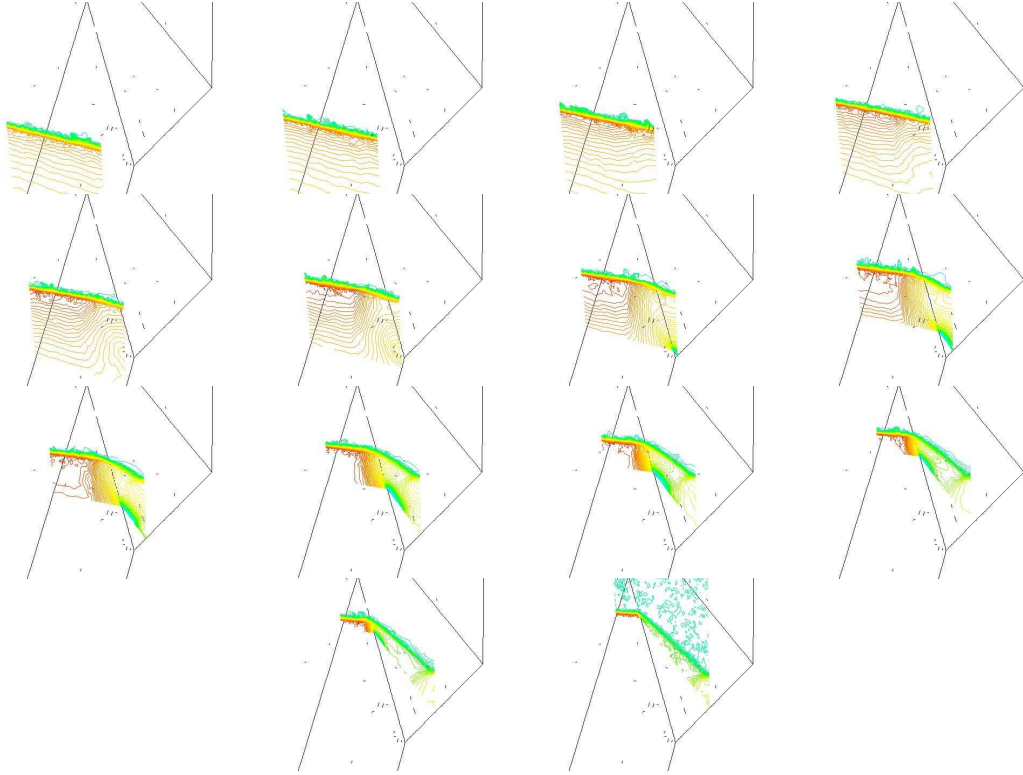


Figure 140: Isometric views of sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 5mm along the z axis.

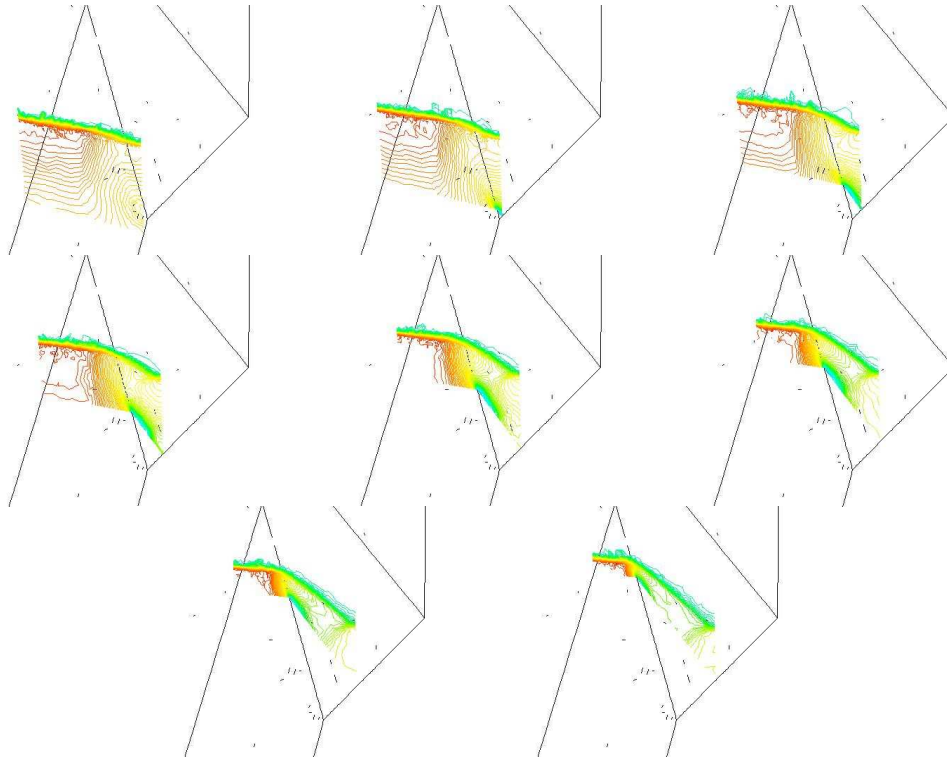


Figure 141: Enlarged isometric views of sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 5mm along the z axis.

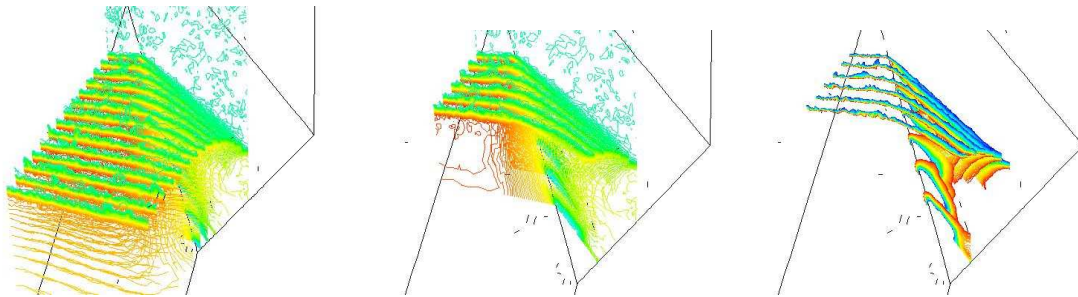


Figure 142: Isometric view of overlaid density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane.

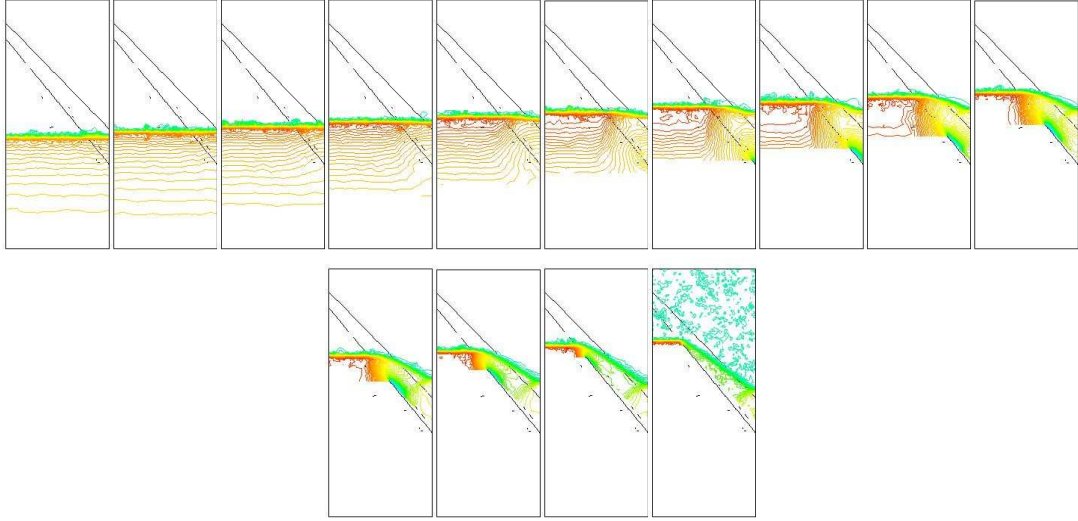


Figure 143: Sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

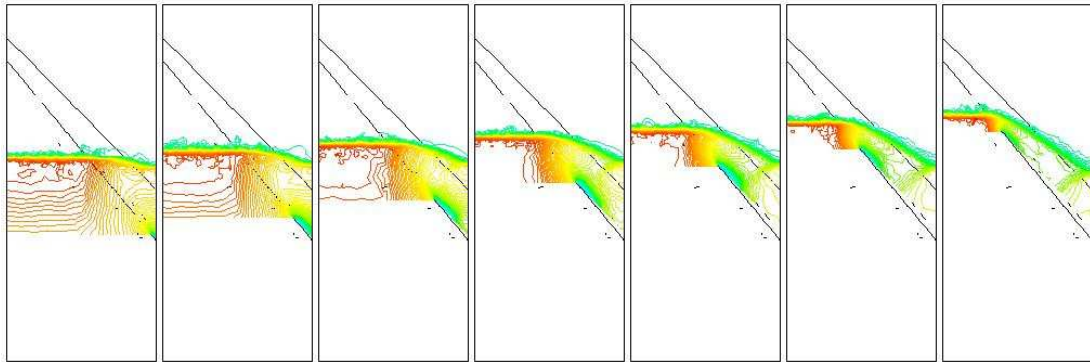


Figure 144: Enlarged sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 5mm along the z axis.

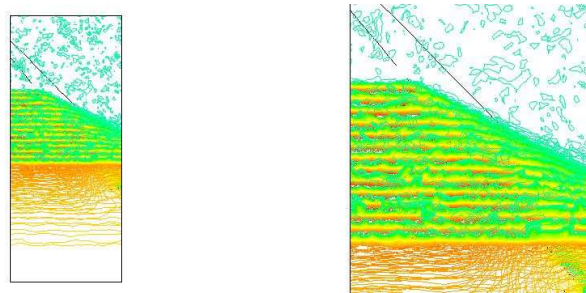


Figure 145: Overlaid density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane.

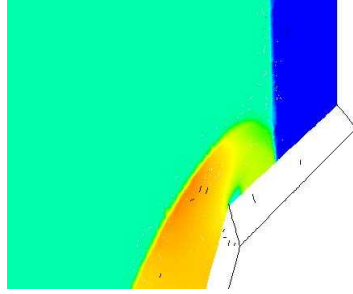


Figure 146: Filled density contour plot of plane in y-z plane for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$, illustrating shear layer.

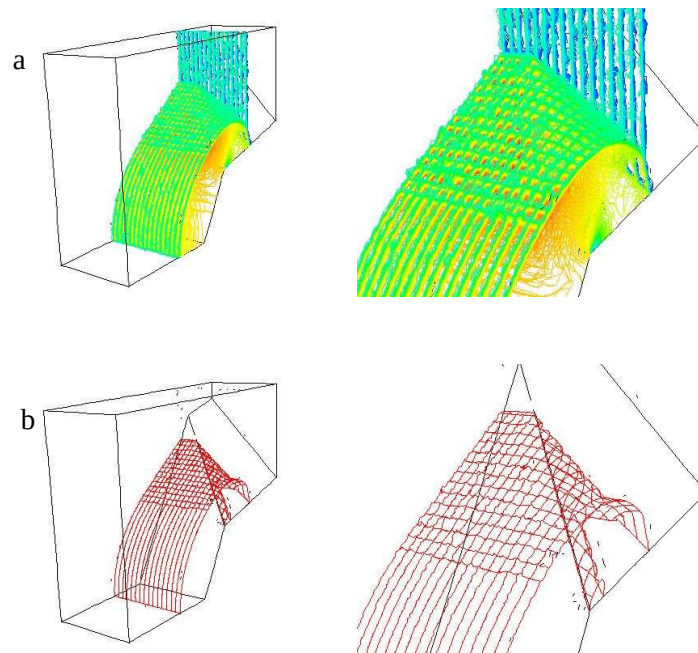


Figure 147: Isometric view of overlaid planes for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 15^\circ$.

a) Entire flow field b) Secondary reflected wave

F.2.3 Triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$

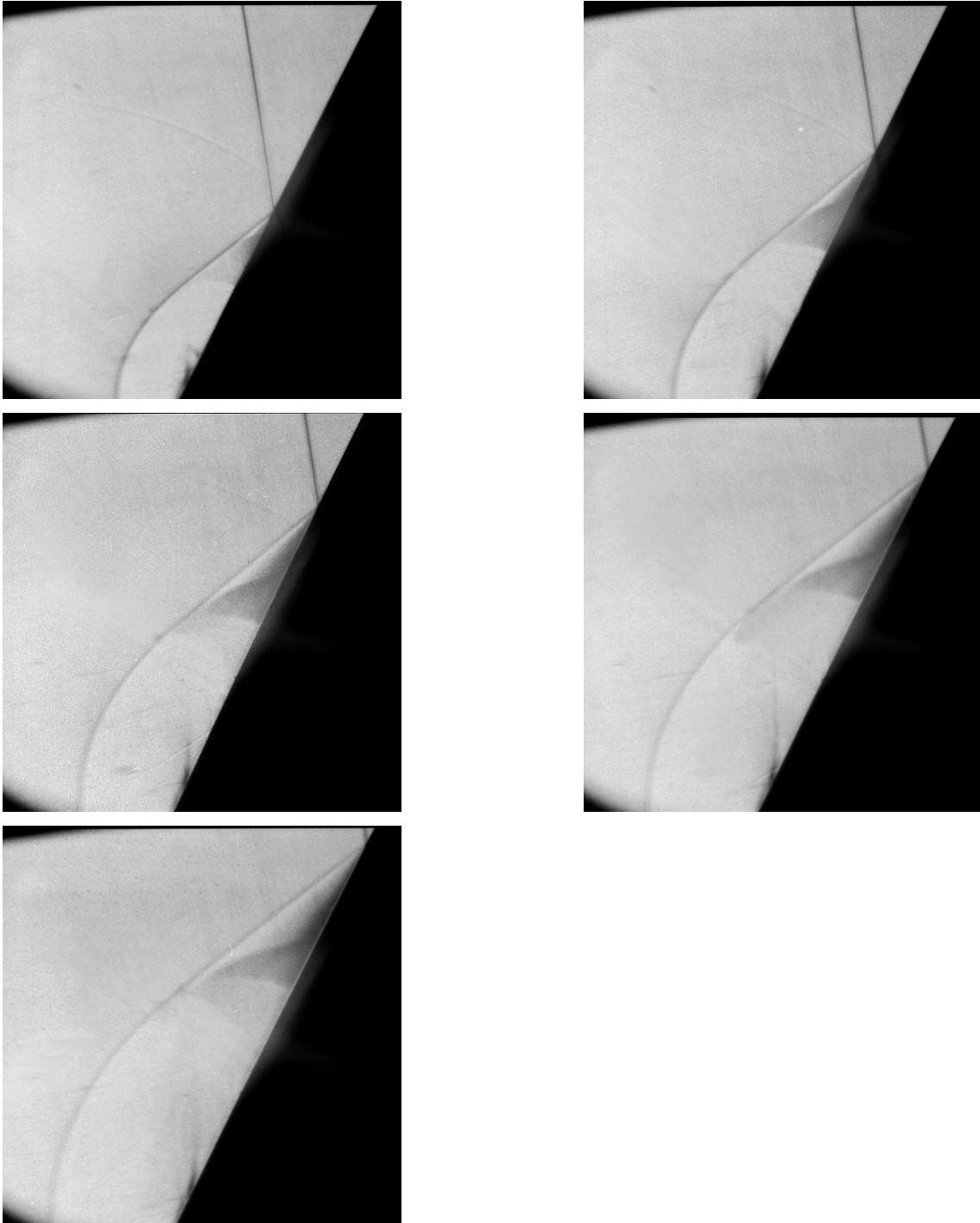


Figure 148: Schlieren images for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, at time delay $1700\mu\text{s}$, $1725\mu\text{s}$, $1750\mu\text{s}$, $1775\mu\text{s}$, and $1800\mu\text{s}$ respectively.

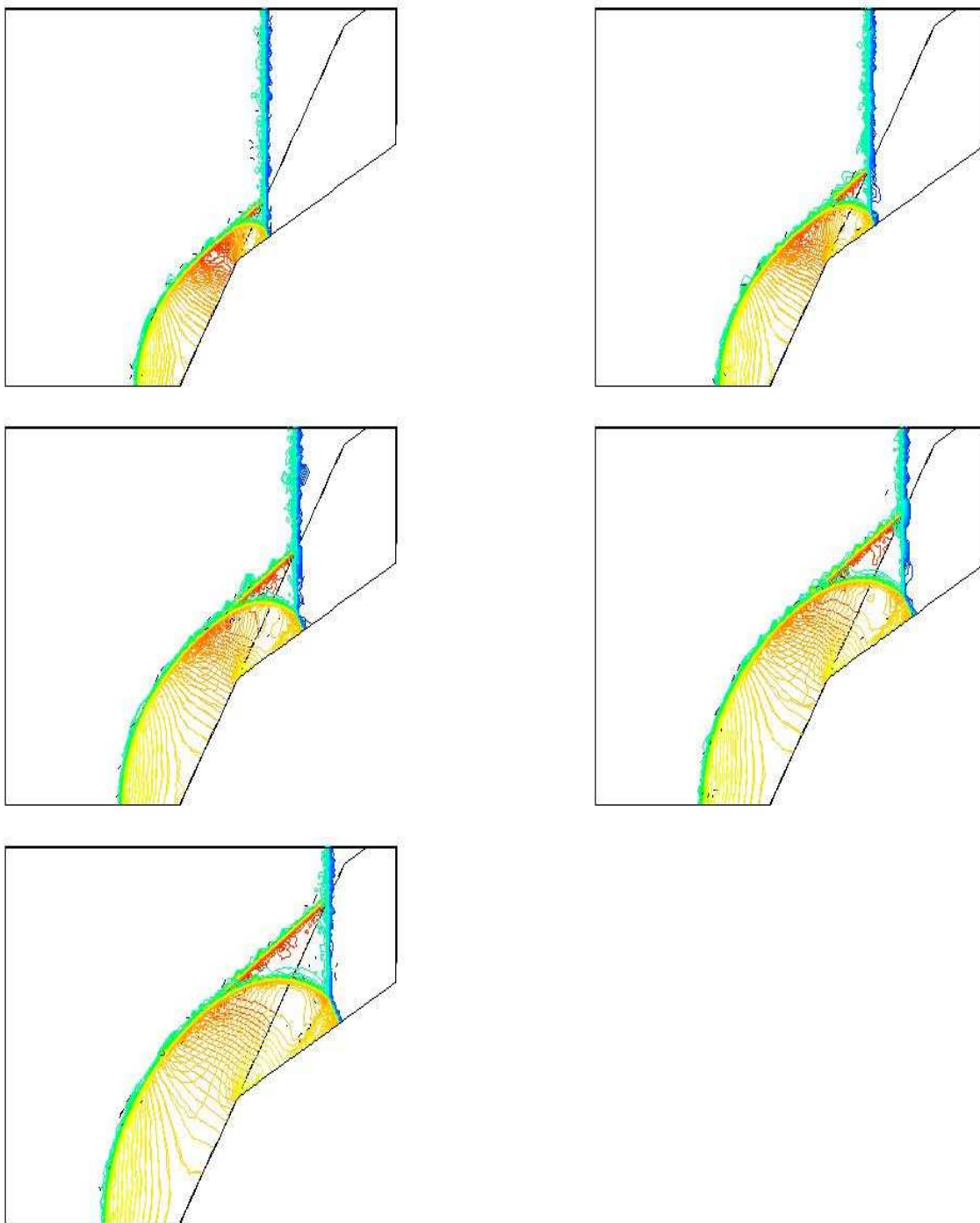


Figure 149: Sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$.

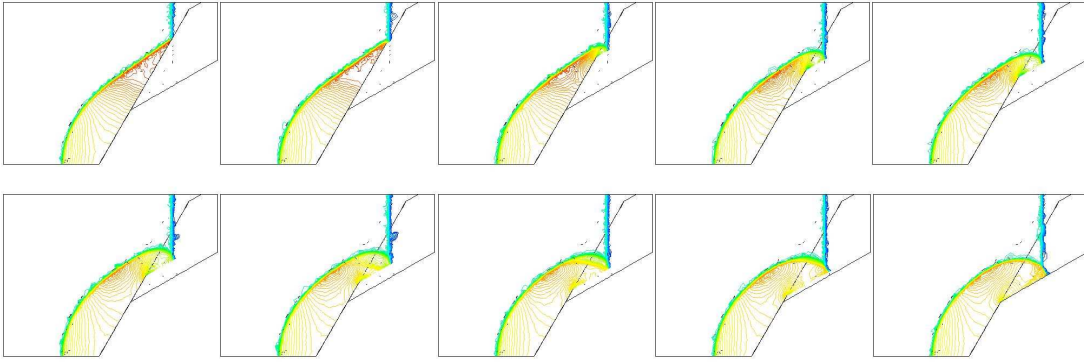


Figure 150: Density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 25mm , 35mm , 45mm , 50mm , 55mm , 60mm , 65mm , 70mm and 75mm respectively.

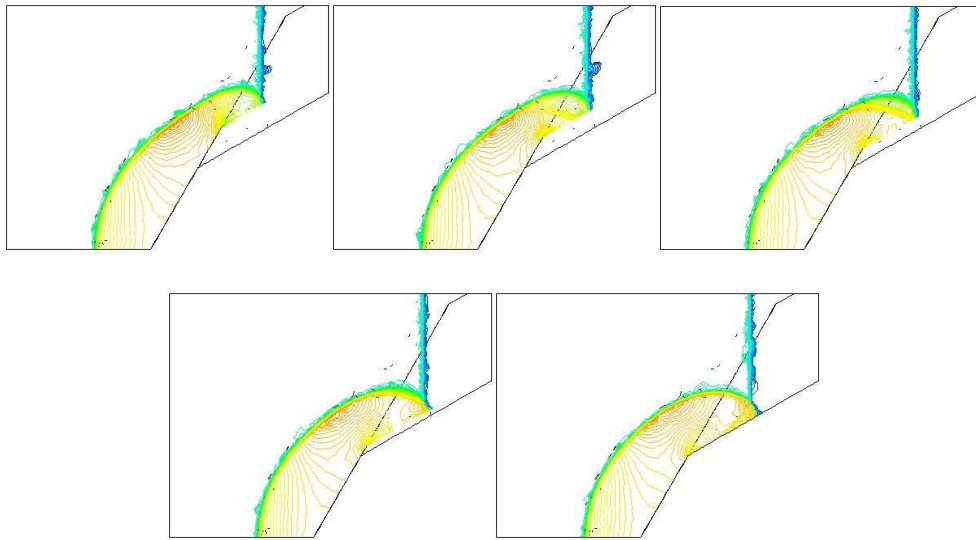


Figure 151: Enlarged density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the y-z plane at $x = 55\text{mm}$, 60mm , 65mm , 70mm , and 75mm respectively.

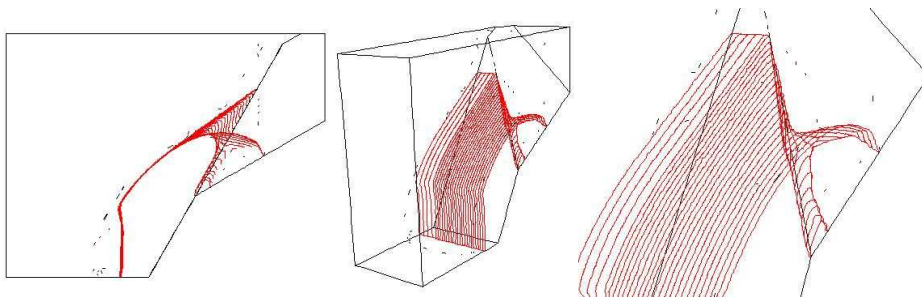


Figure 152: Overlaid pressure contour plots (single level) of secondary reflected wave for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$.

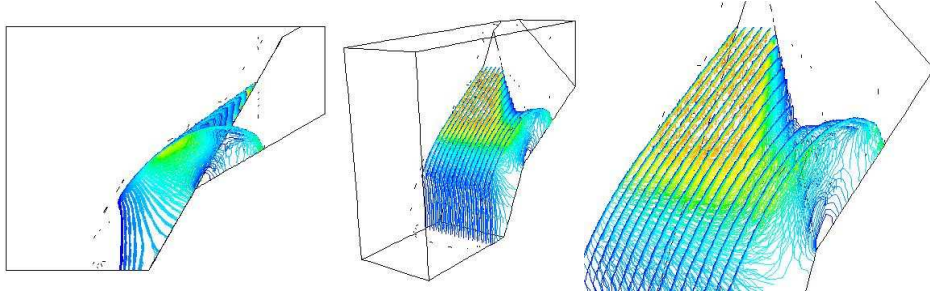


Figure 153: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$.

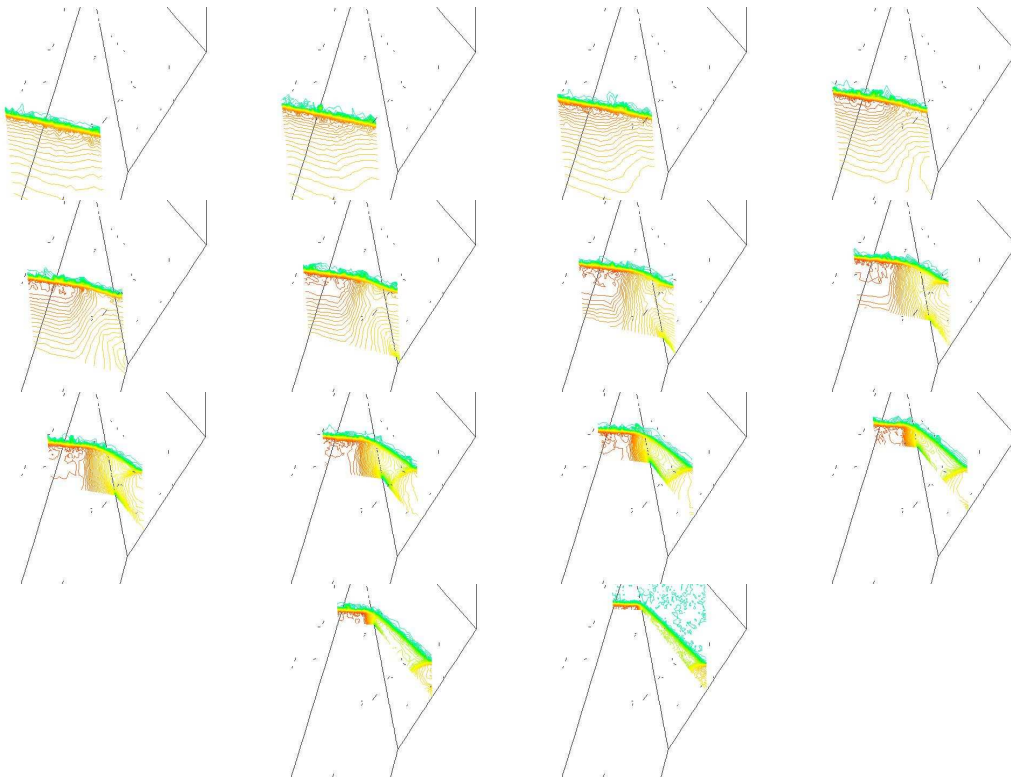


Figure 154: Isometric views of sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 5mm along the z axis.

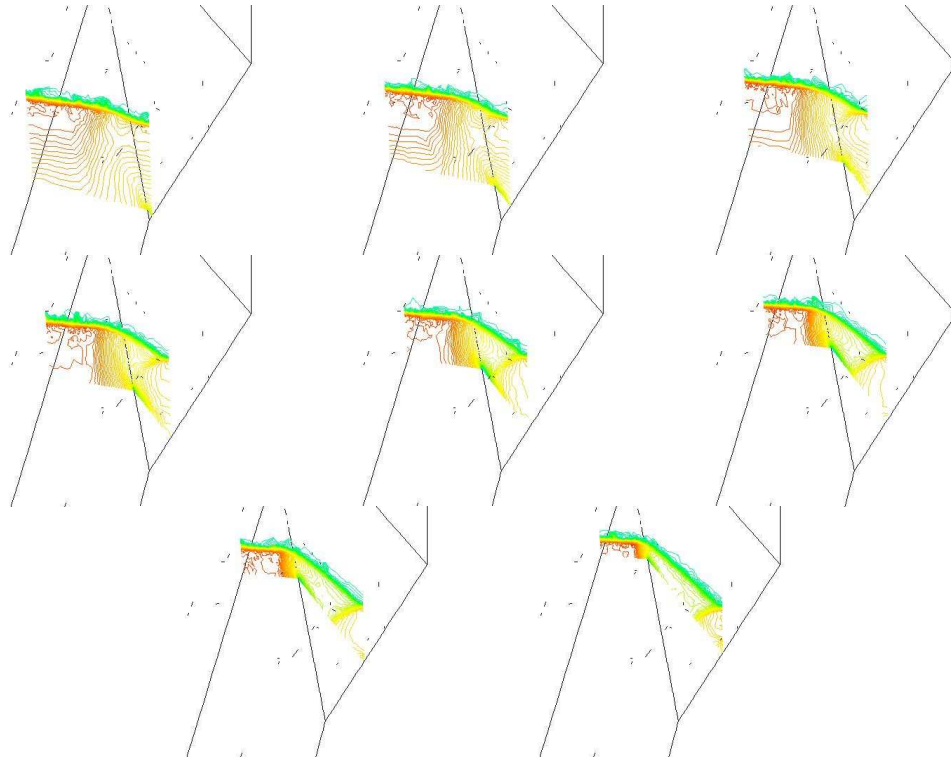


Figure 155: Enlarged isometric views of sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 5mm along the z axis.

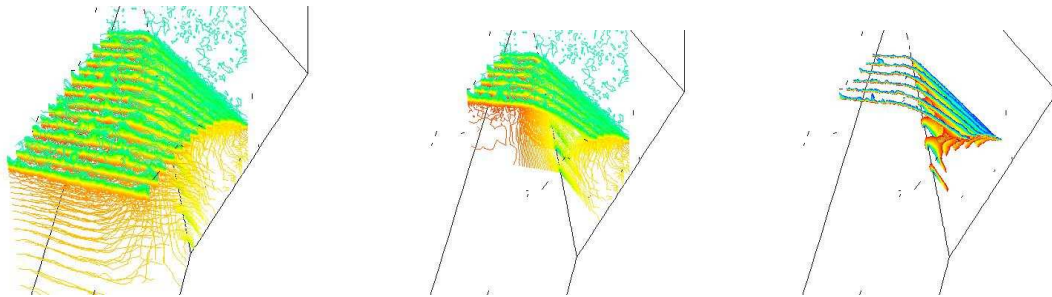


Figure 156: Isometric view of overlaid density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane.

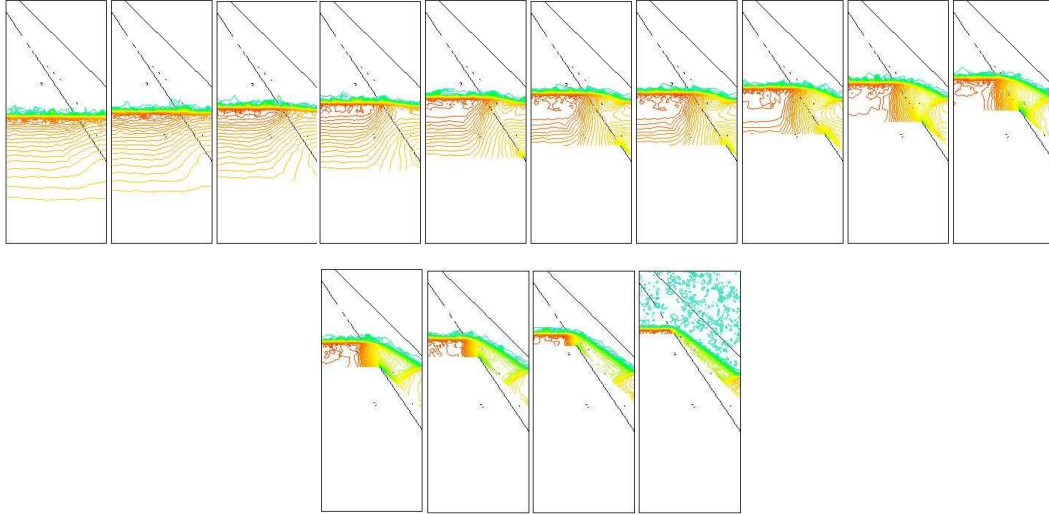


Figure 157: Sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

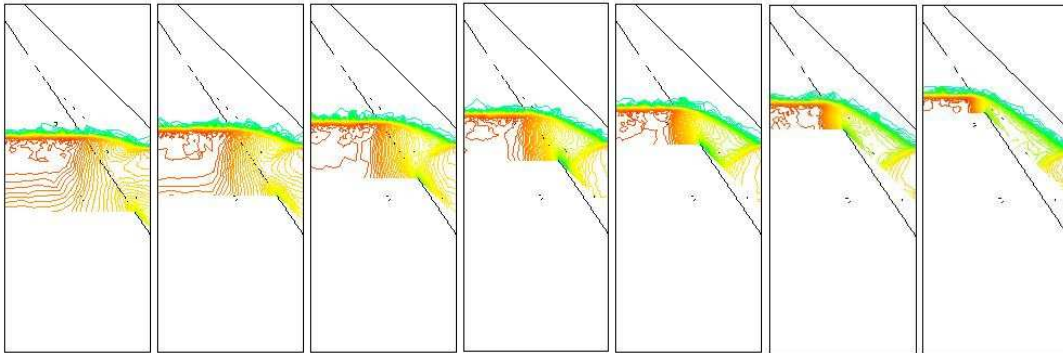


Figure 158: Enlarged sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 5mm along the z axis.

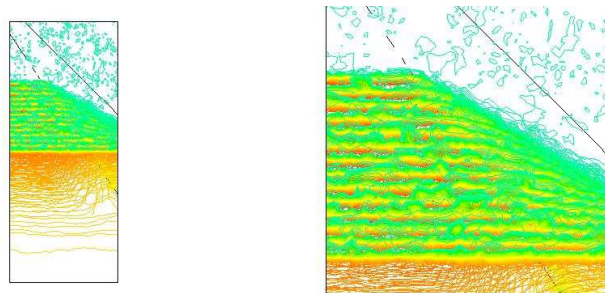


Figure 159: Overlaid density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane.

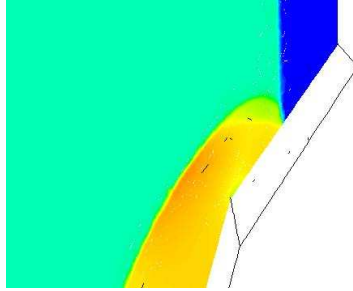


Figure 160: Filled density contour plot of plane in y-z plane for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$, illustrating shear layer.

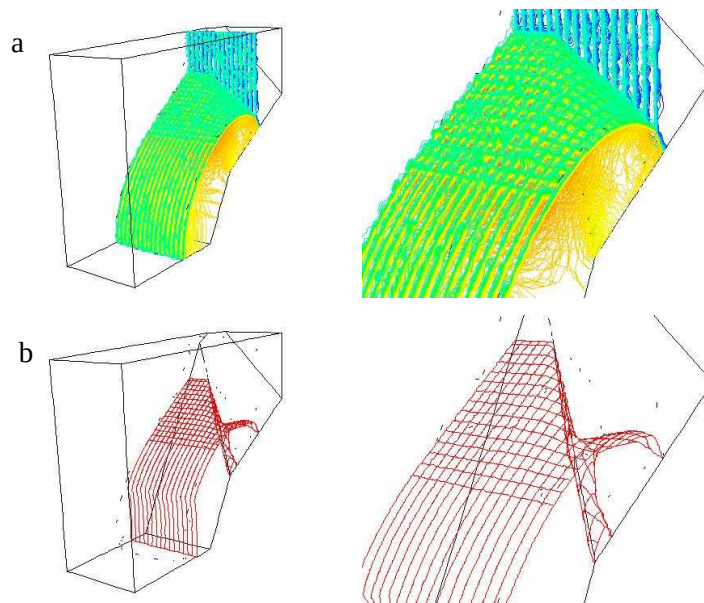


Figure 161: Isometric view of overlaid planes for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 30^\circ$.

a) Entire flow field b) Secondary reflected wave

F.2.4 Triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$

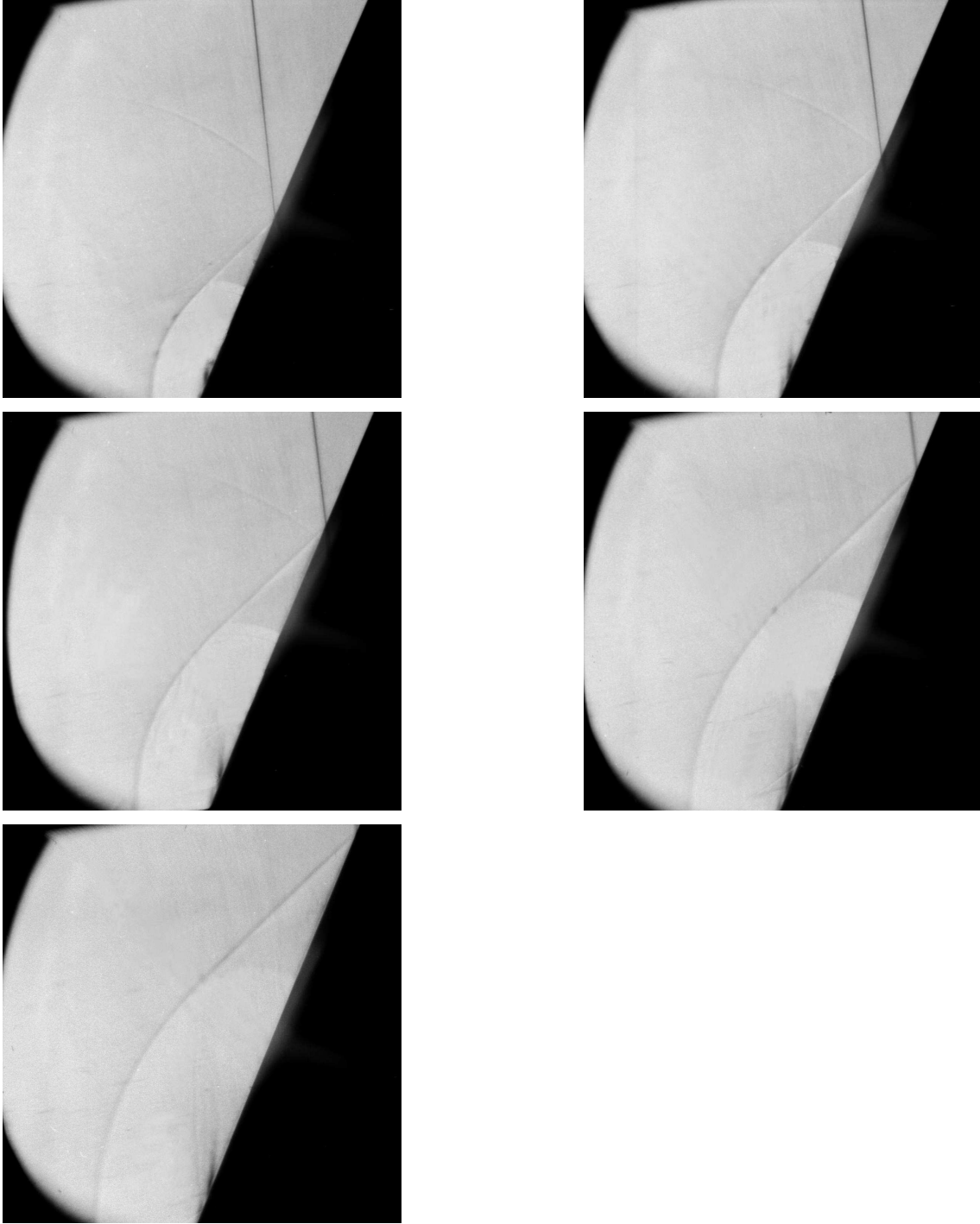


Figure 162: Schlieren images for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, at time delay 1700 μ s, 1725 μ s, 1750 μ s, 1775 μ s, and 1800 μ s respectively.

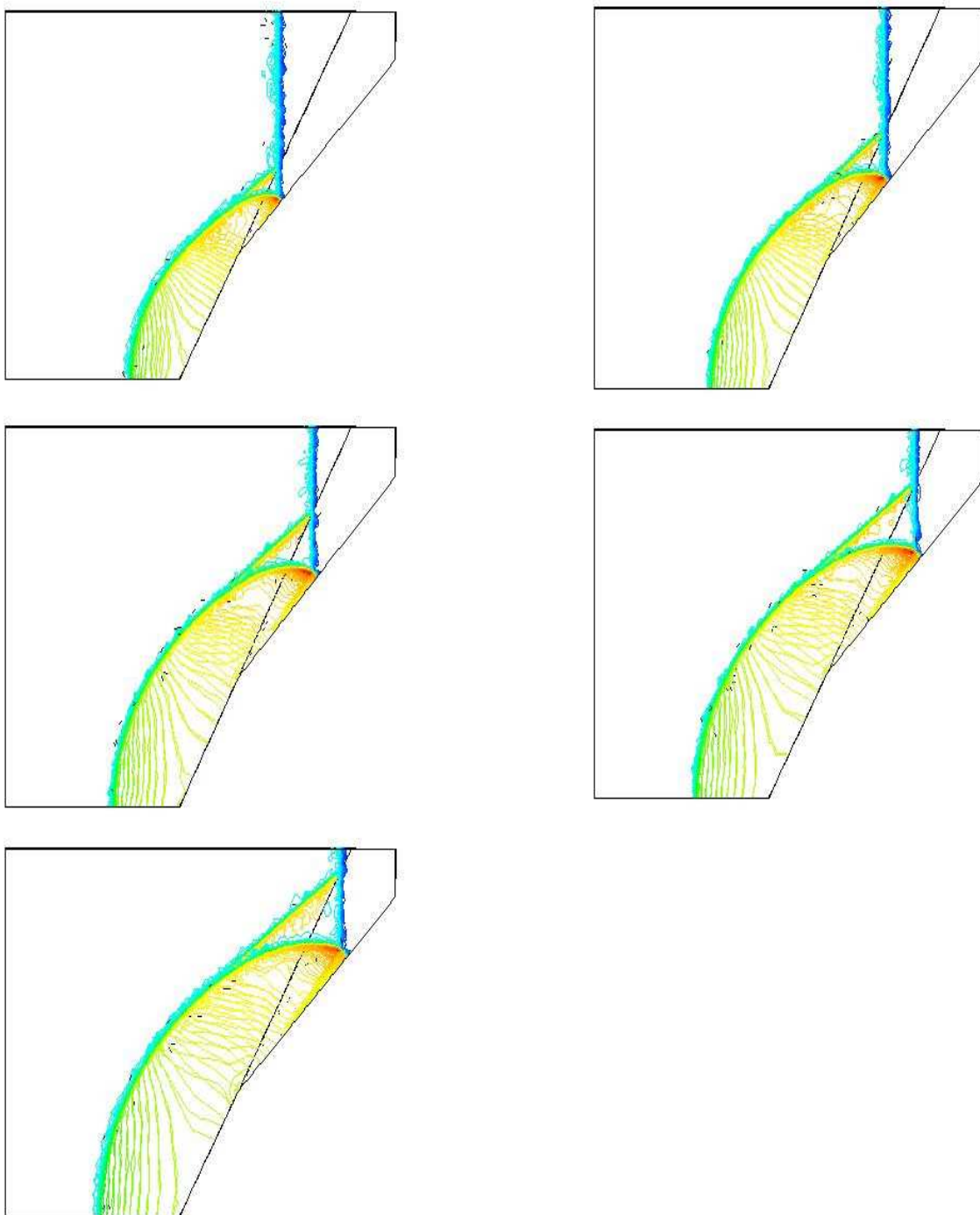


Figure 163: Sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$.

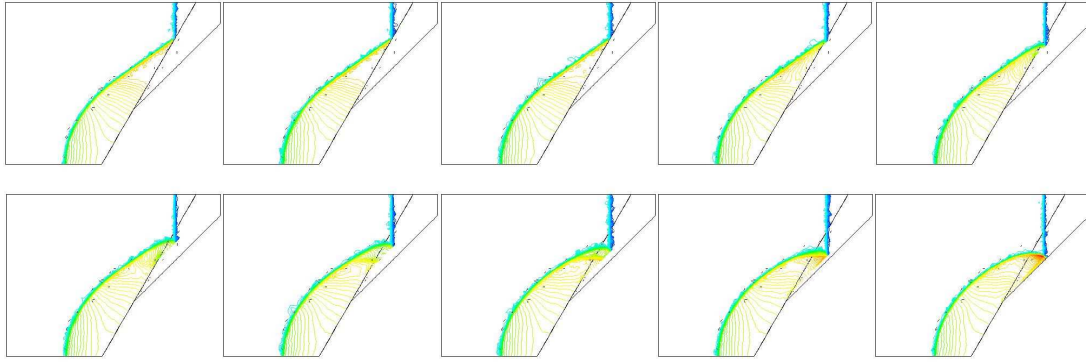


Figure 164: Density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 25mm , 35mm , 45mm , 50mm , 55mm , 60mm , 65mm , 70mm and 75mm respectively.

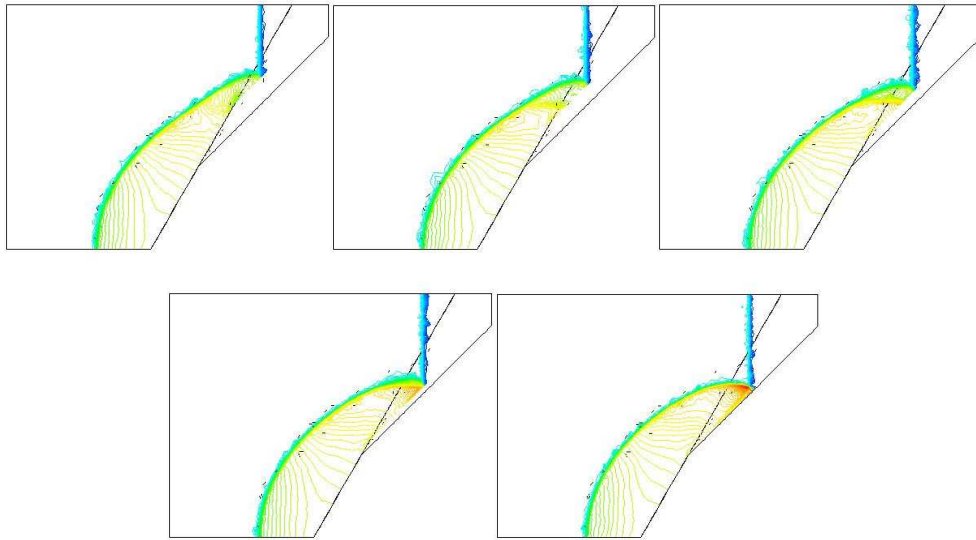


Figure 165: Enlarged density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the y-z plane at $x = 55\text{mm}$, 60mm , 65mm , 70mm , and 75mm respectively.

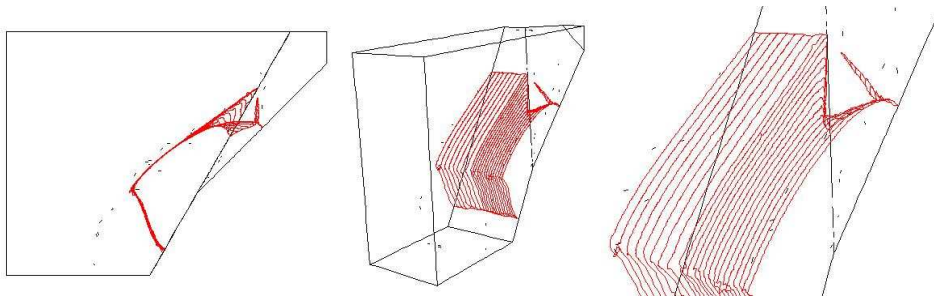


Figure 166: Overlaid pressure contour plots (single level) of secondary reflected wave for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$.

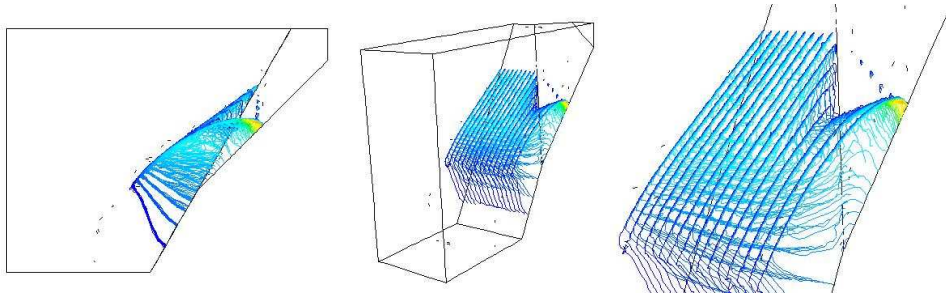


Figure 167: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$.

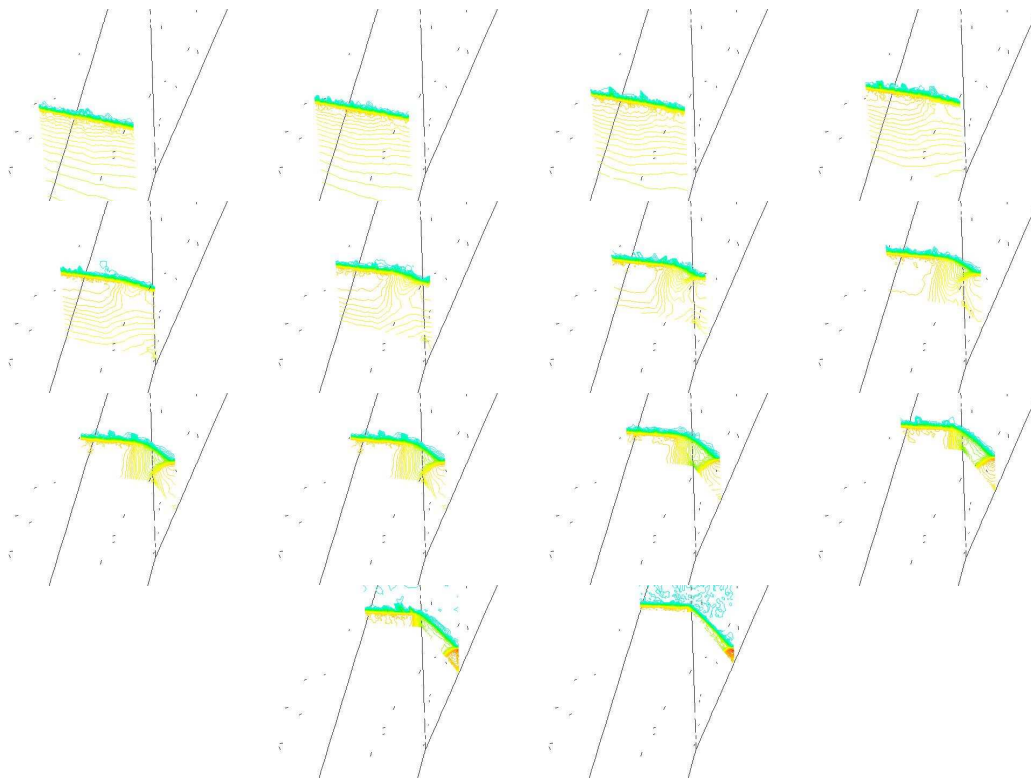


Figure 168: Isometric views of sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y in steps of 5mm along the z axis.

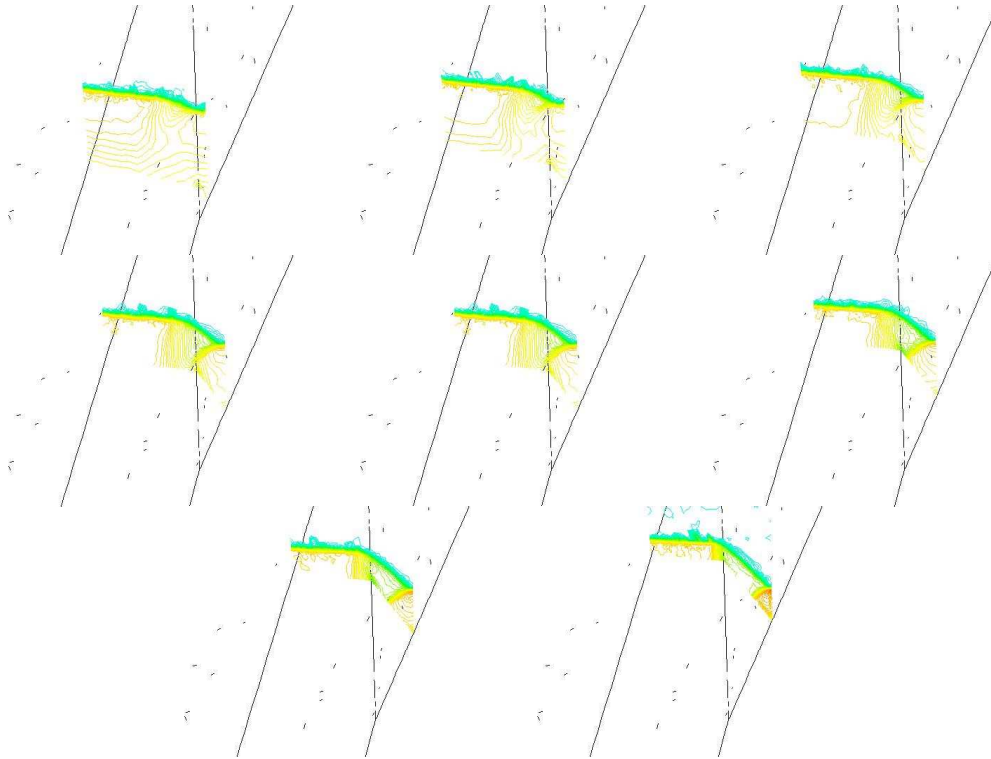


Figure 169: Enlarged isometric views of sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y in steps of 5mm along the z axis.

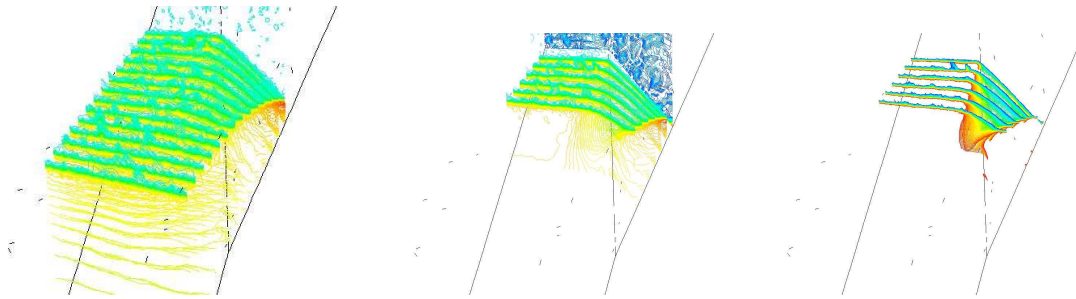


Figure 170: Isometric view of overlaid density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane.

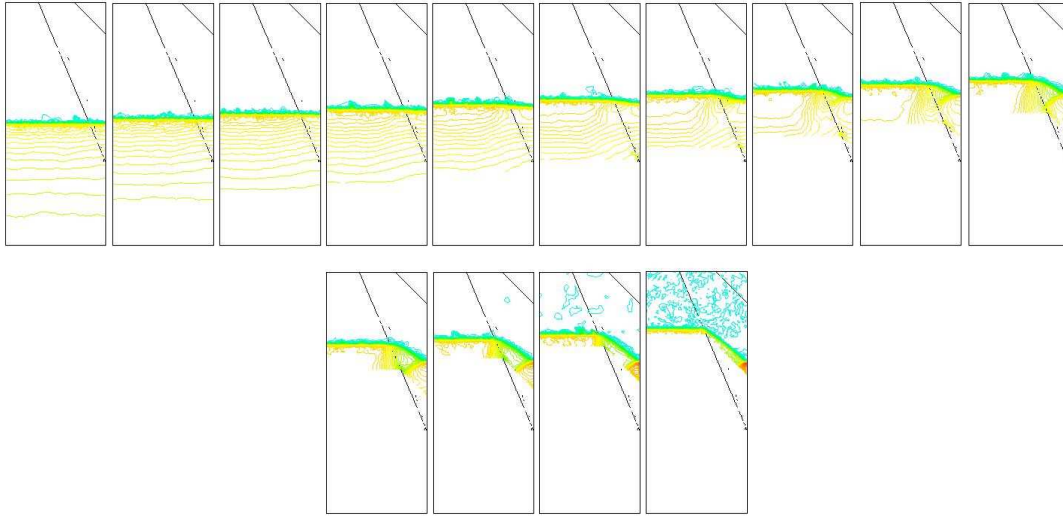


Figure 171: Sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

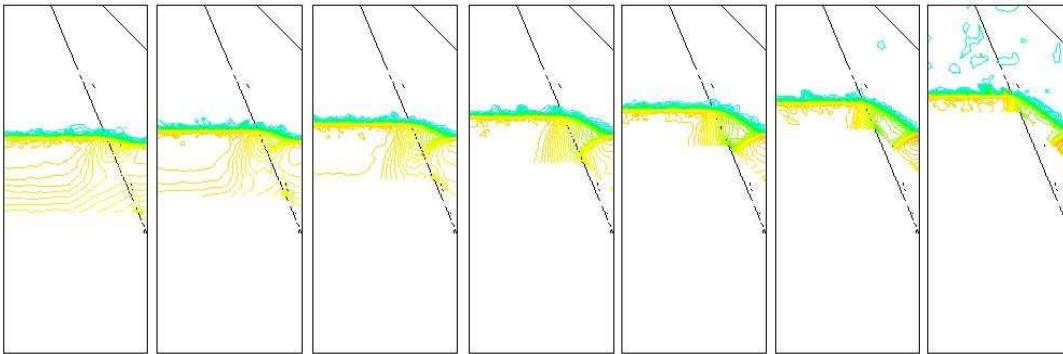


Figure 172: Enlarged sequential density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

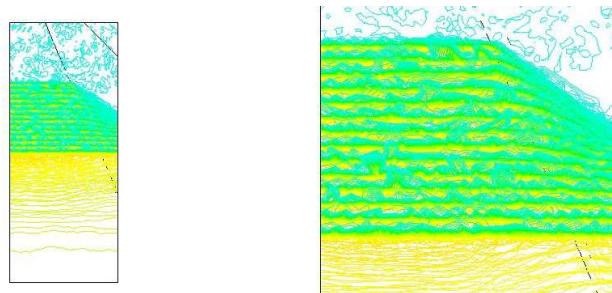


Figure 173: Overlaid density contour plots for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane.

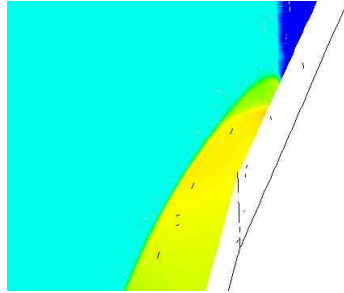


Figure 174: Filled density contour plot of plane in y-z plane for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$, illustrating shear layer.

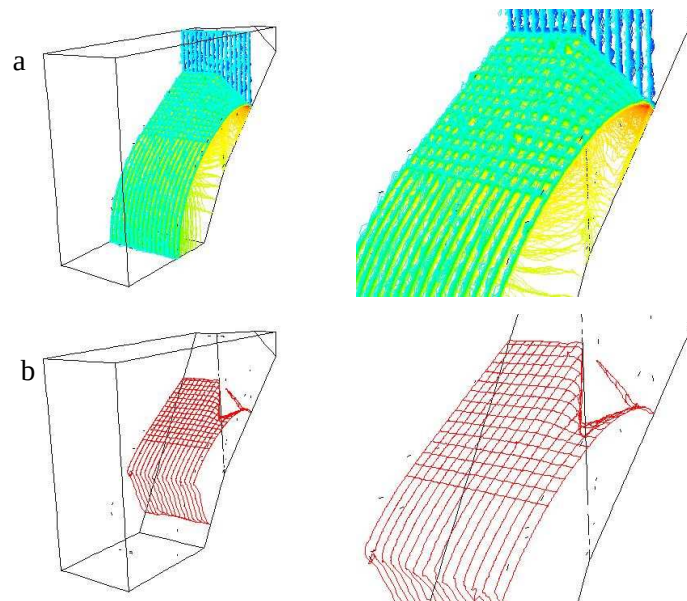


Figure 175: Isometric view of overlaid planes for triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$.

a) Entire flow field b) Secondary reflected wave

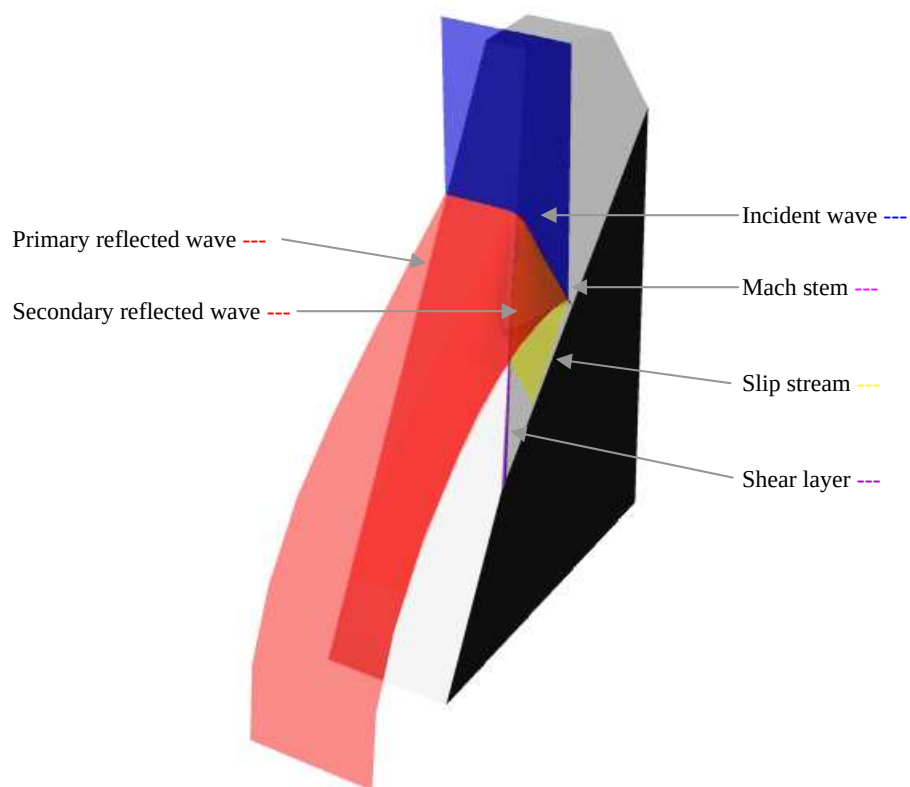
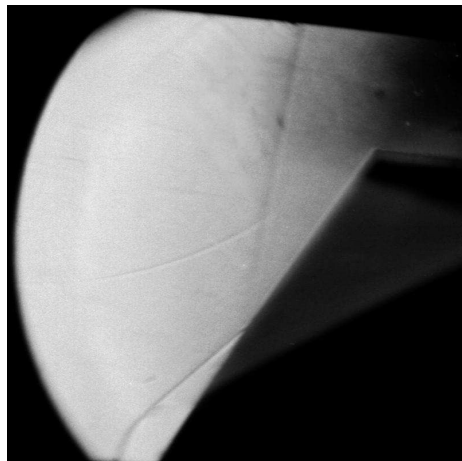


Figure 176: Three-dimensional NURBS model of triangular valley, $\theta_w = 60^\circ$, $\theta_v = 45^\circ$.

F.2.5 Triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$



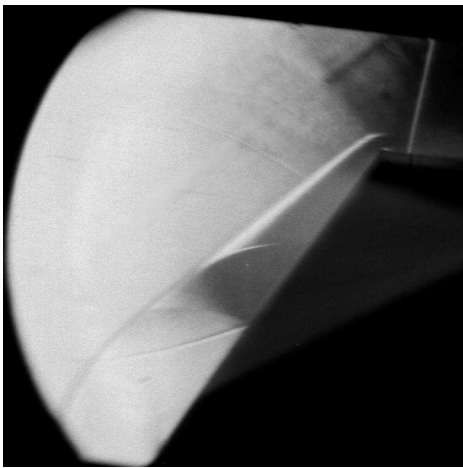
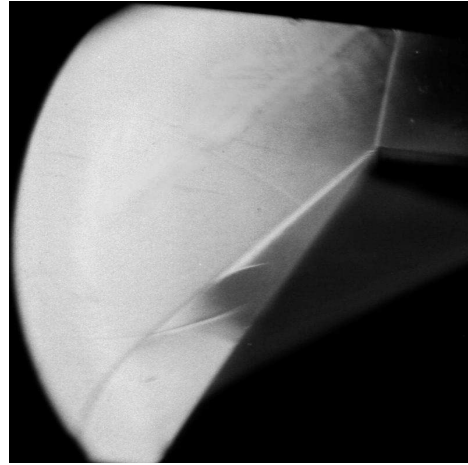
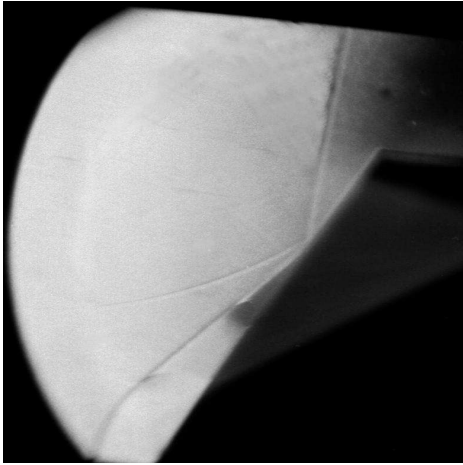
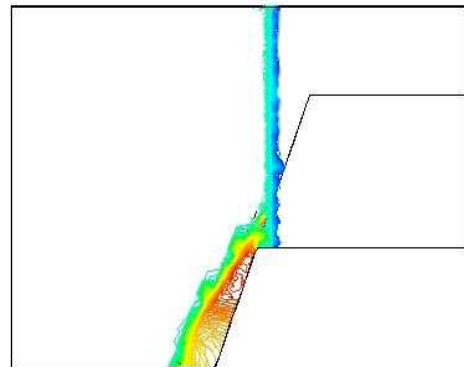
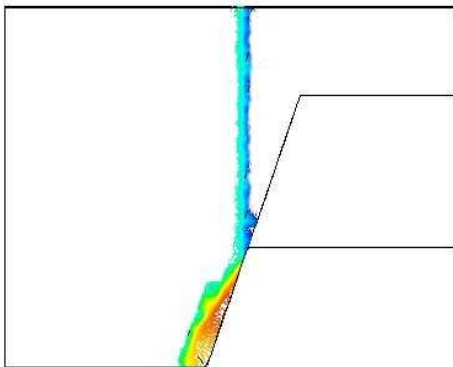


Figure 177: Schlieren images for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, at time delay $1600\mu\text{s}$, $1625\mu\text{s}$, $1650\mu\text{s}$, $1675\mu\text{s}$, and $1700\mu\text{s}$ respectively.



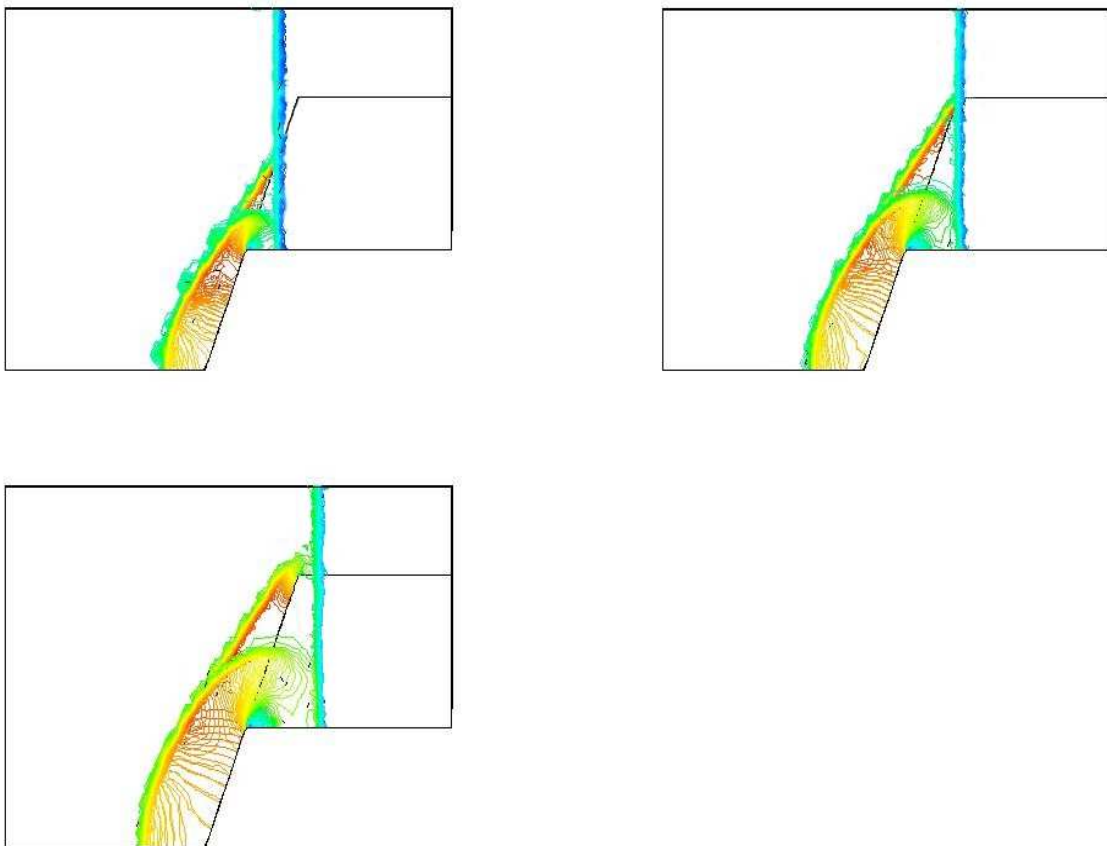


Figure 178: Sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$.

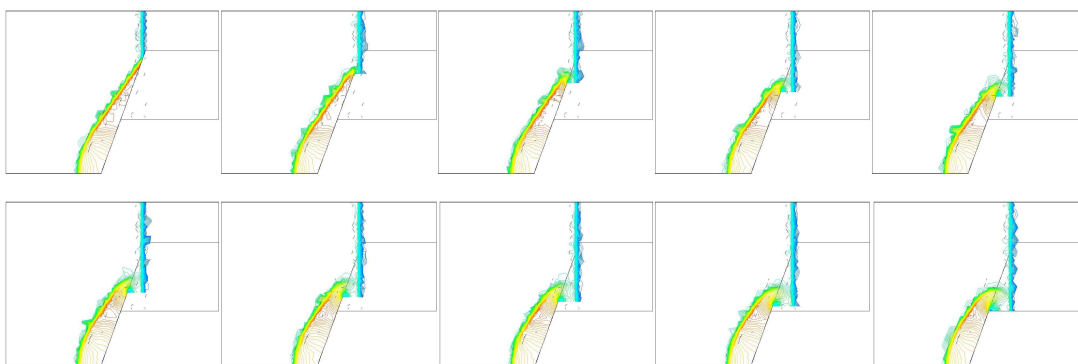


Figure 179: Density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 25mm , 35mm , 45mm , 50mm , 55mm , 60mm , 65mm , 70mm and 75mm respectively.

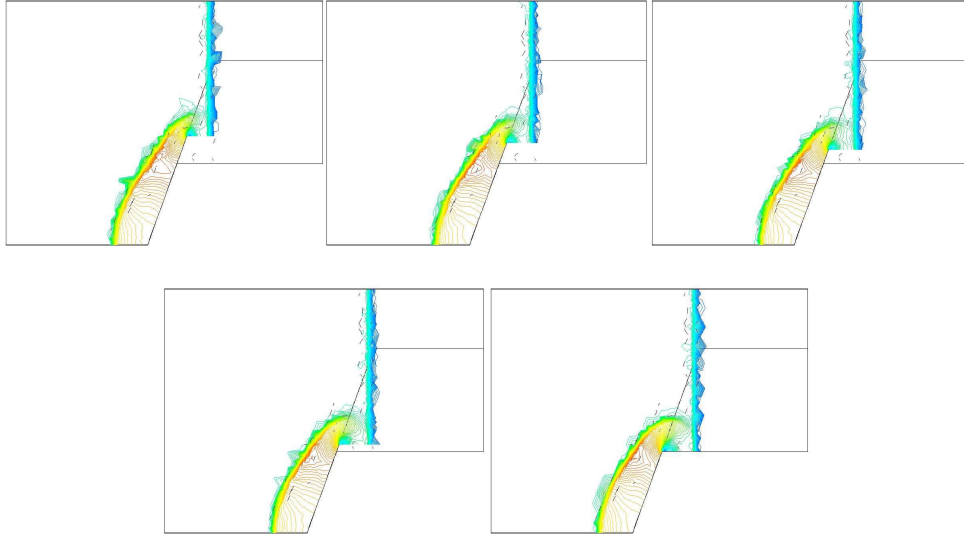


Figure 180: Enlarged density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the y-z plane at $x = 55\text{mm}$, 60mm , 65mm , 70mm , and 75mm respectively.

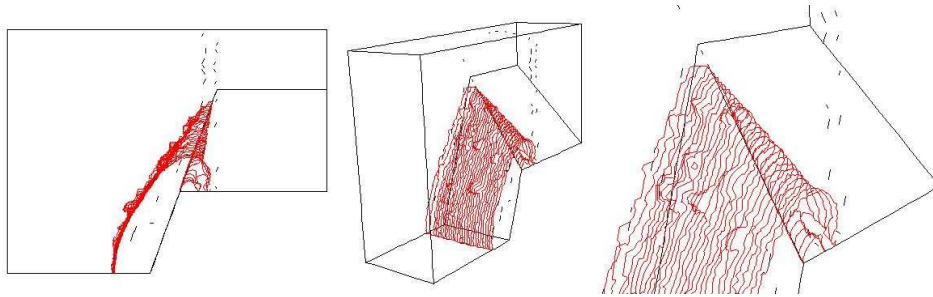


Figure 181: Overlaid pressure contour plots (single level) of secondary reflected wave for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$.

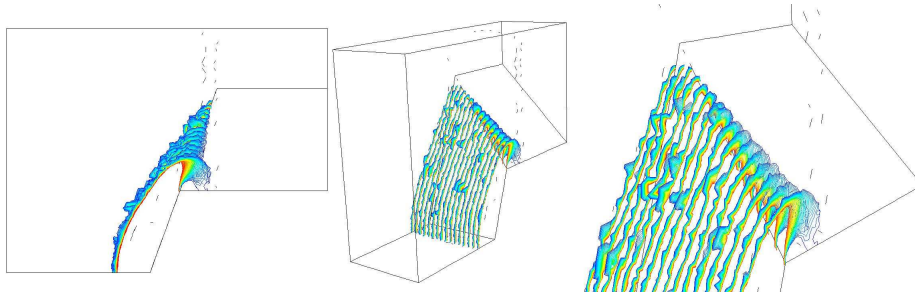


Figure 182: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$.

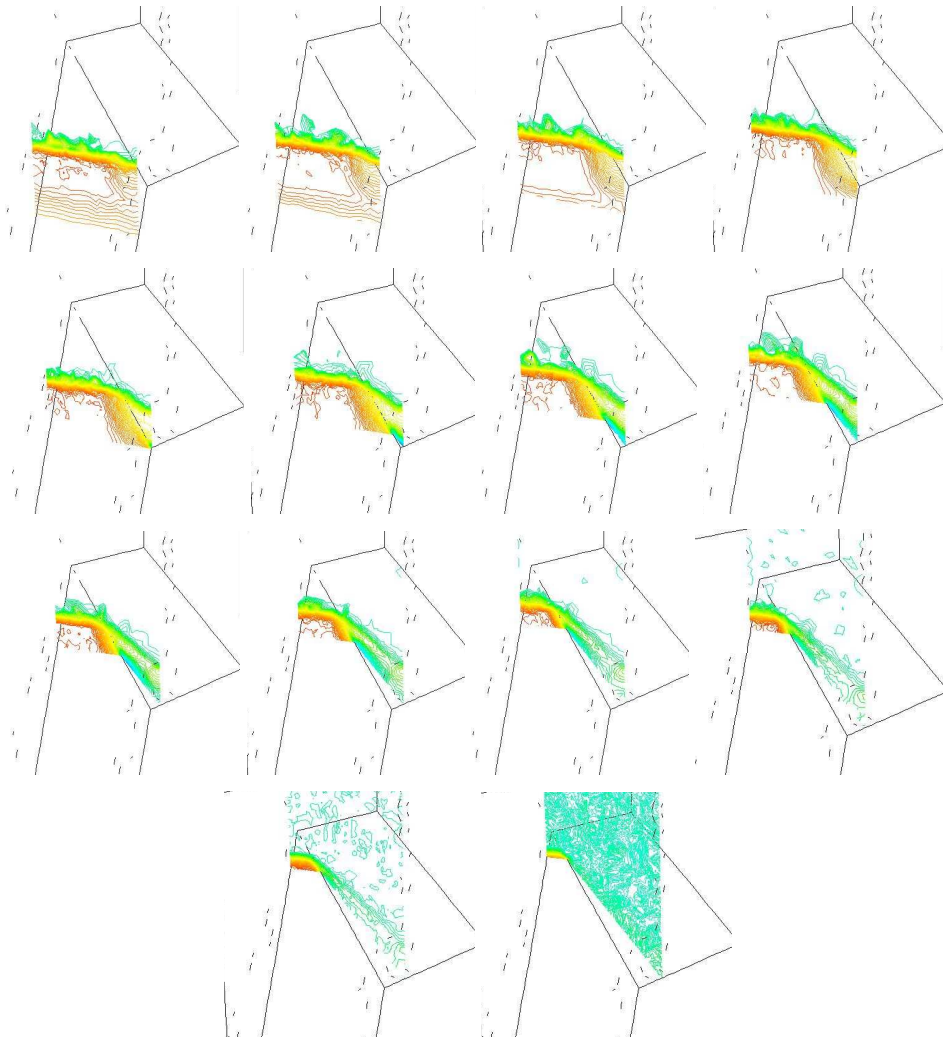


Figure 183: Isometric views of sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 5mm along the z axis.

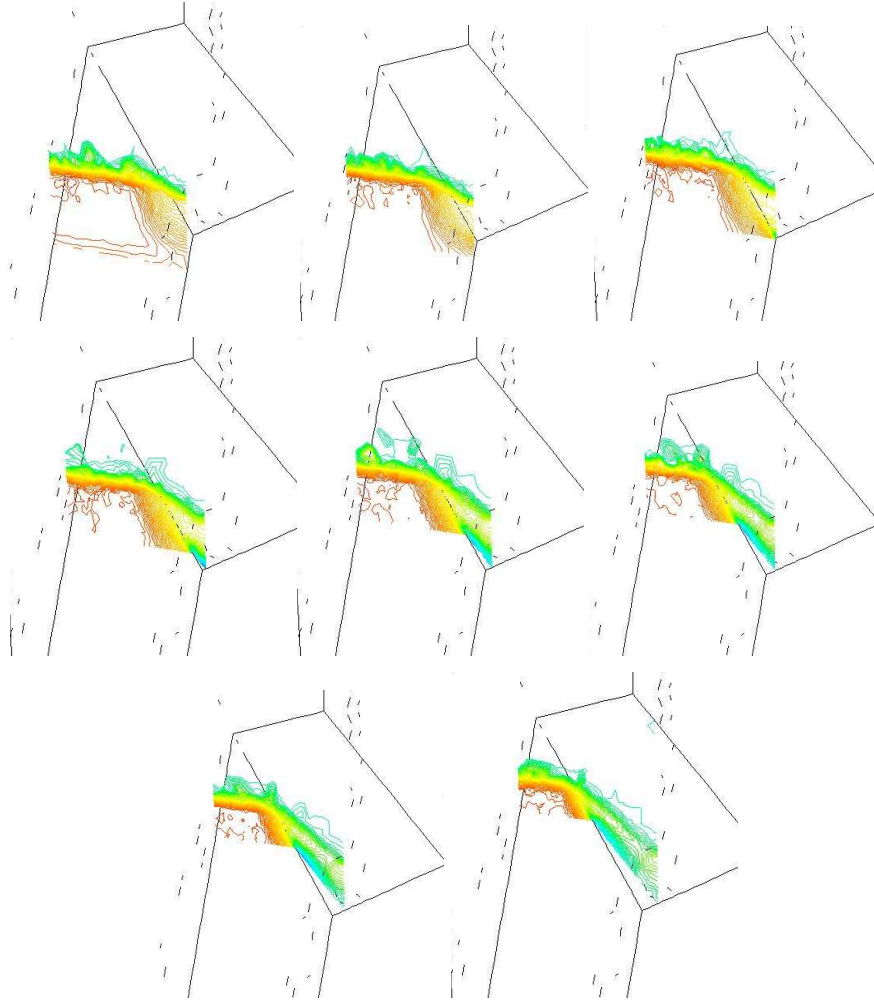


Figure 184: Enlarged isometric views of sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 5mm along the z axis.

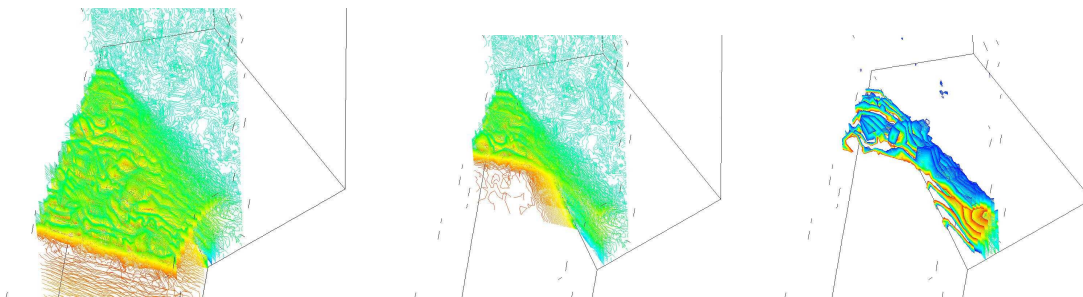


Figure 185: Isometric view of overlaid density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane.

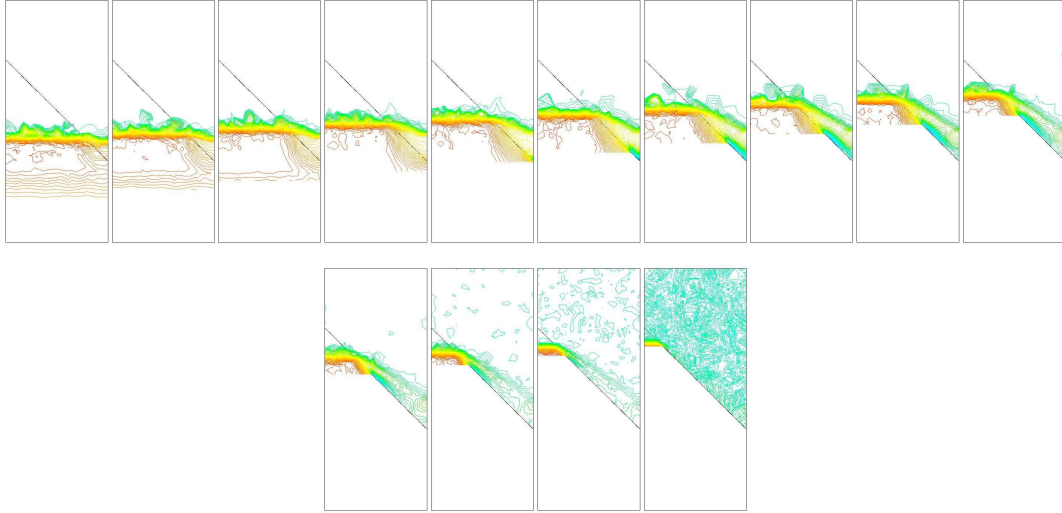


Figure 186: Sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane in steps of 5mm along the z axis

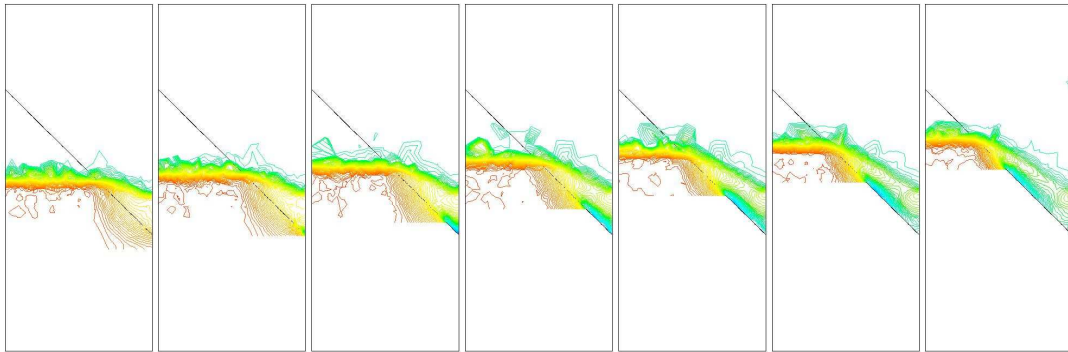


Figure 187: Enlarged sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y in steps of 5mm along the z axis.

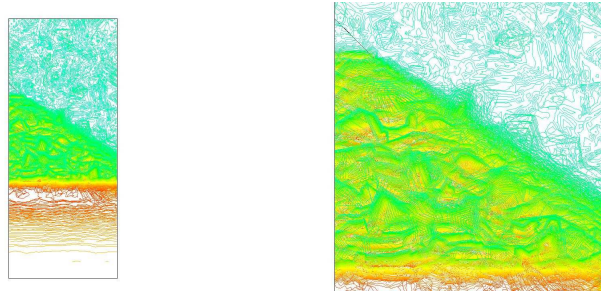


Figure 188: Overlaid density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, taken in the x-y plane.

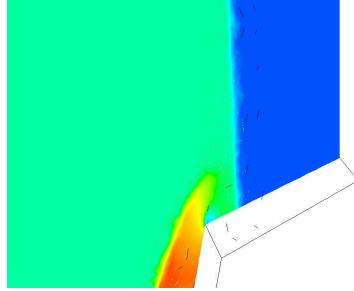


Figure 189: Filled density contour plot of plane in y-z plane for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$, illustrating shear layer.

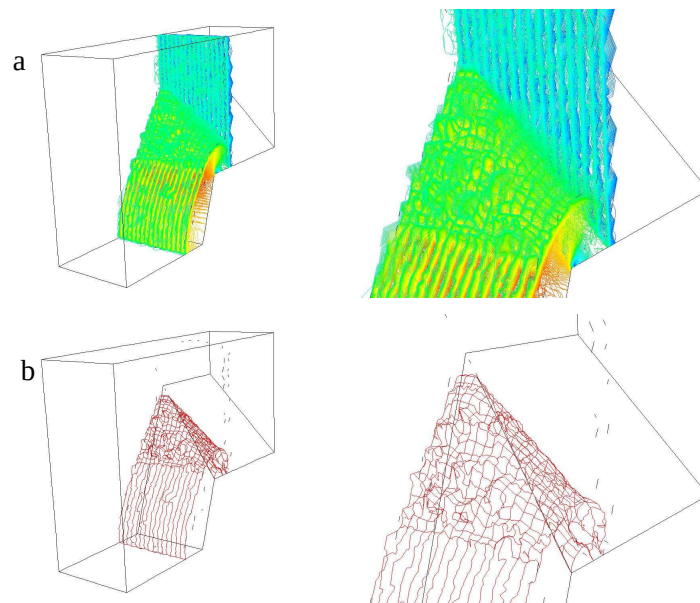


Figure 190: Isometric view of overlaid planes for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$.

a) Entire flow field b) Secondary reflected wave

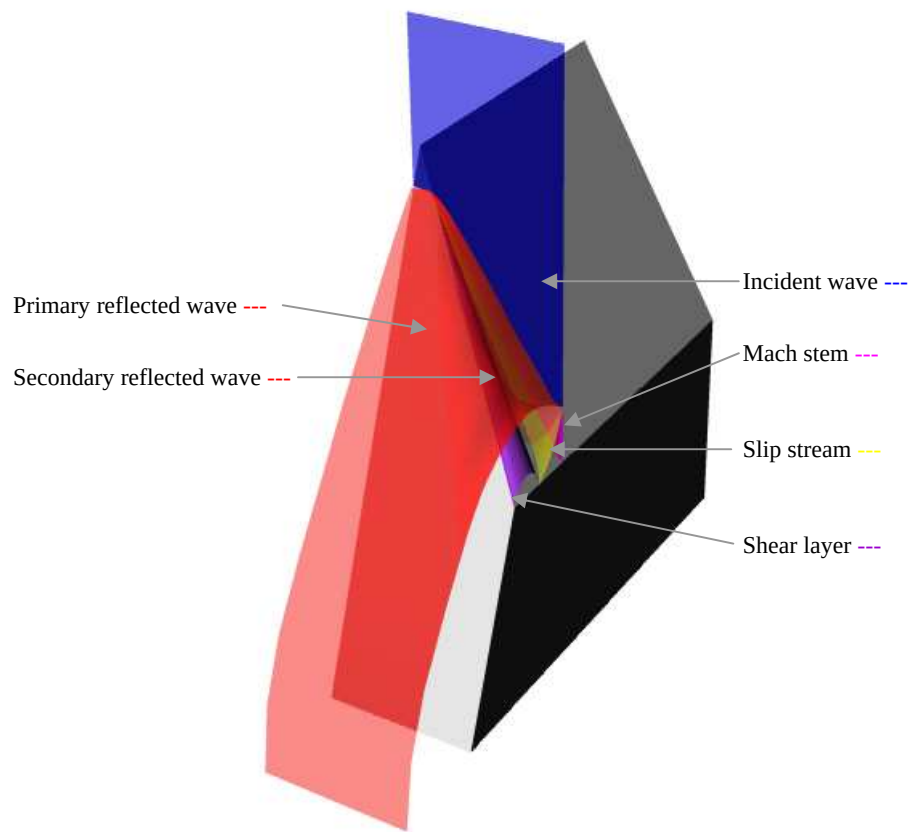
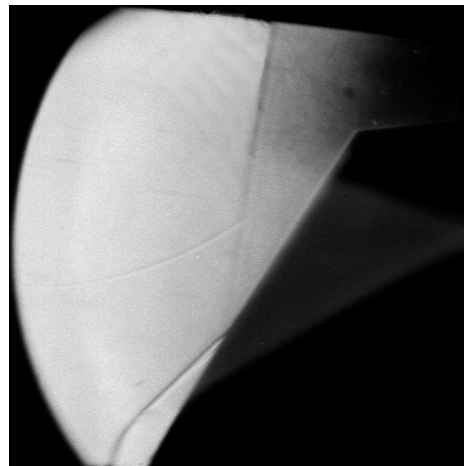
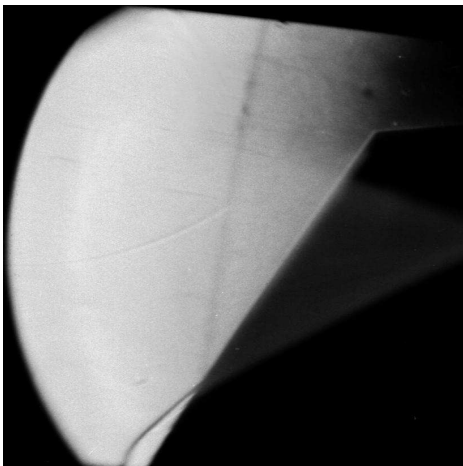


Figure 191: Three-dimensional NURBS model of triangular valley, $\theta_w = 70^\circ$, $\theta_v = 0^\circ$.

F.2.6 Triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$



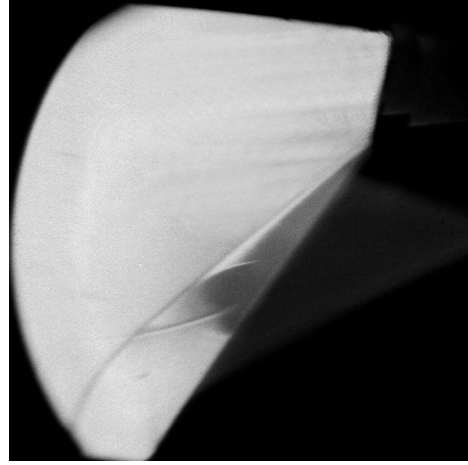
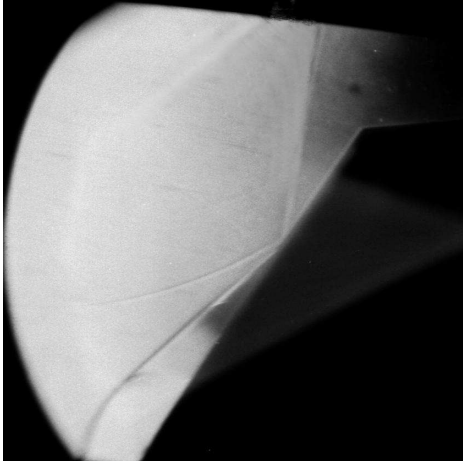


Figure 192: Schlieren images for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, at time delay $1600\mu\text{s}$, $1625\mu\text{s}$, $1675\mu\text{s}$, and $1700\mu\text{s}$ respectively.

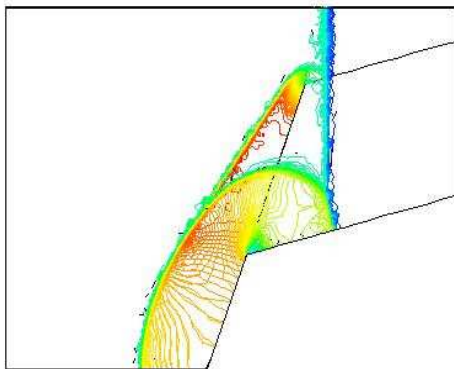
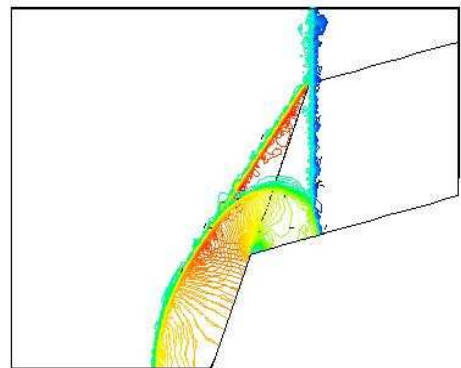
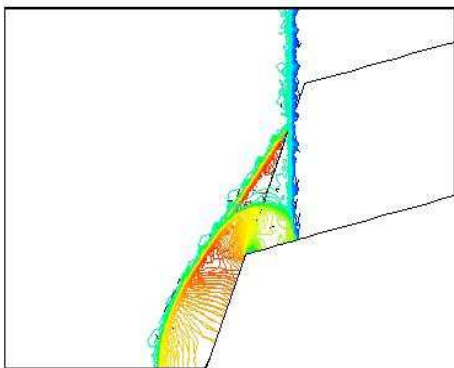
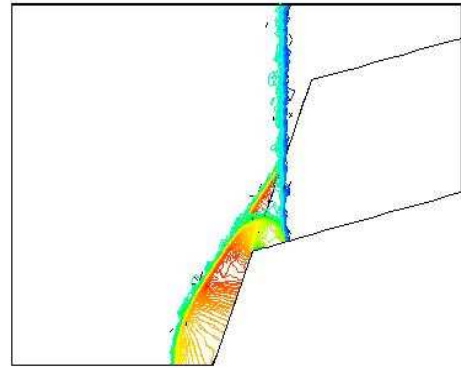
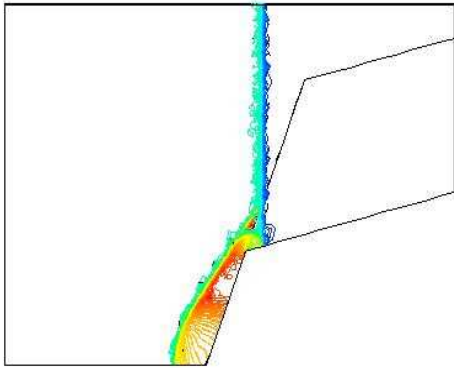


Figure 193: Sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$.

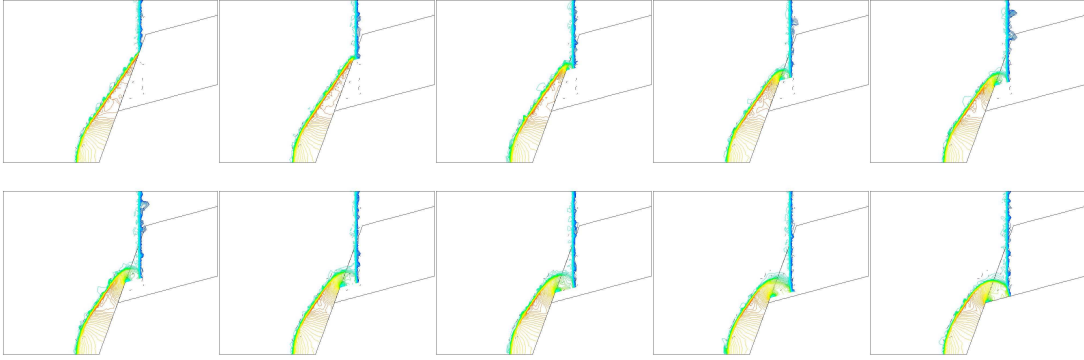


Figure 194: Density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 25mm , 35mm , 45mm , 50mm , 55mm , 60mm , 65mm , 70mm and 75mm respectively.

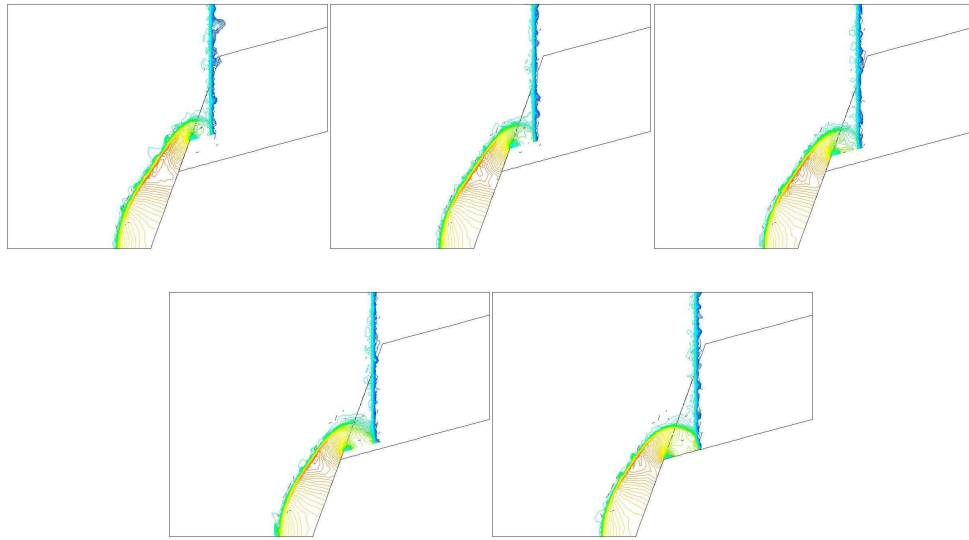


Figure 195: Enlarged density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the y-z plane at $x = 55\text{mm}$, 60mm , 65mm , 70mm , and 75mm respectively.

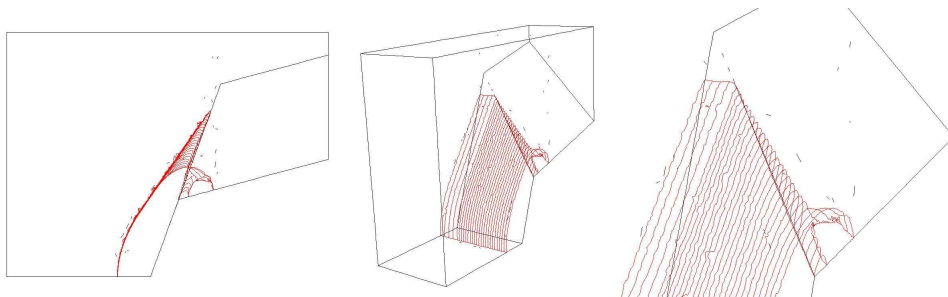


Figure 196: Overlaid pressure contour plots (single level) of secondary reflected wave for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$.

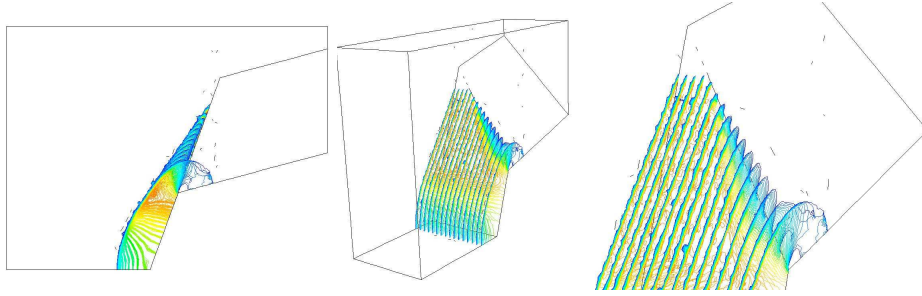


Figure 197: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$.

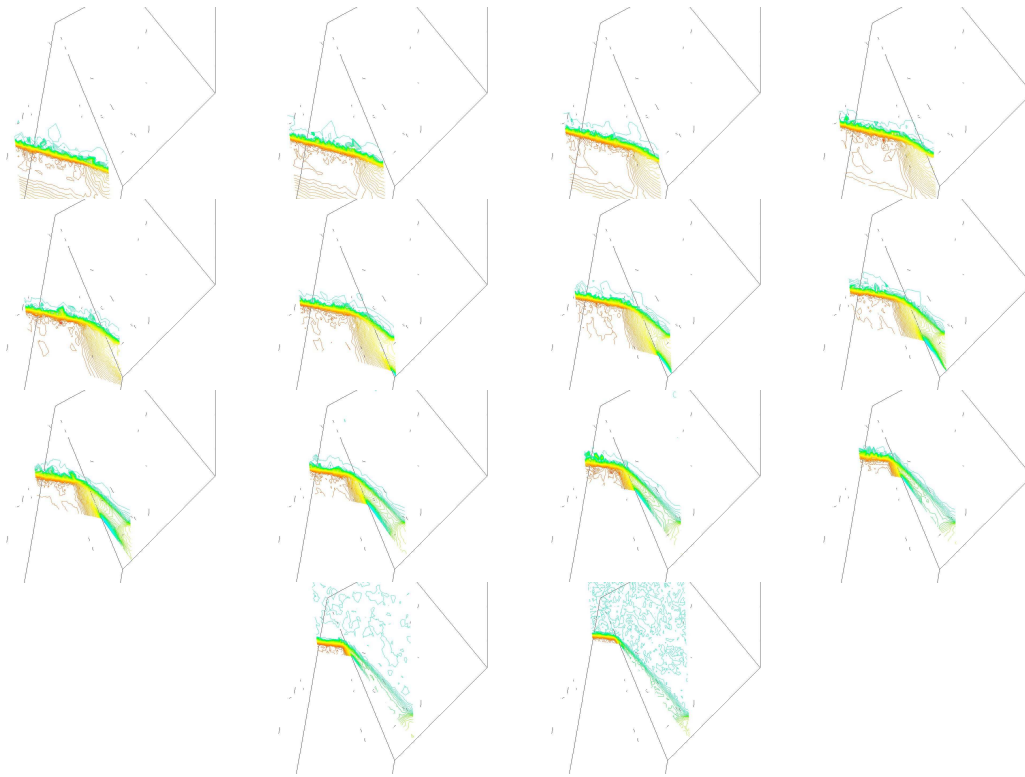


Figure 198: Isometric views of sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 5mm along the z axis.

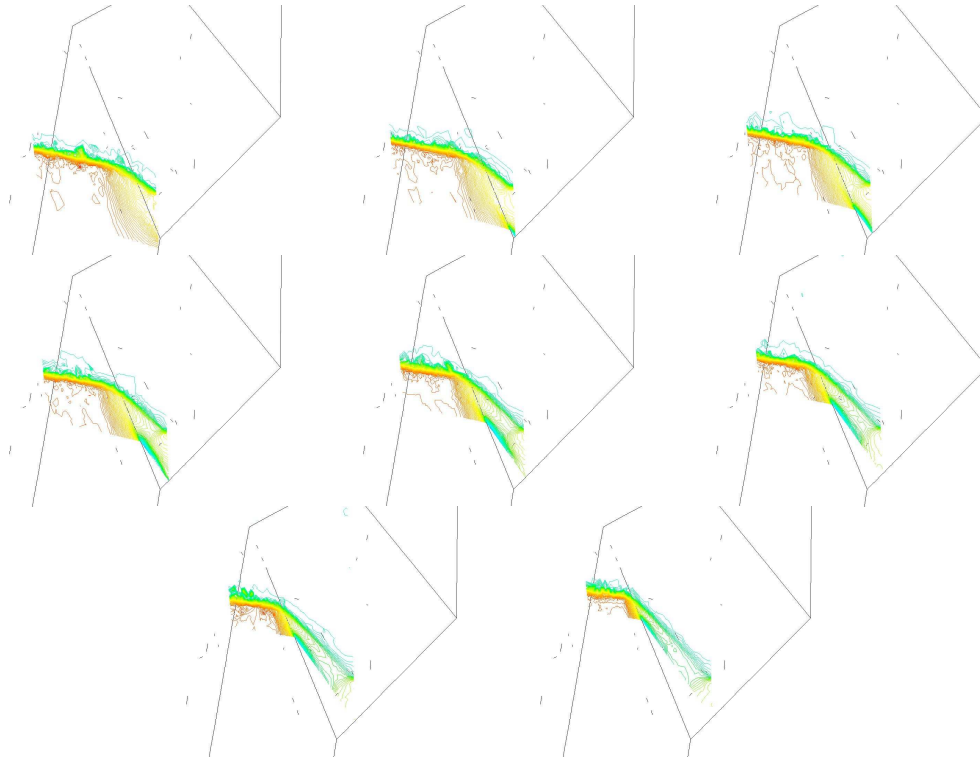


Figure 199: Enlarged isometric views of sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 5mm along the z axis.

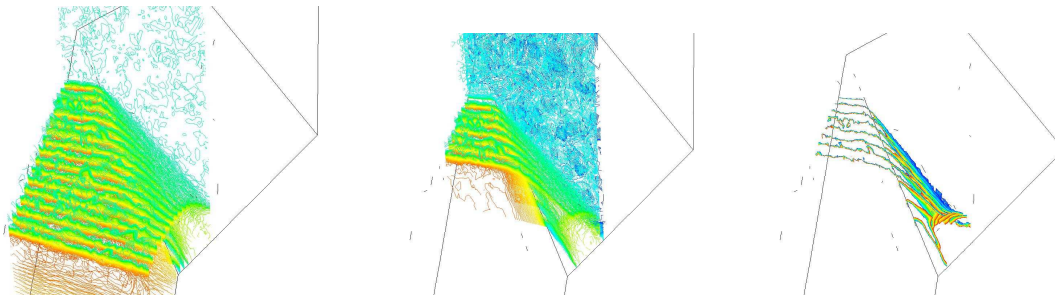


Figure 200: Isometric view of overlaid density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane.

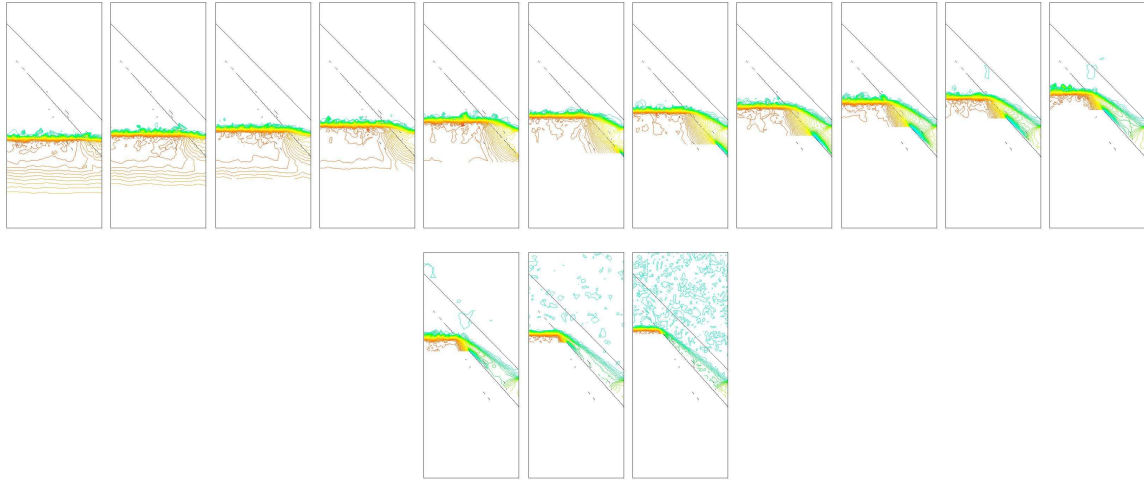


Figure 201: Sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

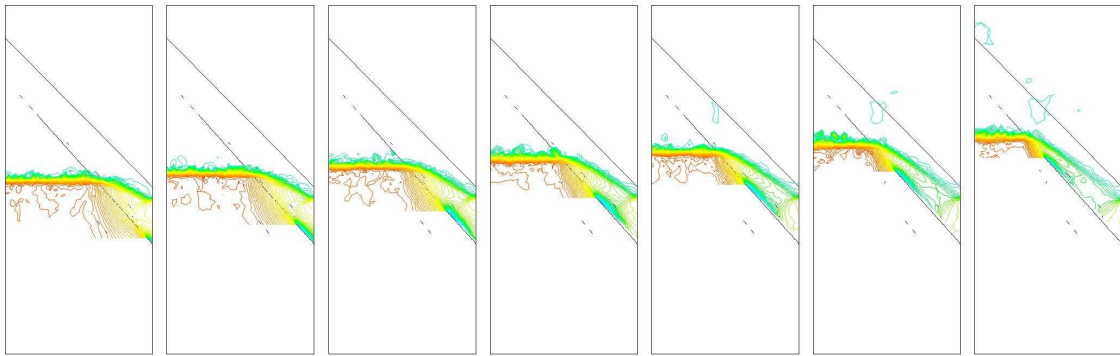


Figure 202: Enlarged sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y in steps of 5mm along the z axis.

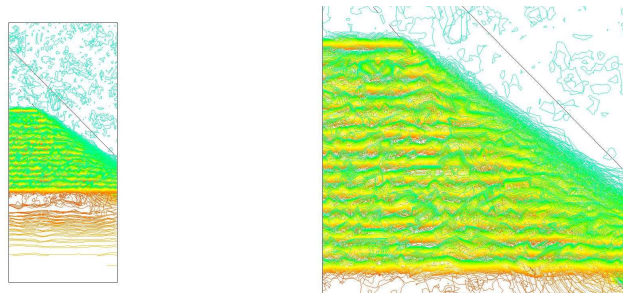


Figure 203: Overlaid density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, taken in the x-y plane.

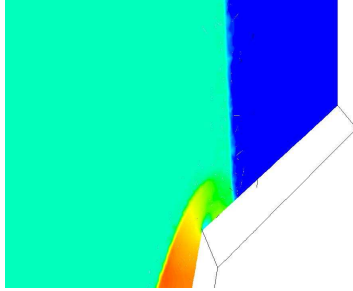


Figure 204: Filled density contour plot of plane in y-z plane for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$, illustrating shear layer.

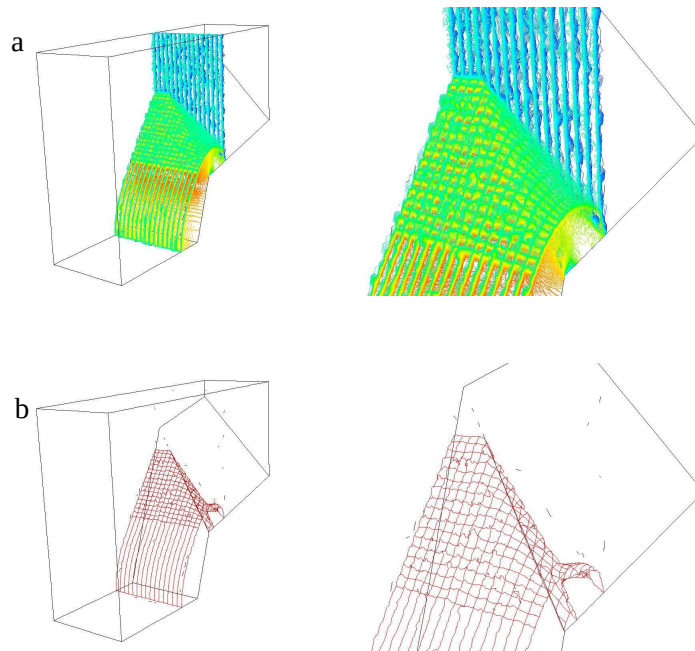


Figure 205: Isometric view of overlaid planes for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 15^\circ$.

a) Entire flow field b) Secondary reflected wave

F.2.7 Triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$

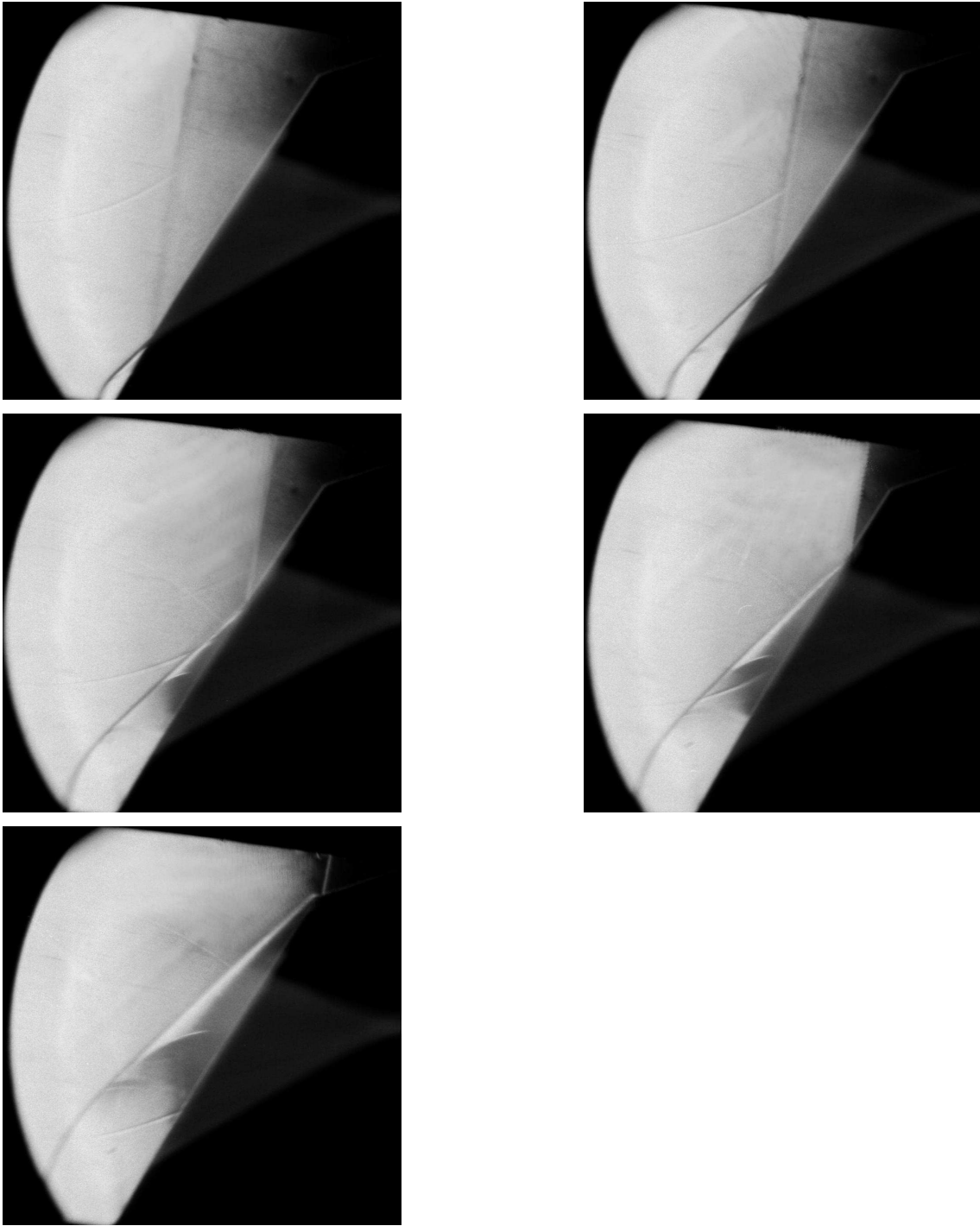


Figure 206: Schlieren images for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, at time delay 1600 μ s, 1625 μ s, 1650 μ s, 1675 μ s, and 1700 μ s respectively.

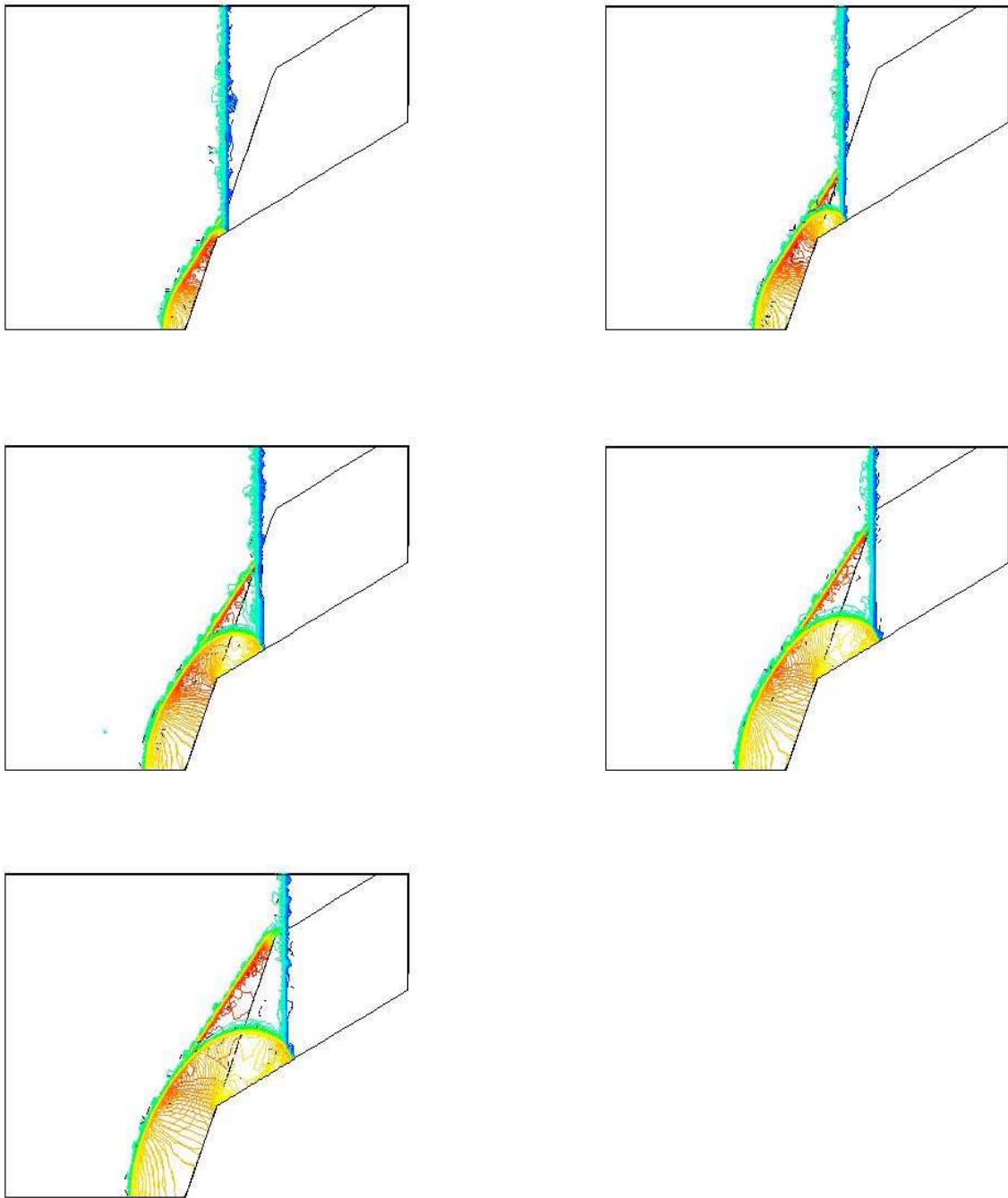


Figure 207: Sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$.

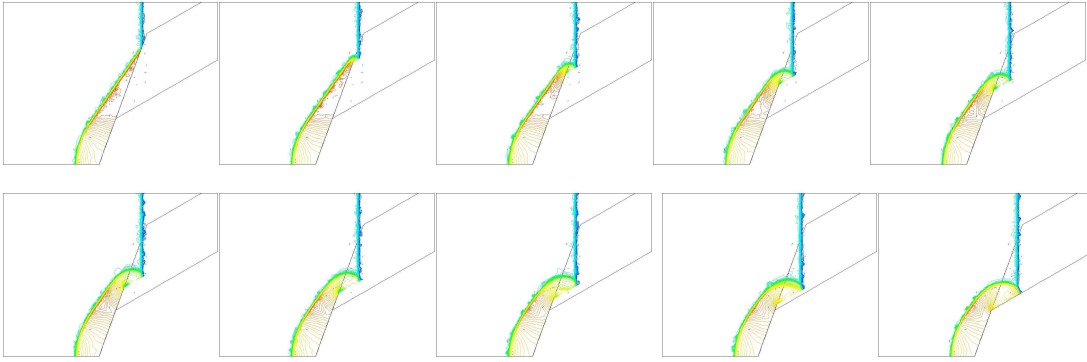


Figure 208: Density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 25mm , 35mm , 45mm , 50mm , 55mm , 60mm , 65mm , 70mm and 75mm respectively.

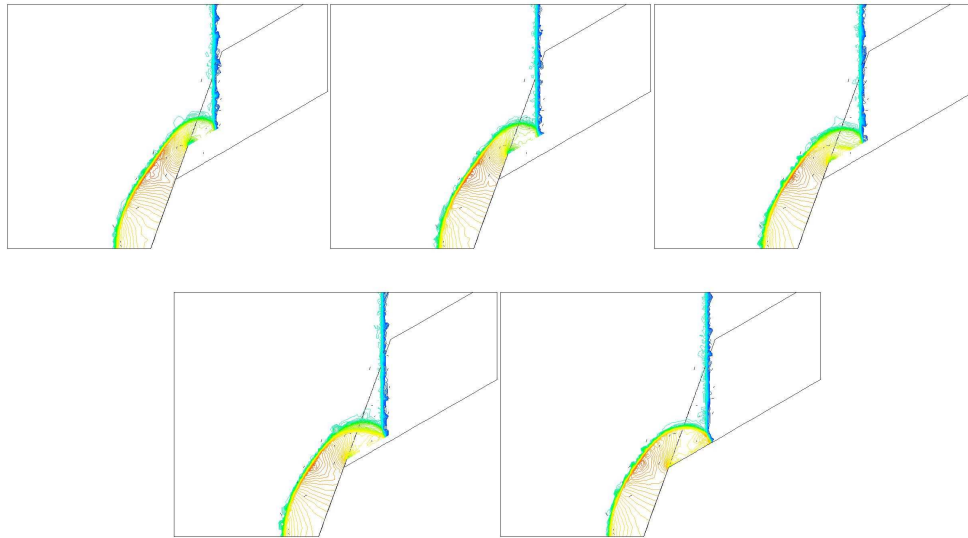


Figure 209: Enlarged density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the y-z plane at $x = 55\text{mm}$, 60mm , 65mm , 70mm , and 75mm respectively.

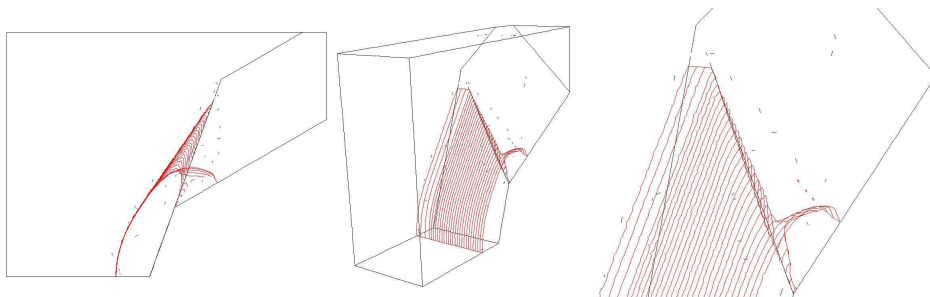


Figure 210: Overlaid pressure contour plots (single level) of secondary reflected wave for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$.

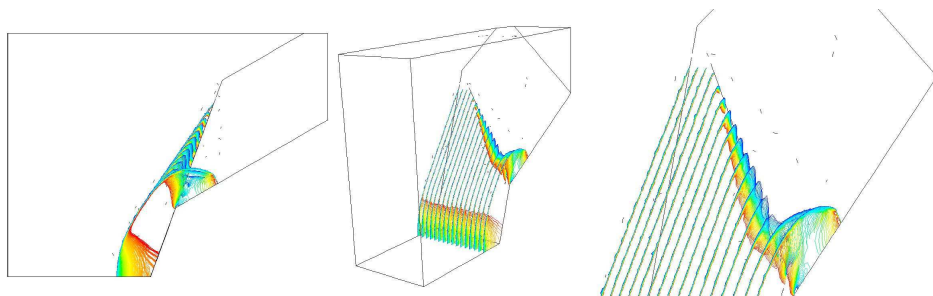


Figure 211: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$.

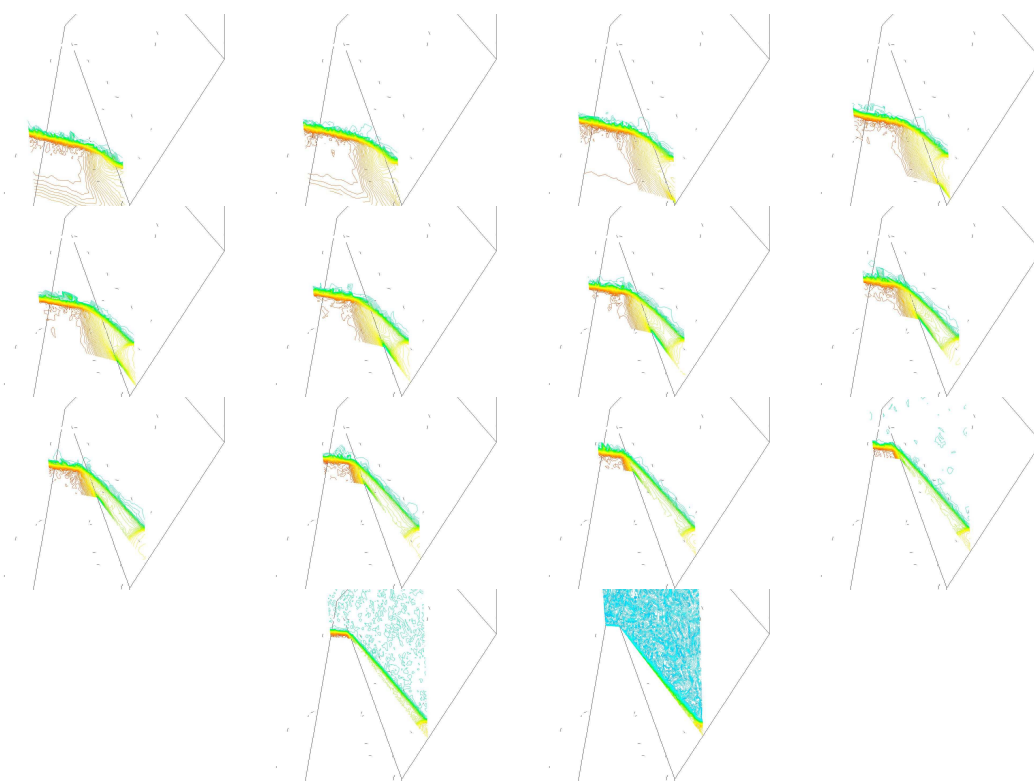


Figure 212: Isometric views of sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 5mm along the z axis.

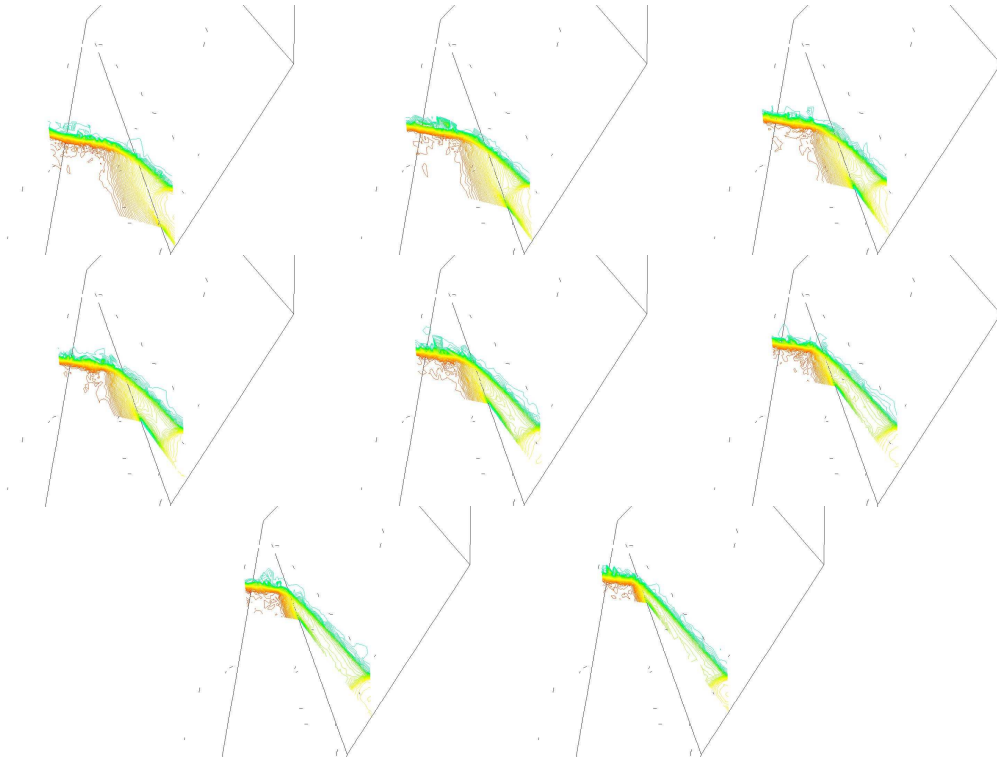


Figure 213: Enlarged isometric views of sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 5mm along the z axis.

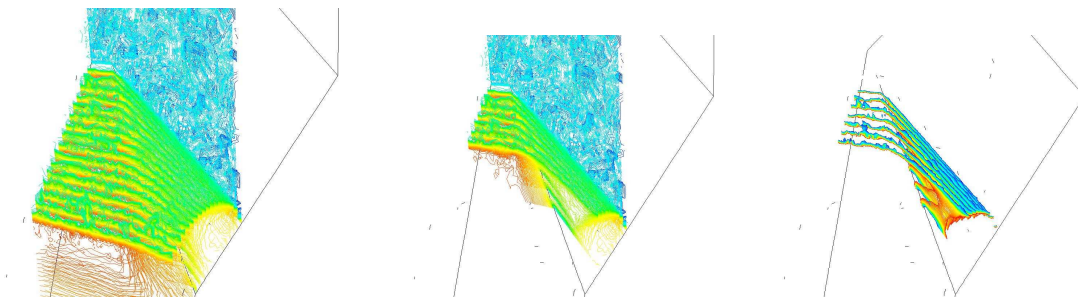


Figure 214: Isometric view of overlaid density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane.

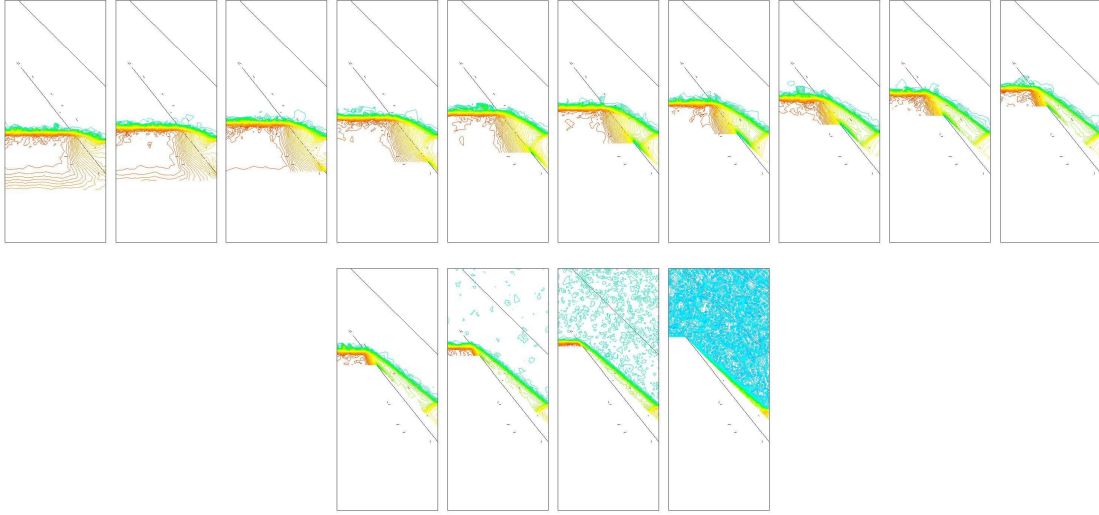


Figure 215: Sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

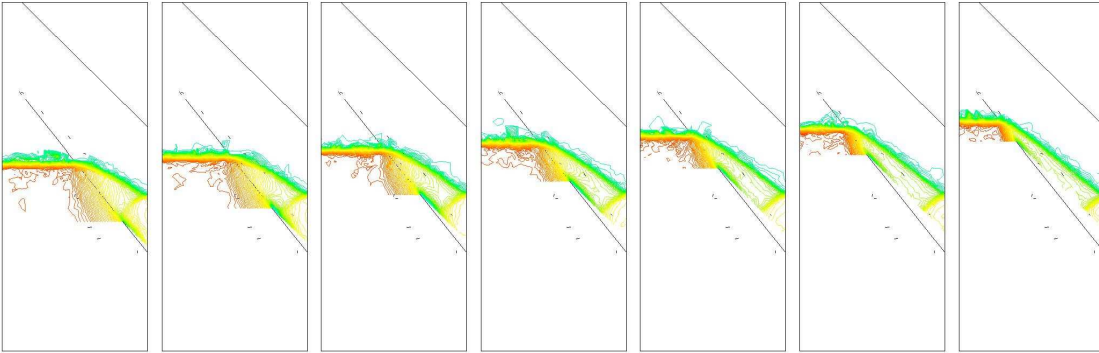


Figure 216: Enlarged sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y in steps of 5mm along the z axis.

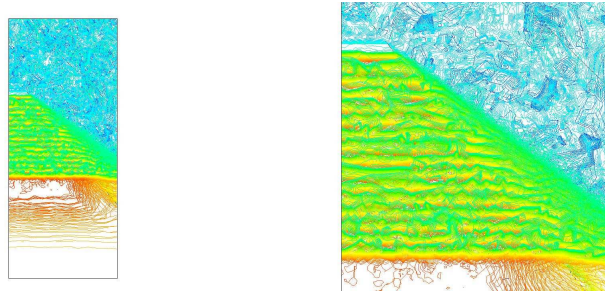


Figure 217: Overlaid density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, taken in the x-y plane.

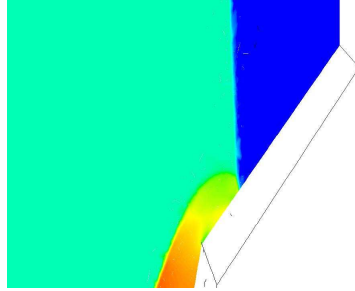


Figure 218: Filled density contour plot of plane in y-z plane for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 30^\circ$, illustrating shear layer.

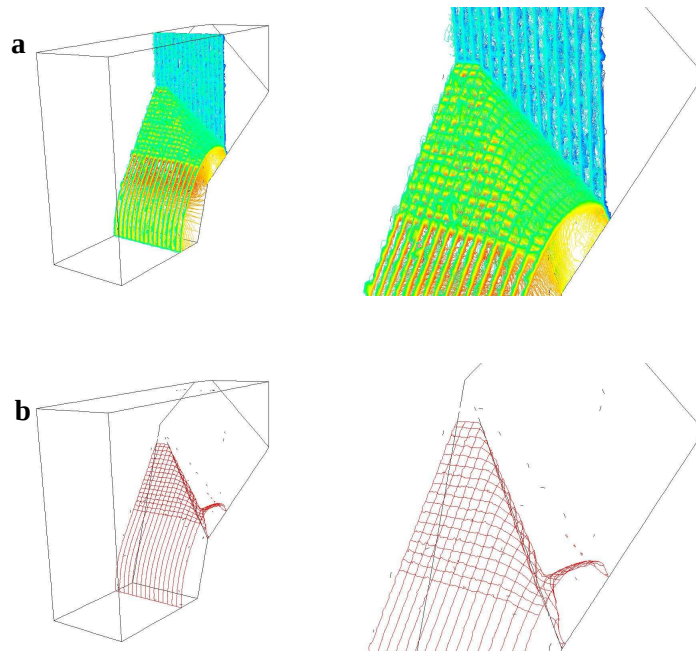


Figure 219: Isometric view of overlaid planes for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$.

a) Entire flow field b) Secondary reflected wave

F.2.8 Triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$

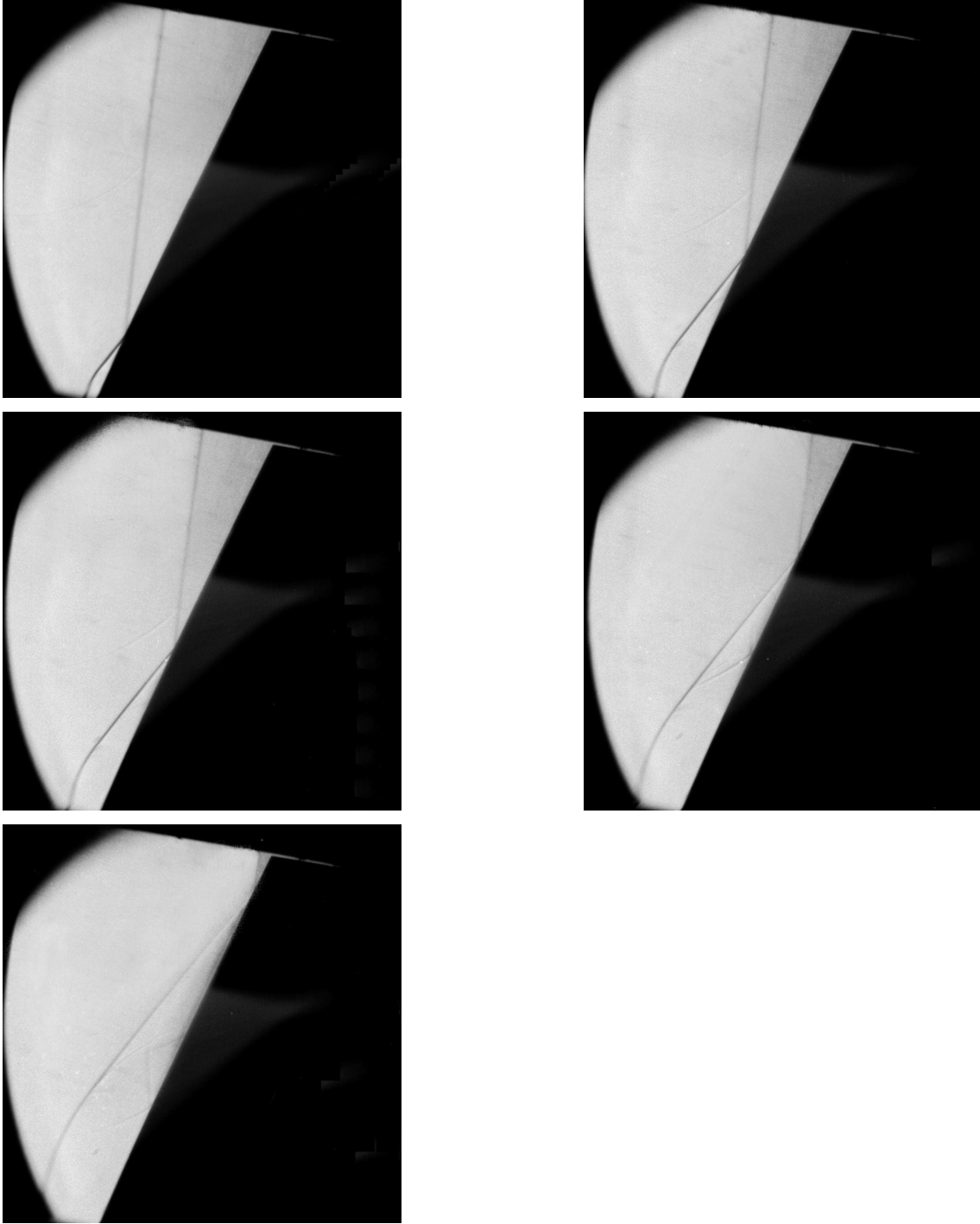


Figure 220: Schlieren images for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, at time delay 1600 μ s, 1625 μ s, 1650 μ s, 1675 μ s, and 1700 μ s respectively.

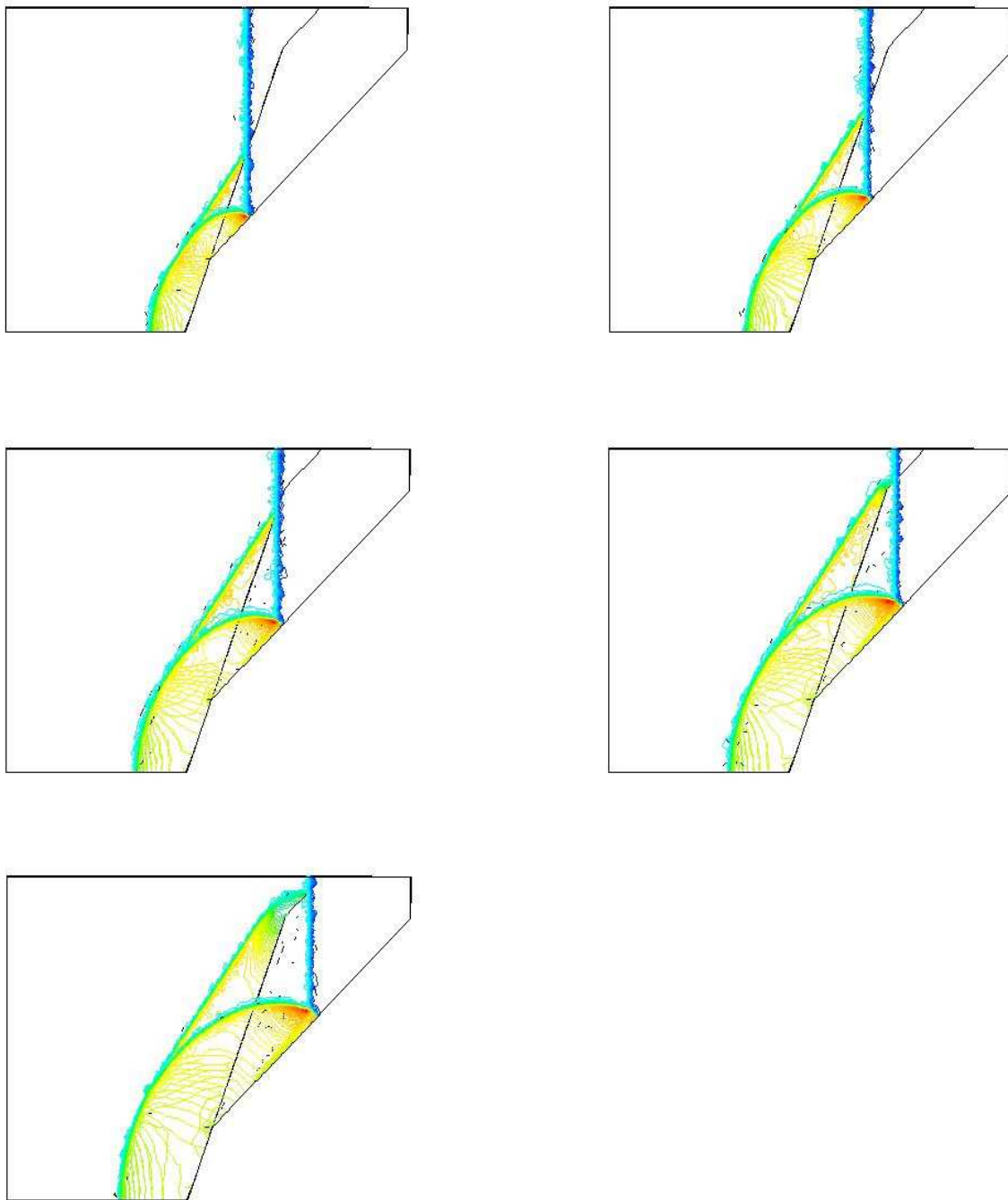


Figure 221: Sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$.

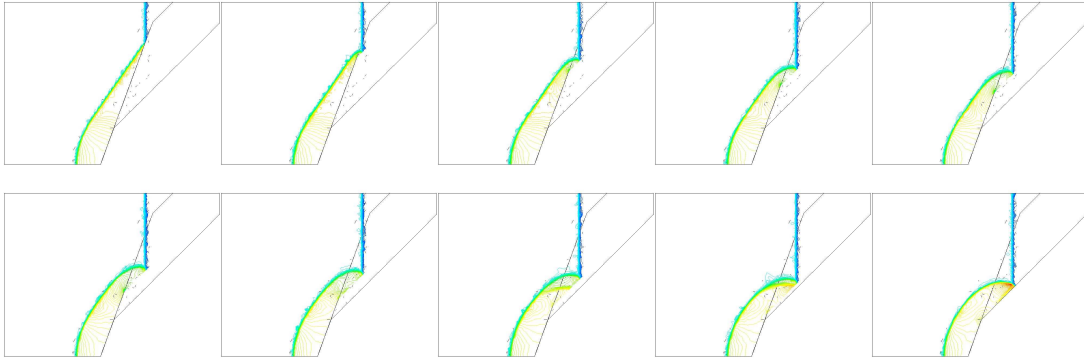


Figure 222: Density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the y-z plane at $x = 0\text{mm}$, 25mm , 35mm , 45mm , 50mm , 55mm , 60mm , 65mm , 70mm and 75mm respectively.

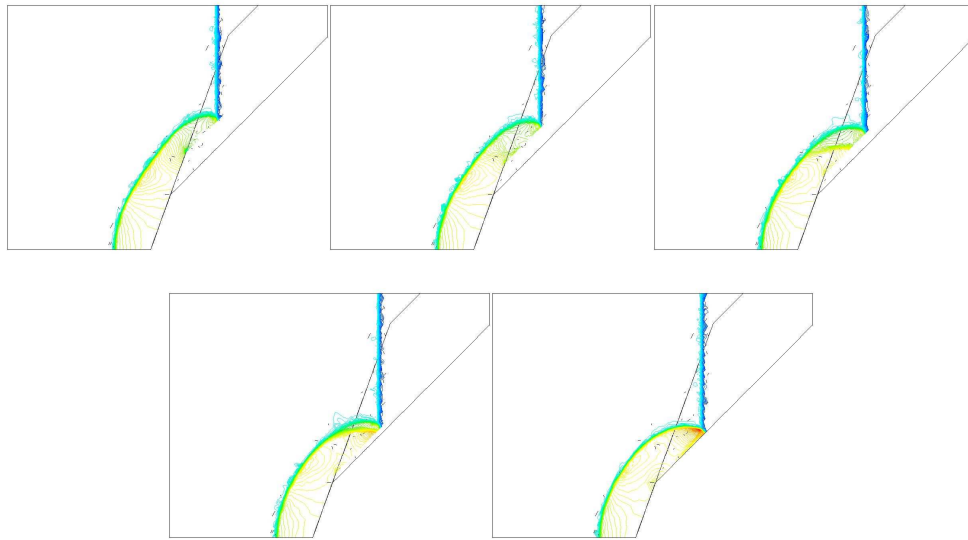


Figure 223: Enlarged density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the y-z plane at $x = 55\text{mm}$, 60mm , 65mm , 70mm , and 75mm respectively.

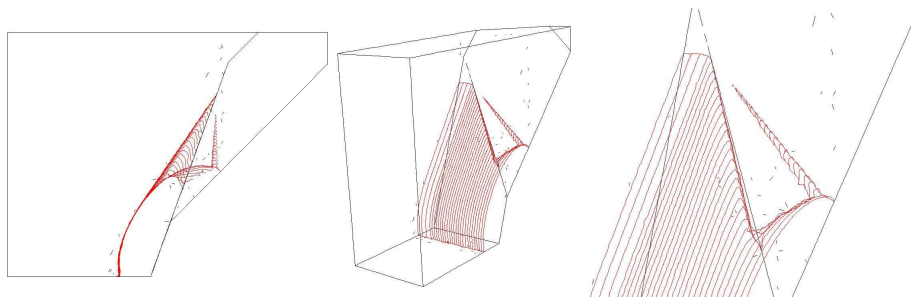


Figure 224: Overlaid pressure contour plots (single level) of secondary reflected wave for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$.

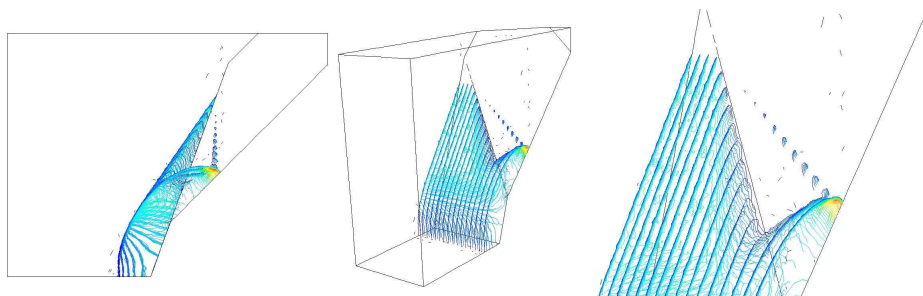


Figure 225: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$.

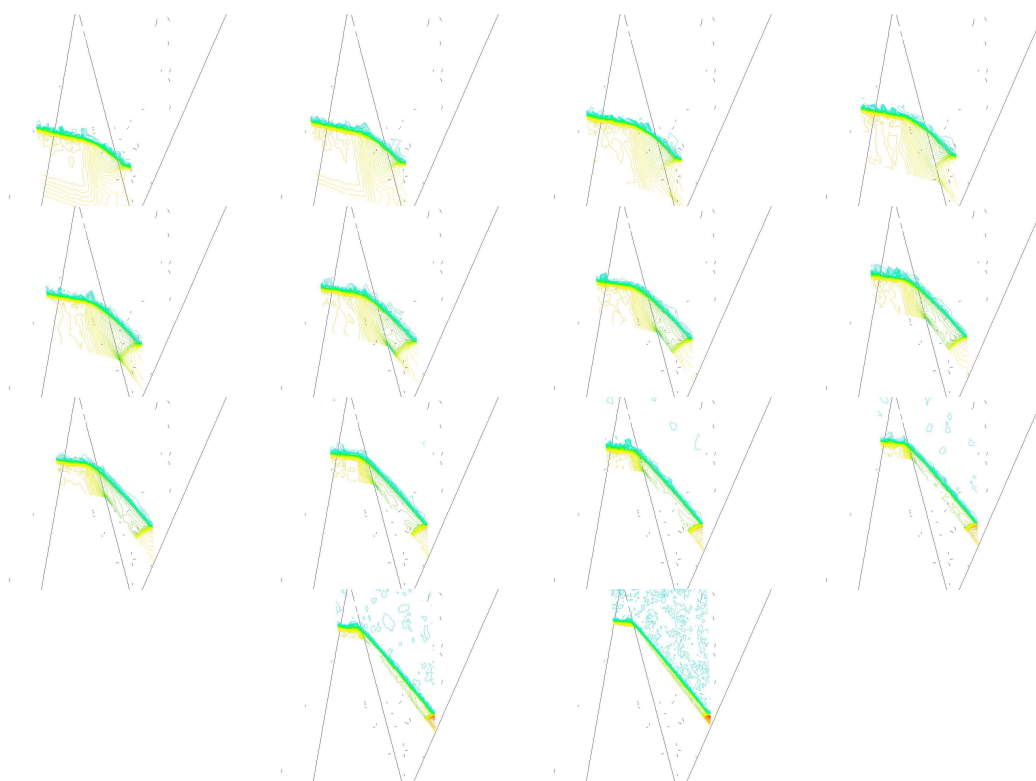


Figure 226: Isometric views of sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y in steps of 5mm along the z axis.

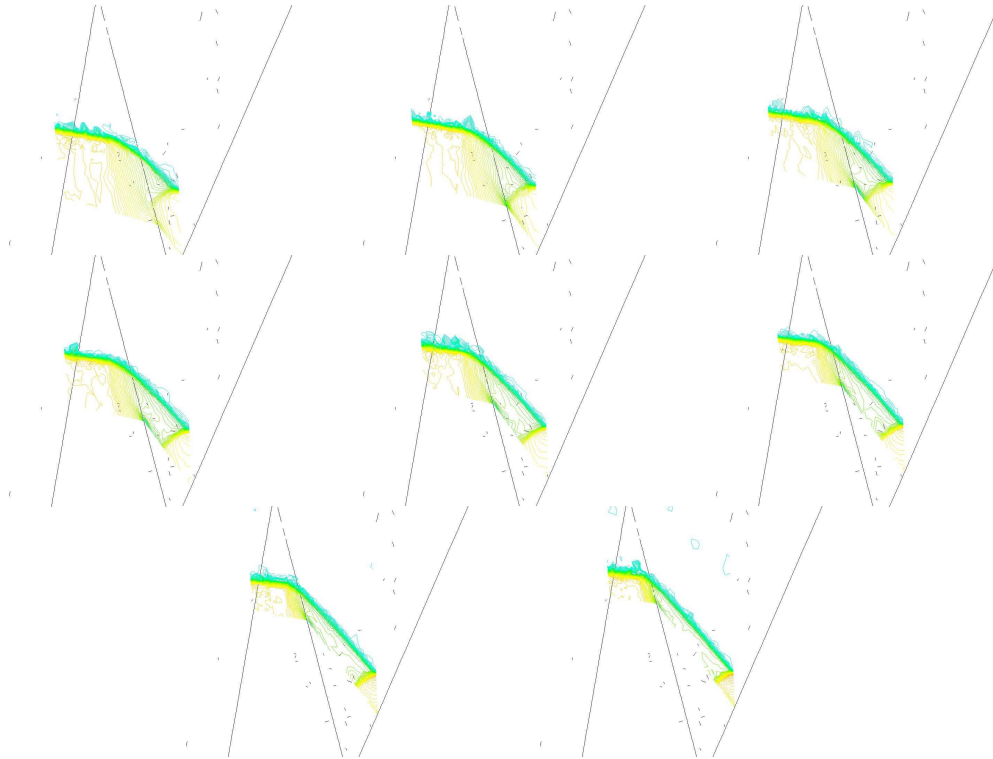


Figure 227: Enlarged isometric views of sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y in steps of 5mm along the z axis.

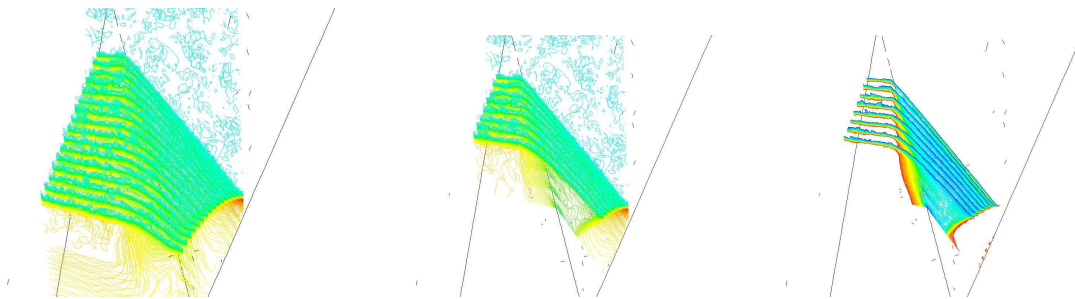


Figure 228: Isometric view of overlaid density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane.

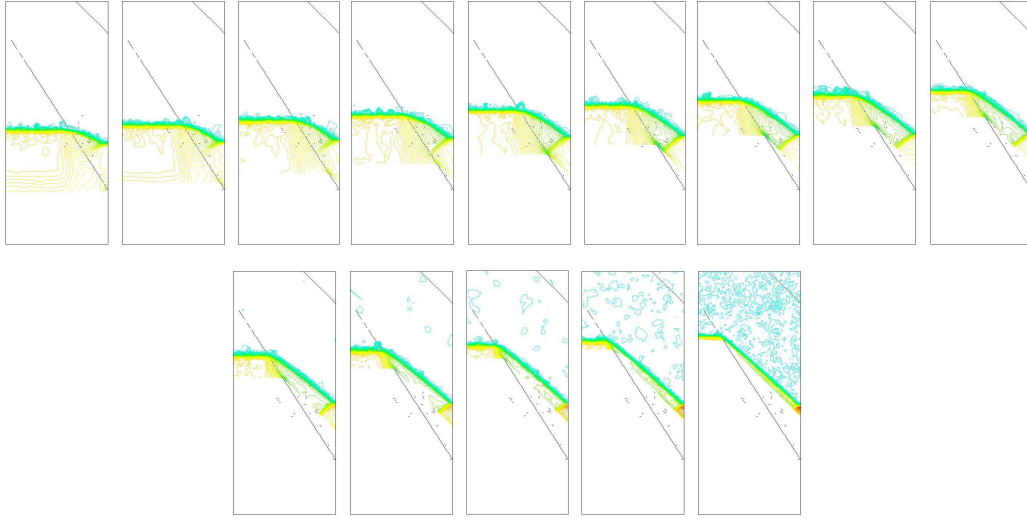


Figure 229: Sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

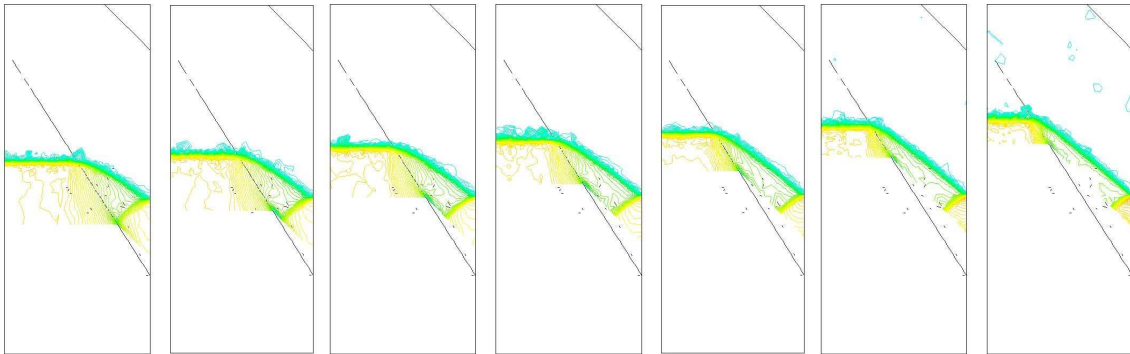


Figure 230: Enlarged sequential density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane in steps of 5mm along the z axis.

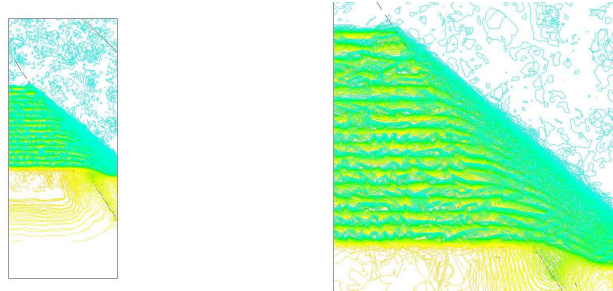


Figure 231: Overlaid density contour plots for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, taken in the x-y plane.

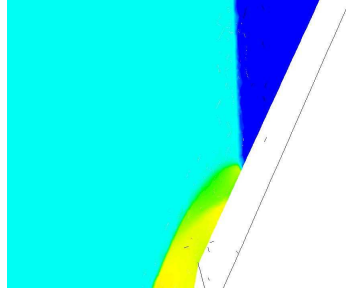


Figure 232: Filled density contour plot of plane in y-z plane for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$, illustrating shear layer.

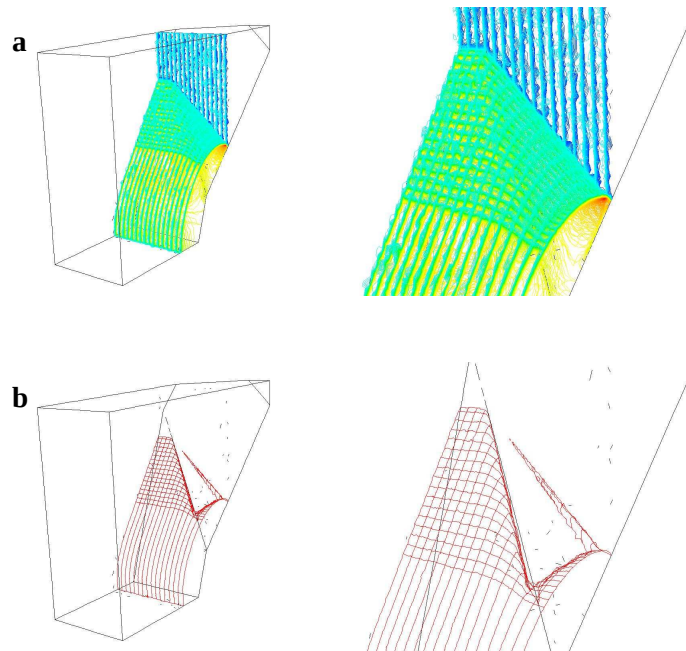


Figure 233: Isometric view of overlaid planes for triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$.

a) Entire flow field b) Secondary reflected wave

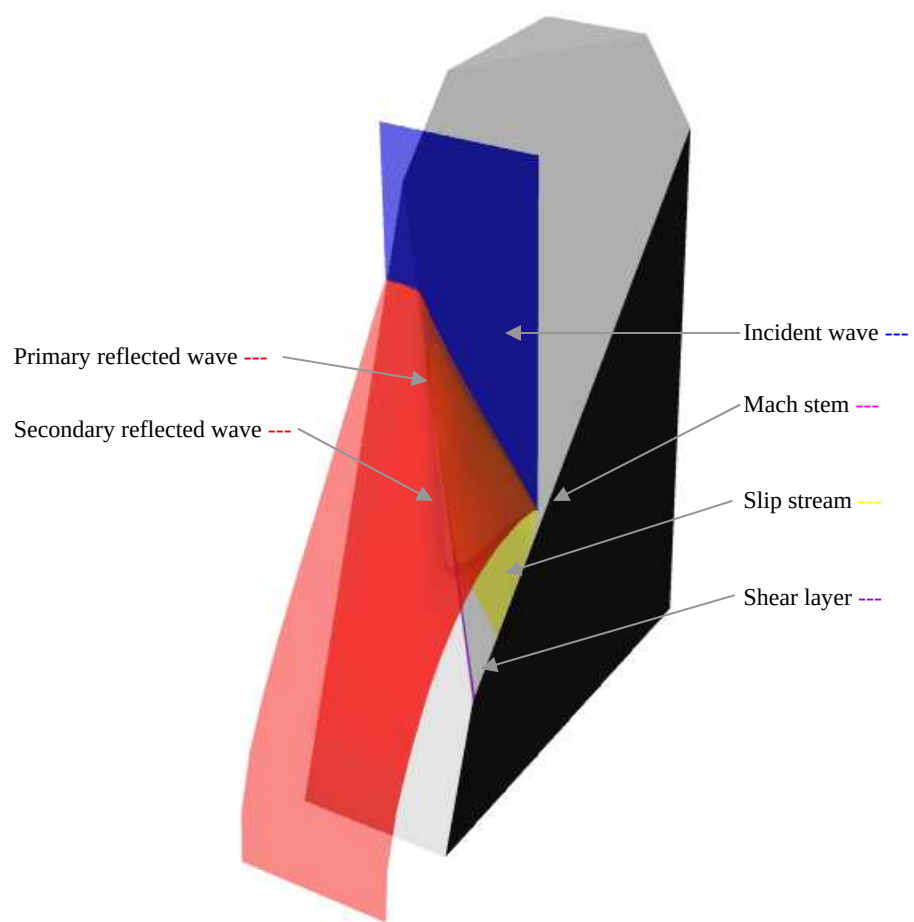


Figure 234: Three-dimensional NURBS model of triangular valley, $\theta_w = 70^\circ$, $\theta_v = 45^\circ$.

F.3.5 Parabolic valley results

F.3.1 Parabolic valley, $a = 0.04$

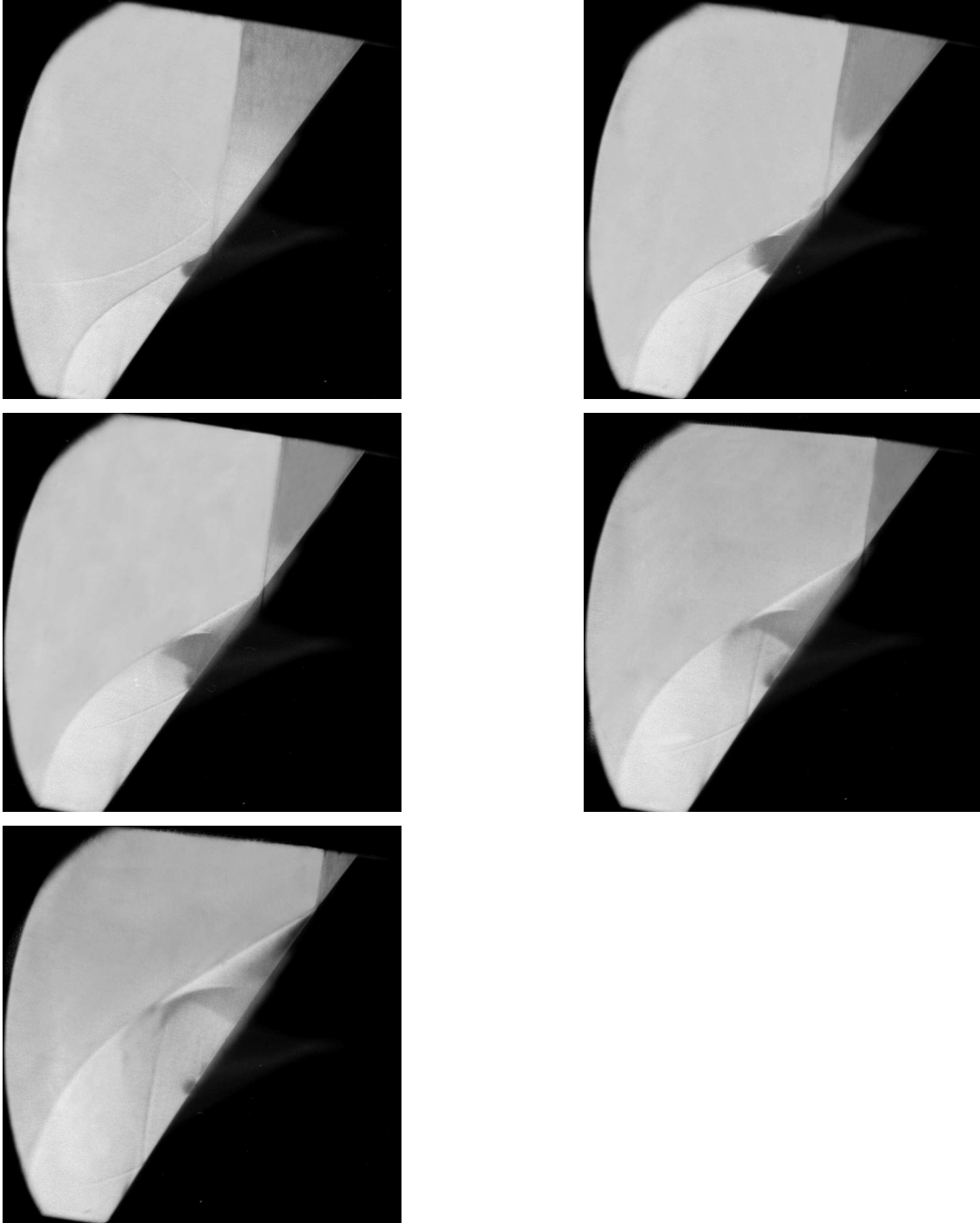


Figure 235: Schlieren images for parabolic valley, $a = 0.04$, at time delay 1650μs, 1675μs, 1700μs, 1725μs, and 1750μs respectively.

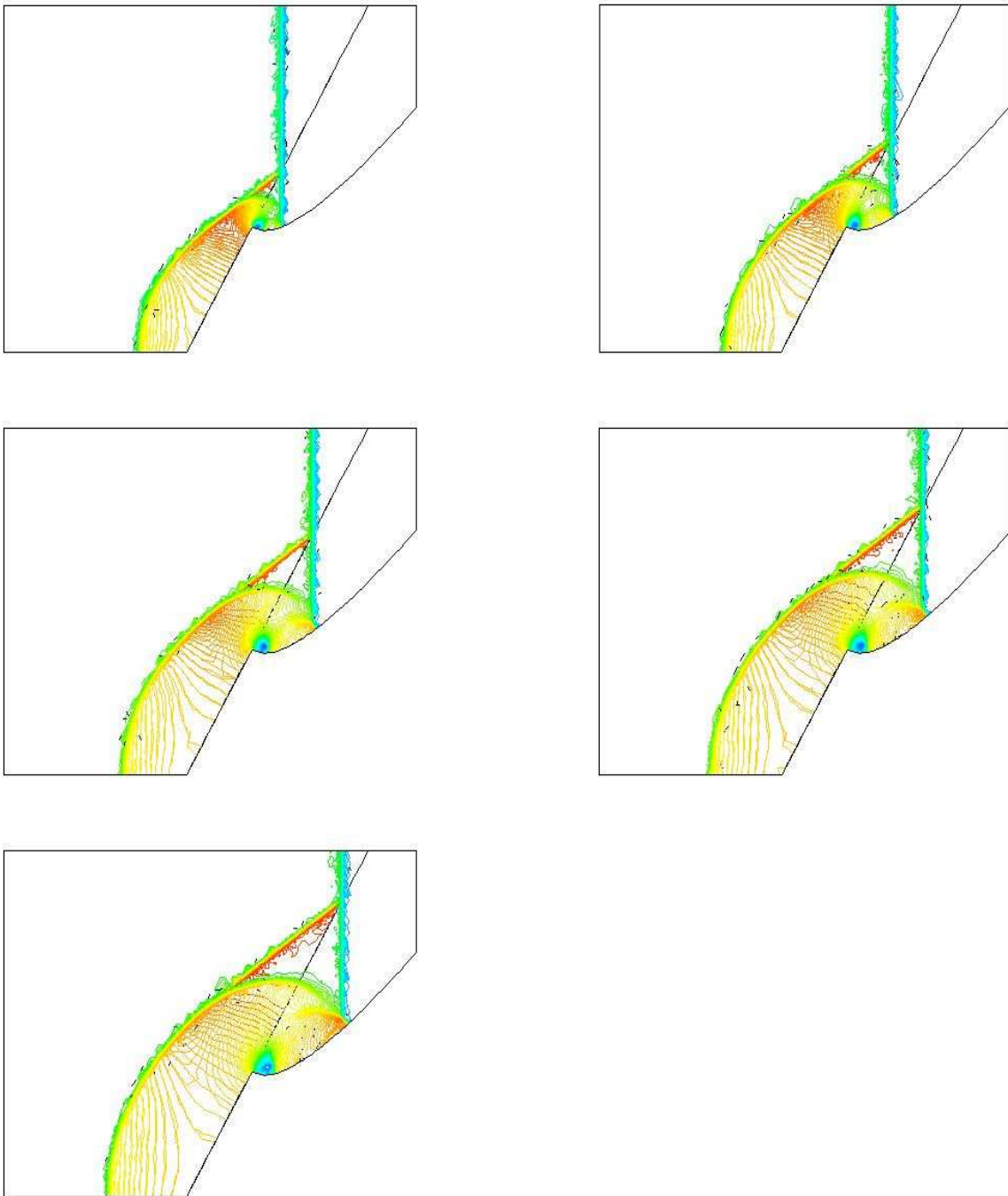


Figure 236: Sequential density contour plots for parabolic valley, $a = 0.04$.

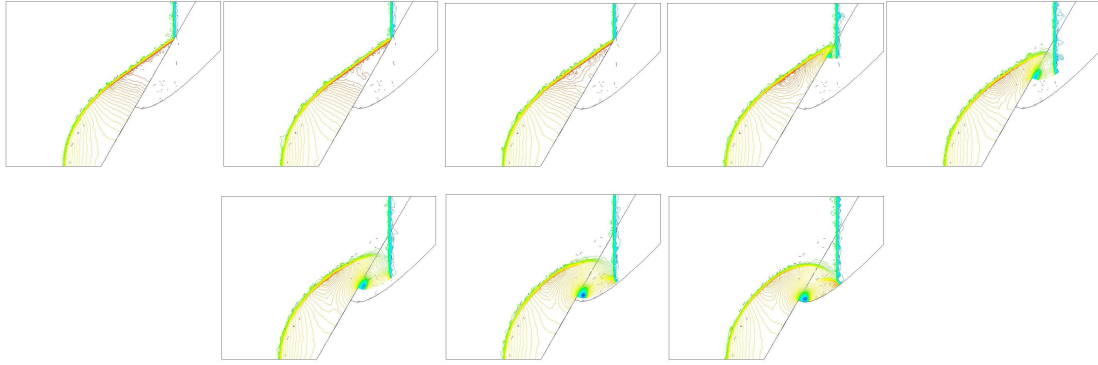


Figure 237: Density contour plots for parabolic valley, $a = 0.04$, taken in the y-z plane at $x = 0\text{mm}$, 15mm , 25mm , 35mm , 45mm , 55mm , 65mm , 75mm , respectively.

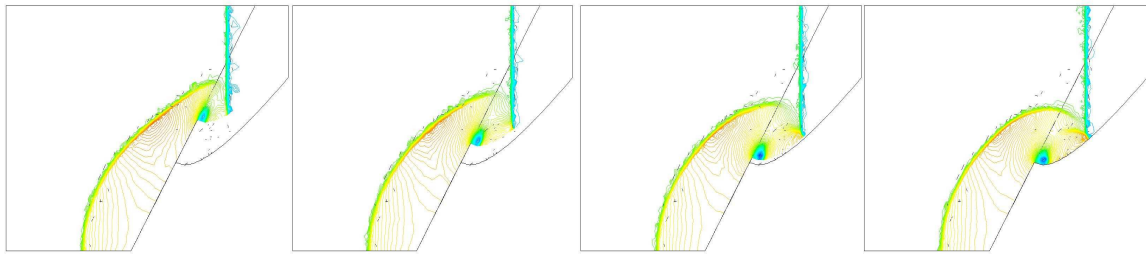


Figure 238: Enlarged density contour plots for parabolic valley, $a = 0.04$, taken in the y-z plane at $x = 35\text{mm}$, 45mm , 55mm , 65mm respectively.

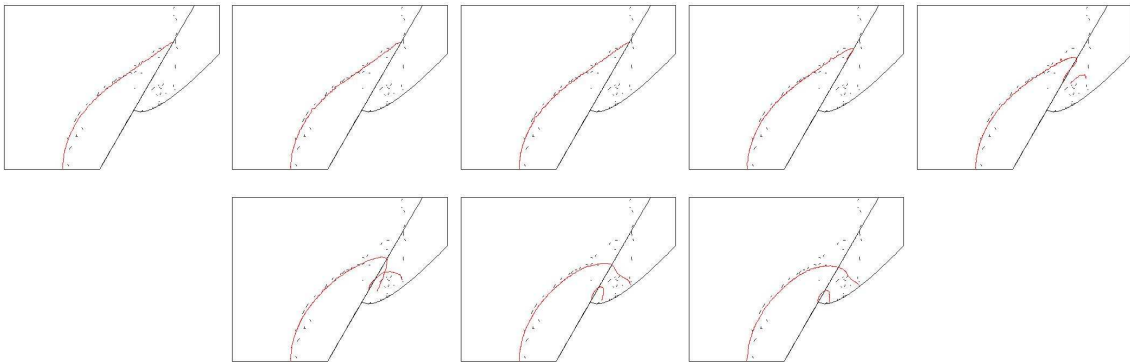


Figure 239: Pressure contour plots (single level) of secondary reflected wave for parabolic valley, $a = 0.04$, taken in the y-z plane at $x = 0\text{mm}$, 15mm , 25mm , 35mm , 45mm , 55mm , 65mm , 75mm , respectively.

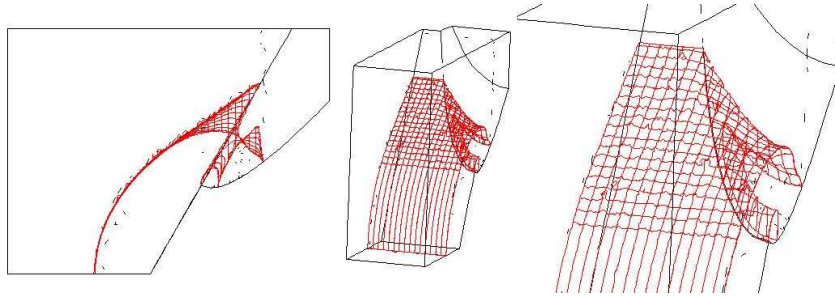


Figure 240: Overlaid pressure contour plots (single level) of secondary reflected wave for parabolic valley, $a = 0.04$.

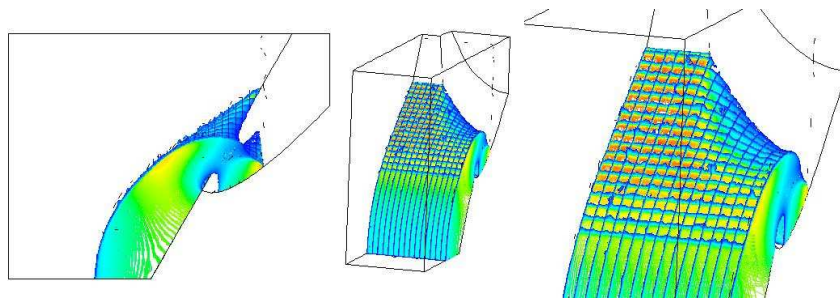


Figure 241: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for parabolic valley, $a = 0.04$.

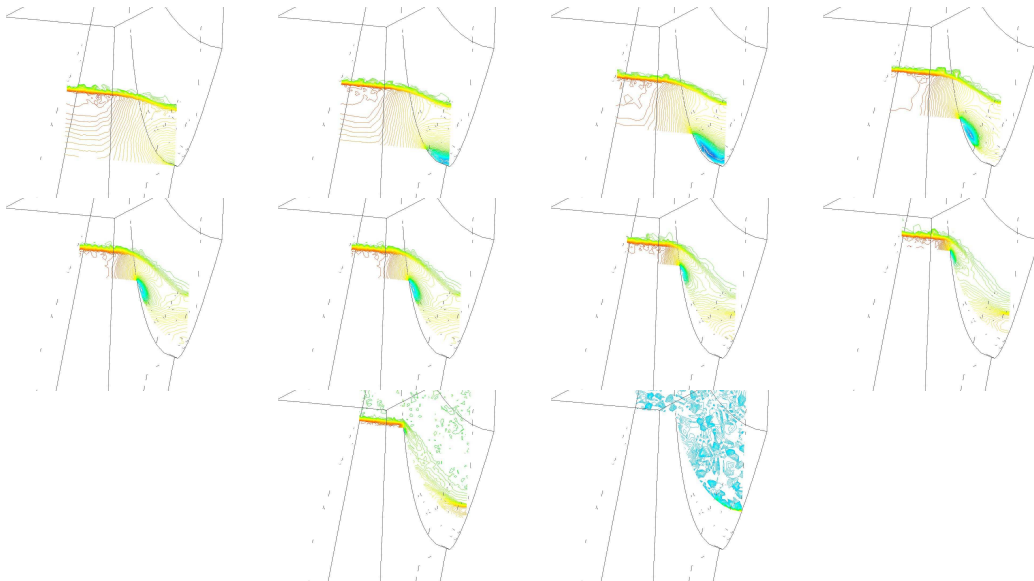


Figure 242: Isometric views of sequential density contour plots for parabolic valley, $a = 0.04$, taken in the x-y in steps of 5mm along the z axis.

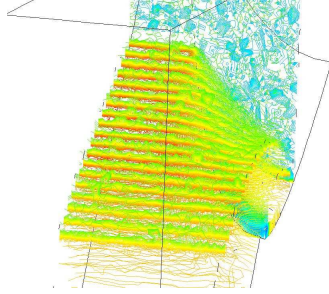


Figure 243: Isometric view of overlaid density contour plots for parabolic valley, $a = 0.04$, taken in the x-y plane.

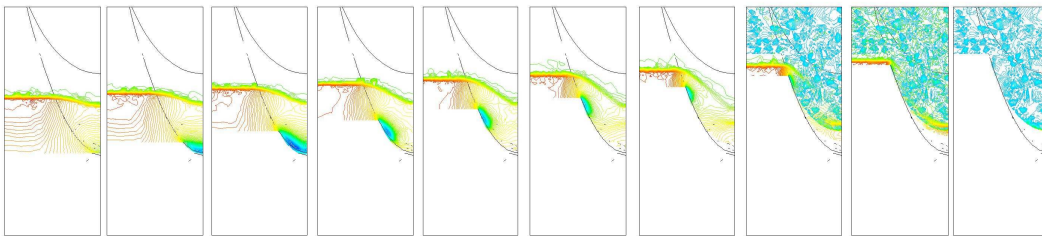


Figure 244: Sequential density contour plots for parabolic valley, $a = 0.04$, taken in the x-y plane in steps of 5mm along the z axis.

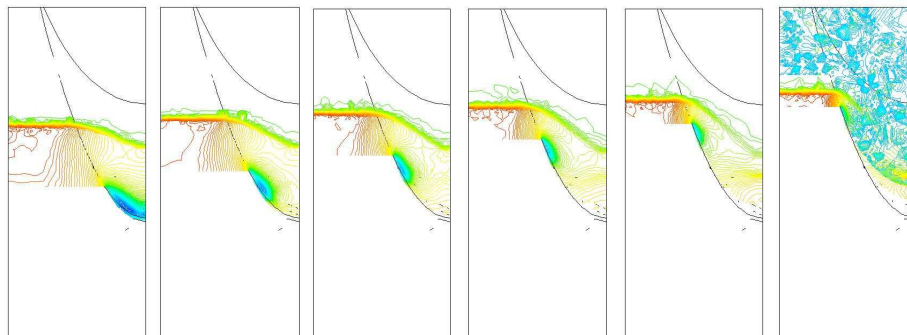


Figure 245: Enlarged sequential density contour plots for parabolic valley, $a = 0.04$, taken in the x-y plane in steps of 5mm along the z axis.

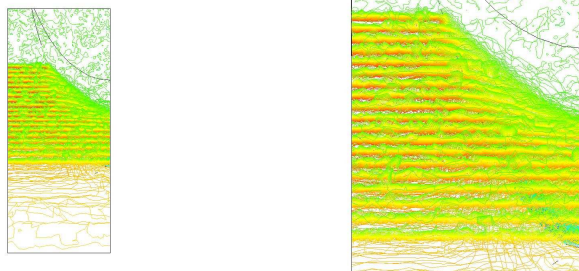


Figure 246: Overlaid density contour plots for parabolic valley, $a = 0.04$, taken in the x-y plane.

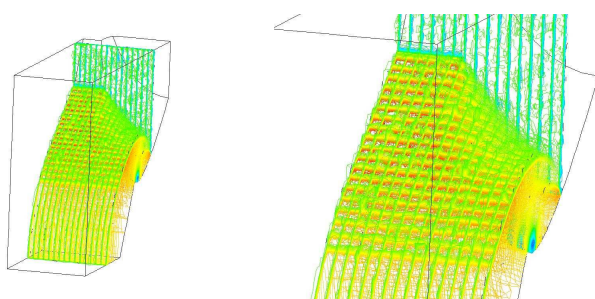
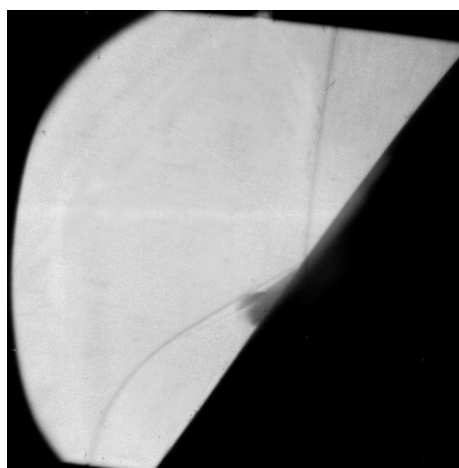
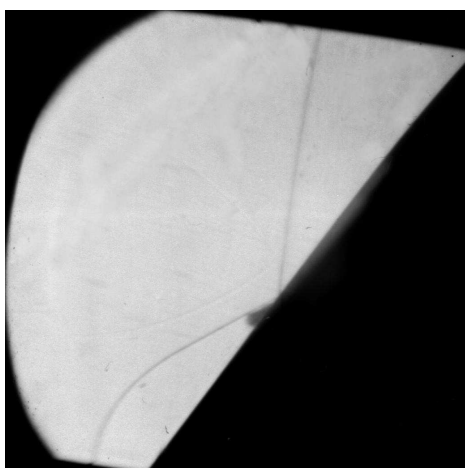


Figure 247: Isometric view of overlaid planes for parabolic valley, $a = 0.04$.

F.3.2 Parabolic valley, $a = 0.055$



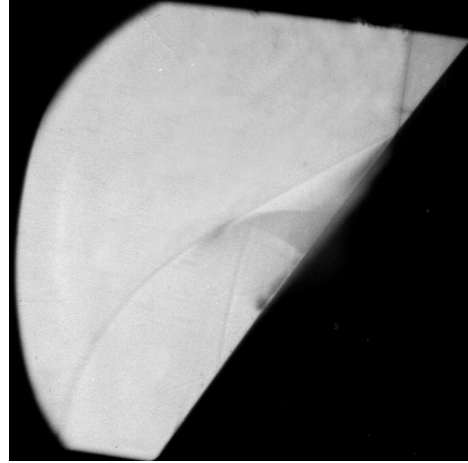
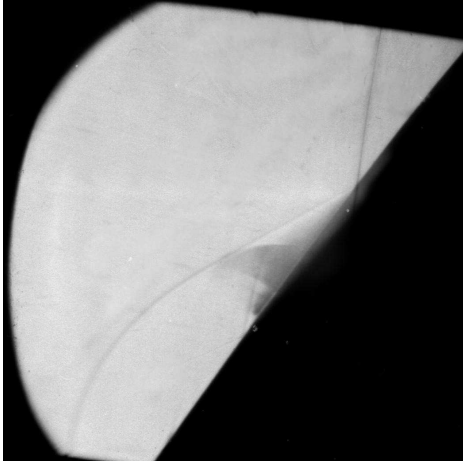
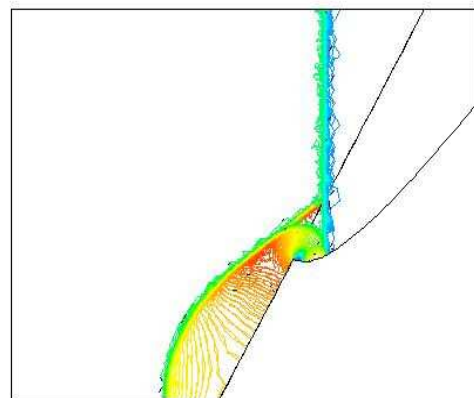
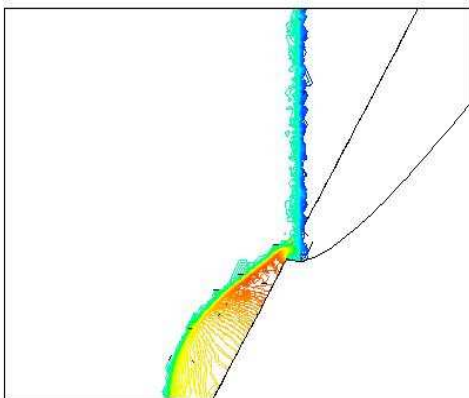


Figure 248: Schlieren images for parabolic valley, $a = 0.055$, at time delay $1650\mu\text{s}$, $1675\mu\text{s}$, $1700\mu\text{s}$, $1725\mu\text{s}$, and $1750\mu\text{s}$ respectively.



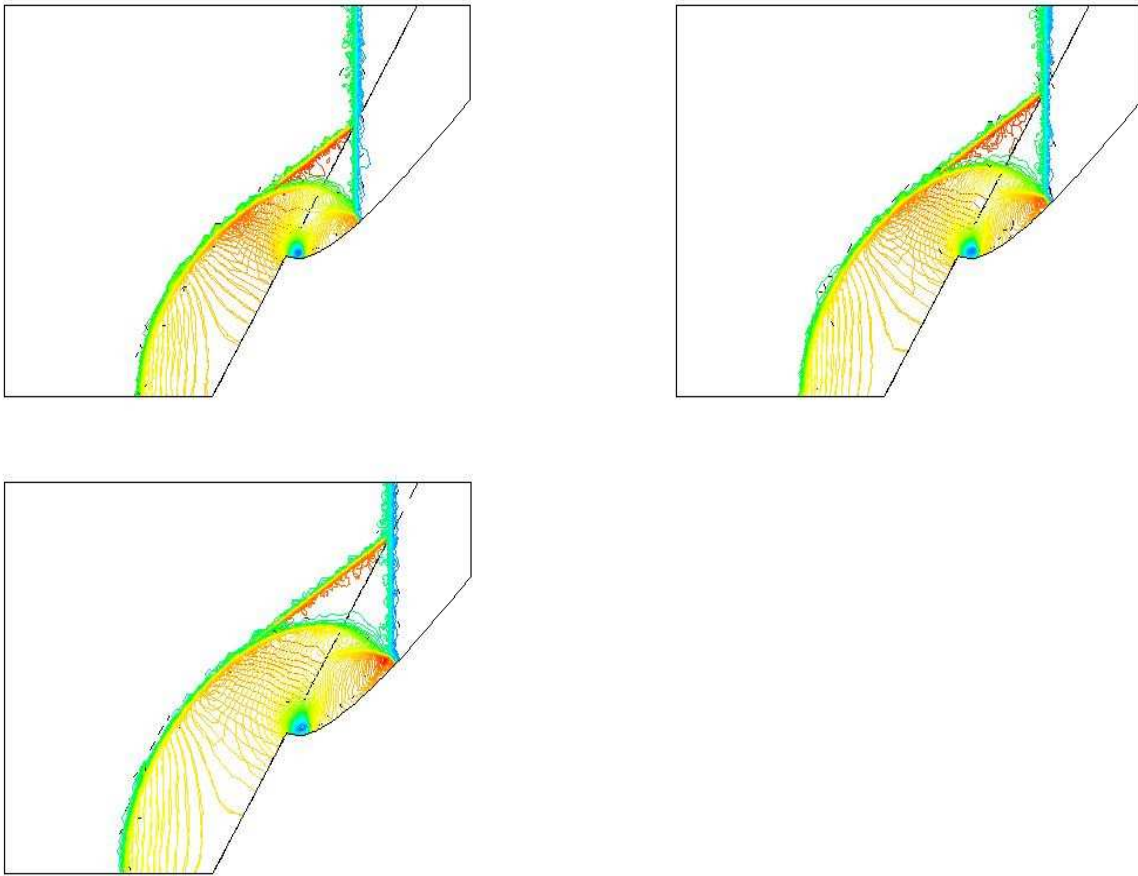


Figure 249: Sequential density contour plots for parabolic valley, $a = 0.055$.

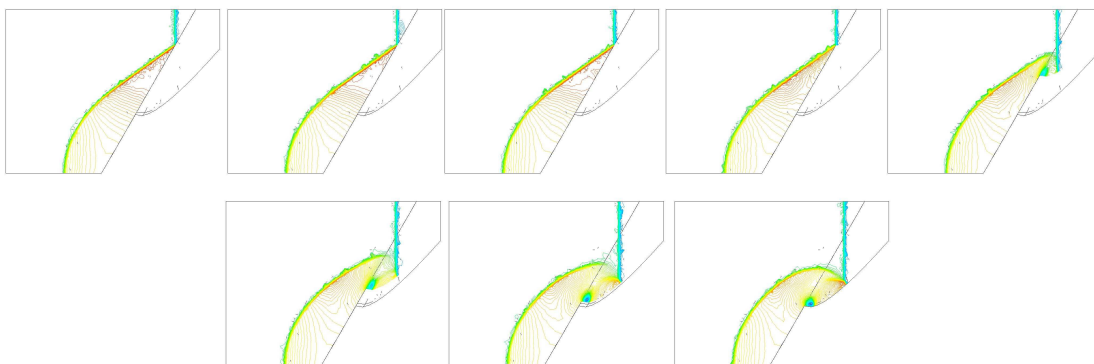


Figure 250: Density contour plots for parabolic valley, $a = 0.055$, taken in the y - z plane at $x = 0\text{mm}$, 15mm , 25mm , 35mm , 45mm , 55mm , 65mm , 75mm , respectively.

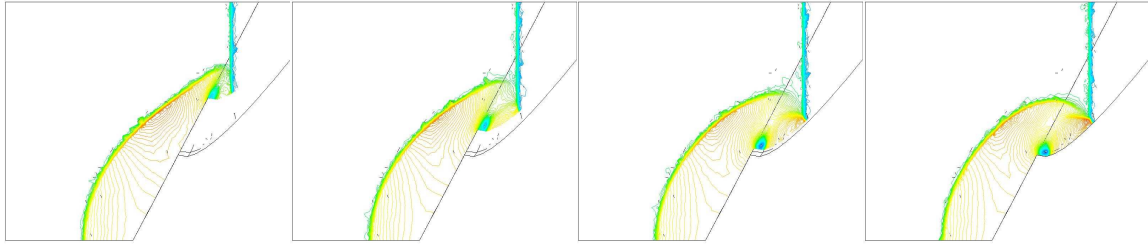


Figure 251: Enlarged density contour plots for parabolic valley, $a = 0.055$, taken in the y-z plane at $x = 35\text{mm}$, 45mm , 55mm , 65mm respectively.

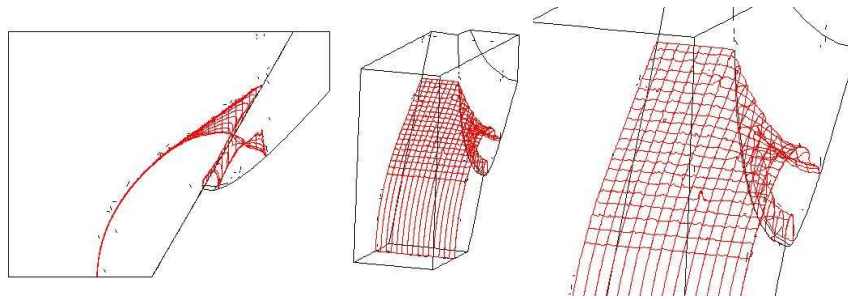


Figure 252: Overlaid pressure contour plots (single level) of secondary reflected wave for parabolic valley, $a = 0.055$.

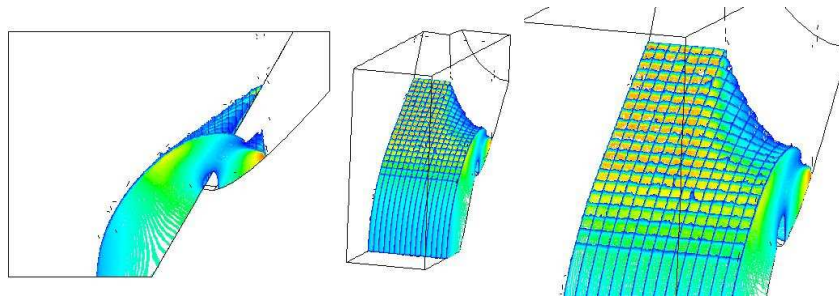


Figure 253: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for parabolic valley, $a = 0.055$.

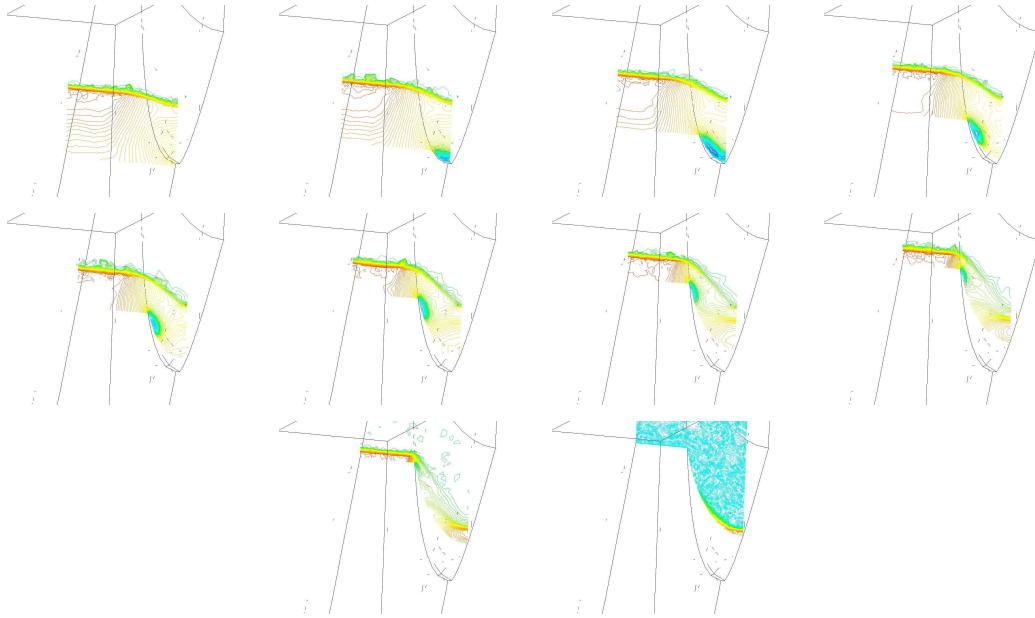


Figure 254: Isometric views of sequential density contour plots for parabolic valley, $a = 0.055$, taken in the x-y in steps of 5mm along the z axis.

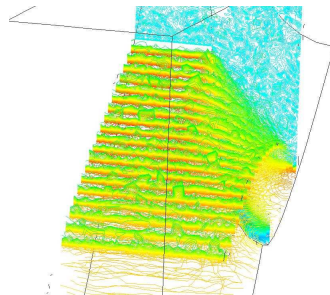


Figure 255: Isometric view of overlaid density contour plots for parabolic valley, $a = 0.055$, taken in the x-y plane.

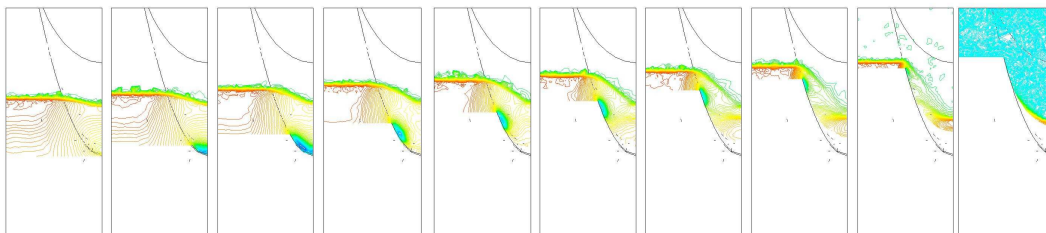


Figure 256: Sequential density contour plots for parabolic valley, $a = 0.055$ taken in the x-y plane in steps of 5mm along the z axis.

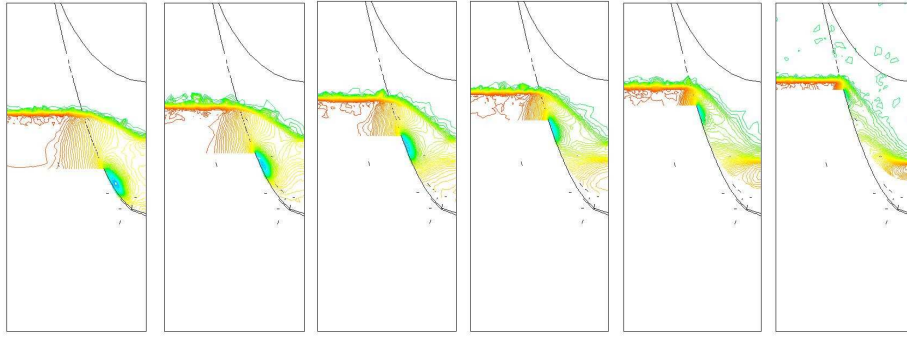


Figure 257: Enlarged sequential density contour plots for parabolic valley, $a = 0.055$ taken in the x-y plane in steps of 5mm along the z axis.

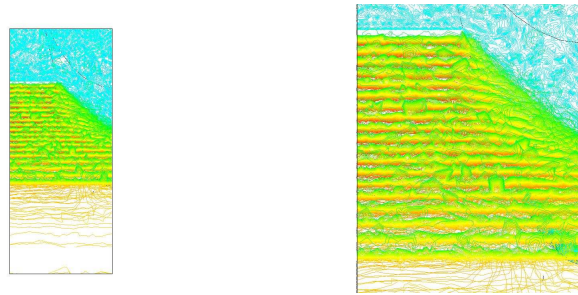


Figure 258: Overlaid density contour plots for parabolic valley, $a = 0.055$, taken in the x-y plane.

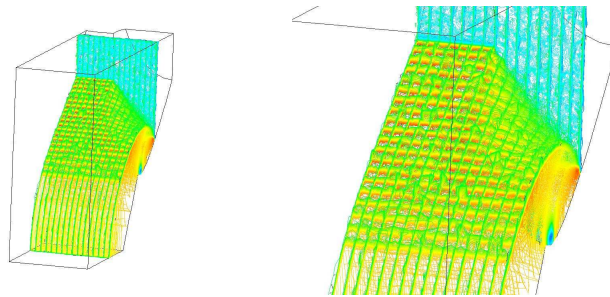


Figure 259: Isometric view of overlaid planes for parabolic valley, $a = 0.055$.

F3.3 Parabolic valley, $a = 0.075$

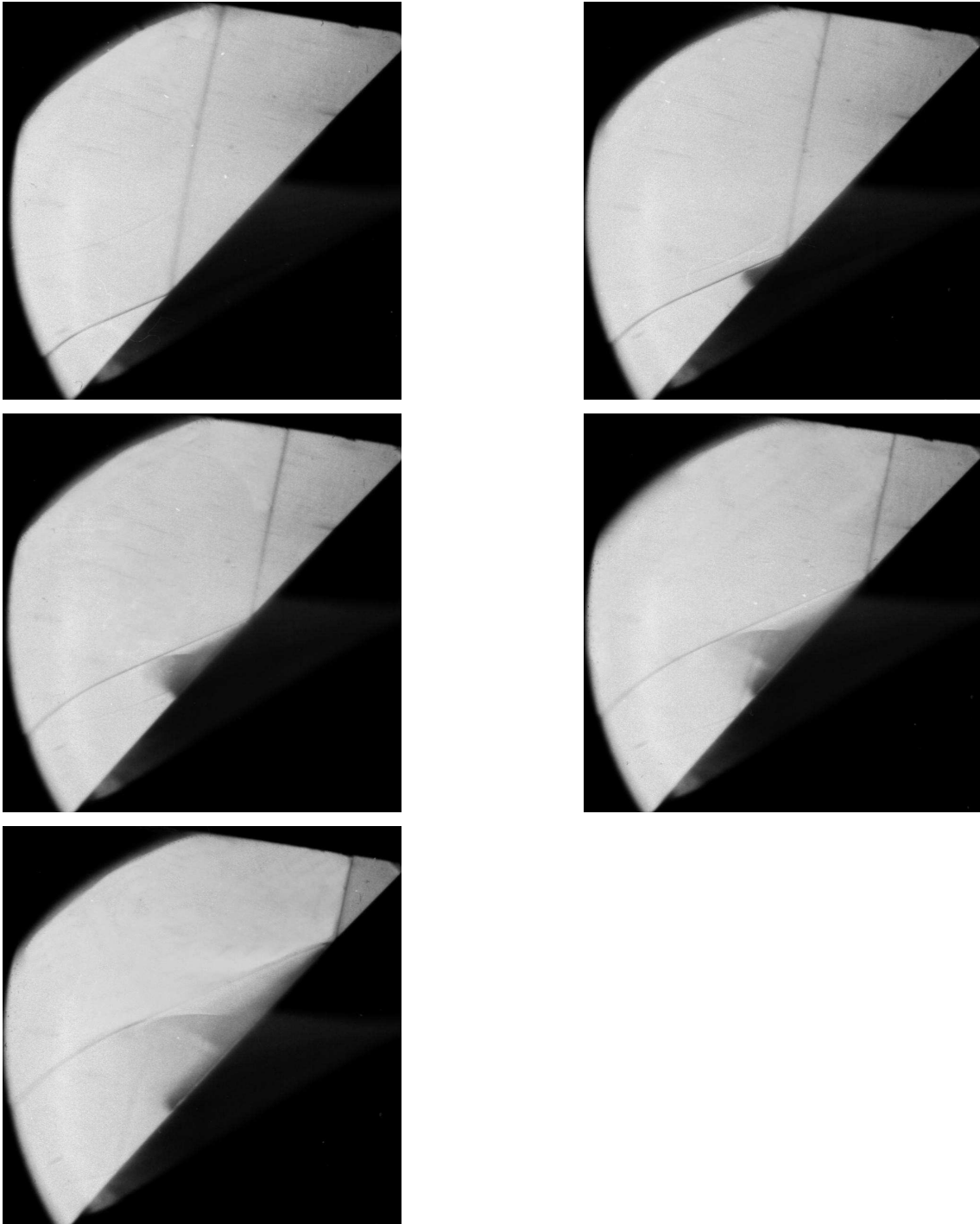


Figure 260: Schlieren images for parabolic valley, $a = 0.075$, at time delay $1650\mu\text{s}$, $1675\mu\text{s}$, $1700\mu\text{s}$, $1725\mu\text{s}$, and $1750\mu\text{s}$ respectively.

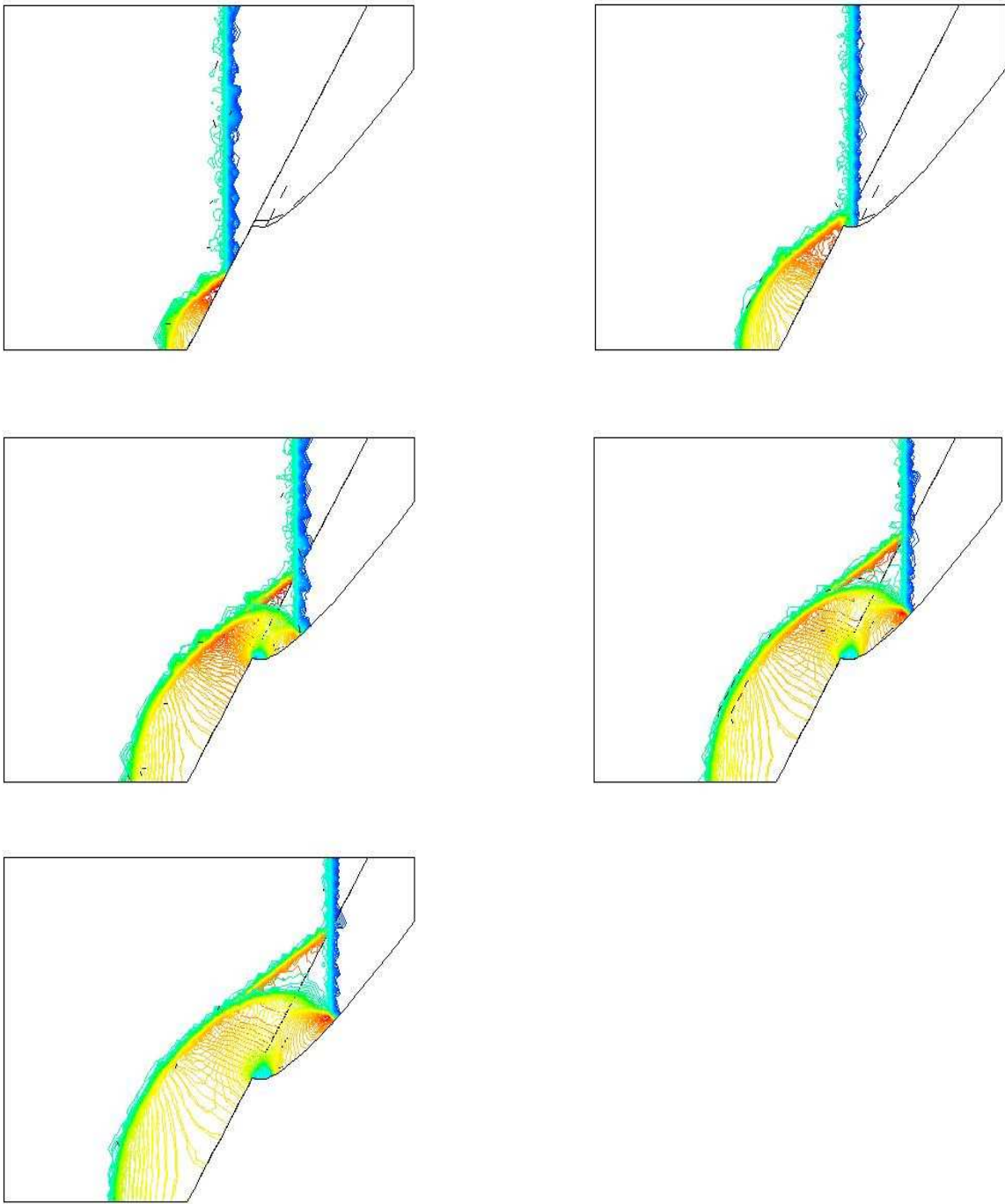


Figure 261: Sequential density contour plots for parabolic valley, $a = 0.075$.

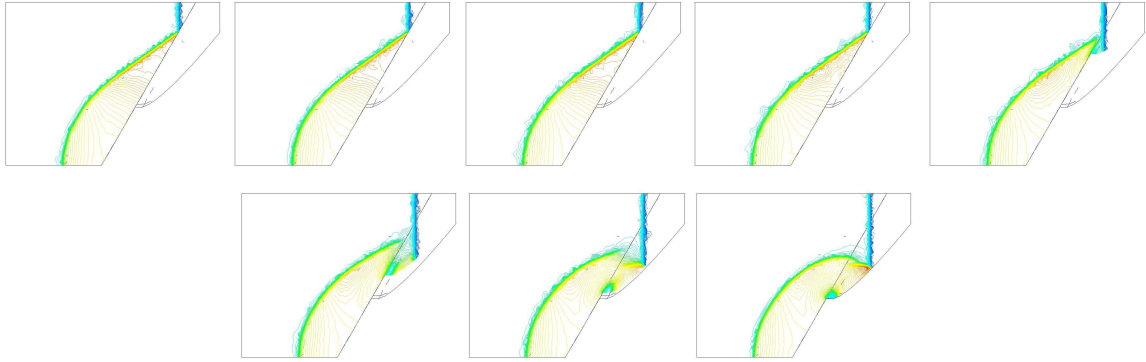


Figure 262: Density contour plots for parabolic valley, $a = 0.075$, taken in the y-z plane at $x = 0\text{mm}$, 15mm , 25mm , 35mm , 45mm , 55mm , 65mm , 75mm , respectively.

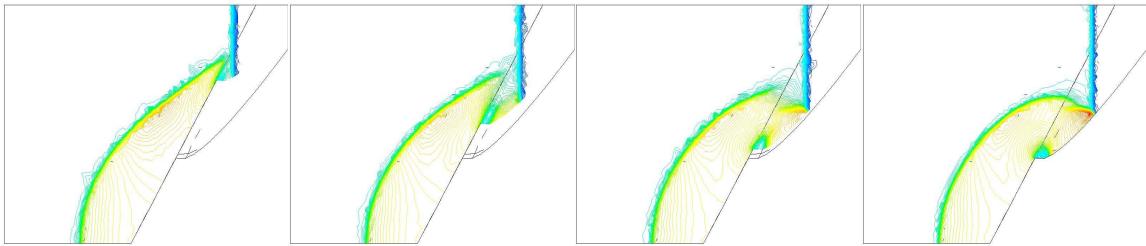


Figure 263: Enlarged density contour plots for parabolic valley, $a = 0.075$, taken in the y-z plane at $x = 35\text{mm}$, 45mm , 55mm , 65mm respectively.

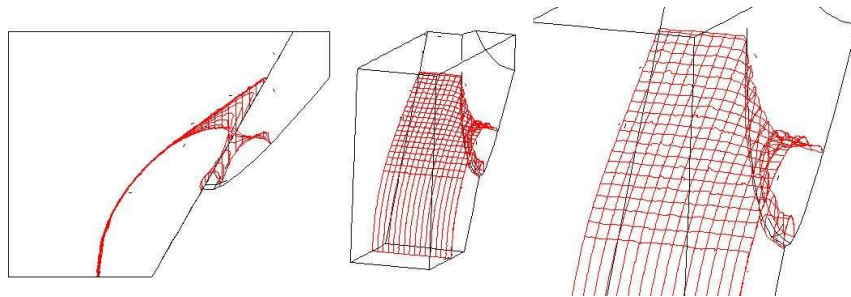


Figure 264: Overlaid pressure contour plots (single level) of secondary reflected wave for parabolic valley, $a = 0.075$.

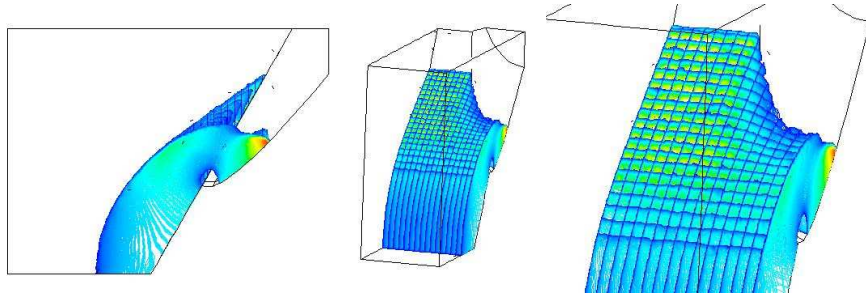


Figure 265: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for parabolic valley, $a = 0.075$.

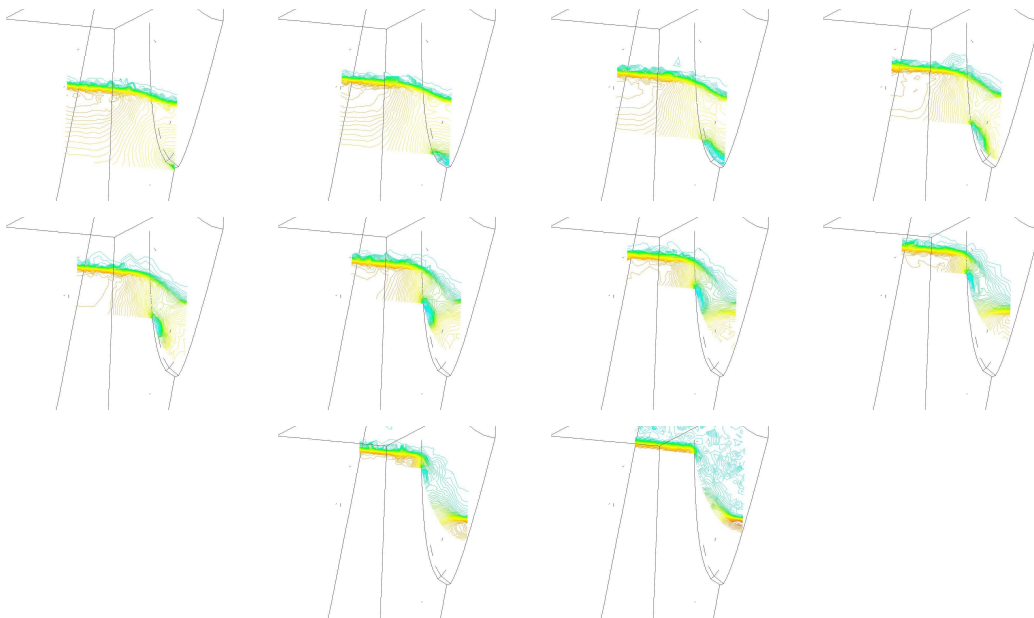


Figure 266: Isometric views of sequential density contour plots for parabolic valley, $a = 0.075$, taken in the x-y in steps of 5mm along the z axis.

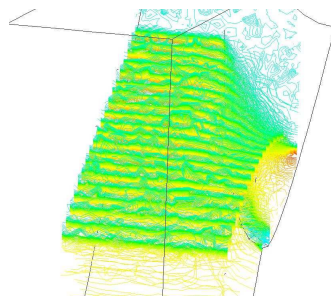


Figure 267: Isometric view of overlaid density contour plots for parabolic valley, $a = 0.075$, taken in the x-y plane.

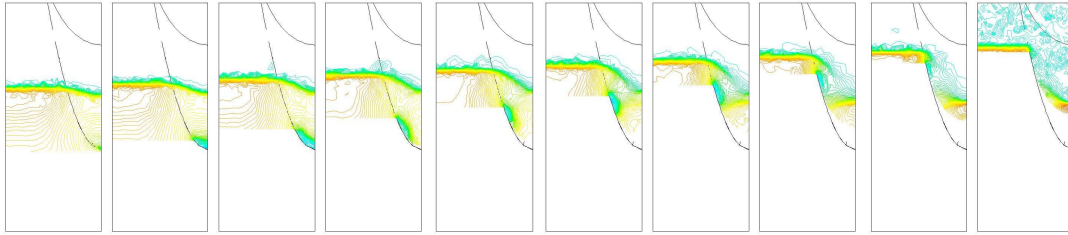


Figure 268: Sequential density contour plots for parabolic valley, $a = 0.075$, taken in the x-y plane in steps of 5mm along the z axis.

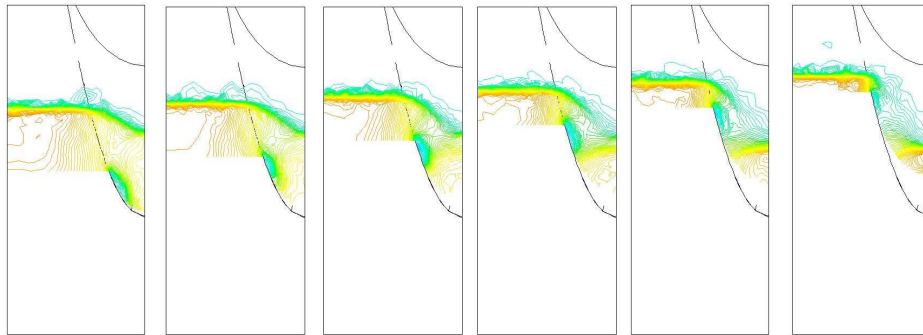


Figure 269: Enlarged sequential density contour plots for parabolic valley, $a = 0.075$, taken in the x-y plane in steps of 5mm along the z axis.

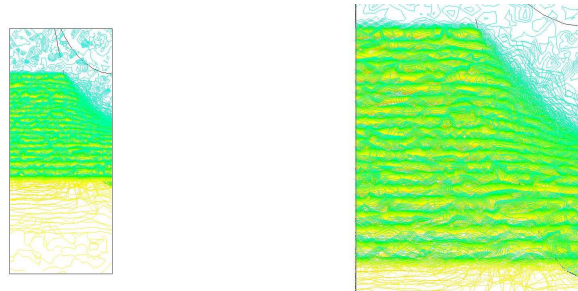


Figure 270: Overlaid density contour plots for parabolic valley, $a = 0.075$, taken in the x-y plane.

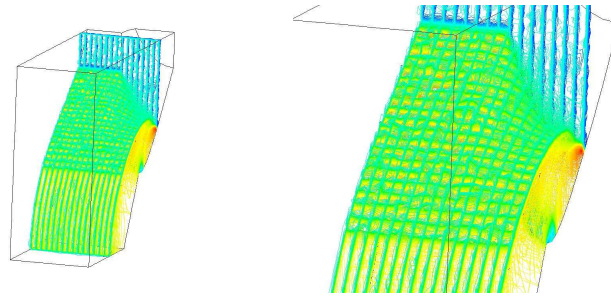


Figure 271: Isometric view of overlaid planes for parabolic valley, $a = 0.075$.

F.4 Conical valley results

F.4.1 Conical valley, 10 degrees

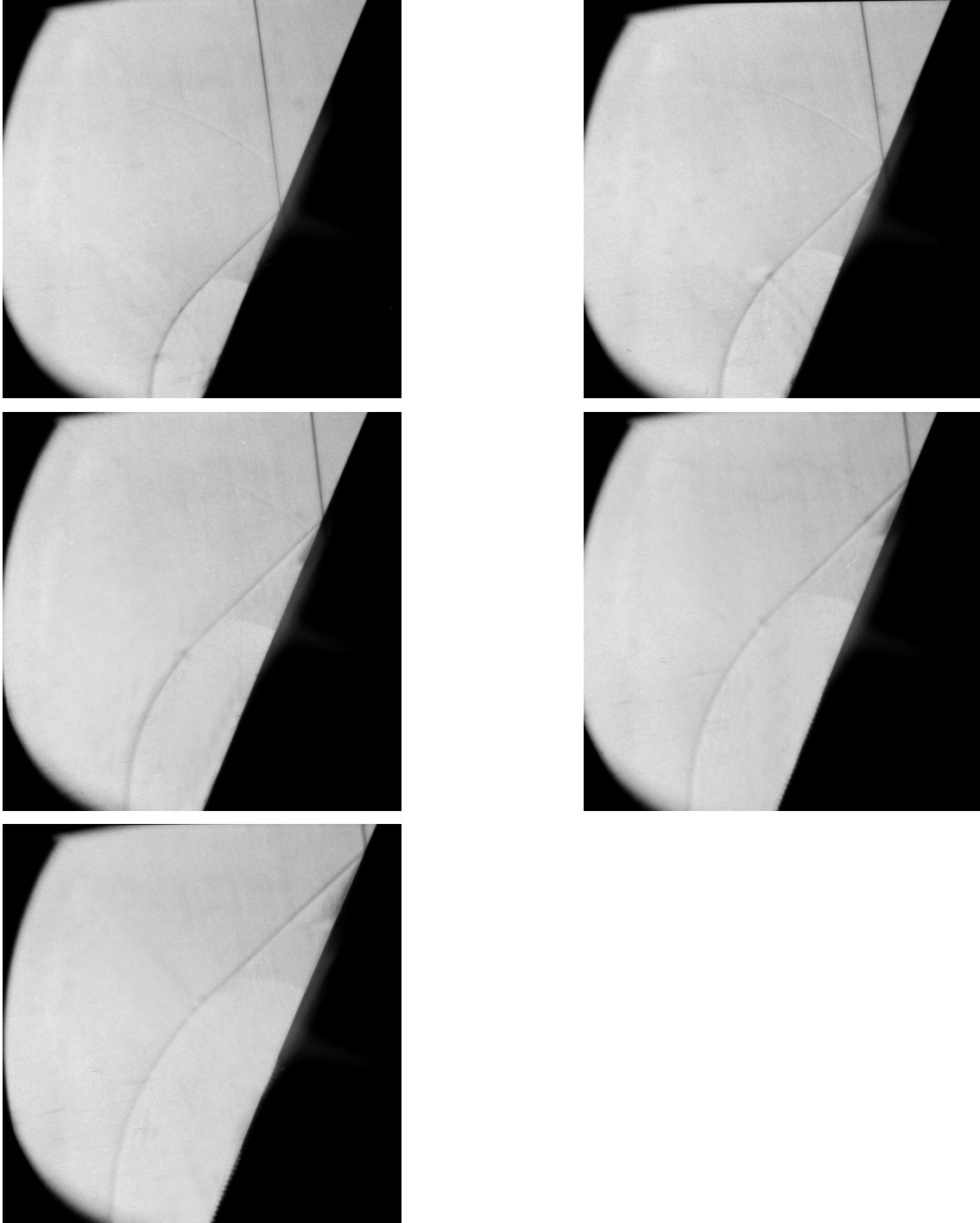


Figure 272: Schlieren images for conical valley, 10 degrees, at time delay 1650 μ s, 1675 μ s, 1700 μ s, 1725 μ s, and 1750 μ s respectively.

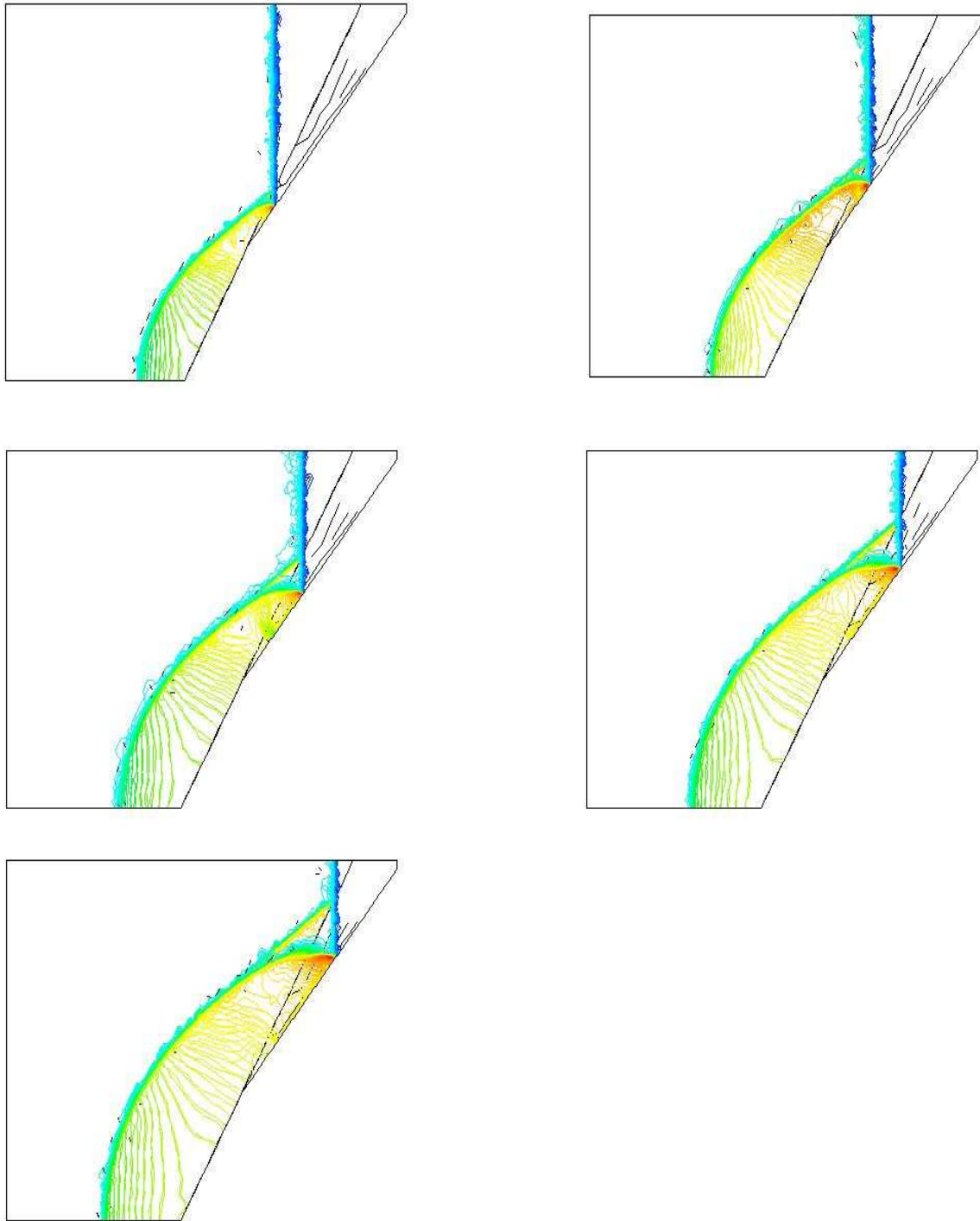


Figure 273: Sequential density contour plots for conical valley, 10 degrees.

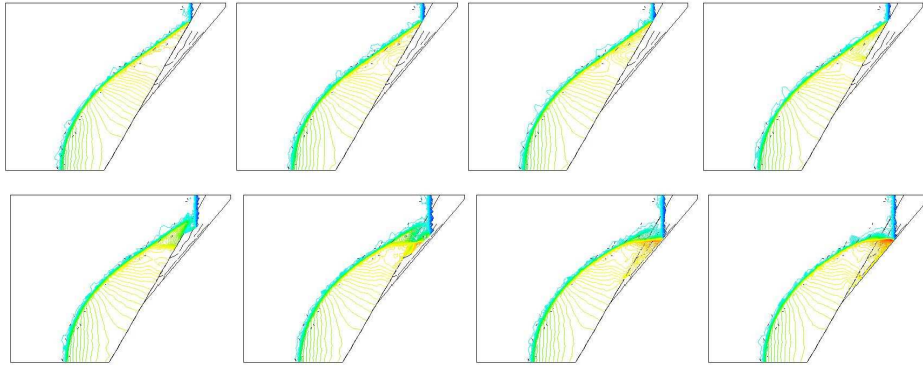


Figure 274: Density contour plots for conical valley, 10 degree, taken in the y-z plane at $x = 0\text{mm}$, 45mm, 50mm, 55mm, 60mm, 65mm, 70mm, 75mm, respectively.

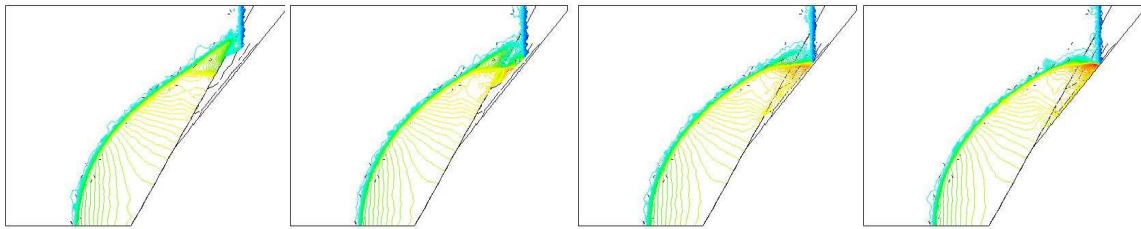


Figure 275: Enlarged density contour plots for conical valley, 10 degree, taken in the y-z plane at $x = 60\text{mm}$, 65mm, 70mm, 75mm respectively.

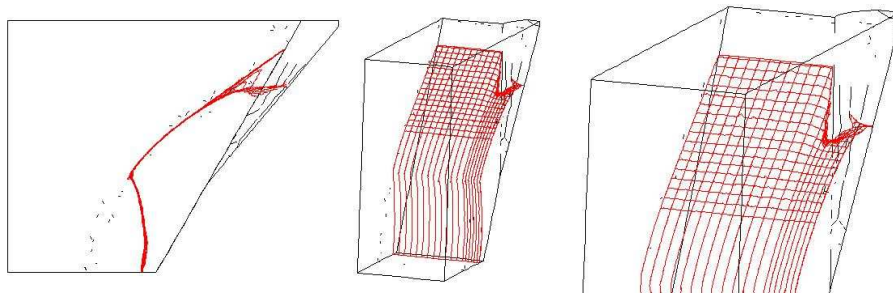


Figure 276: Overlaid pressure contour plots (single level) of secondary reflected wave for conical valley, 10 degree.

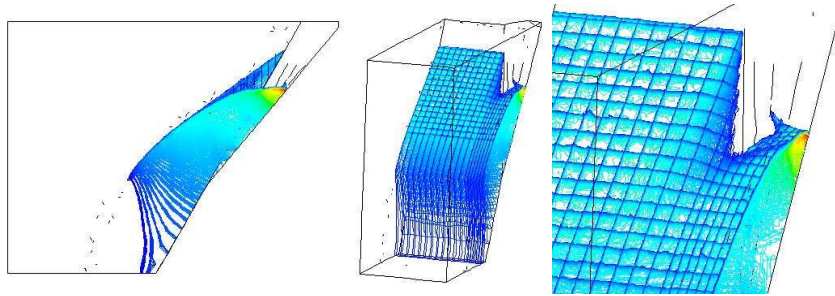


Figure 277: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for conical valley, 10 degrees.

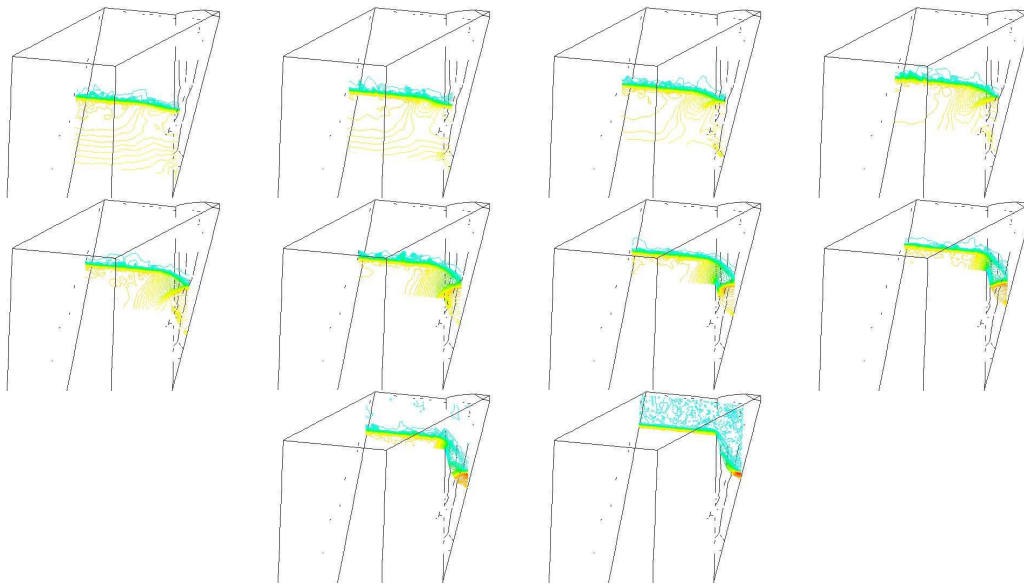


Figure 278: Isometric views of sequential density contour plots for conical valley, 10 degree, taken in the x-y in steps of 5mm along the z axis.

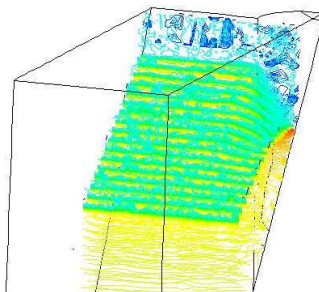


Figure 279: Isometric view of overlaid density contour plots conical valley, 10 degree, taken in the x-y plane.

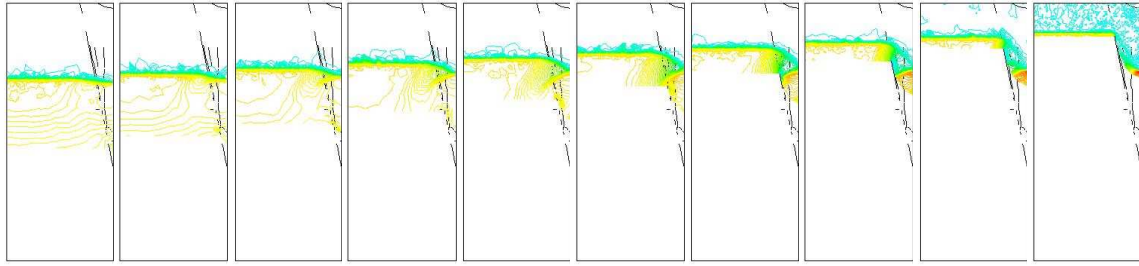


Figure 280: Sequential density contour plots for conical valley, 10 degrees, taken in the x-y plane in steps of 5mm along the z axis.

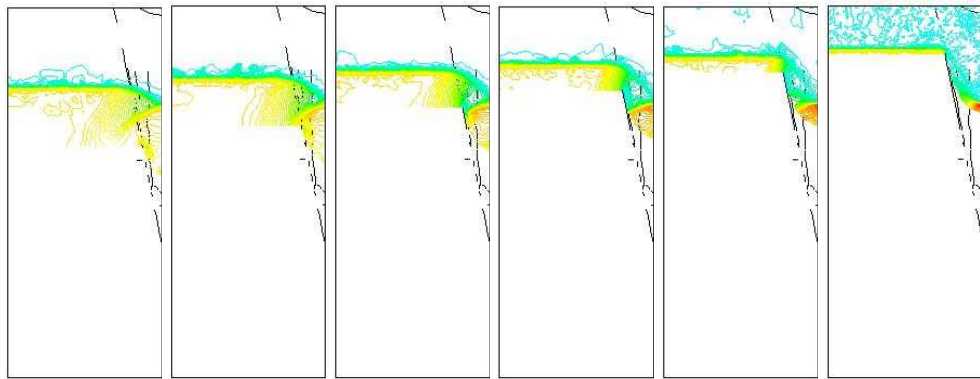


Figure 281: Enlarged sequential density contour plots for conical valley, 10 degrees, taken in the x-y plane in steps of 5mm along the z axis.

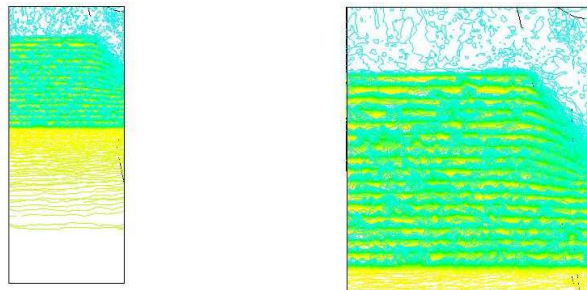


Figure 282: Overlaid density contour plots for conical valley, 10 degree, taken in the x-y plane.

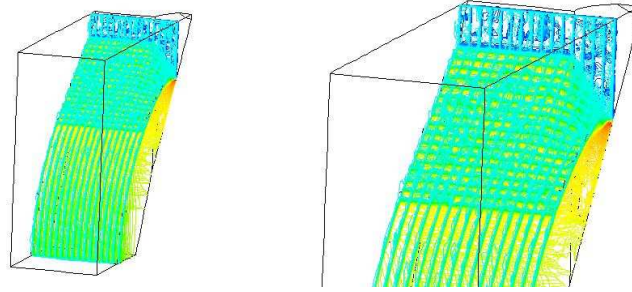
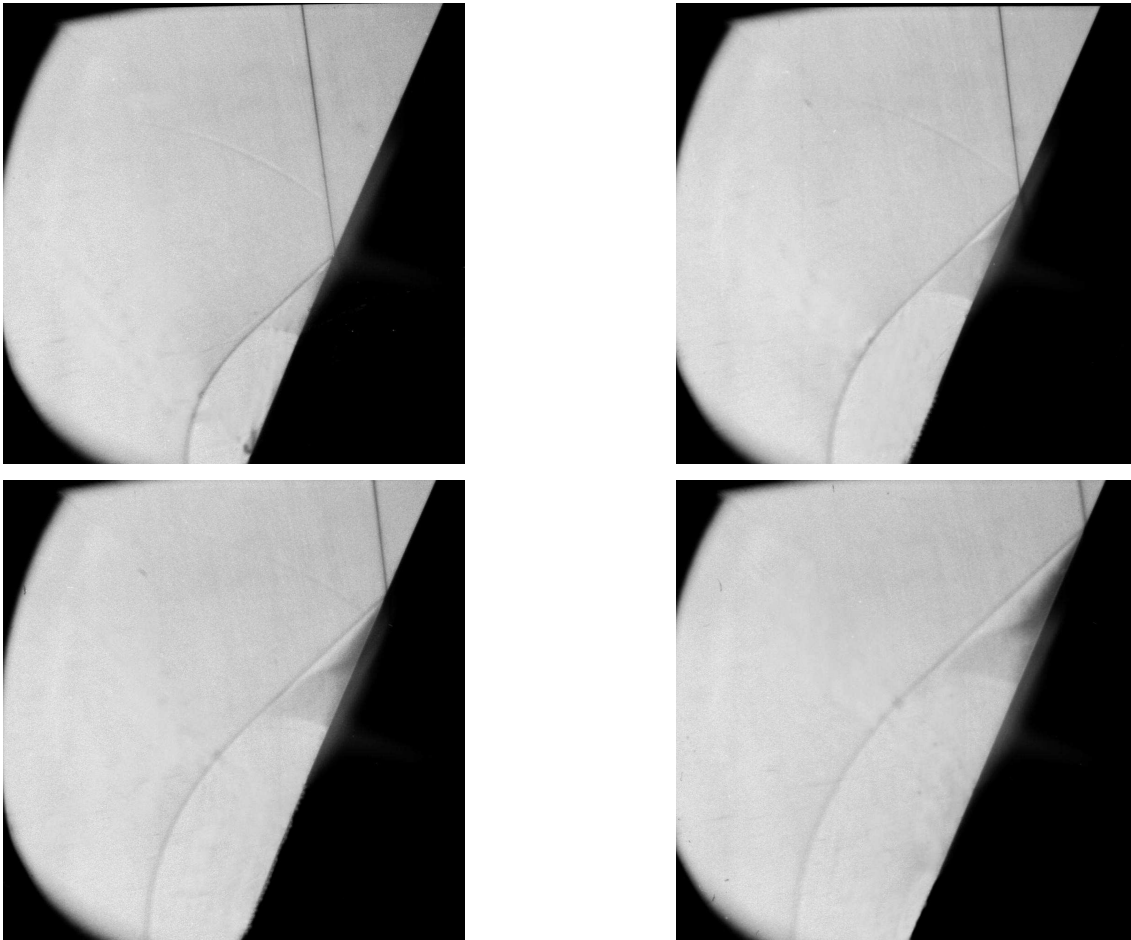


Figure 283: Isometric view of overlaid planes for conical valley, 10 degree.

F.4.2 Conical valley, 20 degrees



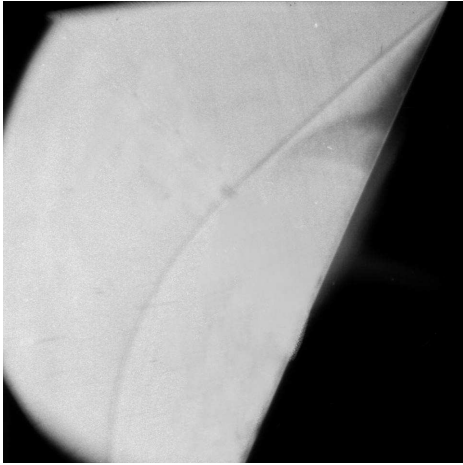
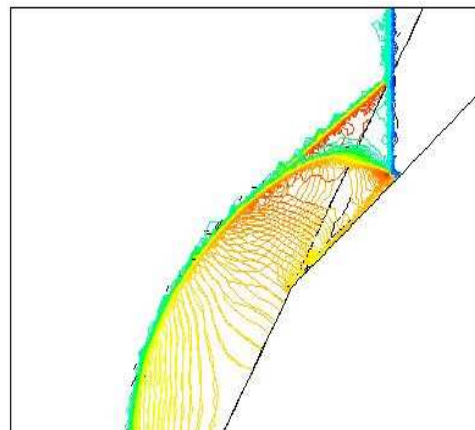
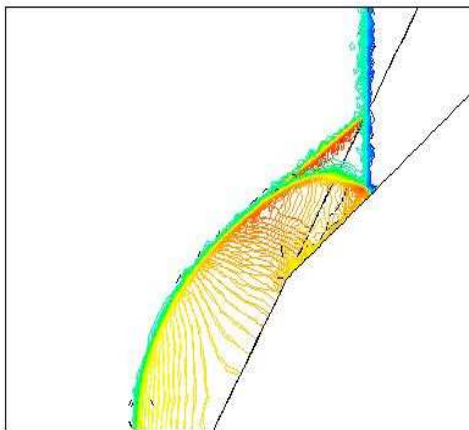
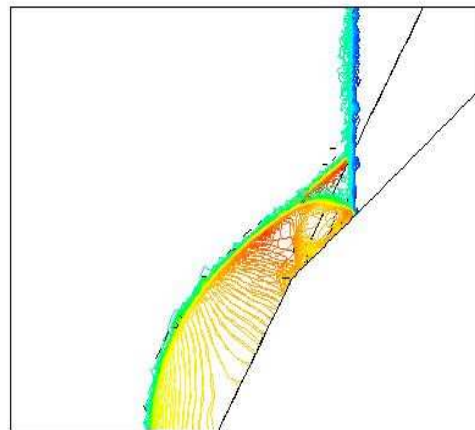
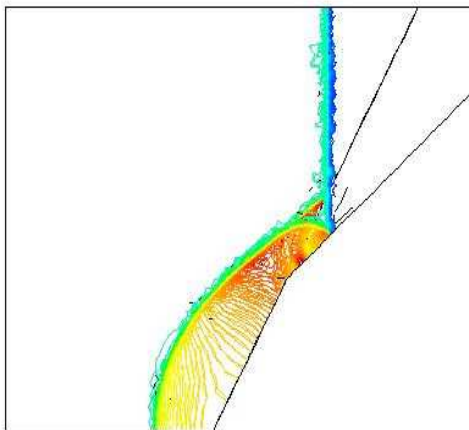


Figure 284: Schlieren images for conical valley, 20 degrees, at time delay 1700 μ s, 1725 μ s, 1750 μ s, 1775 μ s, and 1800 μ s respectively.



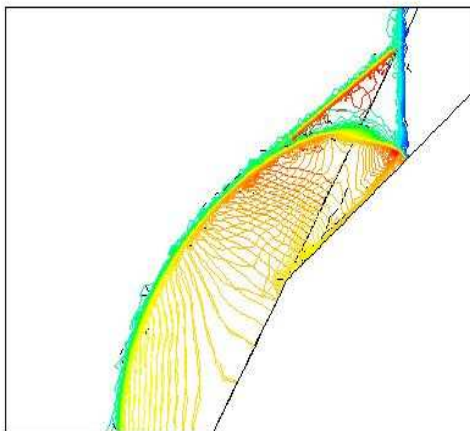


Figure 285: Sequential density contour plots for conical valley, 20 degrees.

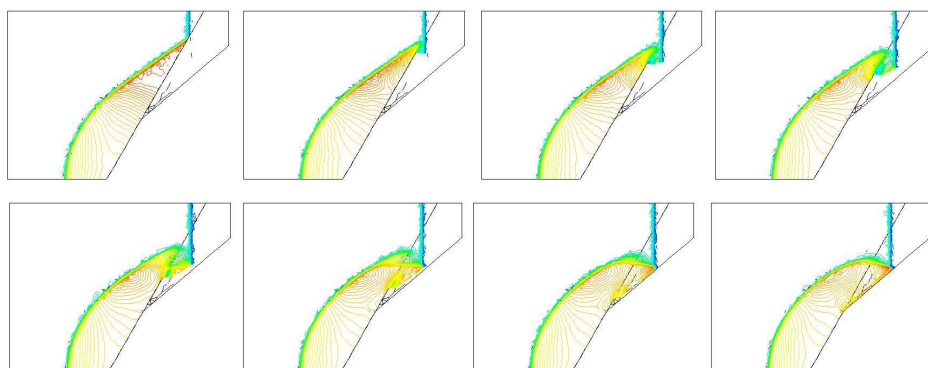


Figure 286: Density contour plots for conical valley, 20 degree, taken in the y-z plane at $x = 0\text{mm}$, 45mm , 50mm , 55mm , 60mm , 65mm , 70mm , 75mm , respectively.

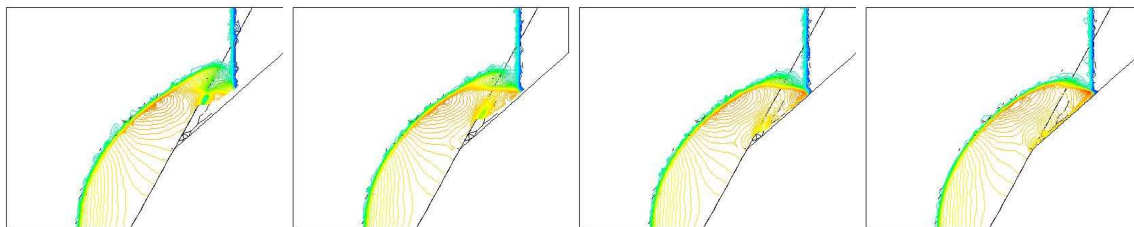


Figure 287: Enlarged density contour plots for conical valley, 20 degree, taken in the y-z plane $x = 60\text{mm}$, 65mm , 70mm , 75mm respectively.

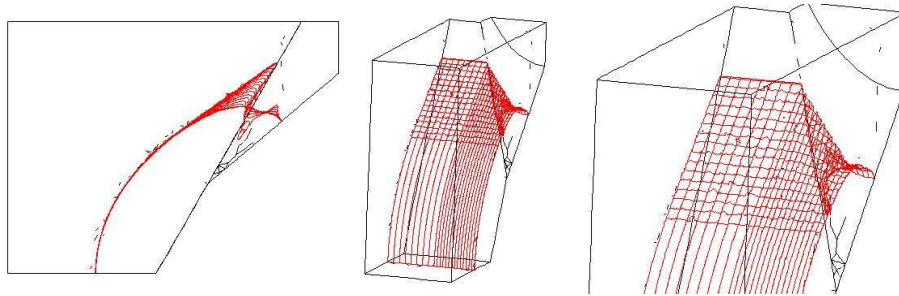


Figure 288: Overlaid pressure contour plots (single level) of secondary reflected wave for conical valley, 20 degrees.

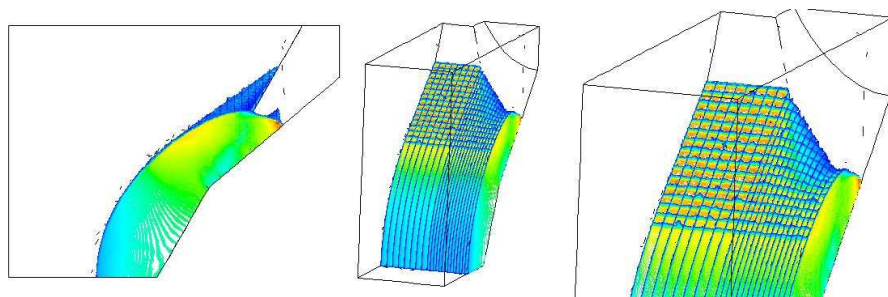


Figure 289: Overlaid pressure contour plots (multiple levels) of secondary reflected wave for conical valley, 20 degrees.

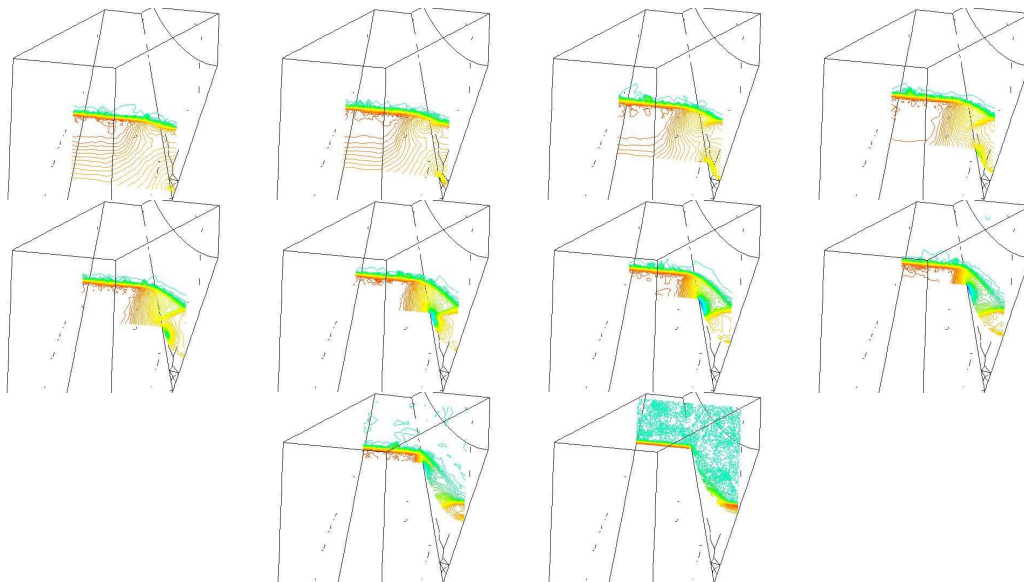


Figure 290: Isometric views of sequential density contour plots for conical valley, 20 degree, taken in the x-y in steps of 5mm along the z axis.

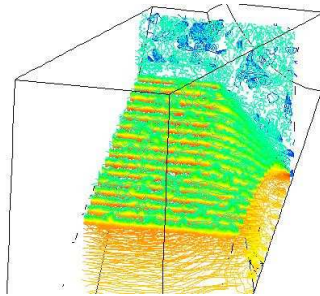


Figure 291: Isometric view of overlaid density contour plots conical valley, 20 degree, taken in the x-y plane.

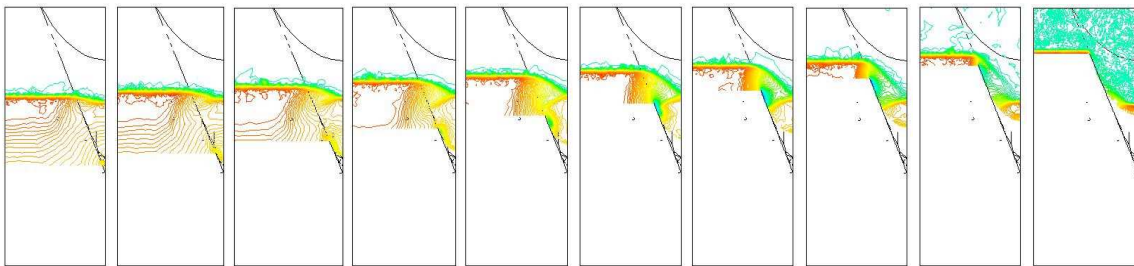


Figure 292: Sequential density contour plots for parabolic valley, 20 degree, taken in the x-y plane in steps of 5mm along the z axis.

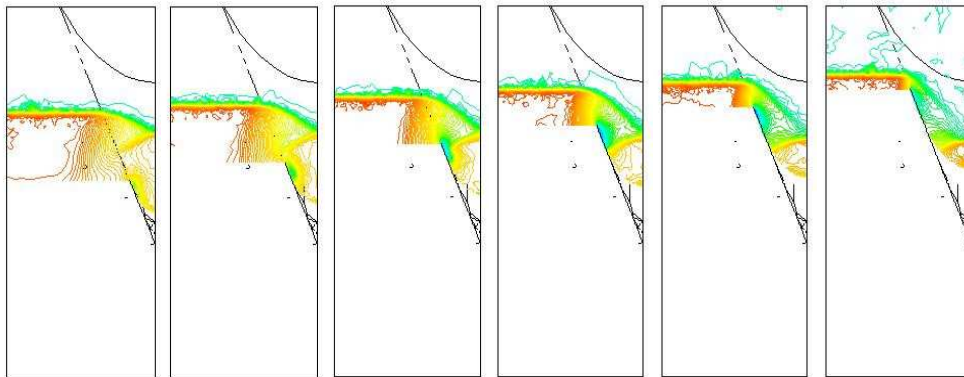


Figure 293: Enlarged sequential density contour plots for parabolic valley, 20 degree, taken in the x-y plane in steps of 5mm along the z axis.

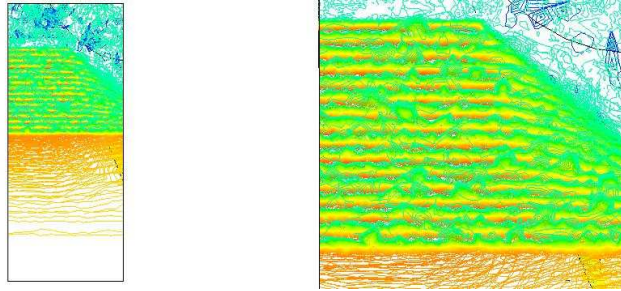


Figure 294: Overlaid density contour plots for conical valley, 20 degree, taken in the x-y plane.

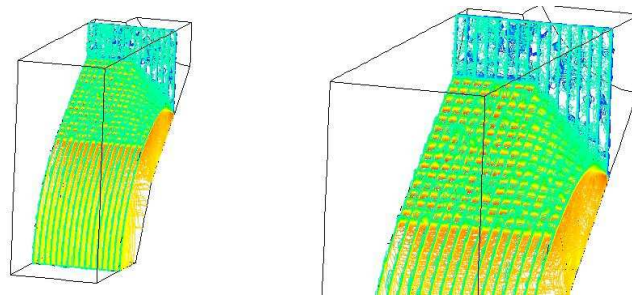


Figure 295: Isometric view of overlaid planes for conical valley, 20 degree.

F5 Hill results

E.5.1 Triangular hill

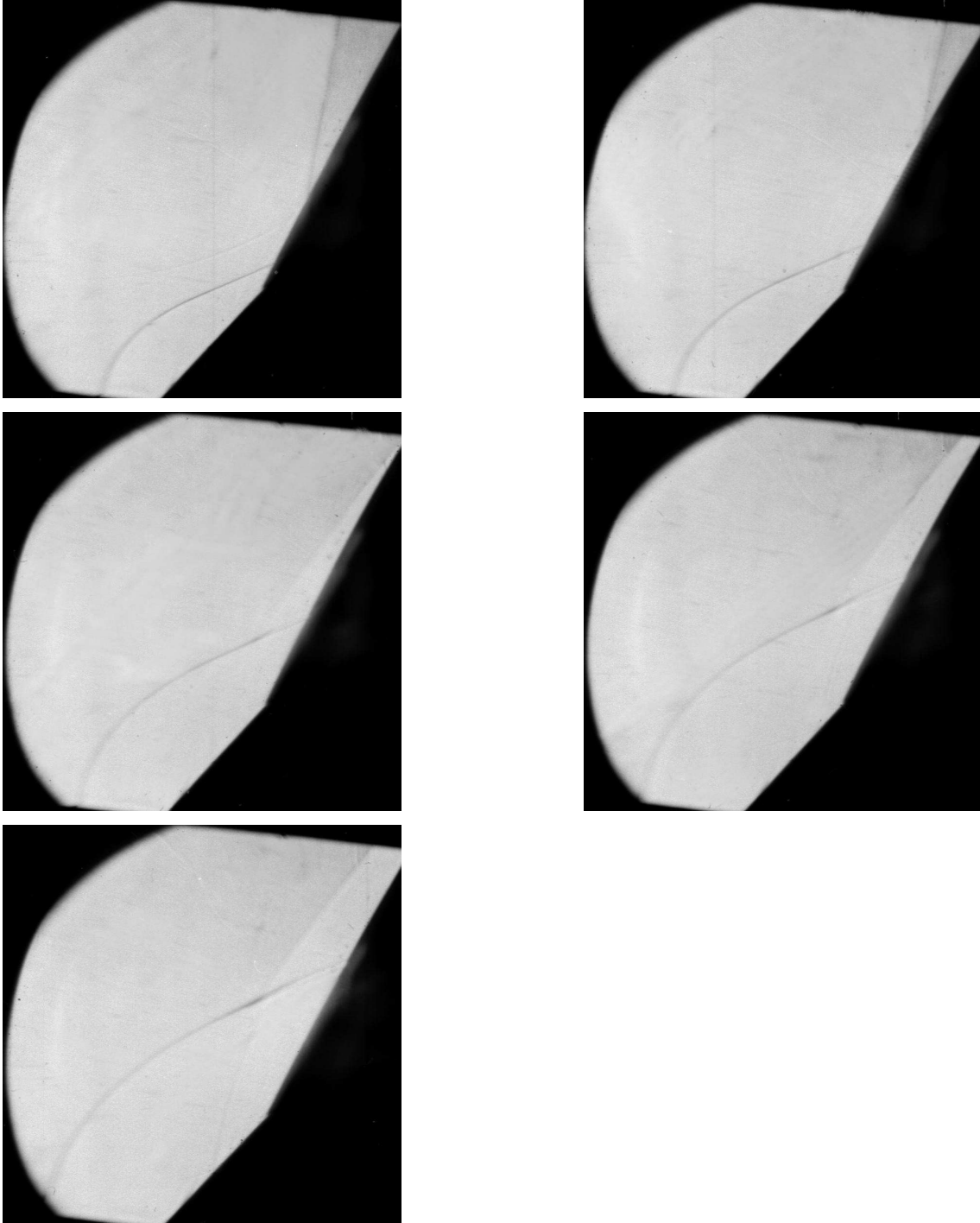


Figure 296: Schlieren images for triangular hill, at time delay 1650μs, 1675μs, 1700μs, 1725μs, and 1750μs respectively.

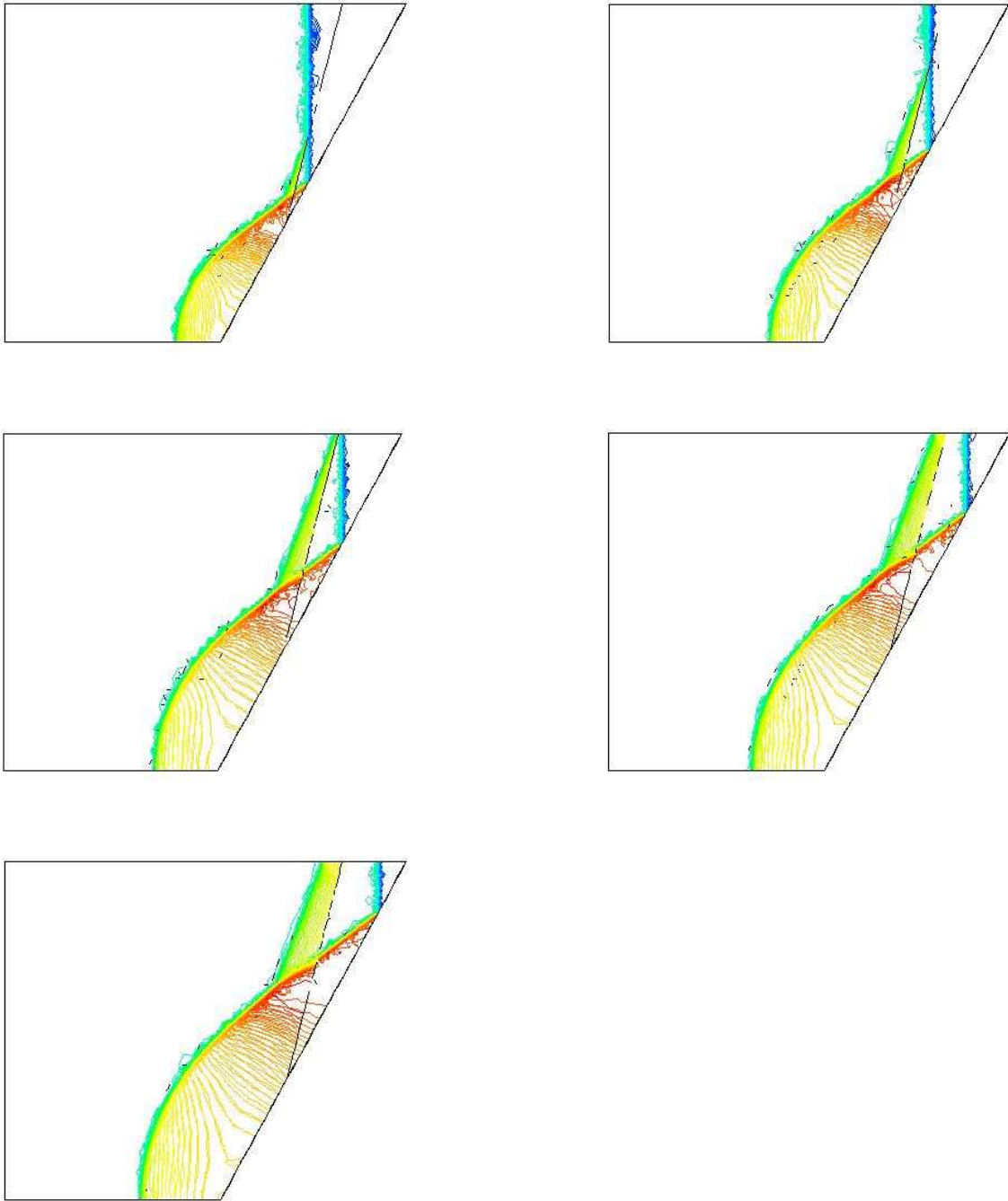


Figure 297: Sequential density contour plots for triangular hill.

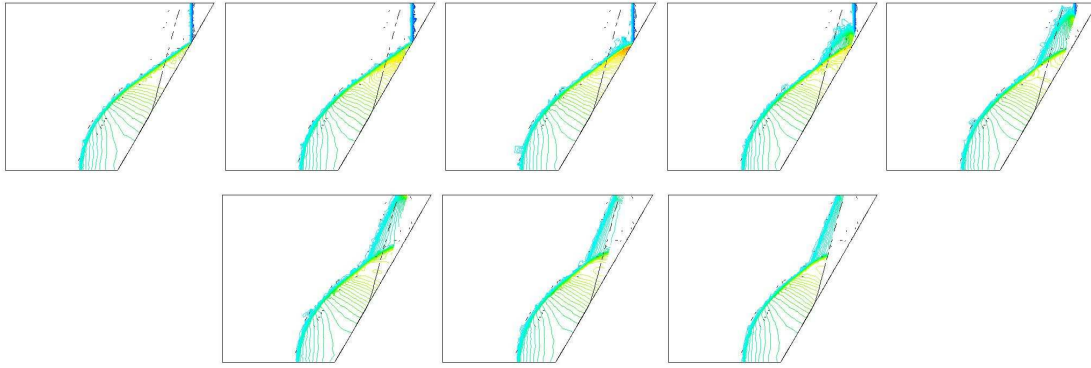


Figure 298: Density contour plots for triangular hill, taken in the y-z plane at $x = 0\text{mm}$, 45mm , 50mm , 55mm , 60mm , 65mm , 70mm , 75mm , respectively.

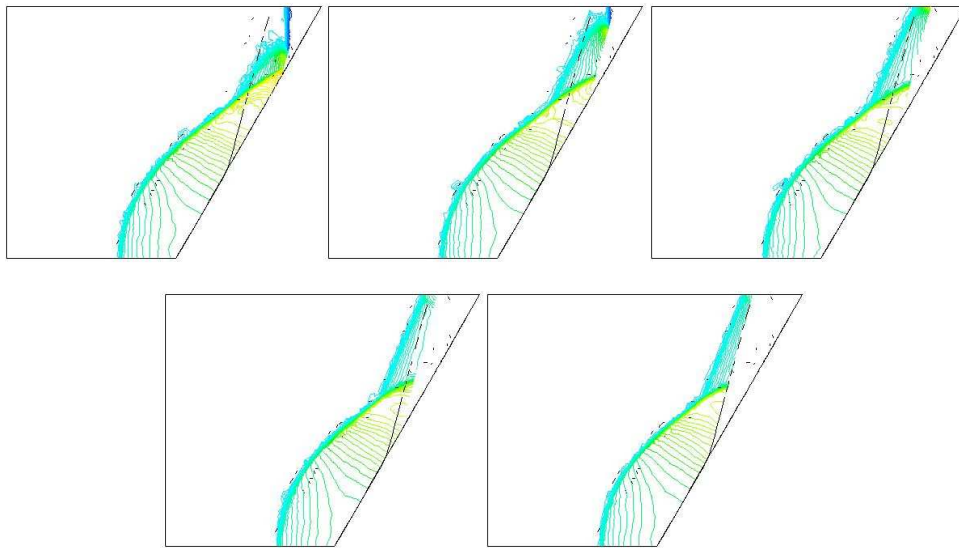


Figure 299: Enlarged density contour plots for triangular hill, taken in the y-z plane at $x = 45\text{mm}$, 55mm , 65mm and 75mm respectively.

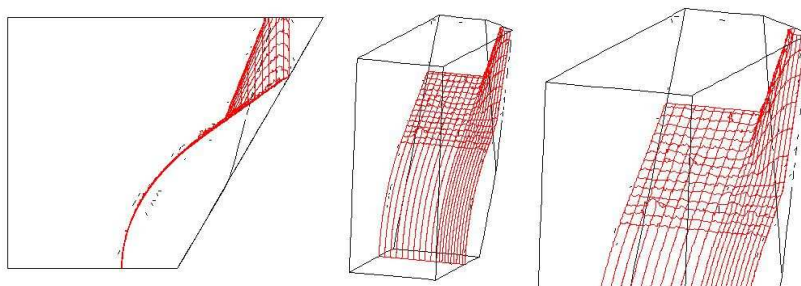


Figure 300: Overlaid pressure contour plots (single level) of reflected wave structure for triangular hill.

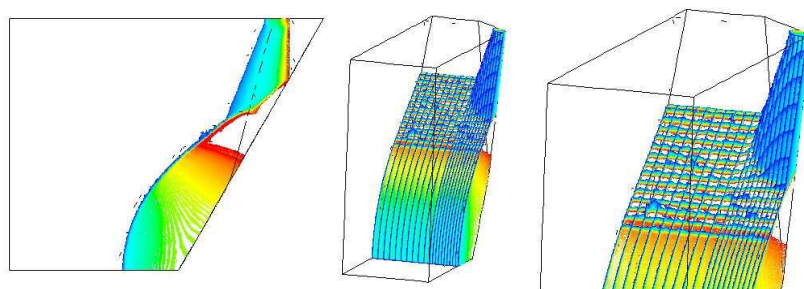


Figure 301: Overlaid pressure contour plots (multiple levels) of reflected wave structure for triangular hill.

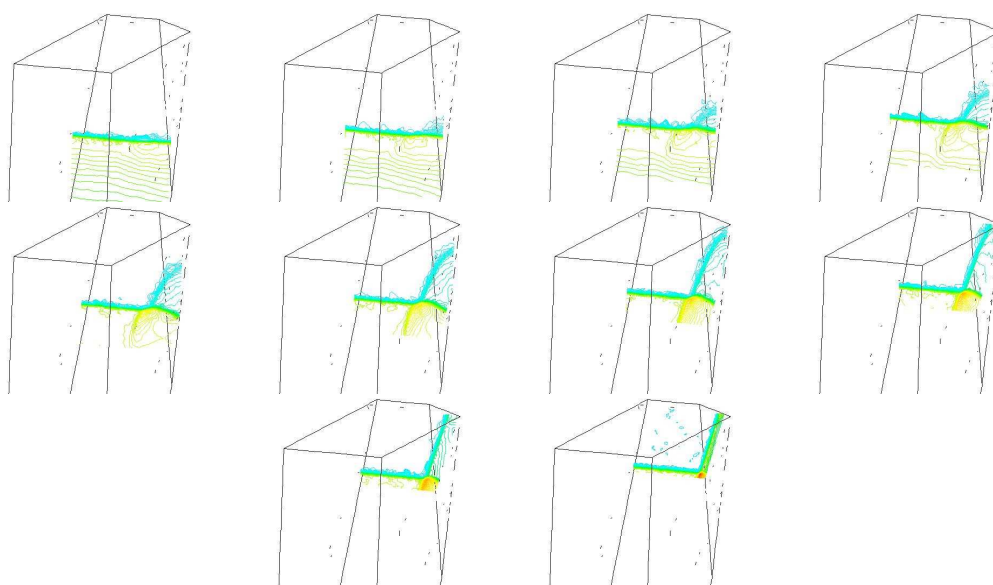


Figure 302: Isometric views of sequential density contour plots for triangular hill, taken in the x-y in steps of 5mm along the z axis.

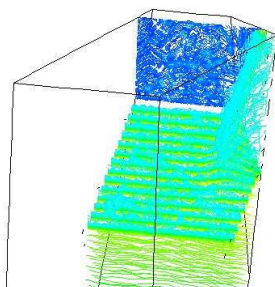


Figure 303: Isometric view of overlaid density contour plots for triangular hill, taken in the x-y plane.

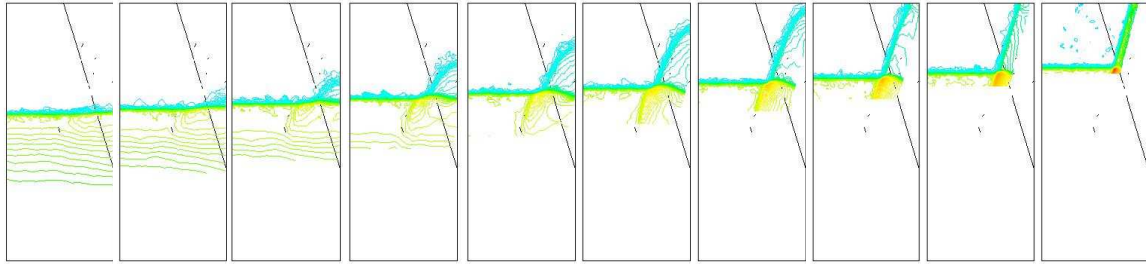


Figure 304: Sequential density contour plots for triangular hill, taken in the x-y plane in steps of 5mm along the z axis.

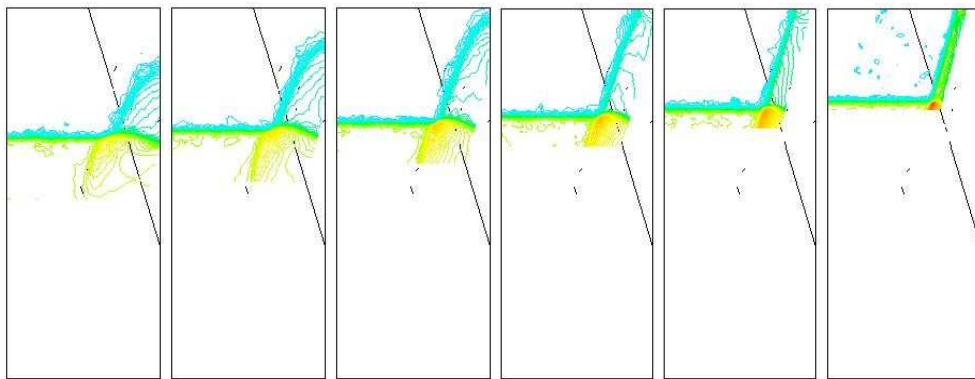


Figure 305: Enlarged sequential density contour plots for triangular hill, taken in the x-y plane in steps of 5mm along the z axis.

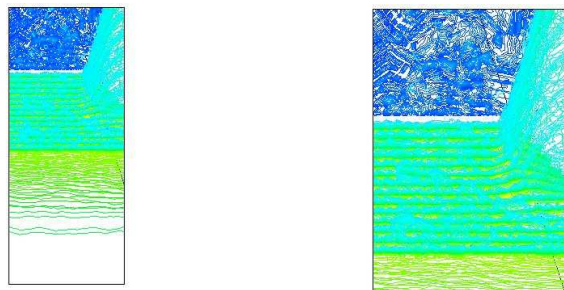


Figure 306: Overlaid density contour plots for triangular hill, taken in the x-y plane.

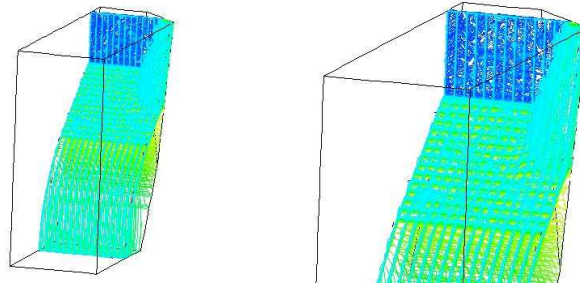
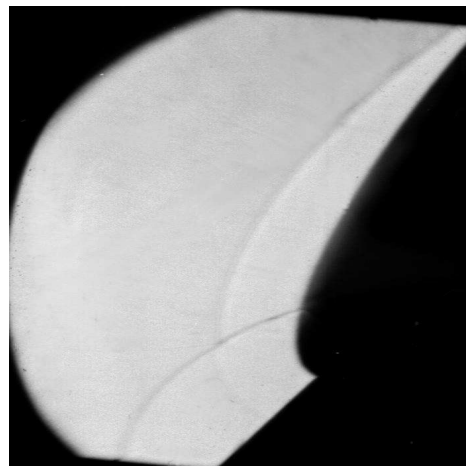
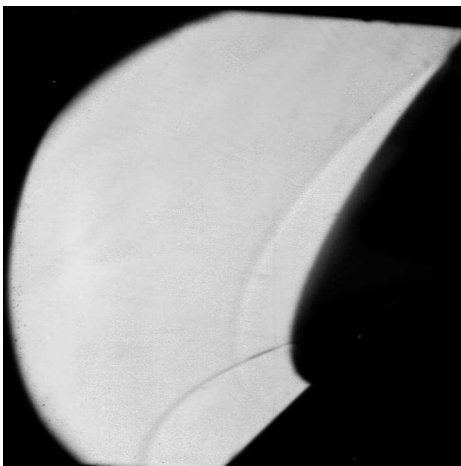
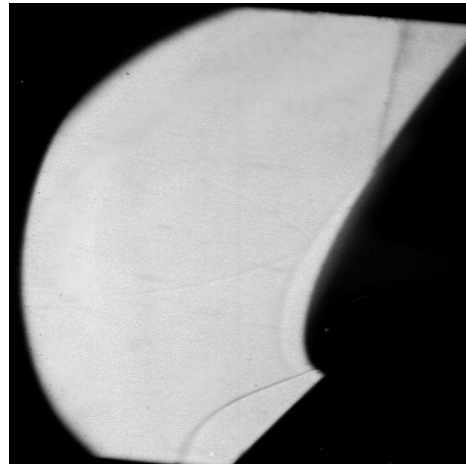
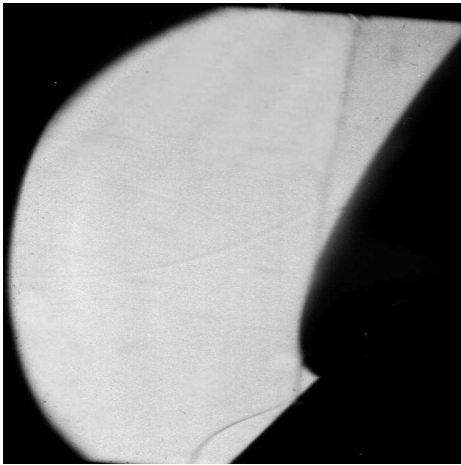


Figure 307: Isometric view of overlaid planes for triangular hill.

F5.2 Parabolic hill



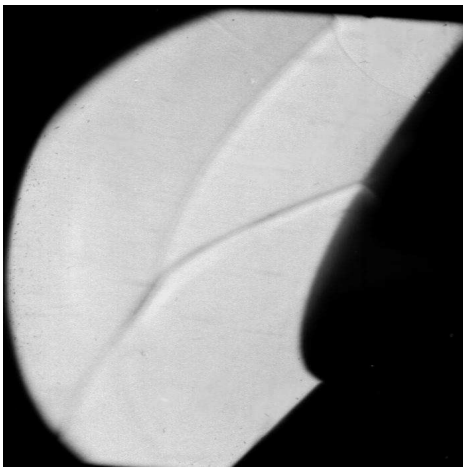
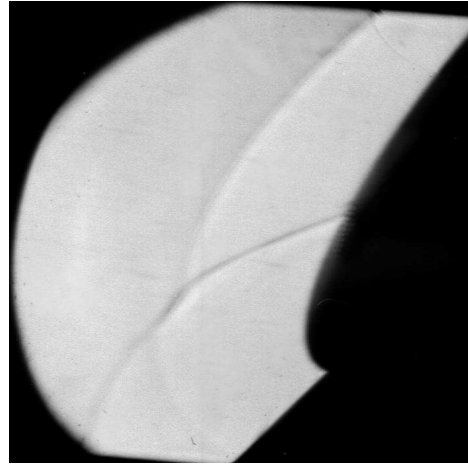
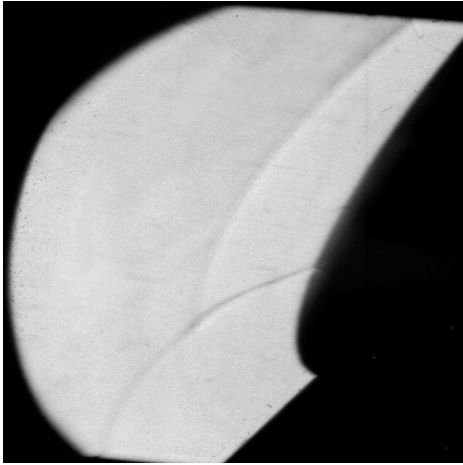
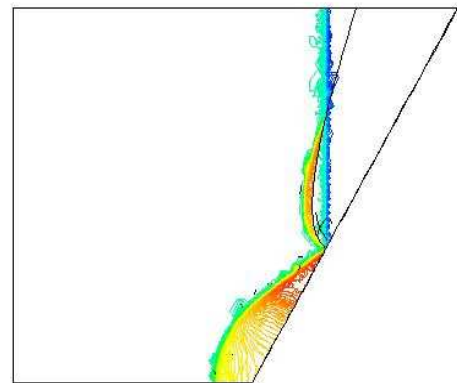
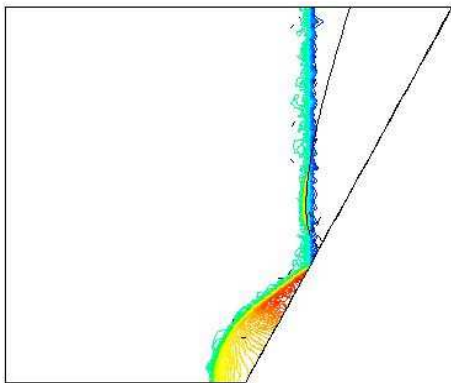


Figure 308: Schlieren images for parabolic hill, at time delay 1600 μ s, 1625 μ s, 1650 μ s, 1675 μ s, 1700 μ s, 1725 μ s, and 1750 μ s respectively.



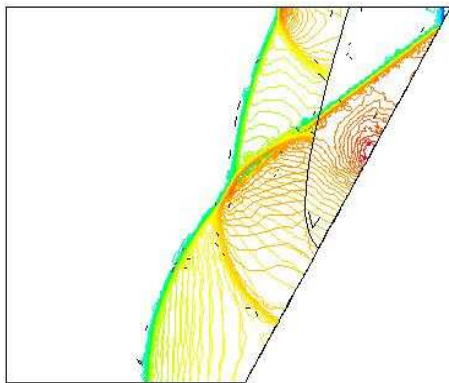
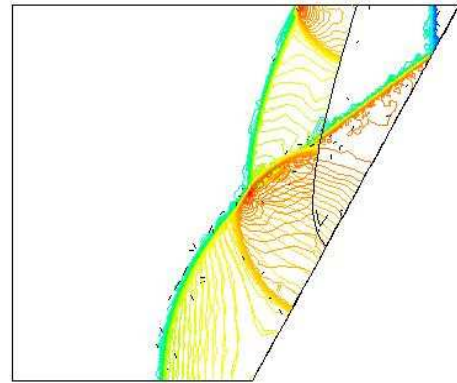
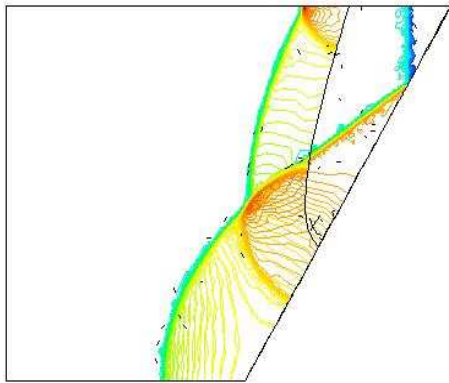
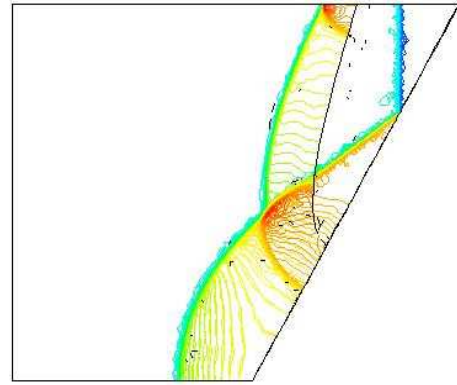
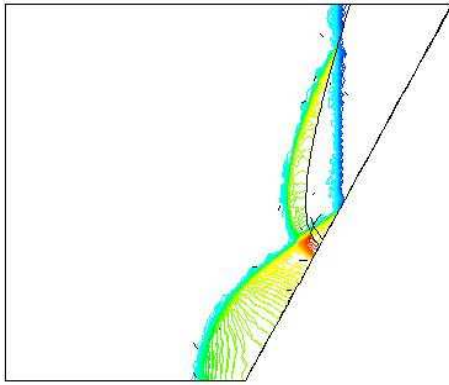


Figure 309: Sequential density contour plots for parabolic hill.

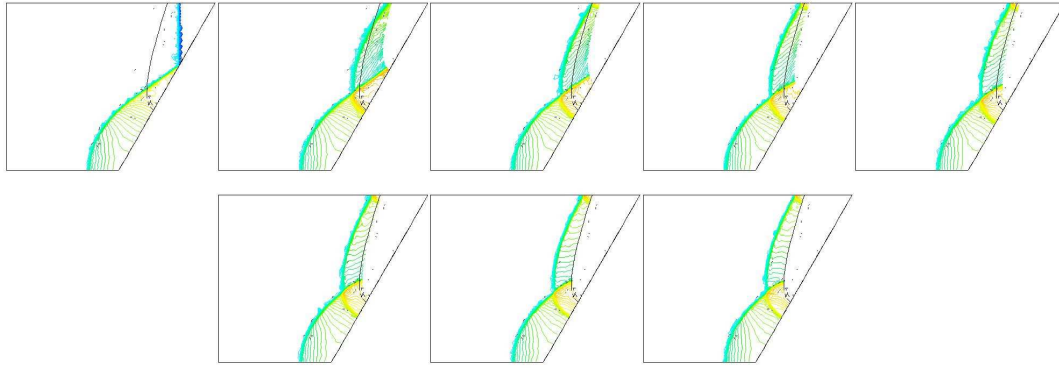


Figure 310: Density contour plots for parabolic hill, taken in the y-z plane at $x = 0\text{mm}$, 45mm , 50mm , 55mm , 60mm , 65mm , 70mm , 75mm , respectively.

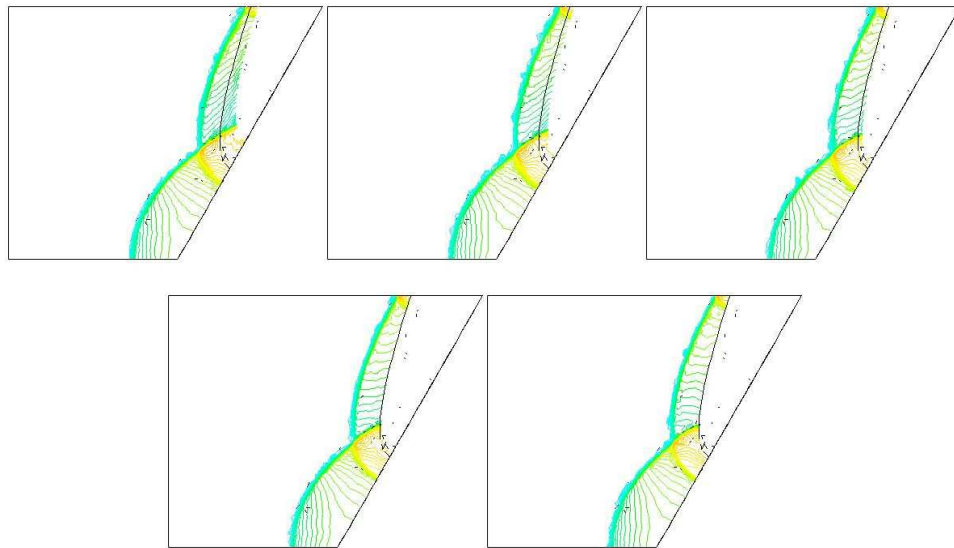


Figure 311: Enlarged density contour plots for parabolic hill, taken in the y-z plane at $x = 45\text{mm}$, 55mm , 65mm and 75mm respectively.

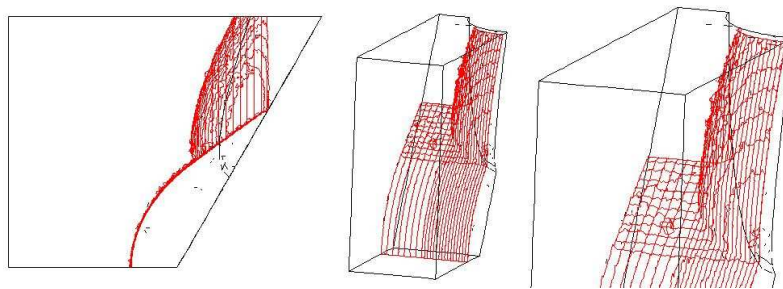


Figure 312: Pressure contour plots (single level) of reflected wave structure for parabolic hill, taken in the y-z plane at $x = 0\text{mm}$, 15mm , 25mm , 35mm , 45mm , 55mm , 65mm , 75mm , respectively.

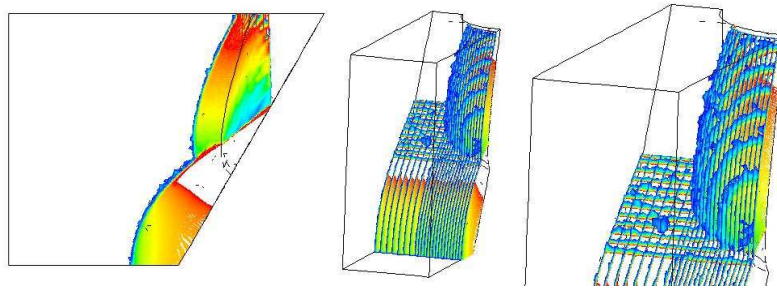


Figure 313: Overlaid pressure contour plots (multiple levels) of reflected wave structure for parabolic hill.

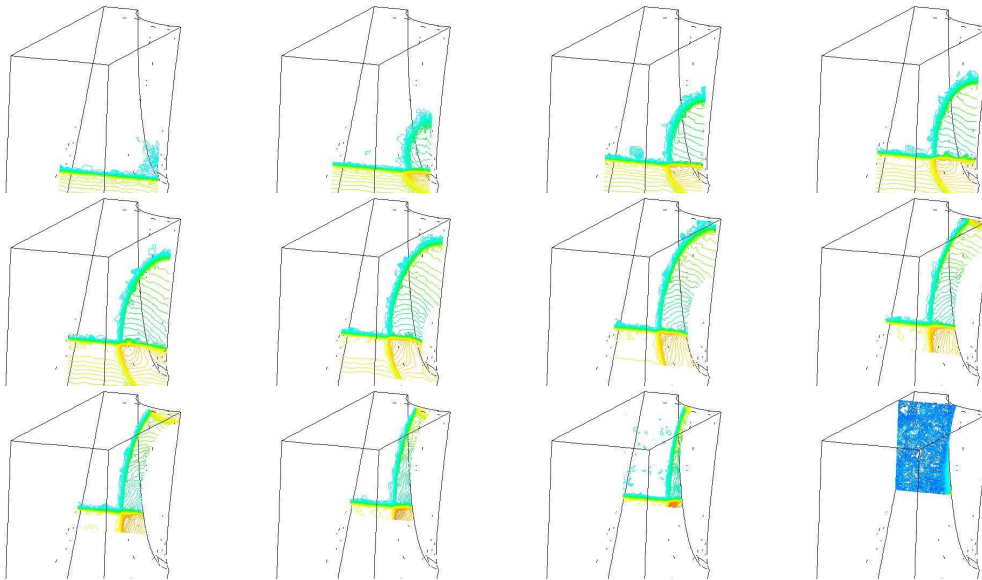


Figure 314: Isometric views of sequential density contour plots for parabolic hill, taken in the x-y in steps of 5mm along the z axis.

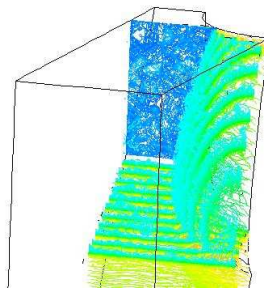


Figure 315: Isometric view of overlaid density contour plots for parabolic hill, taken in the x-y plane.

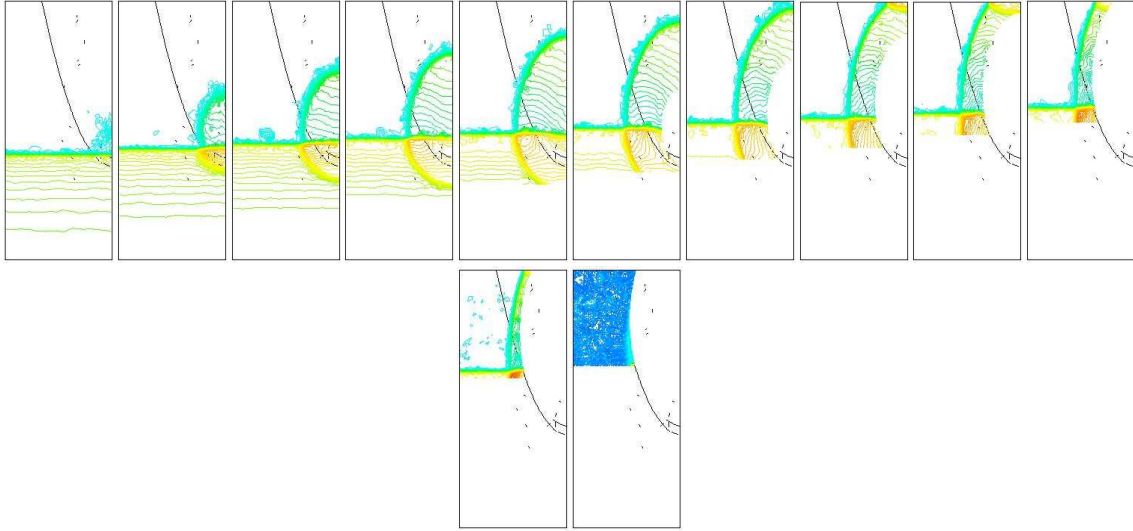


Figure 316: Sequential density contour plots for parabolic hill, taken in the x-y plane in steps of 5mm along the z axis.

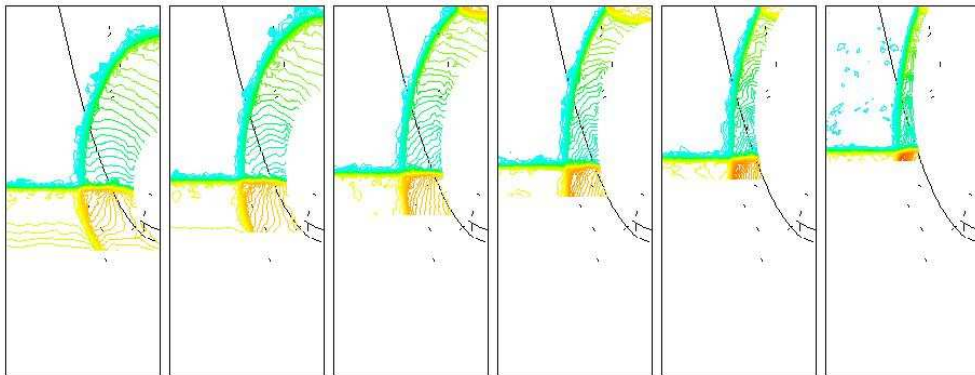


Figure 317: Enlarged sequential density contour plots for parabolic hill, taken in the x-y plane in steps of 5mm along the z axis.

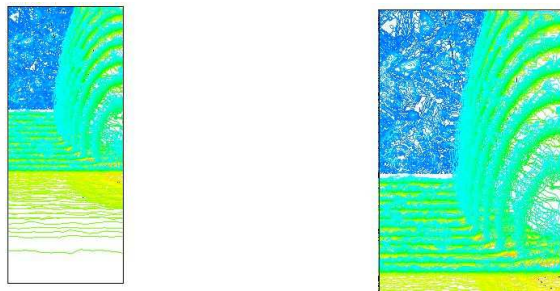


Figure 318: Overlaid density contour plots for parabolic hill, taken in the x-y plane.

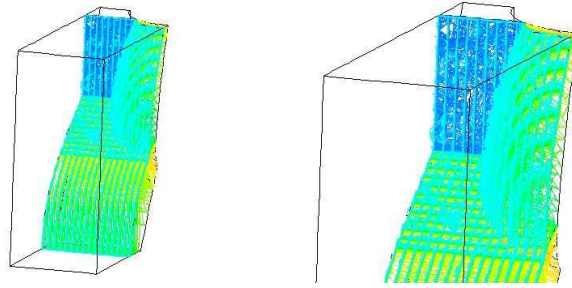
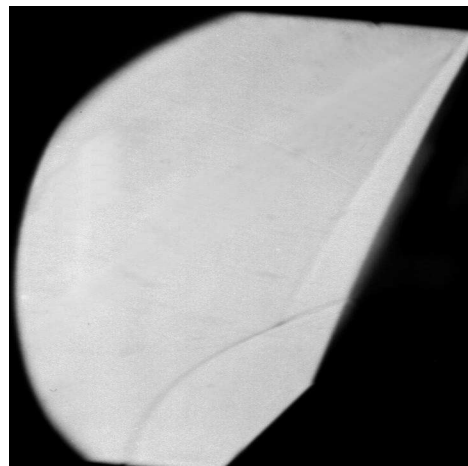
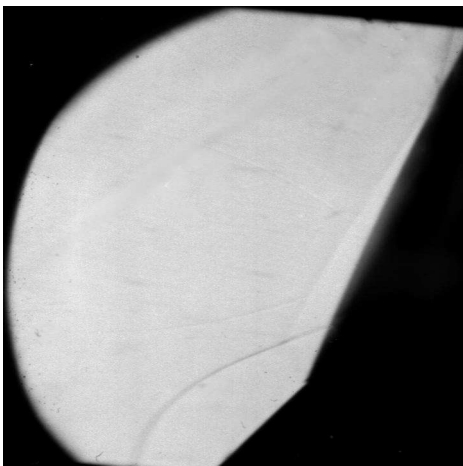
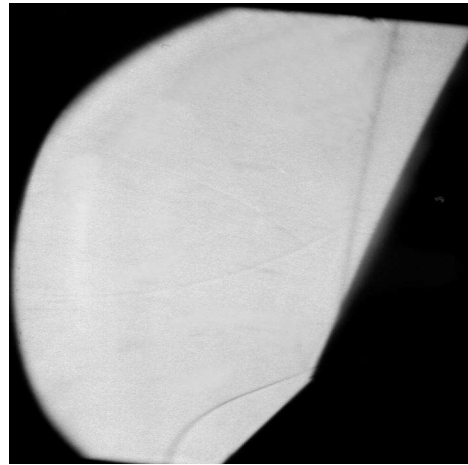
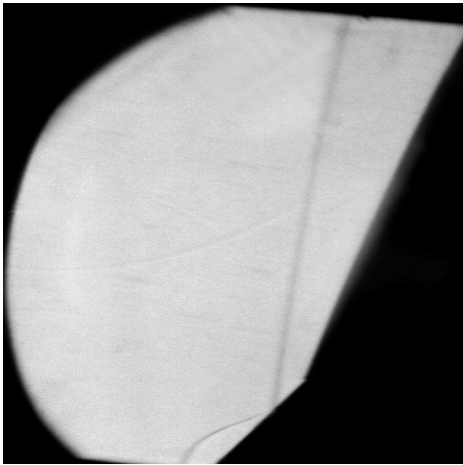


Figure 319: Isometric view of overlaid planes for parabolic hill.

F5.3 Conical hill



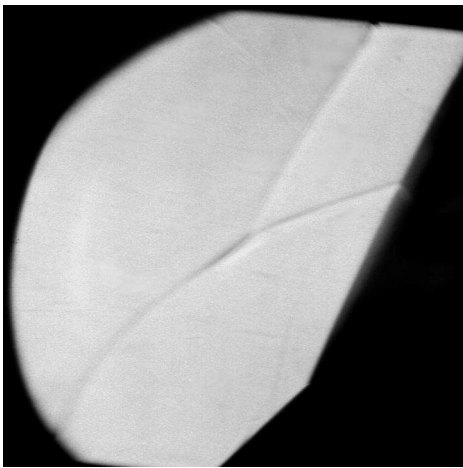
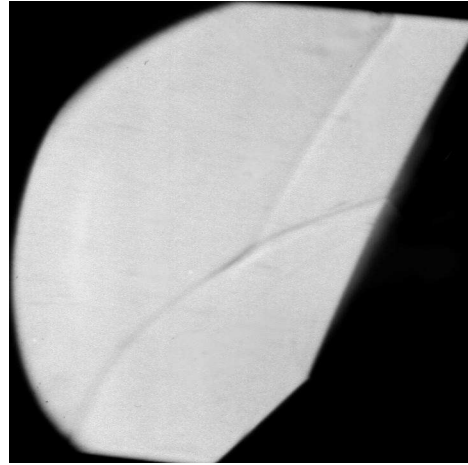
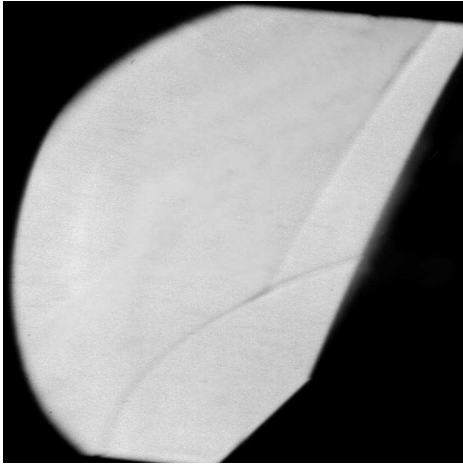
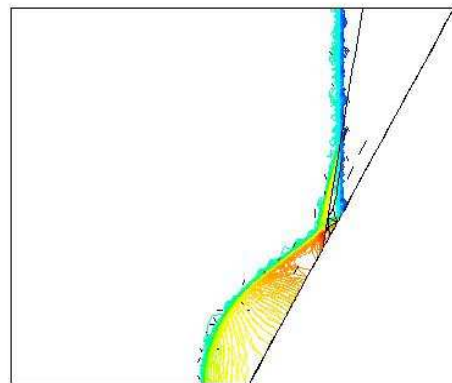
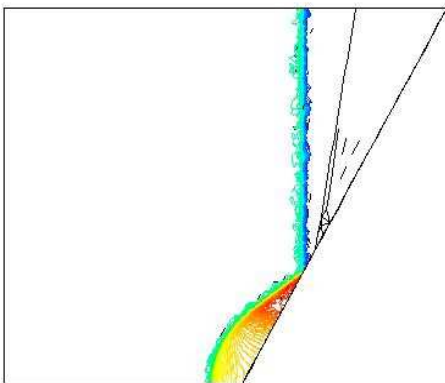


Figure 320: Schlieren images for conical hill, at time delay 1600 μ s, 1625 μ s, 1650 μ s, 1675 μ s, 1700 μ s, 1725 μ s, and 1750 μ s respectively.



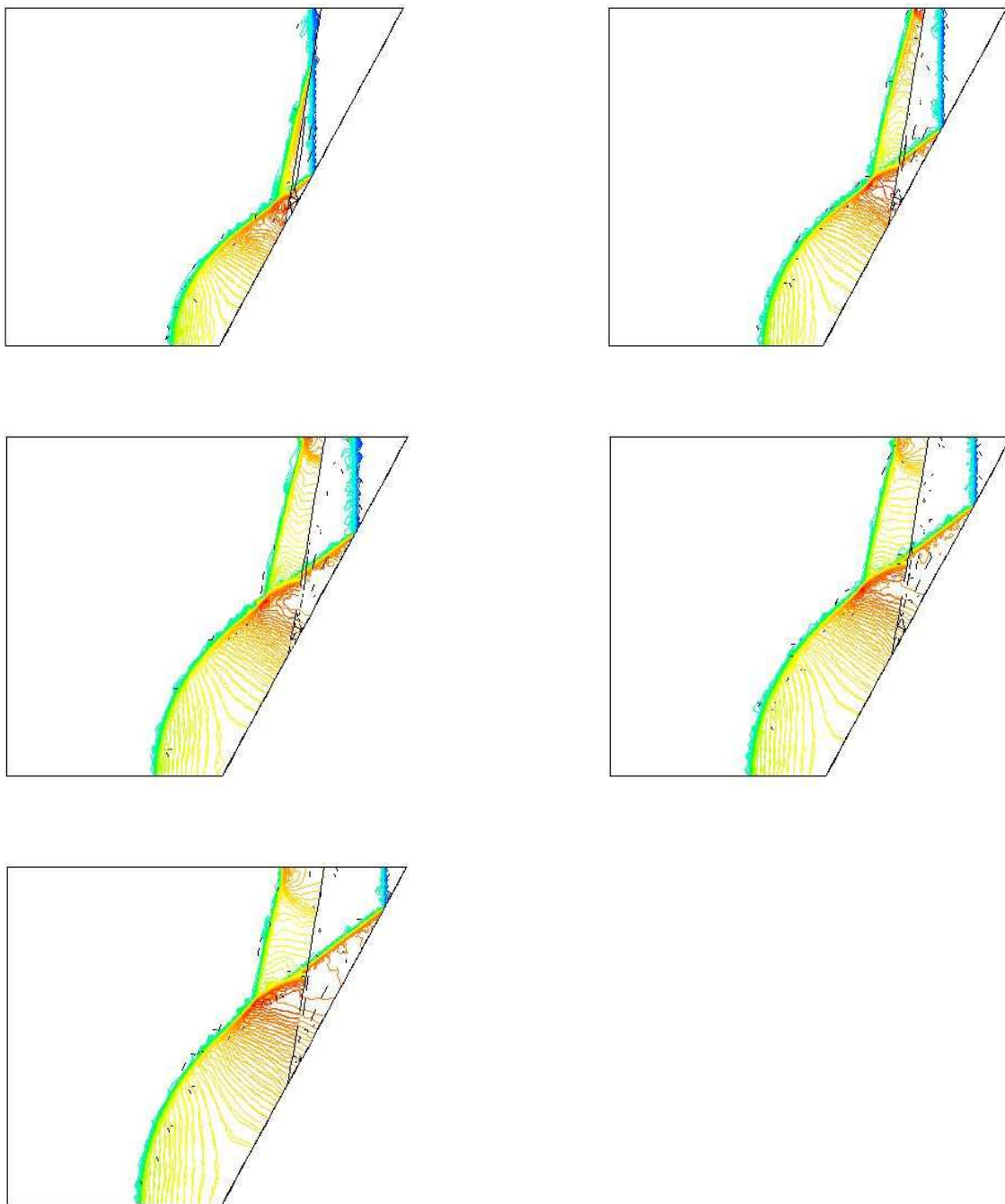


Figure 321: Sequential density contour plots for conical hill.

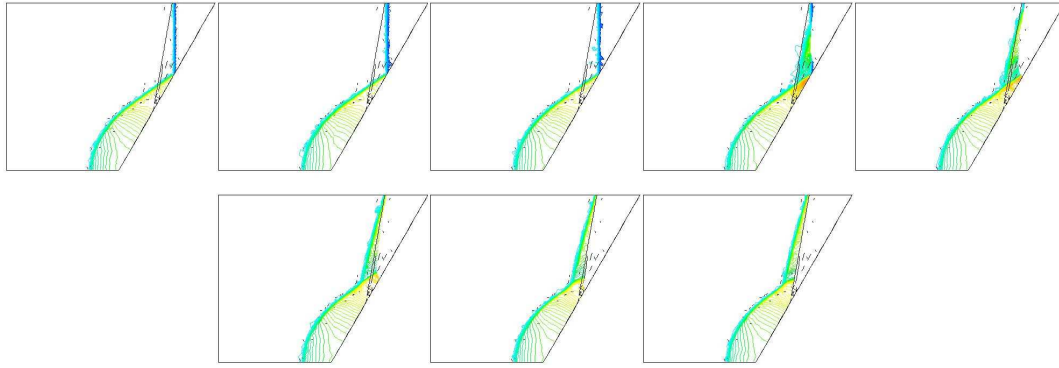


Figure 322: Density contour plots for conical hill, taken in the y-z plane at $x = 0\text{mm}$, 45mm , 50mm , 55mm , 60mm , 65mm , 70mm , 75mm , respectively.

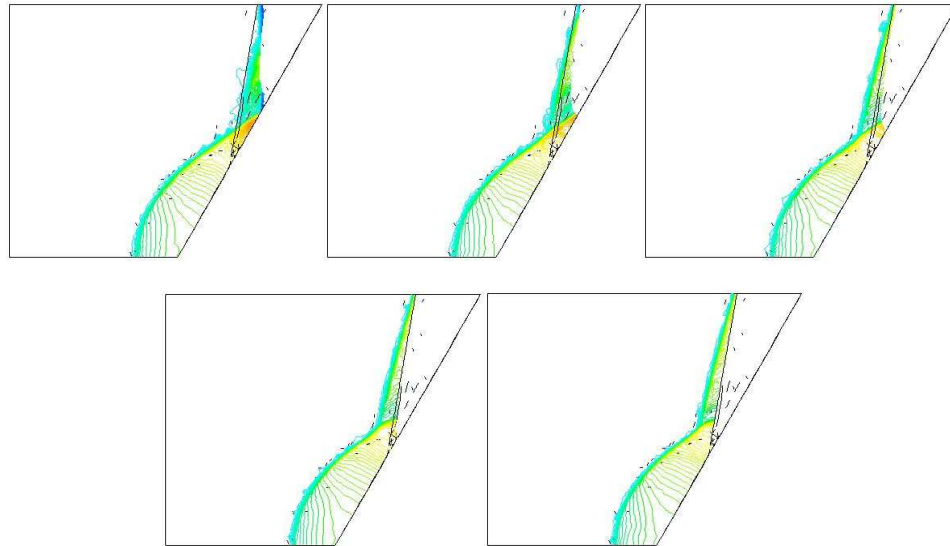


Figure 323: Enlarged density contour plots for conical hill, taken in the y-z plane at $x = 45\text{mm}$, 55mm , 65mm and 75mm respectively.

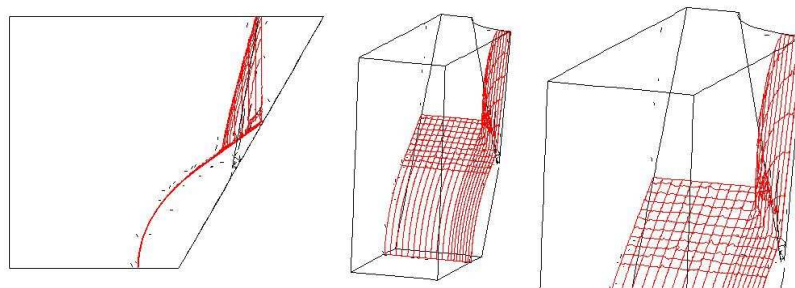


Figure 324: Pressure contour plots (single level) of reflected wave structure for conical hill, taken in the y-z plane at $x = 0\text{mm}$, 15mm , 25mm , 35mm , 45mm , 55mm , 65mm , 75mm , respectively.

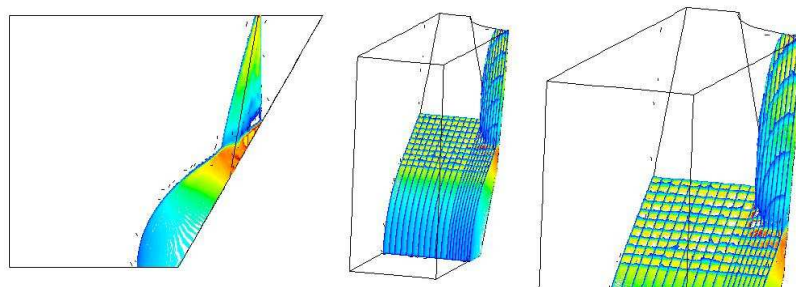


Figure 325: Overlaid pressure contour plots (multiple levels) of reflected wave structure for conical hill.

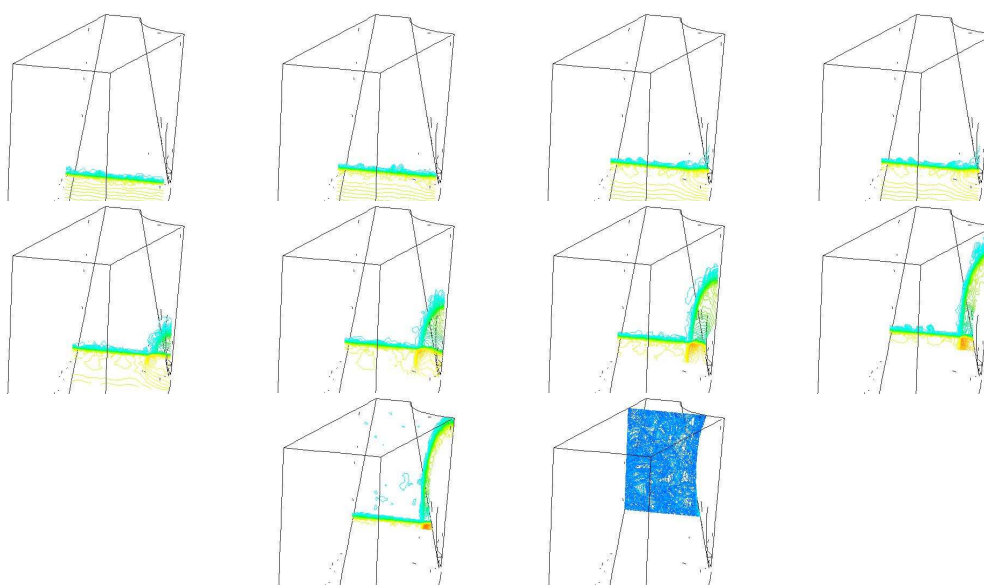


Figure 326: Isometric views of sequential density contour plots for conical hill, taken in the x-y in steps of 5mm along the z axis.

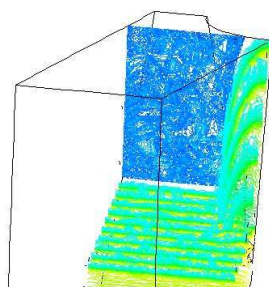


Figure 327: Isometric view of overlaid density contour plots for conical hill, taken in the x-y plane.

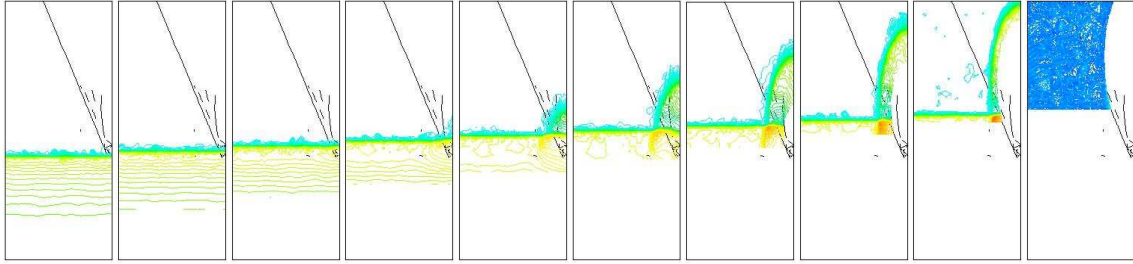


Figure 328: Sequential density contour plots for conical hill, taken in the x-y plane in steps of 5mm along the z axis.

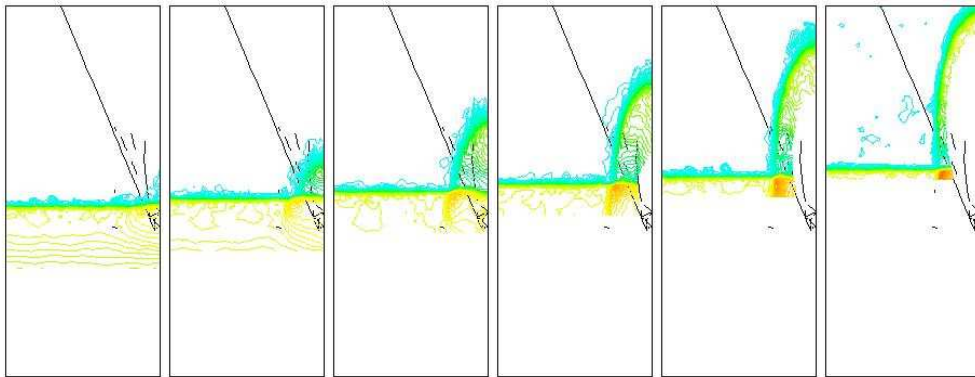


Figure 329: Enlarged sequential density contour plots for conical hill, taken in the x-y plane in steps of 5mm along the z axis.

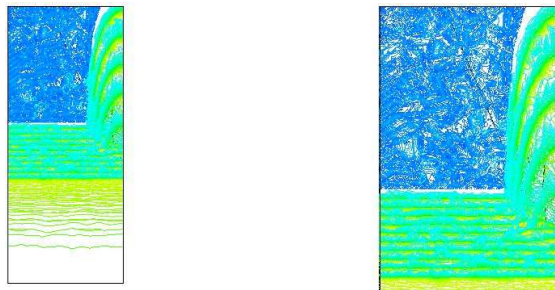


Figure 330: Overlaid density contour plots for conical hill, taken in the x-y plane.

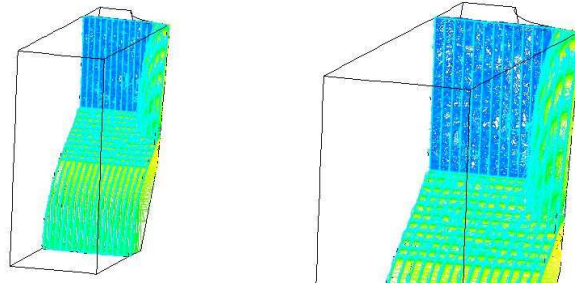


Figure 331: Isometric view of overlaid planes for conical hill.