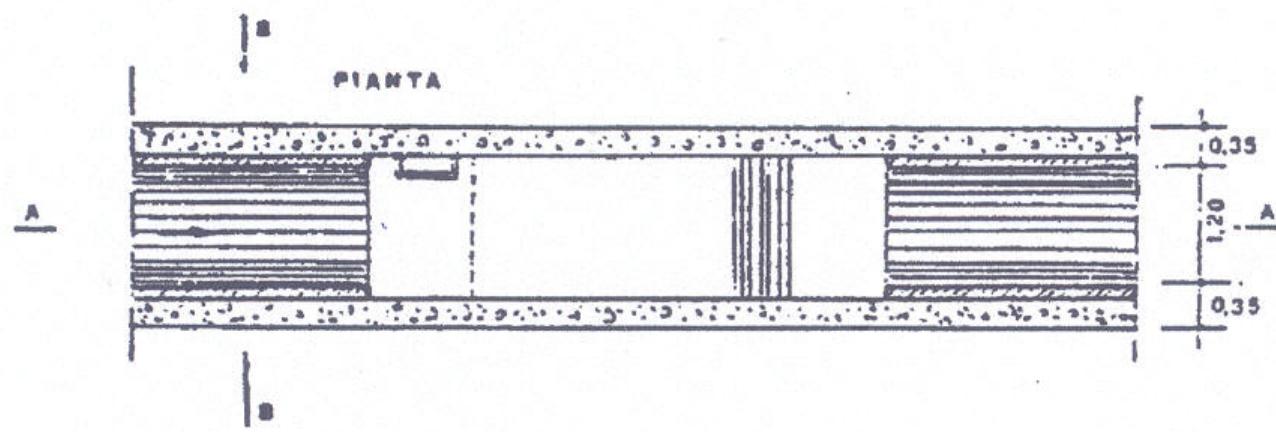
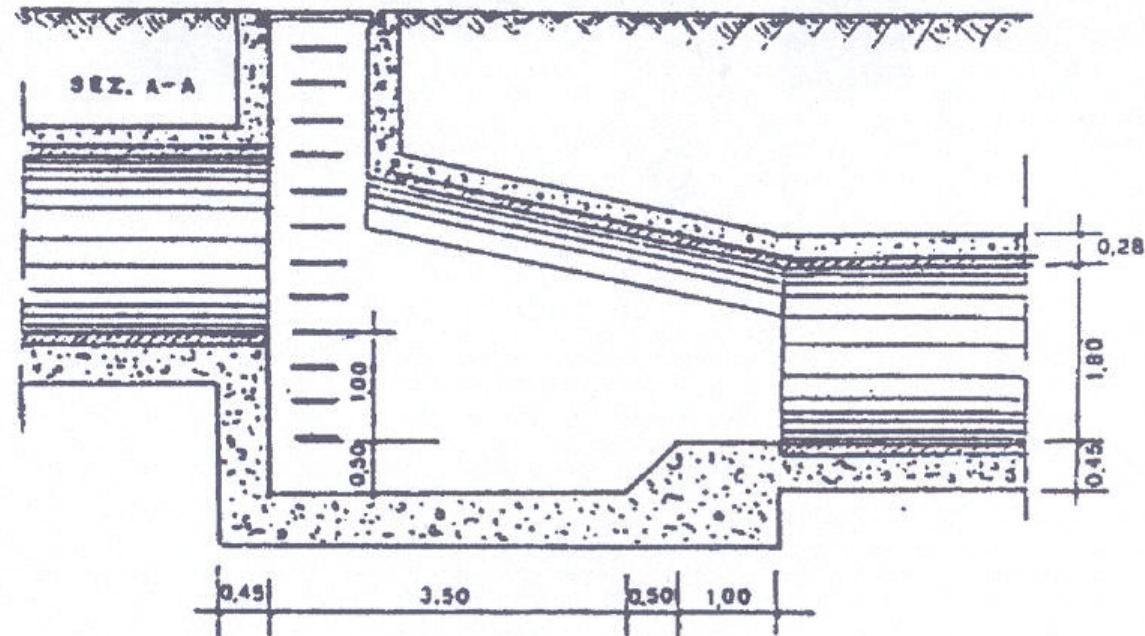
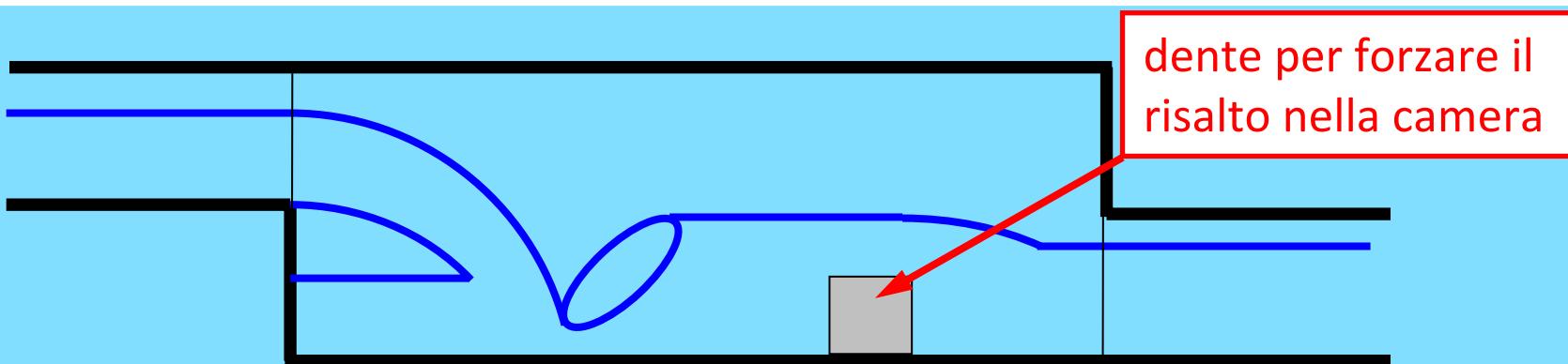
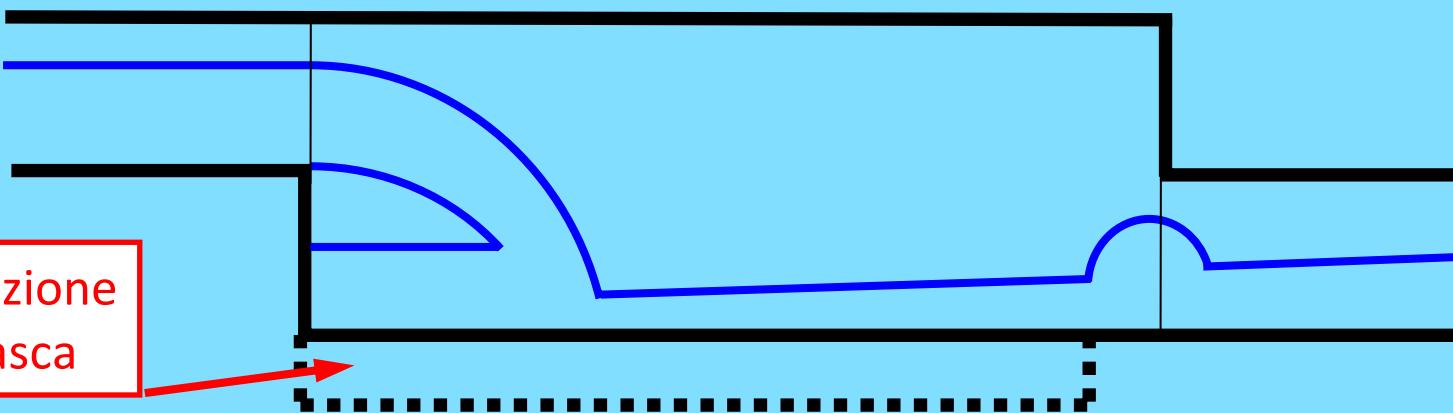
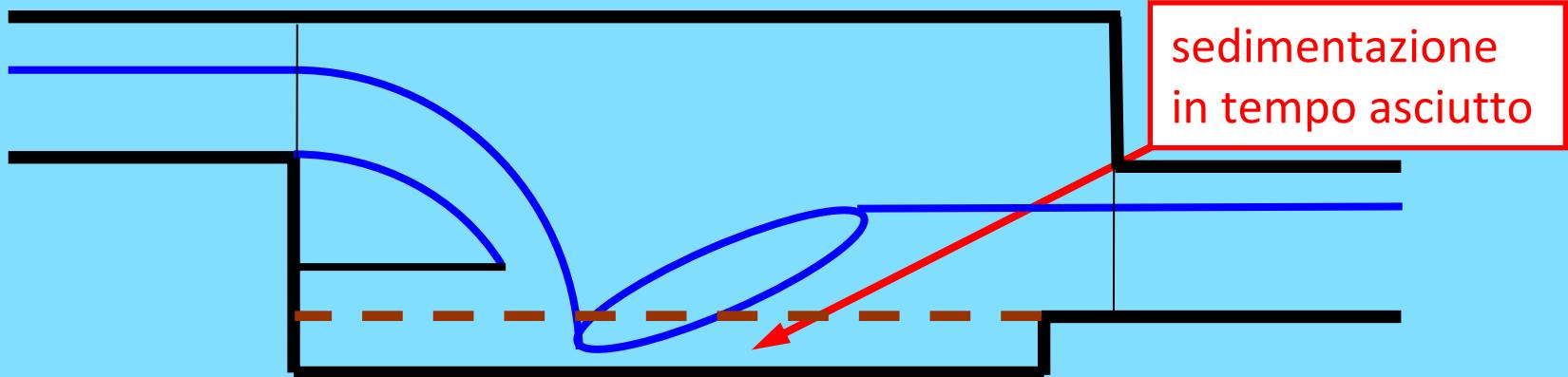


SALTI IN FOGNA: CONFRONTO TRA OSSERVAZIONI SPERIMENTALI E SIMULAZIONI NUMERICHE

G. CALENDA, M. DI LAZZARO, A. FIORI, F. PATANÉ, P. PRESTININZI, E.VOLPI

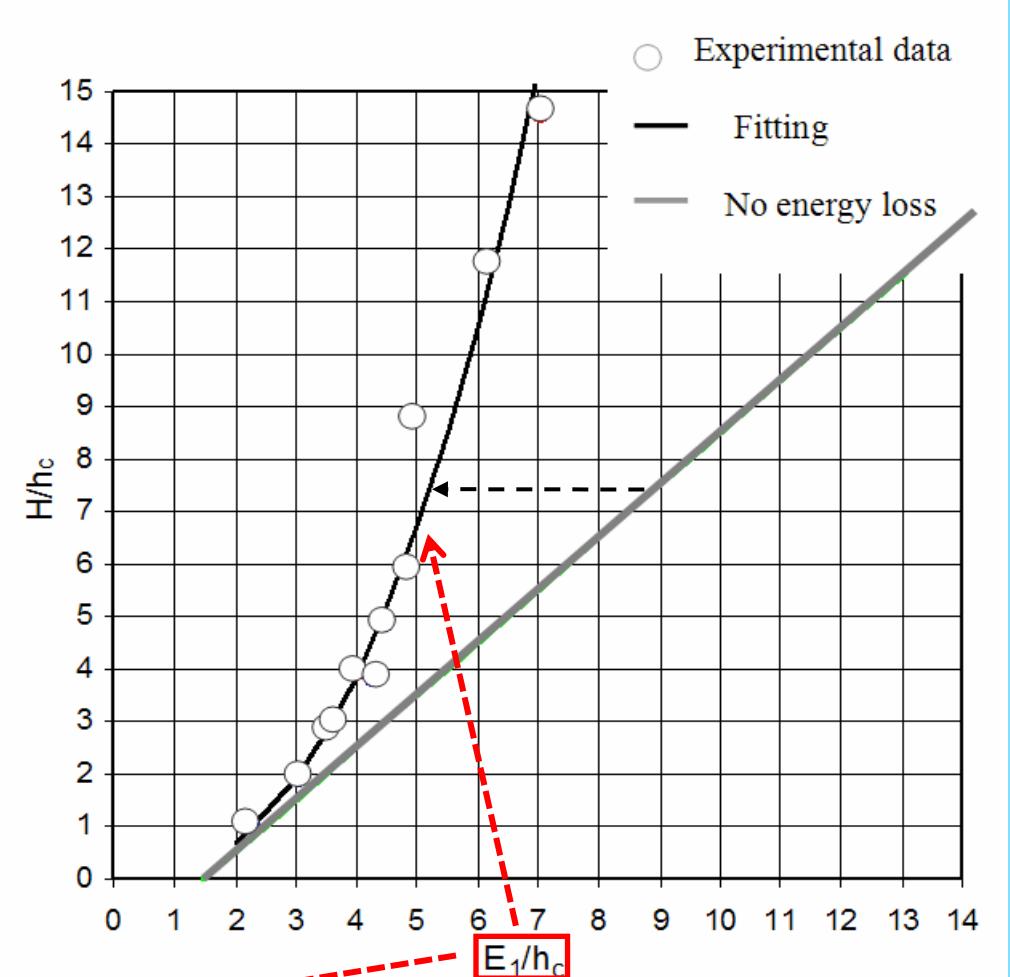
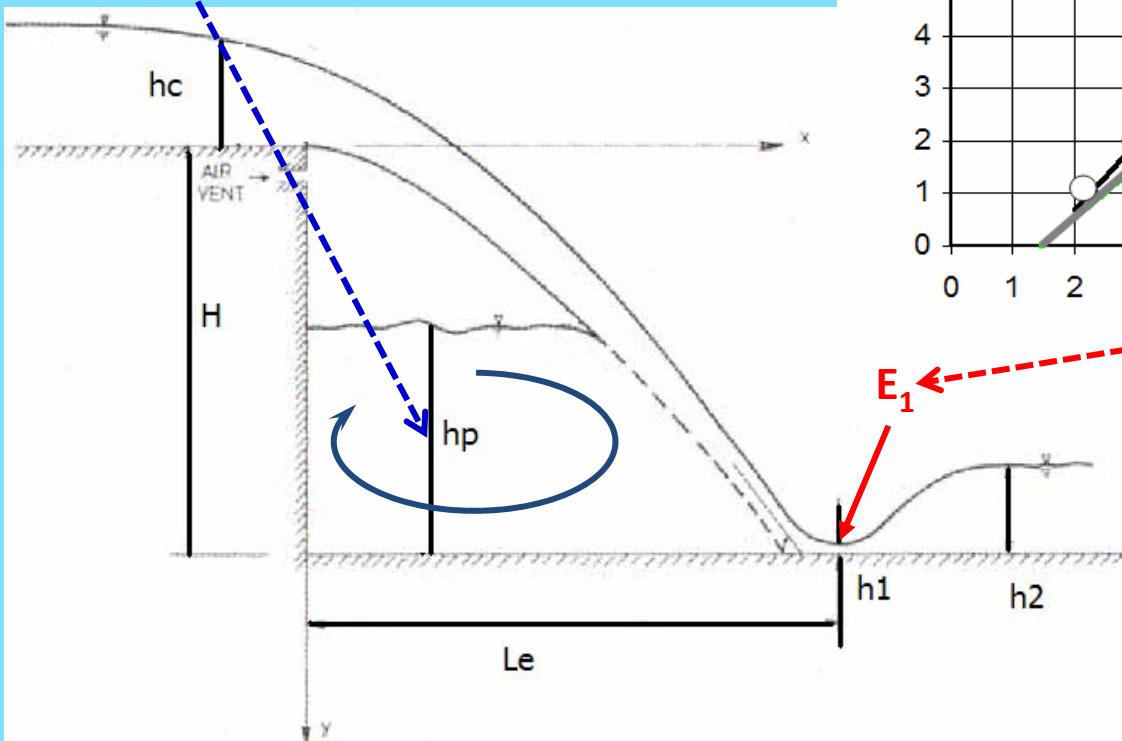
Dipartimento di Scienze dell'Ingegneria Civile, Università degli Studi Roma Tre



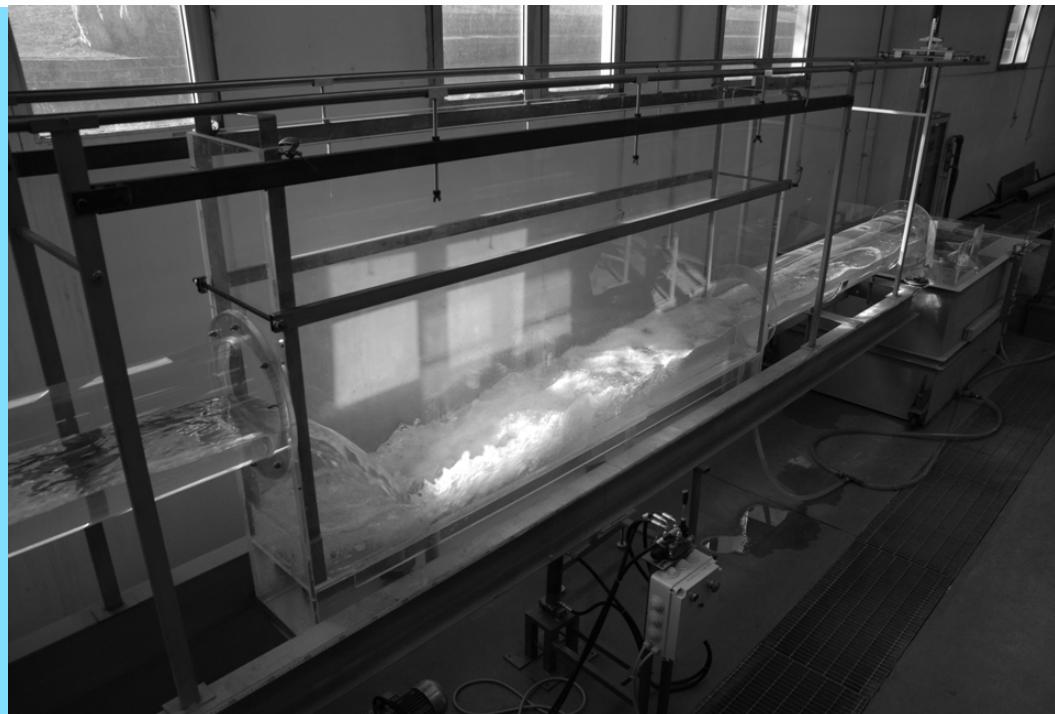
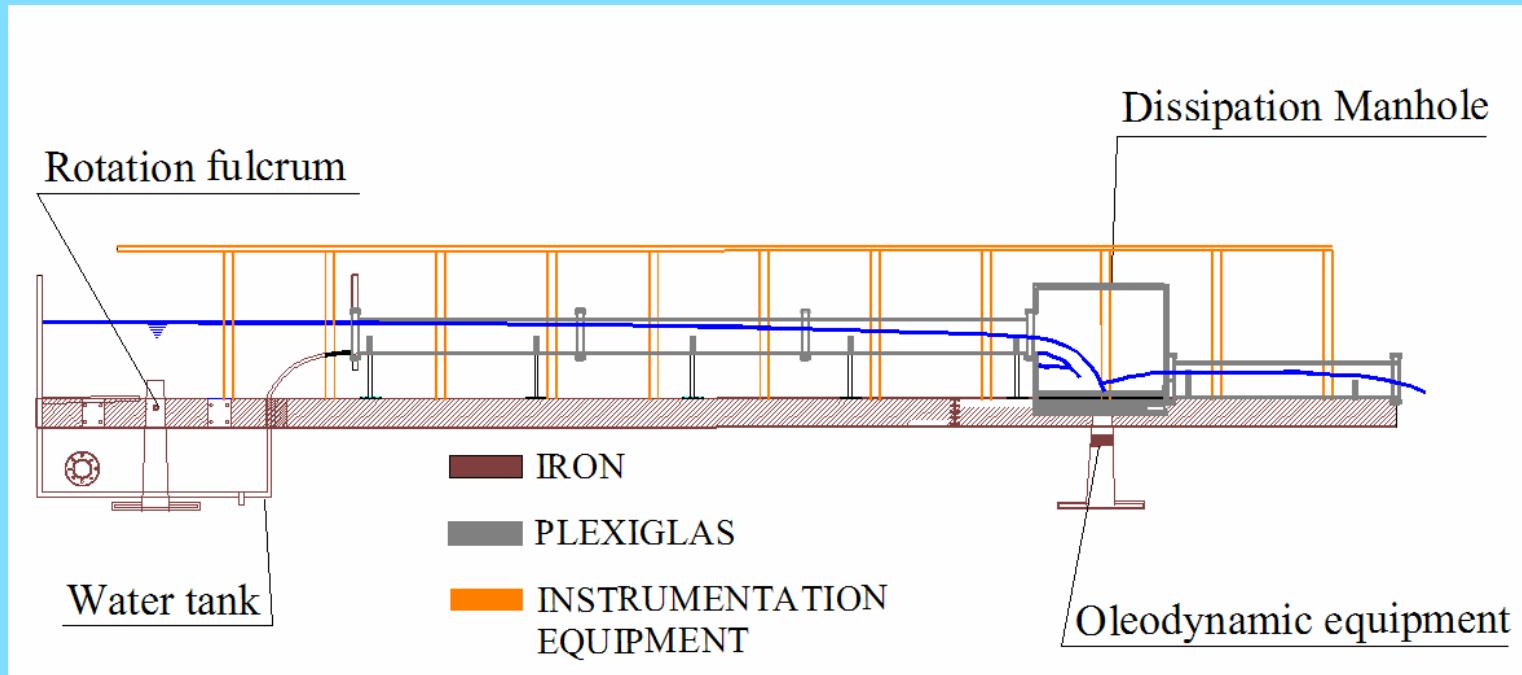


Moore (1943)

$$\frac{h_p}{h_c} = \left(\frac{h_l}{h_c} \right)^2 + \frac{h_c}{h_l} - 3$$

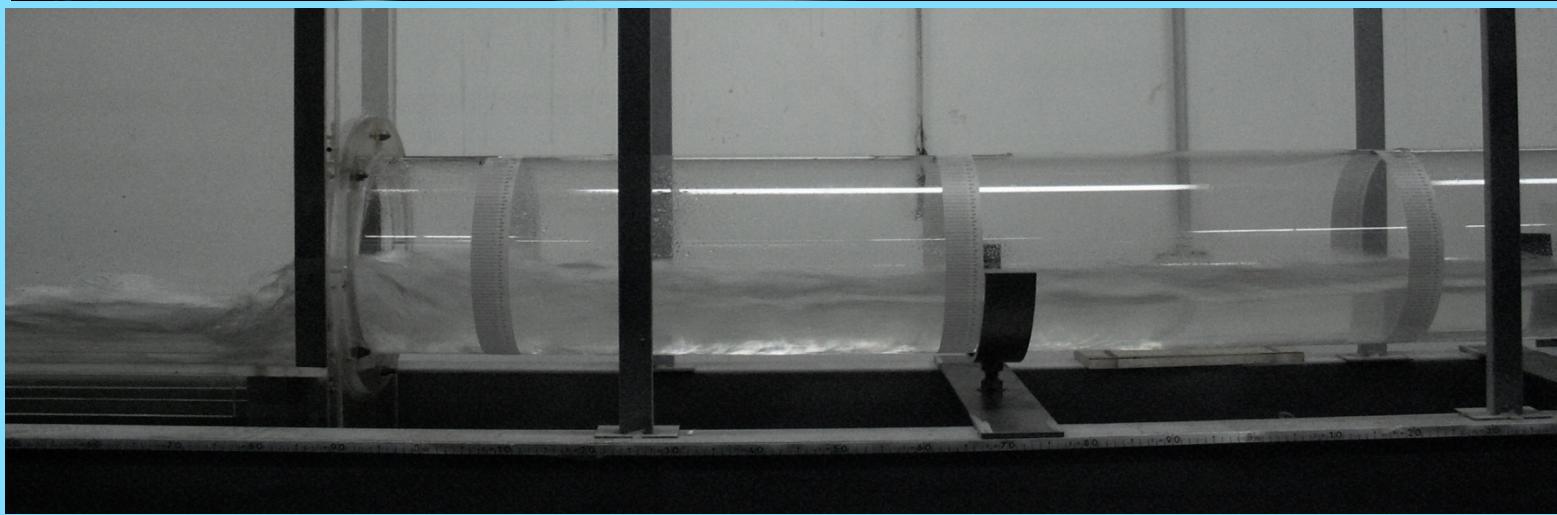


$$\frac{E_1}{h_c} = \frac{H}{h_c} + 1 + \frac{Q^2}{2gb^2 h_c^3} = \frac{H}{h_c} + \frac{3}{2}$$



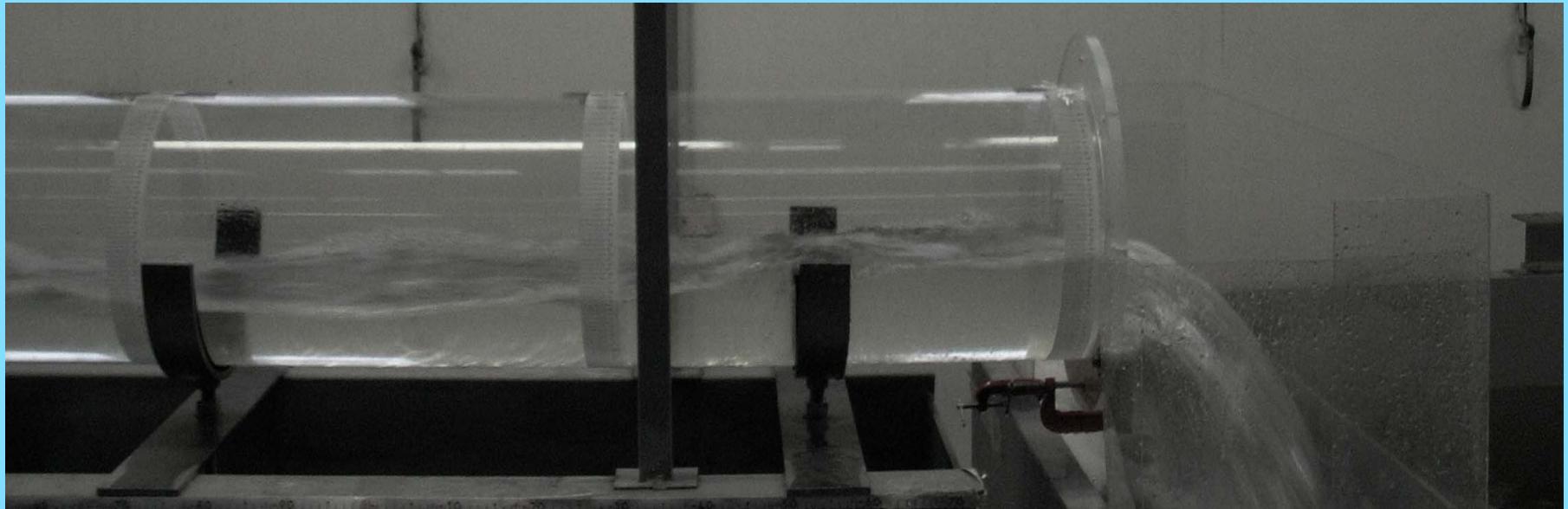
CONDIZIONI DI MOTO

1 – senza stramazzo a valle: corrente veloce



2 – altezza dello stramazzo di valle 0,033 m:

- corrente veloce
- risalto idraulico a ridosso del petto dello stramazzo



3 - altezza dello stramazzo di valle 0,053 m:

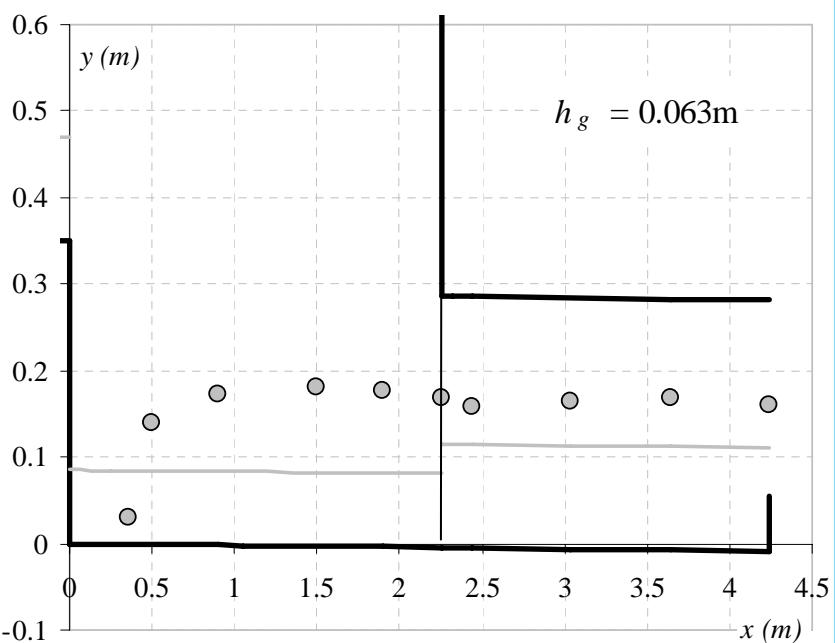
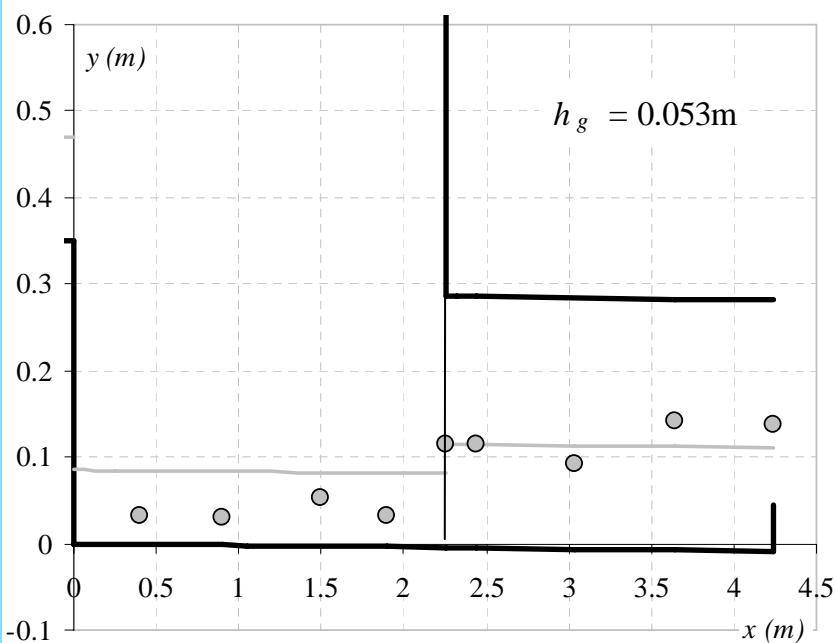
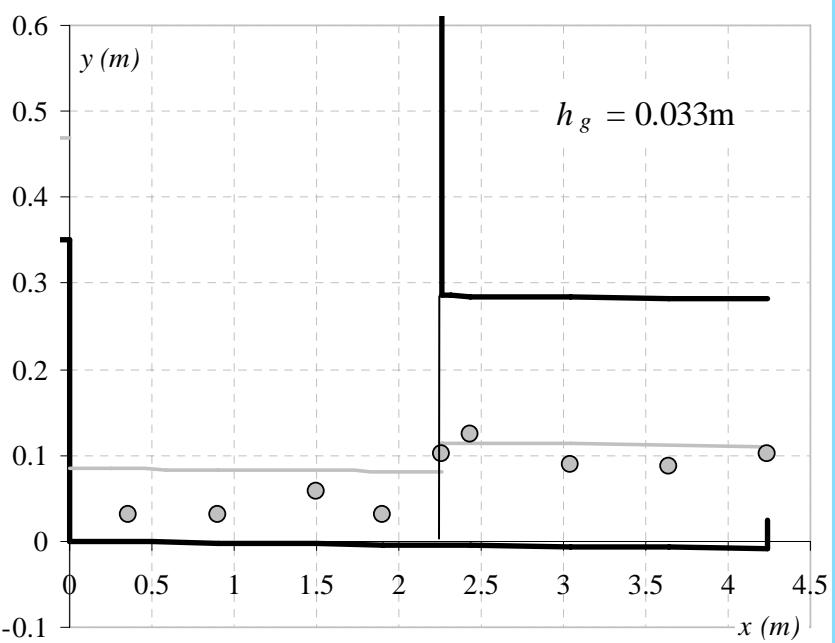
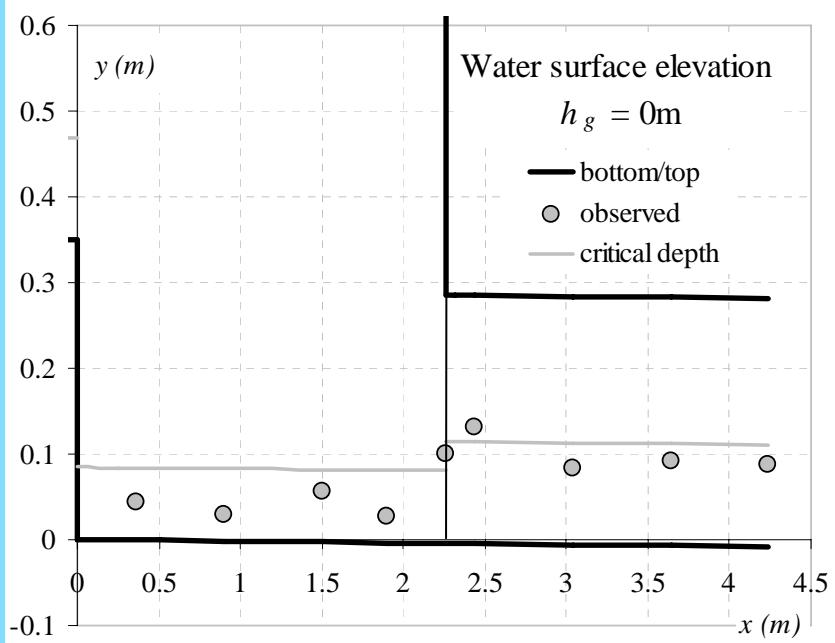
- il risalto idraulico risale verso monte;

4 - altezza dello stramazzo di valle 0,063 m:

- il risalto idraulico è annegato
- corrente lenta ovunque



CONDIZIONI DI MOTO



MODELLO NUMERICO

FLOW-3D: risolve su una griglia cartesiana non uniforme le equazioni di Navier-Stokes:

$$\begin{cases} \frac{\partial u_i}{\partial t} + \frac{\partial u_i}{\partial x_j} = \frac{1}{\rho} \frac{\partial p}{\partial x_i} + G_i - \frac{\tau_{bi}}{\rho} + \frac{1}{\rho} \frac{\partial \tau_{ij}}{\partial x_i} \\ \frac{\partial u_i}{\partial x_i} = 0 \end{cases}$$

Per la chiusura utilizzato un modello $k-\varepsilon$

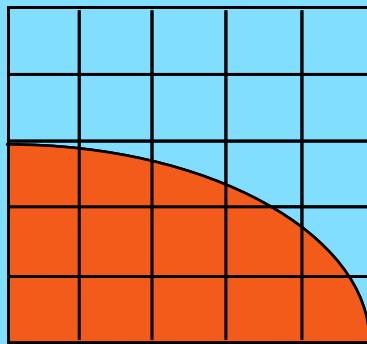
**Algoritmo per la determinazione della superficie libera: *Volume-of-Fluid* (VOF)
calcola la frazione di fluido in ogni cella di calcolo:**

F = 1 la cella è completamente occupata dal fluido

F = 0 la cella è completamente vuota

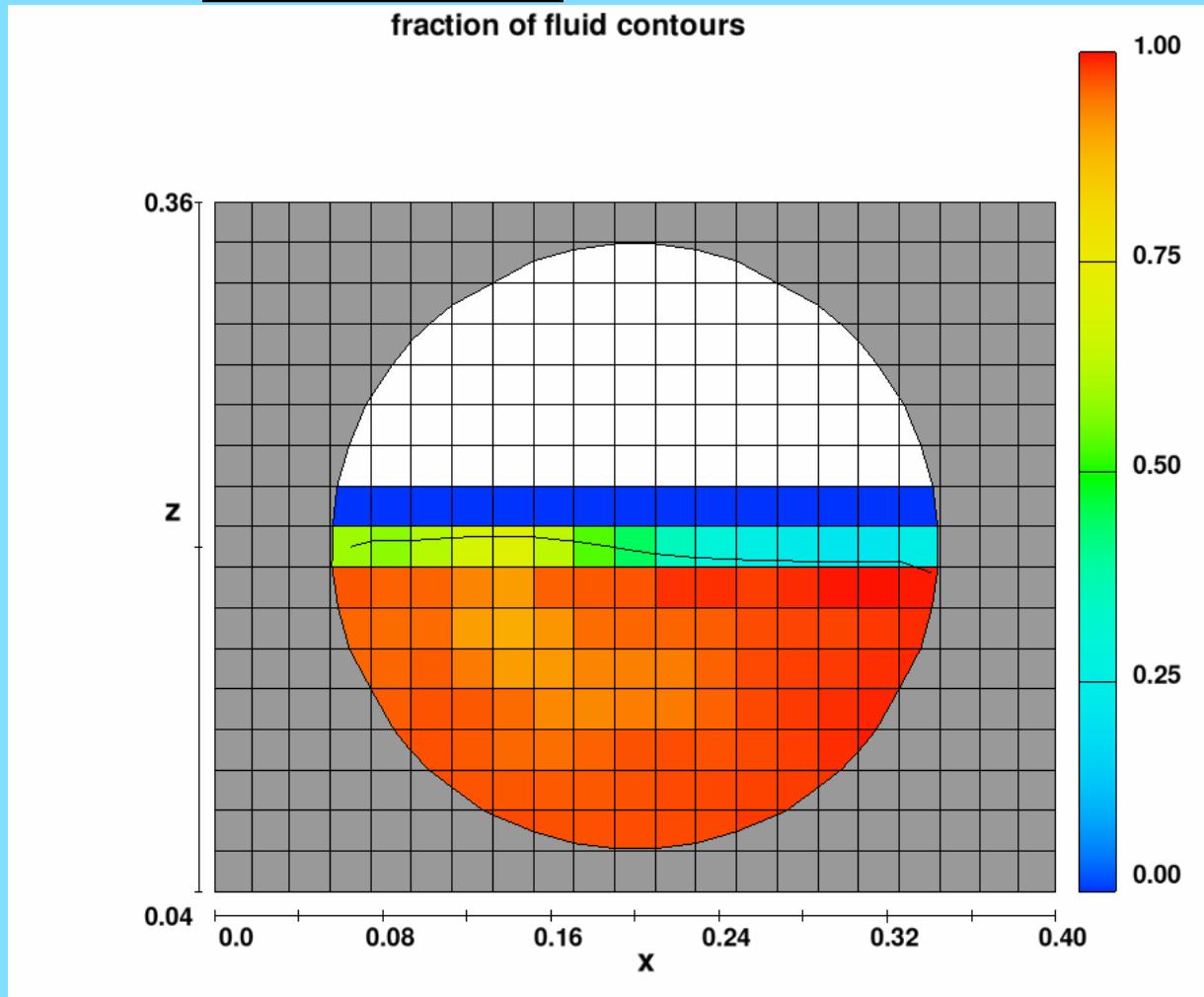
L'evoluzione di F è risolta simultaneamente tramite l'equazione di conservazione:

$$\frac{\partial F}{\partial t} + \frac{\partial (F u_j)}{\partial x_j} = 0$$



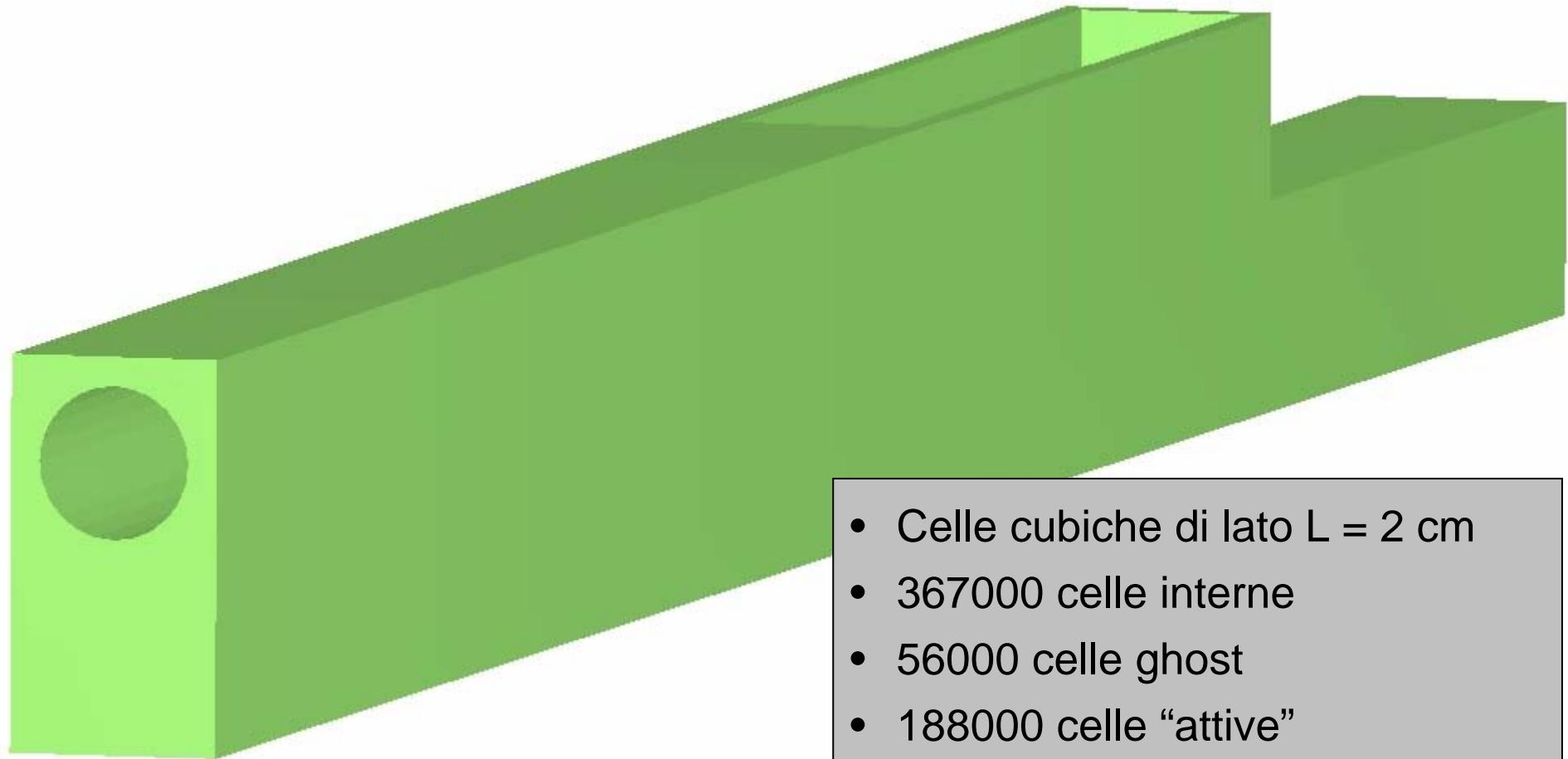
0	0	0	0	0
0	0	0	0	0
.98	.86	.59	.15	0
1	1	1	.91	.25
1	1	1	1	.91

fraction of fluid contours



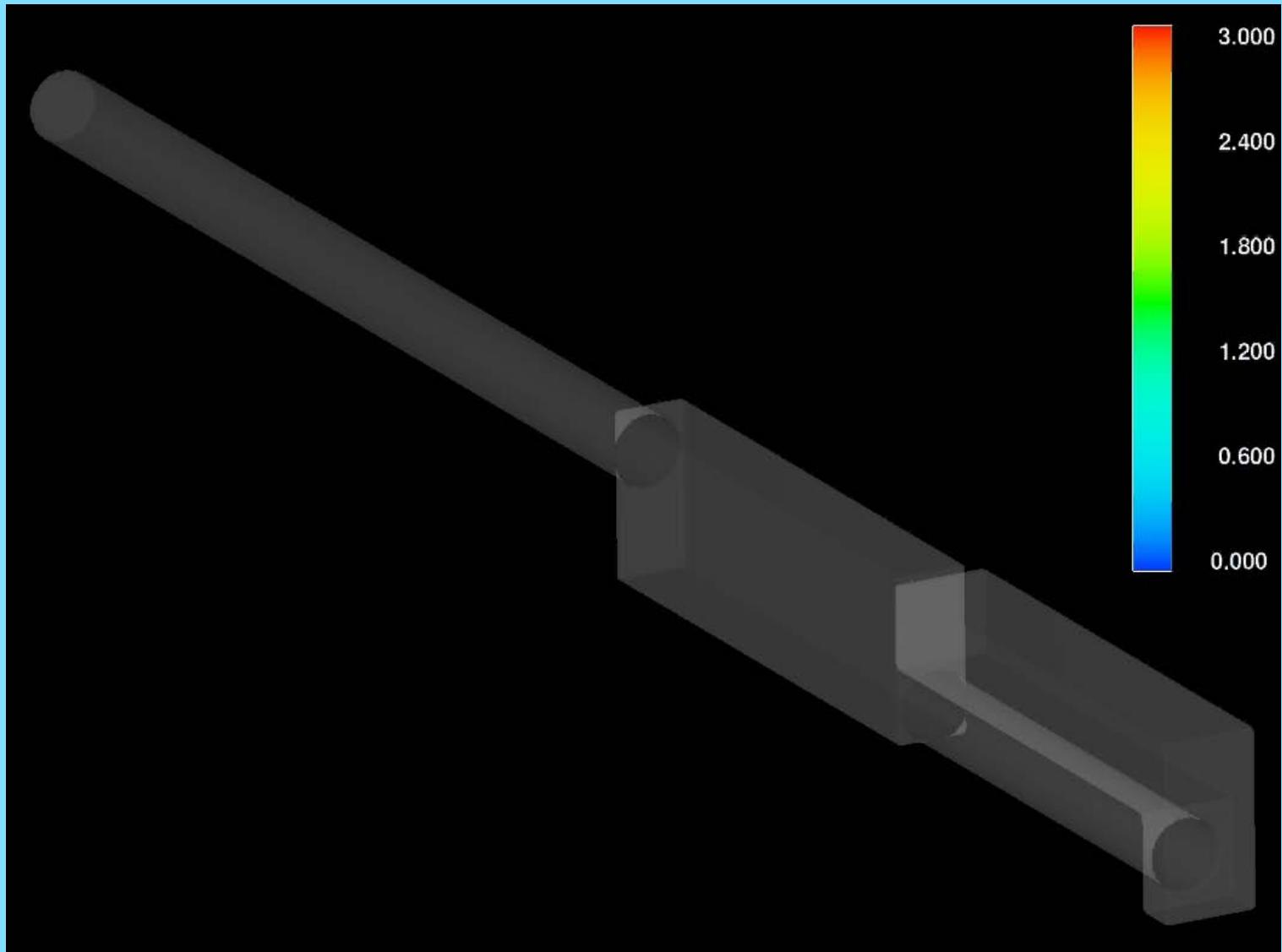
MODELLO NUMERICO

Riproduzione della geometria del salto: caratteristiche della griglia



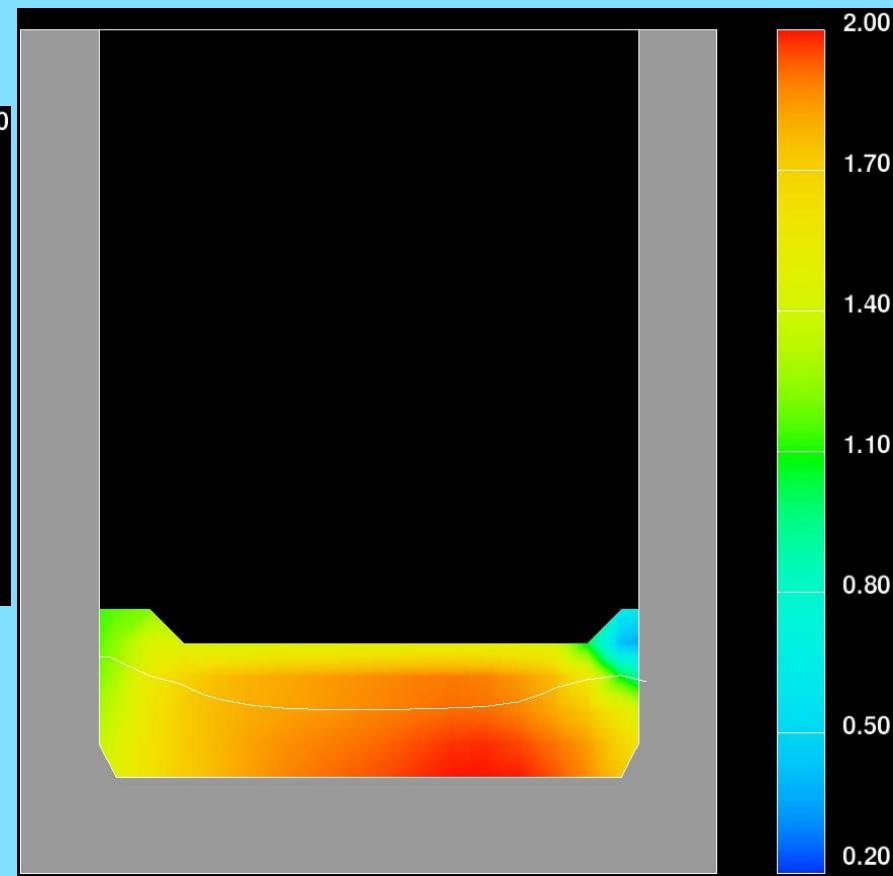
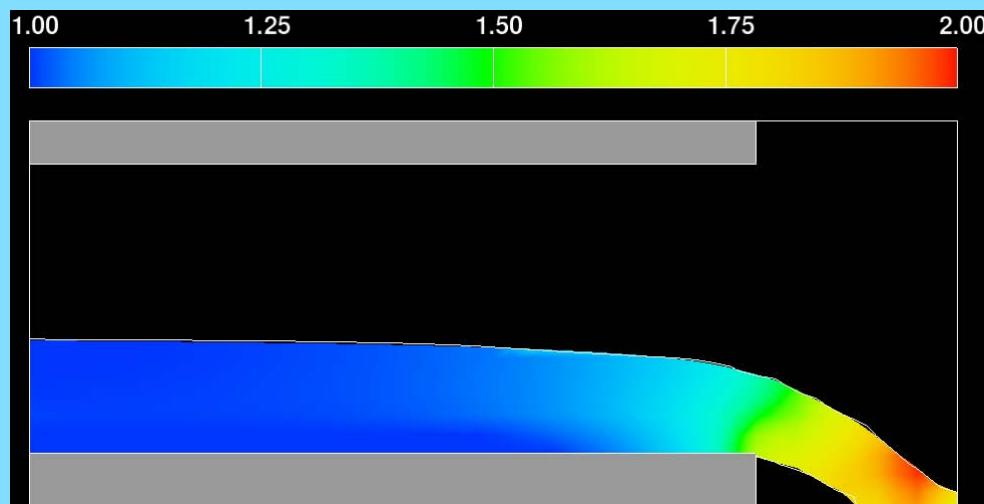
MODELLO NUMERICO

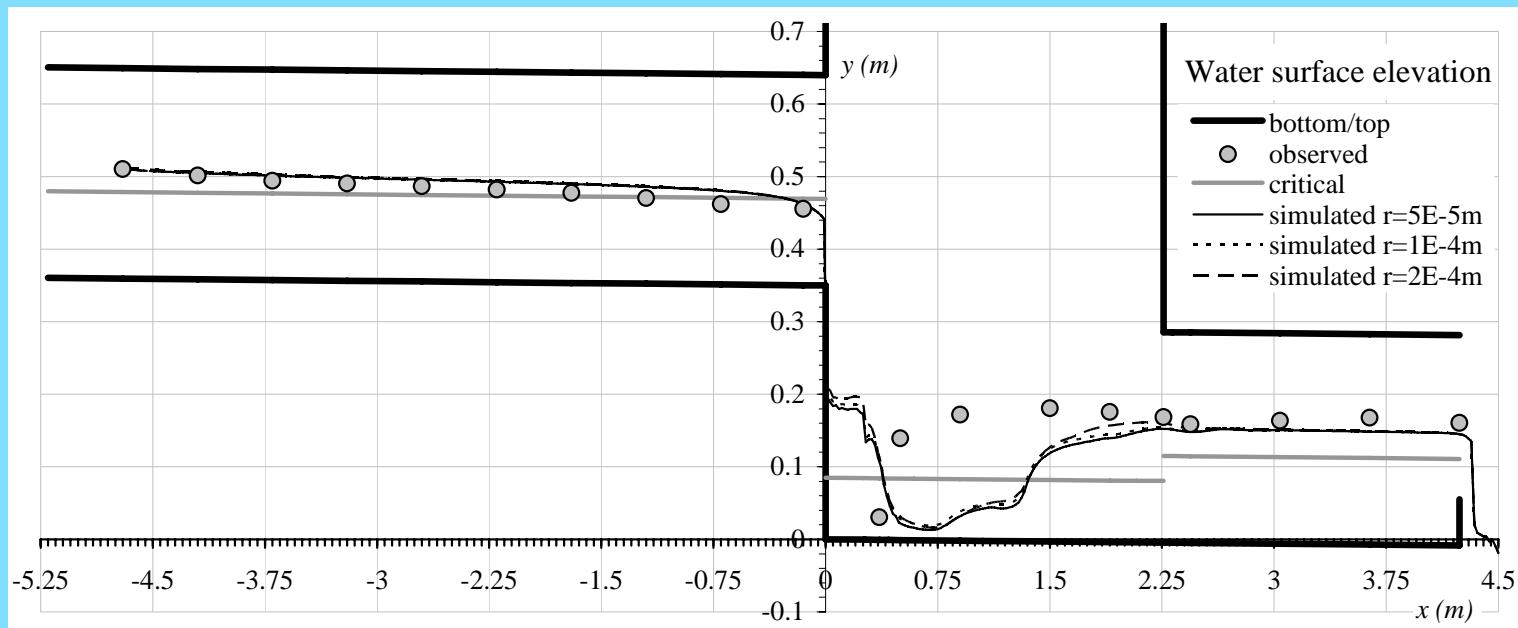
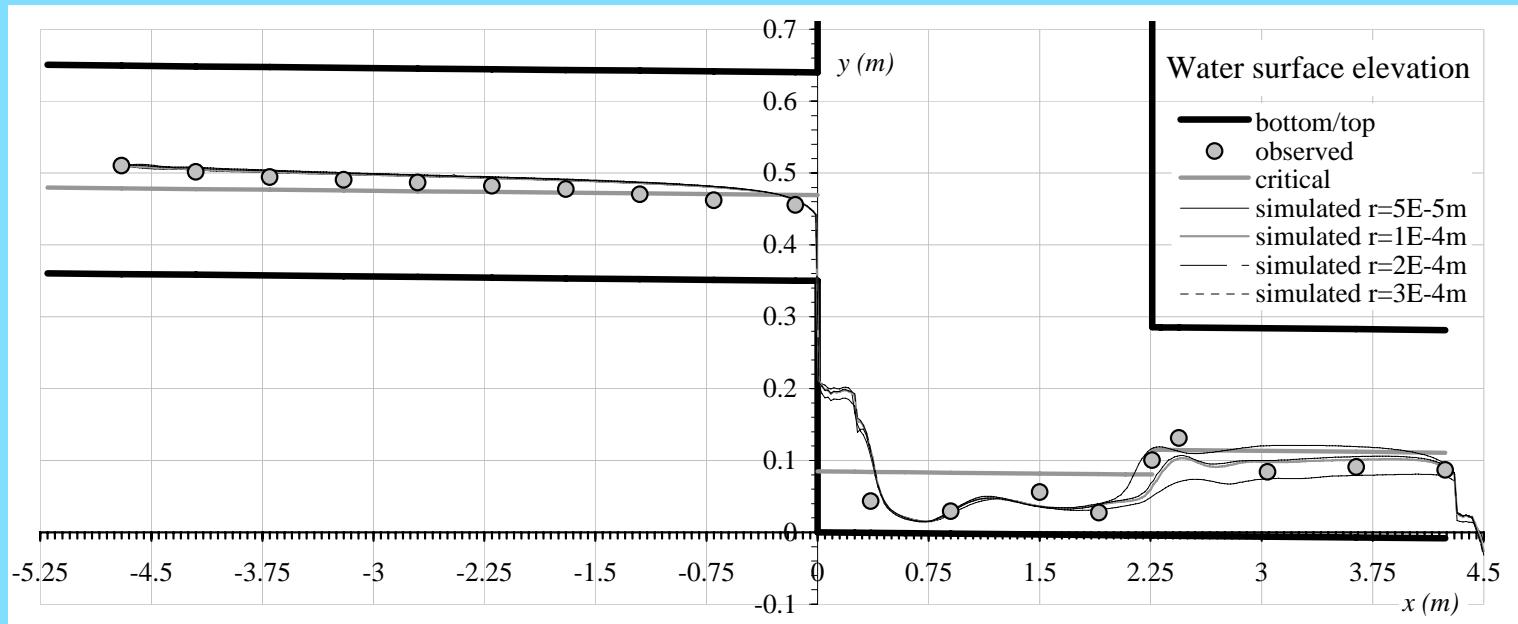
Simulazione in corrente veloce

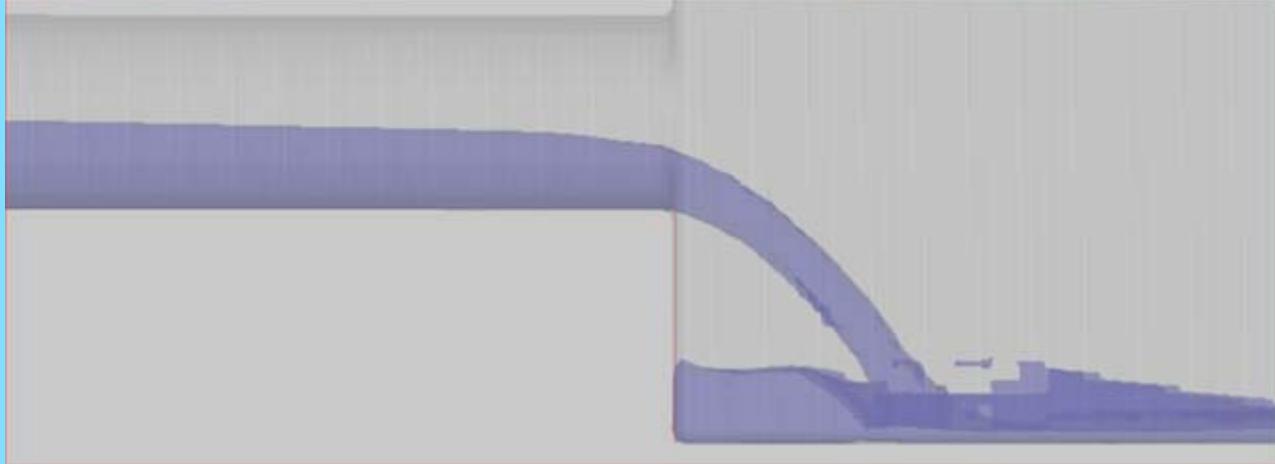


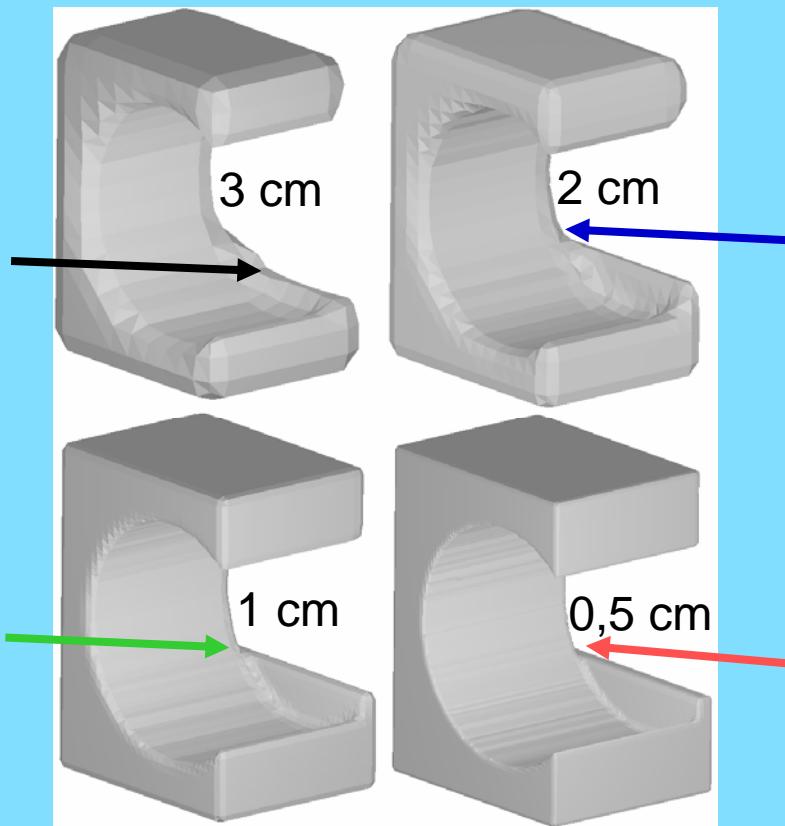
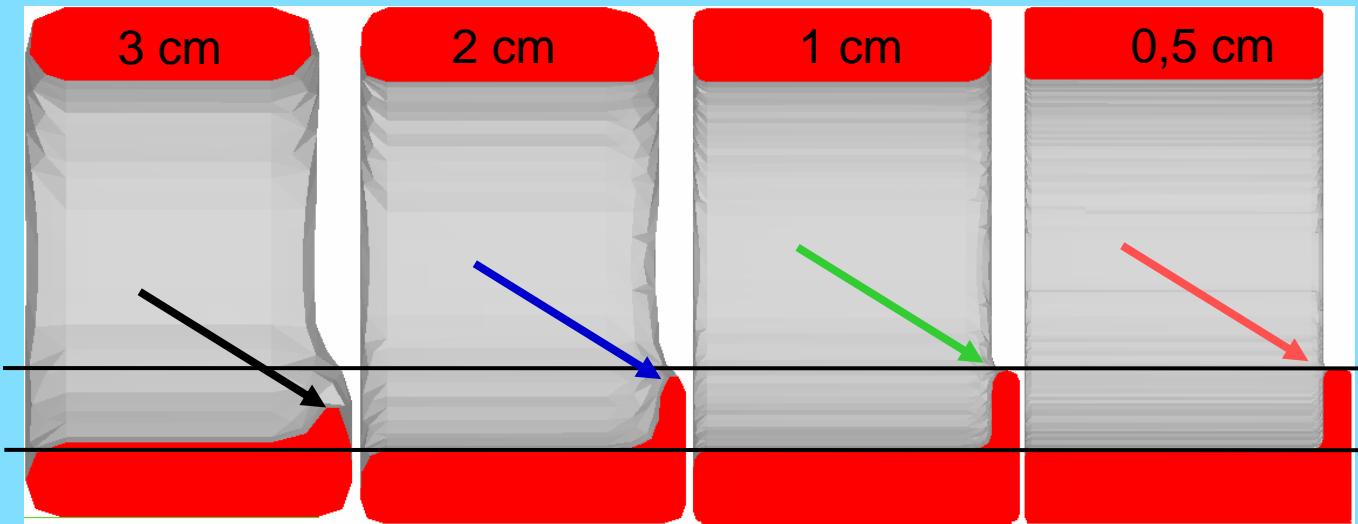
MODELLO NUMERICO

Riproduzione della geometria del salto: velocità









Tempo di elaborazione senza tratto a valle del salto

maglia → tempo

1 cm → 7 giorni

2 cm → 2.5 ore

3 cm → 1.5 ore