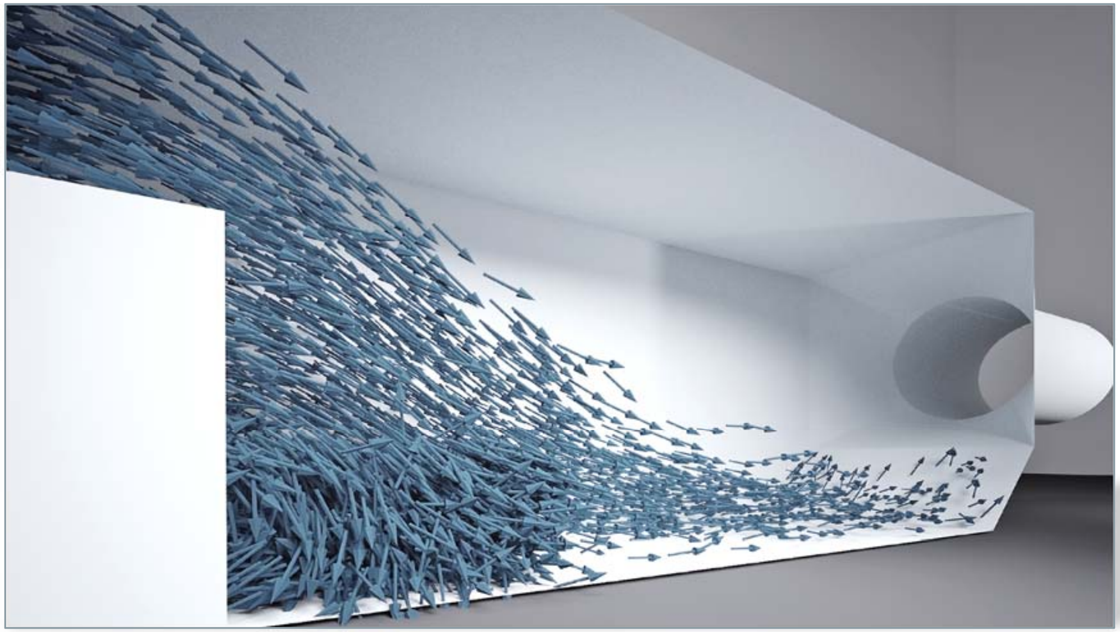
L. Beck, J. Gutekunst, P. Sabrowski



ADAPTIVITY IN SPH

A REVIEW OF VACONDIO'S APPROACH

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INTRODUCTION

THIN CONSTRICTIONS

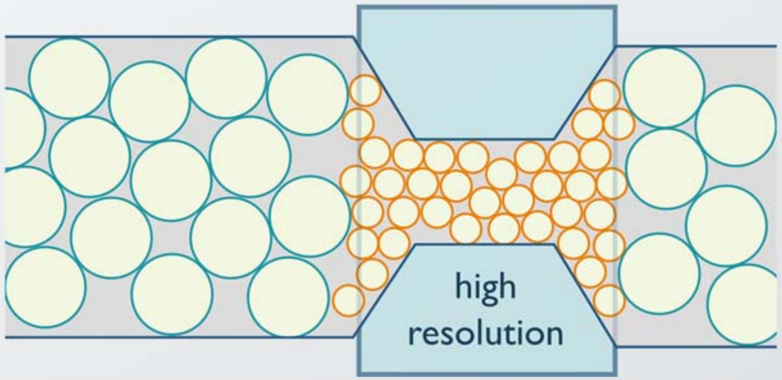


FIGURE: VARIABLE RESOLUTION IN SPH

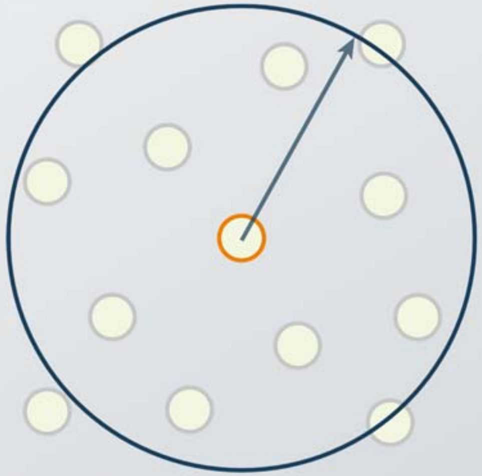


FIGURE: BEFORE SPLITTING

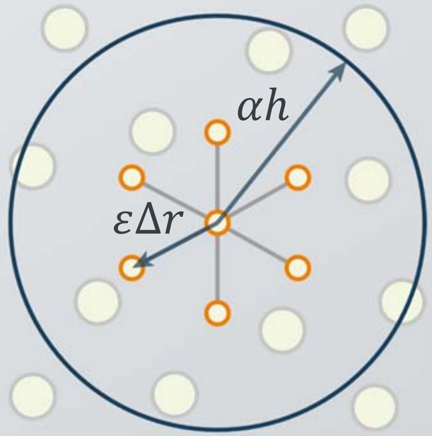


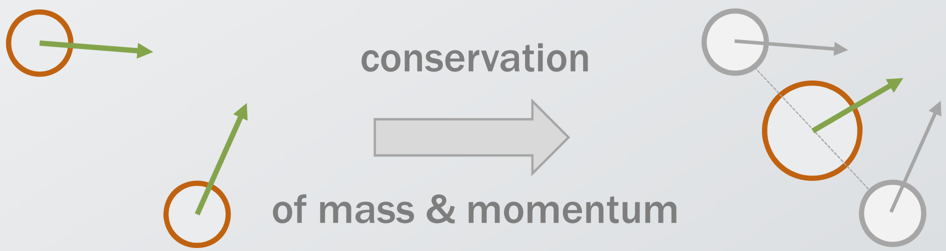
FIGURE: AFTER SPLITTING

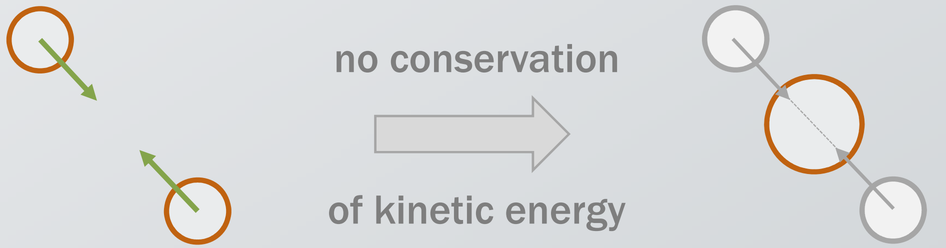
DISCRETIZED MOMENTUM EQUATION WITH VARIABLE H

$$\frac{d\boldsymbol{v_a}}{dt} = -\sum_b \frac{m_b}{\rho_a \rho_b}\left[p_a \nabla w(\boldsymbol{r_{ab}}, h_b) + p_b \nabla w(\boldsymbol{r_{ab}}, h_a)\right] + \sum_b m_b \frac{4\,\nu\,\boldsymbol{r_{ab}} \cdot \nabla \overline{w_{ab}}}{(\rho_a + \rho_b)\, r_{ab}^2} \boldsymbol{v_{ab}}$$

ADAPTIVITY

CONSERVATION OF PHYSICAL PROPERTIES



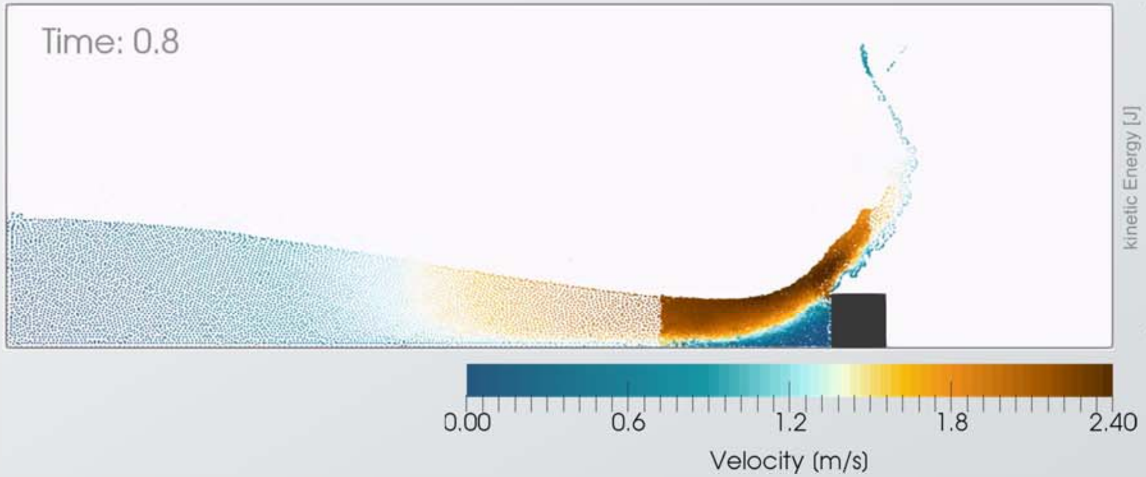


ADAPTIVITY RESULTS

SPHERIC BENCHMARK TESTCASE #2 – 2D

Resolution	adaptive	fine	coarse
Particle diameter [m]	0.01	0. 00378	0.01
Initial number of particles	6,710	46,980	6,710
Maximum number of particles	32.193	-	-

FIGURE: 2D DAMBREAK BY ISSA, VIOLEAU & KLEEFSMAN



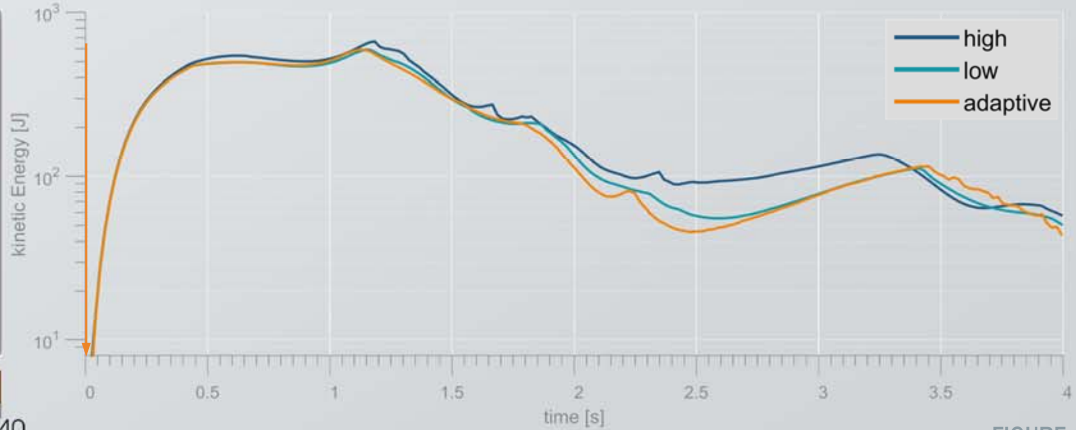


FIGURE:
2D DAMBREAK: KINETIC ENERGY OVER TIME

ADAPTIVITY RESULTS

SPHERIC BENCHMARK TESTCASE #2 – 3D

Viscosity model	Lo – Shao laminar viscosity
Particle diameter [m]	0.02
Initial number of particles	82,350
Splitting pattern	Icosahedron

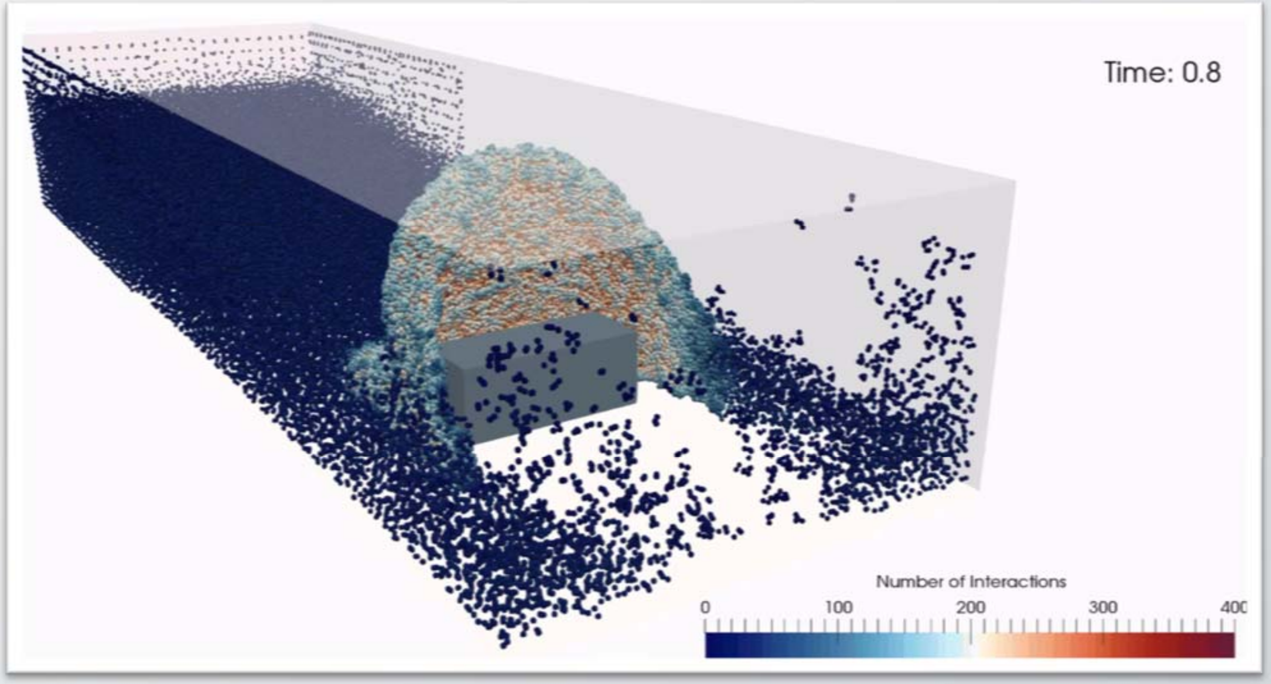
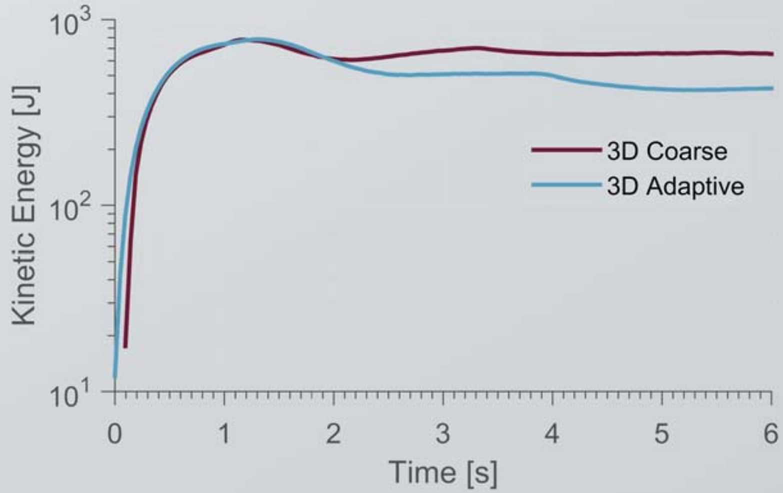


FIGURE: 3D DAMBREAK: ADAPTIVE RESOLUTION NUMBER OF INTERACTIONS



ADAPTIVITY RESULTS

CAVITY FLOW

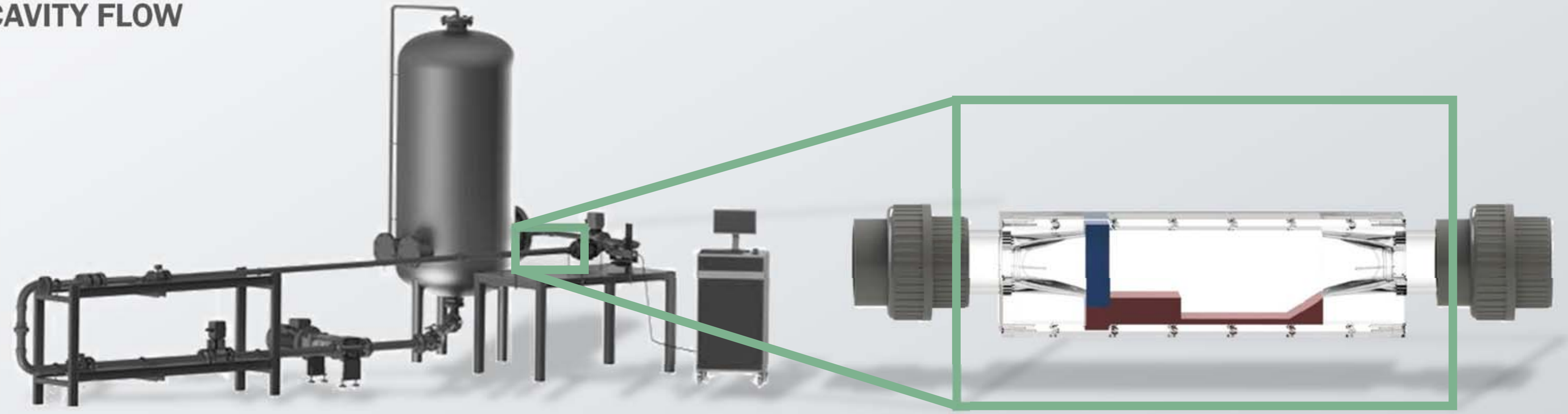


FIGURE: EXPERIMENTAL SETUP FOR CAVITY FLOW

Inlet	6 cm x 6 cm
Inlet Velocity	1 m/s
Domain Length	55 cm

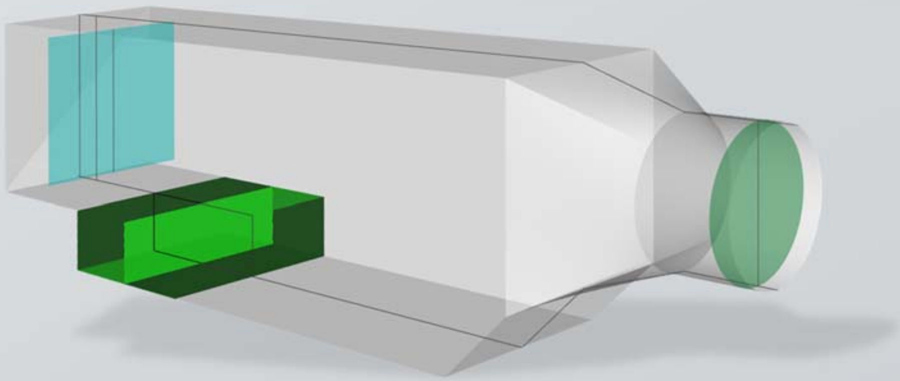


FIGURE: SIMULATION SETUP

ADAPTIVITY RESULTS

2D CAVITY FLOW

Resolution	adaptive	fine	coarse
Particle diameter [m]	0.0026	0.001	0.0026
Maximum number of particles	11,400	70,500	9,300
Viscosity model	Lo – Shao Laminar Viscosity		

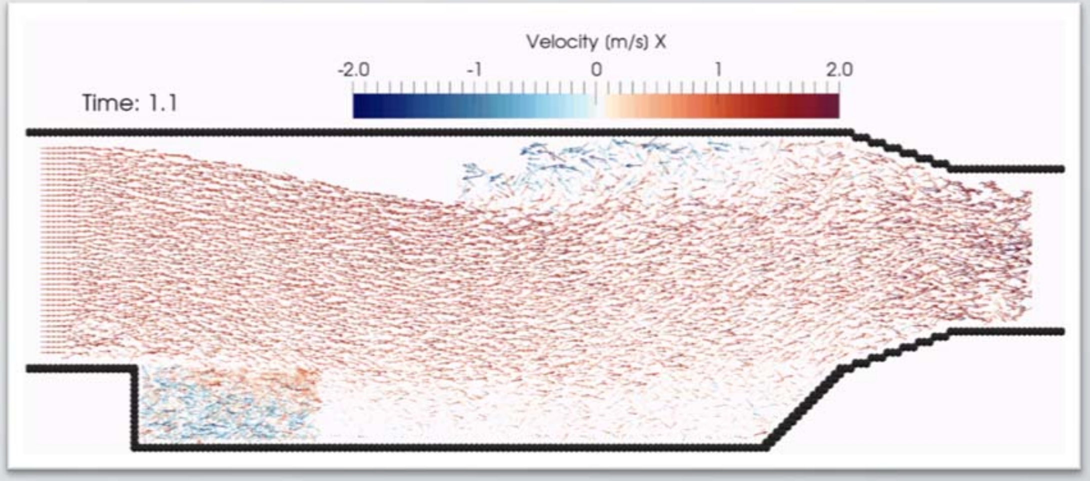


FIGURE: ADAPTIVE RESOLUTION

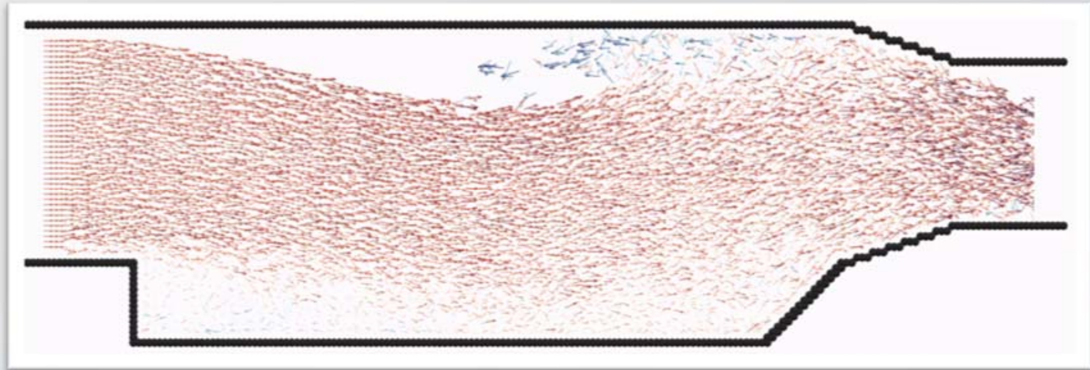


FIGURE: LOW RESOLUTION

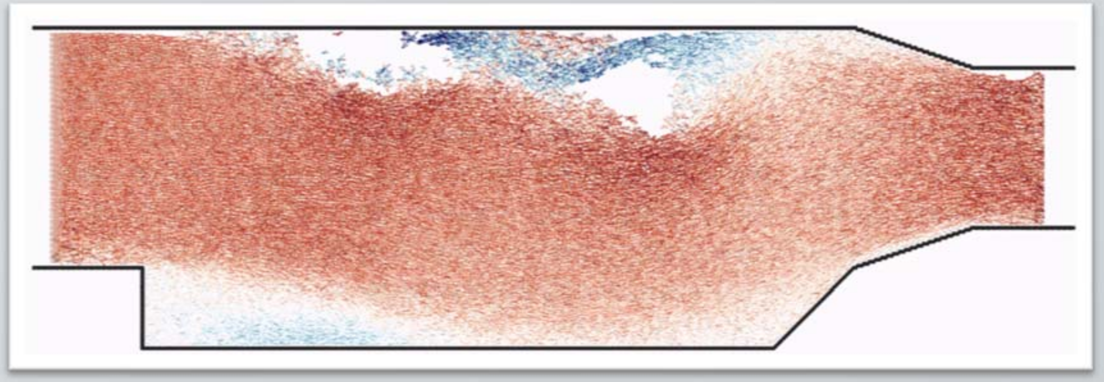
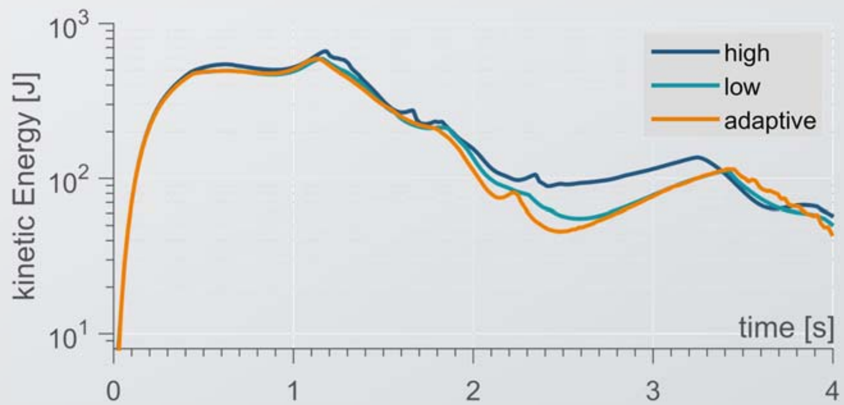


FIGURE: HIGH RESOLUTION

CONCLUSION

KINETIC ENERGY

„Influence of kinetic energy loss is negligible.“



VISCOUS EFFECTS

„Viscous effects & vortex dissipation in adaptive region.“

$t = 0.95$ s

FUTURE WORK

1. Investigation in smoothing length effects
2. Validation with experimental data
3. Comparison to the adaptive approach by Barcarolo & Chiron

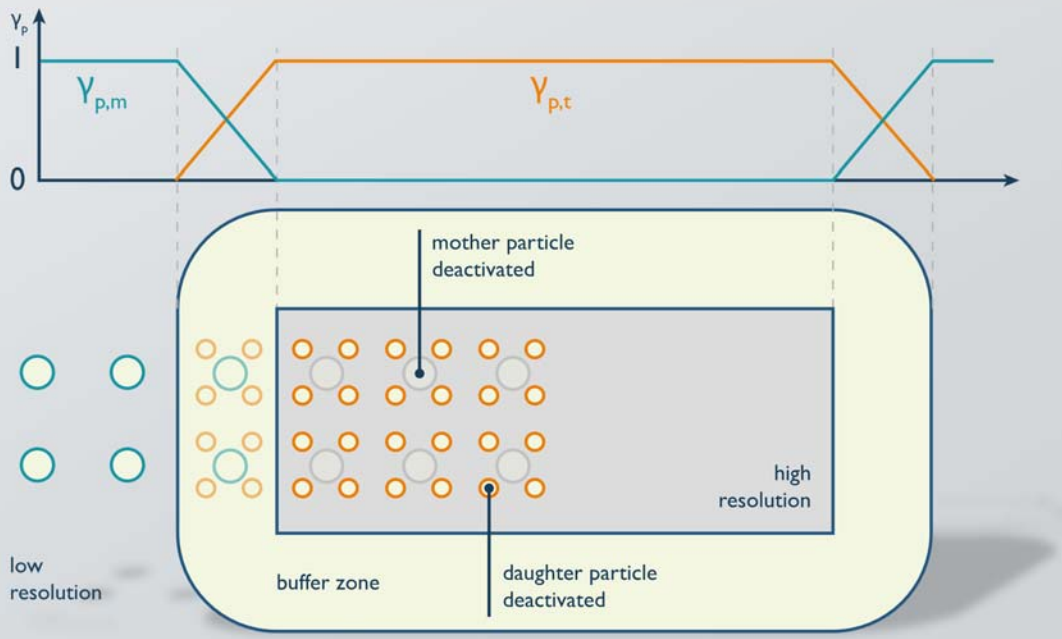


FIGURE: ADAPTIVE APPROACH BY BARCAROLO

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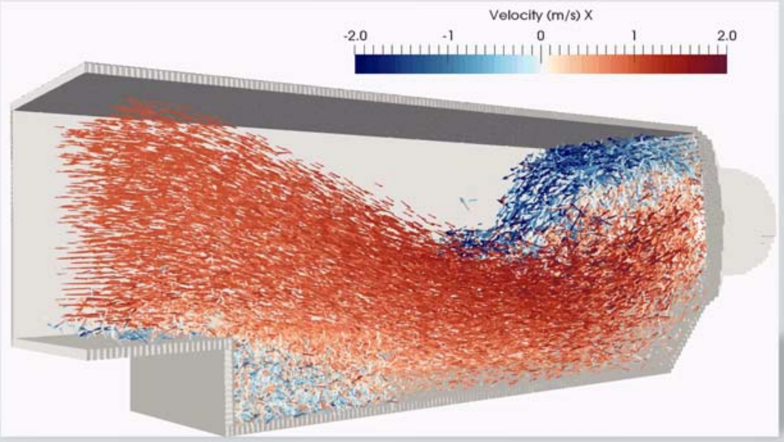

FIGURE: **3D CAVITIY FLOW WITH ADAPTIVITY**
600.000 PARTICLES

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