Simulation of Dynamic Interaction of the Neutrino Factory Mercury Jet with the Mercury Collection Pool/Beam Dump

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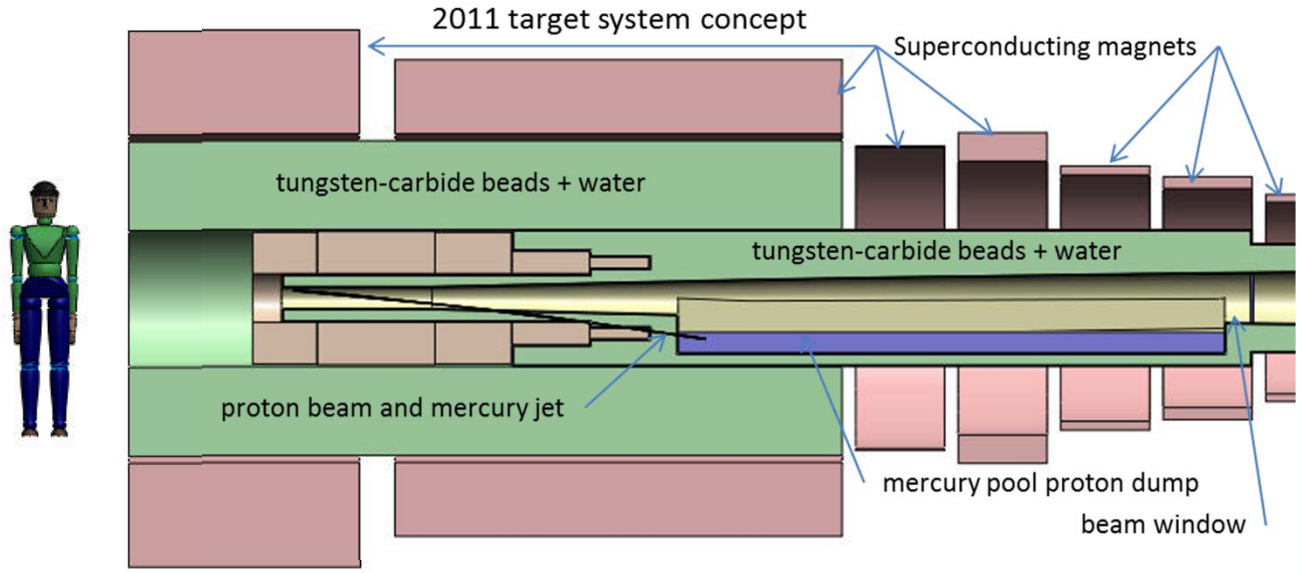
[Presented by K. McDonald, *Princeton U]*



The target system concept for a Muon Collider/Neutrino Factory incorporates a mercury jet at the target and a pool of mercury as the beam dump and catcher of the mercury jet.

The surface of the pool will be disrupted by the splash of the jet (and by the proton beam)

How can this disruption be mitigated?

Challenges:

Need Hg equation of state for both liquid and gas phases

SESAME Library revisited in attempt to numerically describe the Hg phase diagram and introduce it to codes such as LS-DYNA

Energy Deposition introduction into Hg jet/pool system

mechanics of it has been solved by utilizing capabilities of different codes

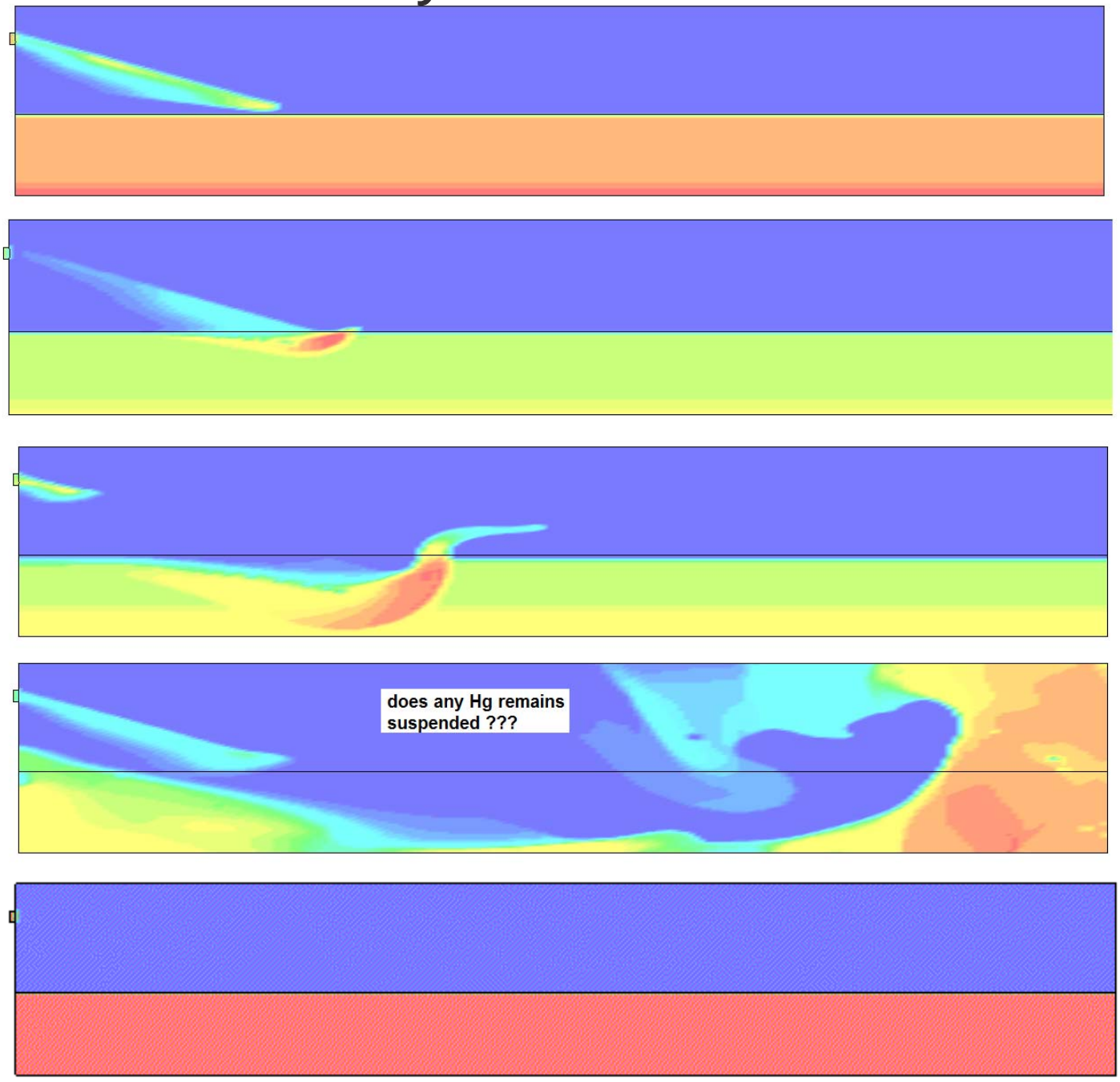
Implementation of Solenoid Tesla Field as part of same analysis

we think we have a solution with “pseudo-angular” rotation of Hg jet providing magneto-confining pressure

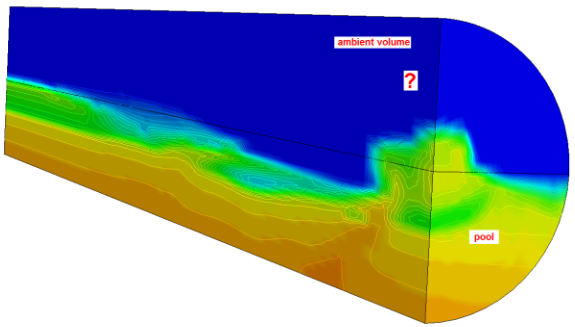
Trusting the predictions of the violent processes that we try to simulate

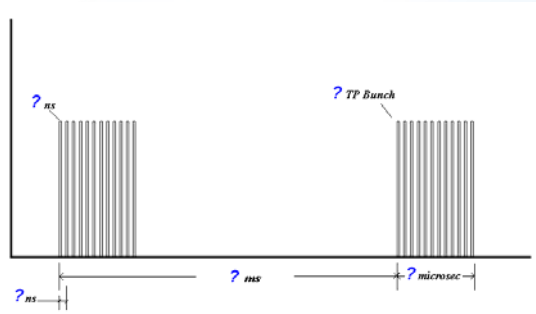
excellent basis due to successful benchmarking of relevant experiments

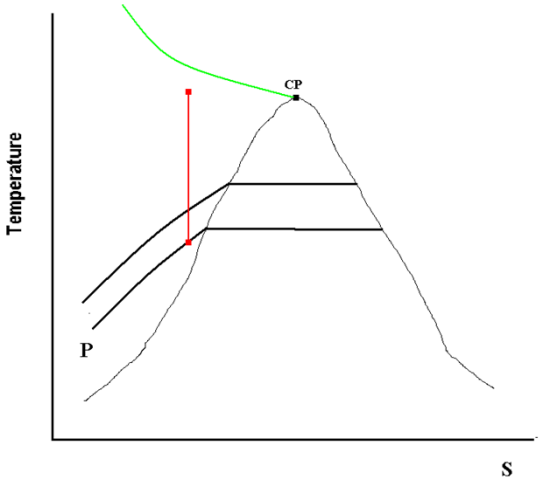
LS-Dyna simulation:



Hg Jet







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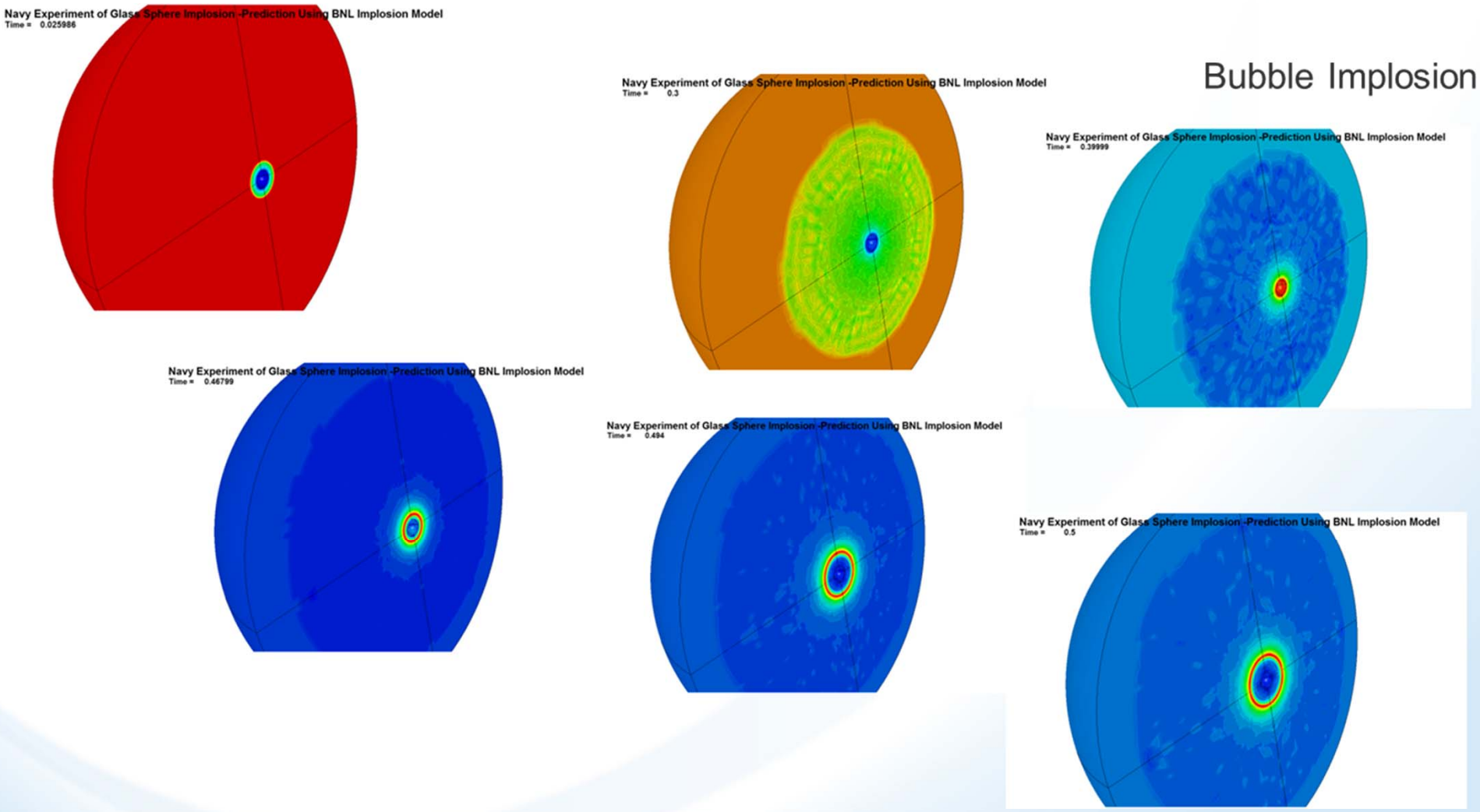
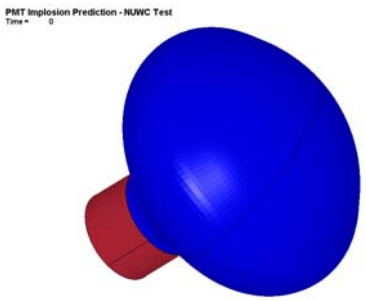
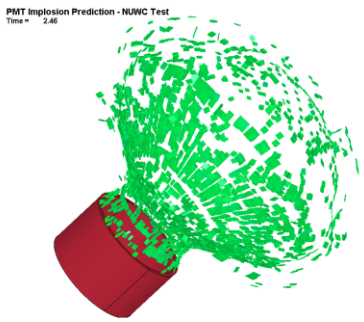
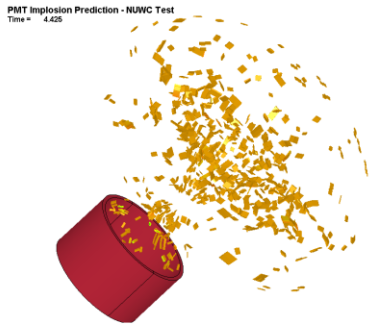
Another Challenge: Modeling of cavitation bubbles during disruption of the Hg Jet/Pool

LS-Dyna simulations:

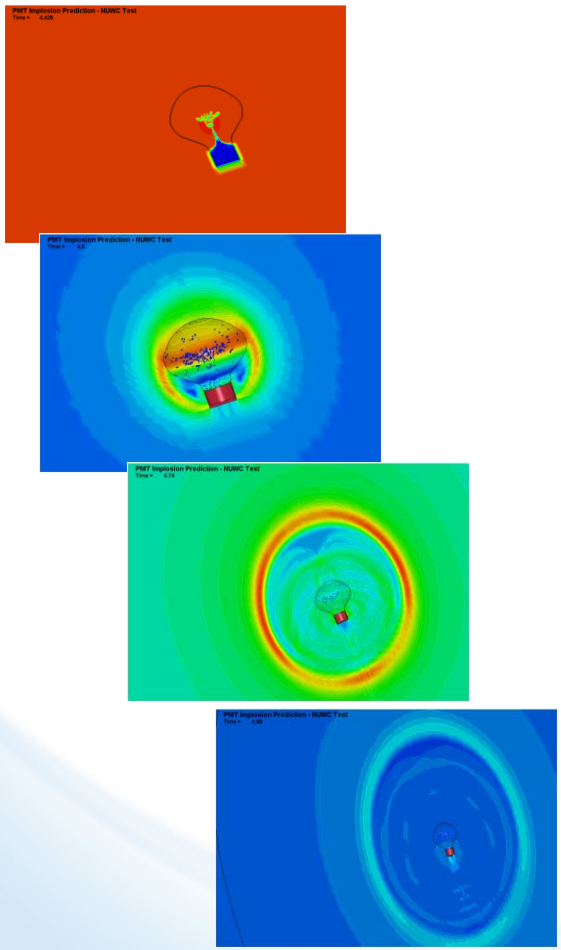


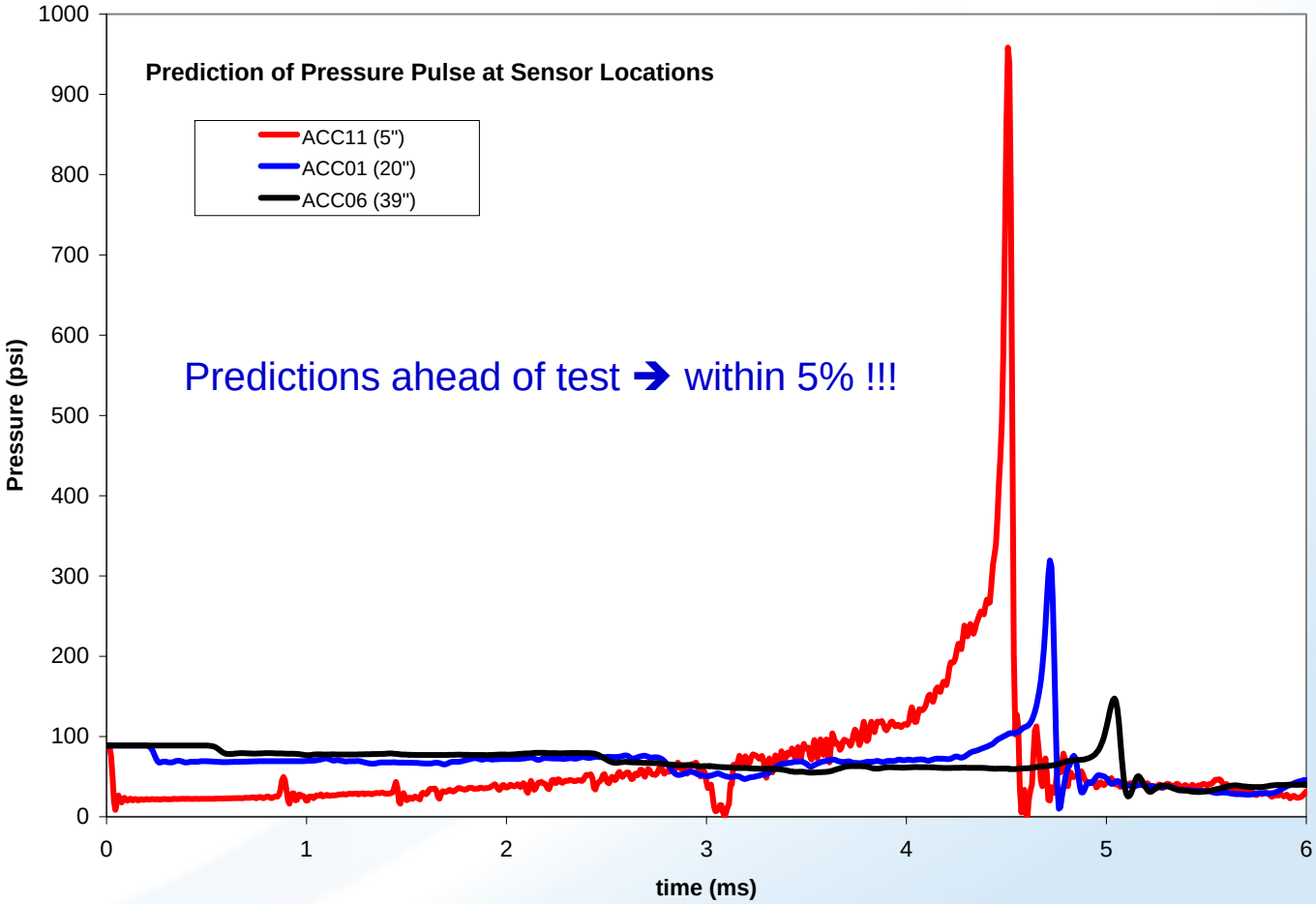






Validation of LS-Dyna with experiments on collapse of 20-cm-diameter PMTs under water:





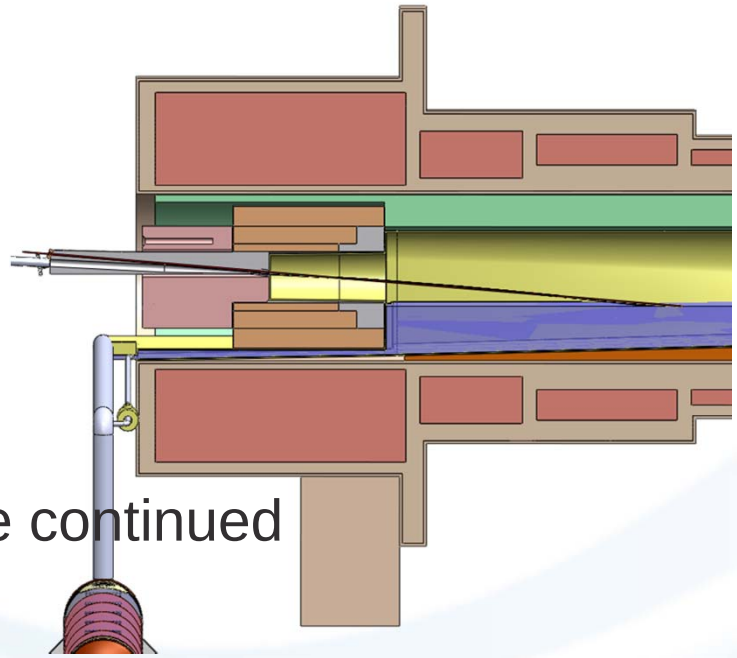
Path Forward:

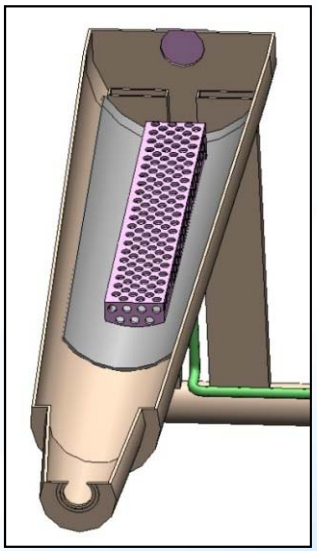
We feel that the simulation processes have been well benchmarked to extrapolate the analysis into the question of phase transitions

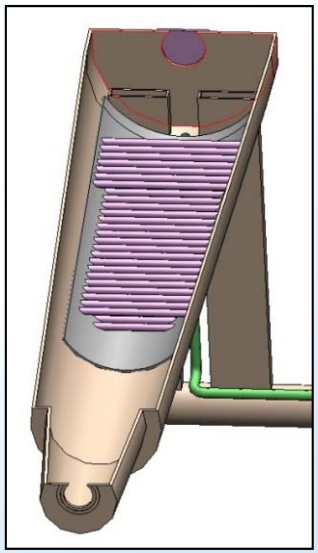
SESAME Library (Hg) EOS described numerically (user input into LS-DYNA)

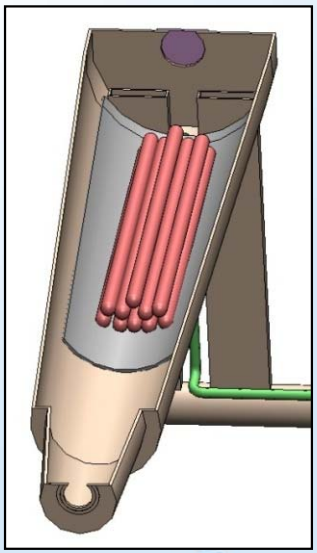
Incorporate all effects (hydrodynamic, beam, solenoid field)

Quantify the ambient space for operational mode









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