

# Progress Report on SPARTAN Chamber Dynamics Simulation Code

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HAPL Meeting

April 8-10, 2003

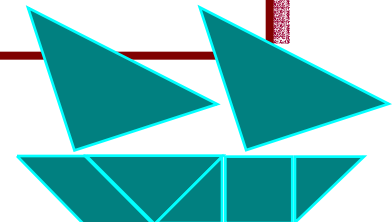
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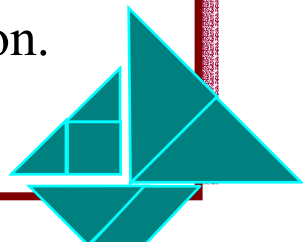
# Since the Last HAPL Meeting, Chamber Simulation Research Was Focused on Two Fronts

- SPARTAN E-meeting was held on Feb. 25:
  - ✓ To develop a high level of confidence in SPARTAN code in the IFE community;
  - ✓ To discuss plans for code physics upgrades.
  
- Publication of SPARTAN code development in J. of Computational Physics:
  - ✓ To further enhance confidence in SPARTAN code.
  - ✓ To underline that HAPL-funded programs are high-quality research and contribute significantly to general science and engineering.
  - ⇒ Required further work on embedded boundary algorithm and Dirichlet boundary conditions.



# Progress in Refining Numerical Algorithms Has Continued

- We modified the embedded boundary algorithm from fully conservative to globally conservative (current state-of-the-art in the field) by re-distribution of errors into neighboring cells.
- We implemented the solution to Riemann problem along the normal to the wall in order to estimate the pressure at the wall (as opposed to extrapolation from the surrounding fluid cells).
- We developed a second order estimation of the energy flux at the wall (Dirichlet boundary condition).
- We implemented Sutherland law for estimation of viscosity and thermal conductivity.
- We obtained ionization levels of Xenon gas from Don Haynes to account for background plasma thermal conductivity, viscosity, and radiation.
- Defined a set of test cases for publication.



# SPARTAN E-Meeting Was Successful

- Participants suggested “0<sup>th</sup> order” tests: “Null test” and “Small Perturbation Test” to demonstrate gross stability:
    - ✓ Both tests were ran and were successful.
    - ✓ Detailed analysis of “Small Perturbation Test” showed that the projections of the normal flux to the wall in x and y directions were not calculated accurately and were fixed.
  - Participants discussed and endorsed our research plan for the coming year.
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- Convergence Analysis of test cases for J. of Computational Physics paper identified problems with the embedded boundary algorithm.
    - ✓ In collaborations with Mark Day of LBL, we are implementing some of the latest techniques to resolve this problem.
    - ✓ We have made good progress and estimate closure this month.

# SPARTAN Research Plan for the Coming Year

- Incorporate cylindrical symmetry.
- Implement and test contributions of viscosity, thermal conductivity, and radiation from background plasma.
- Implement multi-species capability.
- Implement of Equation of State.
- Parametric investigation of chamber dynamics with different gas, gas pressure, target yield, chamber size, beam ports, *etc.*.
- At SPARTAN E-Meeting, we discussed implementation of SPARTAN on parallel processors. We agreed to shelf this unless SPARTAN run times become substantially long.

