

Center for Tokamak Transient Simulations

Computational and Applied Math Issues

M.S. Shephard – Intro and meshes

Sherry Li – Solvers

Sam Williams – Performance

Proposed Efforts

Original proposal had a full set of applied math and CS activities

■ Solver developments

- Scaling of triangular solves
- Leveraging Trilinos solvers
- Structure level preconditioning

■ Finite element discretization improvements

■ Mesh related operations

- Mesh adaptation and solution transfer and execution on new machines
- Multiscale coupling – emphasis on coupling with FronTier
- Parallel mesh based PIC operations

■ Performance optimization

■ Uncertainty quantification (UQ)

■ Data management and fault tolerance

■ Software engineering

The Trilinos based efforts and UQ dropped entirely

Other areas cut quite a bit

One Cut at Efforts to be Carried Out

- Solver developments – important to advance the whole solve
 - Scaling of triangular solves
 - Structure level preconditioning
 - Work with STRUMPACK group to develop a robust solver algorithm
- Finite element discretization improvements – likely limited to looking for opportunities based on advances we see elsewhere
- Mesh related operations
 - Mesh adaptation and solution transfer and execution on new machines
 - Multiscale coupling – emphasis on coupling with FronTier
 - Parallel mesh based PIC – take advantage of efforts supported by other fusion SciDACs
- Performance optimization – hope to take advantage of the expertise through out all parts of the codes
- Data management and fault tolerance – take advantage of WDM center efforts for data management. Expect little to no effort on fault tolerance.
- Software engineering

Agenda for Today

- Solver Efforts – Sherry Li
- Performance Optimization – Sam Williams
- Parallel Mesh including status of a parallel mesh PIC development (will not cover all the slides) – Mark Shephard
- Fusion domain meshing tool (will not cover all the slides) – Mark Shephard
- Discussion