SAND2020-0298R

SANDIA NATIONAL LABORATORIES

SNL ADTM

FY20Q1 report for ATDM AD projects to ECP

December 2019

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Prepared for:

ECP Confluence updates

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Performance to Plan:

- SPARC: The SPARC and SPARC V&V teams successfully presented their work at the Dec 11-12 L1 milestone mid-year review. The teams received overwhelmingly positive feedback at the review.
- EM Survivability:
    - EMPIRE:
        - Presented the EMPIRE application space, background, milestone assessment metrics, and current status of the target SGEMP and Hybrid simulations at the L1 milestone mid-year review. The review feedback was very positive, with the panel both appreciating the challenge of the physics problem and being satisfied with our progress to date. They believe we are on track for successful milestone completion.
        - Initial runs of the SGEMP Generic Cavity were completed in both EMPIRE and EMPHASIS for the mid-year review. These were vacuum, not gas-filled, but are a first data point in the code-to-code comparison for the milestone on the target problem.
        - Substantial progress was also made in hybrid simulations of the RKA experiment. Comparisons with PIC-only results showed nearly identical quantities of interest and a performance advantage for Hybrid when particle counts start increasing exponentially in PIC. This neutral-fluid hybrid case is the low-bar milestone capability; work on charged-fluid hybrid for the high-bar SREMP demonstration is under way.
        - Initial scaling studies were performed on Sierra and Astra using both the FY18 surrogate problem and the FY19 B-dot. Highlights include that EMPIRE is close to the required node counts for the milestone (ahead of the other labs' projects), and B-dot scaling on Astra is near-optimal up to 2048 nodes. However, scaling on Sierra with both the surrogate cavity problem and the B-dot performance test shows concerns with the linear solver, particularly for the B-dot, that will need to be addressed.
- Components
    - Percept has been integrated into Trilinos and EMPIRE and is protected with unit tests. The capability is being used by EMPIRE for L1 milestone calculations
    - There has been much activity to support Trilinos components for the L1 Milestone in EMPIRE, including multiple refactoring efforts to remove deprecated code, adjust to code updates, and to work on memory management.
    - Work has continued on the lightweight unstructured mesh refinement capability (UMR lite). Performance using the array-based data structures continues to be very impressive, producing approximately 35 million refined tets per second. The algorithm takes advantage of a task-based approach and multi-threading to achieve this performance.
    - Two key capabilities have been added to SGM over the last quarter. (1) Feature recognition for a number of common CAD geometry features has been added, such as holes, blends, chamfers, pockets, locally thin regions, and others. (2) Boolean algorithms (unite, subtract, intersect, and imprint) have been implemented in SGM to support model creation and editing. (Joint with ASC/IC.)

Exceeds:

- SPARC: The SPARC team was praised by the L1 milestone panel for embedding V&V in their code development process; achieving significant, growing, and early mission impact; leveraging

existing relevant flight test data; demonstrating scalable performance portability on all three target HPC platforms, and addressing milestone completion criteria through a user/developer survey.