Energy Frontier Tracking Detector Mechanics R&D at Argonne National Laboratory

As the energy frontier moves towards more extreme collision conditions – higher energies and luminosities – there is a strong need for the development of light-weight detector support structures. The Snowmass Instrumentation Frontier report mentioned the following as two of the critical near-term priorities for solid-state tracking:

• "IF03-2: Adapt new materials and fabrication/integration techniques for particle tracking in harsh environments, including sensors, support structures and cooling"
• "IF03-3: Realize scalable, irreducible-mass trackers in extreme conditions"[1].

One potential path toward this goal is to optimize mass by integrating services and cooling into support structures [2]. This could also help mitigate a problem that "complex stresses in composite structures consisting of multiple parts are a consequence of different manufacturing techniques utilized"[3]. This is a perfect fit for the expertise at Argonne National Lab – both cooling for ATLAS inner tracker local supports and additive manufacturing facilities. Regarding the latter, the ANL Materials Manufacturing Innovation Center (MMIC) has advanced metal, composite, and polymer additive manufacturing facilities, as well as AI-driven methods for improving additive manufacturing. We propose to bridge the two in order to advance the goal of light-weight detectors for future colliders.


Early Career
Yes

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