Test-Beam Support

Goals:

- **Integration of Test Setups**: Integrate test setups with ePIC Software and, at a later stage, with ePIC Computing.
- **Understanding DSC Plans and Needs**:
  - **Particularly** regarding the use of the ePIC Software and their test-beam support requirements.
  - **Collaboration**: Initially work with DSCs who have reached out and continue to encourage collaboration among all DSCs on integrating simulations and test-beam data analyses.
  - **Future Survey**: Once we have a deeper understanding of test-beam support requirements, conduct a comprehensive survey of all DSCs.

Discussion:

- **Importance of Simulations**: Detector simulations are crucial for preparing for test beams and understanding the test-beam data.
- **Improving Simulations through Test Data**: Use test-beam setups and measurements to enhance and validate our detector simulations.
- **Integration Strategies**: Develop strategies to integrate test beam geometries with ePIC reference design geometries, aiming to minimize redundant simulation and validation efforts.
- **Ease of Use:** Discuss how we can simplify the process for DSCs to use integrated simulations for their detector prototypes, making it more accessible and efficient.

Example for Test-Beam Support Beyond Simulations

Example from MPGD DSC: *"Our test beam data provides us with the hit point resolution for a particle traversing the detector volume as a function of its angle with respect to the readout plane. Given the track angle we know the reconstructed hit resolution, which effectively eliminates the need for digitization. How/where should we implement the test beam data into simulation?"*

Discussion:

- In this example, the test-beam data replaces the simulation of the detector and its digitization:
- **Discussion Points Linked to Reconstruction**:
  - How can we efficiently and effectively translate the test-beam data to PODIO?
  - How can adjustments to EICrecon be made efficiently and effectively?
    - In the example from MPDG DSC, we require tracking solely in the MPGDs.
- **Discussion Points Linked Back to Simulation**:
  - Test-beam geometry must be implemented in DD4hep, as it is required for the reconstruction process.
  - Back to the question to integration of test beam geometries with ePIC reference design geometries.

Outlook: Milestones During Detector Construction Phase

- **Ongoing planning with Electronics and DAQ WG to align on shared priorities**:

  - **Provisioning DAQ and software sufficient for test beams, which can serve as small scale real-world testbeds for the developing DAQ and software.**

  - Streaming challenges exercising the streaming workflows from DAQ through offline reconstruction, and the Echelon 0 and Echelon 1 computing and connectivity.

- Data challenges exercising scaling and capability tests as distributed ePIC computing resources at substantial scale reach the floor, including exercising the functional roles of Echelon 1 and 2, particularly Echelon 2, the globally distributed resources essential to meeting ePIC's computing requirements.

- Analysis challenges exercising autonomous alignment and calibrations.

- Analysis challenges exercising end-to-end workflows from (simulated) raw data to exercising the analysis model.

> **Supporting test-beam measurements will be our major activity during construction phase.**
>
> **With the first DSCs now reaching out, it is the ideal time to ramp up these activities.**