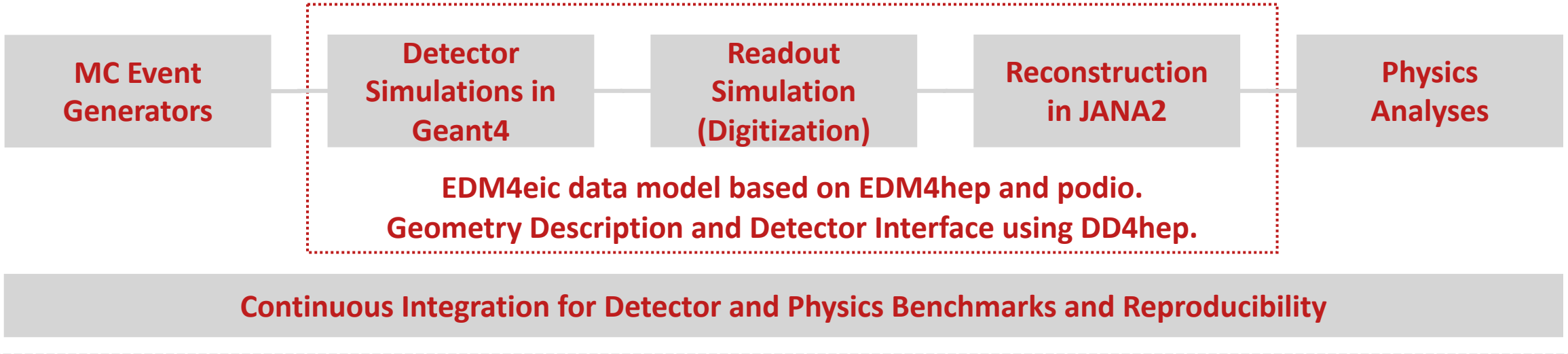
ePIC Software for the Realization of the ePIC Experiment

Our software design is based on **lessons learned in the worldwide NP and HEP community** and a **decision-making process** involving the whole community. We will continue to work with the worldwide NP and HEP community.

Modular Simulation, Reconstruction, and Analysis Toolkit using tools from the NP-HEP community



We are providing a production-ready software stack throughout the development:

- **Milestone**: Software enabled first large-scale simulation campaign for ePIC.

We have a good foundation to meet the near-term and long-term software needs for ePIC.

Simulations for the ePIC Detector Design

Strategy for simulation productions for detector and physics studies:

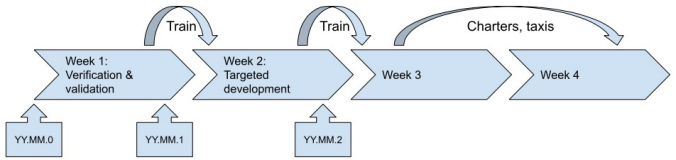
What does this mean for the DSCs?

Validation of simulations:

Input from the DSCs

Simulation Production Strategy

Link to Simulation Production Strategy Document (anyone can comment)



- **On the first Monday of the month** (Tuesday if US federal holiday):
  - A new geometry release is tagged with version `YY.MM.0` (release branch `YY.MM`).
  - A new reconstruction release is tagged with a semver `MM.mm.pp`.
  - A new stable software environment is tagged with version `YY.MM.0` (with release branch `YY.MM`).
  - The cutoff for inclusion in these release tags should be considered to be COB of the last working day before the first Monday of the month.
- **On the Wednesday of the first working week**, a segment of the weekly software and computing meeting will be dedicated to a summary of changes, identification of missed targets, and prioritization of sprint goals.
- **The first working week of the month** is used for verification and validation. No new features are allowed to be merged into production main branches during this first week.
  - By COB on the last working day of this first week (at the latest), a standard DIS NC Pythia8 data set *train* is submitted for simulation production. This production typically takes about 125k core-hours per detector configuration (2 days at 2000 cores). As the validation and verification process becomes more detailed, it is expected to encompass other physics processes as well.
- **On the Wednesday of the second working week**, a segment of the weekly software and computing meeting will be dedicated to an overview of the verification and validation, and of the first *train* data sets.
- **The second working week of the month** is used for a development sprint towards specific goals identified during the first week (essentially, what didn't get done yet).
  - On the last working day of this second week, a new geometry and reconstruction release is tagged (see above), and a new stable software environment.
  - By COB on the last working day of this second week (at the latest), a standard DIS NC Pythia8 data set *train* is submitted for simulation production. This production typically takes about 125k core-hours per detector configuration (2 days at 2000 cores).
- In the **third and fourth weeks of the month**, there will be no major changes to the geometry and reconstruction (those should be deferred to the next month). This period of stability is intended for ***charter*** **and** ***taxi*** simulation production.

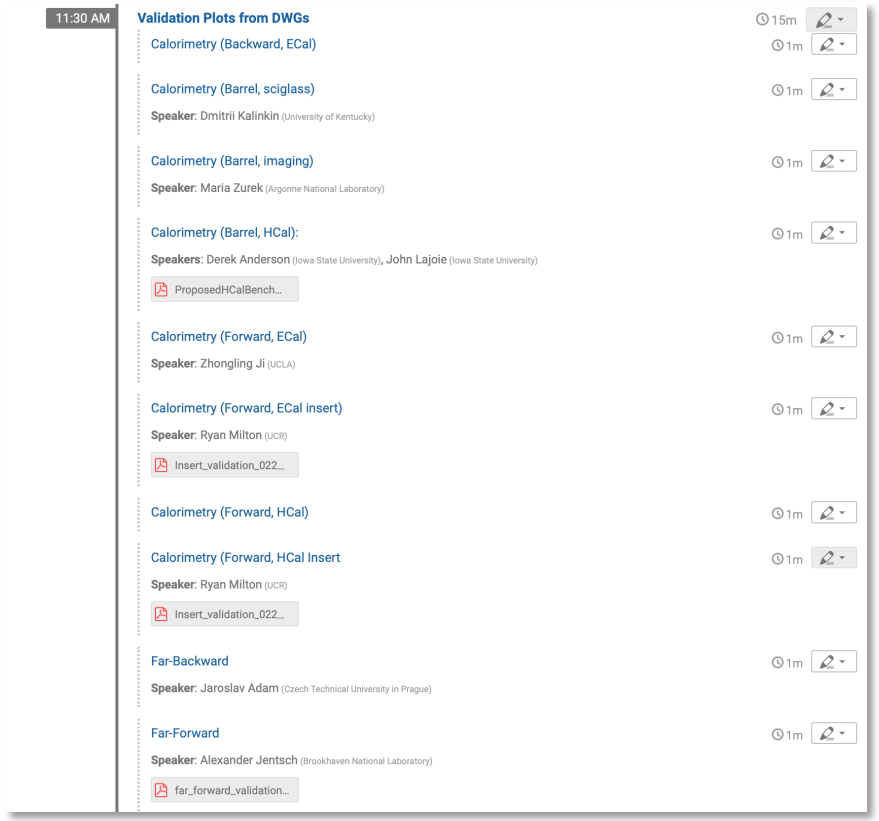
Two Important Deadlines:

1. **End of the month**: Provide any updates to the detector information (geometry, services, readout electronics, noise models, …)

2. **Begin of third week of a month**: Provide requests for charter productions via TC. We can use the TIC meeting of that week to finalize the list.

Detector Validation

ePIC Software & Computing Meeting on February 22: Detector Validation Plots



11:30 AM **Validation Plots from DWGs** 15m

- Calorimetry (Backward, ECal) 1m
- Calorimetry (Barrel, sciglass) 1m
  - **Speaker**: Dmitrii Kalinkin (University of Kentucky)
- Calorimetry (Barrel, imaging) 1m
  - **Speaker**: Maria Zurek (Argonne National Laboratory)
- Calorimetry (Barrel, HCal): 1m
  - **Speakers**: Derek Anderson (Iowa State University), John Lajoie (Iowa State University)
  - ProposedHCalBench...
- Calorimetry (Forward, ECal) 1m
  - **Speaker**: Zhongling Ji (UCLA)
- Calorimetry (Forward, ECal insert) 1m
  - **Speaker**: Ryan Milton (UCR)
  - Insert_validation_022...
- Calorimetry (Forward, HCal) 1m
- Calorimetry (Forward, HCal Insert 1m
  - **Speaker**: Ryan Milton (UCR)
  - Insert_validation_022...
- Far-Backward 1m
  - **Speaker**: Jaroslav Adam (Czech Technical University in Prague)
- Far-Forward 1m
  - **Speaker**: Alexander Jentsch (Brookhaven National Laboratory)
  - far_forward_validation...

Input from DSC:

1. **Define validation plots for your detector system**: The plots should allow to assess the performance of the detector system and allow (at a later moment) to compare to a baseline.
2. **Define liaison to the Software & Computing effort**

Updates

1

Draft: Software Progress

Increasing the level of detail and correctness of the ePIC detector geometry description

- Full changelog: https://github.com/eic/epic/compare/22.12.0...main
- Automatic population of website with detector views, https://eic.github.io/epic/
- Implemented asymmetric tracking region where secondaries are stored
- Implementation of cladding in fibers of barrel imaging ECAL
- Improved modeling of fiber placement in barrel imaging ECAL
- Improved detail in barrel sciglass ECAL families
- Addition of the lumi direct photon calorimeter in the far backward system
- Enable import of components through gdml (used for review of pfRICH)
- Reduce the forward ECAL insert block sizes from 2 x 2 cm to 1 x 1 cm
- Improved modeling of the backward ECAL at high eta, near the beampipe
- Improved ability to run with different far forward and far backward beam energy settings

Improve simulations of the ePIC detector

- Ability to embedded background from synchrotron radiation and beam gas in detector simulations.

Improve user experience with eic-shell environment containers

- Implement running at native speeds for users on Mac M1/M2 systems
- Traced back source of spurious geant4 volume overlaps to vecgeom library

Increase the ability of EICrecon reconstruction based on first campaign input

- Full changelog: https://github.com/eic/EICrecon/compare/v0.4.0...main
- PODIO integration in JANA2: Support of the direct read and write of PODIO collections. Even when vector-of-pointers style references are used, PODIO objects are always registered to a collection and that collection is registered to a frame. JANA understands and abides by PODIO's memory ownership semantics, including supporting subset collections.
- PODIO associations in EICrecon due to PODIO integration in JANA2. This in turn allows for matching clusters with tracks (and finding unmatched clusters).
- Faster build times.
- Calorimeter clustering implemented.
- Flexible methods for cluster finding based on adjacency matrices are now used in various calorimeters.
- Barrel ecal fiber z-position clustering based on timing resolution from GlueX.
- Jet finder implemented (documentation)

Software Progress:

We will share asap an email summarizing our progress since the last simulation campaign. You find the draft document linked to Indico.

For Further Updates:

Join the:

Weekly ePIC Software & Computing Meetings

Wednesdays at

11:00 a.m. (EDT) / 5:00 p.m. (CEST) / 8:30 p.m. (IST)

https://indico.bnl.gov/category/435/