Offline Data Reconstruction: Outstanding Issues

Norman Graf (SLAC)

HPS Analysis Workshop

October 18, 2022

Offline Data Reconstruction

- Much has been done to prepare the offline reconstruction software to reconstruct the 2019 and 2021 data sets
- Quite a bit remains to be done
- My incomplete and personal list of outstanding issues

SVT Hit Finding

- Need to identify dead & hot channels, populate the offline database, and modify code to correctly handle such cases
- Could benefit from a review of the SVT hit-finding process
  - APV25 waveform fitting (time and amplitude extraction)
  - Strip clustering
  - Hit position calculation
    - Known systematic errors in MC. Do they also affect the data?
  - See Rory's talk earlier this morning.
- Some evidence of loss of signal towards the end of the 2021 data
  - If true, need to quantify on run-by-run basis

Alignment, Alignment, Alignment

- We continue to work on the alignment and calibration of the SVT.
- Using E/p and beamspot constraints to align and calibrate modules and sensors in the top and bottom halves of the SVT.
- Need to analyze all special runs to fully understand weak modes
  - SVT top/bottom wire targets
  - Field-off runs
- This will provide “local” alignments which calibrate the momentum scale and establish the momentum resolution in each half of the SVT.
- See the presentations by PF (2019) and Cameron (2021) at the alignment mini-workshop and in their talks earlier today.

“Global” SVT Alignment

- Once each half of the SVT has been locally aligned we will need to align them “globally”
  - align top with bottom
    - ensure both halves point to a common IP
  - ensure that track-Ecal cluster matching is free of offsets
  - align with / determine “beam coordinates”
    - use θ-p relationship in Møller tracks in 2021 data
    - use internal consistency of Møller mass from unconstrained and beam-constrained fits to check/establish IP z position
    - 2019 data more difficult without Møller scatters

Ecal Calibration

- Cluster energy corrections have been derived and have been released
- Position surveys show minimal changes between runs
  - current geometry should be fine
- Time corrections for the 2019 and 2021 data need to be determined
  - Crystal-by-crystal corrections need to be derived and uploaded to the offline database

Track Finding Efficiencies

- Using calorimeter-only selection criteria, can select relatively pure samples of FEEs, WABs and tridents
- These samples can be used to determine track-finding efficiency as a function of charge, position and momentum
  - Will need to robustify the procedures
  - Will also need to determine this as a function of time during the run
- See Matt's talk from earlier this morning.

ReconstructedParticle Fitting

- Characterize track momentum and calorimeter cluster energy resolutions using FEEs, WABs and tridents and compare with MC expectations
  - See Tongtong's talk later today
- For tracks associated with calorimeter clusters:
  - include the Ecal cluster energy and position into the final track fit
  - incorporate particle ID (e/μ) into reconstruction
- Understand / improve track timing
- Revisit ReconstructedParticle quality cuts in the reconstruction software

Data Reconstruction

- Last benchmarking of reconstruction time and output data size indicated that we were within specifications
- We can always do better, so a review of the reconstruction time and output collection composition and size would be helpful
  - Need to systematically study as a function of run number throughout the 2019 and 2021 campaigns
    - Different amounts of backgrounds and noise on a run-by-run basis
- “Faster and smaller” is the goal

Reconstruction

- A number of issues remain before we can fully process the 2019 and 2021 data
- Outstanding issues run the full gamut of detector readout, to calibration, to reconstruction software, to data processing

This is your data!

Get Involved!