Software for KLF

Sean Dobbs
Florida State U.

KLF Collaboration Meeting
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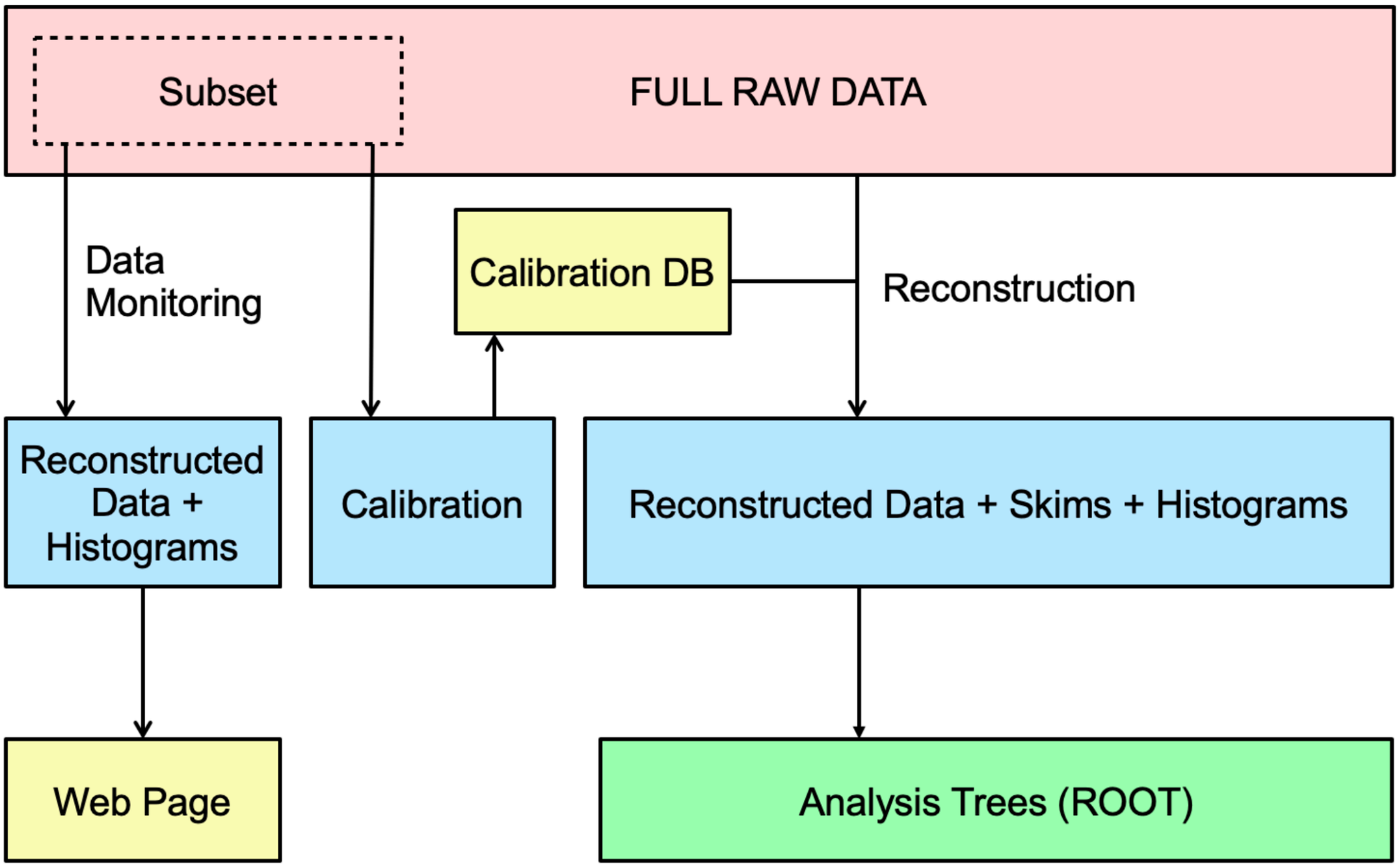
Hall D Software

- Existing software used by GlueX to regularly process and analyze PBs of raw data through amplitude analysis



h/t A. Austregesilo

What does KLF Need?

- Current GlueX reconstruction and calibration procedures rely on two pieces of information that KLF does not have
  - Precision timing information on incoming beam
    - Important for ToF PID and calibrations
  - Precise knowledge of beam energy
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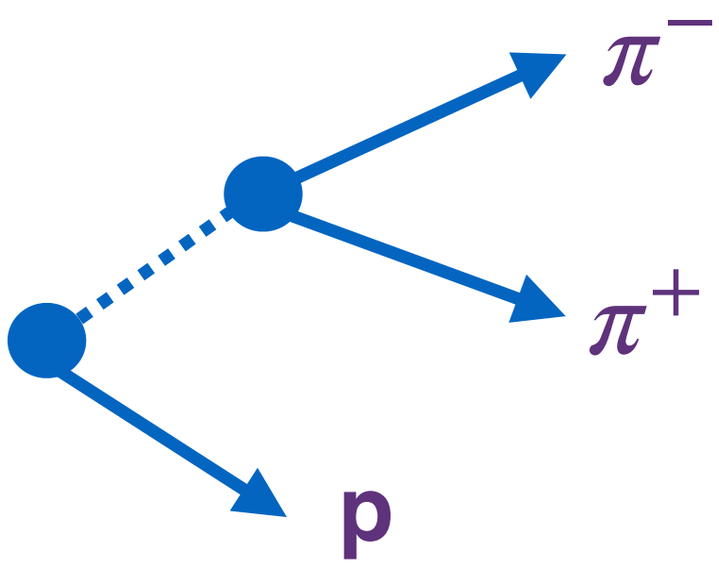
    - Important input to kinematic fit of fully reconstructed reactions
- Updates to calibration and monitoring procedures required
- Updates to simulation pipeline needed
- New amplitude fitting developments required

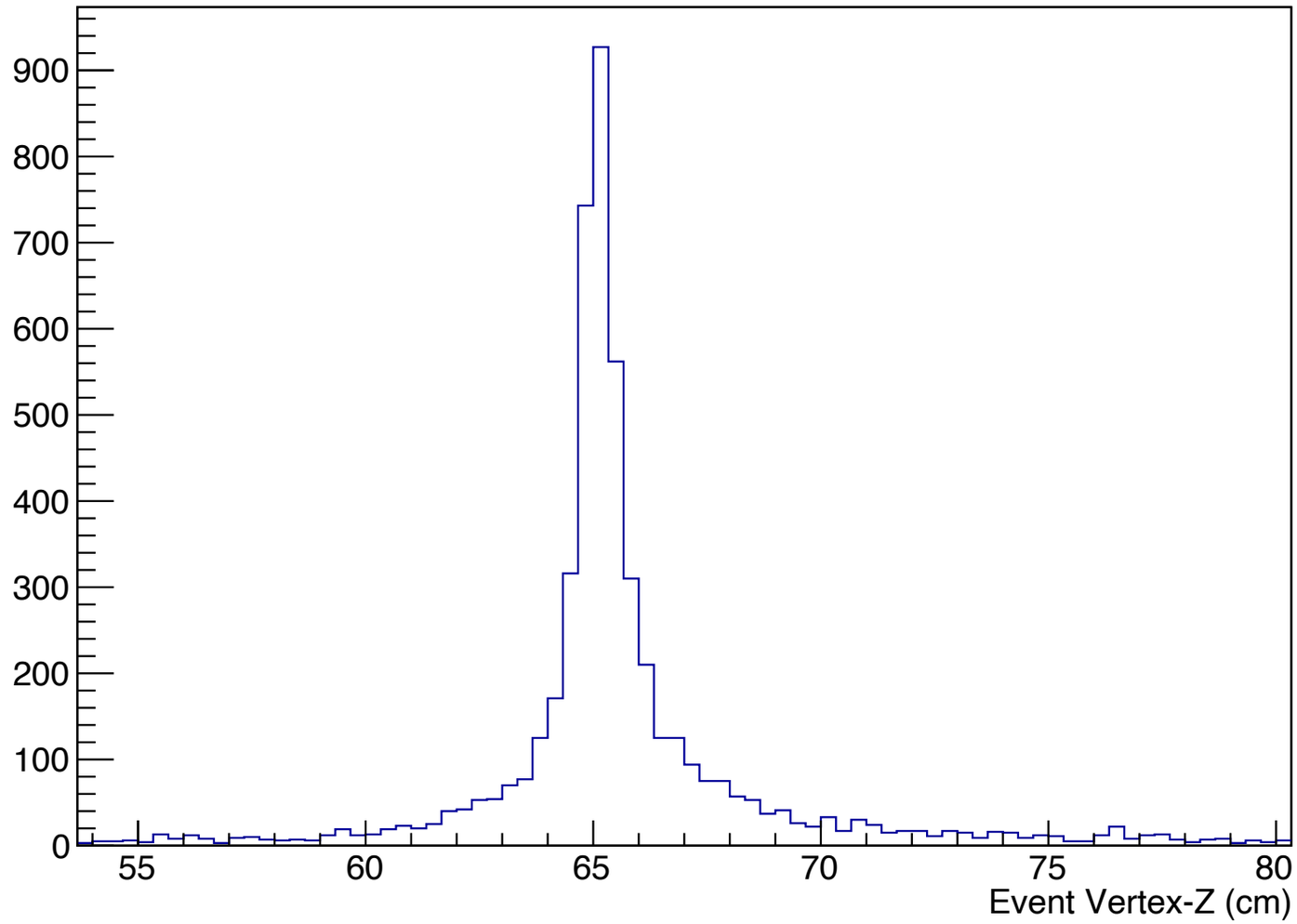
KLF Software Instructions

- Initial instructions on how to run reconstruction & simulation codes on wiki
  - https://wiki.jlab.org/klproject/index.php/2023_KLF_Simulations
- Several ways to access software
  - Common config script on JLab CUE
  - Containerized version (in process)
  - Build-your-own stack
- Forked version of KLGenerator_hddm_V3
  - To be integrated into halld_sim
- Instructions on how to run halld_recon for KLF configuration
- Suggestions of interesting things to look at

Example: Vertex Reconstruction

- Reconstruction of $K_L p \to K_S p$ events thrown with $p(K_L) = 1 - 4$ GeV at the center of the cryo target (z=65 cm)
  - Avg. event vertex — full reaction reconstruction uses displaced K_S vertex
  - Systematic study of multiplicity and displaced vertex dependence required

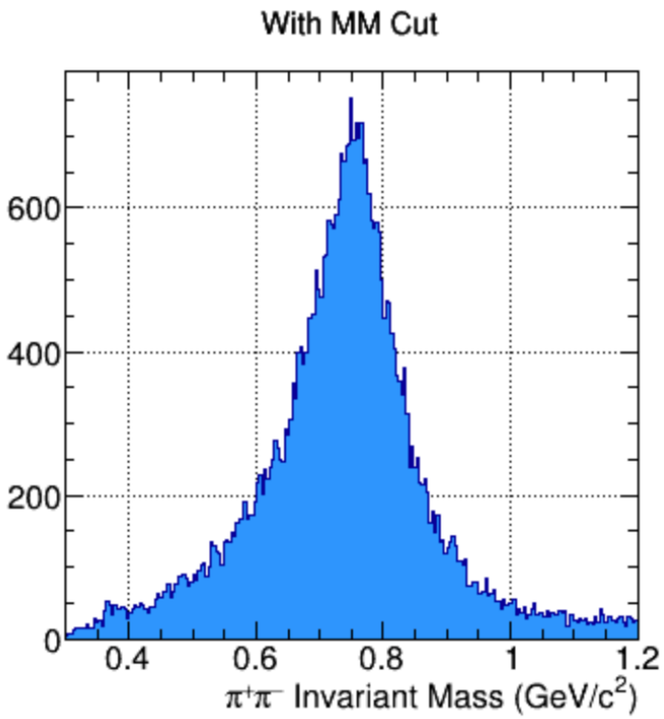


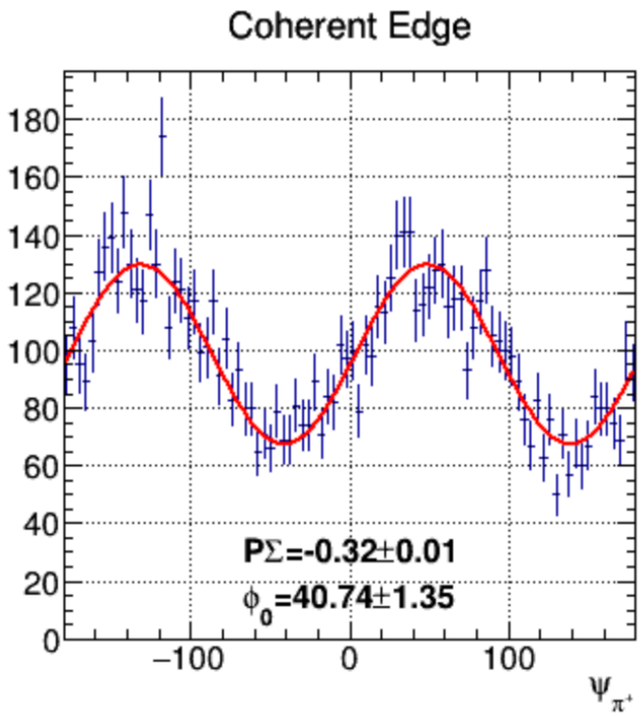


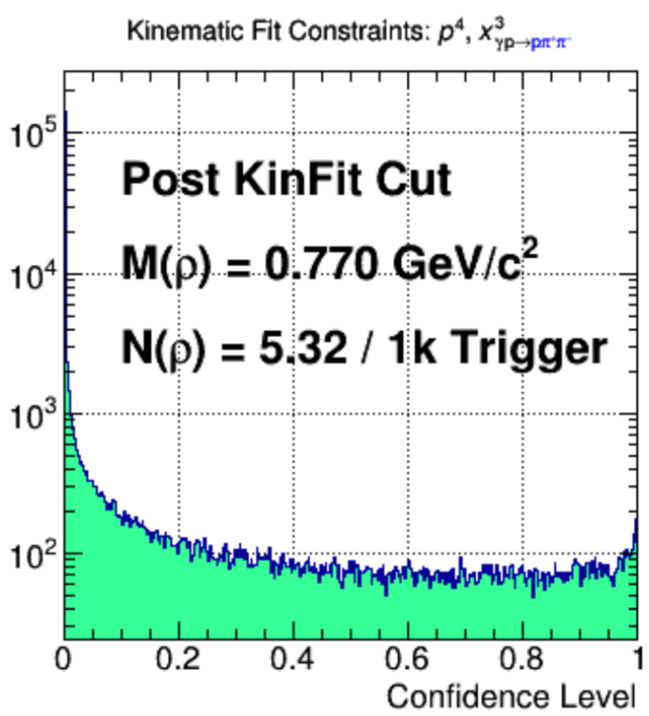
Calibration & Monitoring

- Many calibration processes require good knowledge of event timing and vertex position
  - Otherwise, GlueX is well-understood and stable detector
- KLF beam intensity several orders of magnitude lower than photon beam
  - Possibility for prompt physics analysis?
- Need to determine list of physics reactions for online monitoring

GlueX Example: $\gamma p \to \pi^+\pi^- p$ prompt monitoring







KLF Simulations

- Current hdgeant4 software should work well with K_L induced reactions
  - Some photon beam assumptions could still be hidden
  - Plan to meet in coming weeks to develop task list
- Other beam line simulations will be needed
  - Simulation of full beam line in Geant4
  - Simulation / inclusion of beam backgrounds
  - Plan to develop strategy, additional effort needed

Summary

- KLF software builds on software infrastructure successfully used for GlueX
  - KLong beam is exciting but presents several challenges
- Implementation of KLF-specific features is ongoing, but requires several efforts
  - Studies of beam/vertex reconstruction and ToF
  - Updating calibration procedures
  - Studies of beamline and beam backgrounds
  - Key point — study reconstruction of interesting reactions
- Many places for new contributions!