Scintillation Efficiency Corrections in Cal Software

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Terms / Definitions

- scintillation efficiency
  - dL/dE
- Qp/e
  - proton_efficiency / e-_eff
- Qi/p (aka “quenching” or “antiquenching” factor)
  - ion_eff / proton_eff (evaluated for each z)
  - Equivalent to Qi/muon
- Qi/e = Qp/e *Qi/p

Terms / Definitions (…)

- CIDAC (DAC)
  - charge injection DAC scale (more linear than ADC scale)
  - Proportional to diode signal
  - One CIDAC scale per diode in cal (2 per xtal face)
- mevPerDAC (MPD)
  - Deposited_ene / signal in CIDAC units
  - 2 MPD constants stored per Cal crystal (one for each diode size, geometric mean of both faces)
- mevPerDAC_p, mevPerDAC_e, mevPerDAC_i
  - mevPerDAC in “particle equivalent” energy units

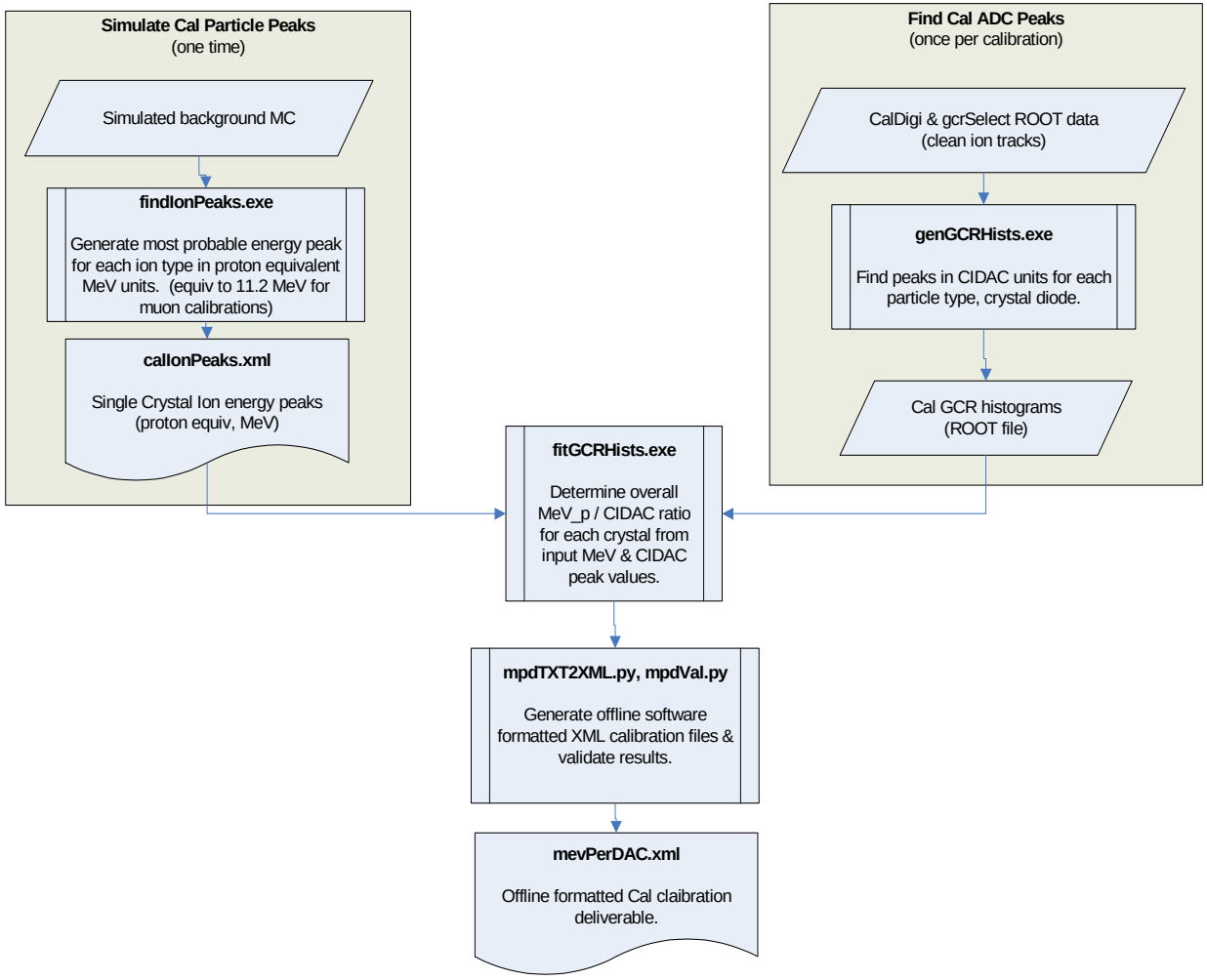
Decisions…

- Which mevPerDAC calibration to store as default?
  - Electron scale makes most sense for science analysis
  - Proton scale is effectively what we've been using so far as muon dL/dE is the same.
  - Either scale can perform all needed tasks, just an issue of conceptual clarity and displacing complexity to different processes.
- We decide to continue with mevPerDAC_p
  - a large amount of infrastructure has been built around muon calibrations.
  - Allows us to continue to use older calibrations with the same code.

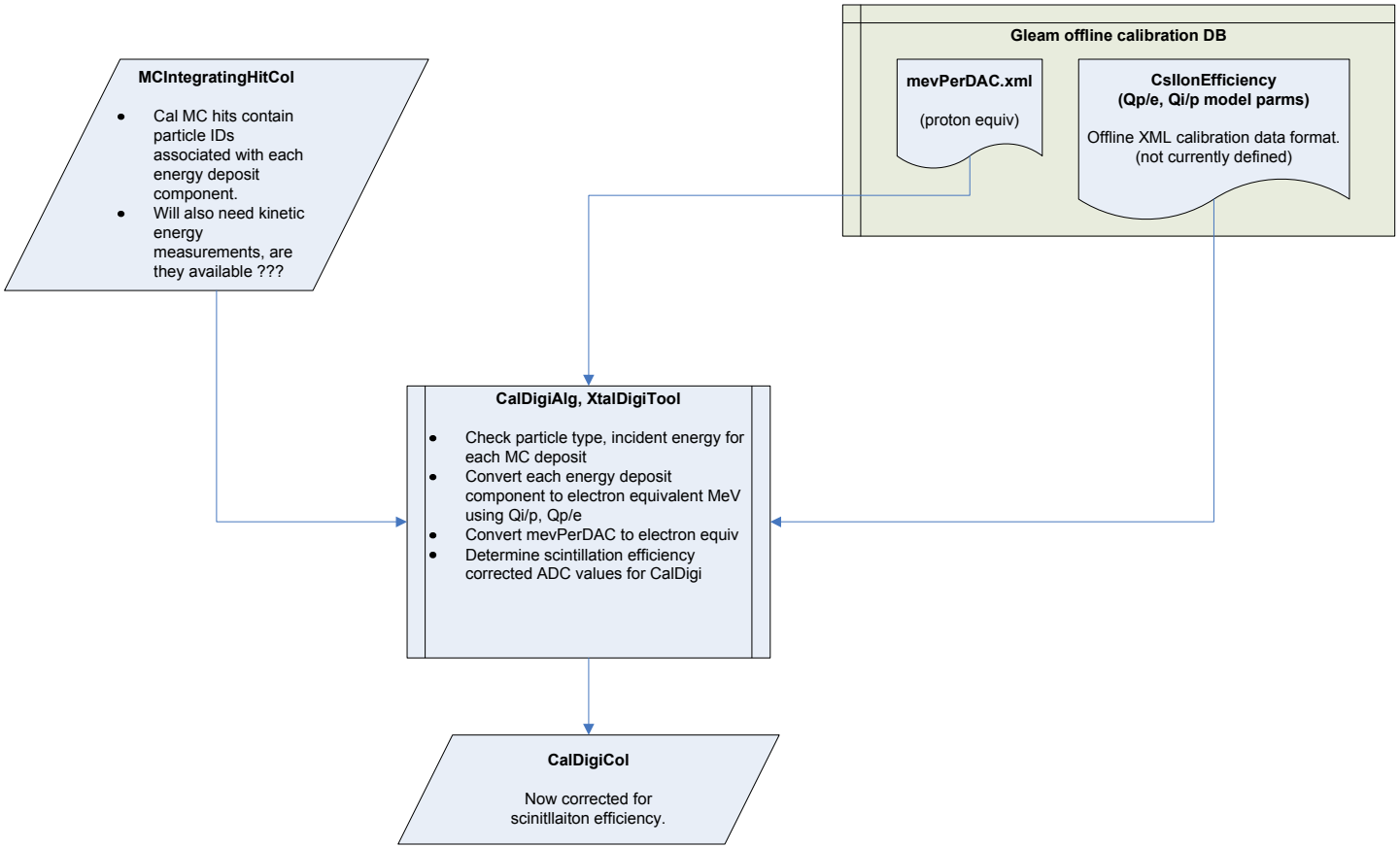
Related Software Packages

- calibGenCAL
  - Handles all generation & analysis of Cal calibrations
- CalXtalResponse
  - Handles simulation and reconstruction of individual Cal crystals
- CalDigi
  - Control logic for simulation of all Cal digital output.
- CalRecon
  - Event level reconstruction for full Cal.

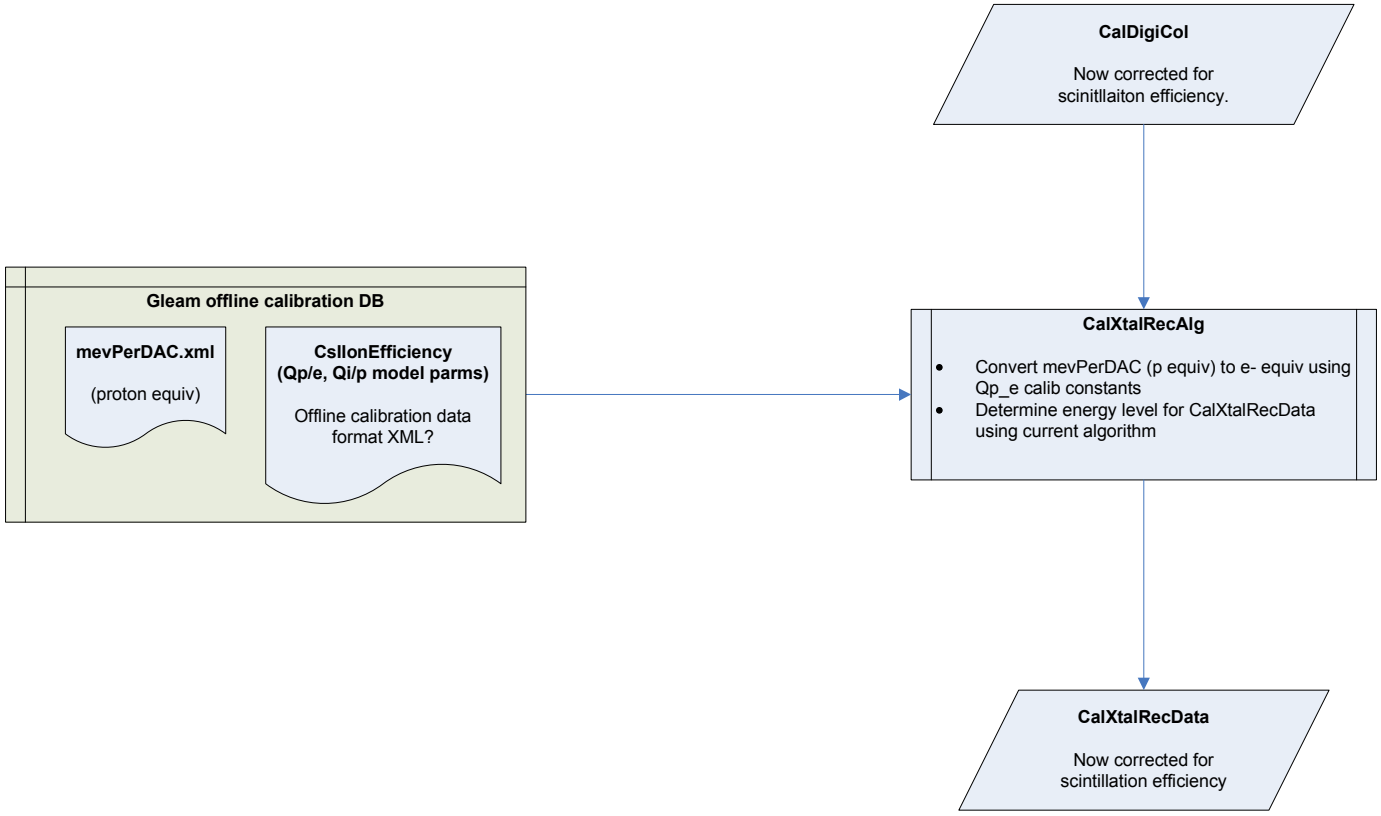
calibGenCAL Scintillation Efficiency Calibration



Cal MC/Digi Simulation Process (Gleam)



Cal Crystal Recon Process (Gleam)



CalXtalResponse

- CalCalibSvc
  - Monolithic ‘façade’ for access to all Cal Calibrations.
  - Provides mevPerDAC_p
  - Provides conversion model parameters for Qp/e, Qi/p
- XtalDigiTool
  - Responsible for simulation CalDigi output for single Cal Xtal.
  - Determine scintillation efficiency corrected ADC values
- XtalRecTool
  - Determine energy deposit level and centroid for individual crystals.
  - Only change is to convert mevPerDAC_p -> mevPerDAC_e using CalCalibSvc provided constants.

CalDigi

- Control logic flow, TDS input & output for overall Cal digitization process
- Should not need major changes for new features
  - All calculations & corrections done @ individual crystal level within XtalDigiTool

CalRecon

- No code changes anticipated
  - CalXtalRecData will be in electron equivalent MeV
  - Recon algorithms may need reoptimization to account for new calibration

Other calibrations

- Pedestals
  - Based off periodic trigger events, very little change from current software
- IntNonlin (CIDAC2ADC)
  - LCI (charge injection scripts) minor changes from current software
- Asymmetry
  - Same program (with minor mods) as currently used for muons, can use any clean ion track for calibration
- Thresholds (LAC,FLE,FHE,ULD)
  - Currently under development. Switching form LCI based data collection to calibration from particle data. Requires several new software components.

Modification Status

Component	**Package**	**Resources Required**
findIonPeaks	calibGenCAL	2 weeks
genGCRHists	calibGenCAL	Complete
fitGCRHists	calibGenCAL	1 week
CalCalibSvc	CalXtalResponse	½ week
XtalDigiTool	CalXtalResponse	1 week

Modification Status (…)

Component	**Package**	**Resources Required**
Pedestal calibration	calibGenCAL	complete
IntNonlin calibration	calibGenCAL	½ week
Asymmetry	calibGenCAL	½ week
Thresholds	calibGenCAL	1.5 weeks