Recent Changes related to GENFIT

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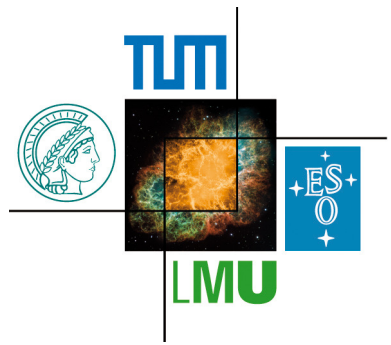

Recent Developments related to GENFIT

1. propagation of time in `RKTrackRep`
2. new `CDCRecoHit`
3. energy loss calculation improved

Propagation of Time

In order to calculate drift times, the wire chamber needs to know the passage time of the track.

- so far not computed by GENFIT: time could be evaluated but only after stepping
- modified `RKTrackRep` to keep track of time at each extrapolation step
- made accessible via `StateOnPlane`, so interfaces are ready for actually fitting the time
- very precise but still room for improvement (continuous velocity loss is handled discretely, see later)

Time is treated as *input* to the track fit, needs to be provided together with the track seed. This is not trivial, think K_S^0 or hyperon decays.

New `CDCRecoHit`

I am sure you became aware of these changes during the past few days … related to realistic simulation and handling of CDC, adds the following capabilities

- use of track propagation time (so far turned off by default)
- use of realistic x-t relation (translator provided by CDC)
- wire sag, misalignments (geometry provided by CDC)

The first two items are trivial: just use the new translator and pass the time from the track extrapolation.

- wire sag needs a three-step process to evaluating the drift circle
  1. extrapolation to nominal wire position
  2. use the found z coordinate to evaluate wire sag
  3. (short) extrapolation to corrected point of closest approach

I played with minimizing the track fit χ^2 as a function of time, behavior appeared consistent between CDC and GENFIT, also Kaons appeared with different propagation speed.

Improved Energy Loss Calculation

Mainly for low-energy tracks

In FOPI analysis it was found that extrapolating a track forward and then backward lead to systematic differences.

- energy loss was evaluated at the end of each step
- which is a systematic difference between directions

We now use a Runge-Kutta (RK4) estimation of energy loss across the step.

- Precision greatly improved (though probably not very important for us)
- same algorithm could also be applied to time if needed