CDC cellular automaton track finding.

Plans
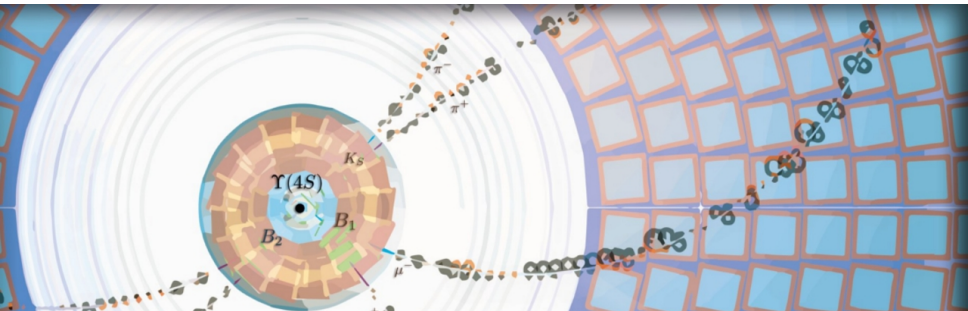
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Planes

Compose a helix class

Rational

> Fragmented efforts to have a simple extrapolation
> Sergey extrapolates cosmics to the radius of the CDC.
> I need to extrapolate cosmics to IP to compare with TrackFitResults.
> Probably similar problem as Giulia solved in her private code.

Questions

> What are the agreed perigee parameter names and ordering?
> d_0, ϕ, ω, z_0, $\cot\theta$
> κ, I, ϕ_0, $\tan\lambda$, z_0
> or even things like ρ, dz/ds

A project glossary might help as well.

Planes

Rational

Needed to prove the test beam data can be processed.

Preliminary results

https://belle2.cc.kek.jp/validation/#tracking

Additional plots?

> First / last hit position
> Measures for the detection inefficiencies?

Extend general validation

Rational

I am looking at a lot of control plots like

> distributions of residuals
> pulls
> scatter plots
> at various stages

which should to be checked regularly.

Question

> How / which do we provide those to the framework in a structured manner?
> Do you want to see plots on the validation framework showing bad performance?
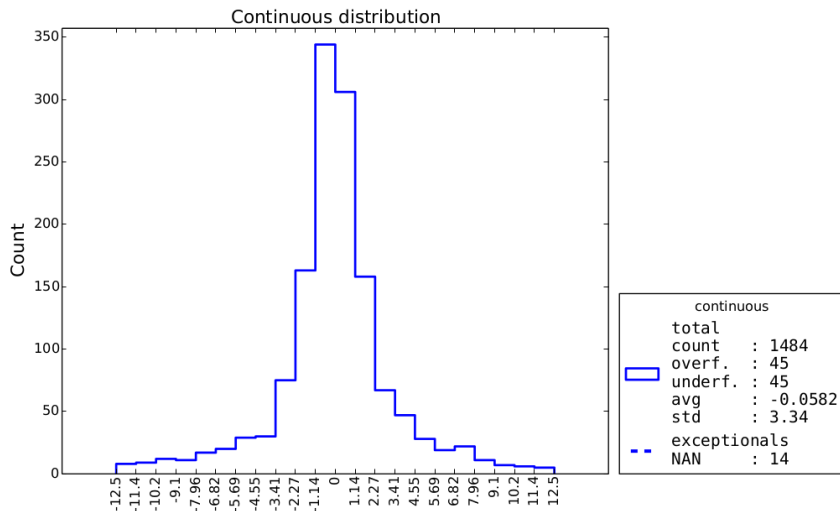
Rational

Weird behavior in the track finder such as:

> Fit pulls are worse in real segments
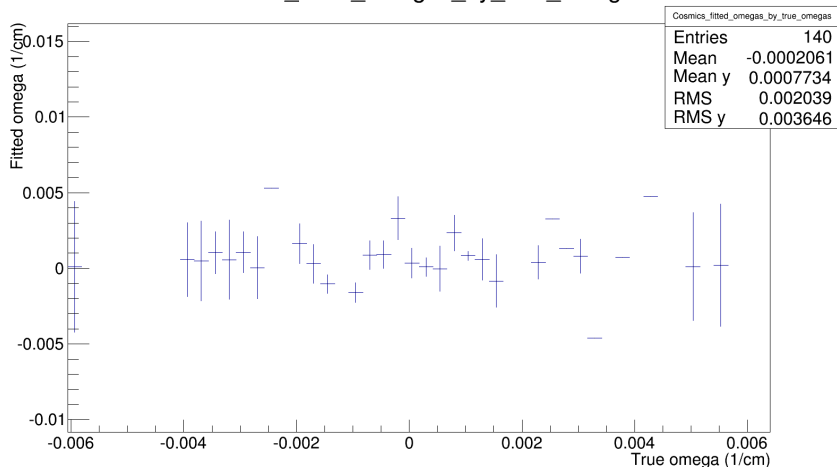> Seed values are not forwarded properly
> Probably more bugs to be found

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Distribution of curvature pull (clipped)

Planes

Distribution of curvature pull (clipped)

Planes
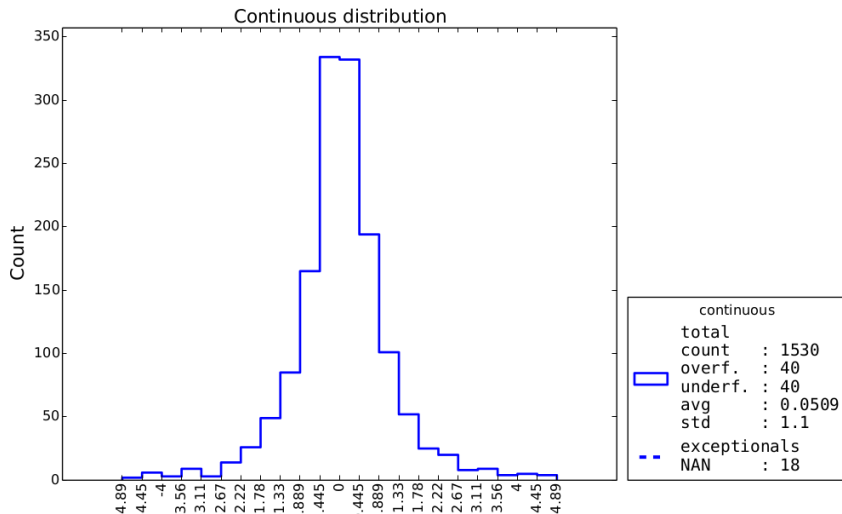
Cosmics_fitted_omegas_by_true_omegas

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Rational

> To serve as input at test time.
> As an instrument to study effects in a cleaner environment than the full simulation.

Optimize the second stage filters

Rational

> Bring the acceptance to a reasonable level using χ^2 values.
> Also investigate if different parameters are needed for
>> different event types / particle mixtures
>> different superlayers

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Rational

Segments in superlayers break easily

> if tracks cross
> in case of detection inefficiencies
> for cosmics where there are two segments in the inner superlayers (display on next page)

Planes
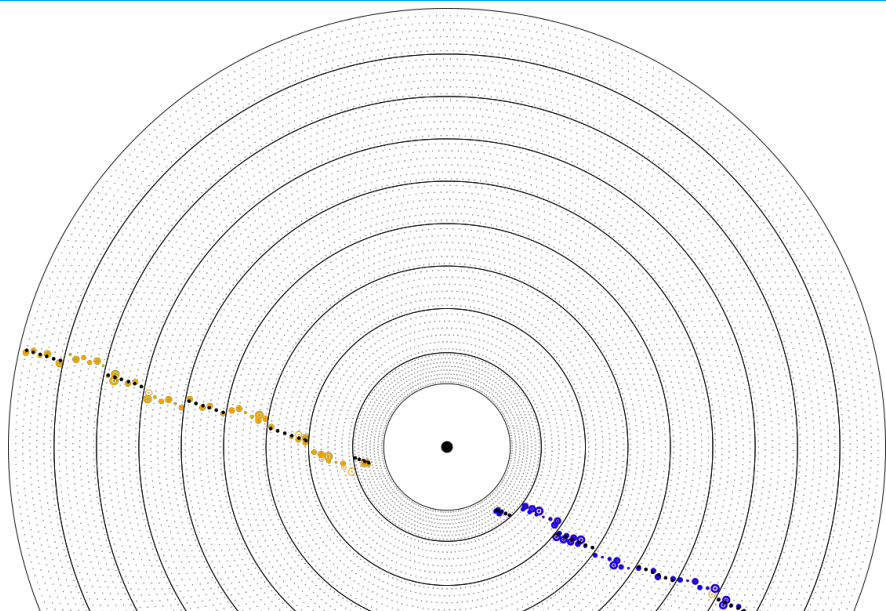
Rational

Fast execution of the track finding is a key feature.

Details

> Find bottle necks with valgrind
> Specifically improve where needed

Implement a drift time less veto in the first stage

Rational

> Many facets in the first stage are created.
> Many tangents are constructed unnecessarily for all right left passage hypothesis combinations.
> May rule out a big chunk by only considering the best ones.
> Expected reduction in facets ~50%

Details

> Vladyslav may help with this.

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Rational

> Many things are implemented twice like
>> Hit objects
>> Track objects
>> Fits
>> Trajectory representations
>> Reconstruction of the z coordinate
>> A basic event display
>> Sorting of hits in a track
>> Merging of tracklet

> Combining the efforts may lead to synergies.
>> Exchange of ideas, experiences and problems
>> Mutual review of code

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