

FilterTimeHits processor

And plans for time selection studies

Muon collider joint tracking and calorimeter meeting - 30/06/2021

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Context and goals

In the current software, the hit “digitisation” (i.e. smearing) and time window selection are performed in a single Marlin processor.

- This tends to create confusion between the readout/data flow (on-detector) and tracking (off-detector) selections that we might want to apply
- This is not flexible enough to optimise the time selections

Discussed in a dedicated meeting and summarised by Massimo in a gdoc.

It would be more convenient and more realistic to **separate the “online” hit digitization/readout step from the “offline” hit reconstruction step**.

Online

- Modify current “digitiser” to only apply a lower edge at $-3 \cdot \sqrt{(\sigma_t^2 + \sigma_{\text{beam}}^2)}$

Offline

- This talk

The FilterTimeHits processor

Implemented the standalone processor for the offline selection

- Takes in a list of collections and applies a time window [ns] on the ToF corrected measurements
- Relativistic beta is a free parameter
- Returns filtered collections

```
<processor name="FilterTime_VXDB" type="FilterTimeHits">
  <parameter name="TrackerHitInputCollections" type="StringVec" lcioInType="TrackerHitPlane">VBTrackerHits </parameter>
  <parameter name="TrackerSimHitInputCollections" type="StringVec" lcioInType="SimTrackerHit">VertexBarrelCollection </parameter>
  <parameter name="TrackerHitInputRelations" type="StringVec" lcioInType="LCRelation">VBTrackerHitsRelations </parameter>
  <parameter name="TrackerHitOutputCollections" type="StringVec" lcioInType="TrackerHitPlane">VBTrackerHits_TimeFiltered </parameter>
  <parameter name="TrackerSimHitOutputCollections" type="StringVec" lcioInType="SimTrackerHit">VertexBarrelCollection_TimeFiltered </parameter>
  <parameter name="TrackerHitOutputRelations" type="StringVec" lcioInType="LCRelation">VBTrackerHitsRelations_TimeFiltered </parameter>
  <parameter name="TargetBeta" type="float"> 1.0 </parameter>
  <parameter name="FillHistograms" type="bool" value="true" />
  <parameter name="TimeLowerLimit" type="float"> -0.09</parameter>
  <parameter name="TimeUpperLimit" type="float"> 0.15 </parameter>
  <parameter name="Verbosity" type="string"> DEBUG </parameter>
</processor>
```

Compiled and tested using the latest geometry and software:

- v02-06-MC → infnpd/mucoll-ilc-framework:1.5-centos8
- Pull request submitted [link](#)

What's next?

- I will modify the standard digitiser to apply only the low edge selection
 - Keep in branch until full study finalised
- Optimise timing selections
 - Set of representative particles: 1 GeV pions, kaons, protons
 - Do we have simulated samples available?