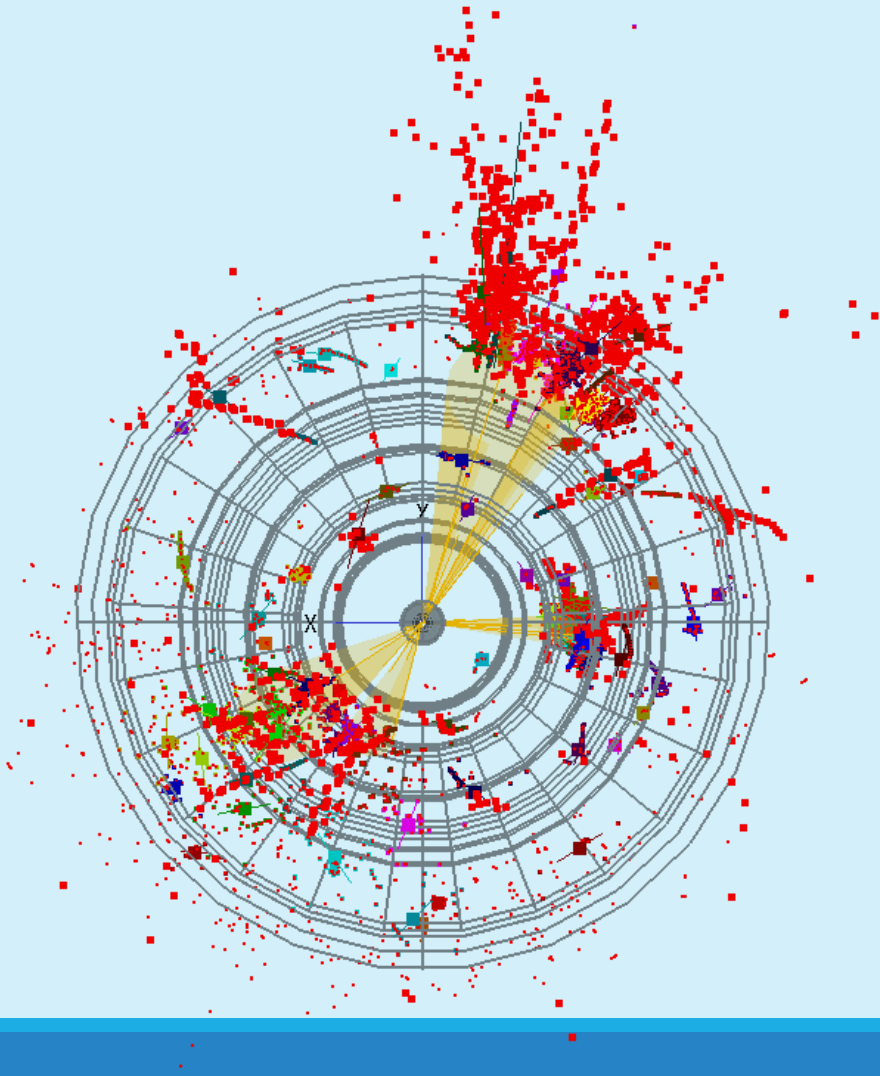
Tracking studies with muon-gun samples + BIB



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April 9, 2021

Tracking strategy

- We are checking the conformal tracking performance in six samples of 10000 prompt muons + BIB (fixed parameters: p = 1, 10, 100 GeV and $\theta = 13, 30, 89$ degrees).

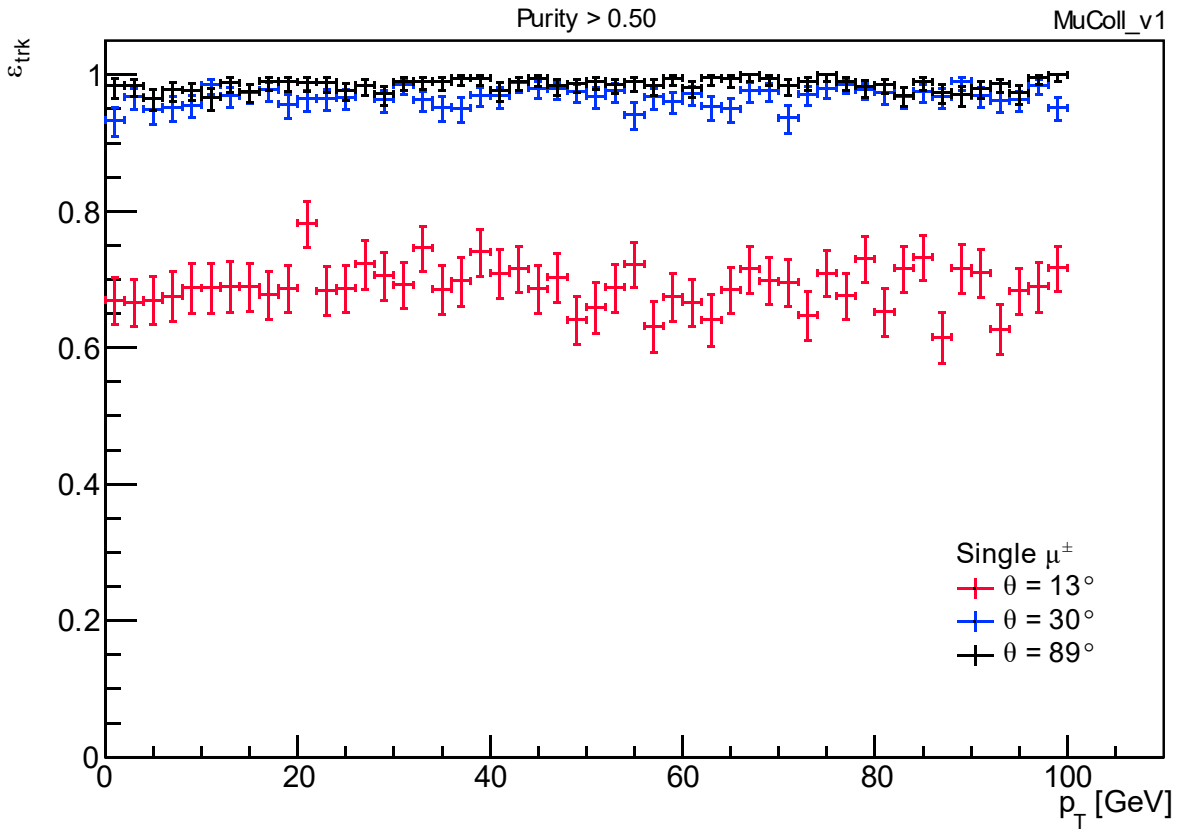
- To be able to process the high-statistics samples in a reasonable time, we applied a cone filter: we select only the tracker hits in a cone around the MC particle (opening angle R = 0.05).

- Among the tracks reconstructed inside the cone, we look for a track with at least 50% of the hits produced by the muon (purity > 50%).

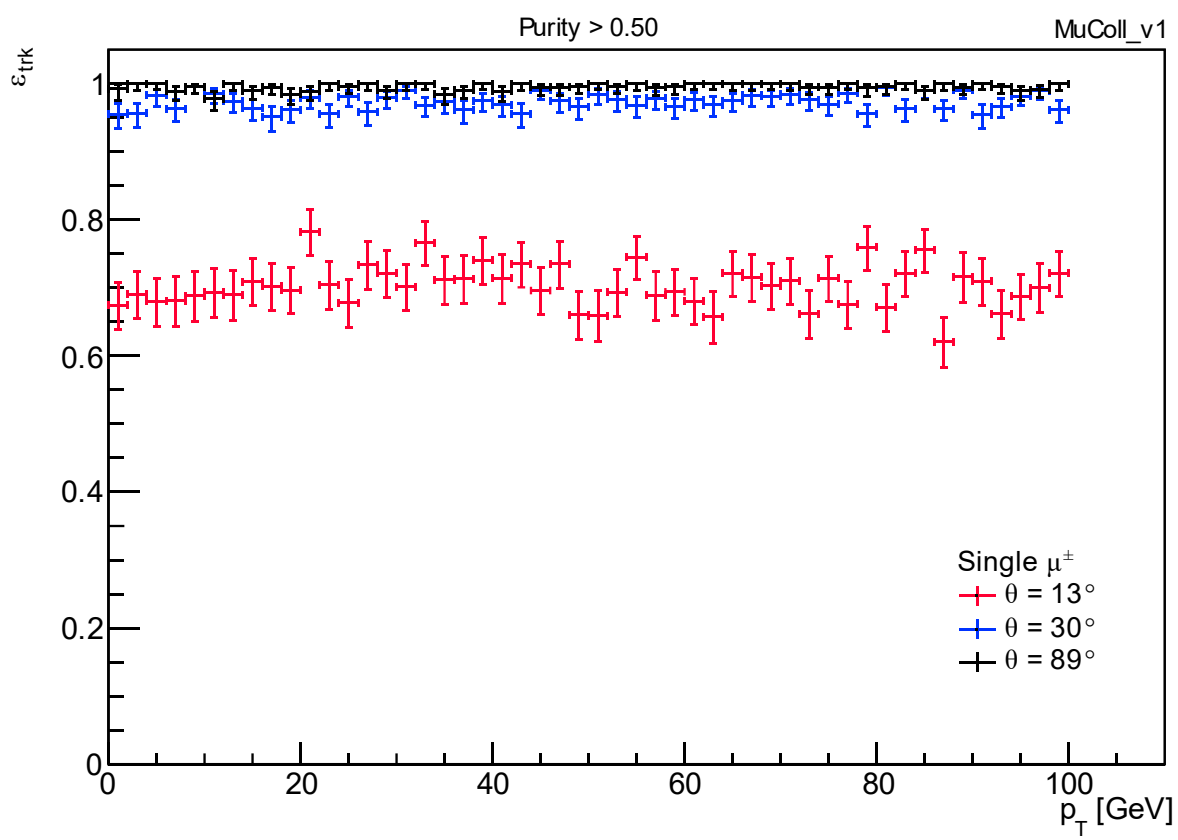
- For a direct comparison with previous results we also check the old simplified configuration, with and without the Double Layer filter.

Efficiency as a function of p_T

- Standard

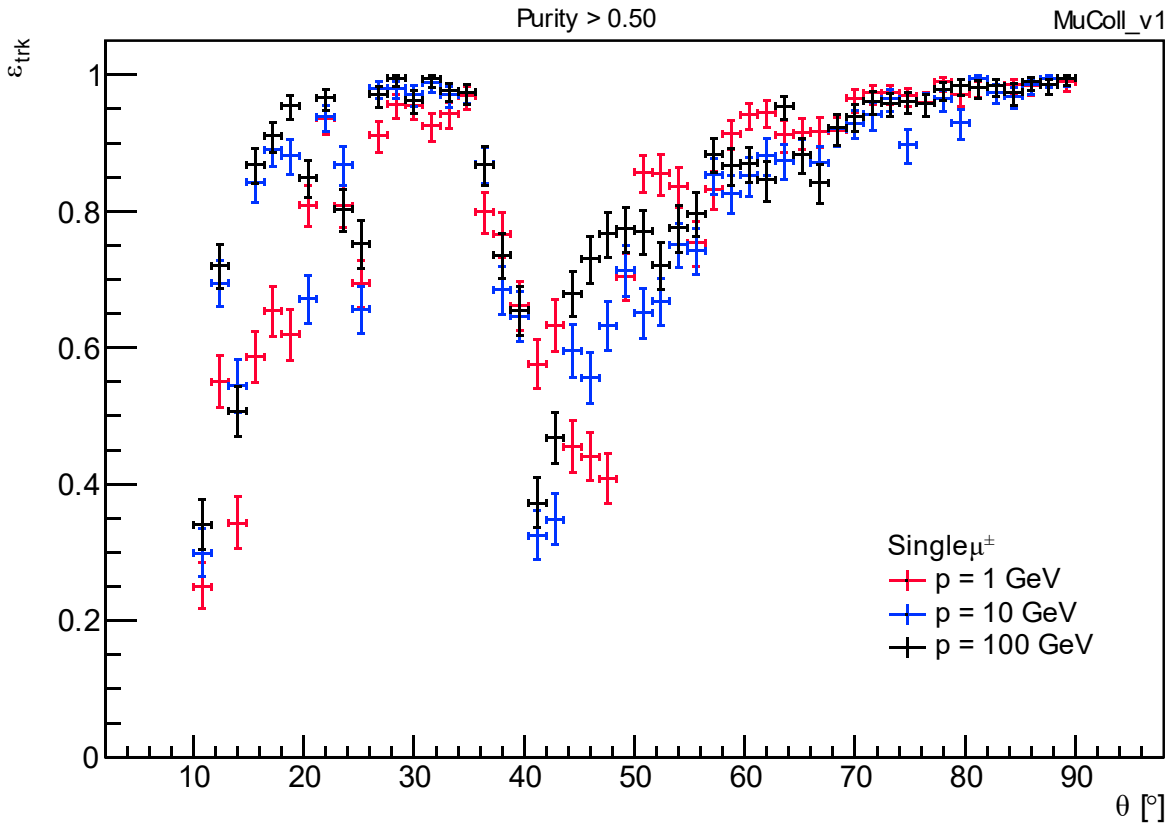


- Standard + DL filter

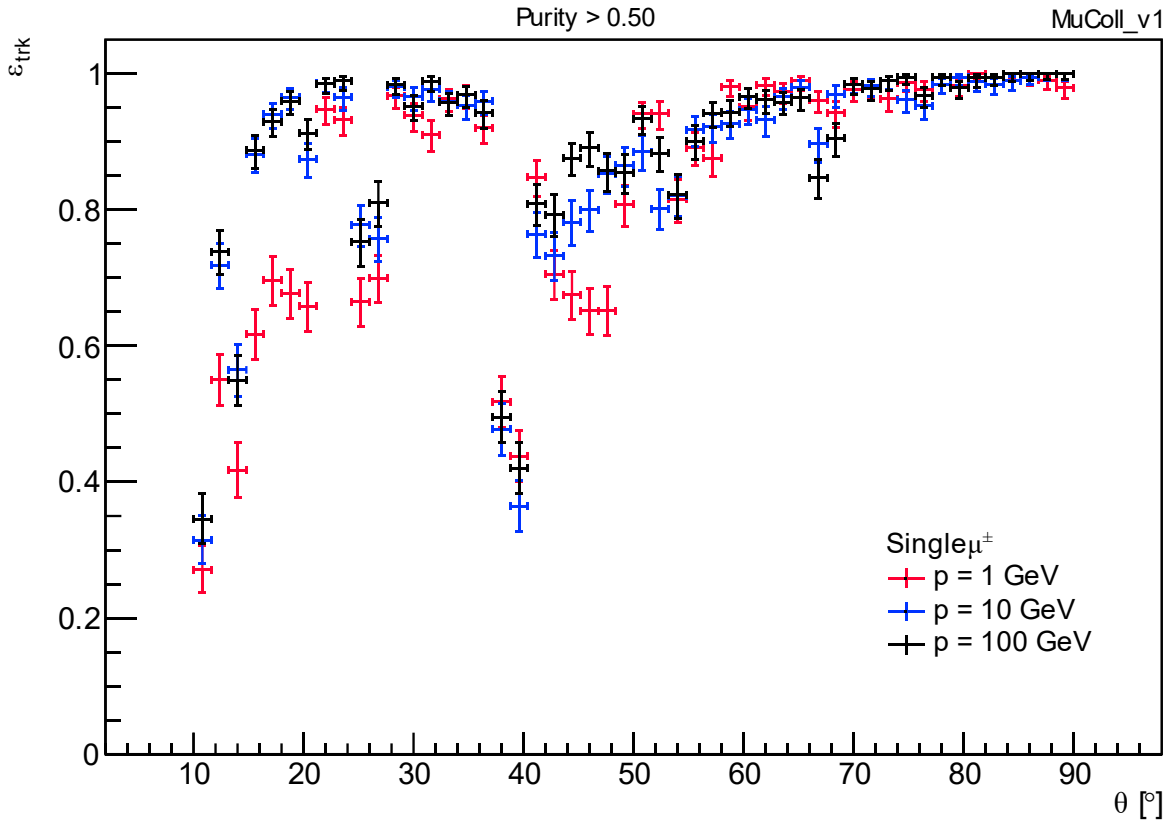


Efficiency as a function of θ

- Standard

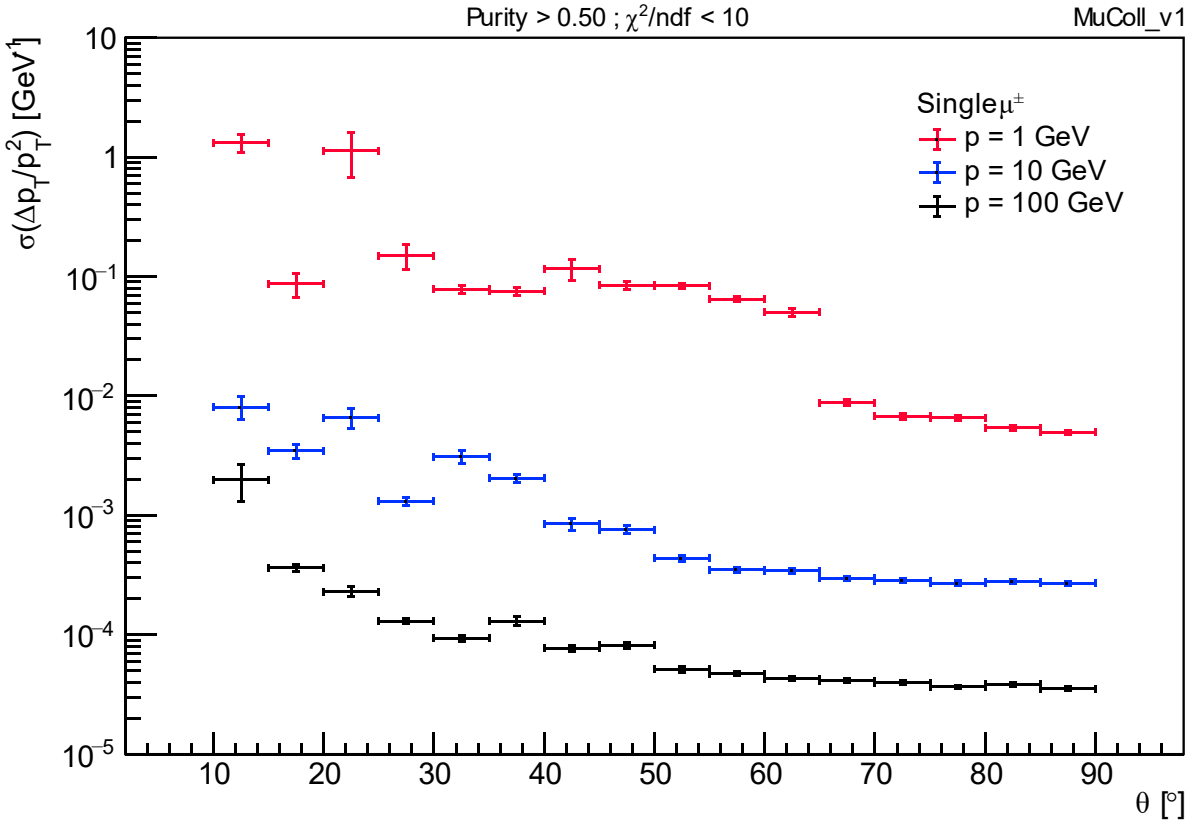


- Standard + DL filter

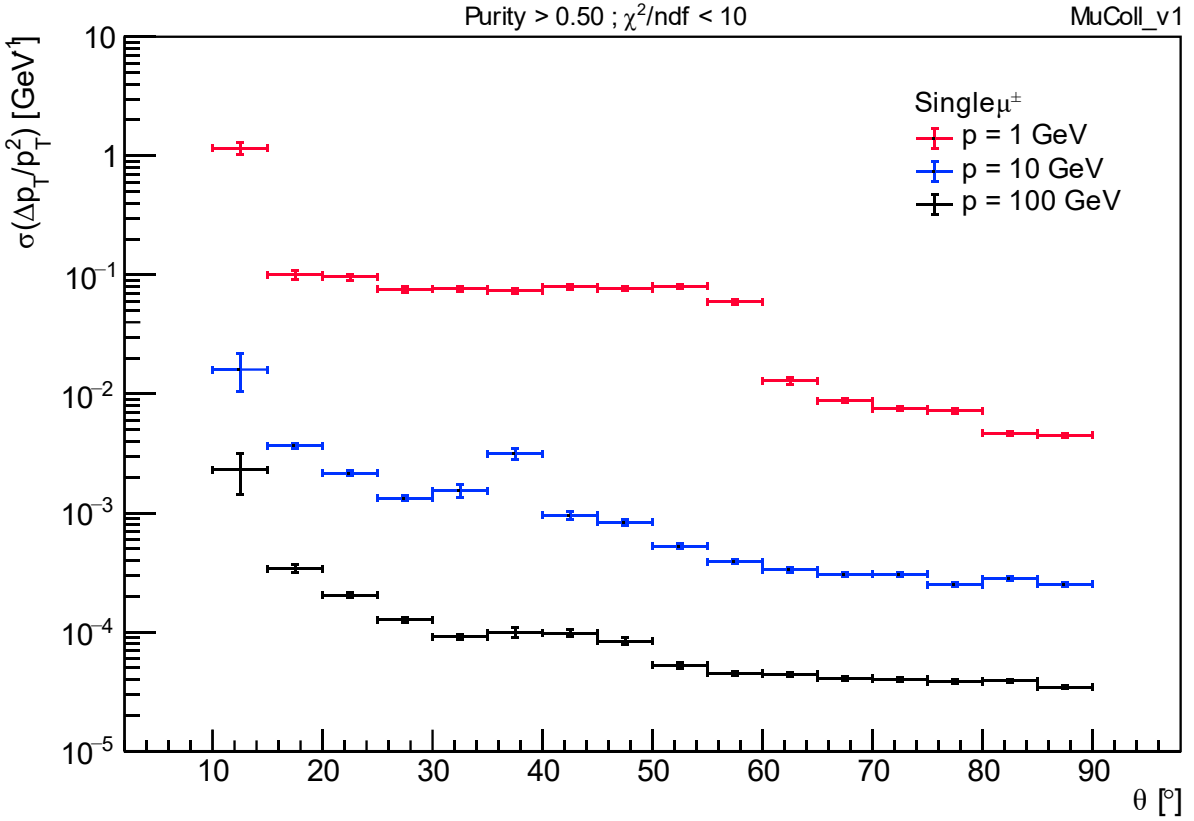


Resolution in p_T as a function of θ

- Standard

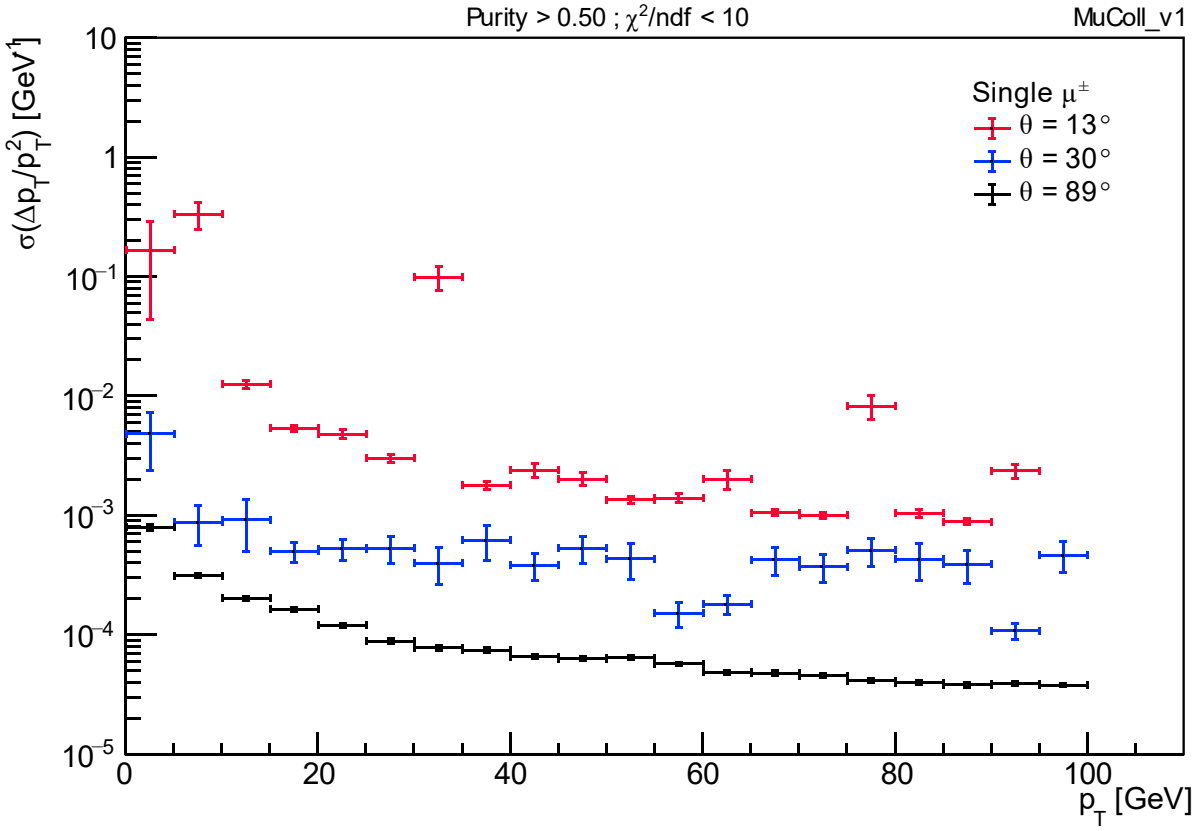


- Standard + DL filter

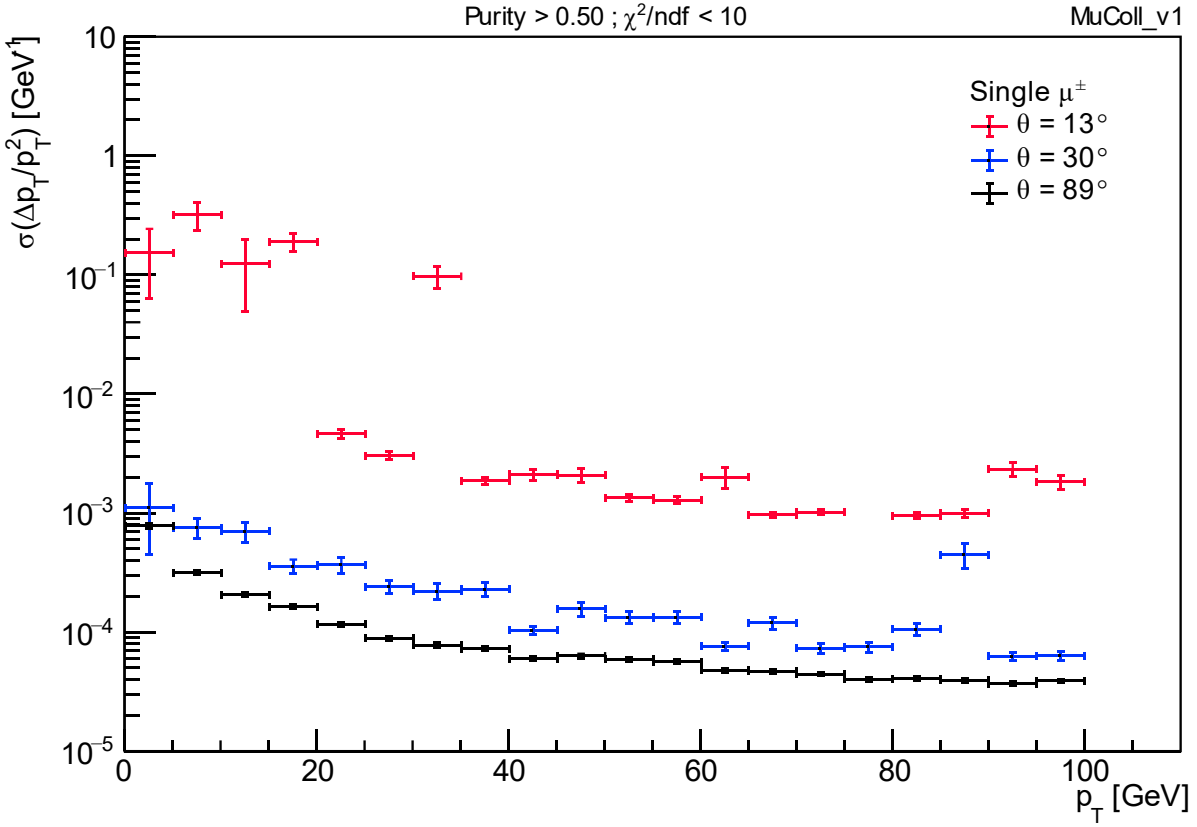


Resolution in p_T as a function of p_T

- Standard

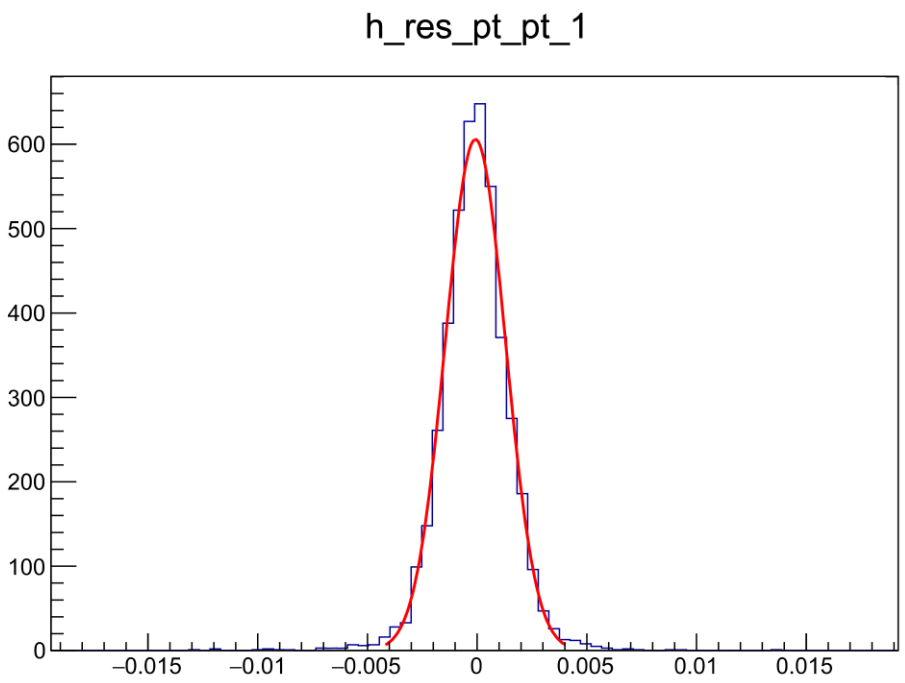


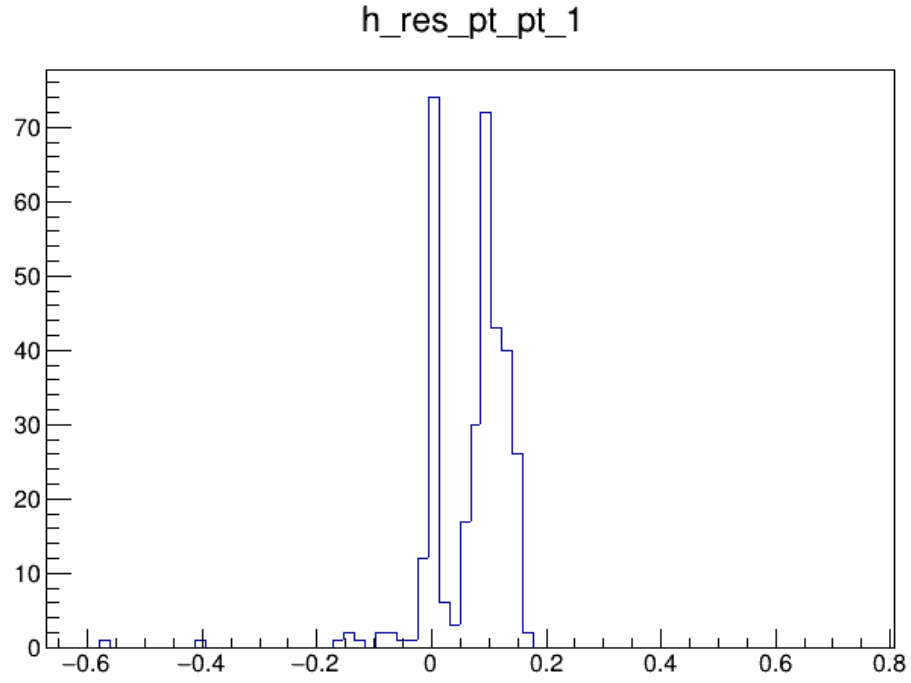
- Standard + DL filter



Resolution in p_T as a function of p_T

- We observed an unexpected double-peak structure in the residuals of p_T for the samples with $\theta = 13°$ and $\theta = 30°$

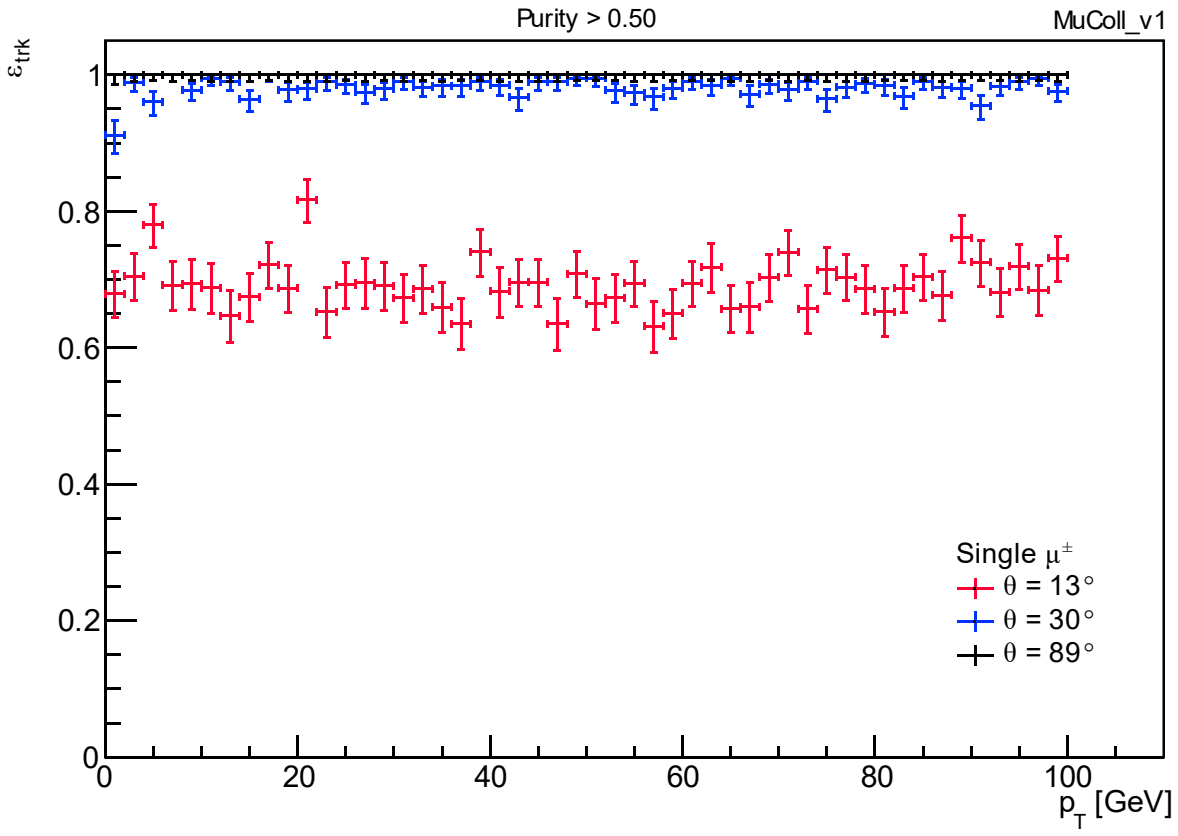




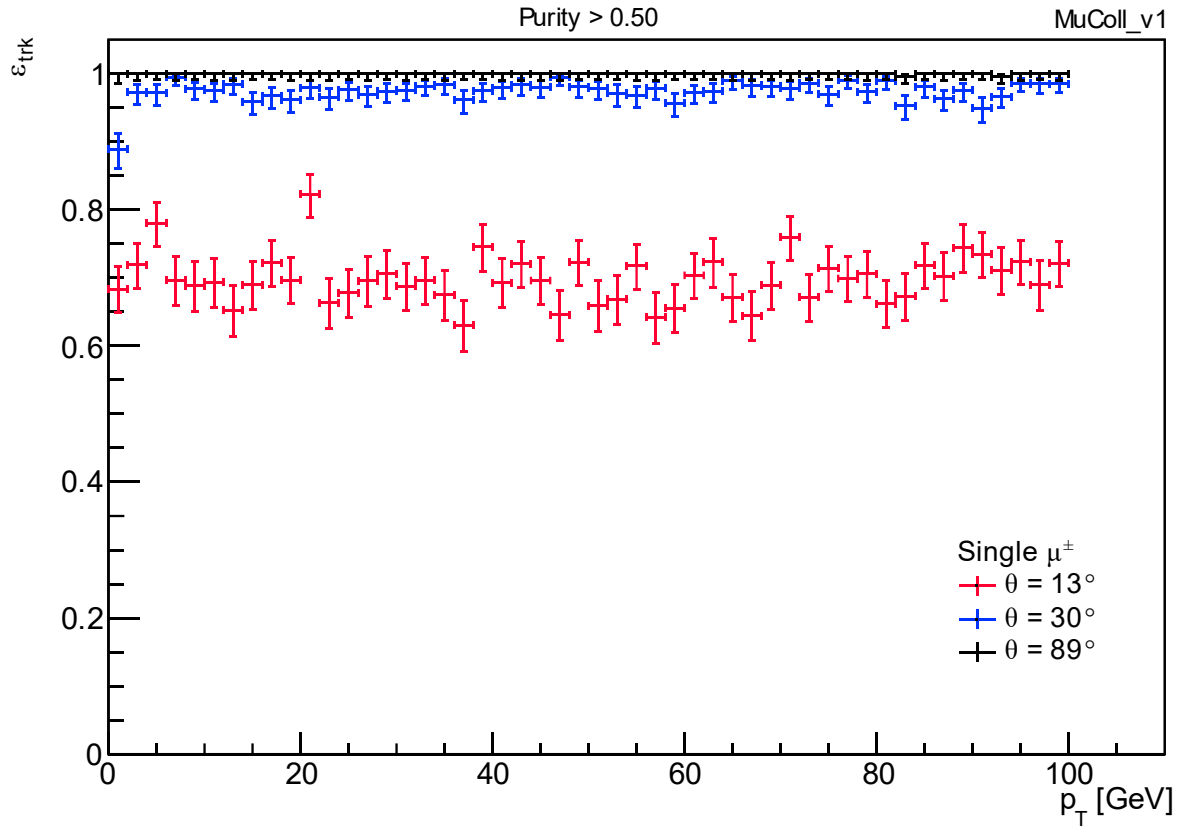
- Without BIB
- With BIB

Efficiency as a function of p_T

- Simplified

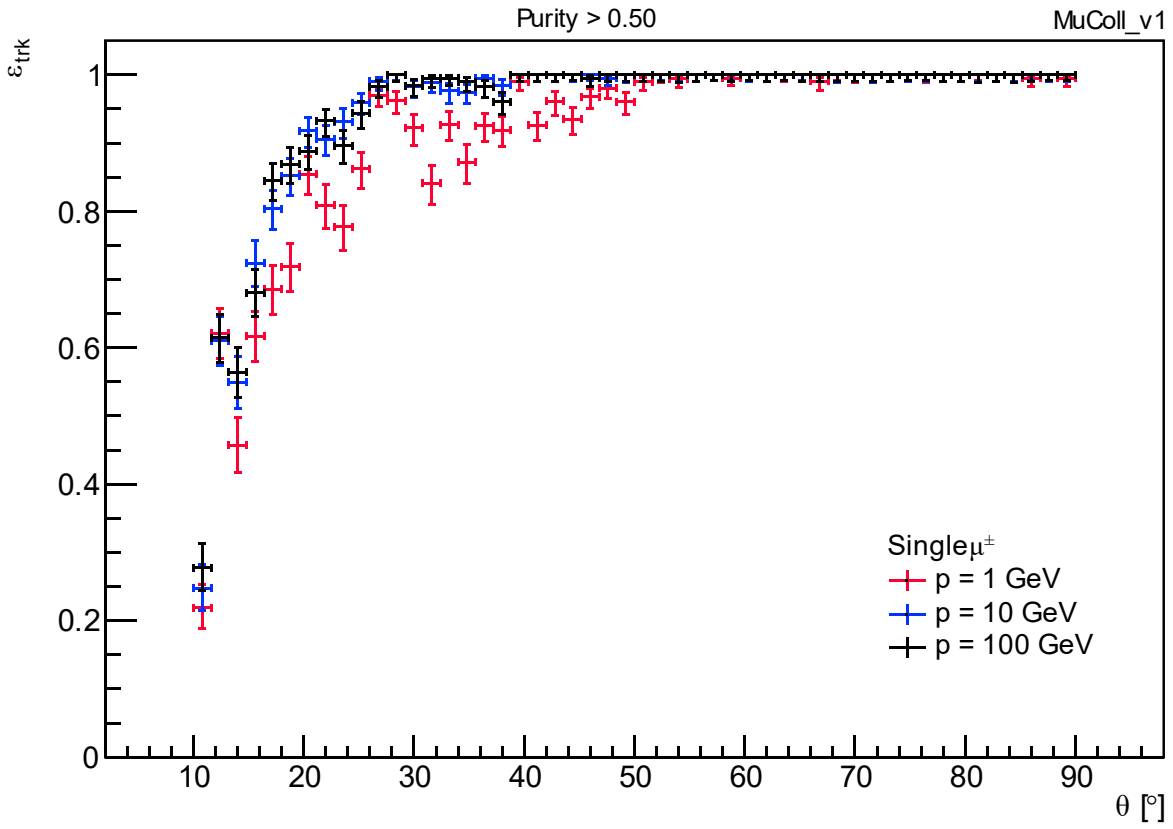


- Simplified + DL filter

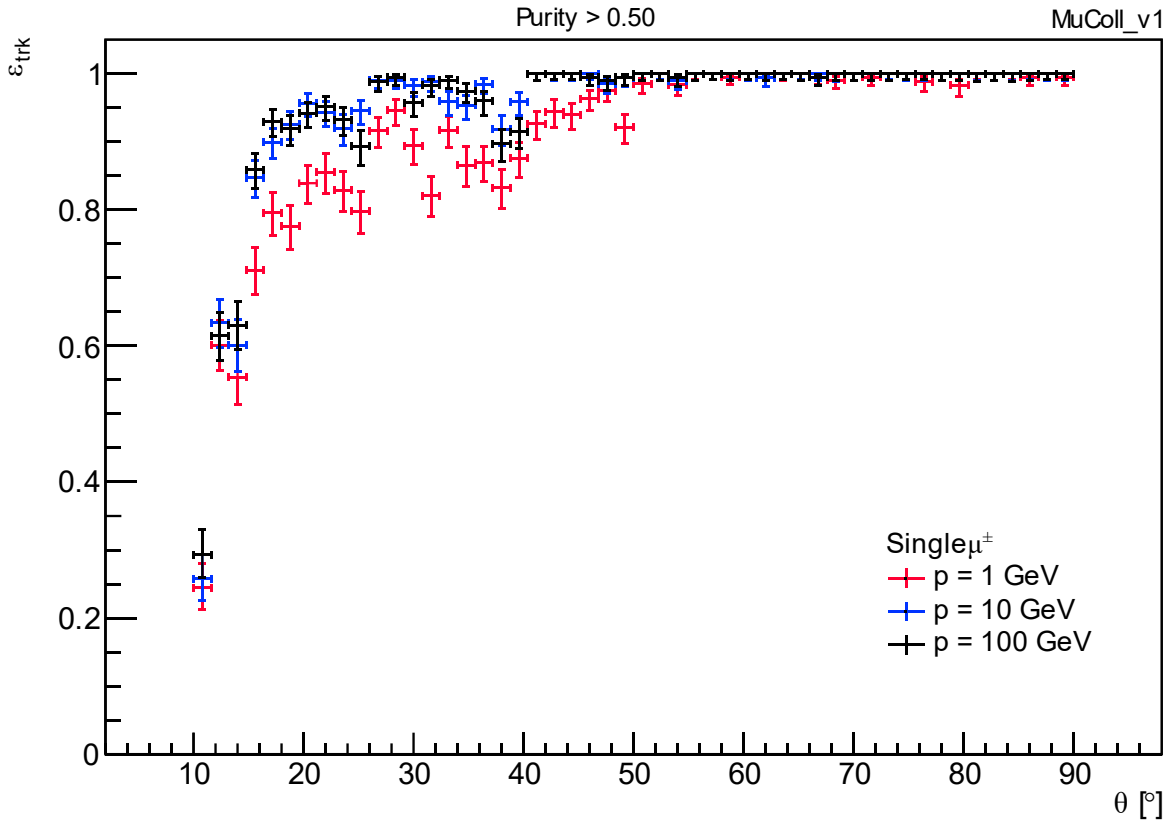


Efficiency as a function of θ

- Simplified

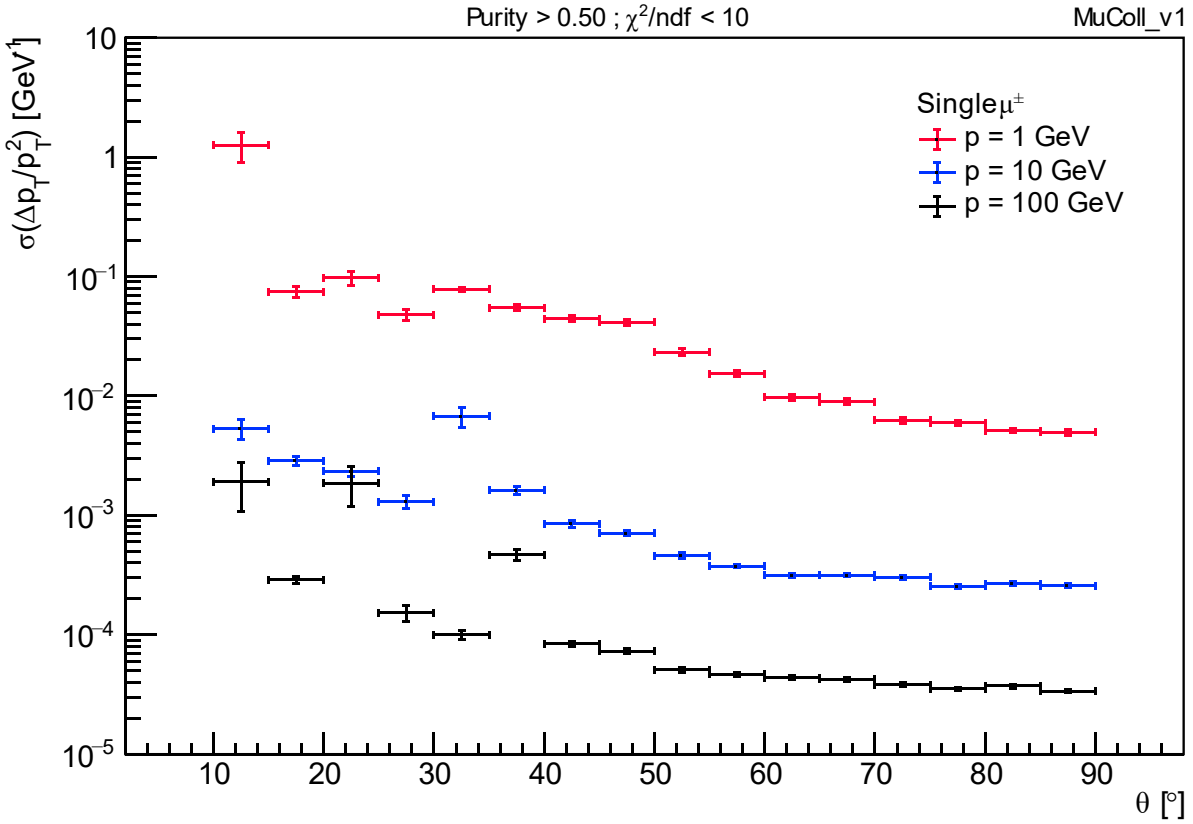


- Simplified + DL filter

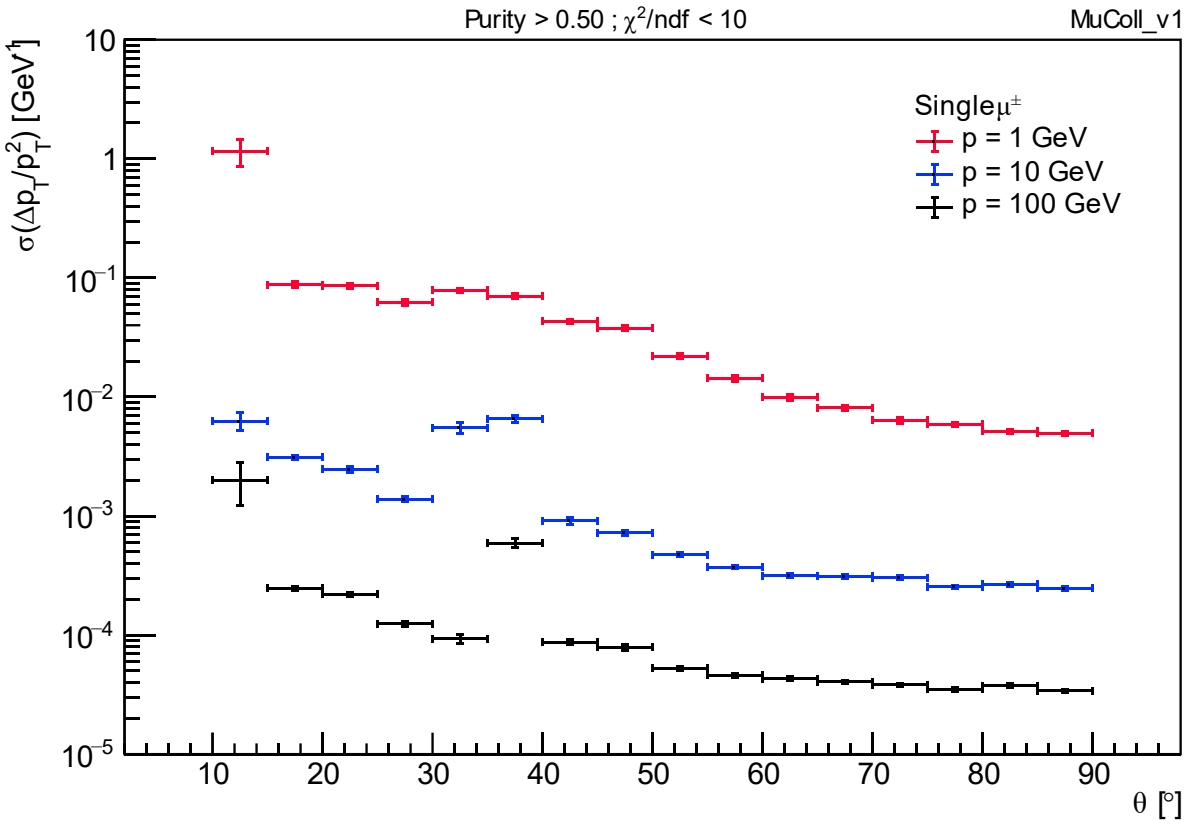


Resolution in p_T as a function of θ

- Simplified

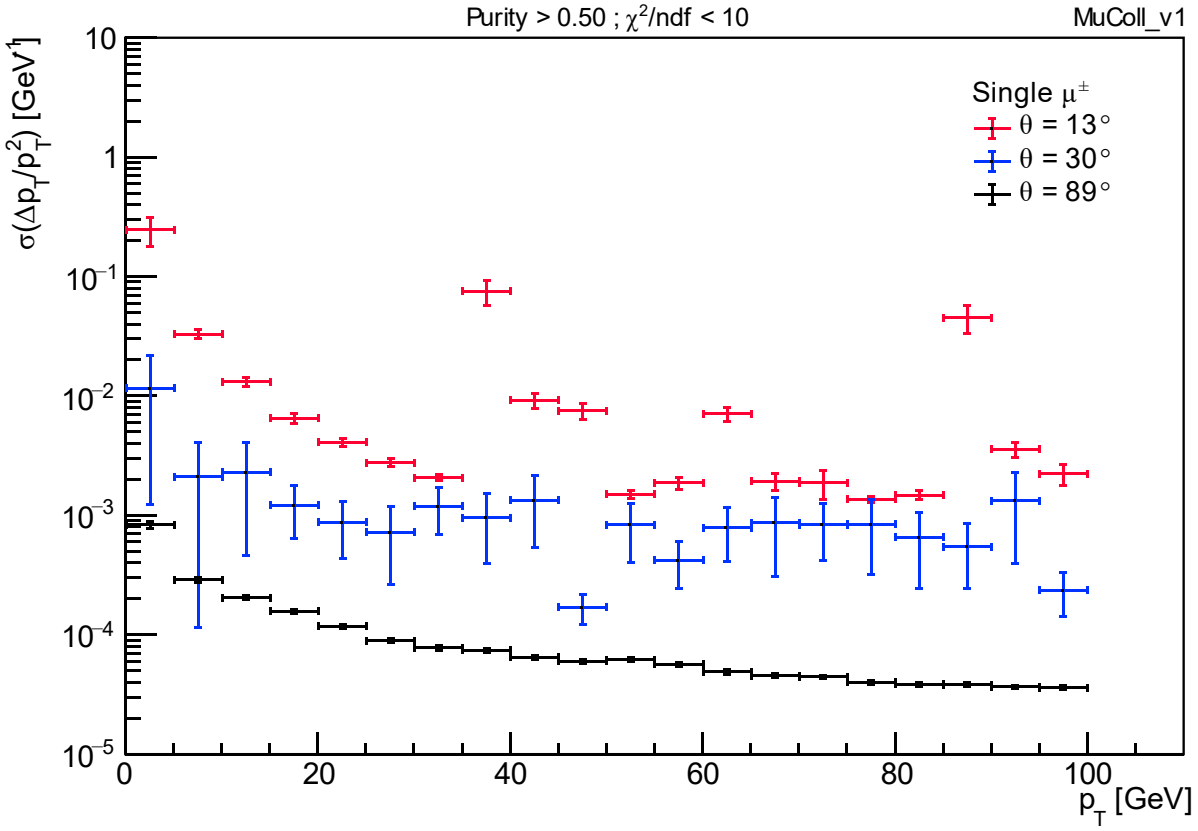


- Simplified + DL filter

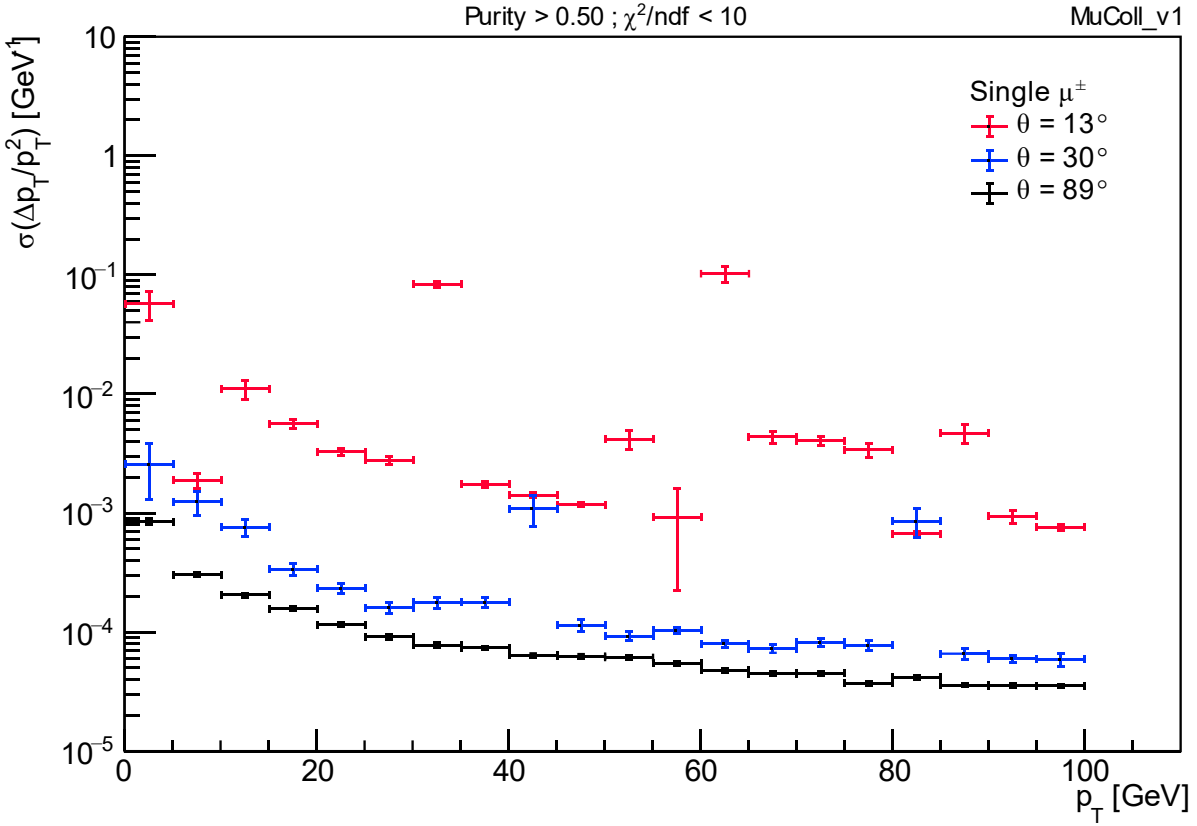


Resolution in p_T as a function of p_T

- Simplified



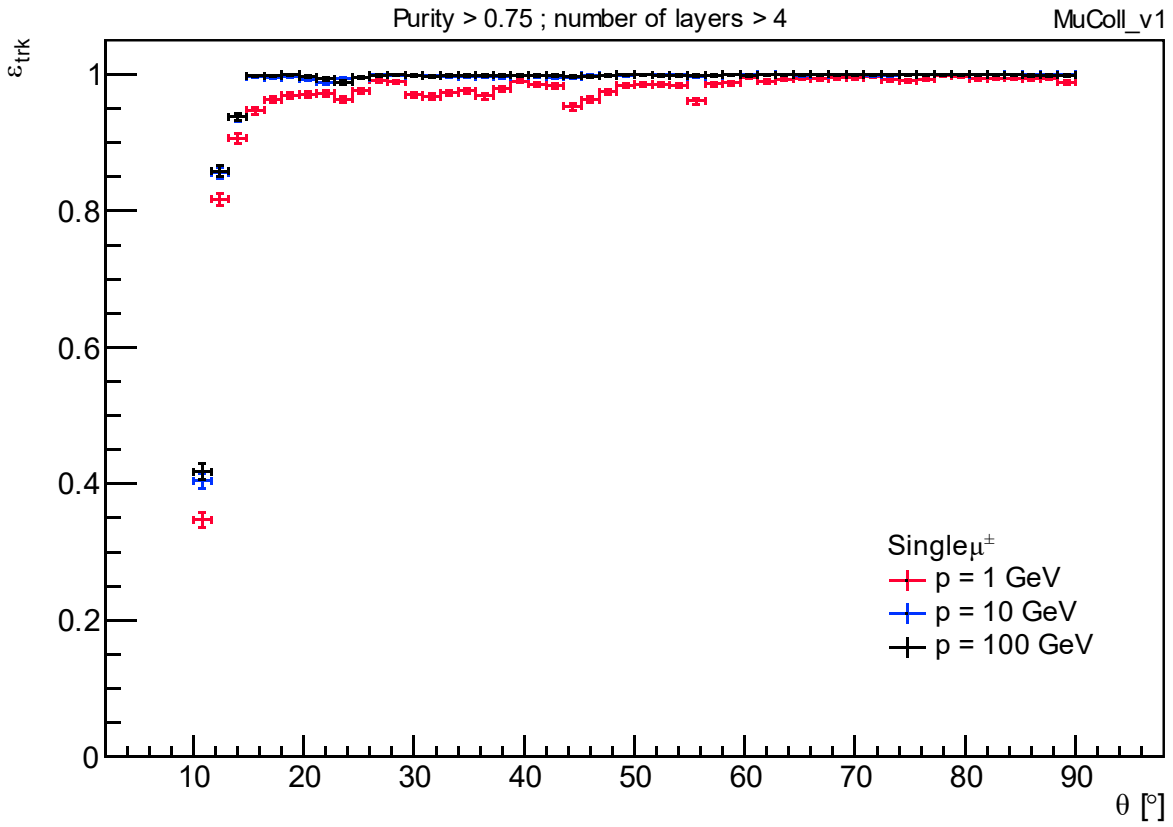
- Simplified + DL filter

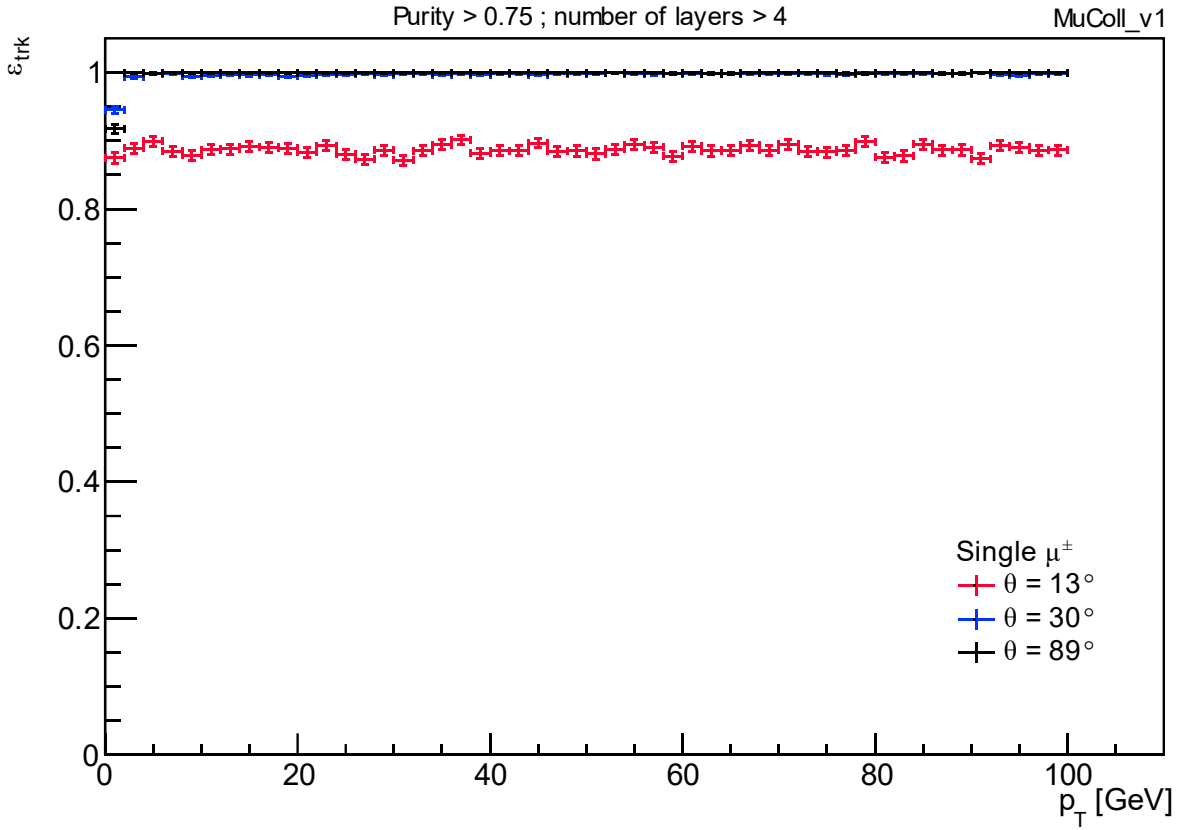


BACKUP

Tracking efficiency as a function of θ and p_T

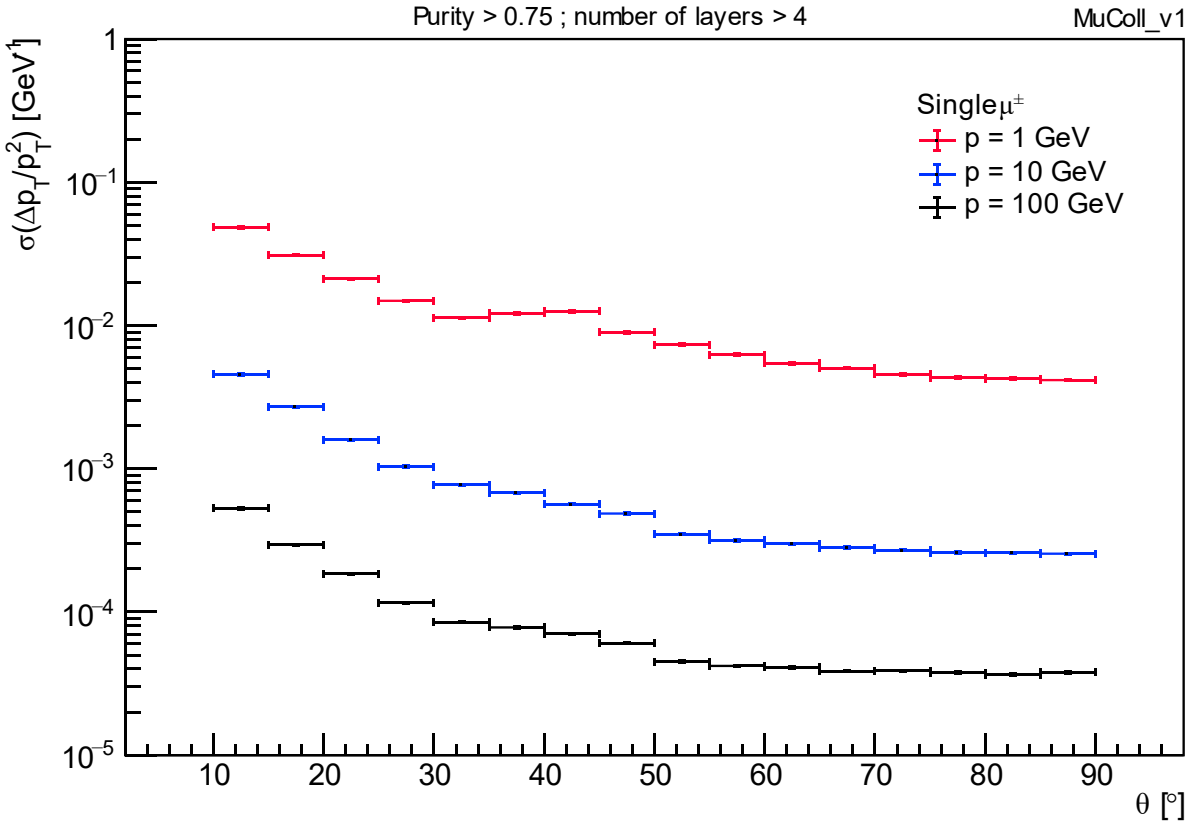
- Single muons without BIB (100k events)

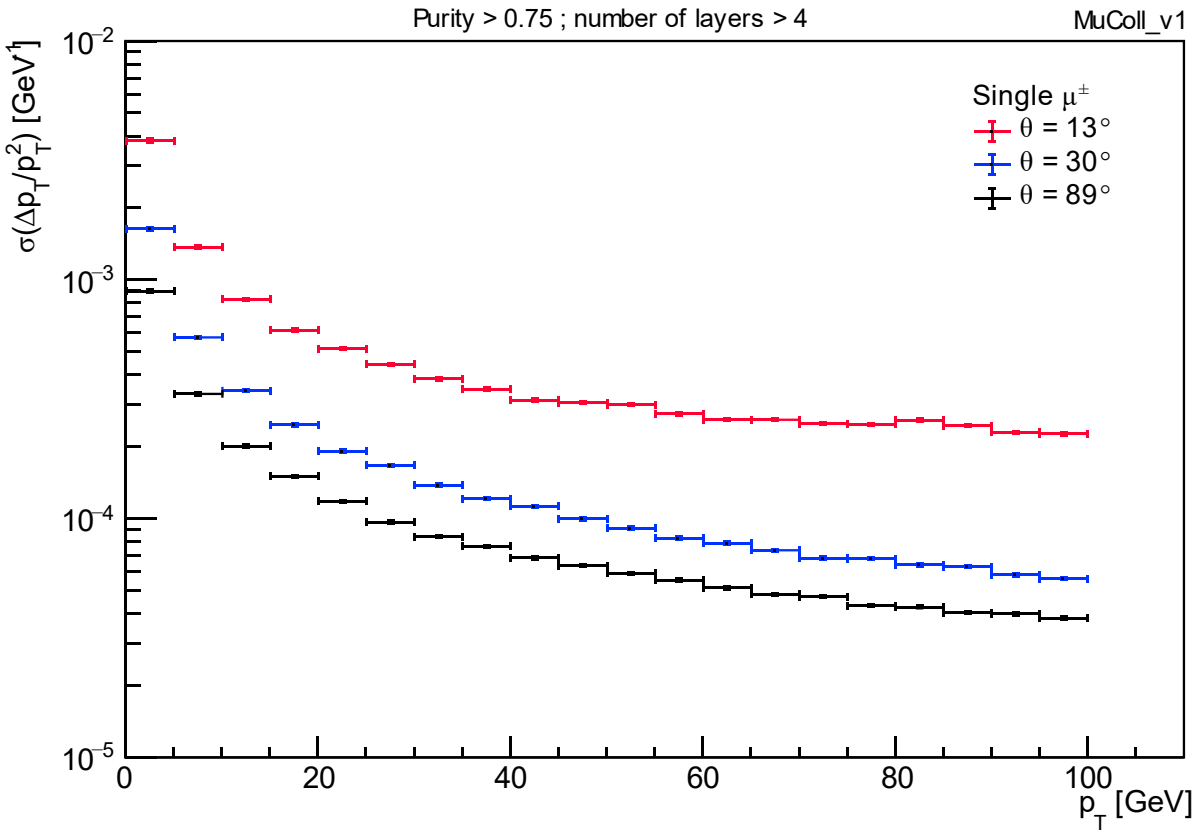




Resolution in p_T as a function of θ and p_T

- Single muons without BIB (100k events)





Double layer filter configuration

```
<processor name="FilterDL_VXDB" type="FilterDoubleLayerHits">
  <parameter name="FillHistograms" type="bool" value="true" />
  <parameter name="SubDetectorName" type="string" value="Vertex" />
  <!-- Name of the input hit collection -->
  <parameter name="InputCollection" type="string" value="VBTrackerHits_Cone" />
  <!-- Name of the output filtered hit collection -->
  <parameter name="OutputCollection" type="string" value="VBTrackerHits_DLFiltered" />
  <!-- Configuration of the maximum dX and dTheta between a pair of hits at the inner and outer layer -->
  <!-- 4 numbers per double-layer: <inner layer ID>  <outer layer ID>  <dX max [mm]>  <dTheta max [mrad]> -->
  <parameter name="DoubleLayerCuts" type="StringVec">
    0 1 1.0 0.6
    2 3 1.0 0.33
    4 5 1.0 0.27
    6 7 1.0 0.21
  </parameter>
  <parameter name="Verbosity" type="string"> MESSAGE </parameter>
</processor>

<processor name="FilterDL_VXDE" type="FilterDoubleLayerHits">
  <parameter name="FillHistograms" type="bool" value="true" />
  <parameter name="SubDetectorName" type="string" value="Vertex" />
  <!-- Name of the input hit collection -->
  <parameter name="InputCollection" type="string" value="VETrackerHits_Cone" />
  <!-- Name of the output filtered hit collection -->
  <parameter name="OutputCollection" type="string" value="VETrackerHits_DLFiltered" />
  <!-- Configuration of the maximum dX and dTheta between a pair of hits at the inner and outer layer -->
  <!-- 4 numbers per double-layer: <inner layer ID>  <outer layer ID>  <dX max [mm]>  <dTheta max [mrad]> -->
  <parameter name="DoubleLayerCuts" type="StringVec">
    0 1 1.0 0.21
    2 3 1.0 0.18
    4 5 0.8 0.12
    6 7 0.6 0.12
  </parameter>
  <parameter name="Verbosity" type="string"> MESSAGE </parameter>
</processor>
```

Standard tracking configuration

```
<parameter name="Steps" type="StringVec">
  [VXDCentral]
  @Collections : VBTrackerHitsMiddle, VBTrackerHitsOuter, VETrackerHitsInner
  @Parameters : MaxCellAngle : 0.01; MaxCellAngleRZ : 0.014; Chi2Cut : 60; MinClustersOnTrack : 4; MaxDistance : 0.01; SlopeZRange: 1.4; HighPTCut: 1.0;
  @Flags : HighPTFit, VertexToTracker
  @Functions : CombineCollections, BuildNewTracks
  [VXDCentralExtend]
  @Collections : VETrackerHitsInner, VETrackerHitsMiddle
  @Parameters : MaxCellAngle : 0.01; MaxCellAngleRZ : 0.007; Chi2Cut : 60; MinClustersOnTrack : 4; MaxDistance : 0.006; SlopeZRange: 1.4; HighPTCut: 1.0;
  @Flags : HighPTFit, VertexToTracker
  @Functions : CombineCollections, ExtendTracks
  [VXDMiddle]
  @Collections : VBTrackerHitsInner, VBTrackerHitsMiddle, VBTrackerHitsOuter, VETrackerHitsInner, VETrackerHitsMiddle
  @Parameters : MaxCellAngle : 0.015; MaxCellAngleRZ : 0.014; Chi2Cut : 60; MinClustersOnTrack : 4; MaxDistance : 0.02; SlopeZRange: 3.0; HighPTCut: 1.0;
  @Flags : HighPTFit
  @Functions : CombineCollections, BuildNewTracks
  [VXDMiddleExtend]
  @Collections : VETrackerHitsOuter
  @Parameters : MaxCellAngle : 0.02; MaxCellAngleRZ : 0.014; Chi2Cut : 60; MinClustersOnTrack : 4; MaxDistance : 0.01; SlopeZRange: 3.0; HighPTCut: 1.0;
  @Flags : HighPTFit, VertexToTracker
  @Functions : CombineCollections, ExtendTracks
  [VXDForward]
  @Collections : VETrackerHitsInner, VETrackerHitsMiddle, VETrackerHitsOuter
  @Parameters : MaxCellAngle : 0.03; MaxCellAngleRZ : 0.03; Chi2Cut : 60; MinClustersOnTrack : 4; MaxDistance : 0.02; SlopeZRange: 6.0; HighPTCut: 1.0;
  @Flags : HighPTFit
  @Functions : CombineCollections, BuildNewTracks
  [VXDInner]
  @Collections : VBTrackerHitsInner
  @Parameters : MaxCellAngle : 0.015; MaxCellAngleRZ : 0.015; Chi2Cut : 60; MinClustersOnTrack : 5; MaxDistance : 0.015; SlopeZRange: 3.0; HighPTCut: 1.0;
  @Flags : HighPTFit, RadialSearch
  @Functions : CombineCollections, ExtendTracks, SortTracks
  [Tracker]
  @Collections : IBTrackerHits_Cone, OBTrackerHits_Cone, IETrackerHits_Cone, OETrackerHits_Cone
  @Parameters : MaxCellAngle : 0.04; MaxCellAngleRZ : 0.03; Chi2Cut : 200; MinClustersOnTrack : 6; MaxDistance : 0.02; SlopeZRange: 6.0; HighPTCut: 1.0;
  @Flags : HighPTFit, VertexToTracker, RadialSearch
  @Functions : CombineCollections, ExtendTracks
</parameter>
```

3-step tracking configuration

```
<parameter name="Steps" type="StringVec">
  [VXD]
  @Collections : VBTrackerHits_Cone, VETrackerHits_Cone
  @Parameters : MaxCellAngle : 0.007; MaxCellAngleRZ : 0.007; Chi2Cut : 100; MinClustersOnTrack : 4; MaxDistance : 0.024; SlopeZRange: 10.0; HighPTCut: 1.0;
  @Flags : HighPTFit
  @Functions : CombineCollections, BuildNewTracks
  [VXDEndcap]
  @Collections : VETrackerHits_Cone
  @Parameters : MaxCellAngle : 0.025; MaxCellAngleRZ : 0.025; Chi2Cut : 100; MinClustersOnTrack : 4; MaxDistance : 0.024; SlopeZRange: 10.0; HighPTCut: 1.0;
  @Flags : HighPTFit
  @Functions : CombineCollections, BuildNewTracks
  [Tracker]
  @Collections : IBTrackerHits_Cone, IETrackerHits_Cone, OBTrackerHits_Cone, OETrackerHits_Cone
  @Parameters : MaxCellAngle : 0.025; MaxCellAngleRZ : 0.05; Chi2Cut : 100; MinClustersOnTrack : 4; MaxDistance : 0.009; SlopeZRange: 10.0; HighPTCut: 0.0;
  @Flags : HighPTFit, VertexToTracker, RadialSearch
  @Functions : CombineCollections, ExtendTracks
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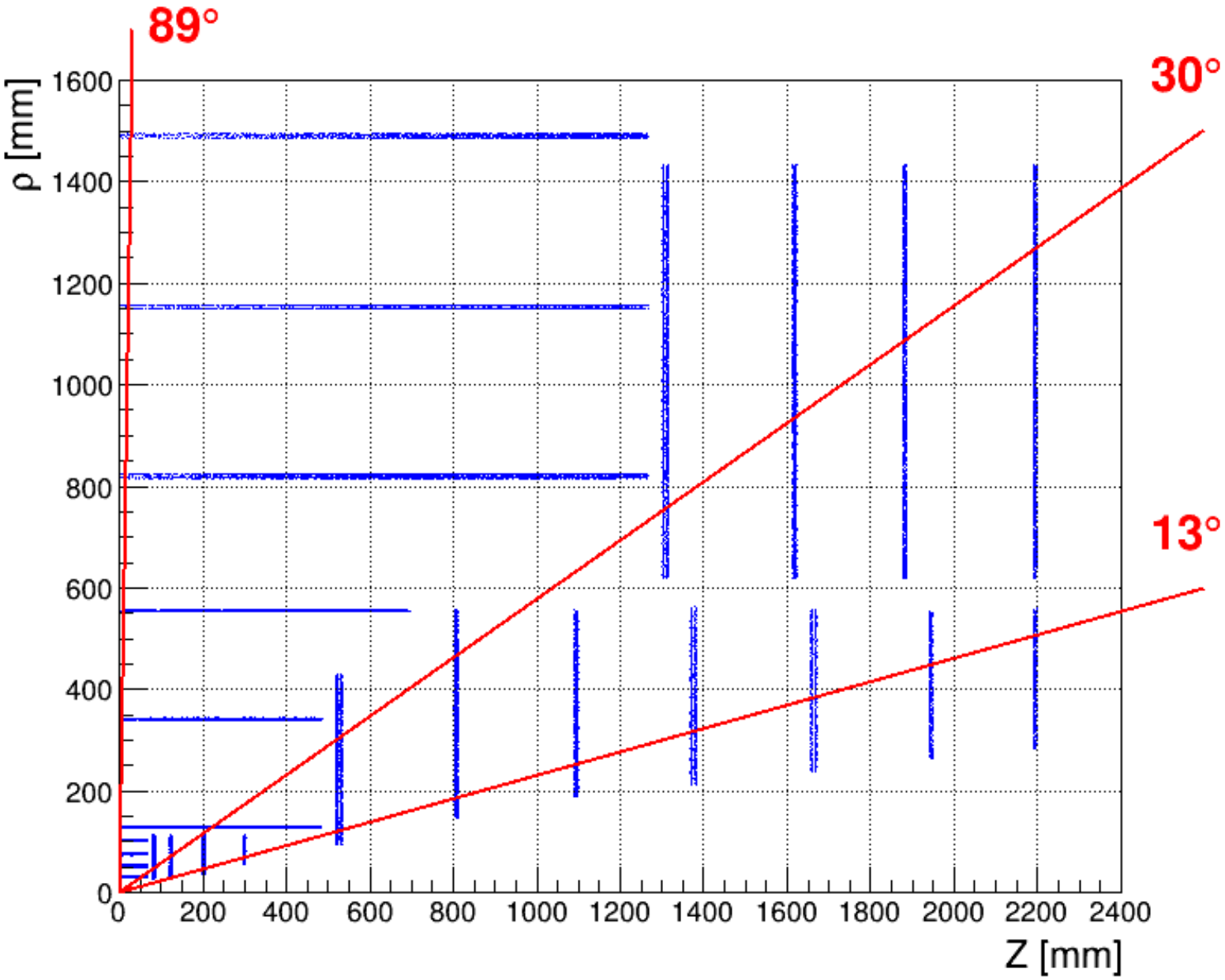
Hits angular distribution



Efficiency and resolution