ILD Silicon Tracking Performance Studies
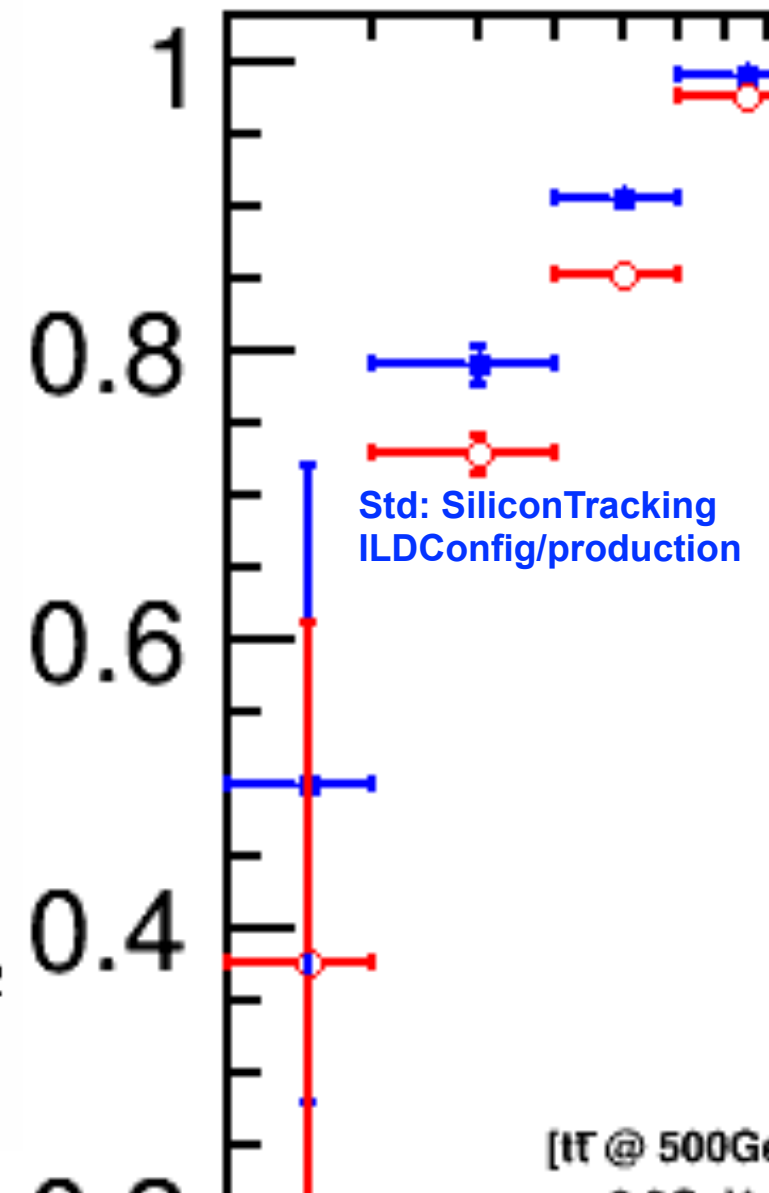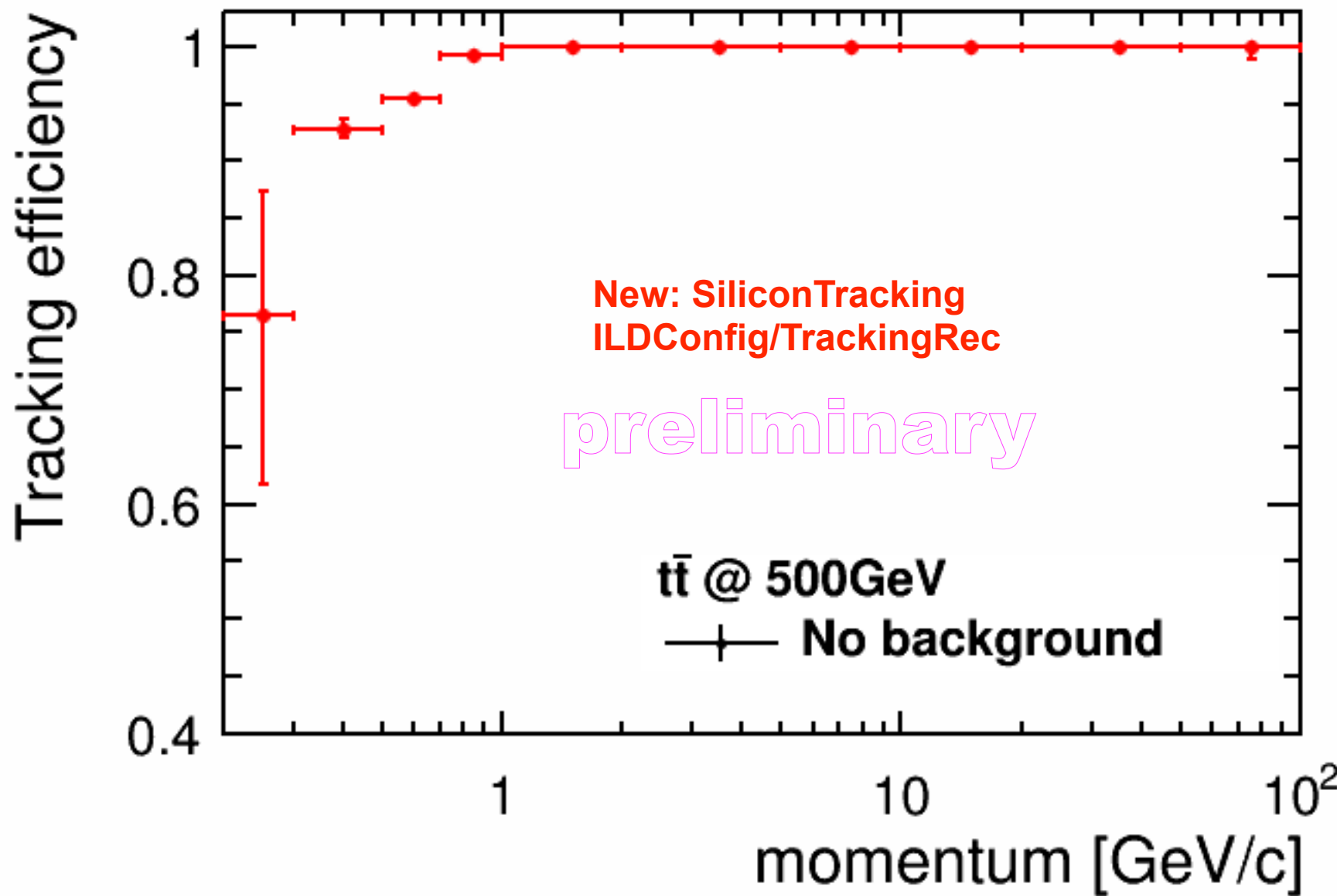
Talk about the triplets finder applied in SiliconTracking:
Try to understand and find out the truth and the key point.
Provide a solution based on the understanding.
Compare the ILD performance with detail studies.

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23.01.2018

HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

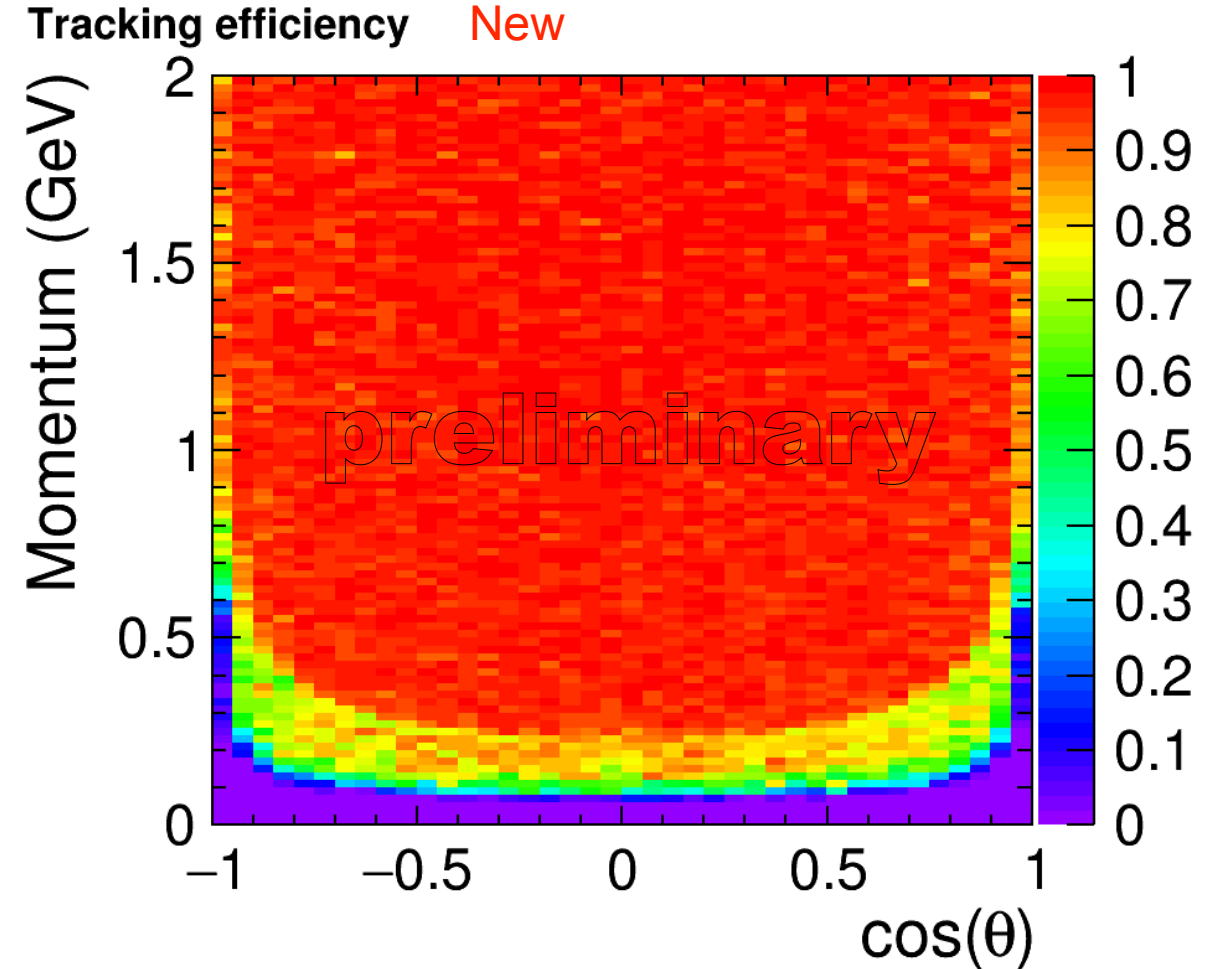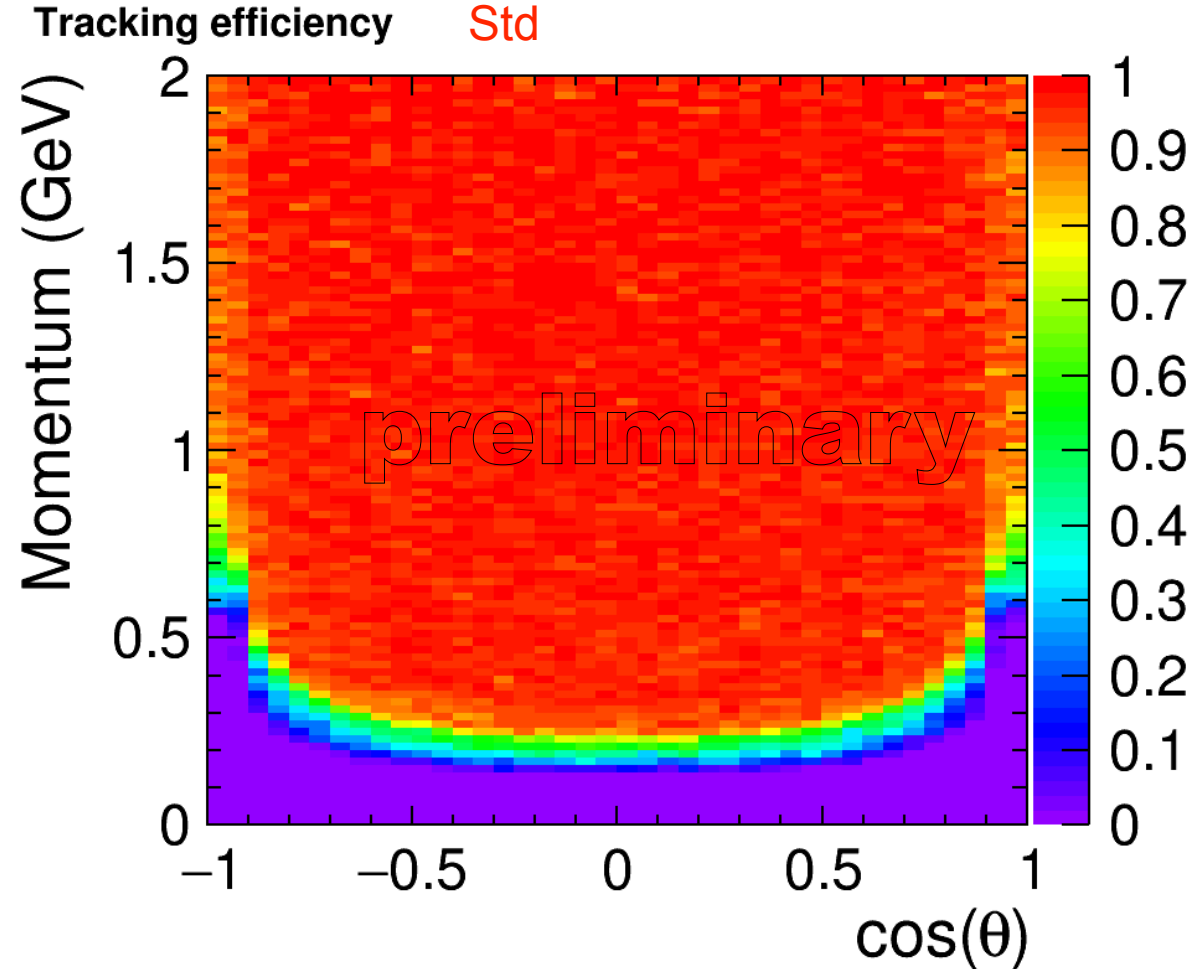iLCSOft

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Triplets finder applied on ILD silicon trackers

- improved SiTrackingProcessor

  - improved update of seed triplets

    - include neighbour bins in next layer

  - improved merging of track segments

    - add hits individually

- improved steering file:

  - add additional seed-triplets search combinations

- observe improved tracking efficiency
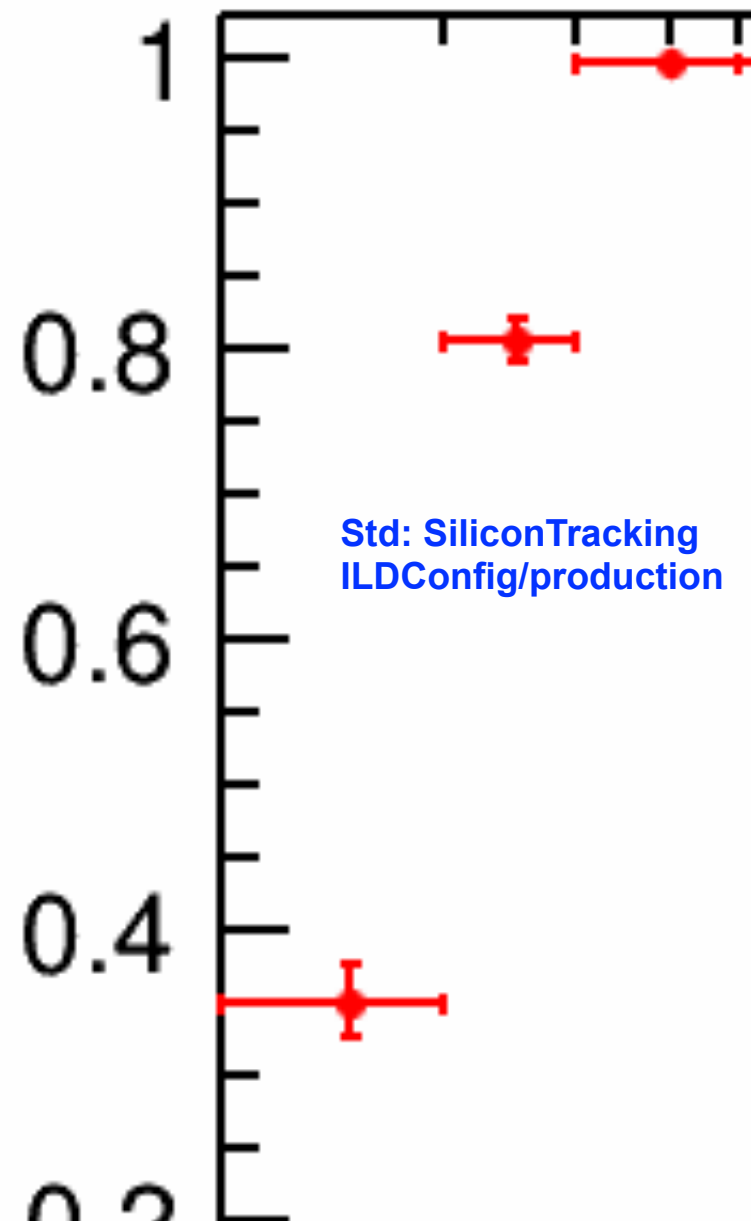
ILD tracking efficiency vs momentum

New: SiliconTracking
ILDConfig/TrackingRec

preliminary

$t\bar{t}$ @ 500GeV

No background

Std: SiliconTracking
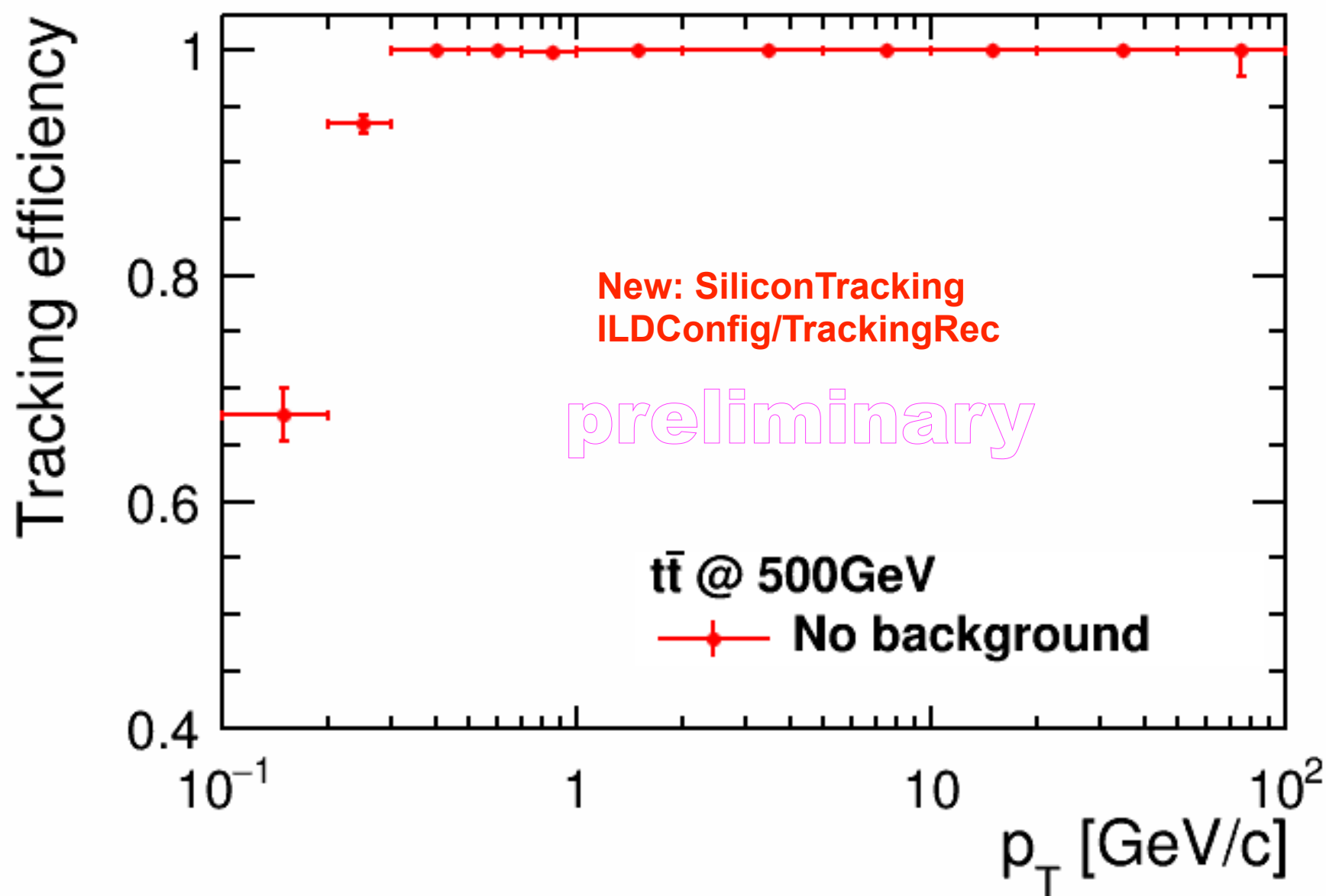ILDConfig/production

Tracking efficiency

momentum [GeV/c]

ILD tracking efficiency: momentum vs cos(θ)

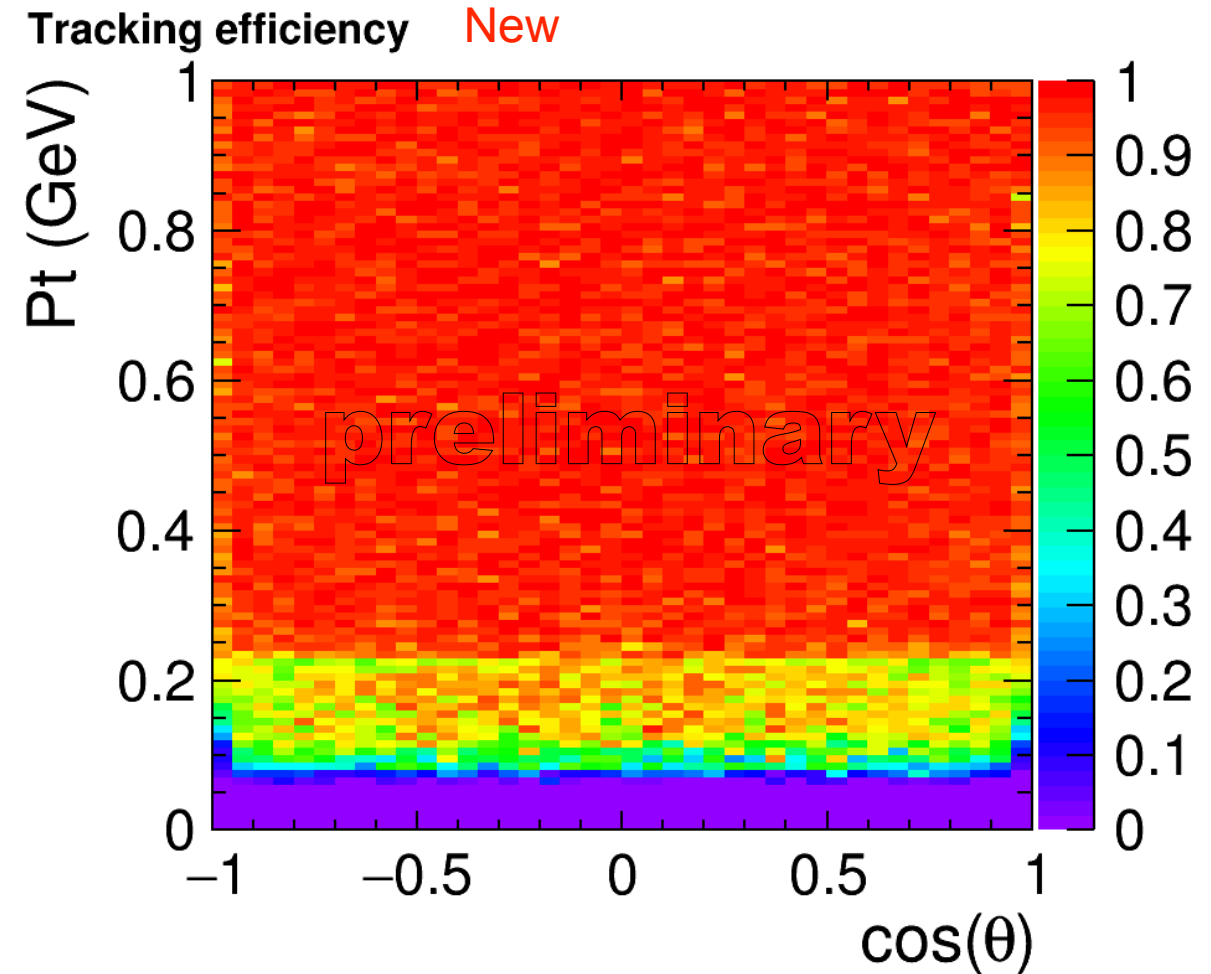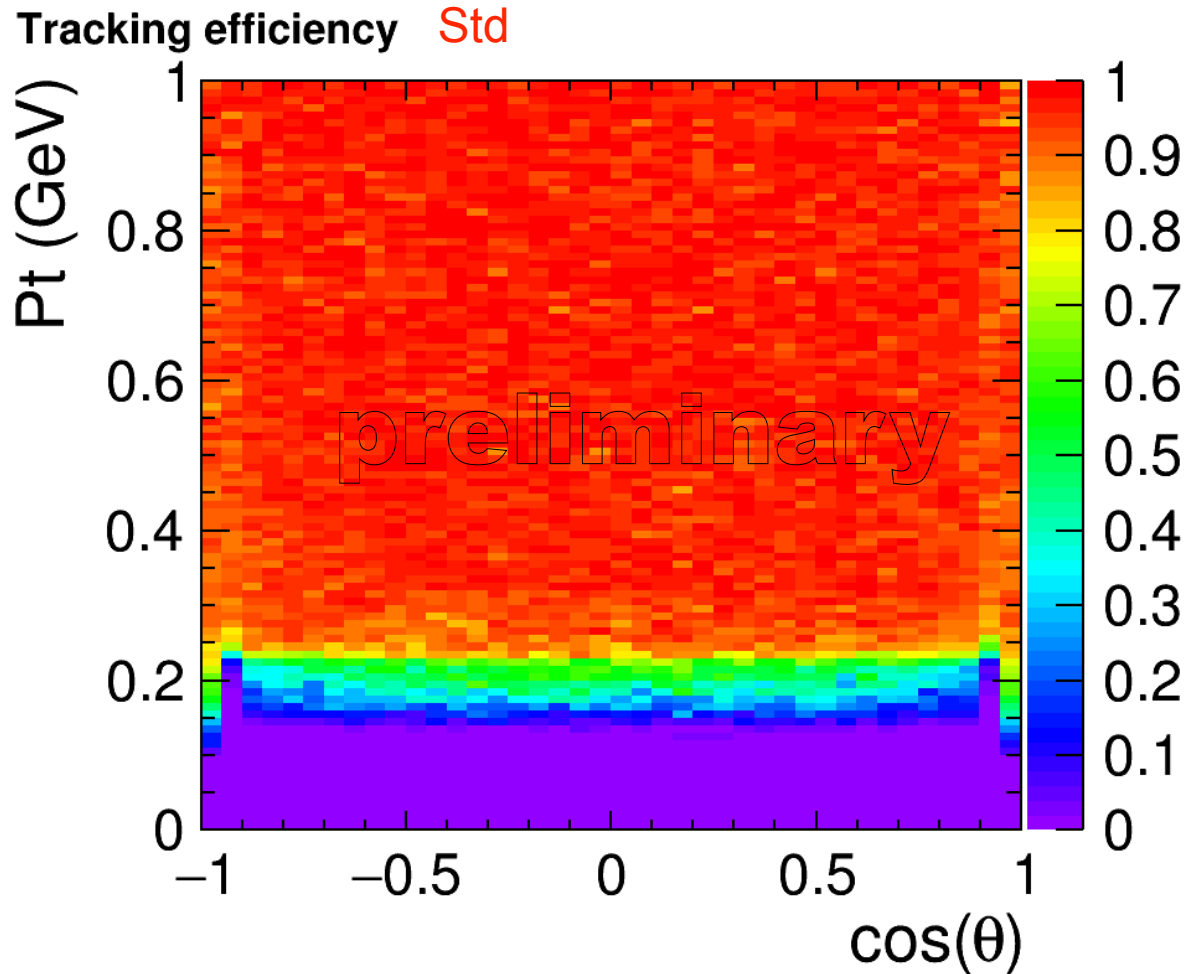
- This update improved overall momentum and theta
  - except the last bin, which is the forward FTD only.

ILD tracking efficiency vs Pt

New: SiliconTracking
ILDConfig/TrackingRec

preliminary

$t\bar{t}$ @ 500GeV
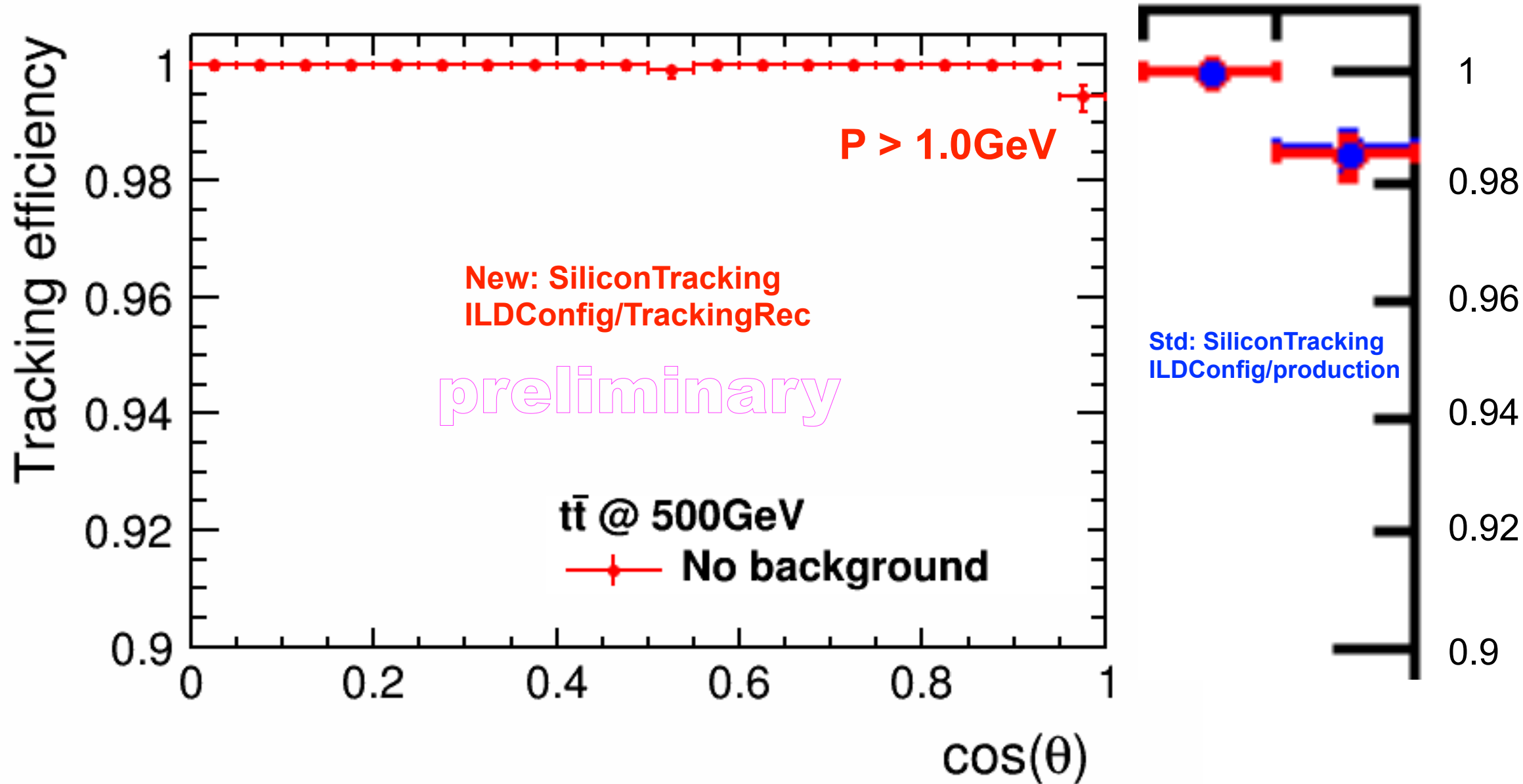
No background

Std: SiliconTracking
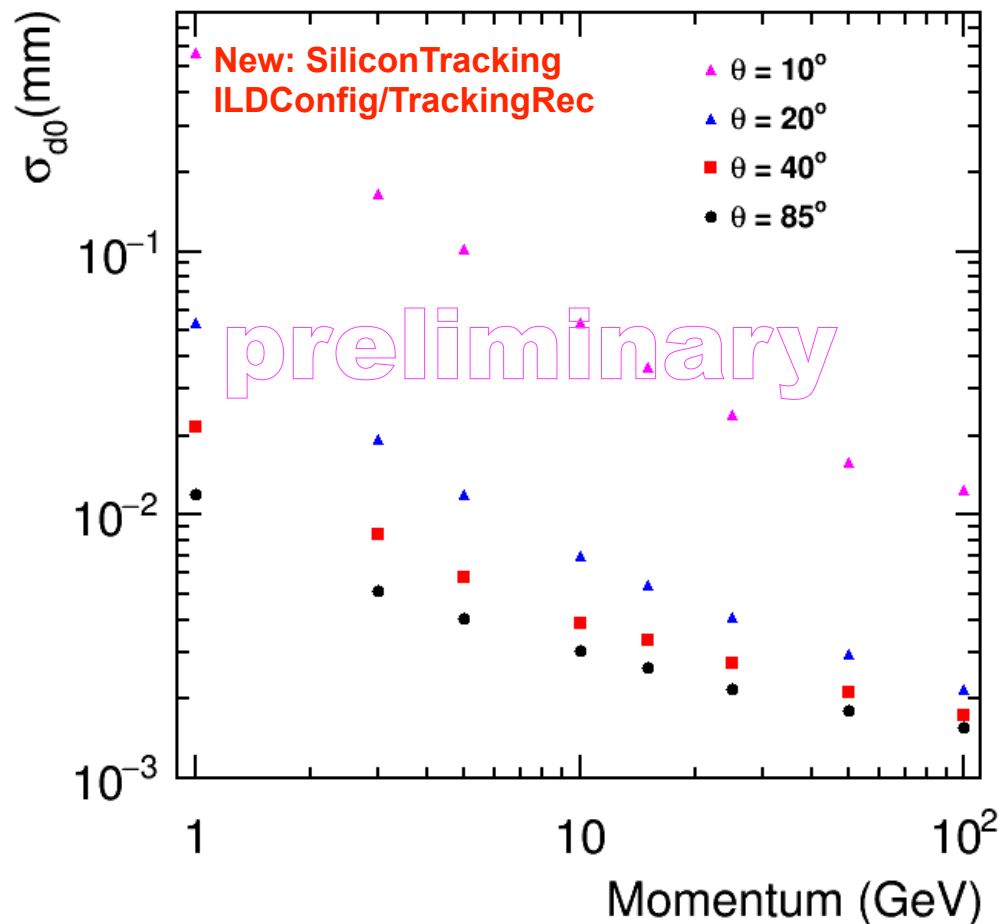ILDConfig/production

ILD tracking efficiency: Pt vs cos(θ)

- This update improved overall Pt and theta
  - except the last bin, which is the forward FTD only.
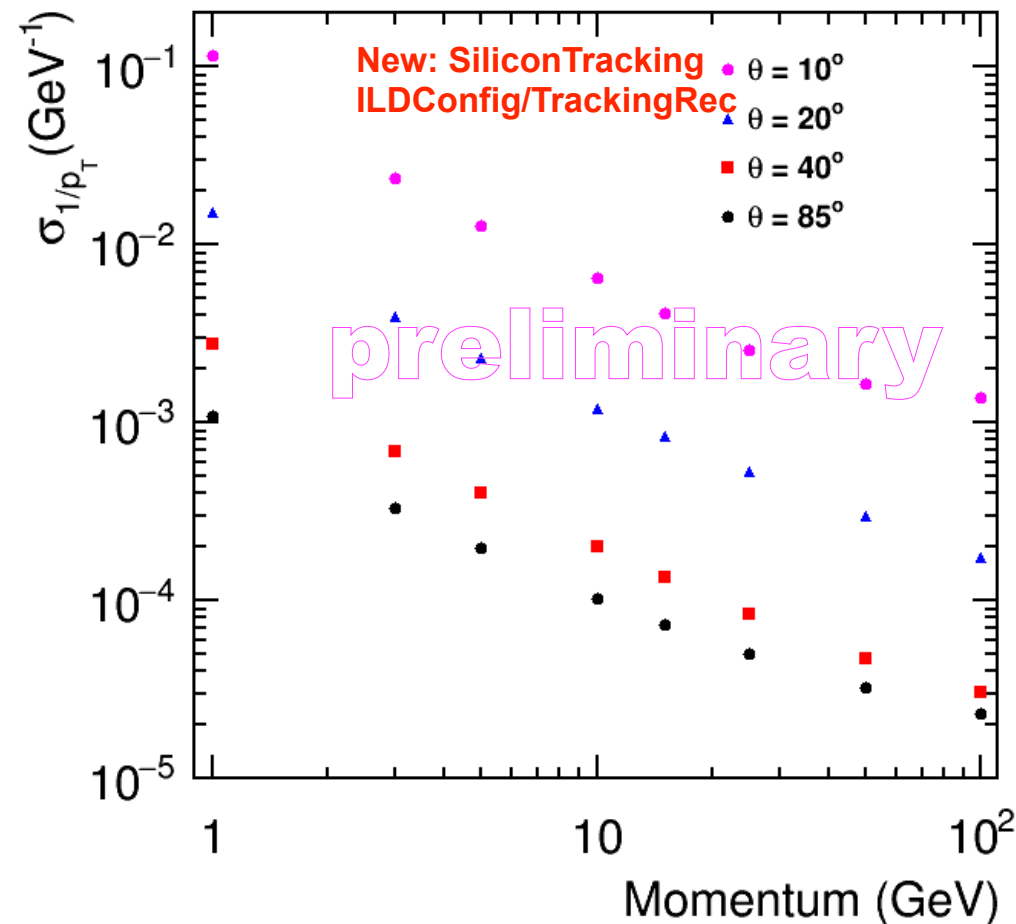
ILD tracking efficiency vs cos(θ)

P > 1.0GeV

New: SiliconTracking
ILDConfig/TrackingRec

preliminary

Std: SiliconTracking
ILDConfig/production

t̄t @ 500GeV

No background

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ILD D0 resolution and momentum resolution

Impact Parameter Resolution

New: SiliconTracking
ILDConfig/TrackingRec

- $\theta = 10°$ (magenta triangle)
- $\theta = 20°$ (blue triangle)
- $\theta = 40°$ (red square)
- $\theta = 85°$ (black circle)

preliminary

σ_{d0} (mm) vs Momentum (GeV)

Momentum Resolution

New: SiliconTracking
ILDConfig/TrackingRec

- $\theta = 10°$ (magenta circle)
- $\theta = 20°$ (blue triangle)
- $\theta = 40°$ (red square)
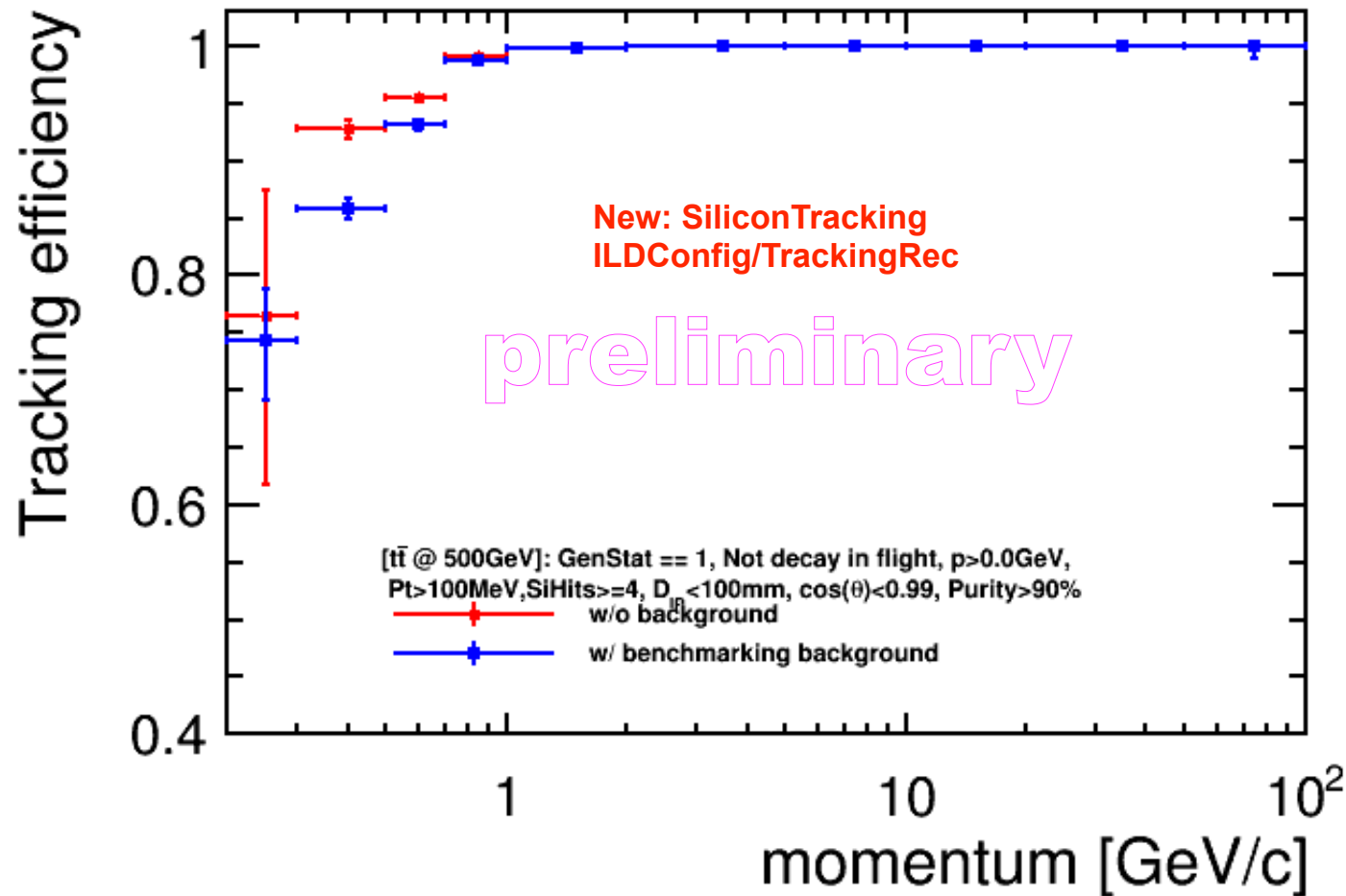- $\theta = 85°$ (black circle)

preliminary

σ_{1/p_T} (GeV^{-1}) vs Momentum (GeV)

20 degree: Track has combination hits from both VXD and FTD measurements
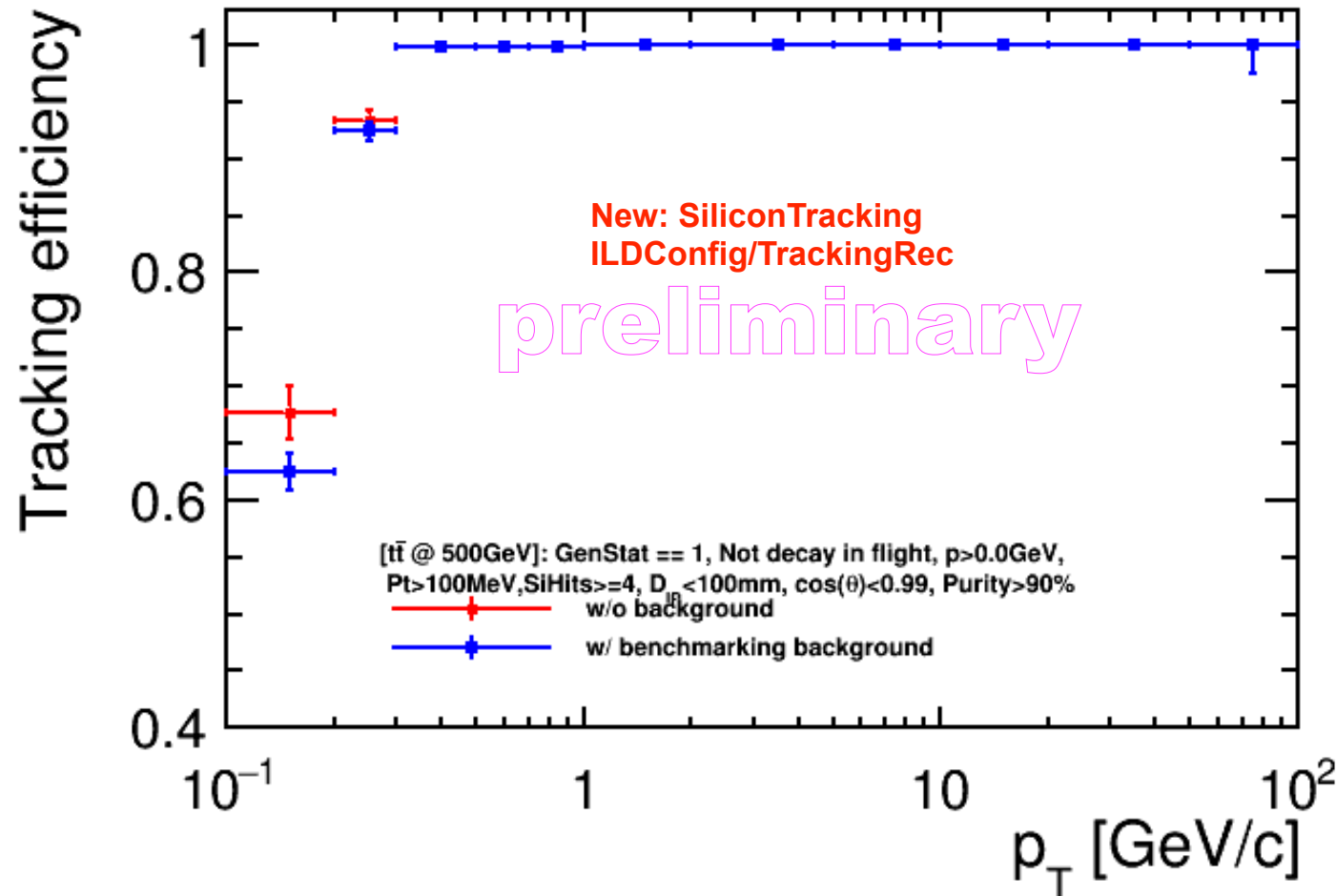Pattern recognition works fine.

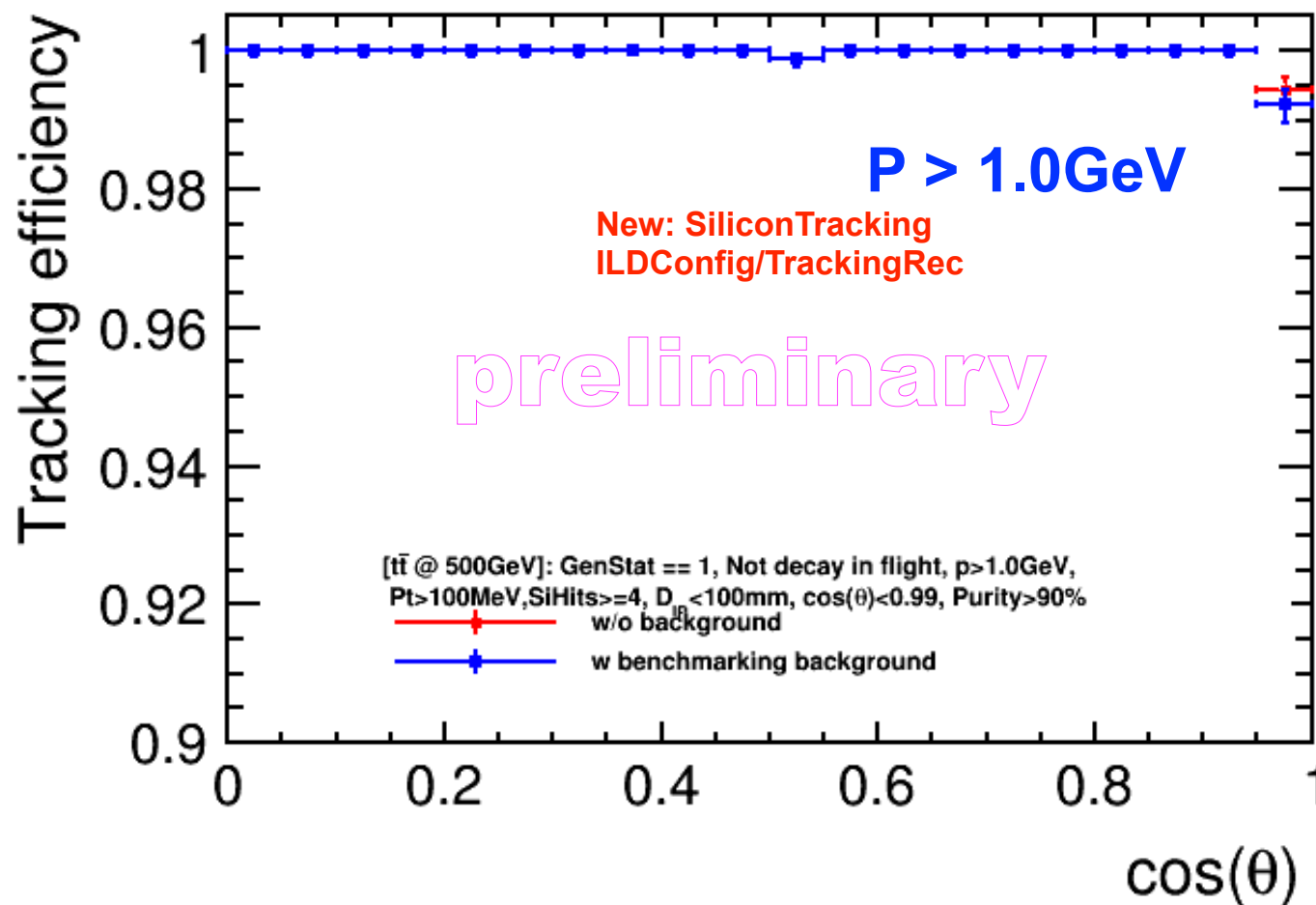# ILD tracking efficiency vs momentum

- With benchmarking background overlaid.
  - Lower momentum tracking performance became worse.

ILD tracking efficiency vs Pt

- With benchmarking background overlaid.
  - Lower Pt tracking performance became worse.
  - But they are still even better than DBD.

ILD tracking efficiency vs cos(θ) P > 1.0GeV

- With benchmarking background overlaid.
  - The forward tracking performance became worse.
  - With P> 1GeV, all are better than 99%

Summary

- The improvements are obviously visible over all momentum, pt and theta.

- All algorithms implemented in the software, can provide the similar performance with identical hardware.

  - The understanding and update on the SiliconTracking have been reported in this talk.

  - The conformal tracking has been reported last summer in Japan.

- The D0 and momentum resolutions are compatible with these update as before.

  - The VXD hits and FTD hits have been recognised and merged successfully at 20 degree transition region.

- The 2D plots help us to understand the improvements in detail for every corner of ILD detector.

- The tracking efficiency become worse with benchmarking background overlaid as physics sample.

  - More low momentum and low pt particles have been combined into the efficiency plots,

  - which can be clearly seen and understood in the 2D plots

- 100 BX pair bg @ 500 GeV have been simulated by Akiya

  - large/small model with anti-DID

  - to be used for tracking performance studies

DESY.