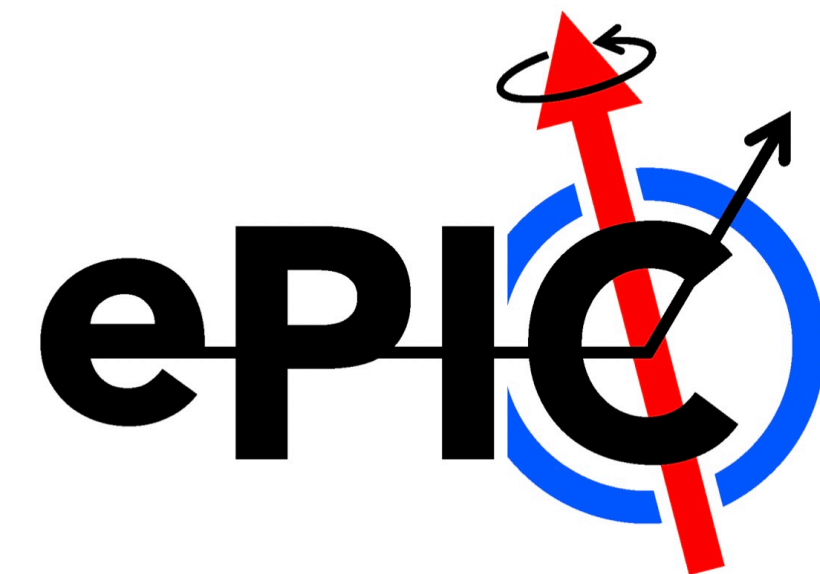# Realistic seeding update

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February 7th, 2023
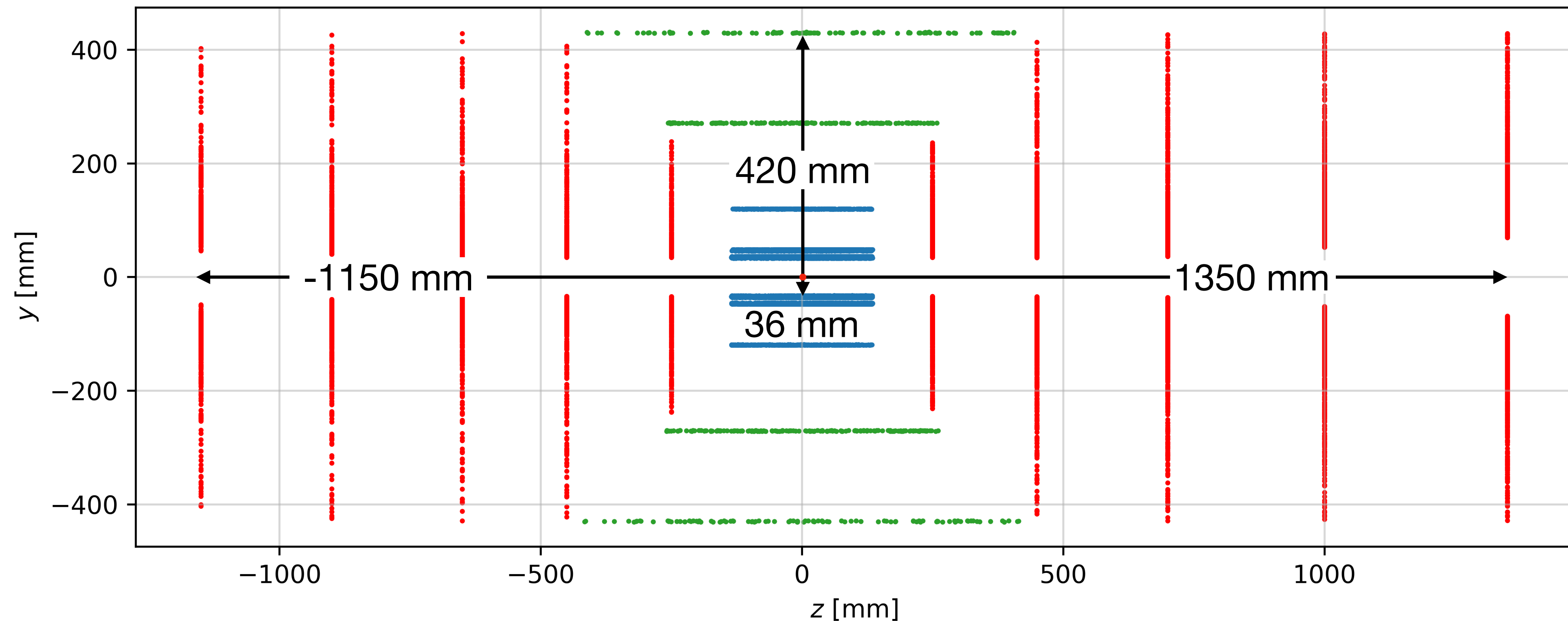
Parameter description

Parameter	Description	Y.S. Lai's default
bFieldInZ	z component of magnetic field	1.7 T
rMax	Maximum r value to look for seeds	440 mm
rMin	Minimum r value to look for seeds	33 mm
zMin	Minimum z value to look for seeds	-1500 mm
zMax	Maximum z value to look for seeds	1700 mm
beamPosX	Beam offset in x	0
beamPosY	Beam offset in y	0
deltaRMinTopSP	Min distance in r between middle and top SP in one seed	50 mm
deltaRMinBottomSP	Min distance in r between middle and bottom SP in one seed	50 mm
deltaRMaxTopSP	Max distance in r between middle and top SP in one seed	220 mm
deltaRMaxBottomSP	Max distance in r between middle and top SP in one seed	220 mm
collisionRegionMin	Min z for primary vertex	-250 mm
collisionRegionMax	Max z for primary vertex	250 mm
cotThetaMax	Cotangent of max theta angle	16.54
minPt	Min transverse momentum	100 MeV/cotThetaMax
maxSeedsPerSpM	Max number of seeds a single middle space point can belong to - 1	0
sigmaScattering	How many standard devs of scattering angles to consider	5
radLengthPerSeed	Average radiation lengths of material on the length of a seed	0.1
impactMax	Max transverse PCA allowed	3 mm
rMinMiddle	Min R for middle space point	—
rMaxMiddle	Max R for middle space point	—
bFieldMin	min B field	0.1 T

Parameter description

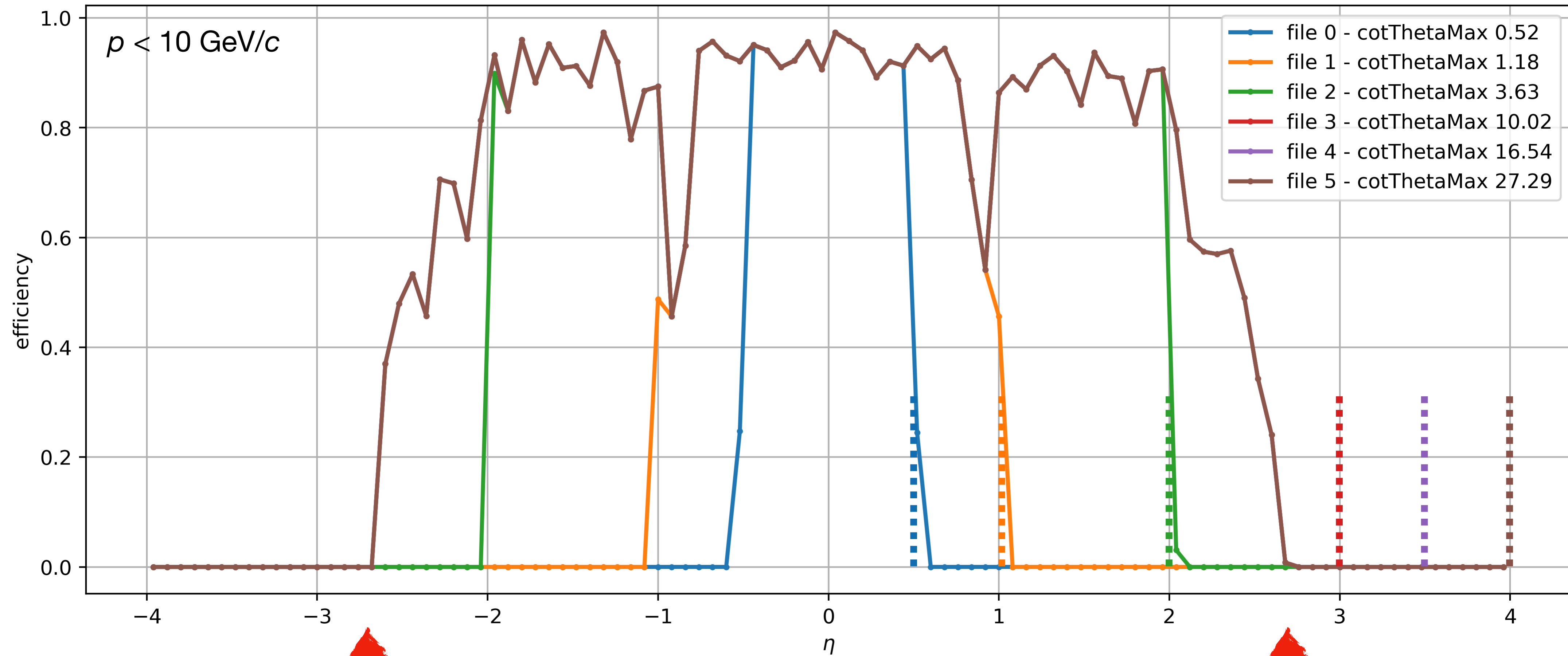| Parameter	Description	Y.S. Lai's default
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Cotangent of theta max
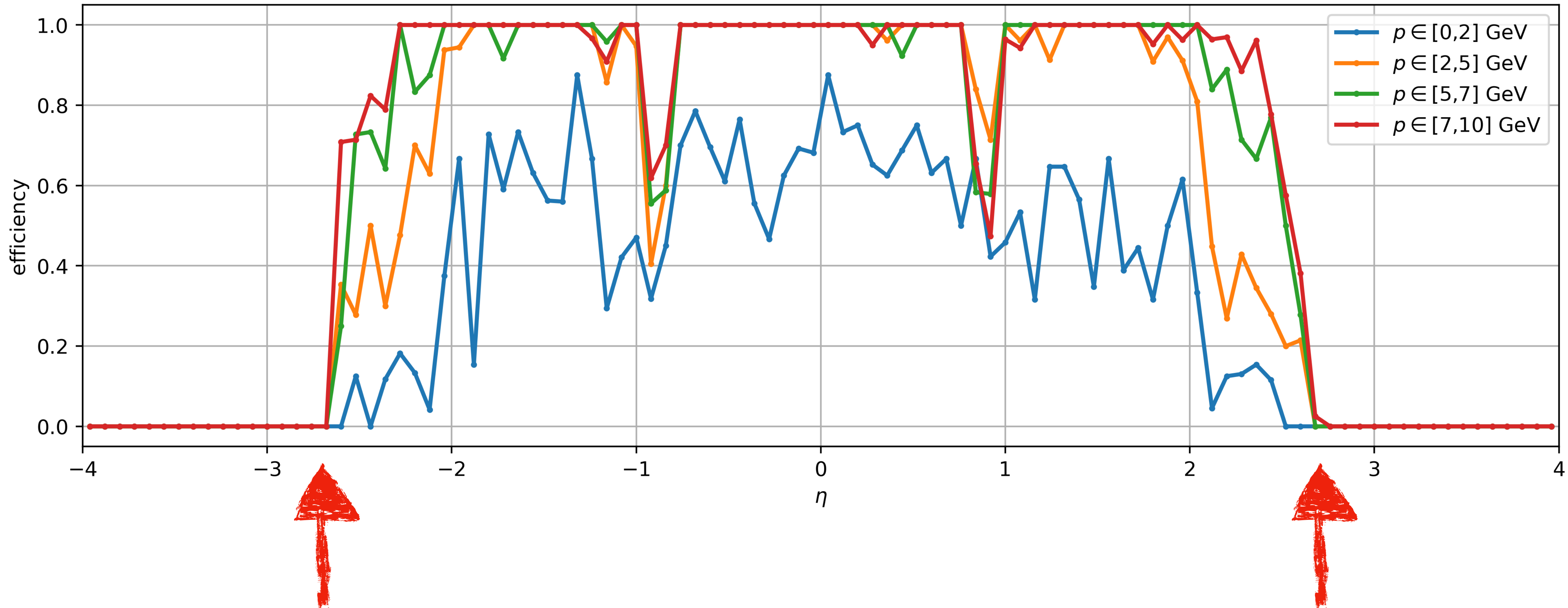
efficiency set to 1 if > 1 seeds reconstructed

$p < 10$ GeV/c

Legend:
- file 0 - cotThetaMax 0.52
- file 1 - cotThetaMax 1.18
- file 2 - cotThetaMax 3.63
- file 3 - cotThetaMax 10.02
- file 4 - cotThetaMax 16.54
- file 5 - cotThetaMax 27.29

$\cot(\theta_{max})$	θ_{max} [°]	η_{max}
0.52	62.5	0.5
1.18	40.4	1
3.63	15.4	2
10.02	5.70	3
16.54	3.46	3.5
27.29	2.10	4

Efficiency dependence on momentum

ACTS 21.1

file 1 - Juggler default, efficiency set to 1 if > 1 seeds reconstructed

Parameter description

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# Efficiency after changing deltaRminSP

ACTS 21.1

$p \in [1,3]$ GeV/c

efficiency set to 1 if > 1 seeds reconstructed

Legend:
- file 0 - deltaRMinSP 0
- file 1 - deltaRMinSP 5
- file 2 - deltaRMinSP 10
- file 3 - deltaRMinSP 15
- file 4 - deltaRMinSP 20
- file 5 - deltaRMinSP 30
- file 6 - deltaRMinSP 50
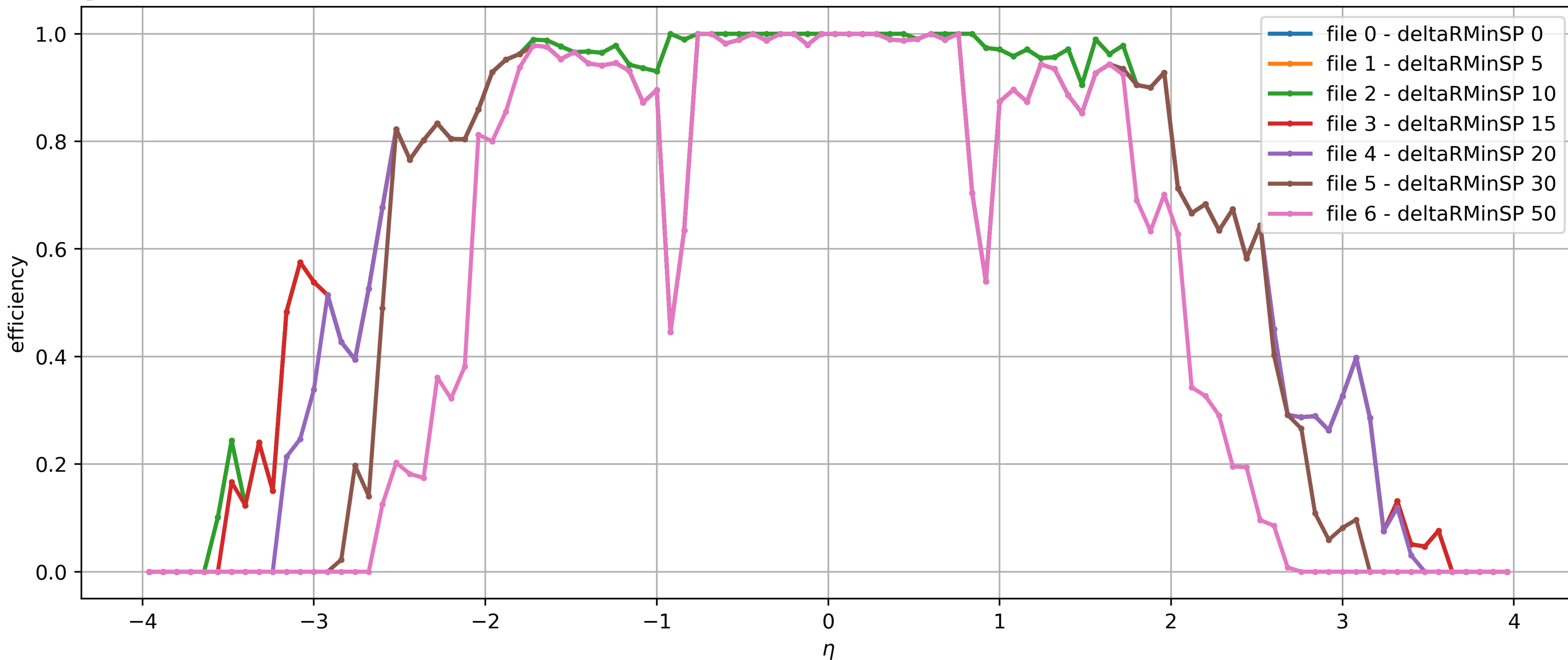
Efficiency after changing deltaRminSP

ACTS 21.1

file 0 - deltaRMinSP 5, efficiency set to 1 if > 1 seeds reconstructed
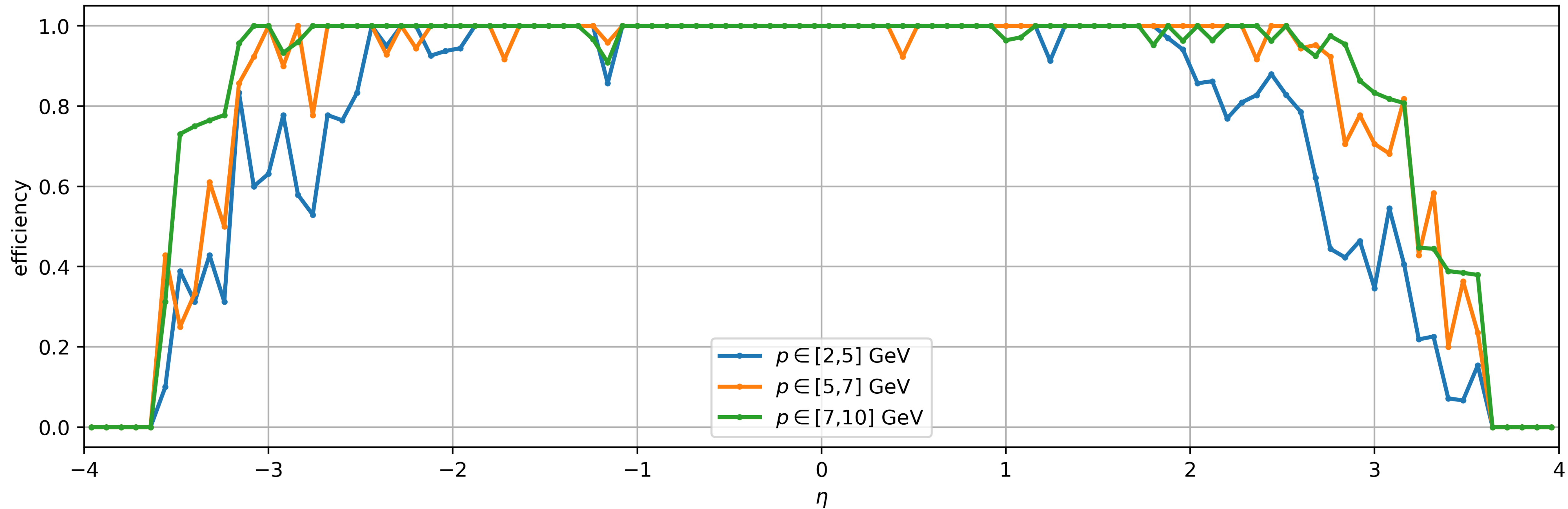
Same as previous results, but at higher momenta

From seeds to tracks

What we **<u>need</u>** in EICrecon

Hits	→	Realistic seeds	→	Realistic tracks (χ^2, n hits, …)

Filter out duplicate tracks, etc

From seeds to tracks

What we **<u>need</u>** in EICrecon

```
┌──────────┐         ┌──────────┐         ┌────────────────────┐
│   Hits   │────────▶│ Realistic│────────▶│  Realistic tracks  │
│          │         │  seeds   │         │ ($\chi^2$, n hits, …) │
└──────────┘         └──────────┘         └────────────────────┘
```

What we **<u>have</u>** in EICrecon

```
                         ┌──────────┐
                    ┌───▶│ Realistic│────▶ ✖
                    │    │  seeds   │
┌──────────┐        │    └──────────┘
│   Hits   │────────┤
└──────────┘        │    ┌──────────┐         ┌──────────────┐
                    └───▶│Truth seeds│────────▶│ Truth tracks │
                         └──────────┘         └──────────────┘
```

11
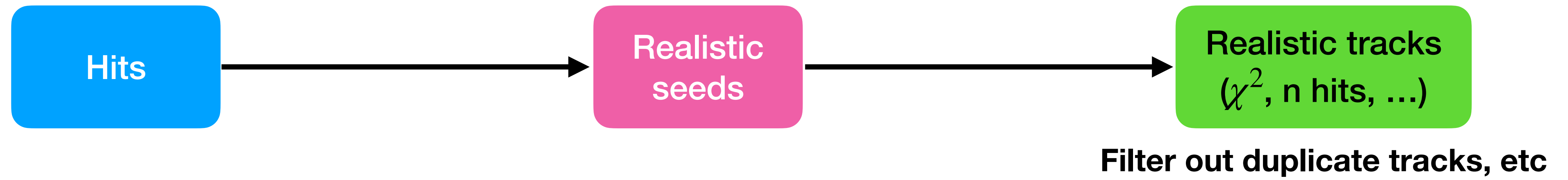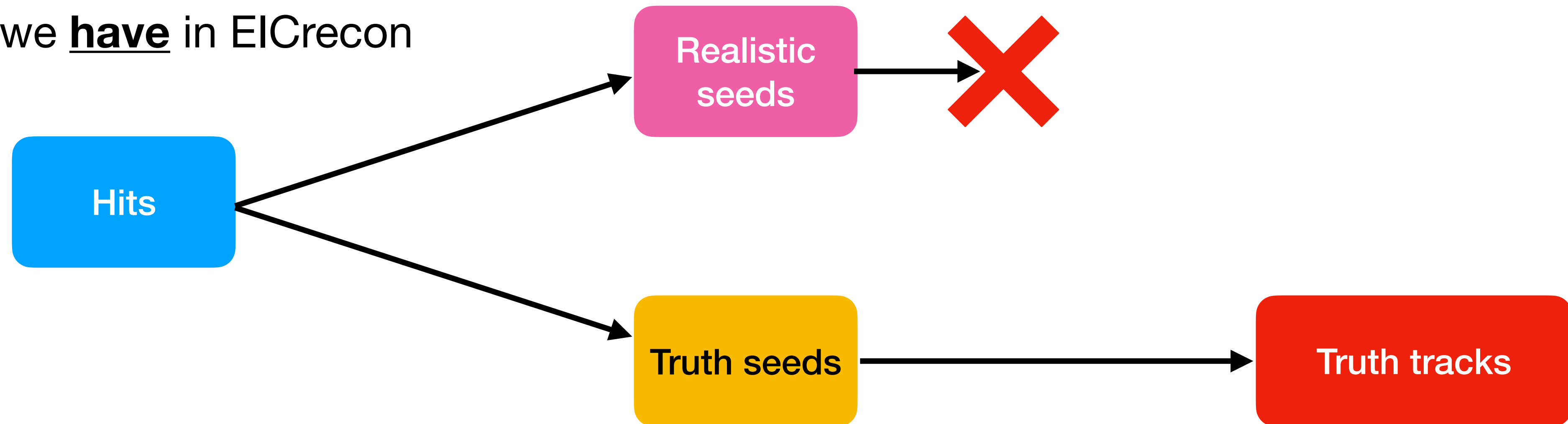
Summary

- Found additional parameters that improve realistic-seeding performance

- Still need to optimize the entire set. However, part of the optimization will come from track-reconstruction (rather than seed-finding) performance

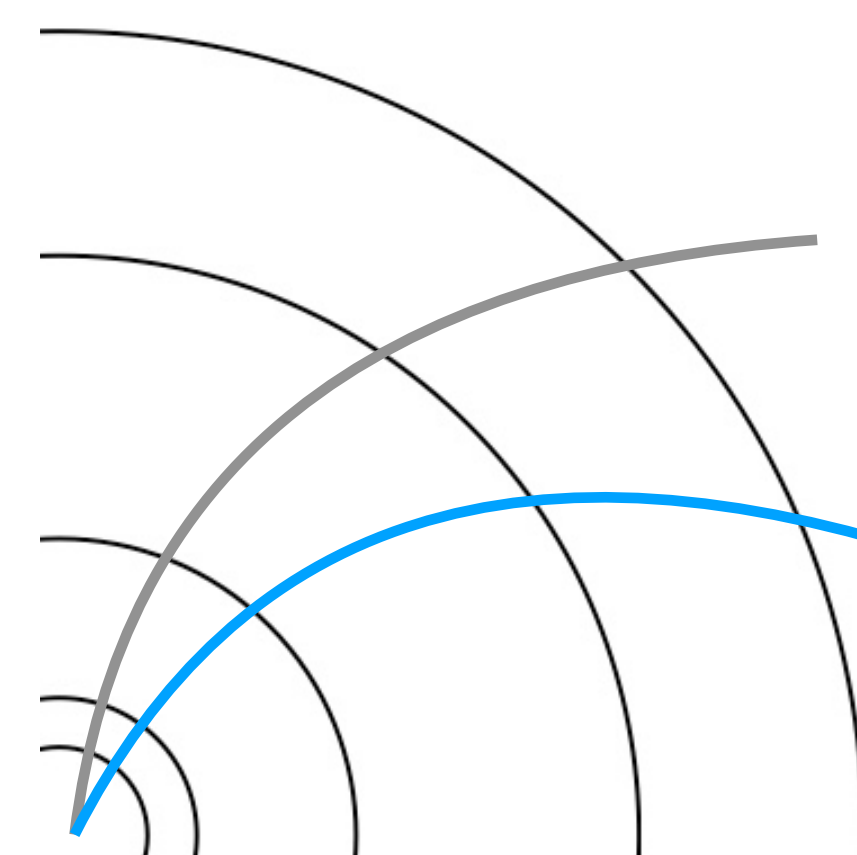- At the moment the realistic seeds are found, but not used. Barak will give an update on this topic.
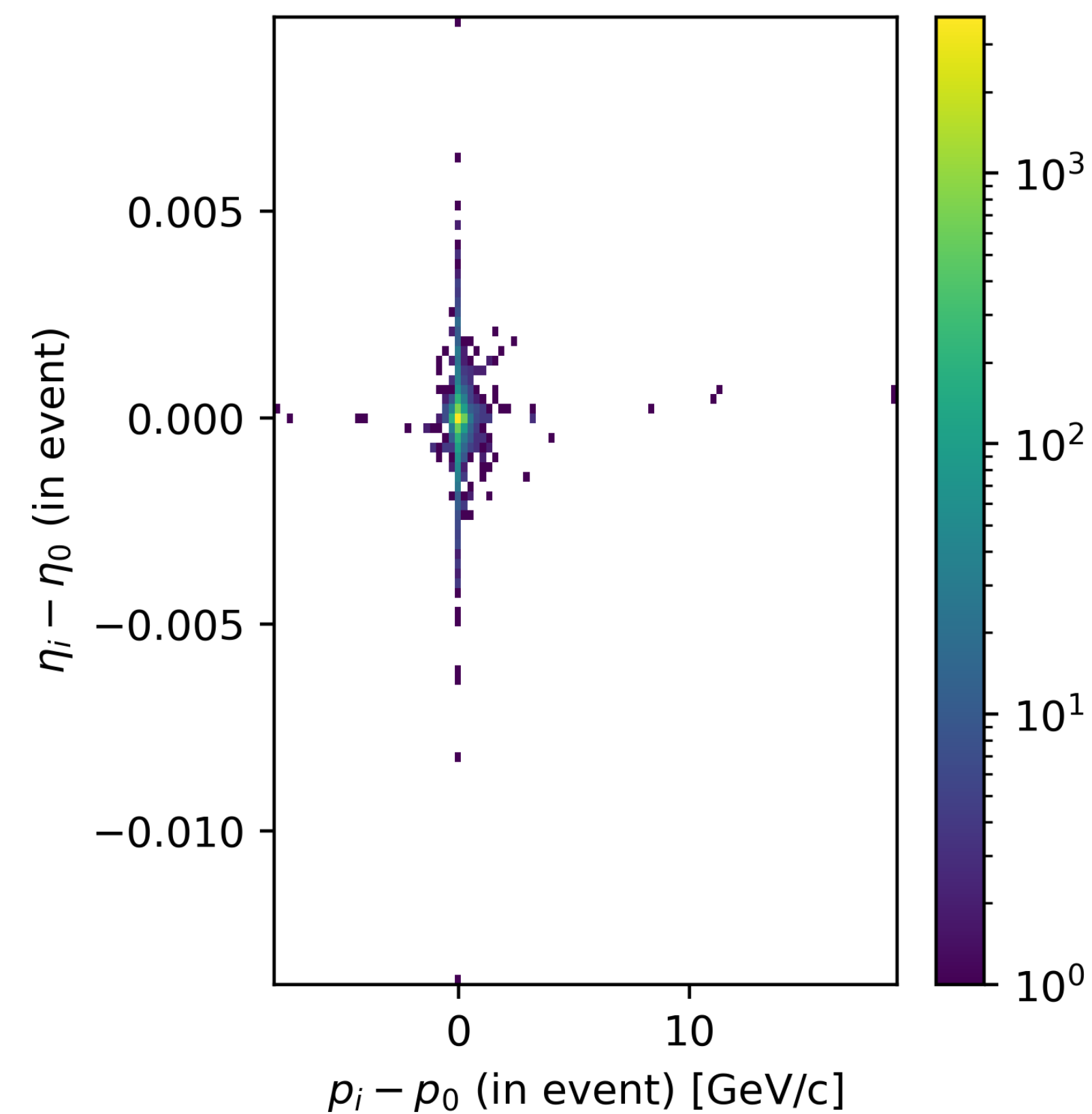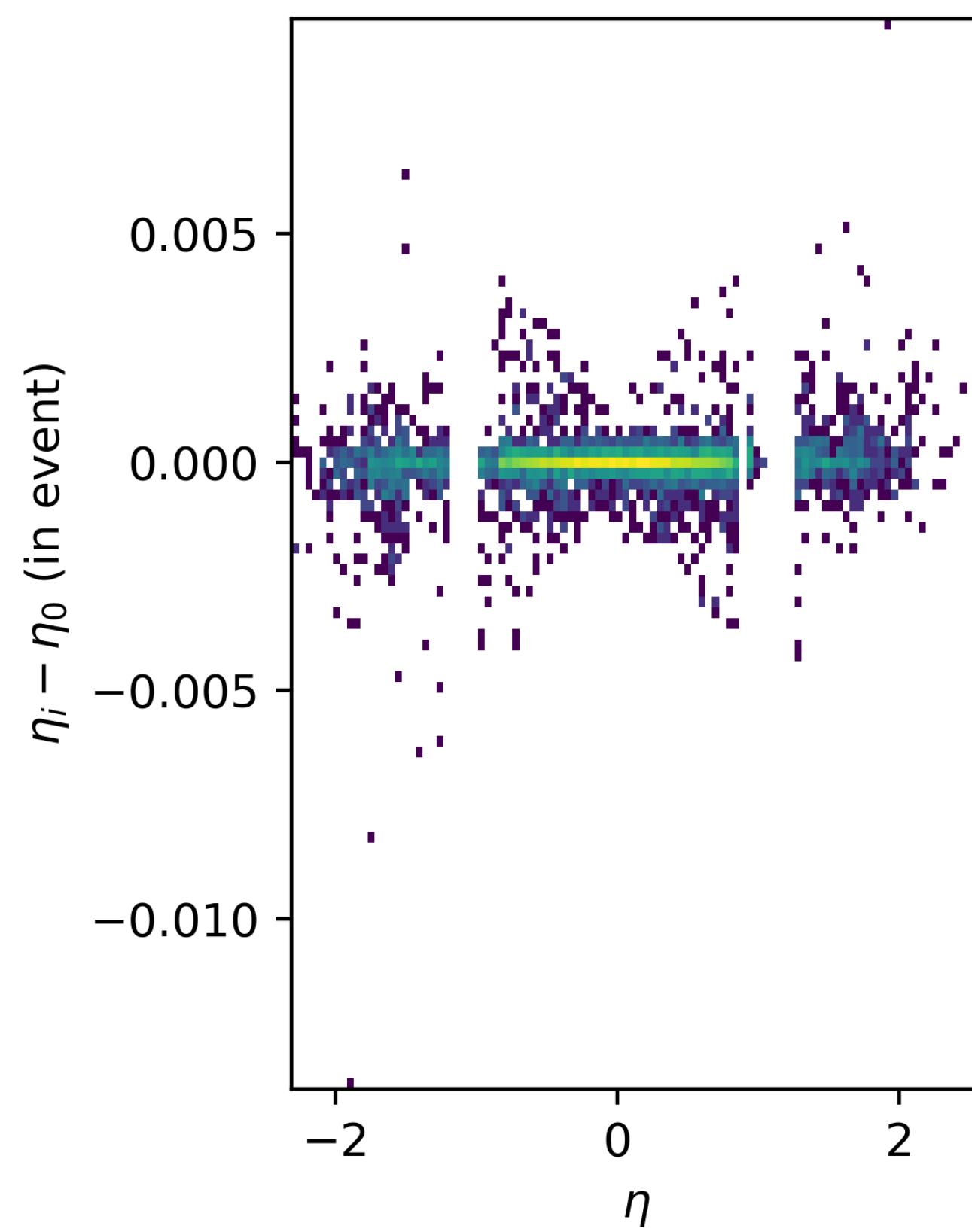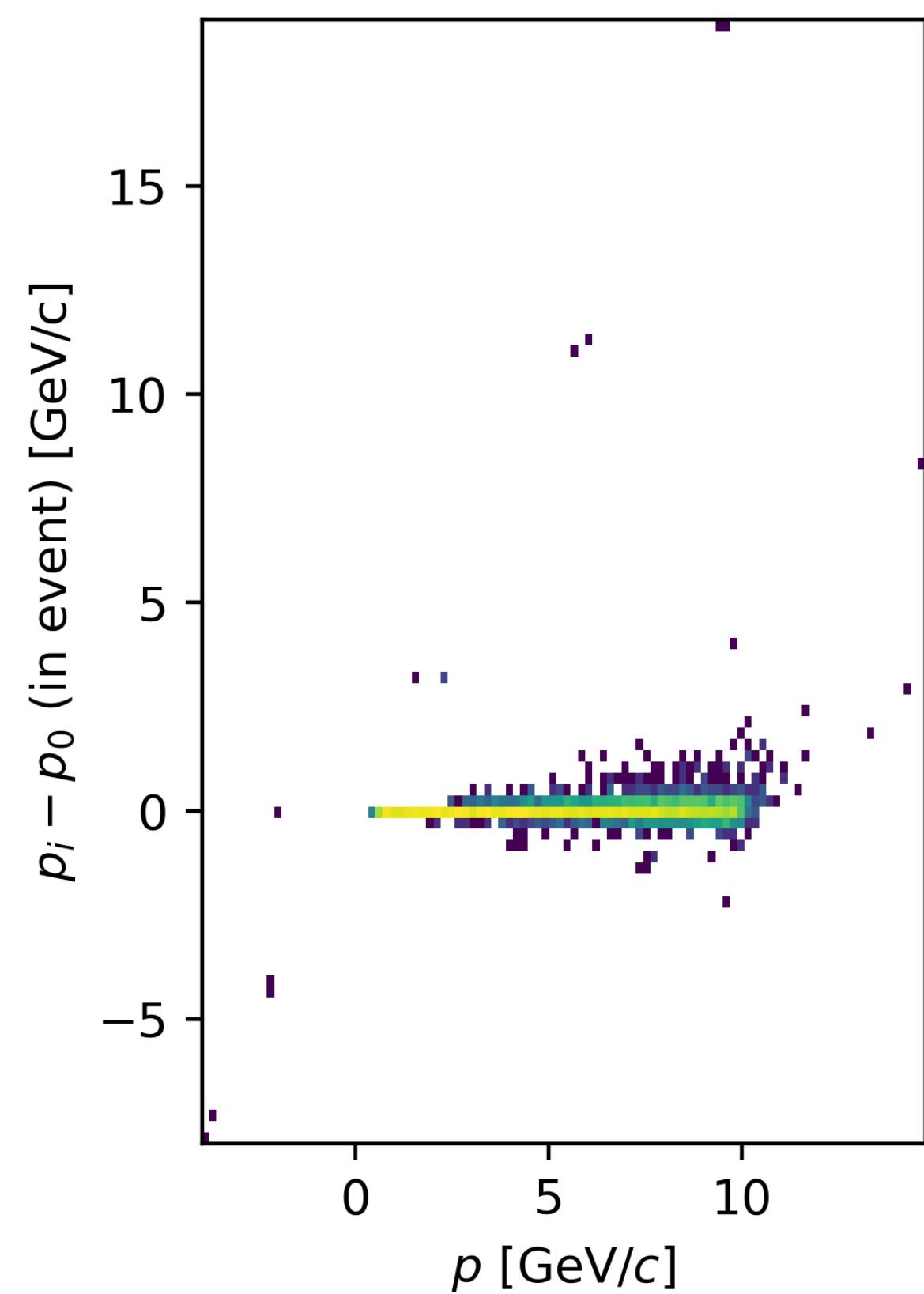
Backup
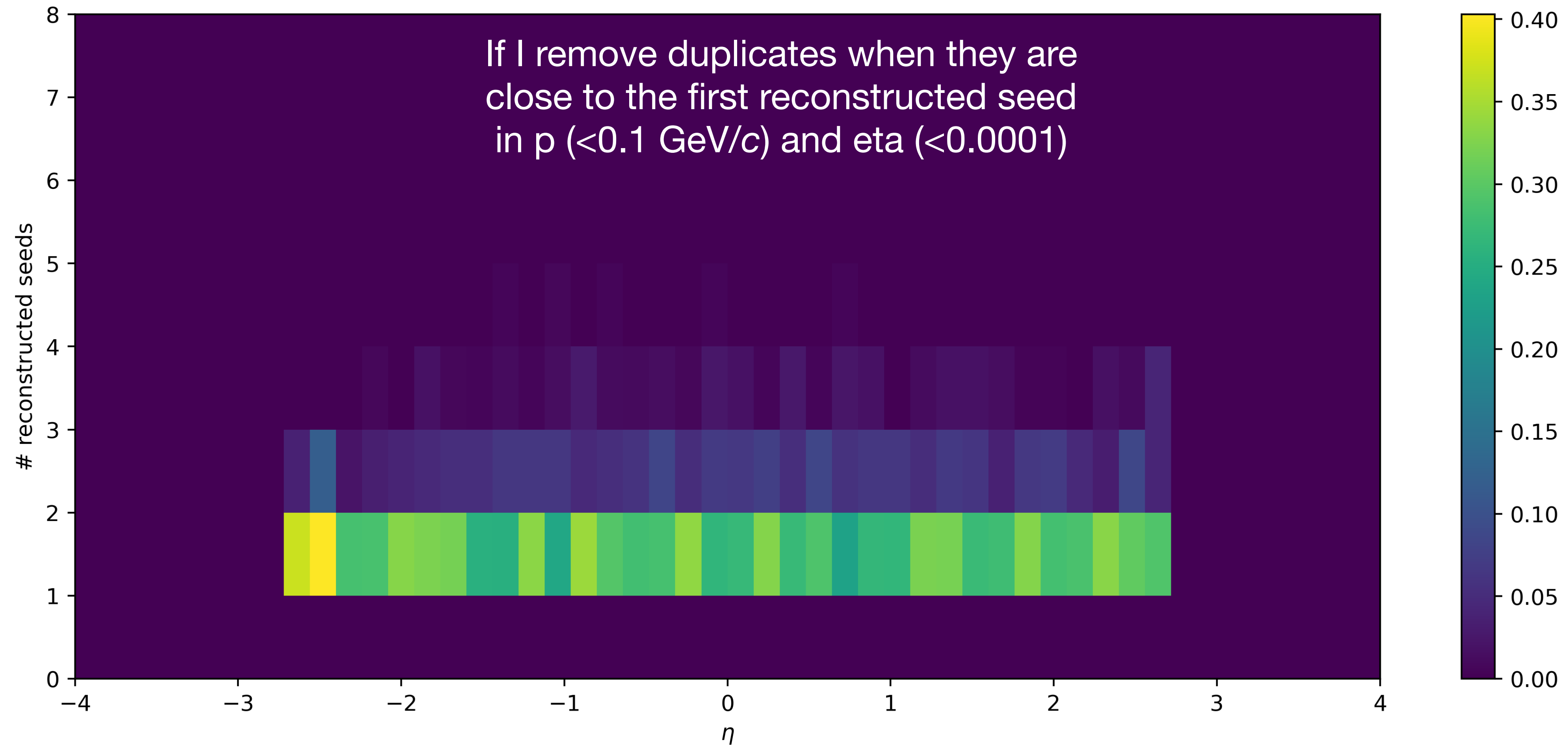
Duplicate seeds, not duplicate tracks?

Three seeds,
One track

vs
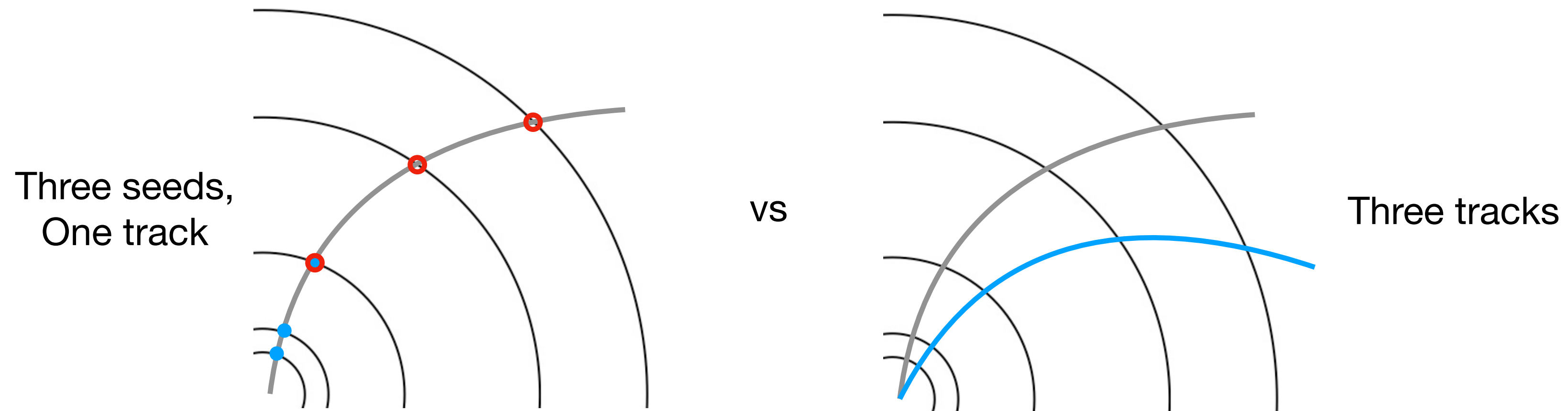
Three tracks

event	Particle	p	p-p0
0	0	p0	0
	1	p1	p1-p0
	2	p2	p2-p0
1	0	p0	0
	1	P1	p1-p0

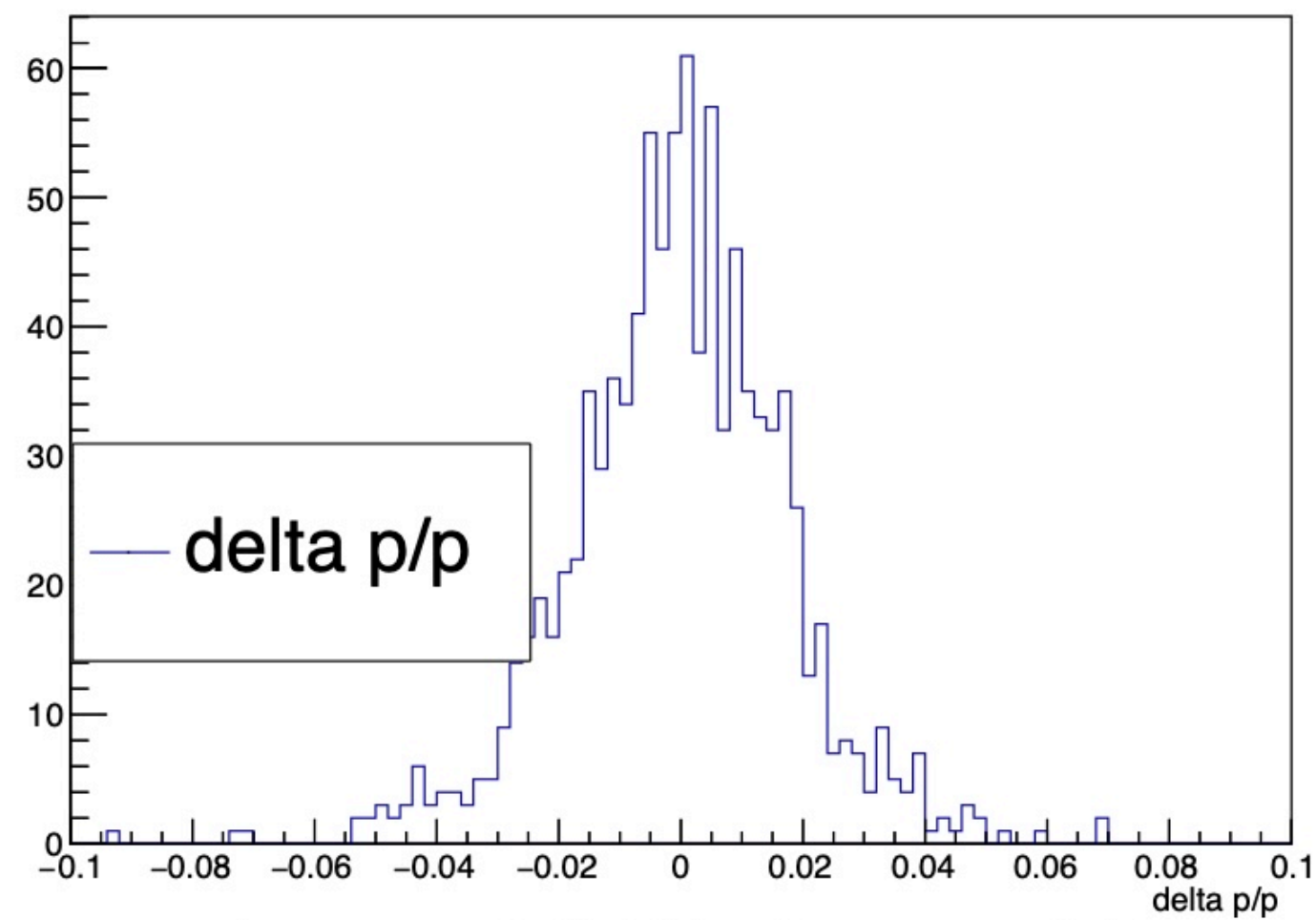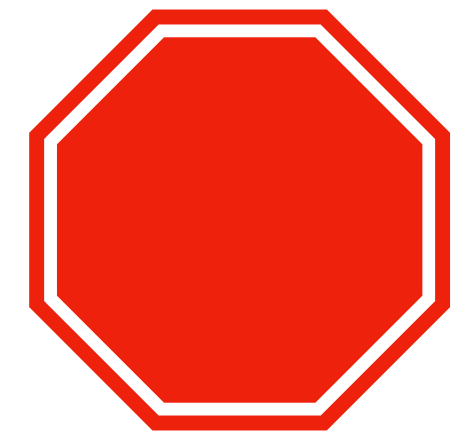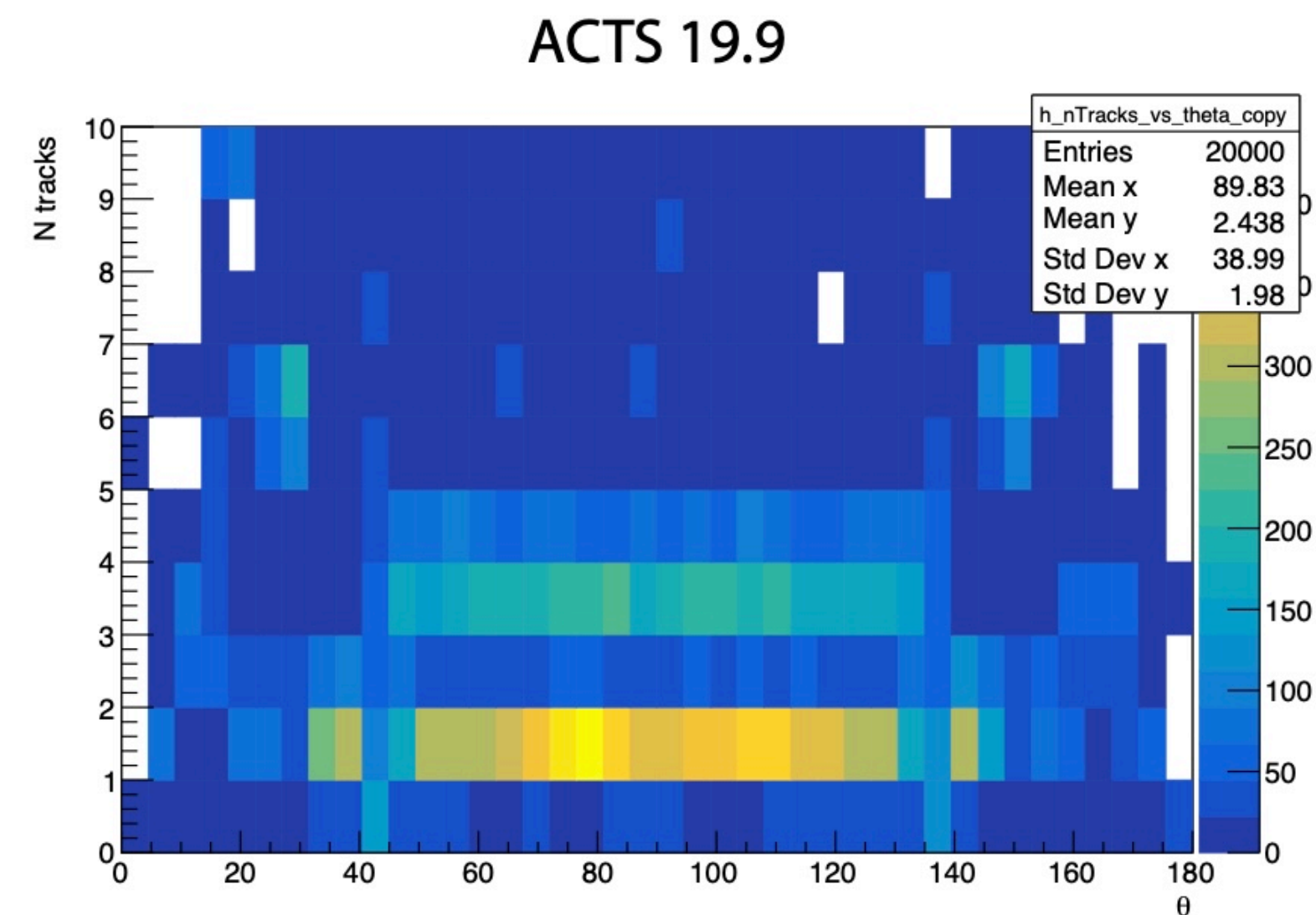# Duplicate seeds, not duplicate tracks?

Three seeds,
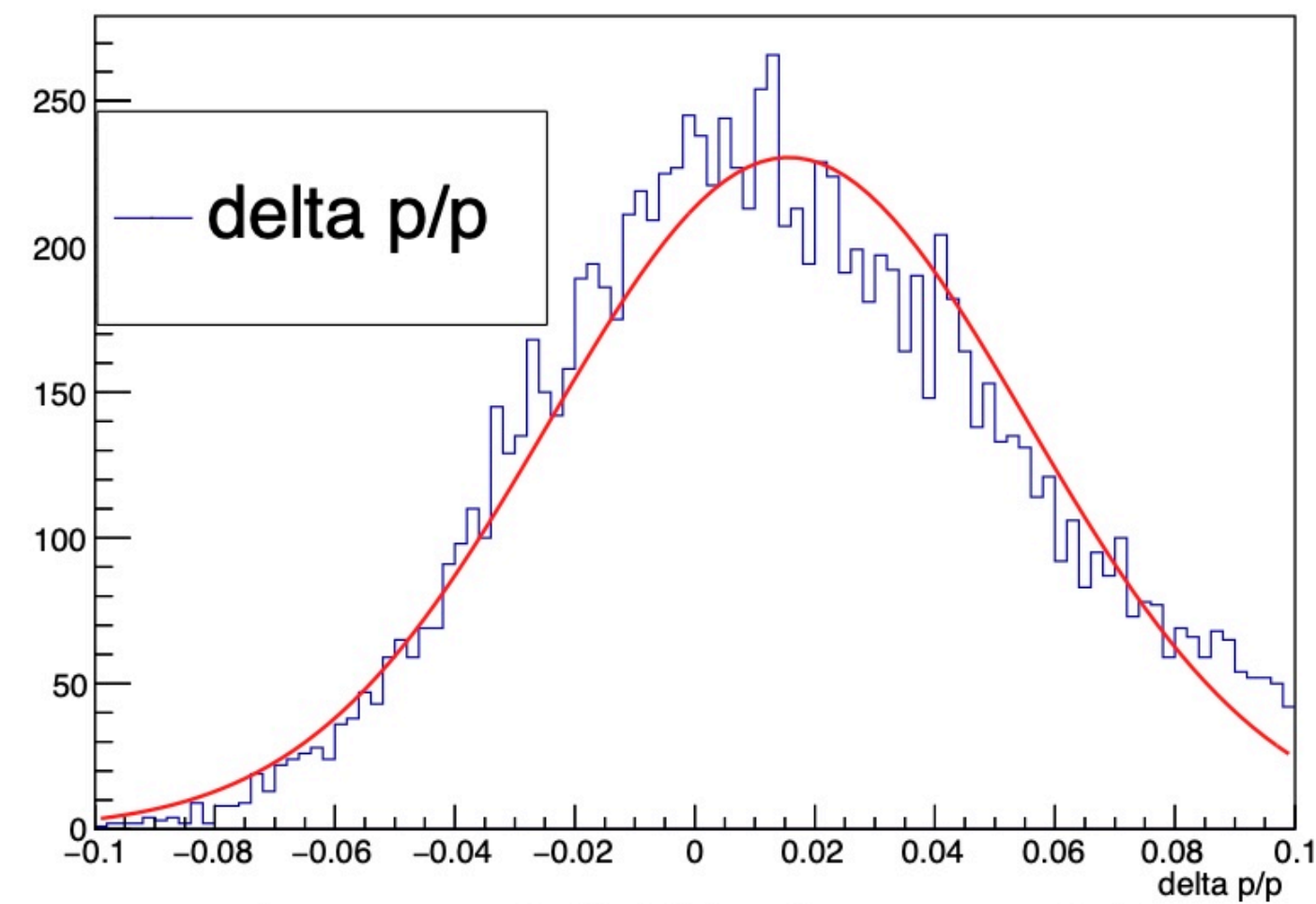One track

vs

Three tracks

Duplicate seeds, not duplicate tracks?

ACTS 21.1

If I remove duplicates when they are
close to the first reconstructed seed
in p (<0.1 GeV/c) and eta (<0.0001)

ACTS version impact
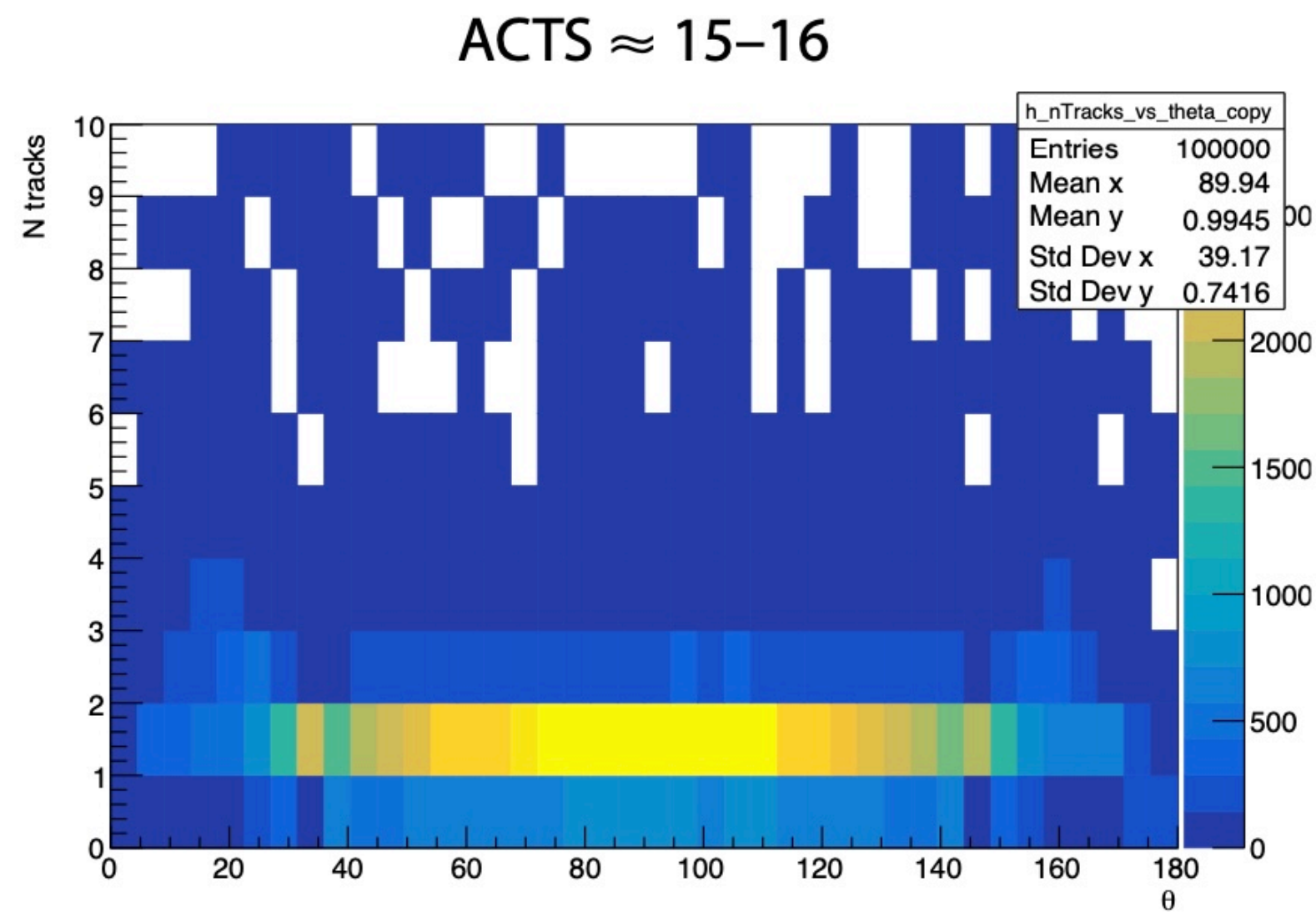
$1 < p < 2\,\mathrm{GeV}/c, 2 < \eta < 2.5$
ACTS 19.9, $\approx 2\%$

$1 < p < 2\,\mathrm{GeV}/c, 2 < \eta < 2.5$
ACTS 20.3, $3.98 \pm 0.03\%$