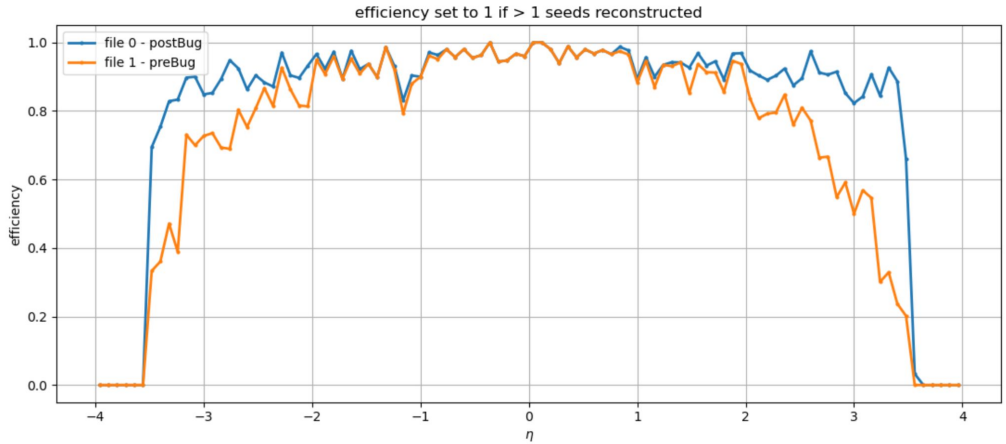
Parameter Exploration for Realistic Seeding - Update



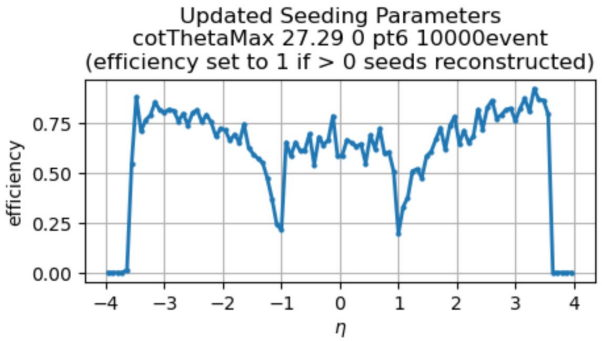
By Emma Yeats

Increased Statistics Update for Realistic Seeding Efficiency

To increase statistics, I ran 10000 events for single pions generated uniformly within three different pT ranges (see below).

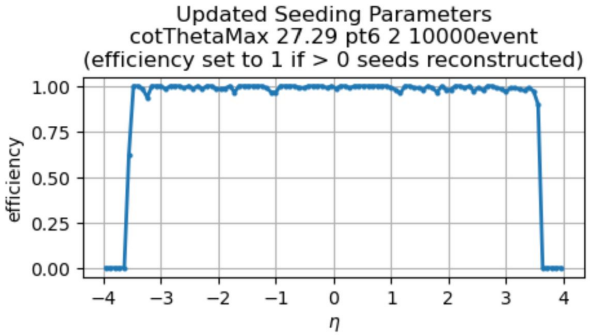
Plots shown are set to optimal parameters highlighted in previous updates.

$0 < p_T < 0.6$ GeV



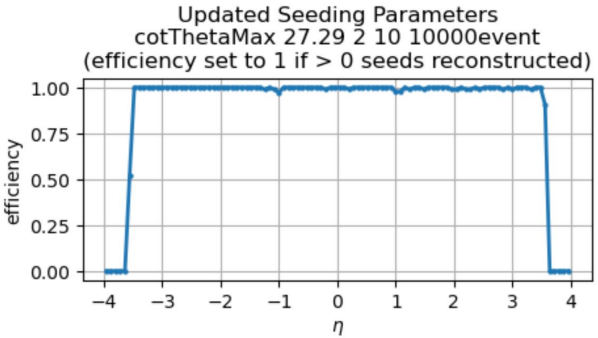
Let's break down this bin further

$0.6 < p_T < 2$ GeV



Looks good!

$2 < p_T < 10$ GeV



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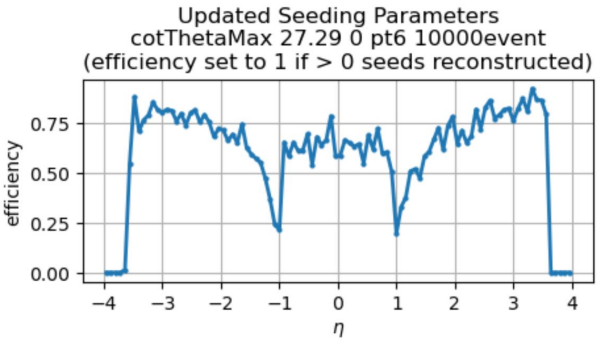

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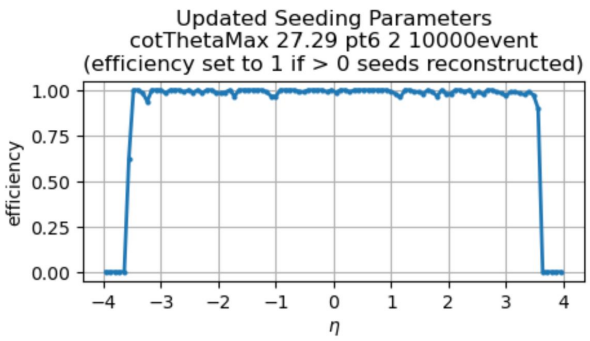

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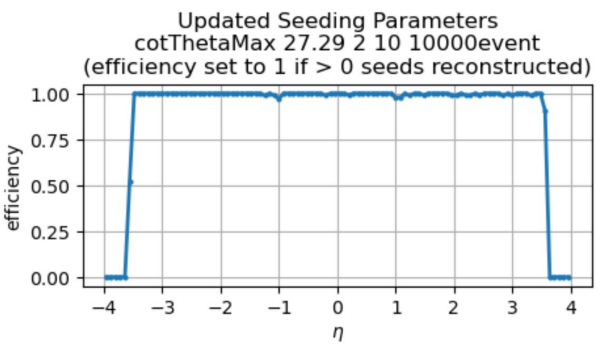
$2 < p_T < 10$ GeV



Looks good!

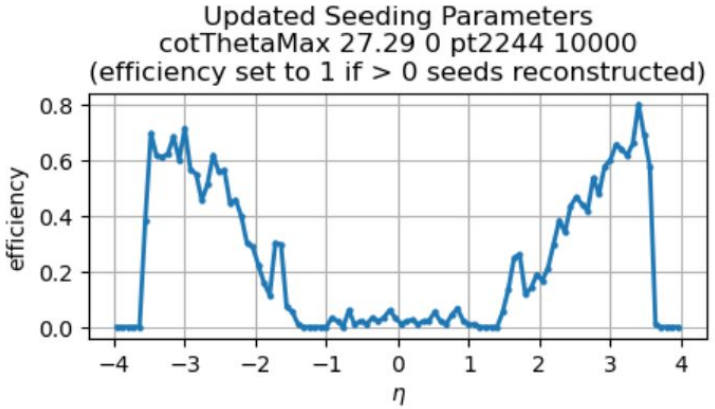
Increased Statistics Update for Realistic Seeding Efficiency

Based on a suggestion from Minjung Kim, we can make an educated guess on which momentum ranges to look at by using the range in *r* where we look for seeds. To see where the efficiency drops in the central η region, let's use our rMax variable (0.44 m) and our relationship between p_T, B and R:

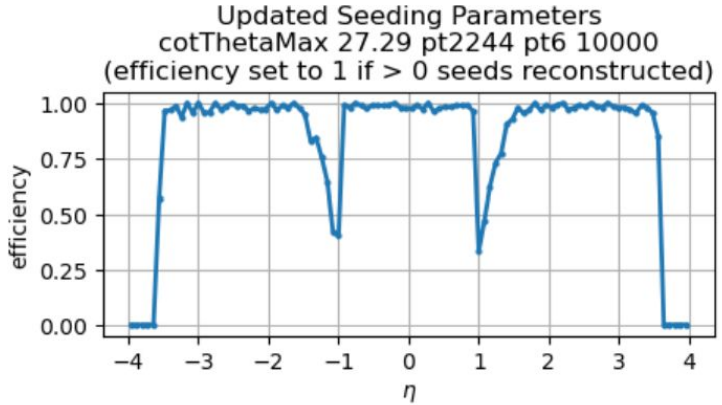
$$p[GeV/c] = 0.3 * R[m] * B[T]$$

From this we get p_T= 0.2244 GeV as a bin edge, which should correspond to tracks with low enough momentum that they don't make it to the outermost silicon layer:

0 < p_T < 0.2244 GeV



0.2244 < p_T < 0.6 GeV



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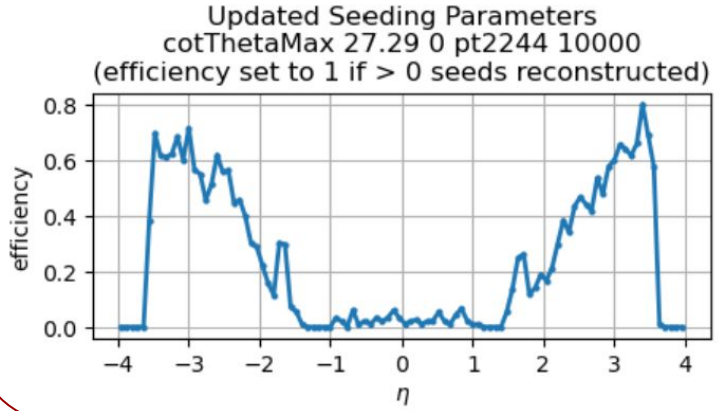
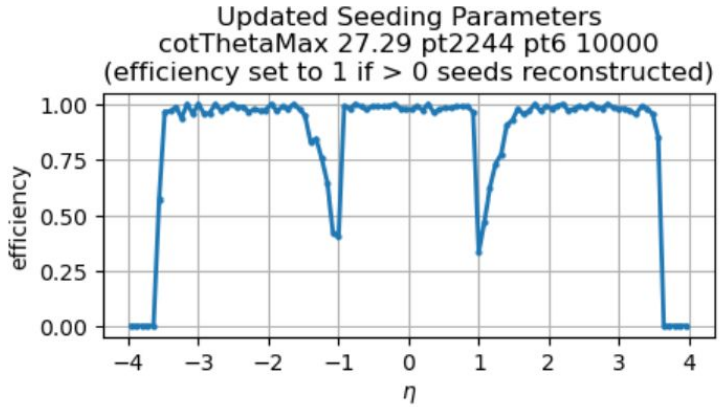
$$p[GeV/c] = 0.3 * R[m] * B[T]$$

From this we get p_T= 0.2244 GeV as a bin edge, which should correspond to not seeing tracks with low enough momentum that they don't make it to the outermost silicon layer:

$0 < p_T < 0.2244$ GeV



$0.2244 < p_T < 0.6$ GeV

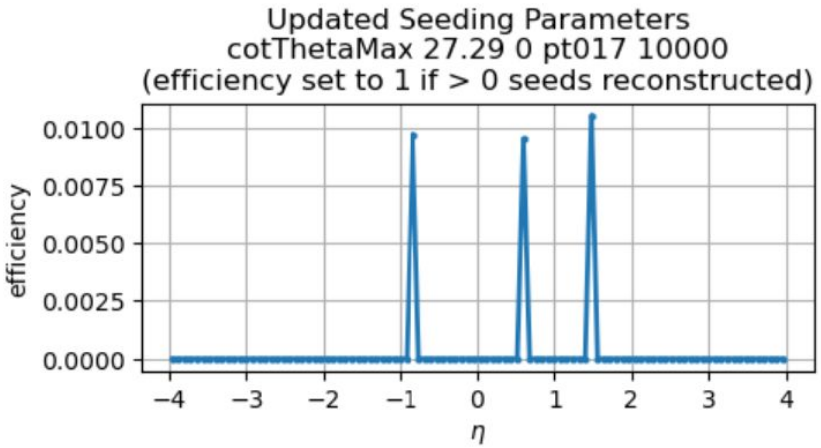


Increased Statistics Update for Realistic Seeding Efficiency

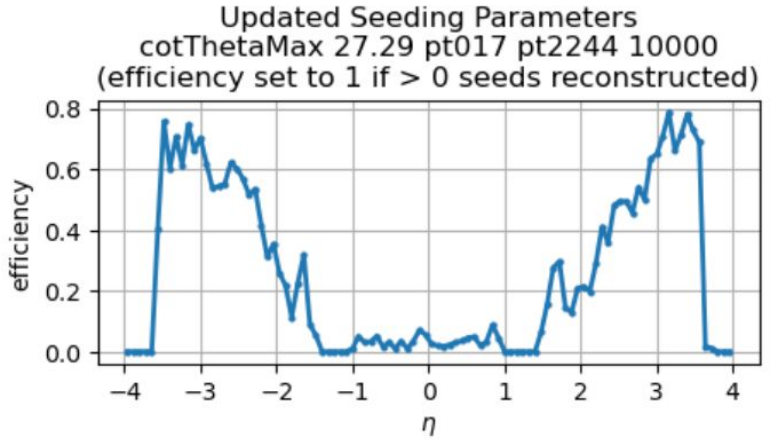
By the same logic, we shouldn't see much at all within our minimum *r* value, rMin = 0.033 m (the innermost layer).

Using the same method we get a corresponding p_T = 0.01683 GeV.

$0 < p_T < 0.01683$ GeV



$0.01683 < p_T < 0.2244$ GeV



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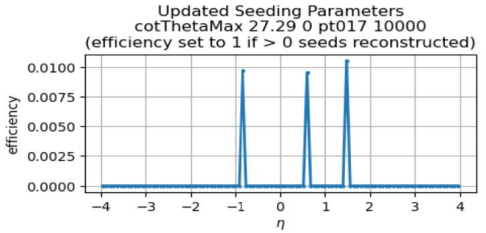
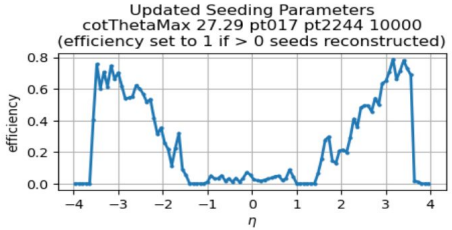
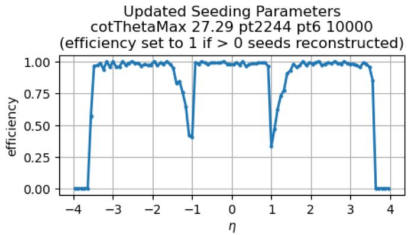


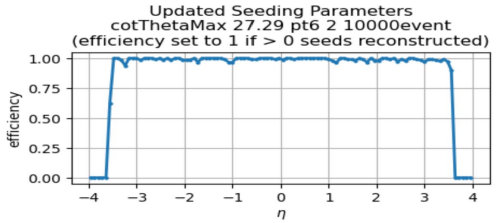
$0 < p_T < 0.01683$ GeV



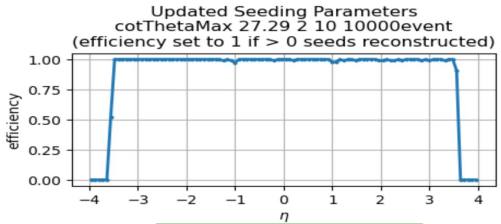
$0.01683 < p_T < 0.2244$ GeV



$0.2244 < p_T < 0.6$ GeV



$0.6 < p_T < 2$ GeV



$2 < p_T < 10$ GeV

Overall, we see really good performance in the last two bins, and can also see the effect of the detector configuration on the efficiency :)

Reference - Parameters for Realistic Seeding Efficiency Studies

Parameter	Description	ElCrecon default	Y.S. Lai's default	My New Default
bFieldInZ	z component of magnetic field	1.7 T	1.7 T	1.7 T
rMax	Maximum r value to look for seeds	500 mm	440 mm	440 mm
rMin	Minimum r value to look for seeds	33 mm	33 mm	33 mm
zMin	Minimum z value to look for seeds	-800 mm	-1500 mm	-1500 mm
zMax	Maximum z value to look for seeds	800 mm	1700 mm	1700 mm
beamPosX	Beam offset in x	0	0	0
beamPosY	Beam offset in y	0	0	0
deltaRMinTopSP	Min distance in r between middle and top SP in one seed	1 mm	50 mm	**10 mm**
deltaRMinBottomSP	Min distance in r between middle and bottom SP in one seed	1 mm	50 mm	**10 mm**
deltaRMaxTopSP	Max distance in r between middle and top SP in one seed	400 mm	220 mm	**200 mm**
deltaRMaxBottomSP	Max distance in r between middle and top SP in one seed	400 mm	220 mm	**200 mm**
collisionRegionMin	Min z for primary vertex	-300 mm	-250 mm	-250 mm
collisionRegionMax	Max z for primary vertex	300 mm	250 mm	250 mm
cotThetaMax	Cotangent of max theta angle	16	16.54	**27.29**
minPt	Min transverse momentum	100	100 MeV/cotThetaMax	100 MeV/cotThetaMax
maxSeedsPerSpM	Max number of seeds a single middle space point can belong to - 1	1	0	0
sigmaScattering	How many standard devs of scattering angles to consider	5	5	5
radLengthPerSeed	Average radiation lengths of material on the length of a seed	0.1	0.1	0.1
impactMax	Max transverse PCA allowed	20 mm	3 mm	3 mm
rMinMiddle	Min R for middle space point	20 mm	—	-
rMaxMiddle	Max R for middle space point	400 mm	—	-
bFieldMin	min B field	—	0.1 T	0.1