A Study of Mapping for g2p instead of Reconstruction?

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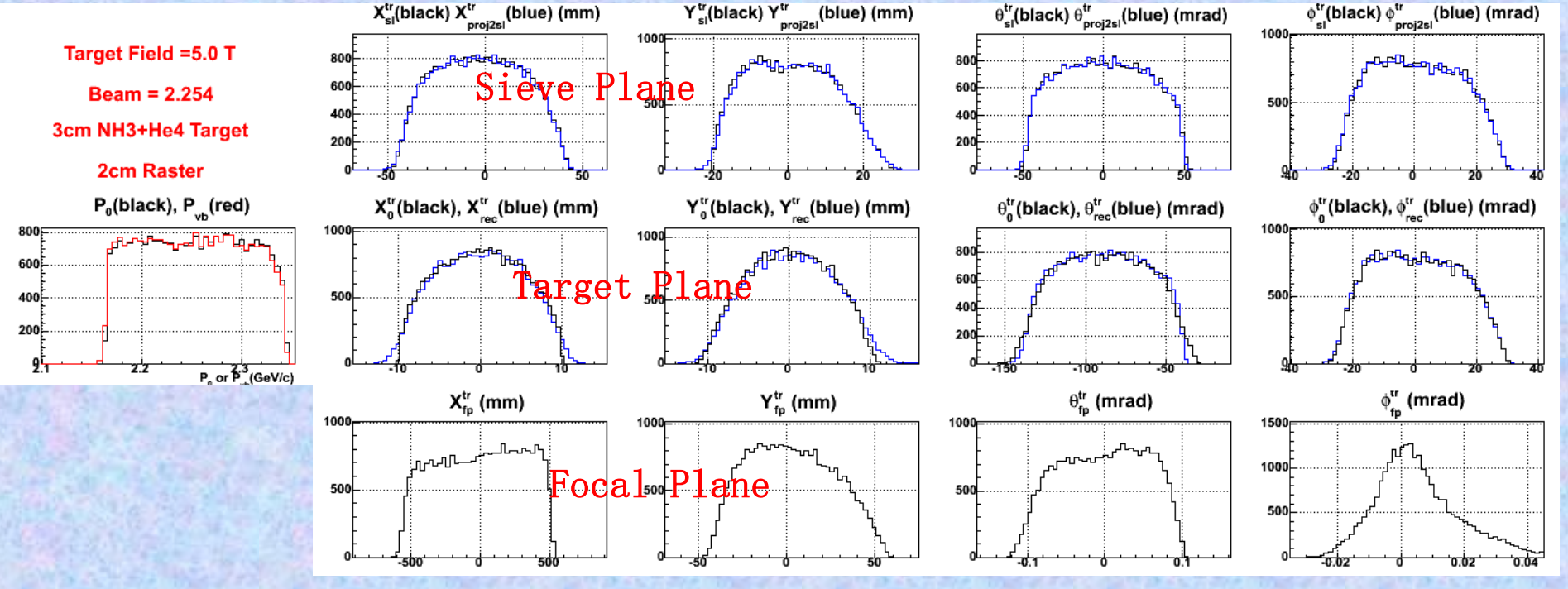
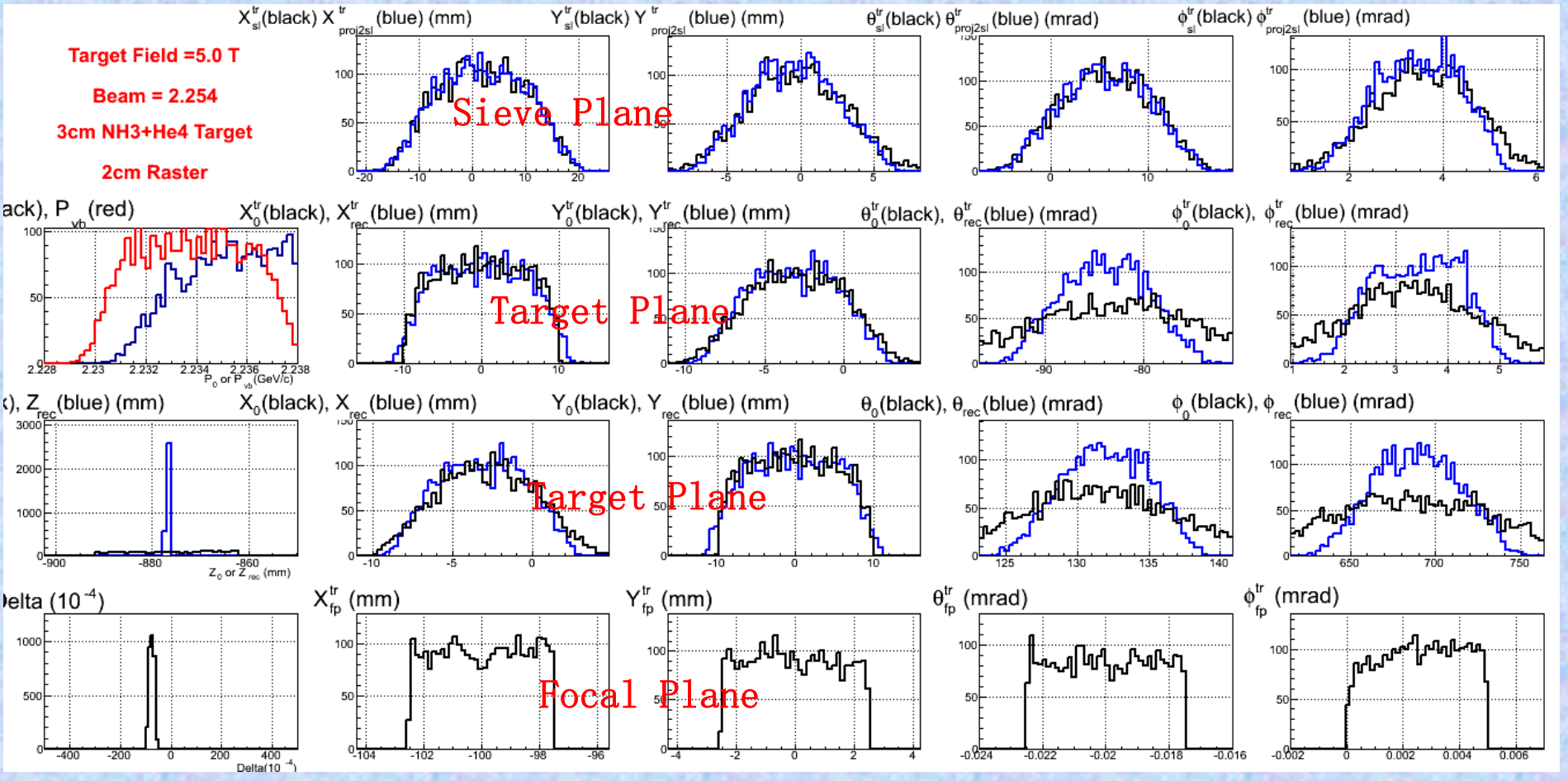
Kenimatic Coverage



5.0 T target field, Delta covers +/- 4.5%

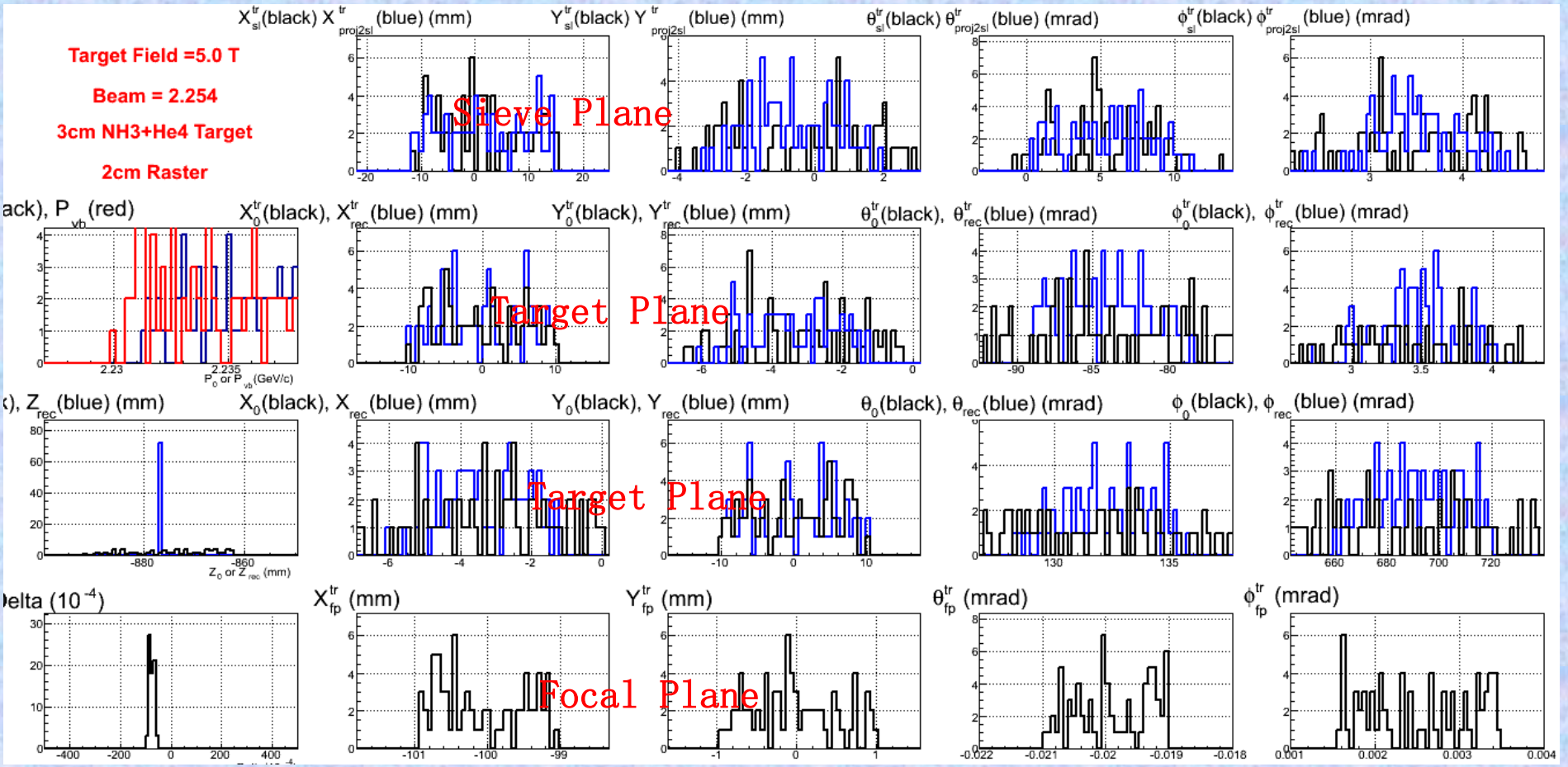
First of all, select 4-D bins in the Focal Plane or the Sieve Plane then look at the distribution of x, theta, y, phi at the Target Plane

Map The Focal Plane, Binned by 5-5-5-5



Select 4-D bins in the Focal Plane, look at the distribution of x, theta, y, phi at the Target Plane

Map Focal Plane, Binned by 2-2-2-2



Change to smaller 4-D grid in the Focal Plane will not reduce the distribution width in the Target Plane

CPU Time Cost for Doing Mapping at FP

Coverage in FP:	Bin Width:	Number of Bins:
-600<x<600	BinWidth_x=2mm	NumBin_x=600
-0.12<theta<0.10	BinWidth_theta=2mr	NumBin_theta=110
-46<y<54	BinWidth_y=2mm	NumBin_y=50
-0.024<phi<0.046	BinWidth_phi=2mr	NumBin_phi=35

Number of events:

Assuming x-theta-y-phi are binned as 2mm-2mr-2mm-2mr, each bin need to simulate 100 events in average, the total number of Focal Plane events will be:

100 x 600 x 110 x 50 x 35 = **11550** M

Considering only 40% of the thrown events can reach the Focal Plane, the total number of thrown events will be:

11550 /40% = **28875** M

CPU Time:

For 5T target field, it costs about 1.5 hours to run one million thrown events with one CPU. The total CPU time will be:

28875 x 1.5 = **43312.5** (hours/CPU)

Or **602** farm jobs if each job run for 72 hours. **(15 days if 128 jobs are running parallely.)**

If Bin The Focal Plane by 5-5-5-5 ...

Number of events can be reduced by a factor of 2.5^4 , almost 40.

CPU Time:

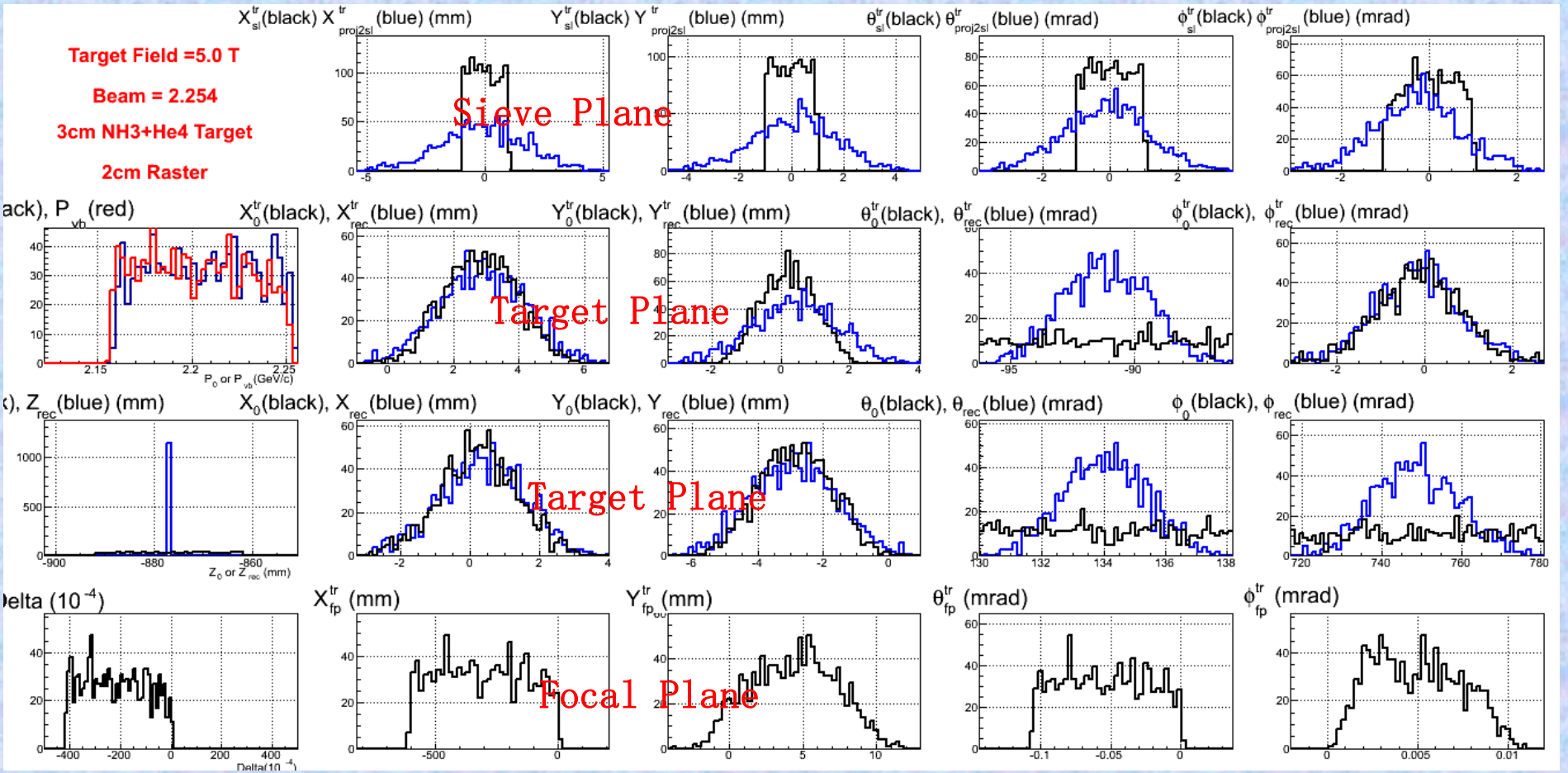
43312.5 /40 = 1082 (hours/CPU)

Or 128 farm jobs if each job run for 8 hours. Somewhat practicable.

The HRSMC program can run about 2-3 times faster if reconstruction and Drift-In-Field module are both turned off. These modules are not needed if we decided to do mapping.

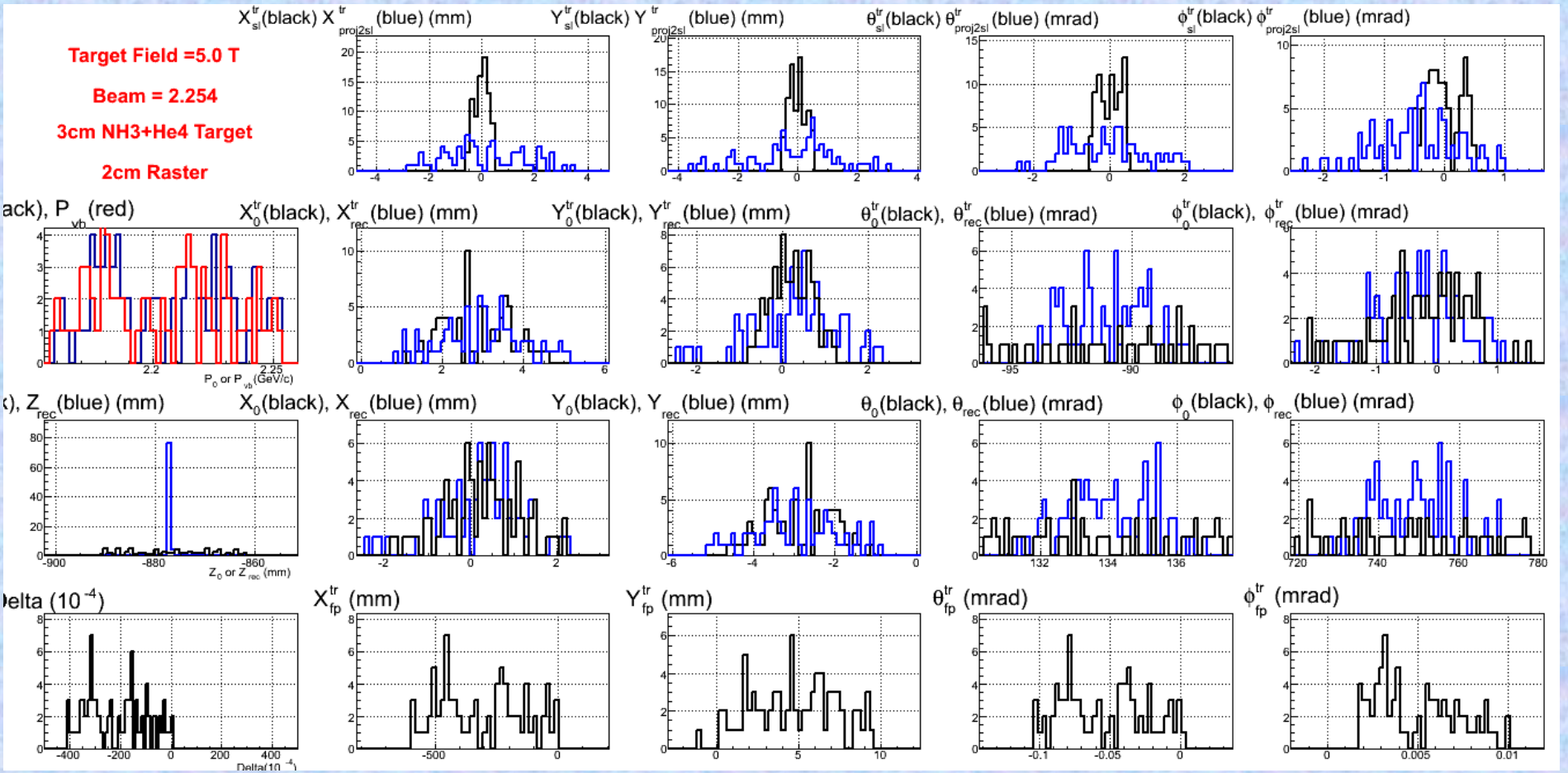
The event generator can also be improved such that less events need to be generatated. This might reduce the total CPU time to 75%.

Map Sieve Plane, Binned by 2-2-2-2



Select 4-D bins in the Sieve Plane, look at the distribution of x, theta, y, phi at the Target Plane

Map Sieve Plane, Binned by 1-1-1-1



Change to smaller 4-D grid in the Sieve Plane will not reduce the distribution width of Theta in the Target Plane

If we do mapping at Sieve Plane...

Coverage in FP:	Bin Width:	Number of Bins:
-46<x<46	BinWidth_x=2mm	NumBin_x=46
-0.05<theta<0.05	BinWidth_theta=2mr	NumBin_theta=50
-24<y<26	BinWidth_y=2mm	NumBin_y=25
-0.026<phi<0.030	BinWidth_phi=2mr	NumBin_phi=28

Number of events:

Assuming x-theta-y-phi are binned as 2mm-2mr-2mm-2mr, each bin need to have 100 events hit the focal plane, the total number of Focal Plane events will be:

100 x 46 x 50 x 25 x 28 = **161** M

Considering only 40% of the thrown events can reach the Focal Plane, the total number of thrown events will be:

11550 /40% = **402.5** M

CPU Time:

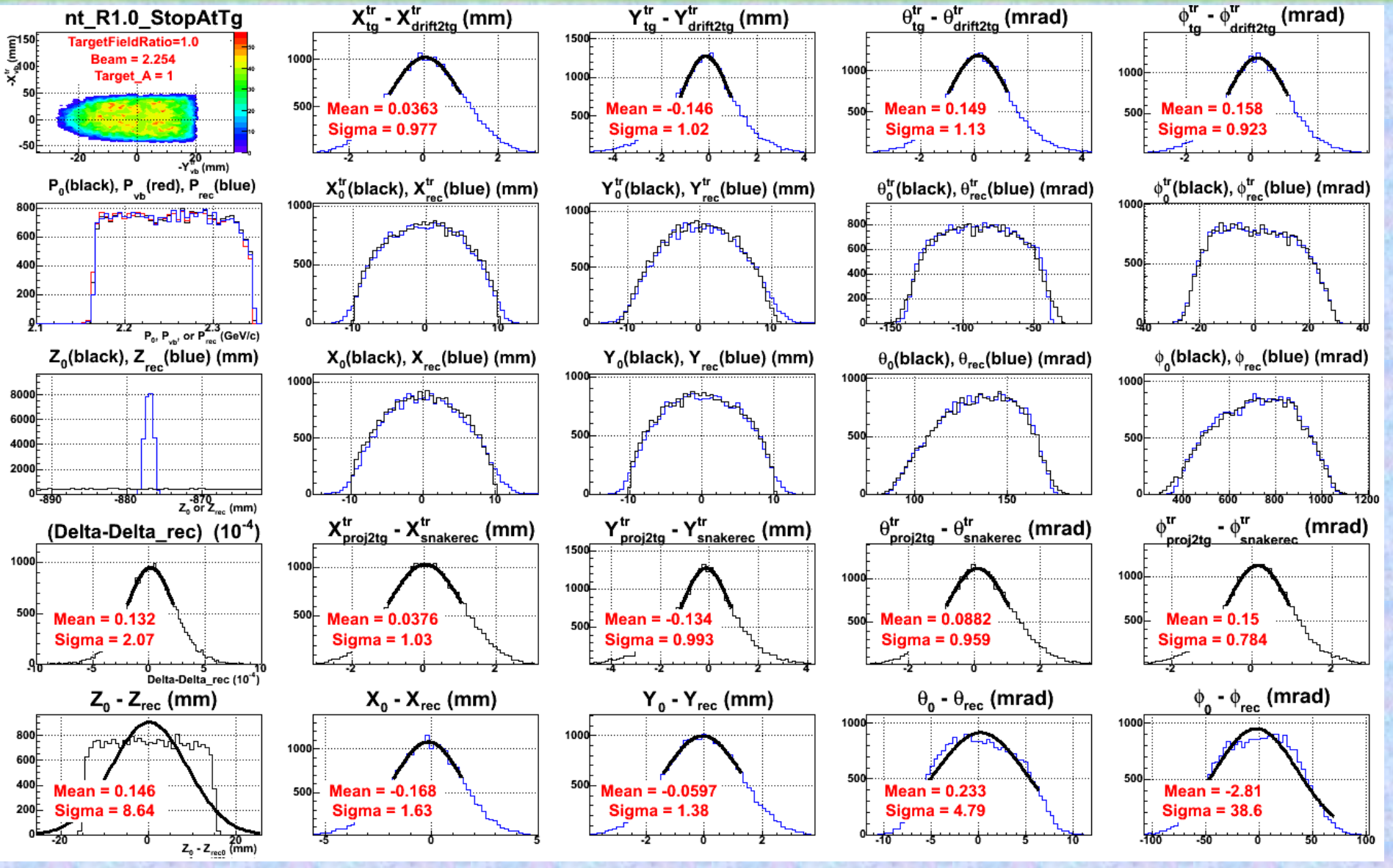
For 5T target field, it costs about 1.5 hours to run one million thrown events with one CPU. The total CPU time will be:

402.5 x 1.5 = **603.75** (hours/CPU)

Or **128** farm jobs if each job run for 5 hours.

If binned by 1-1-1-1, the CPU time will increase by a factor of 16.

Resolution of Reconstruction



Summary

- To do mapping, we have to solve the discrepancy between the snake forward model and the real spectrometer first. This can be done by fitting the real optics sieve data.
- For those data set that a straight throught optics runs were not taken, we have to use mapping other than reconstruction.
- A practicable 4-D bin width for mapping in the Focal Plane is 5-5-5-5 (mm or mrad of x-theta-y-phi).
- Mapping in the Sieve Plane gridded by 2-2-2-2 is also feasible in CPU time, but introducing the uncertainty of the straight throught reconstruction in the results.
- Need to study how precise can we determine the mean value for a given distribution. We should weight the data by its cross section. How precise can it determine the mean value is not studied yet.
- The uncertainty of reconstruction method for each event will be dominated by the vertex z position. In overall, we can reach 4.8 mrad for the scattering angle for each event.