Optics Status Update

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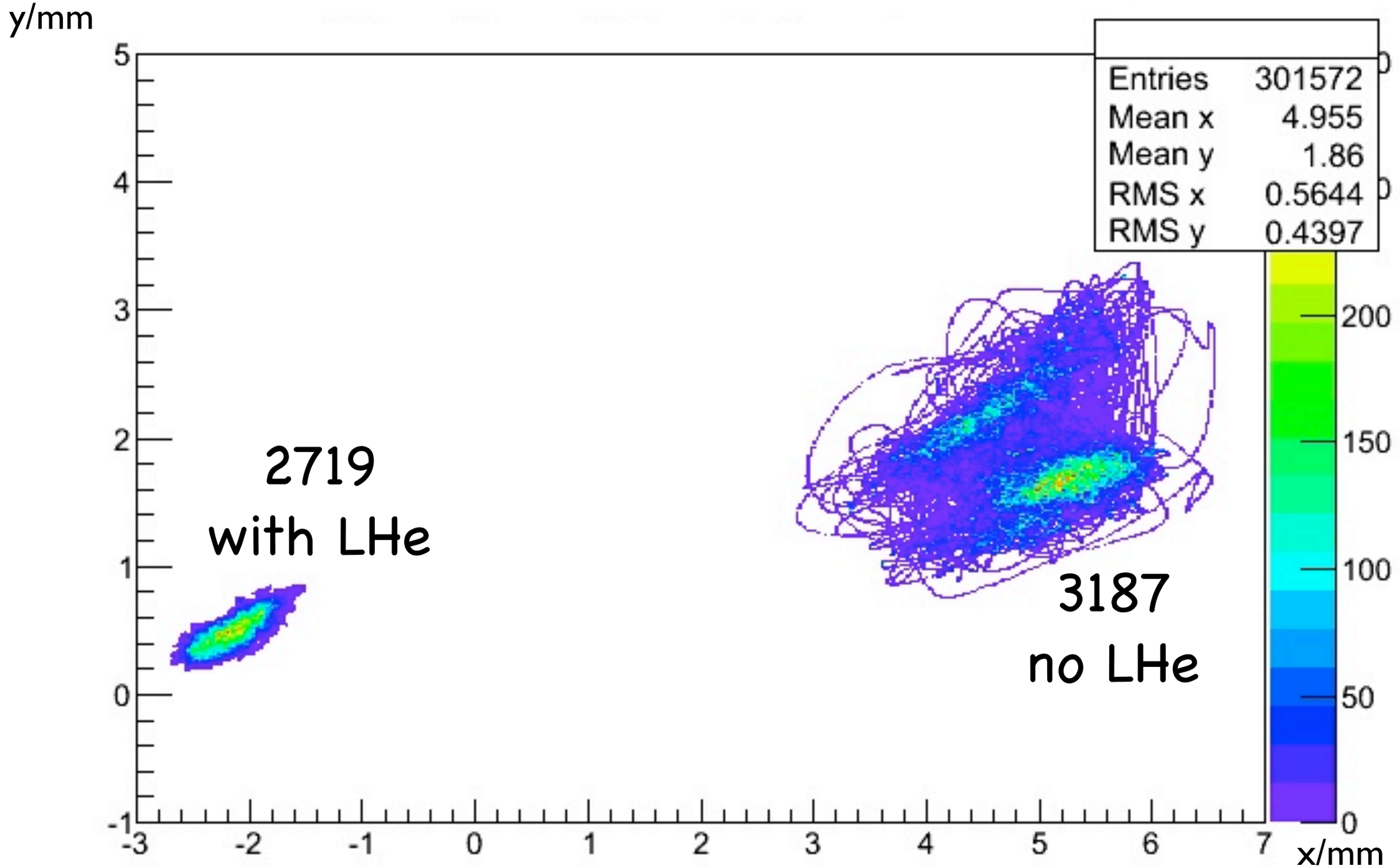
Optics Status

- Last meeting:
  - Offset between 2 sets of straight-through optics data
    - 1st order matrix elements
- Differences between these 2 sets:
  - No LHe X_{beam}~5.0mm Y_{beam}~1.5mm
  - With LHe X_{beam}~-2.0mm Y_{beam}~0.5mm

Optics Status



Matrix Calibration

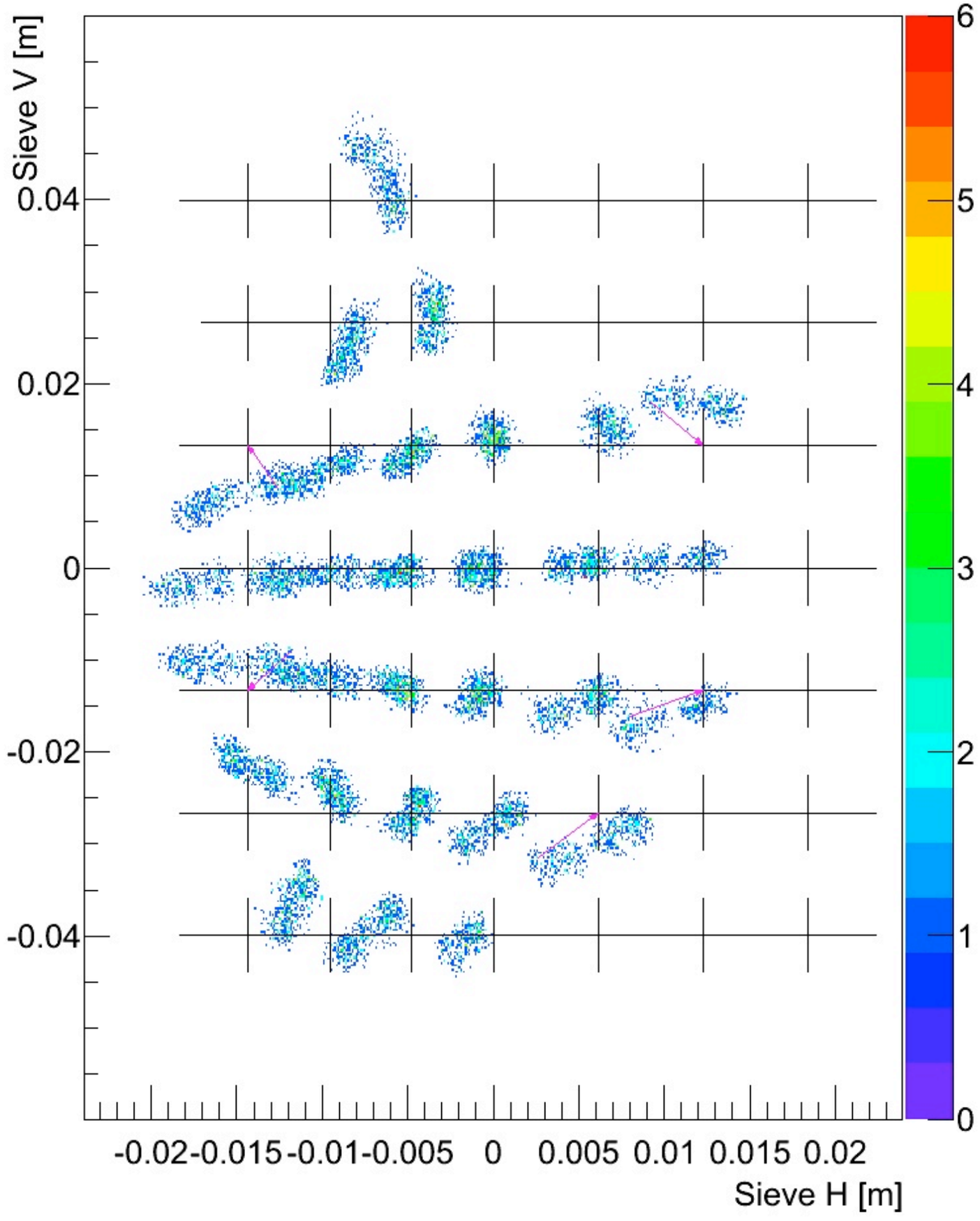
- Only use 1st order matrix elements to optimize

$$\theta_{tg} = T_{0000} + T_{1000}\, x + T_{0100}\, \theta + T_{0010}\, y + T_{0001}\, \varphi$$

$$\varphi_{tg} = P_{0000} + P_{1000}\, x + P_{0100}\, \theta + P_{0010}\, y + P_{0001}\, \varphi$$

	T_{0000}	T_{1000}	T_{0100}	T_{0010}	T_{0001}
No LHe	1.171E-03	2.563E-02	-2.673E+00	-7.826E-02	6.595E-02
With LHe	8.548E-04	2.503E-02	-2.694E+00	-1.234E-01	1.502E-01
	P_{0000}	P_{1000}	P_{0100}	P_{0010}	P_{0001}
No LHe	-1.146E-02	7.419E-03	-1.473E-01	-8.411E-01	6.151E-01
With LHe	-2.181E-03	2.447E-03	-8.840E-02	-9.170E-01	7.631E-01

- After calibration by using only the 1st order matrix elements
- Sieve pattern is not aligned to its ideal position very well



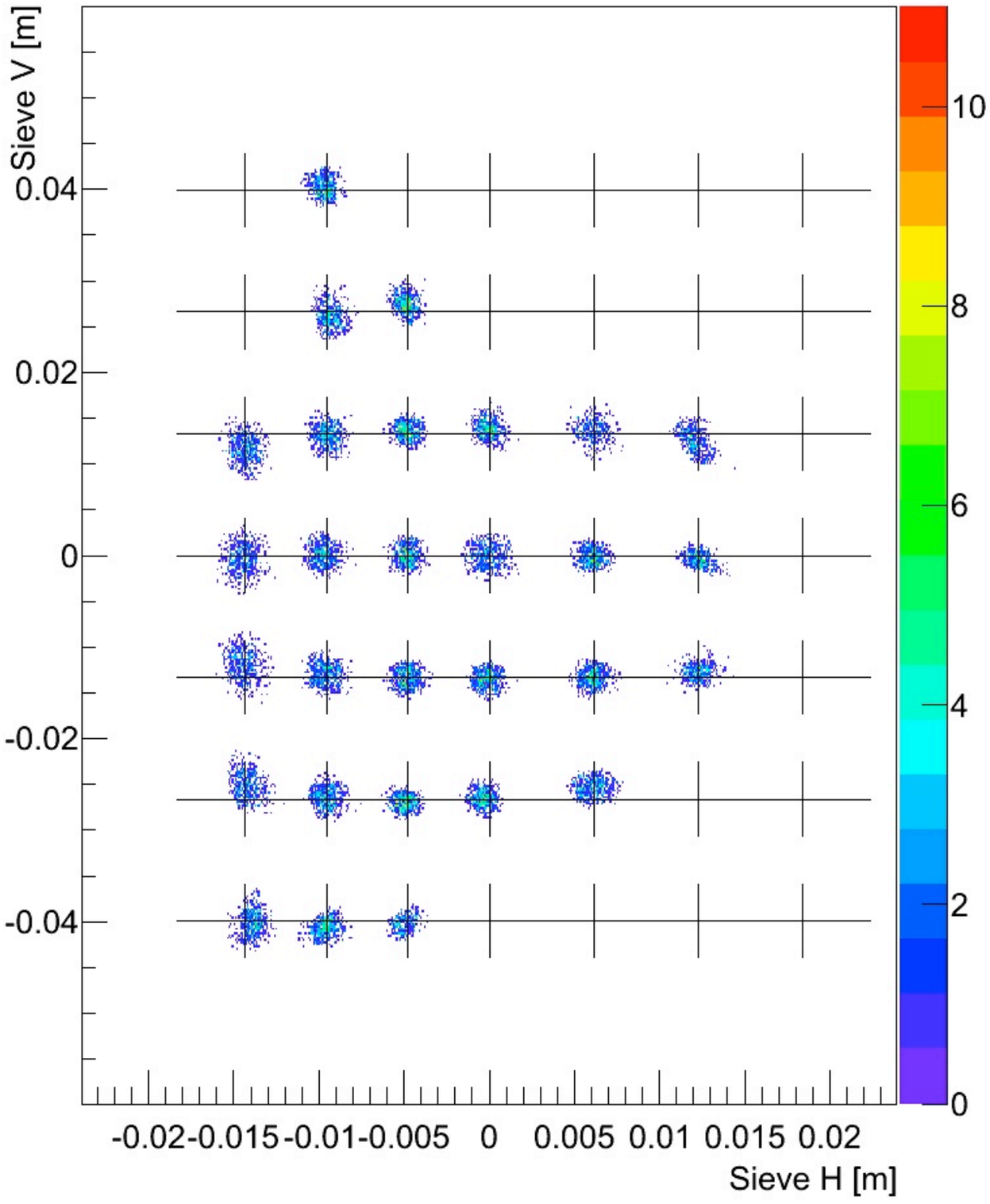
Matrix Calibration

- Put 2nd order matrix elements into optimize

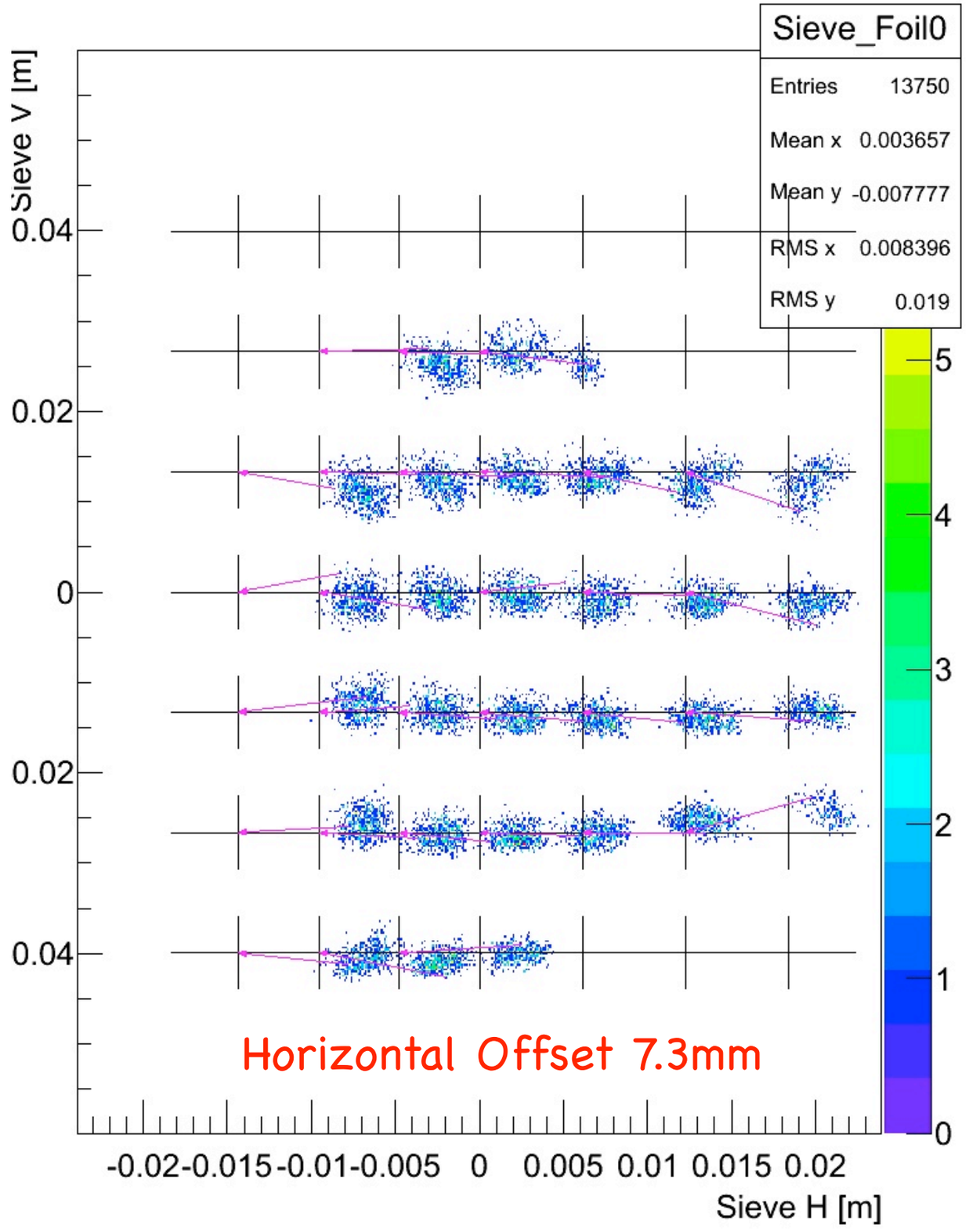
$$\theta_{tg} = T_{0000} + T_{1000}\,x + T_{0100}\,\theta + T_{0010}\,y + T_{0001}\,\varphi + T_{2000}\,x^2 + T_{1100}\,x\theta + T_{0200}\,\theta^2 + T_{0020}\,y^2 + T_{0011}\,y\varphi + T_{0002}\,\varphi^2 + T_{1010}\,xy + T_{1001}\,x\varphi + T_{0110}\,\theta y + T_{0101}\,\theta\varphi$$

	T_{0000}	T_{1000}	T_{0100}	T_{0010}	T_{0001}
No LHe	1.726E-03	2.603E-02	-2.814E+00	-3.663E-02	6.747E-02
With LHe	1.024E-03	2.560E-02	-2.804E+00	-7.711E-02	1.558E-01
	P_{0000}	P_{1000}	P_{0100}	P_{0010}	P_{0001}
No LHe	-1.013E-02	2.170E-03	-2.008E-02	-8.482E-01	6.873E-01
With LHe	-1.578E-03	-7.523E-04	5.409E-03	-8.906E-01	7.672E-01

calibration using up to 2nd order matrix elements (with LHe setting)

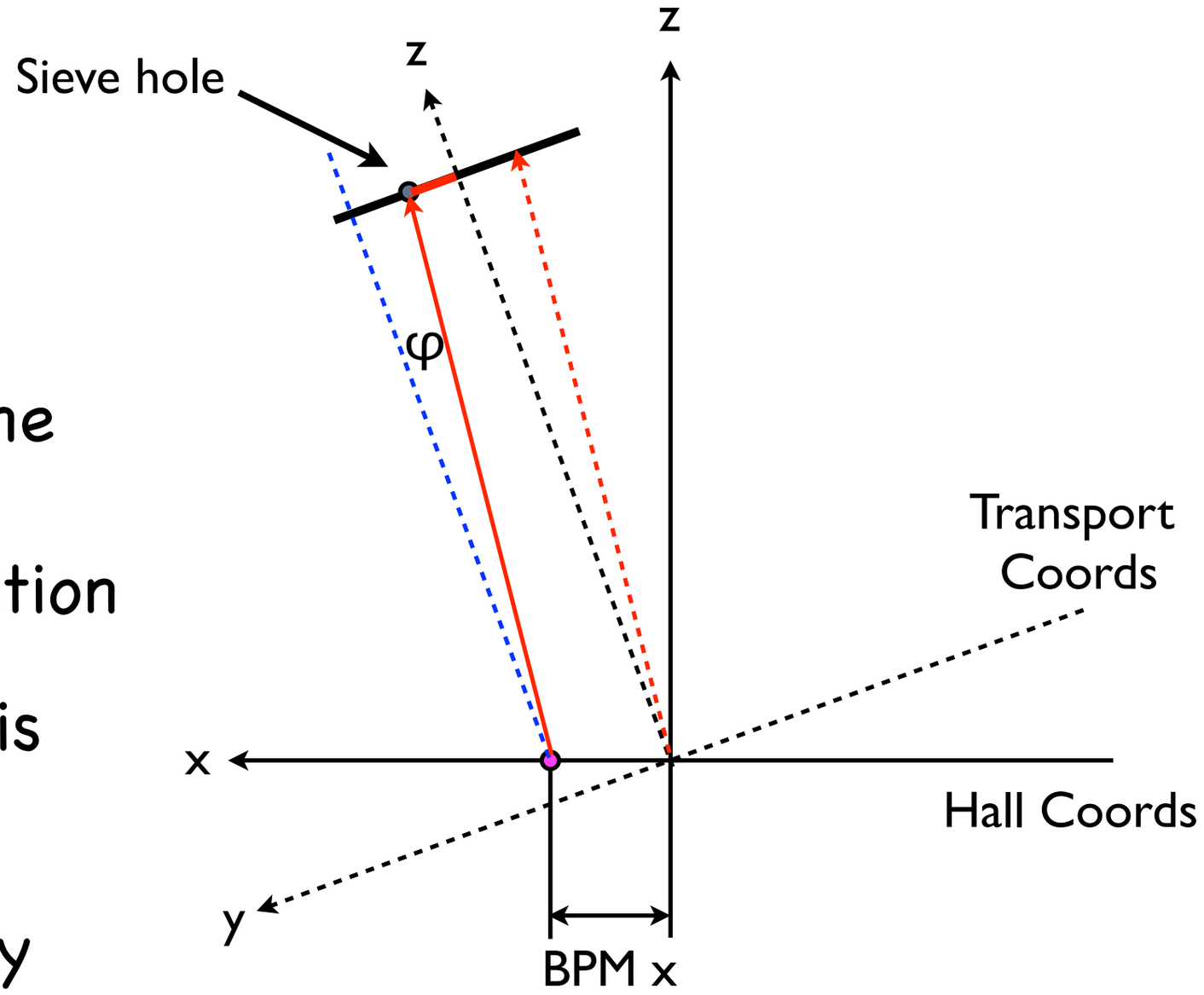


Use this database to plot No-LHe data



Matrix Calibration

- The offset on sieve plane is almost equal to the difference of beam position
- A possible reason of this offset:
  - BPM x is not properly considered in the calculation



Optics Status

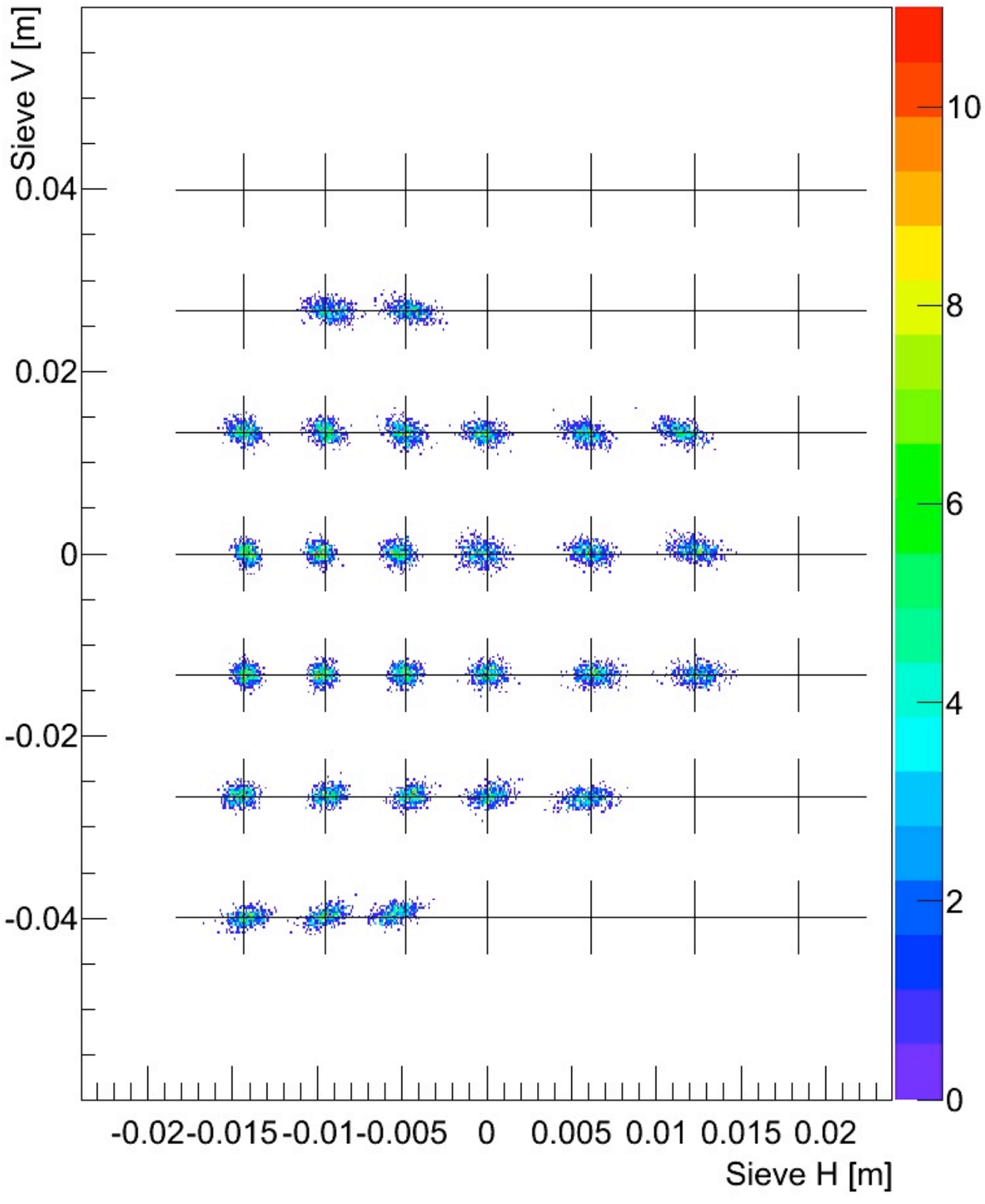
- Assume BPM is the reason:
  - Optimizer program did not treat BPM properly
  - BPM value we used does not represent the real beam position
- Optimizer program can be test with simulation:
  - generate 2 sets of data with different beam position settings
  - put those data into the calibration program and check if there is still a large offset

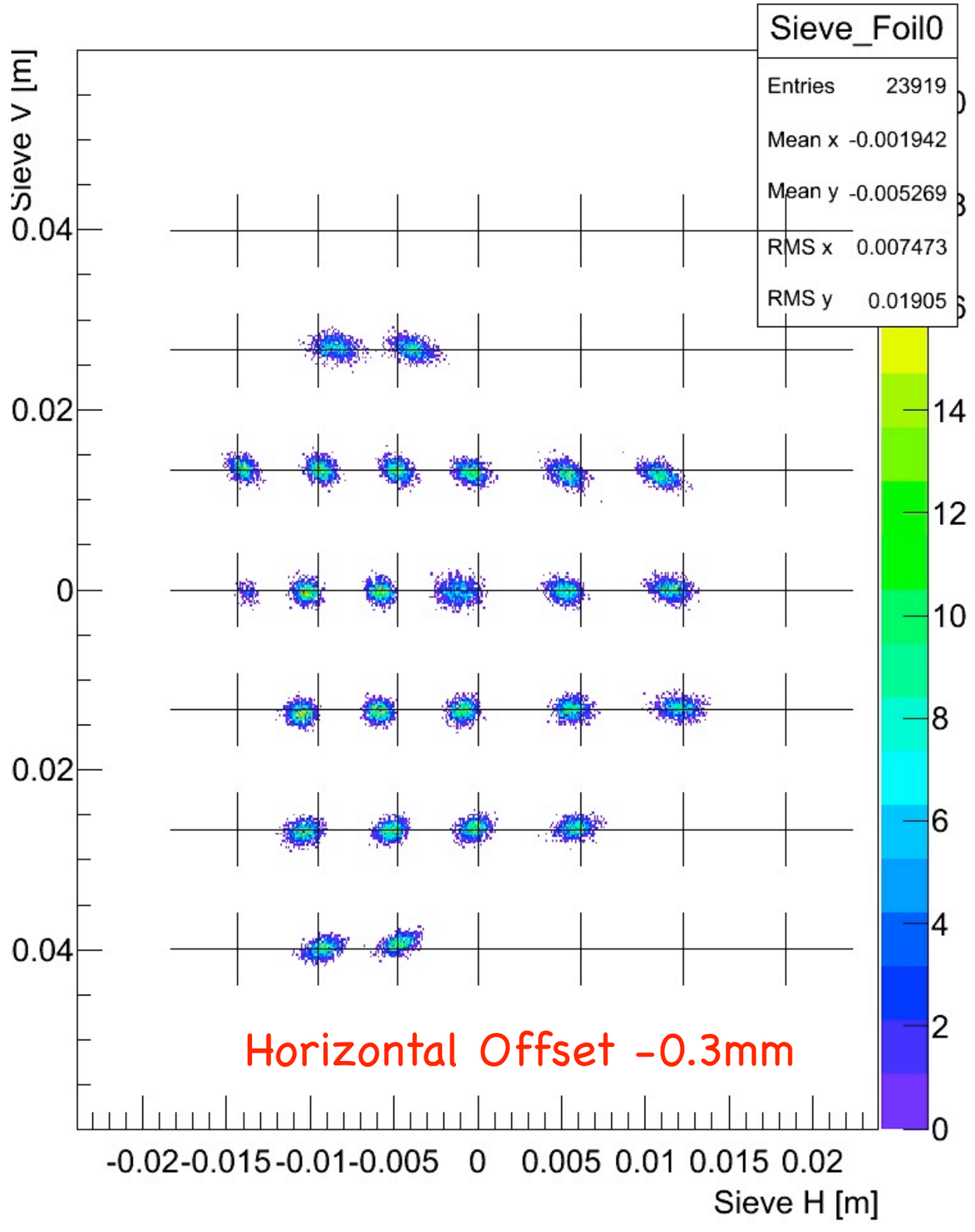
Optics Status

- Simulation condition:
  - Normal optics setting
    - Ebeam = 2.254GeV, dp = 0%
    - Set 1: beam position (0,0)
    - Set 2: beam position (5mm,0)

calibration using up to 2nd order matrix elements (data set 1)

Use the same database to plot data set 2

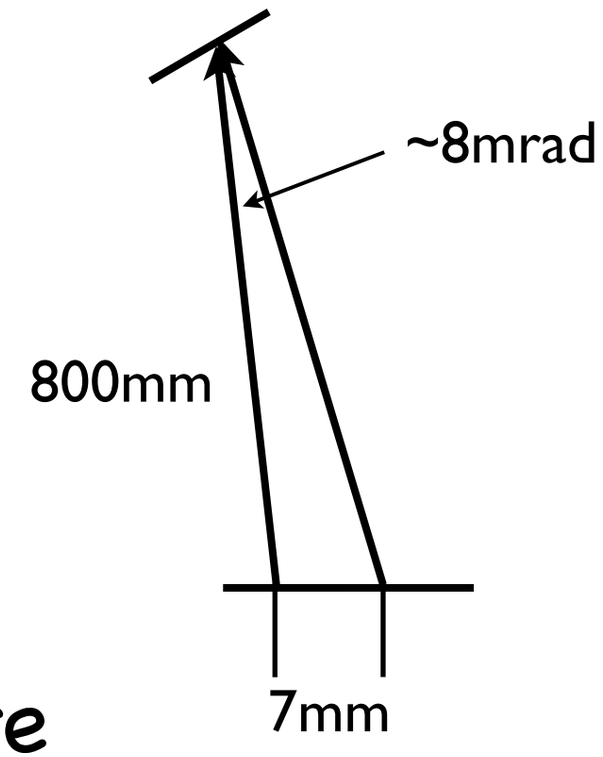




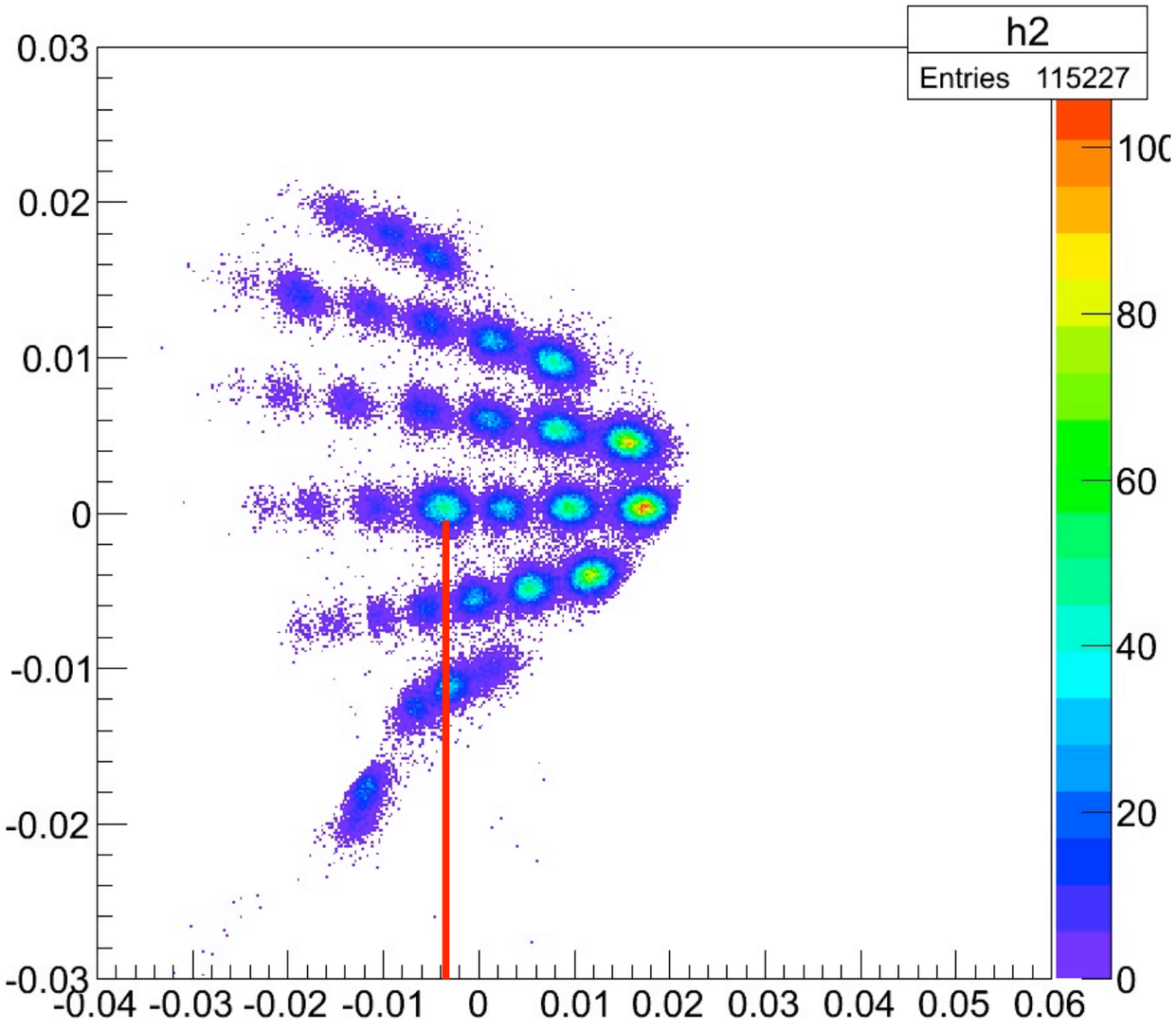
Slightly distorted because of high order effect

Optics Status

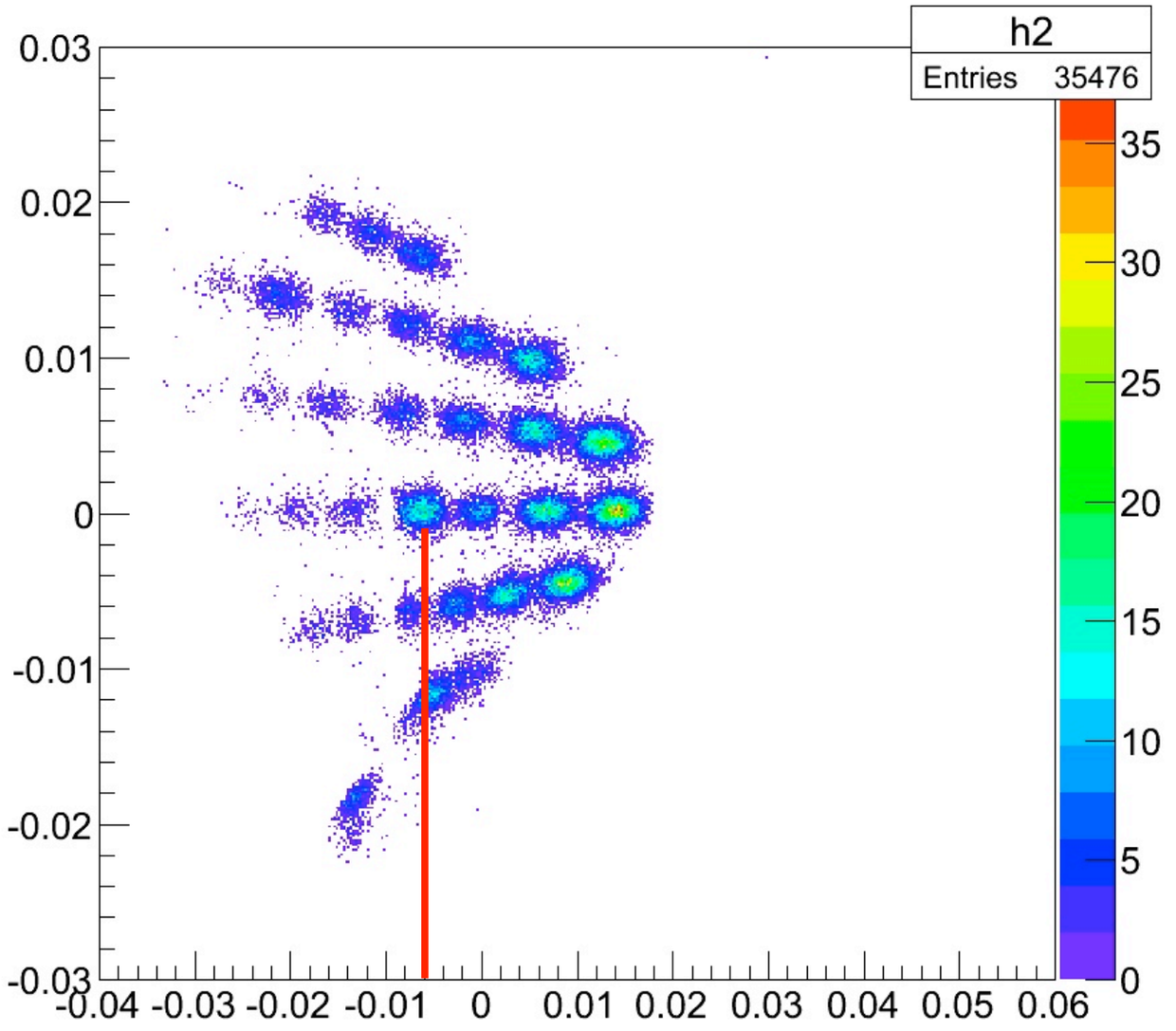
- Simulation looks normal
- Compare focus plane plots for No/ With LHe settings:
  - BPM tell us there is a ~7mm difference between 2 settings
  - geometry relations suggests there should be an 8mrad difference between the real phi angle
  - we could expect a $\varphi_{fp} \sim 1.0\ \varphi_{tg} \sim$ 6mrad difference on focus plane



run 2726 (with LHe setting)



run 3185 (no LHe setting)



The difference is about 2mrad on focus plane

Optics Status

- TODO:
  - Combine the y_{tg} calibration result