



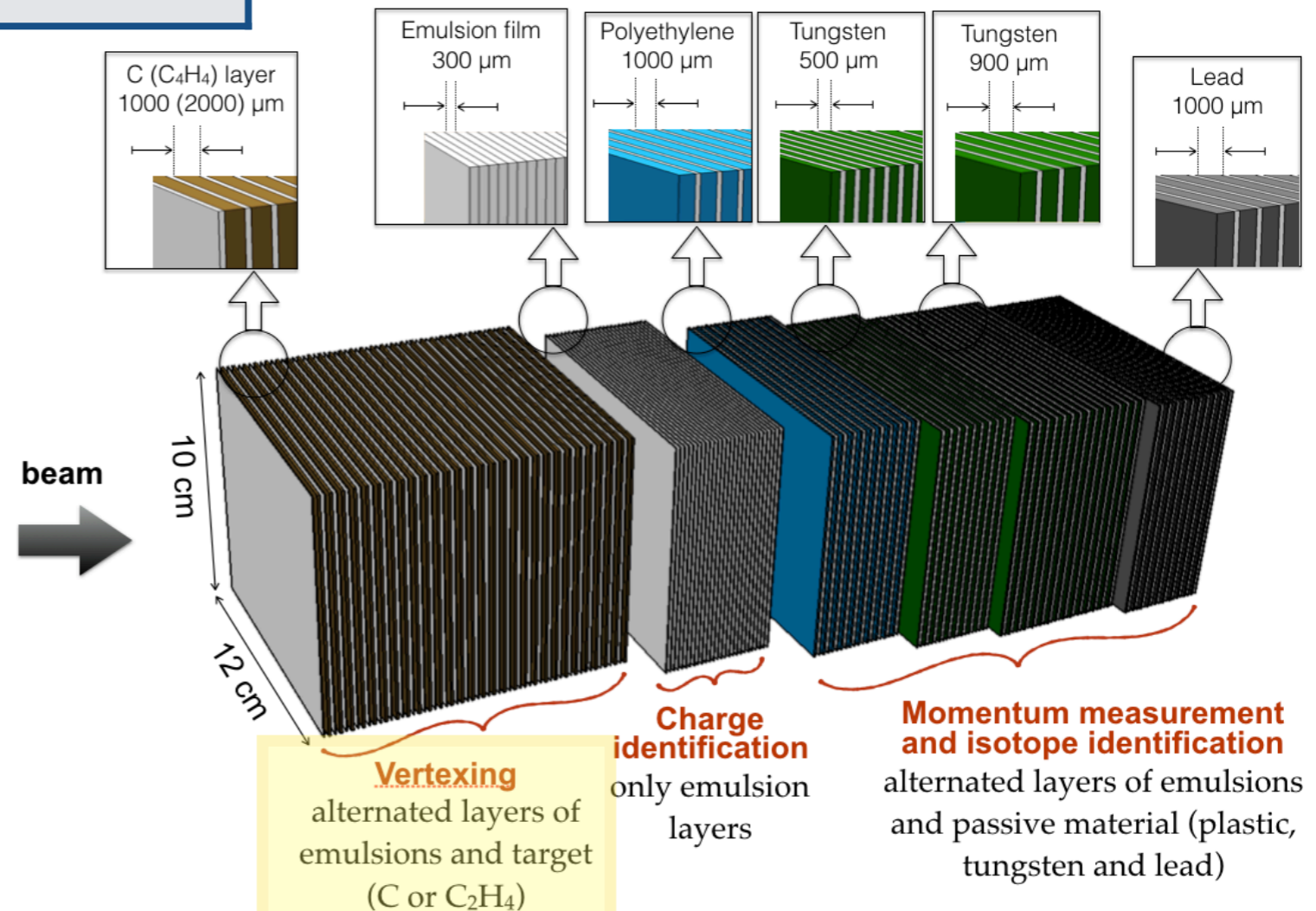
# NUCLEAR EMULSIONS: STATUS OF THE ANALYSIS

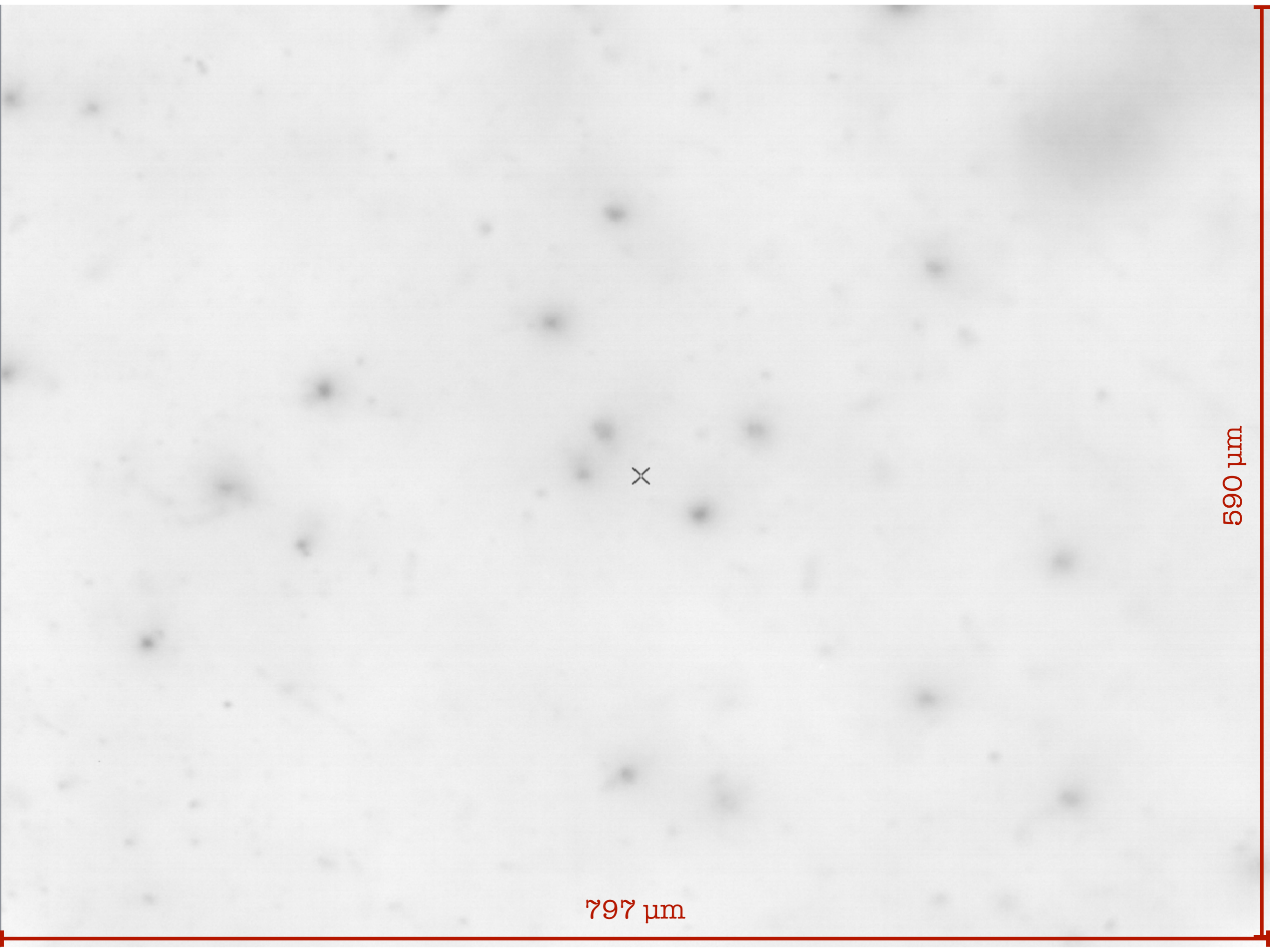
A. Alexandrov, G. De Lellis, A. Di Crescenzo, G. Galati,  
A. Iuliano, A. Lauria, M. C. Montesi, A. Pastore, V. Tioukov

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# ANALYSIS ON-GOING

		BEAM	
		Oxygen 200 MeV/n	Oxygen 400 MeV/n
TARGET			
Carbon	GSI1	GSI3	
Polyethylene	GSI2	GSI4	





797  $\mu\text{m}$

590  $\mu\text{m}$

# EFFICIENCY PLATE BY PLATE (ALL TRACKS)

$$\text{Eff}_{plate} = \frac{\text{Number of basetracks found}}{\text{Number of passing tracks}}$$

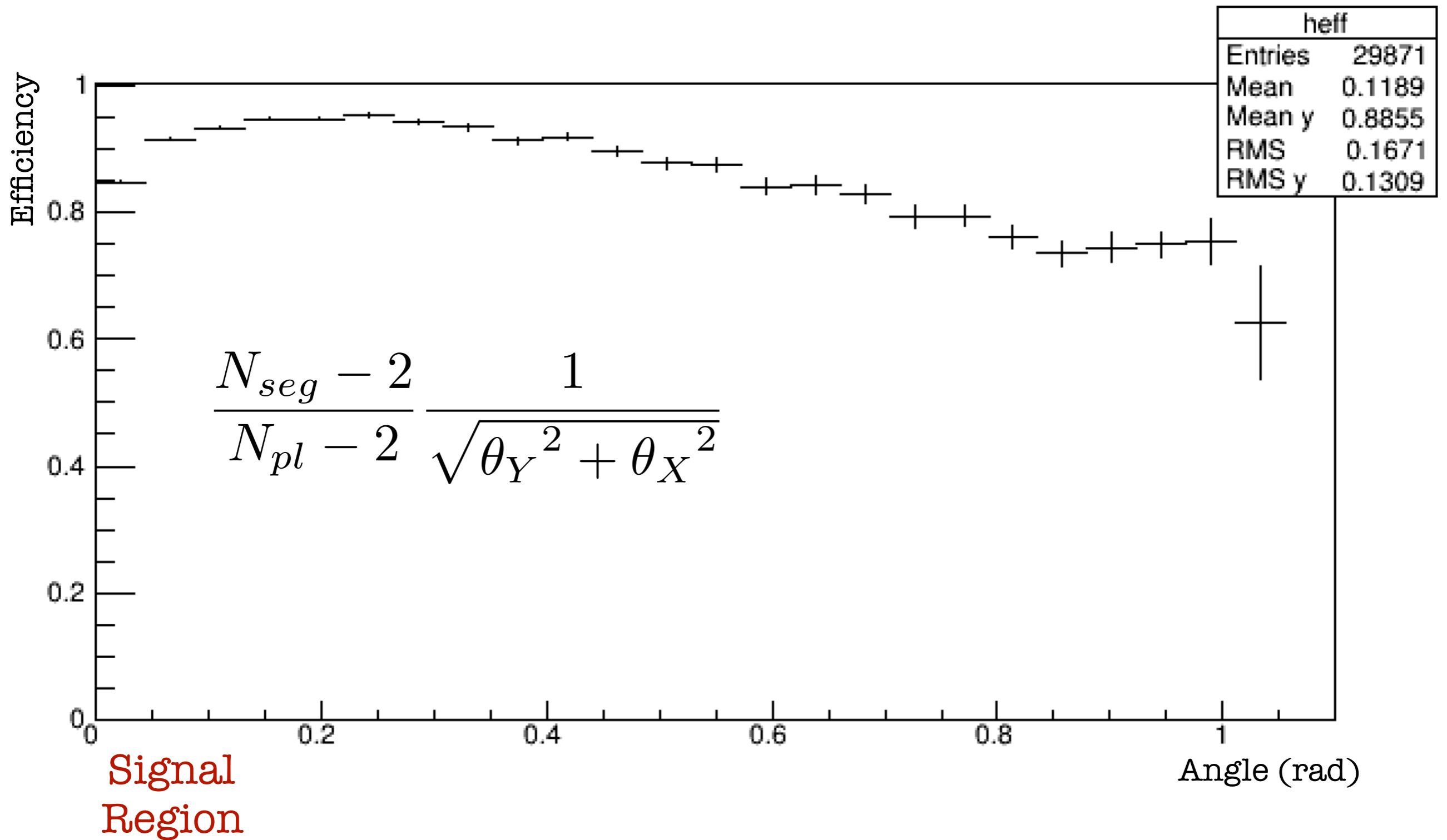
Plate Id	eff all tracks	eff Oxy	Plate Id	eff all tracks	eff Oxy
1	100.0%	100.0%	16	92.8%	91.2%
2	100.0%	100.0%	17	100.0%	100.0%
3	100.0%	100.0%	18	89.9%	85.0%
4	86.8%	86.6%	19	93.5%	92.9%
5	93.8%	94.0%	20	94.8%	94.2%
6	98.0%	99.8%	21	89.5%	77.2%
7	72.2%	22.9%	22	93.1%	94.0%
8	96.4%	99.6%	23	93.9%	92.5%
9	92.9%	93.5%	24	95.6%	94.5%
10	93.4%	93.3%	25	93.7%	94.8%
11	91.2%	91.8%	26	97.3%	98.8%
12	92.2%	91.8%	27	100.0%	100.0%
13	92.1%	92.2%	28	100.0%	100.0%
14	92.4%	89.8%	29	100.0%	100.0%
15	89.7%	88.8%	30	100.0%	100.0%

**Mean Efficiency all = 94%**

**Mean Efficiency Oxy = 91%**



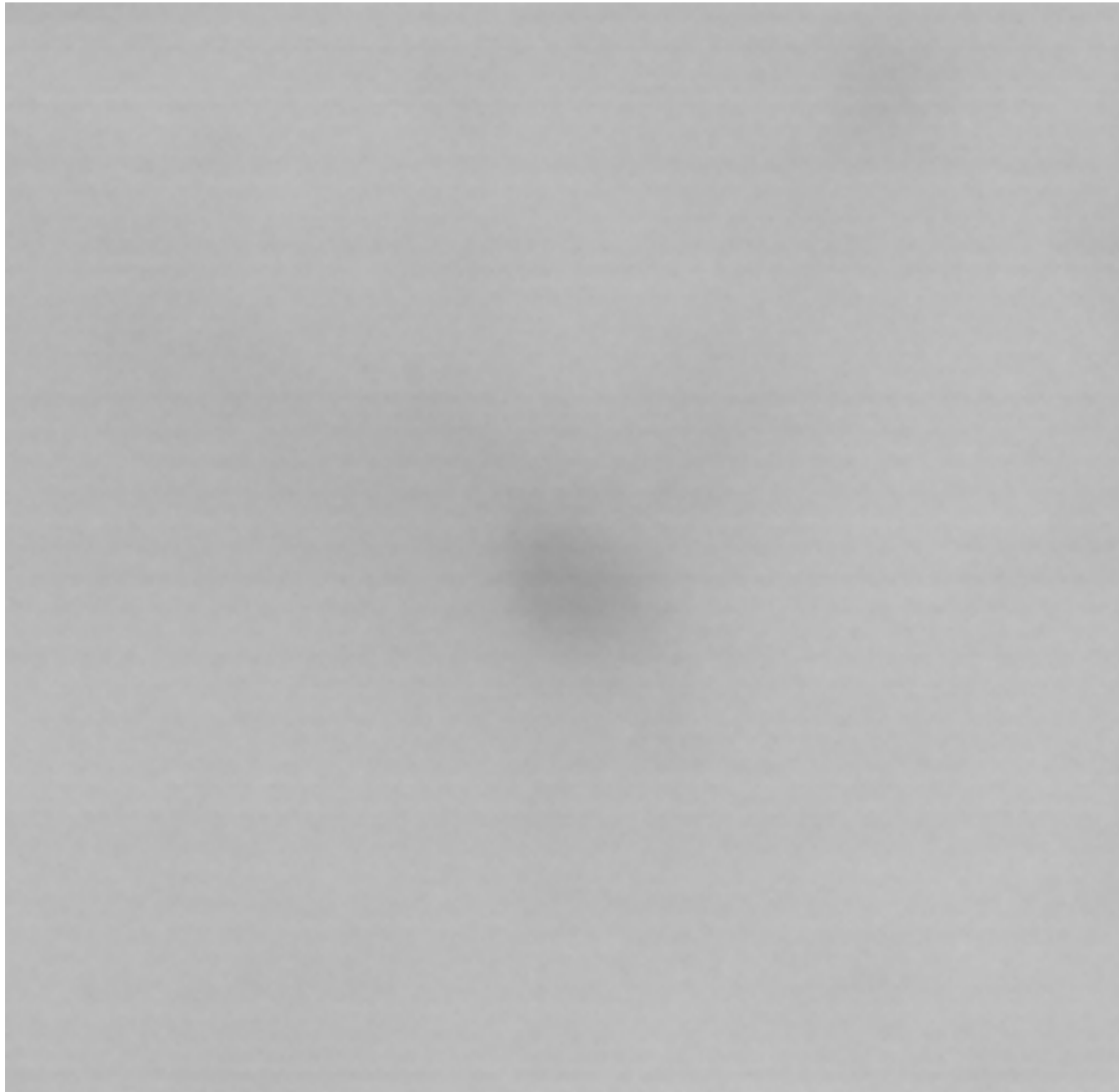
# TRACK EFFICIENCY BY ANGLE



To be improved...

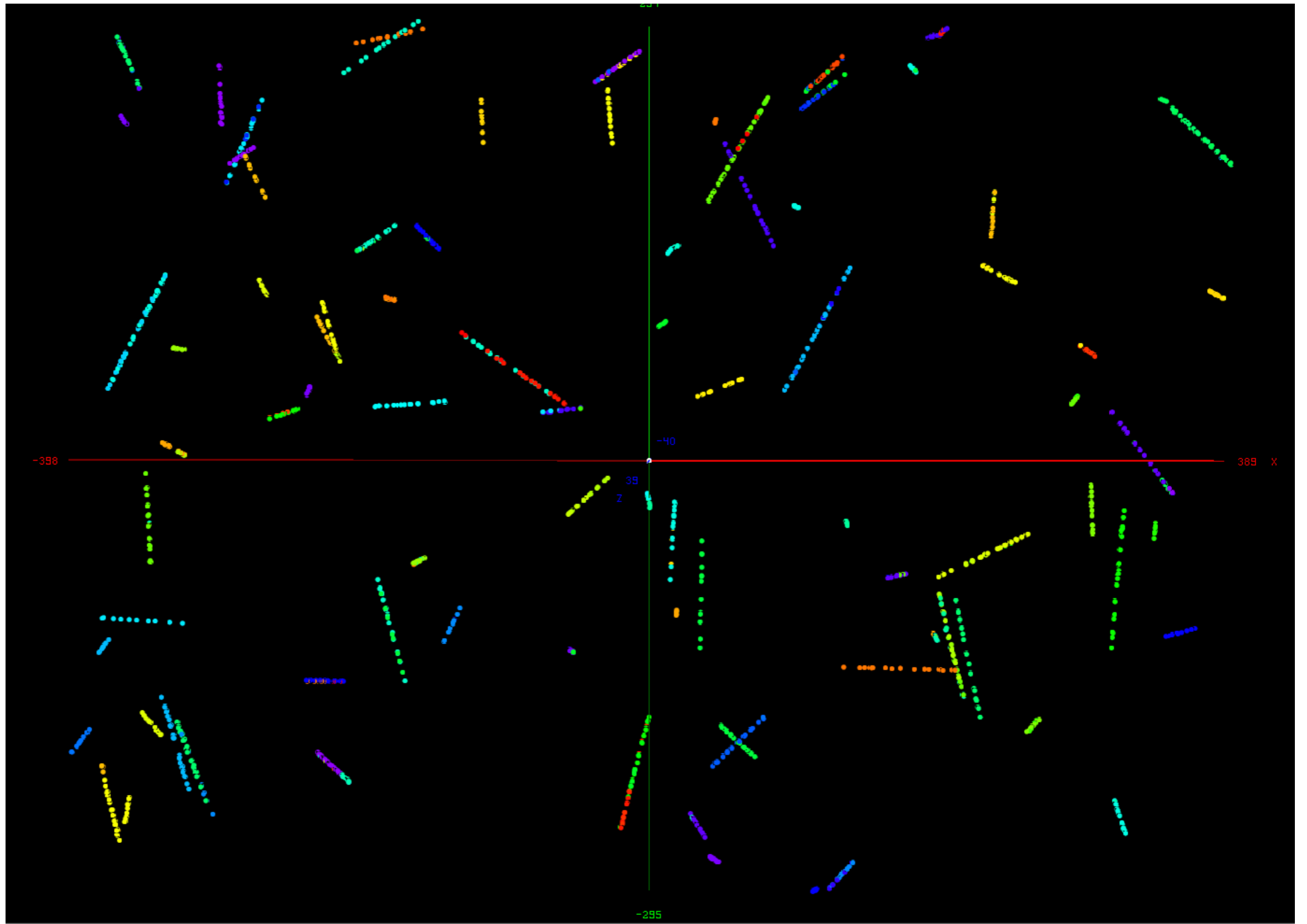
# OXYGEN COUNTING

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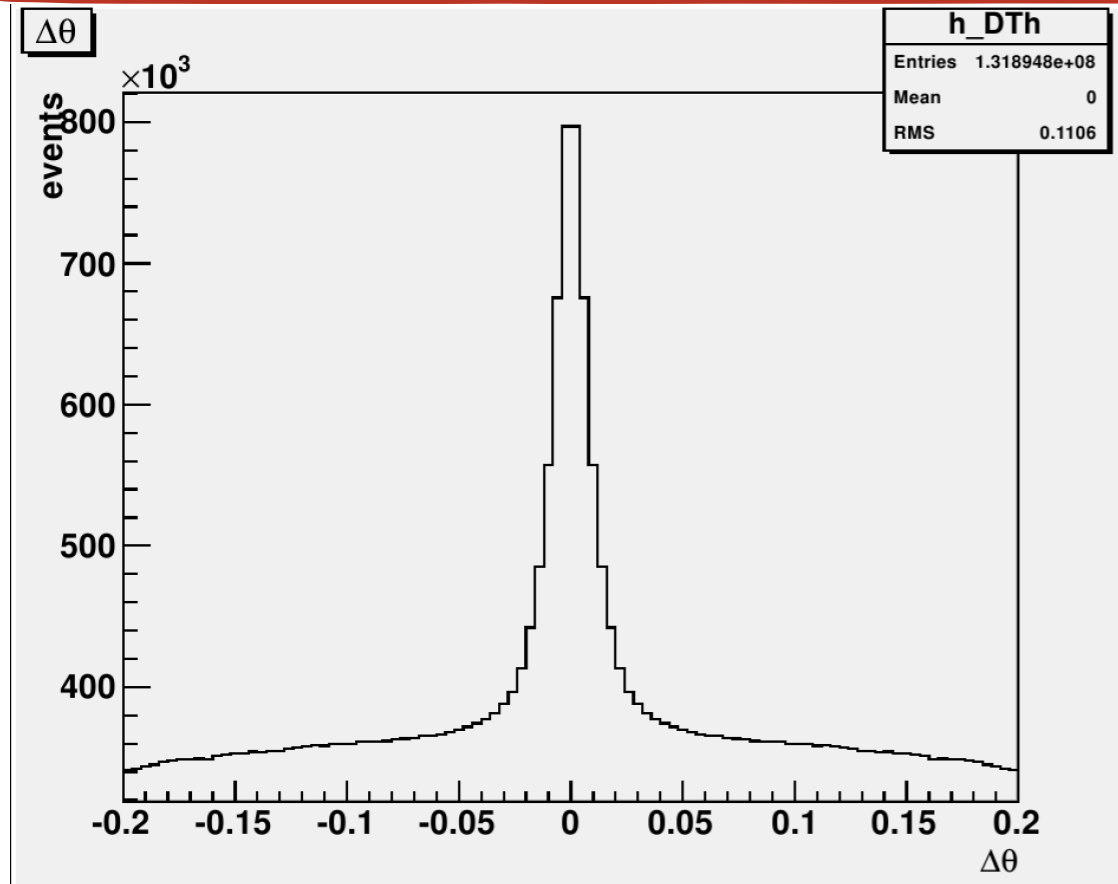


# OXYGEN COUNTING

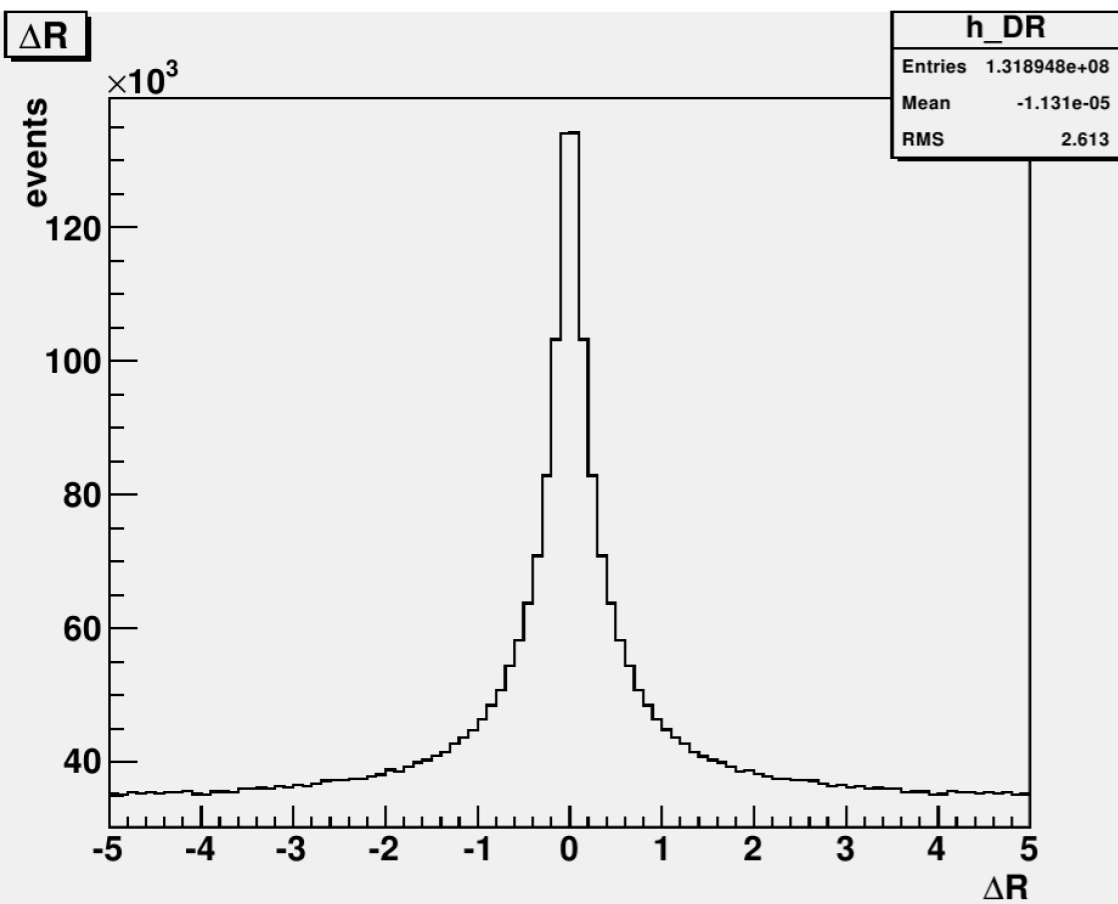
- Our scanning software is not optimized for such ionizing particles
- The grains along the oxygen trajectory are not separated and on a straight line
- Oxygen grains created by the same particle are associated with close segments



# OXYGEN COUNTING



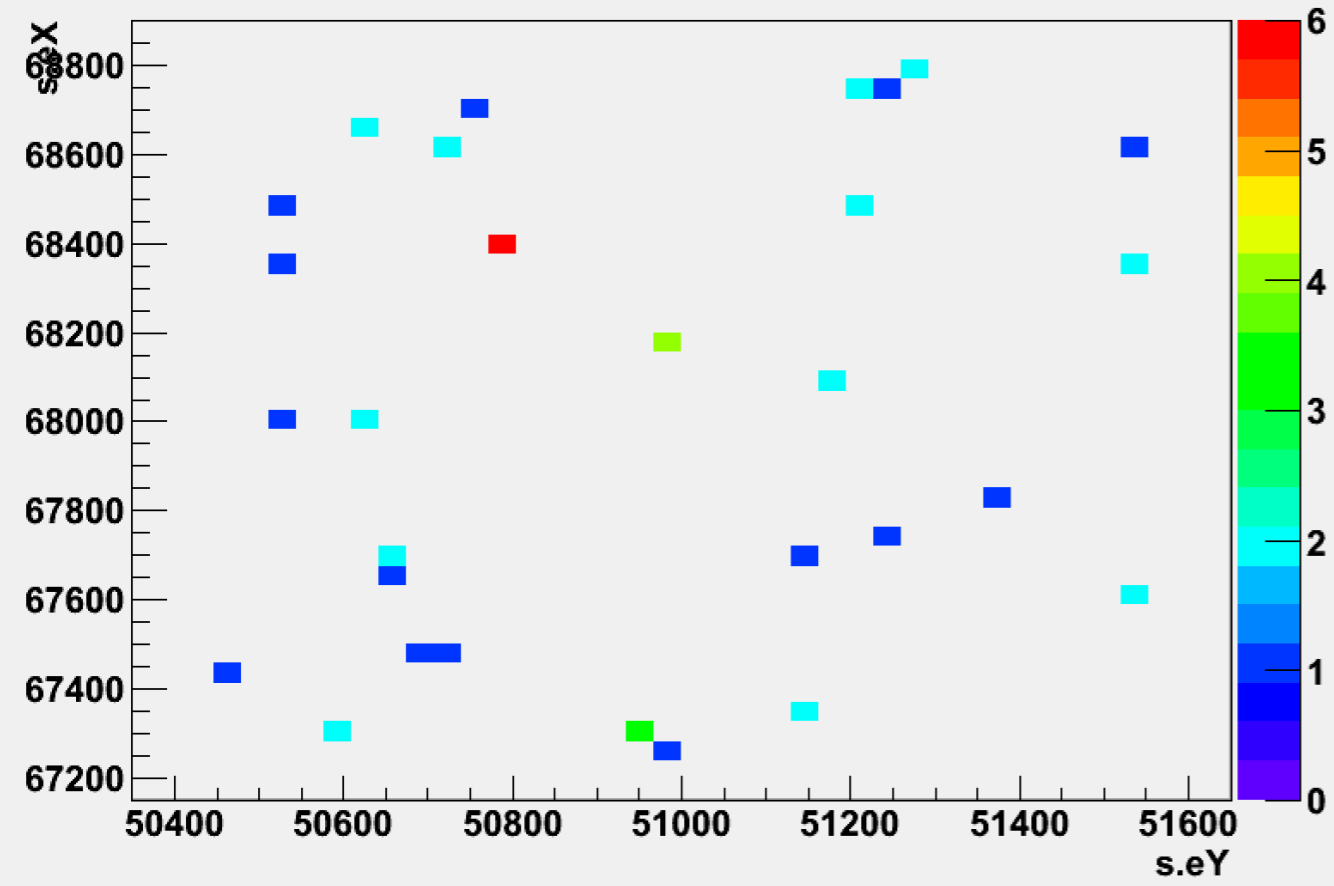
- Segments with  $\Delta R_{xy} < 1.5 \mu\text{m}$  &&  $\Delta\theta < 0.04 \text{ rad}$  are replaced by a single segment that combines properly all the information





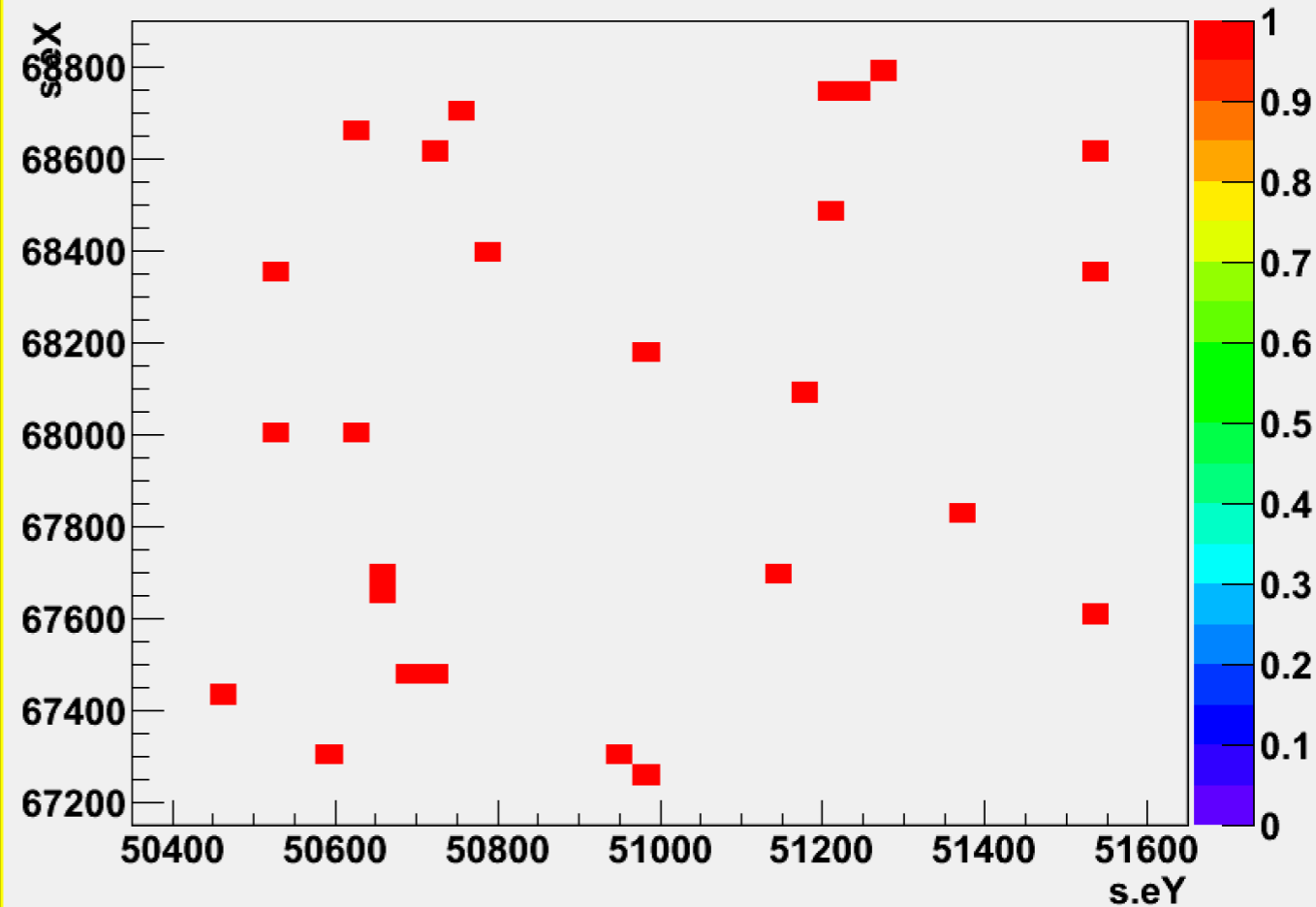
# OXYGEN COUNTING

s.eX:s.eY {TMath::Abs(eX-68000)<797&&TMath::Abs(eY-51000)<590&&Theta()<0.04}



BEFORE

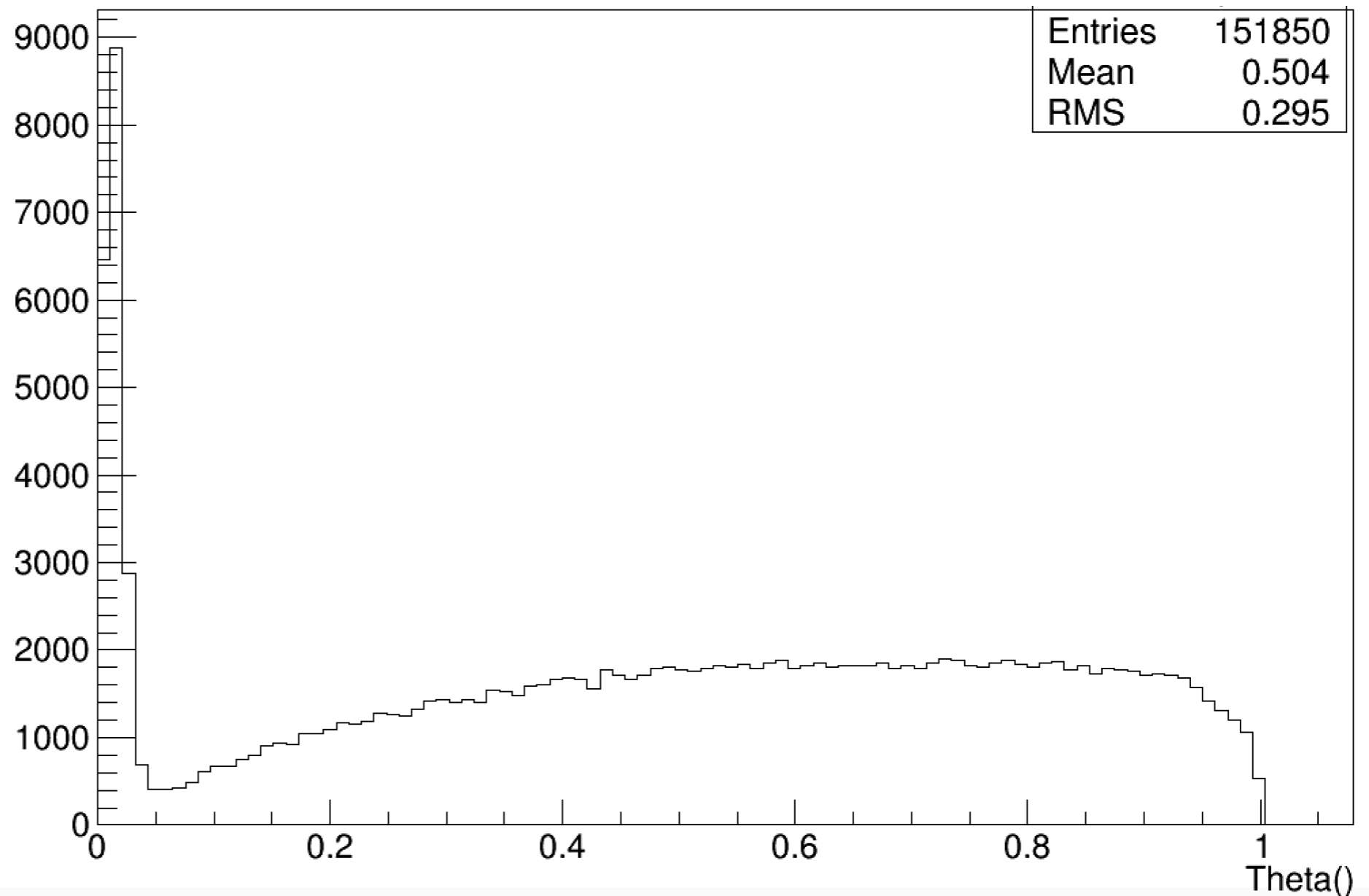
s.eX:s.eY {TMath::Abs(eX-68000)<797&&TMath::Abs(eY-51000)<590&&Theta()<0.04}



AFTER

# OXYGEN COUNTING

- Beam: 19375 Oxygen ions
- Reconstructed base tracks with  $\theta < 0.04$  rad rad on Plate 1: 18778



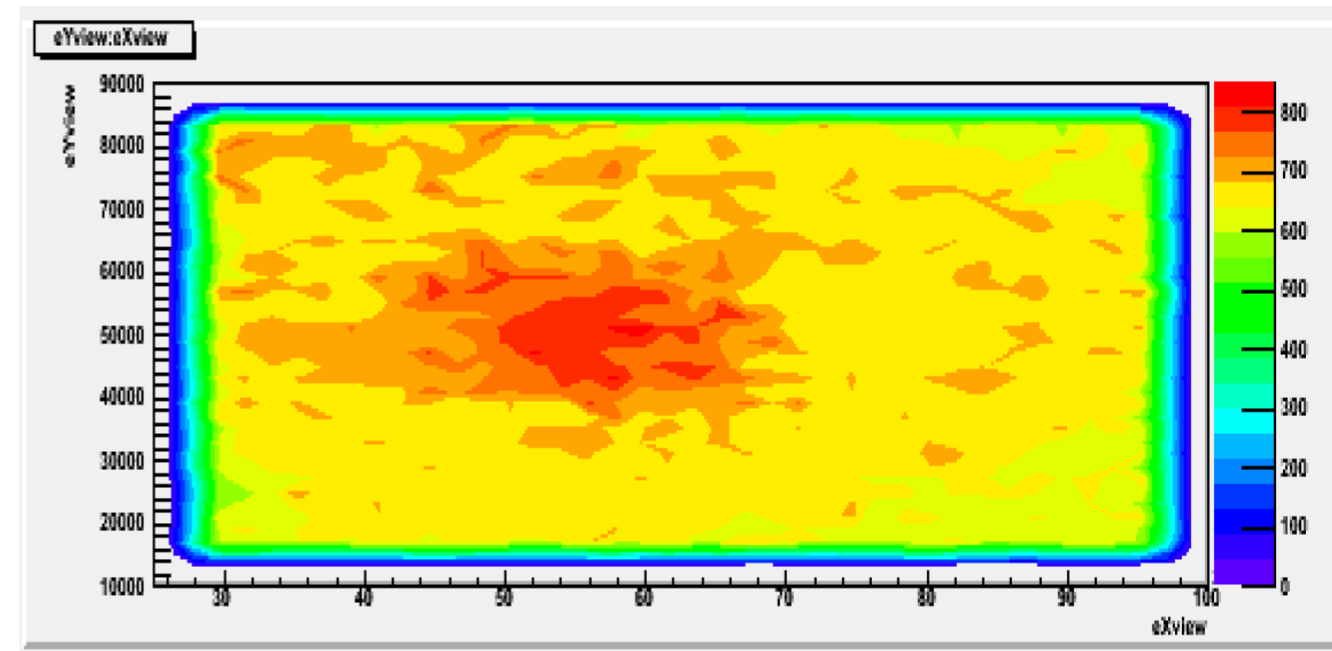
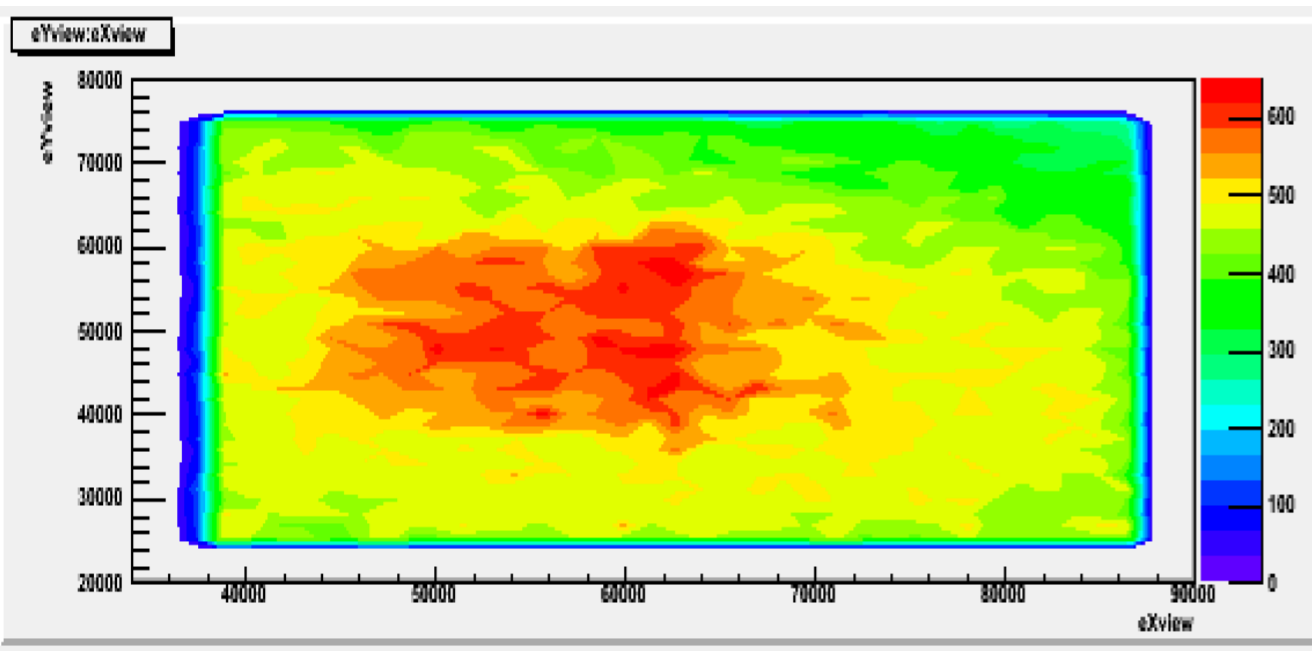
**Efficiency ~ 97%**

# MICROTRACKS

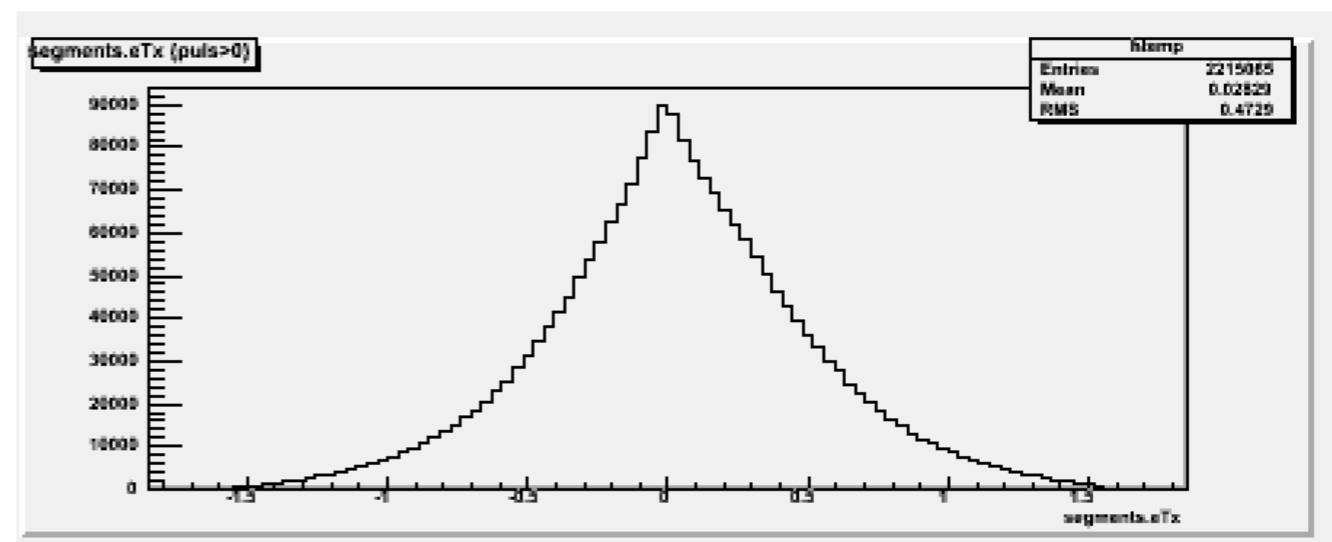
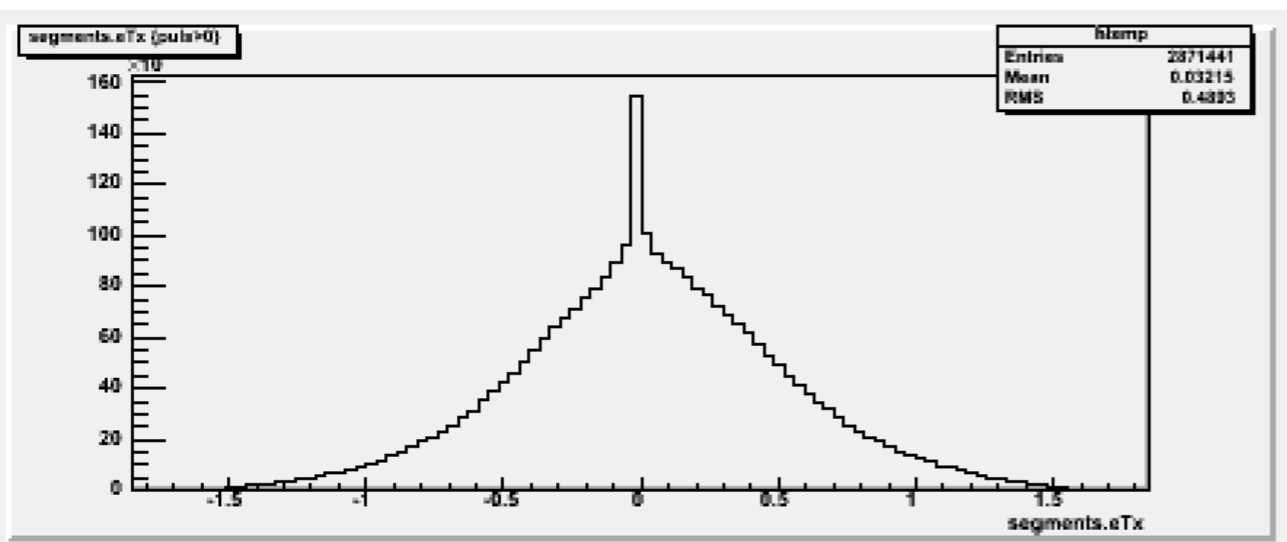
## PLATE 1

## PLATE 30

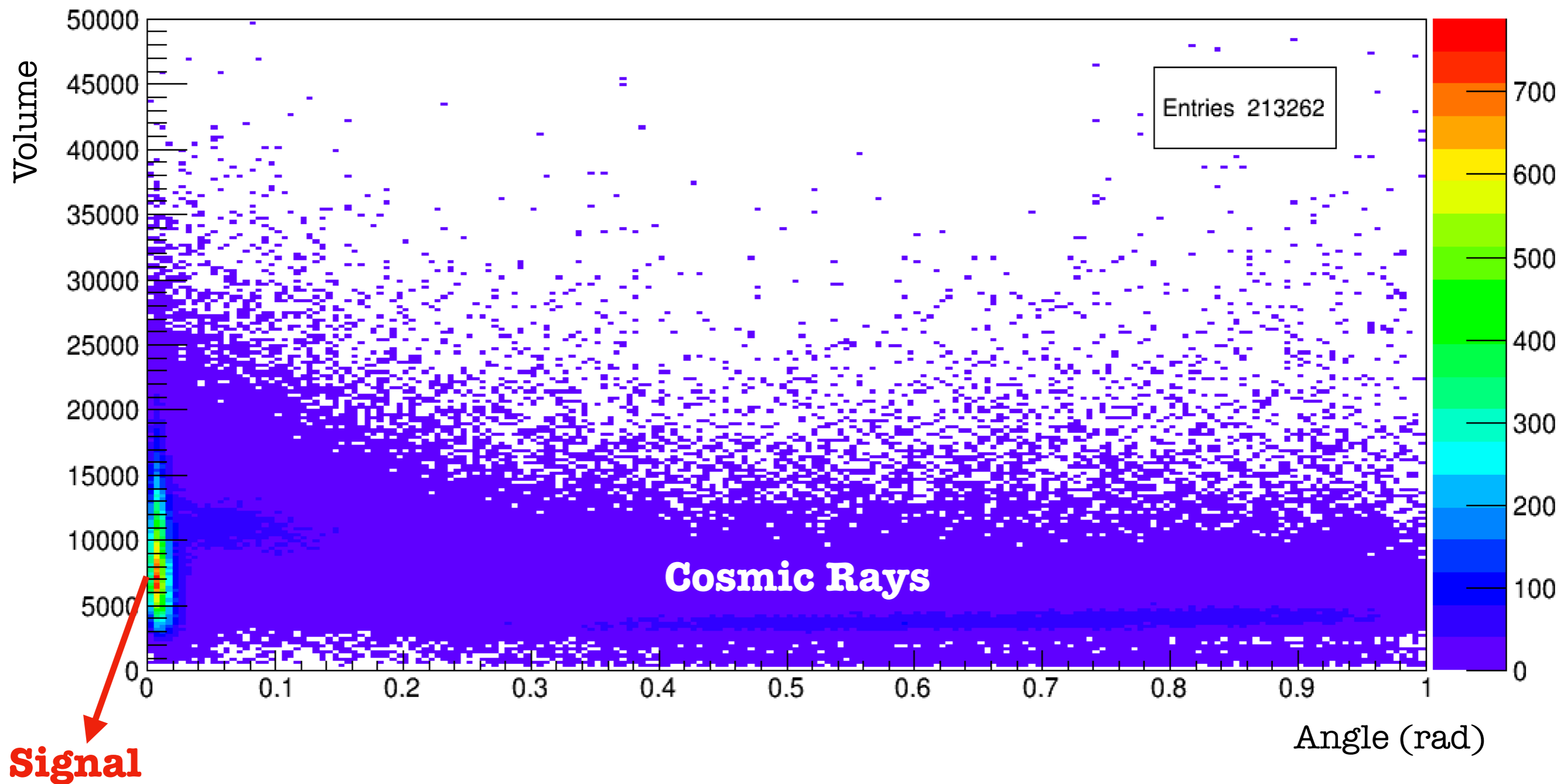
### X - Y microtrack distributions



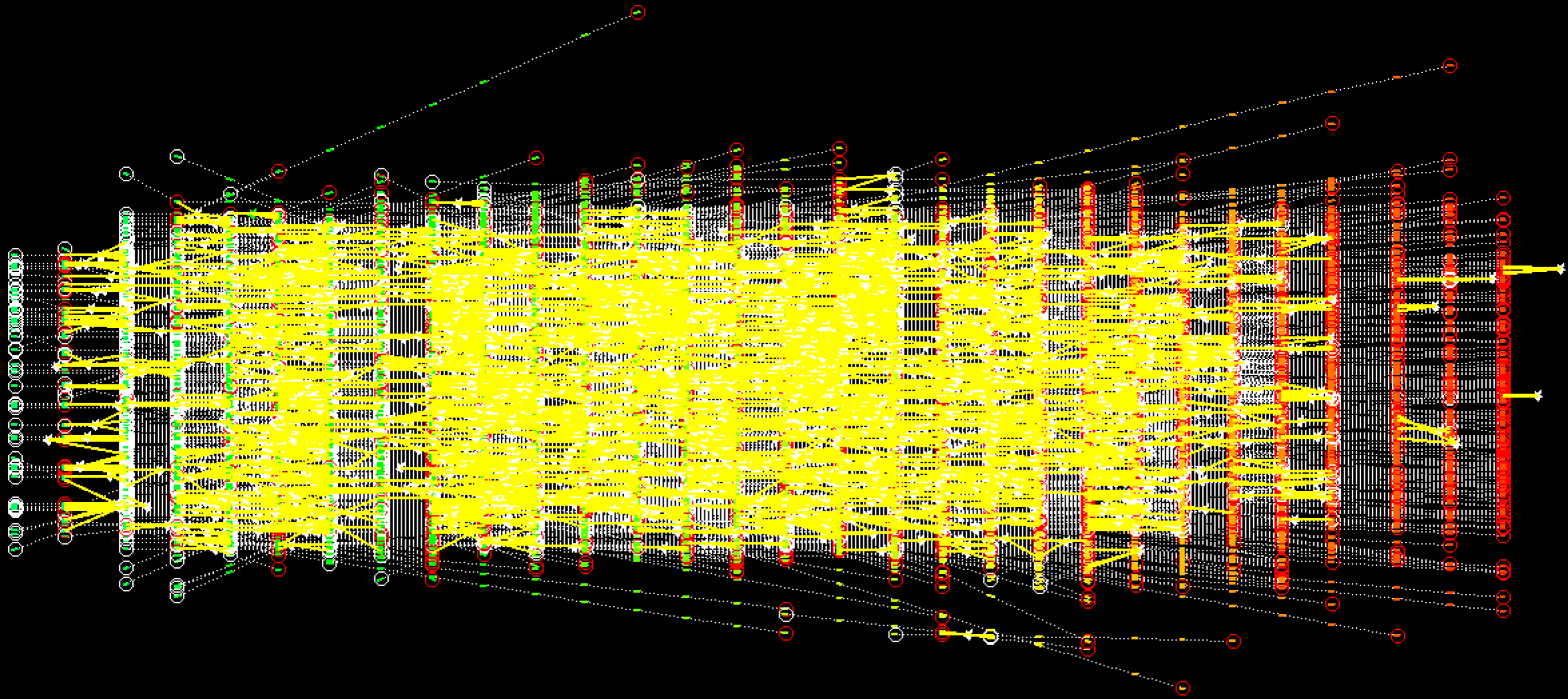
### Slope X microtrack distributions



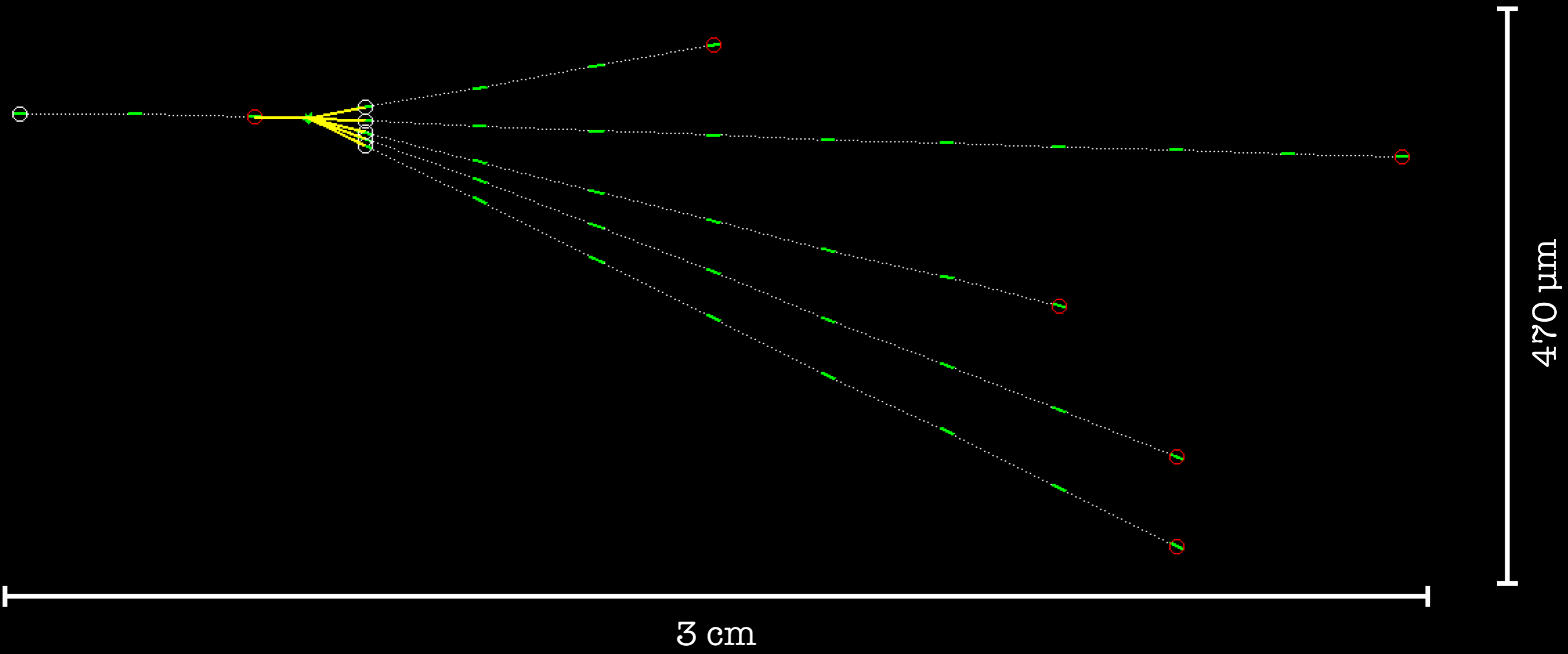
# SIGNAL VS COSMIC RAYS SEPARATION



# ALL OXYGEN VERTICES



# VERTEXING - EXAMPLE





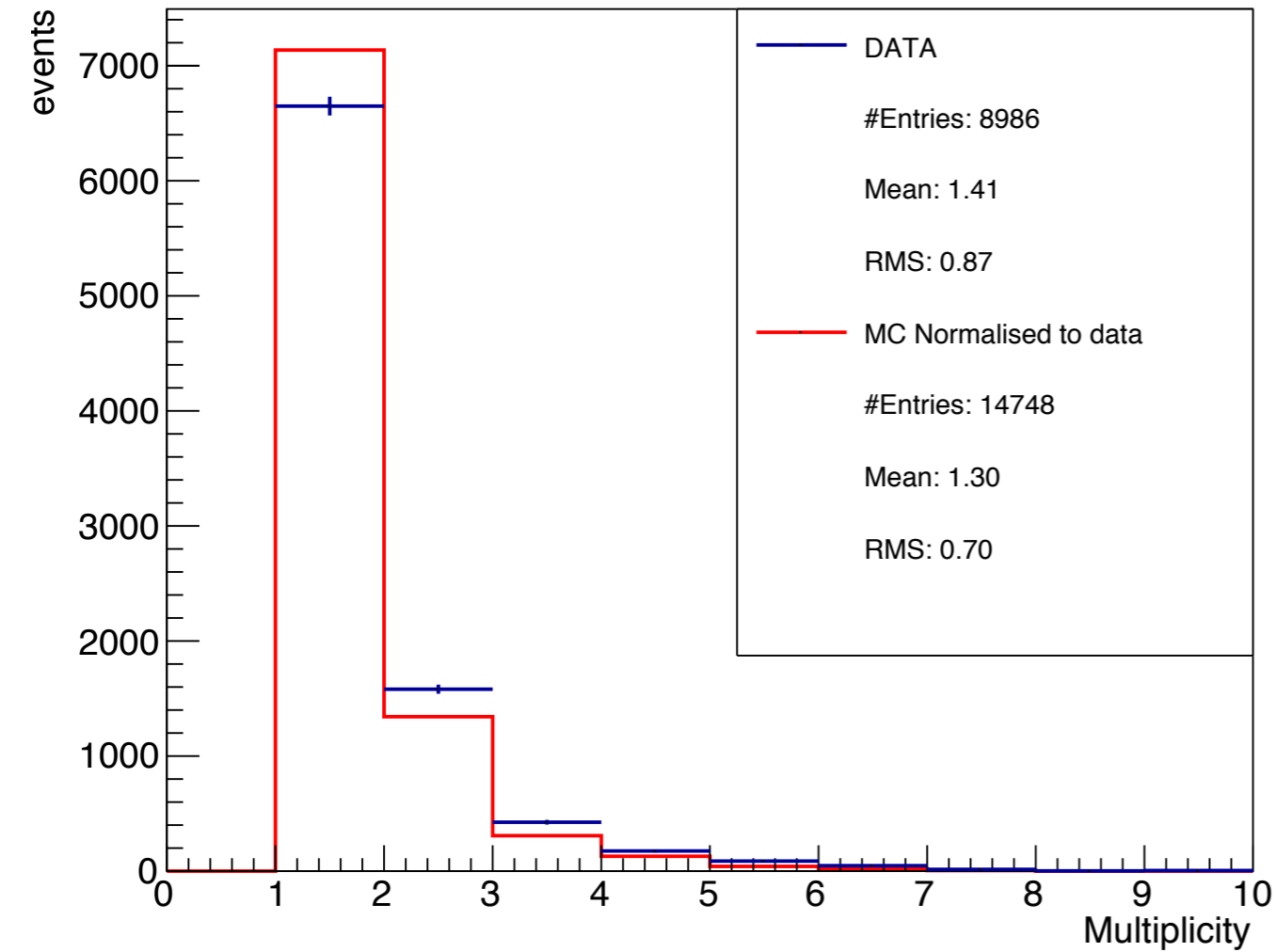
# COMPARISON WITH SIMULATION

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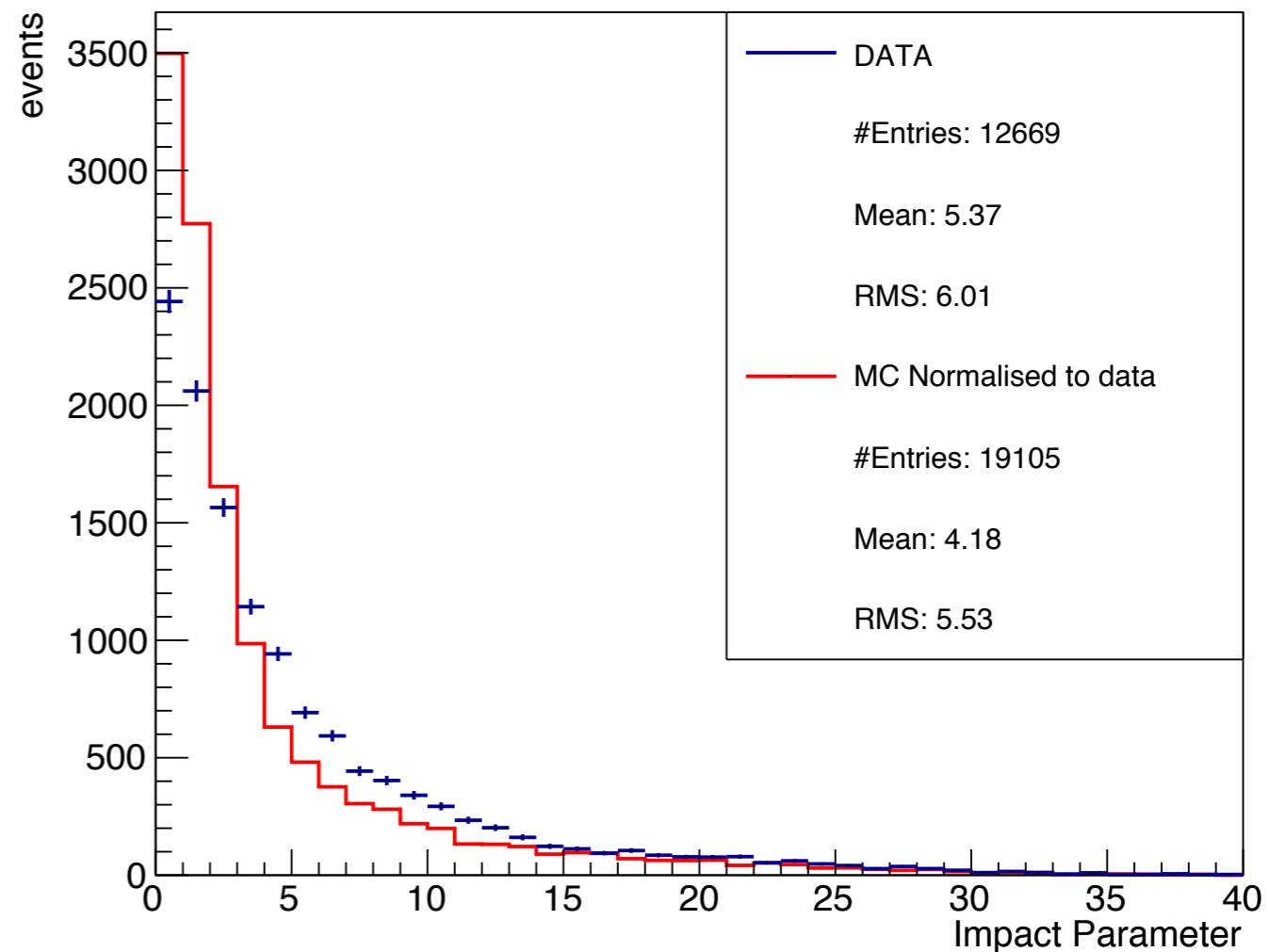
- MonteCarlo Simulation was converted into the raw data files format and underwent the tracking reconstruction
- **Flat** efficiency was set at 94%
- 4 mrad smearing was applied on angles
- No misalignment was simulated
- No cosmic rays or background were simulated

# COMPARISON WITH SIMULATION

## Multiplicity



## Impact Parameter

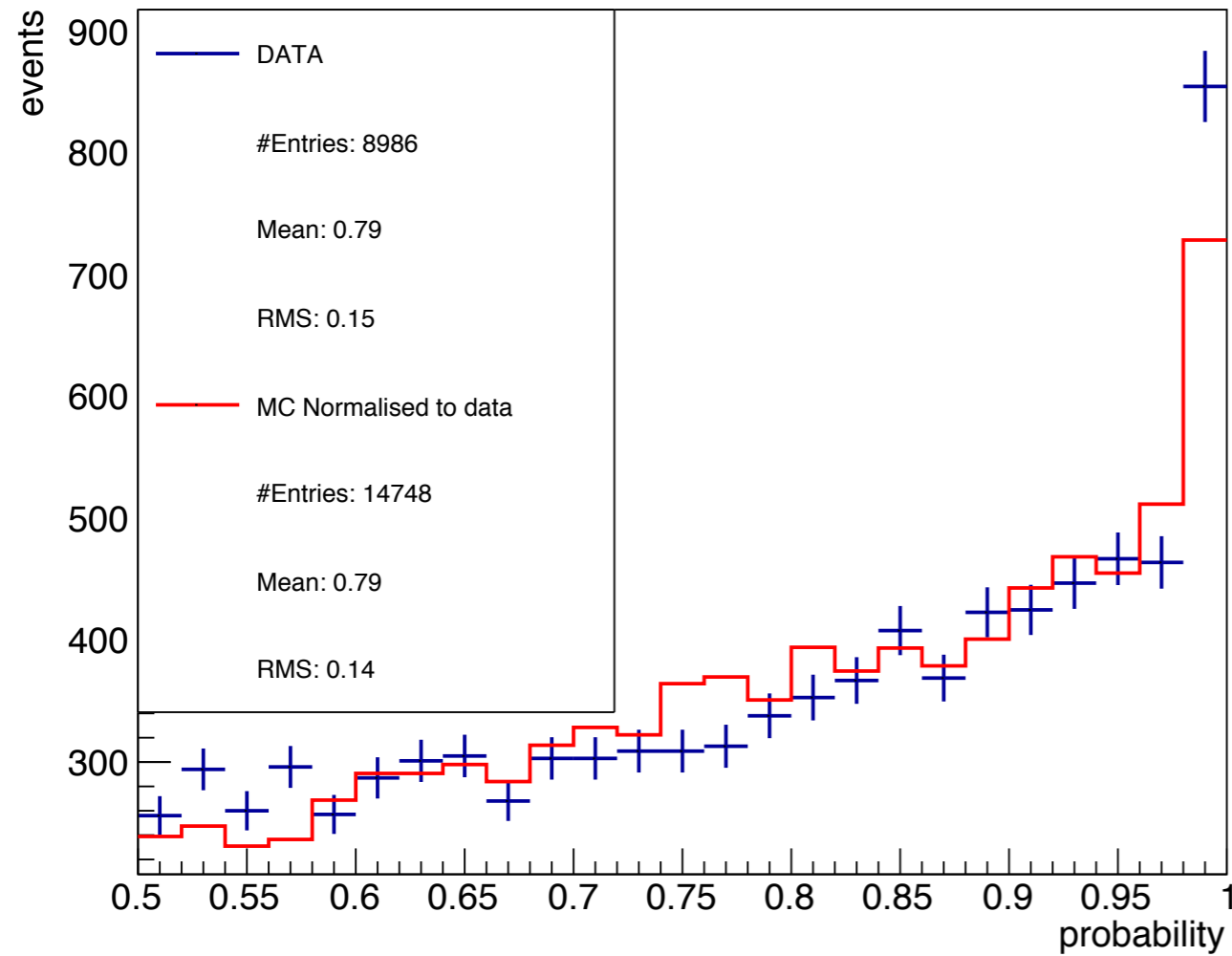


Selection: incoming particle with  $\theta < 0.04$  rad  
Vertex probability  $> 0.5$

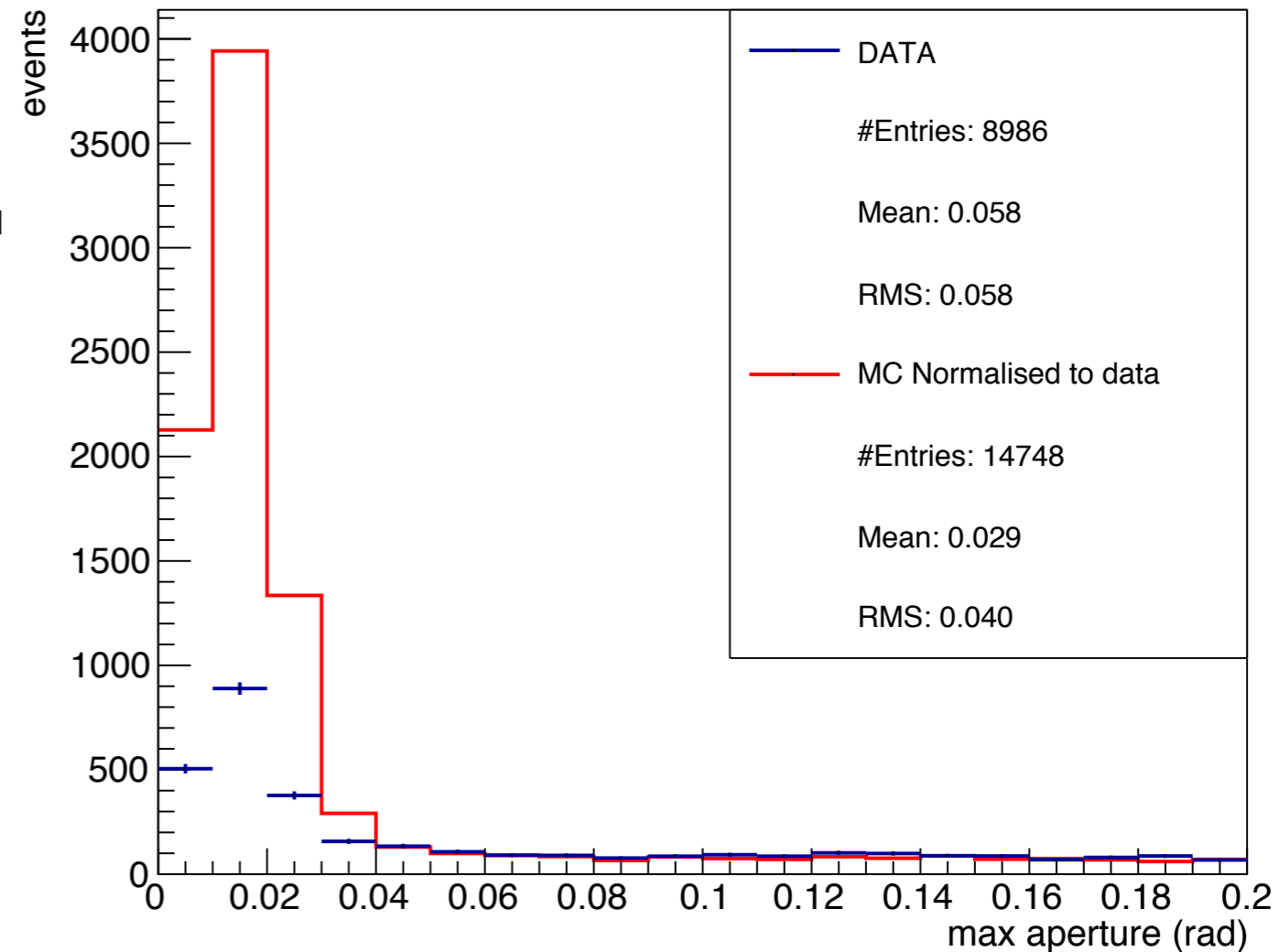
MC normalized to data

# COMPARISON WITH SIMULATION

## Vertex Probability



## Max Aperture

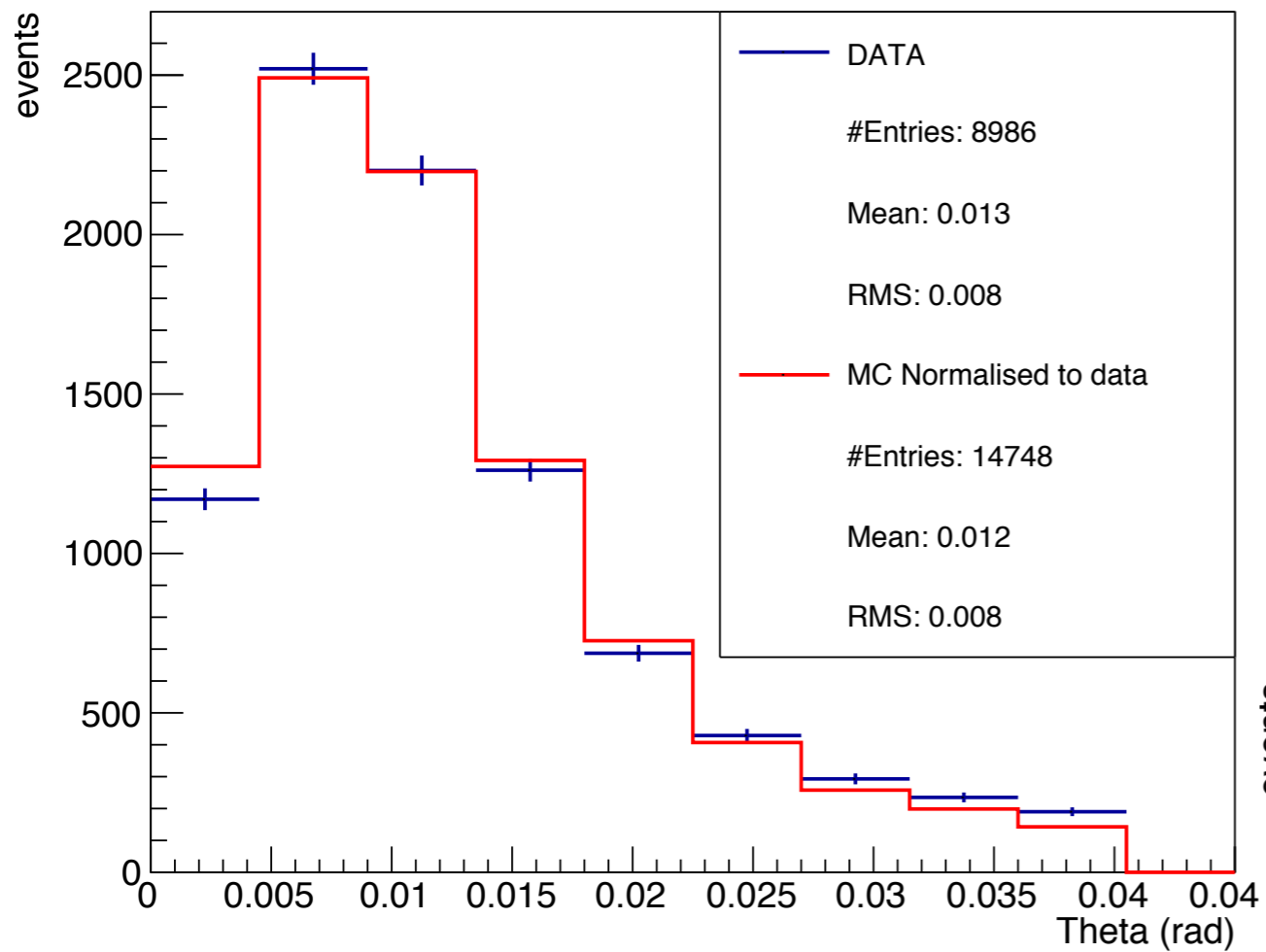


Selection: incoming particle with  $\theta < 0.04$  rad  
Vertex probability  $> 0.5$

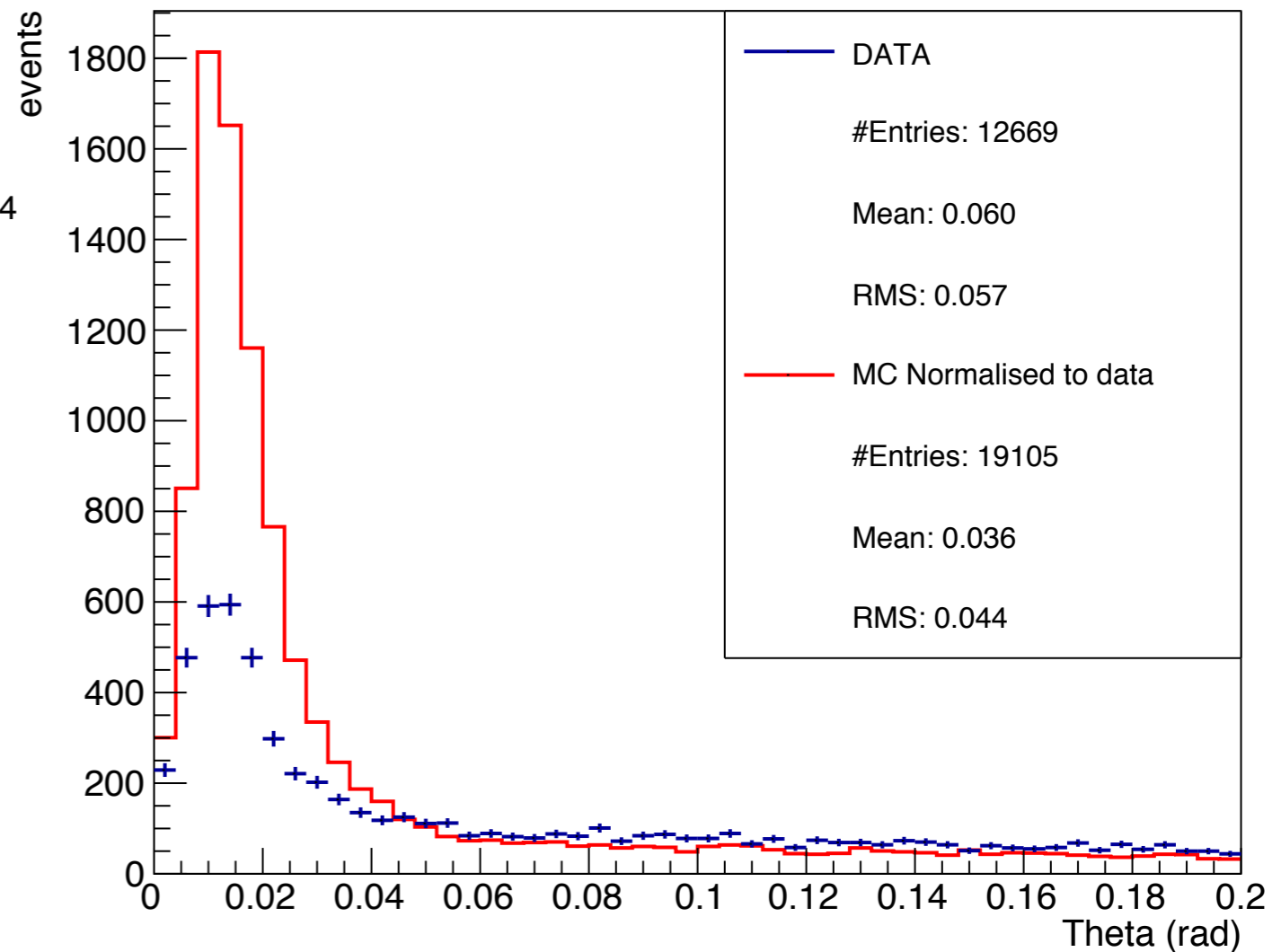
MC normalized to data

# COMPARISON WITH SIMULATION

## Theta Oxy



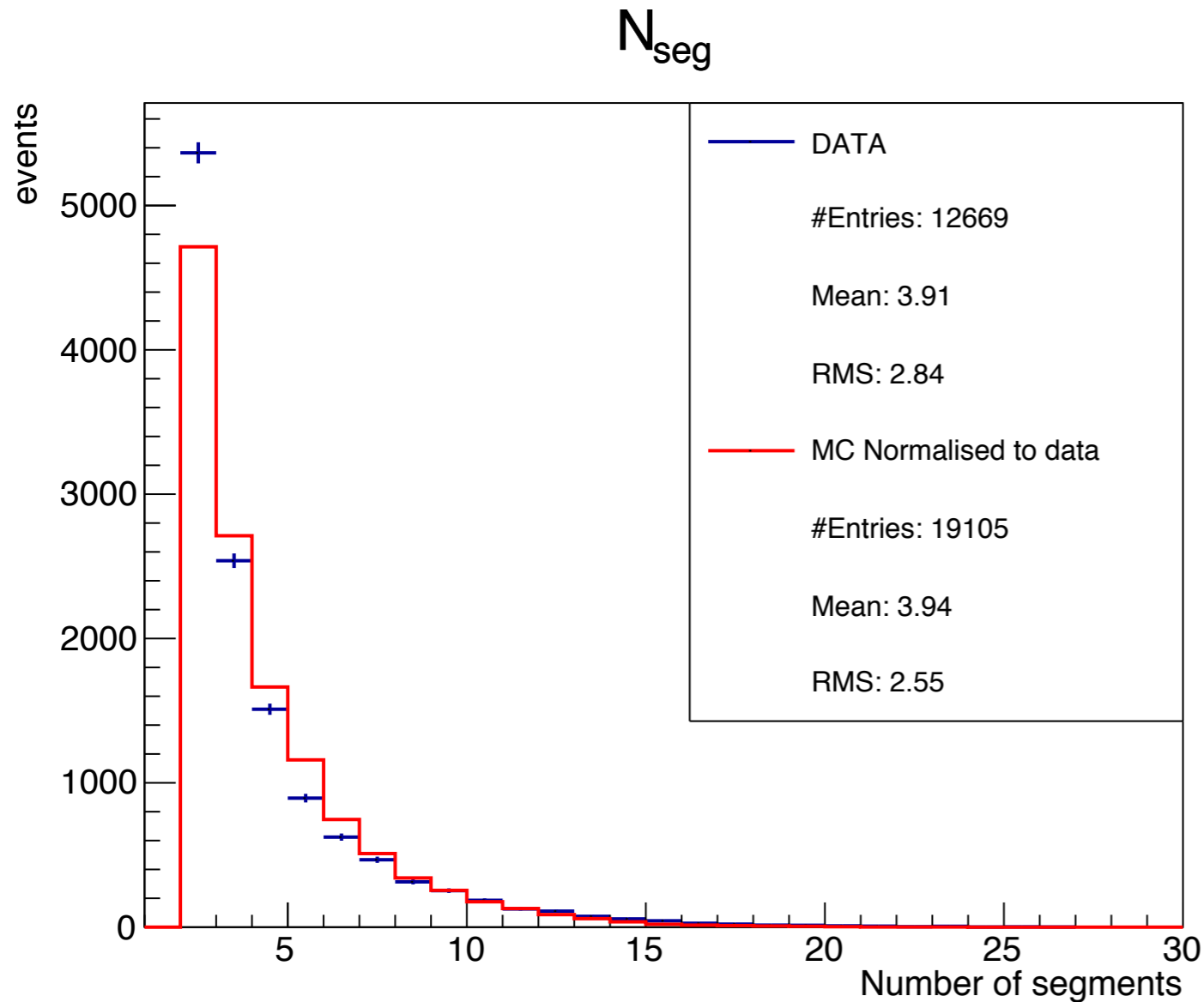
## Theta



Selection: incoming particle with  $\theta < 0.04$  rad  
Vertex probability  $> 0.5$

MC normalized to data

# COMPARISON WITH SIMULATION



Selection: incoming particle with  $\theta < 0.04$  rad  
Vertex probability  $> 0.5$

MC normalized to data

# NEXT STEPS

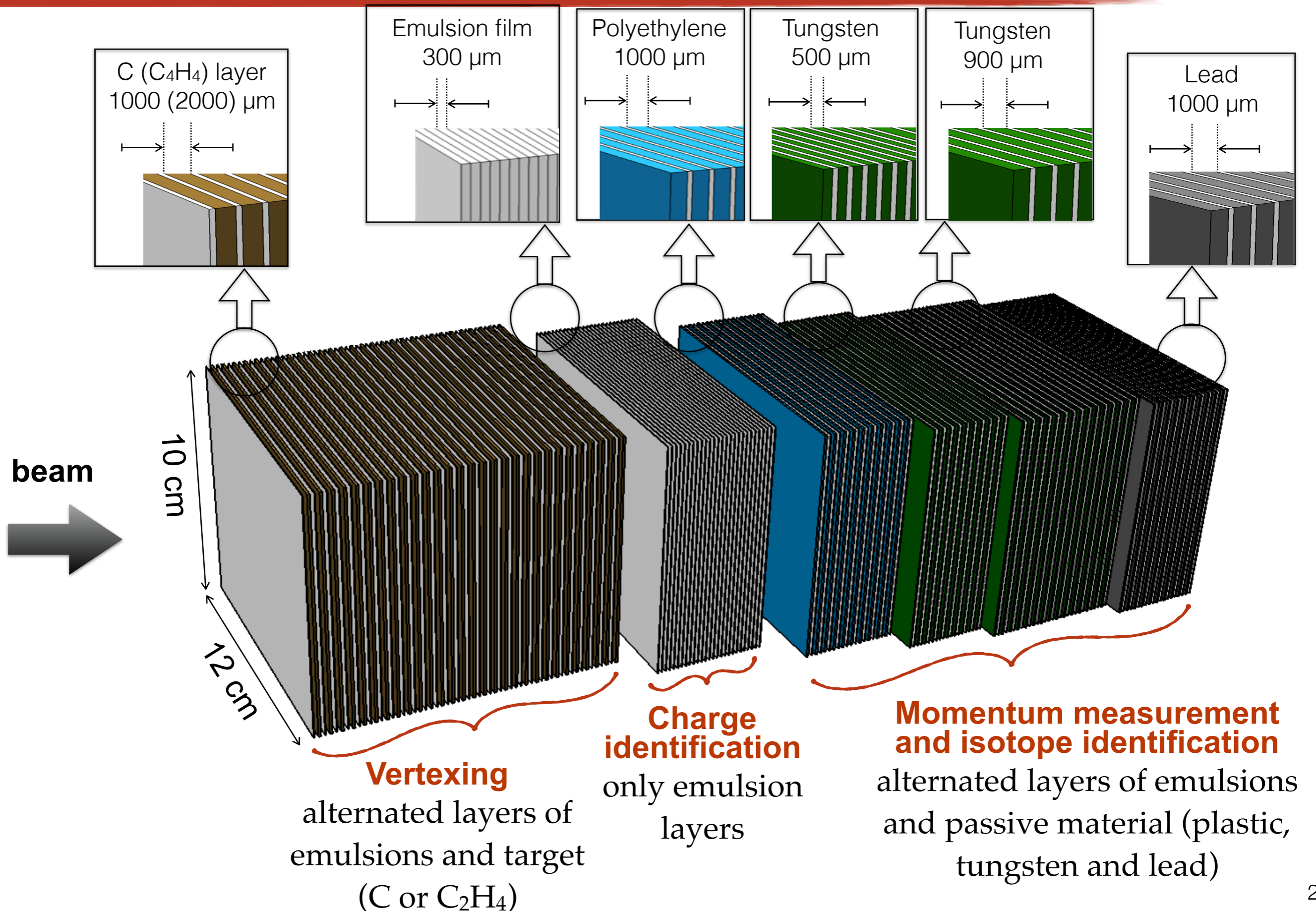
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- Improve tracking efficiency
- Vertices manual check and one by one analysis to better understand interactions characteristics and validate the analysis
- Continue emulsion scanning and microscope tuning



BACK UP SLIDES

# EMULSION SPECTROMETER DESIGN



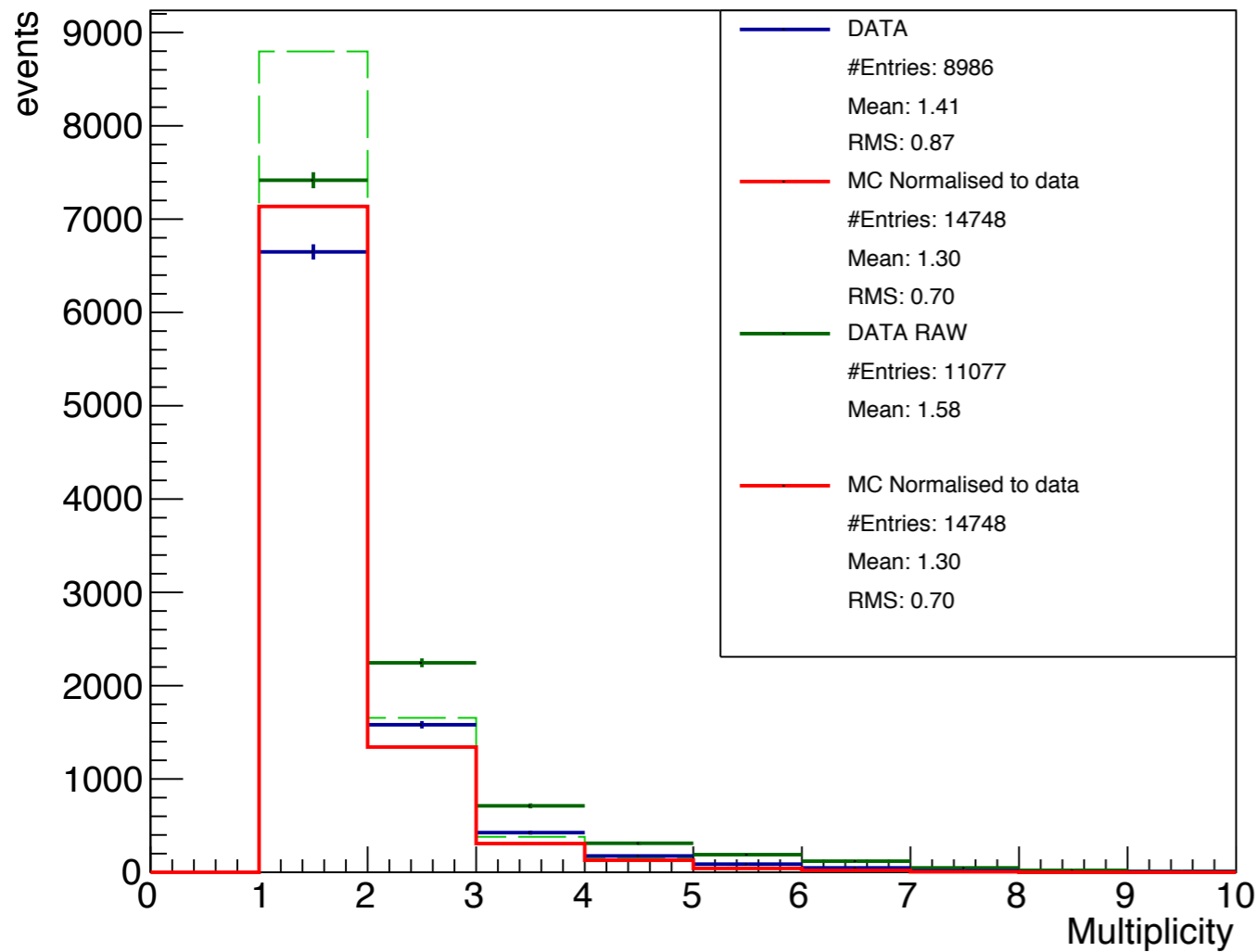
# DETECTOR STRUCTURE

	Oxygen 200 MeV/n	Oxygen 400 MeV/n
<b>S1</b>	C (30x1mm) / C2H4 (30x2mm) + 29 emu	
<b>S2</b>	Emu (36)	
<b>S3</b>	Polyethylene (10x1mm)+10emu	
<b>S4</b>	W (10x0.5mm)+10emu	
<b>S5</b>	W (15x0.9mm)+15emu	
<b>S6</b>	Pb (20x1mm)+20emu	Pb (40x1mm)+40emu



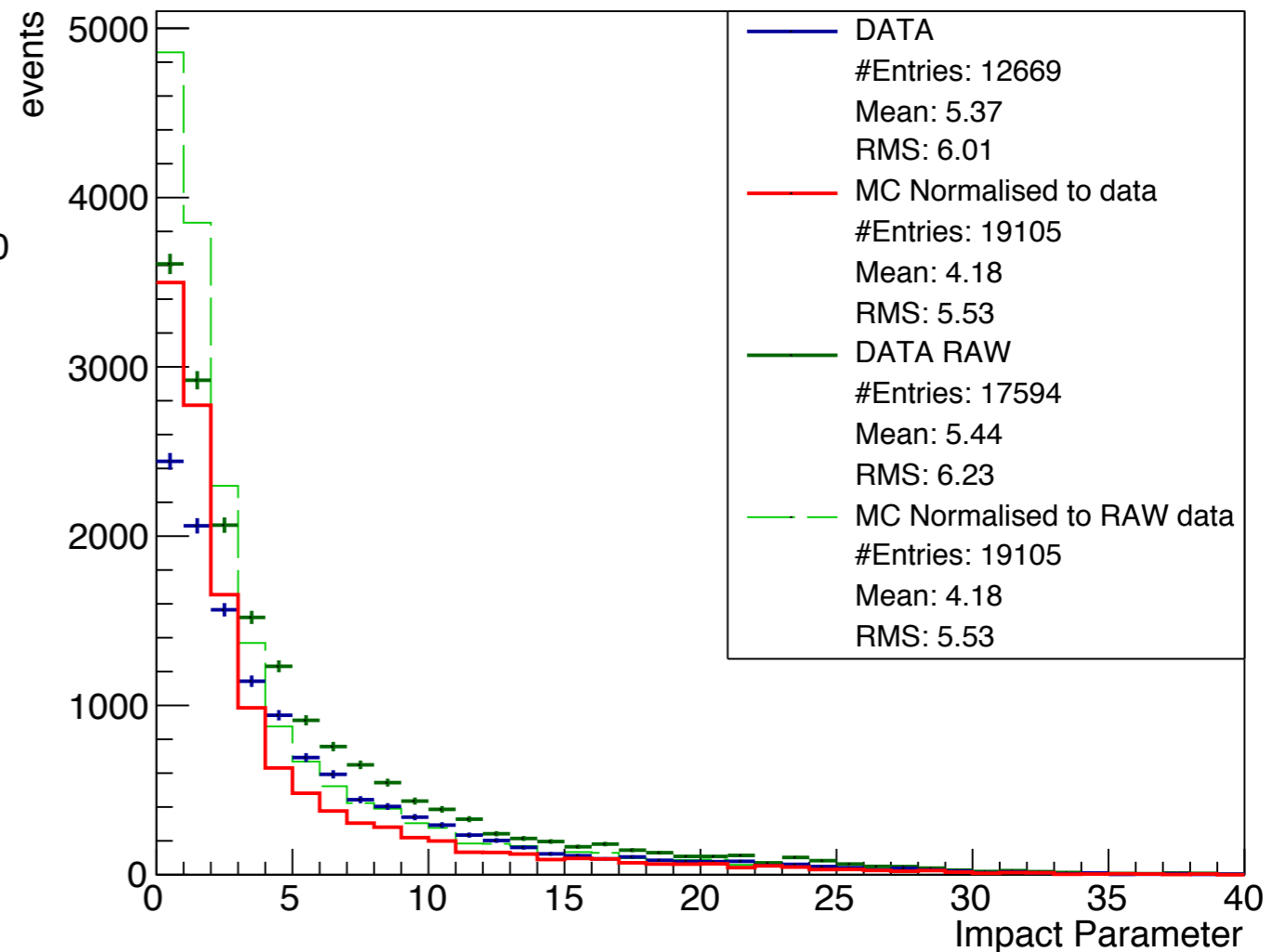
# COMPARISON WITH SIMULATION

## Multiplicity



RAW Data = Data before replacing fragmented oxygens with a single segment

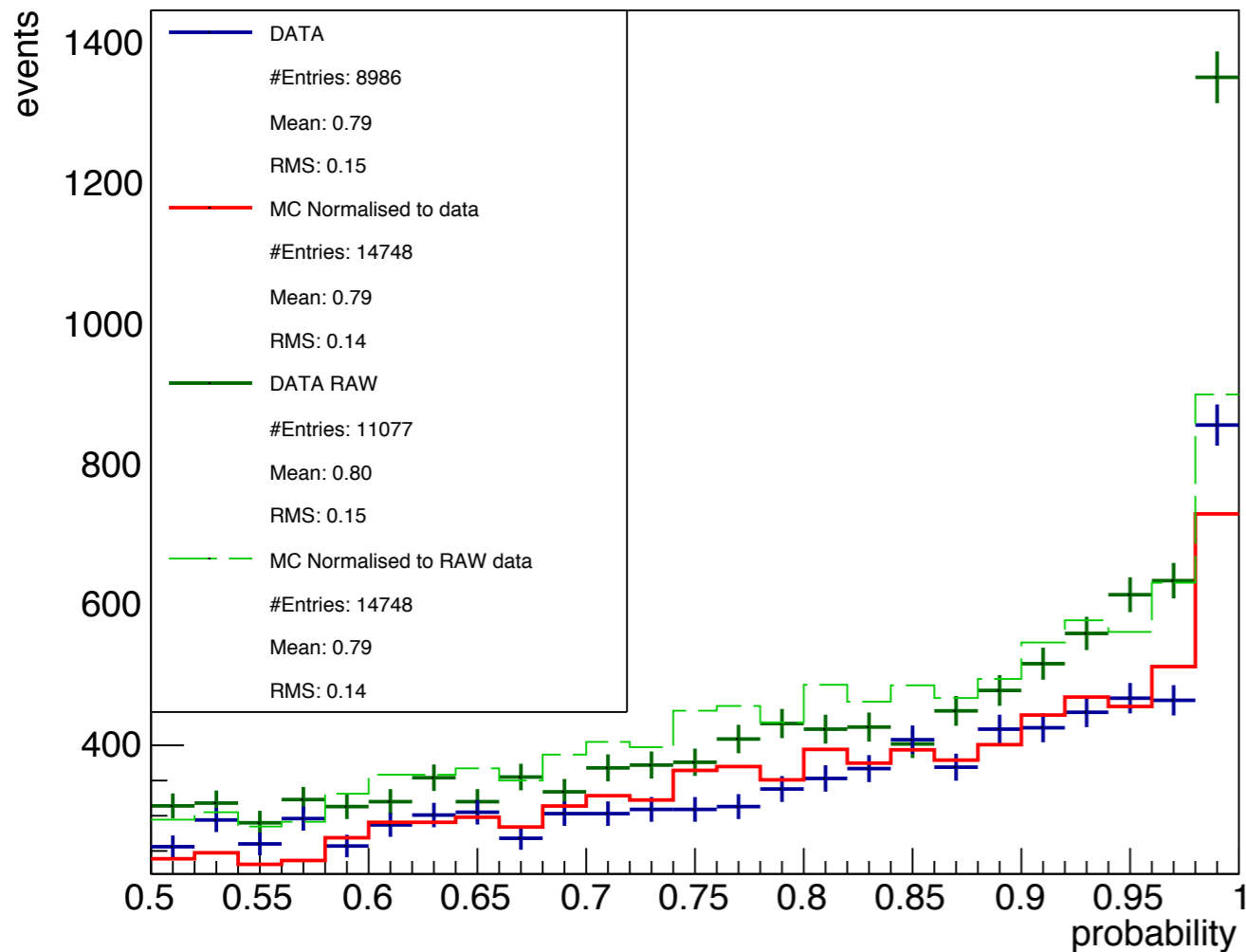
## Impact Parameter



Selection: incoming particle with  $\theta < 0.04$  rad  
Vertex probability  $> 0.5$

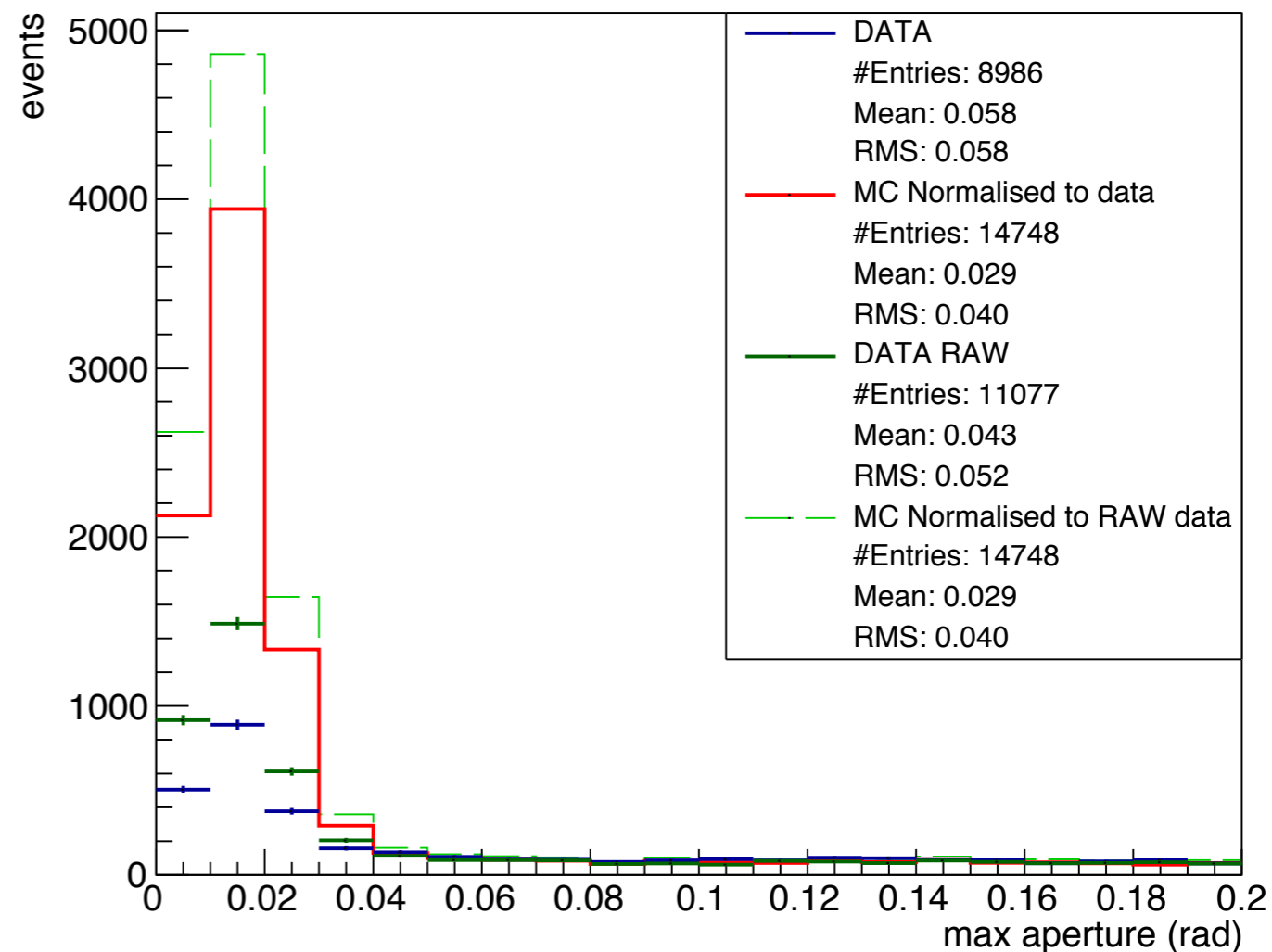
# COMPARISON WITH SIMULATION

## Vertex Probability



RAW Data = Data before replacing fragmented oxygens with a single segment

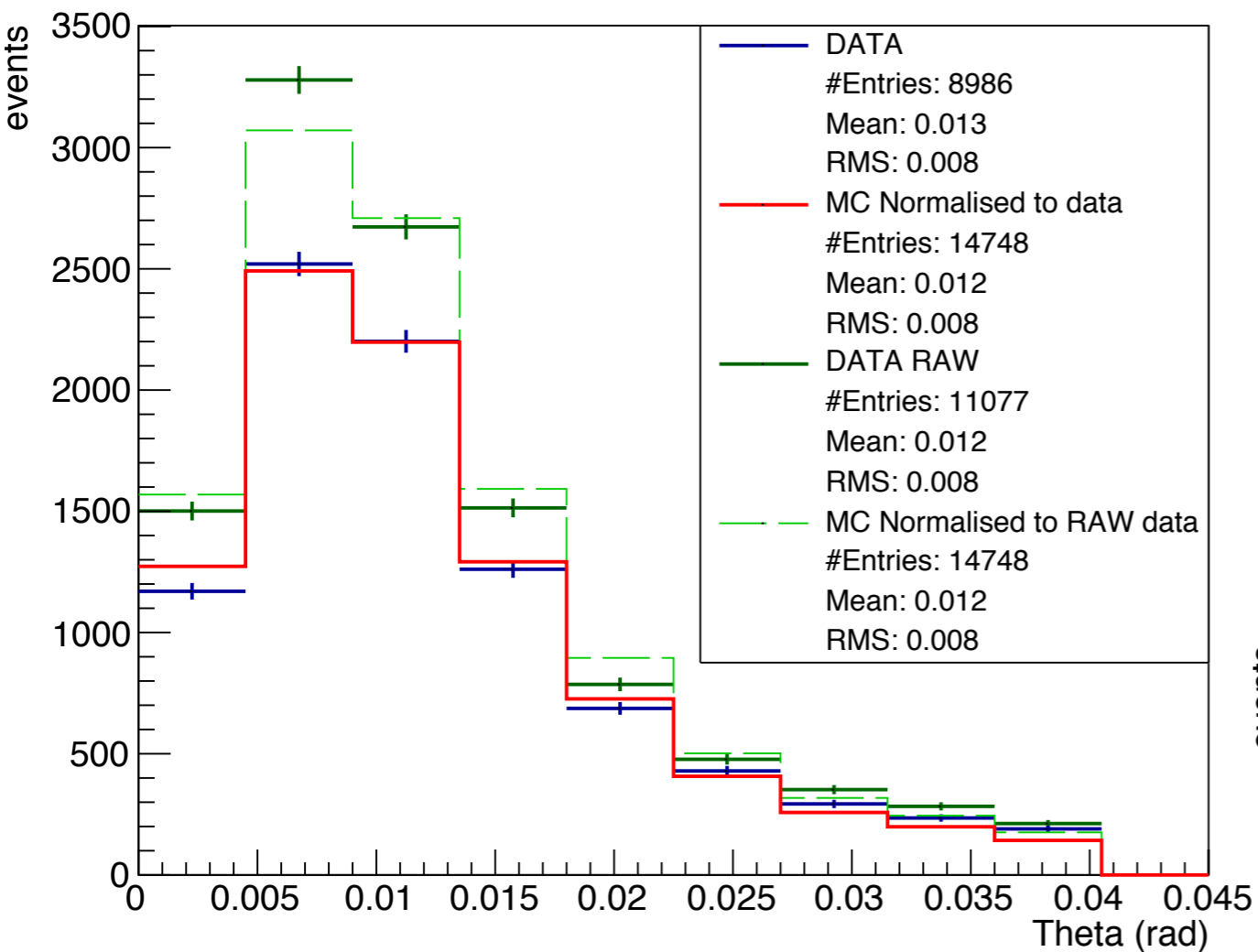
## Max Aperture



Selection: incoming particle with  $\theta < 0.04$  rad  
Vertex probability  $> 0.5$

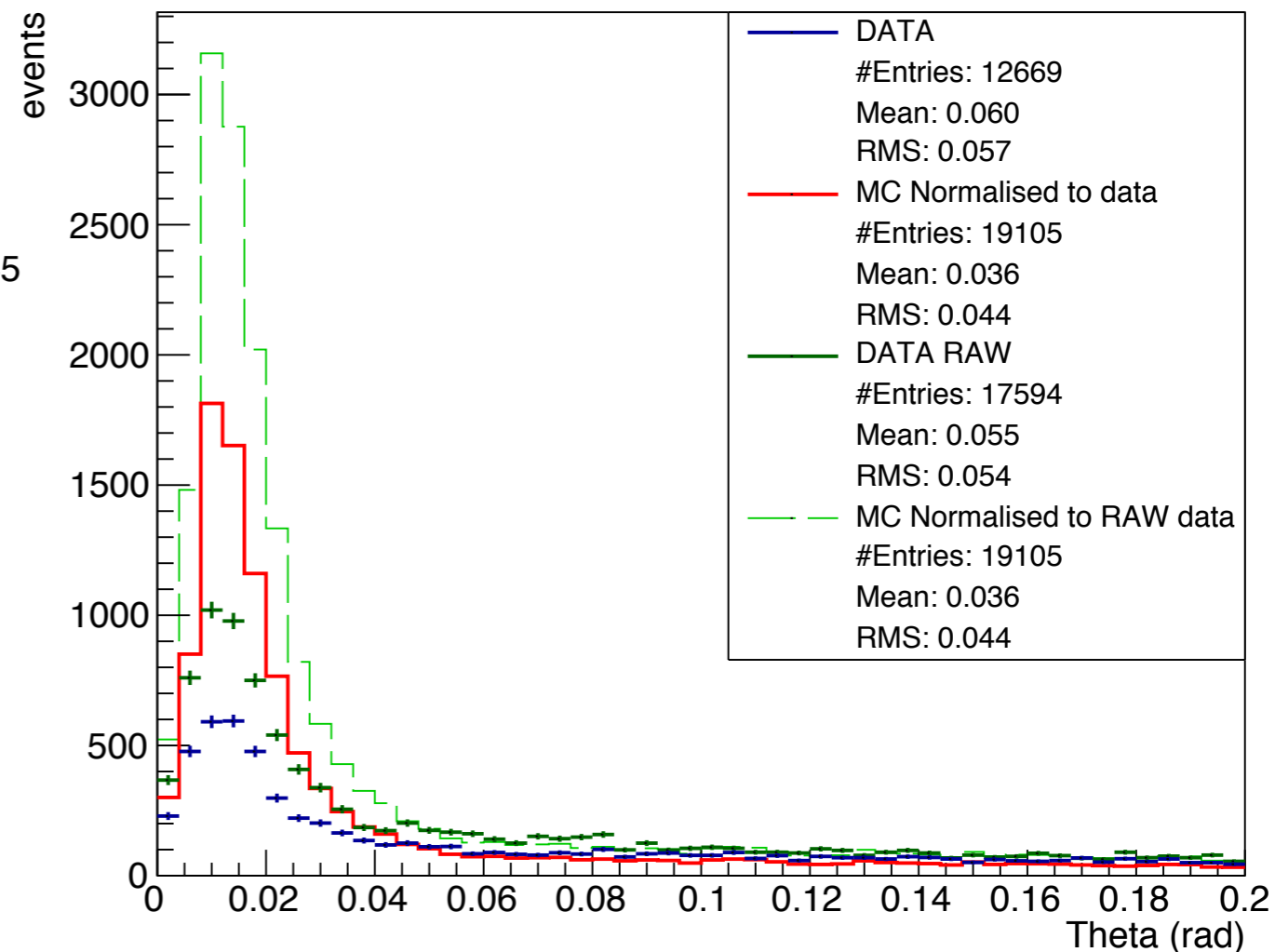
# COMPARISON WITH SIMULATION

## Theta Oxy



RAW Data = Data before replacing fragmented oxygens with a single segment

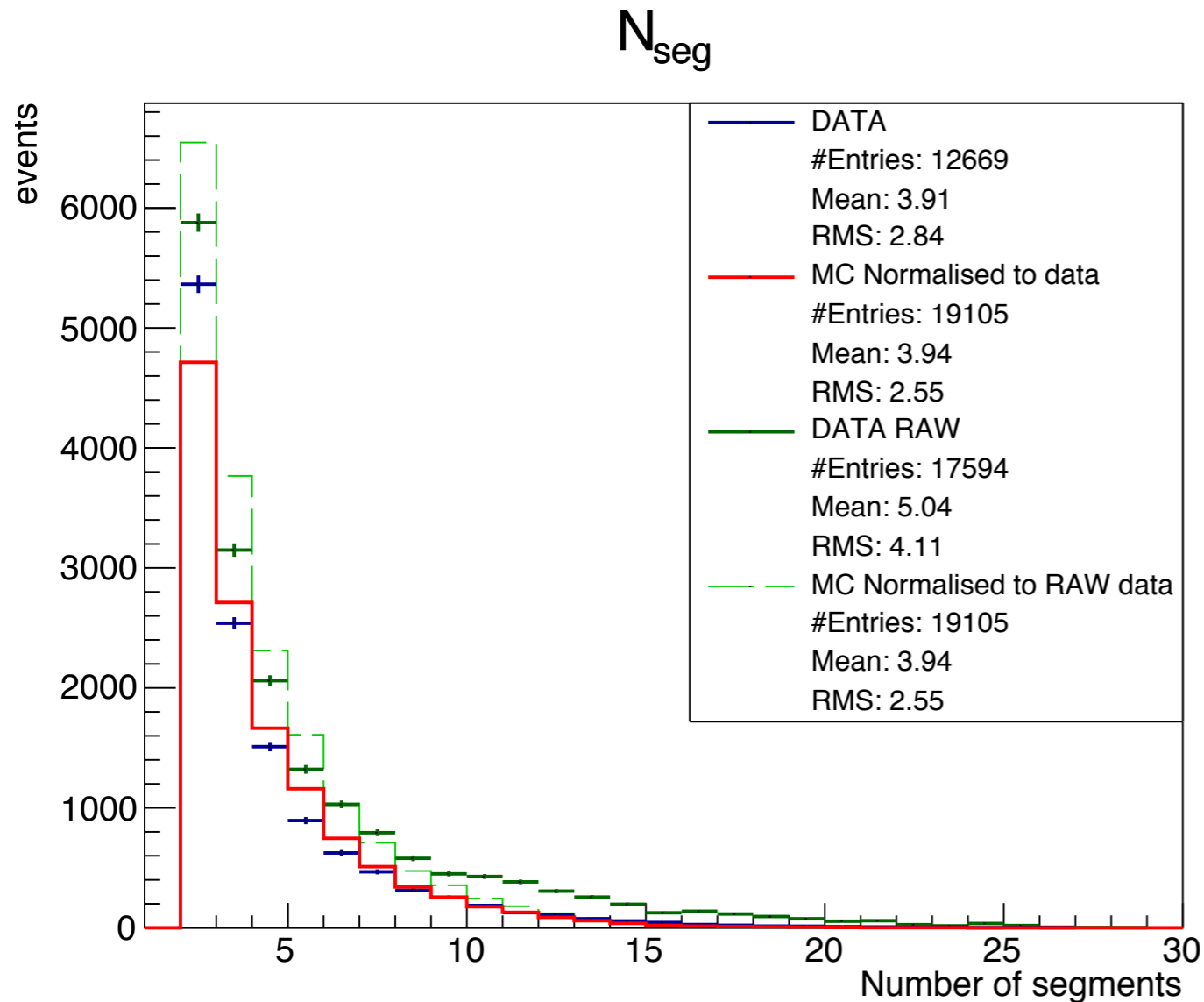
## Theta



Selection: incoming particle with  $\theta < 0.04$  rad  
Vertex probability  $> 0.5$



# COMPARISON WITH SIMULATION



RAW Data = Data before replacing fragmented oxygens with a single segment

Selection: incoming particle with  $\theta < 0.04$  rad  
Vertex probability  $> 0.5$