# Digitalization and Track-Reconstruction

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**Topics:**

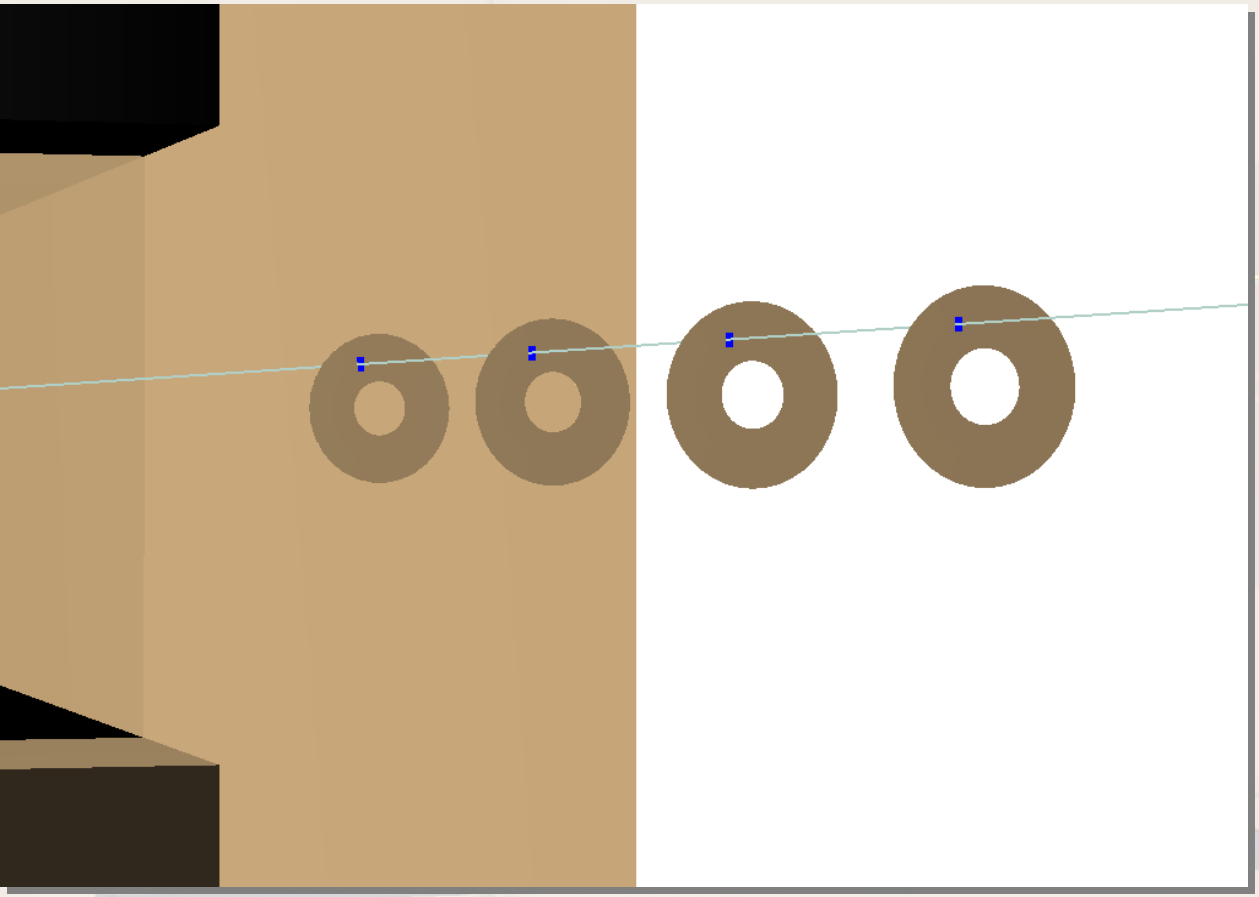
- **Simulation of different pitch-values with new digitization**
- **Reconstruction of multiple tracks**

**Collaboration Meeting GSI**

**December 10, 2009**

JOHANNES GUTENBERG UNIVERSITÄT MAINZ

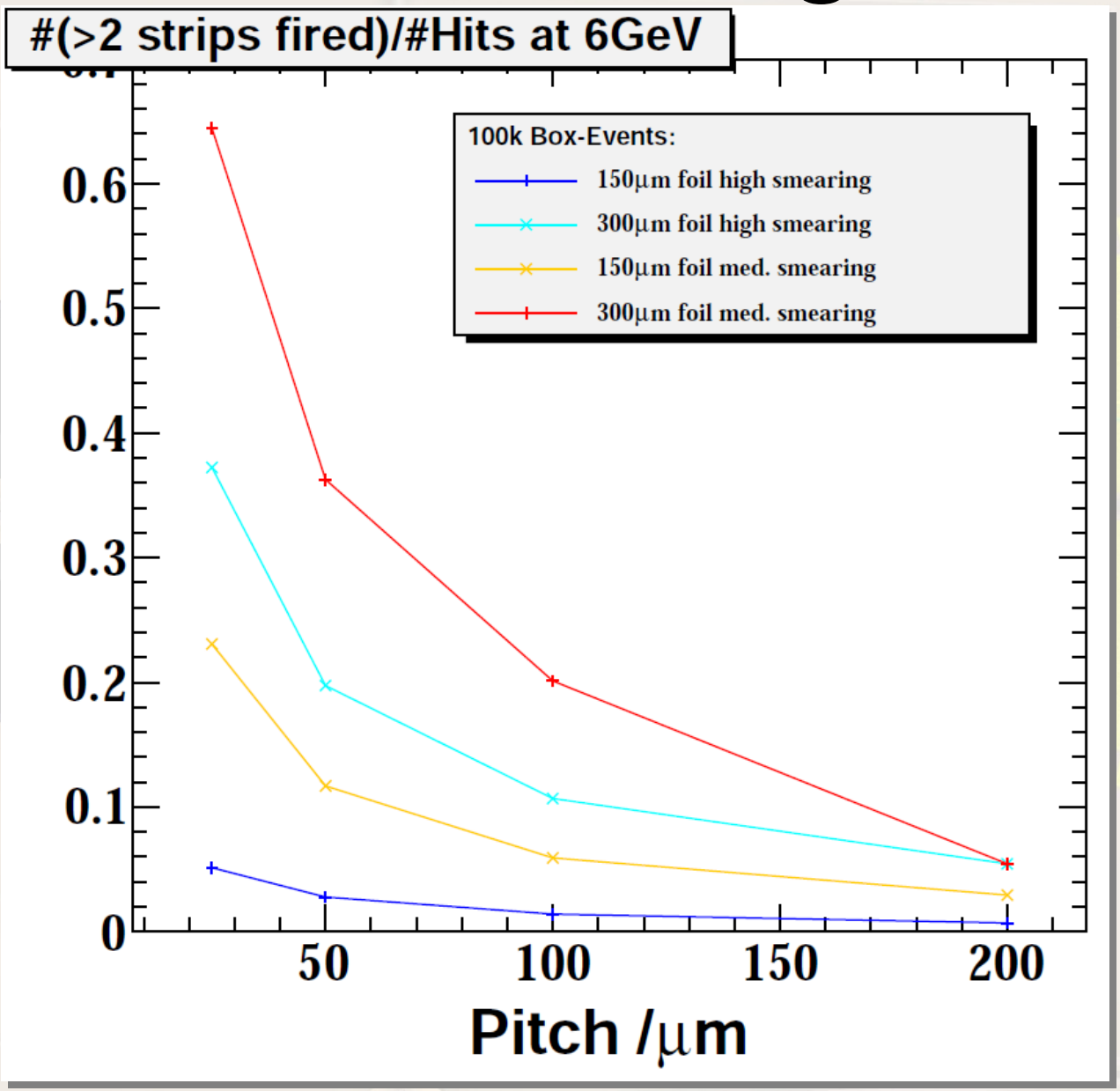
# Configuration



- 10 000 events per config.
- Box-Generator
- No magnetic field
- No beampipe, just vacuum
- 4 Si-discs, 3-8 mrad
  at 10.7 + 0.5 m each
- Thickness: 150 µm & 300 µm

| | noise /e | threshold /e |
|---|---|---|
| Med: | 500 | 2000 |
| High: | 1000 | 5000 |

# New Digitalization



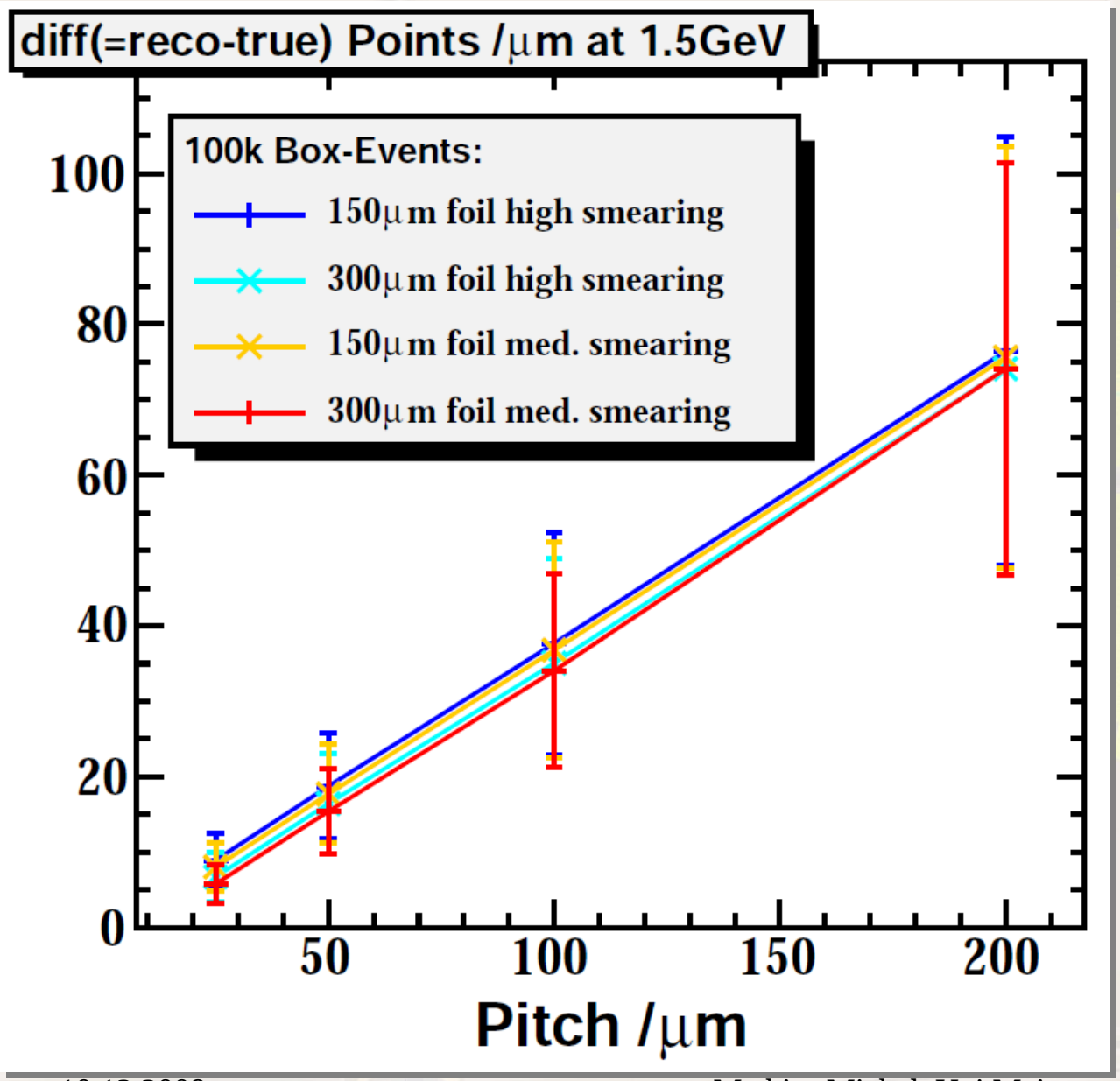

**More than 2 strips fired**

50 µm pitch:

150 µm thickness: ~ 3 %

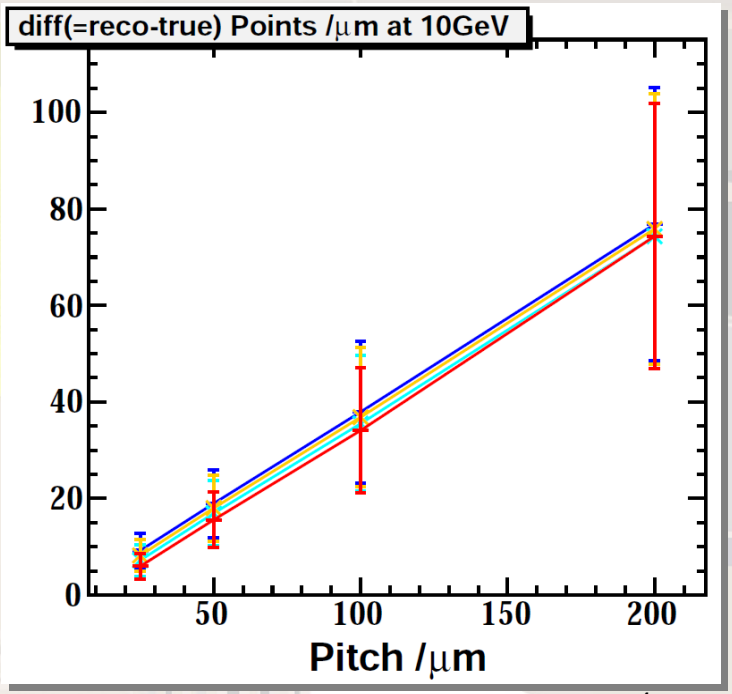
300 µm thickness: ~ 20 %

# Digitalization Effects

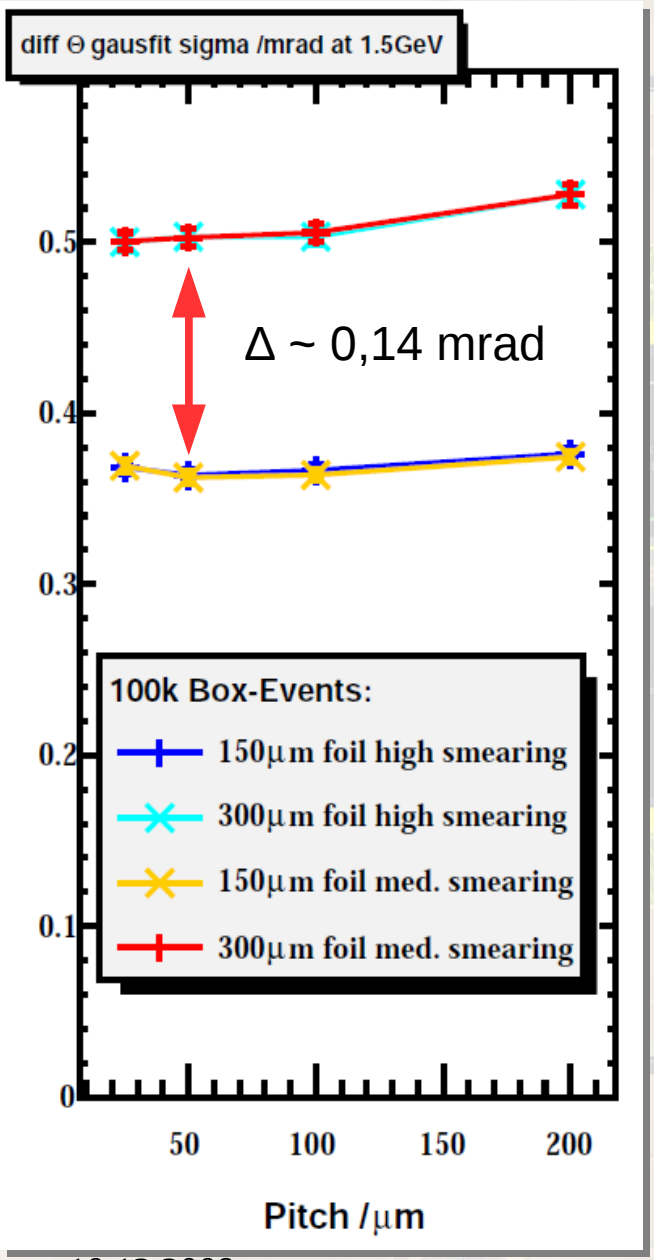


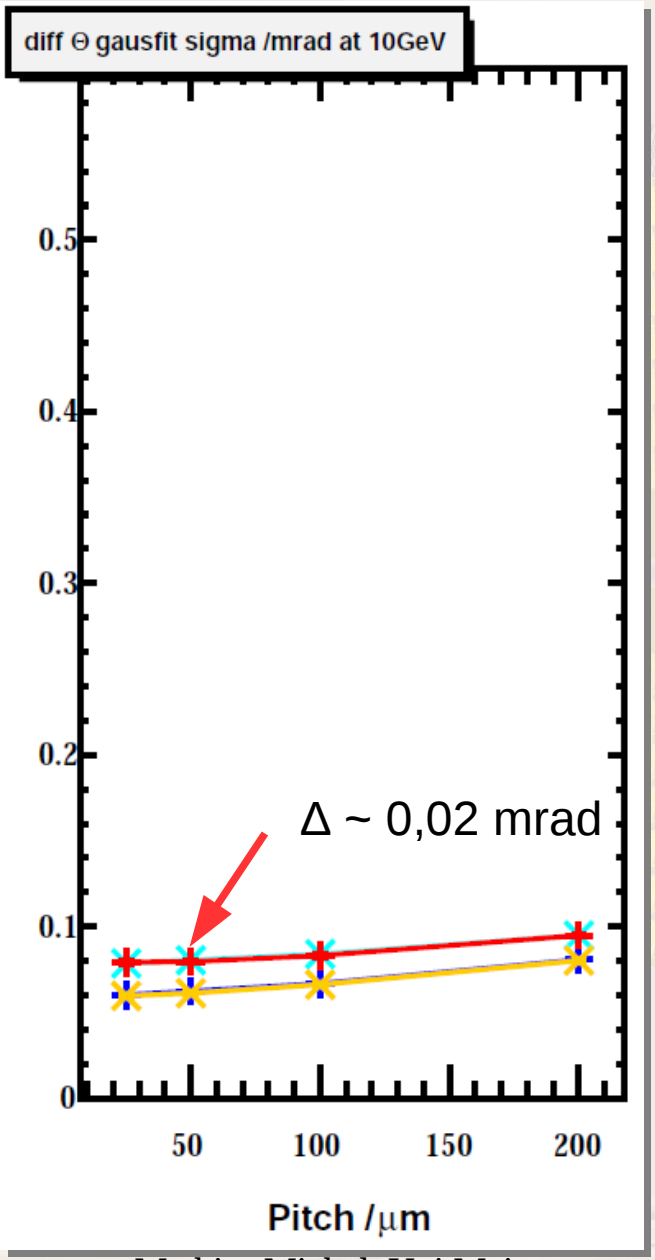

**Mean dist. between reconstr. and MC-Hits**

- linear in pitch-size
- no scattering-effects
- small smearing effects



# Theta-Resolution



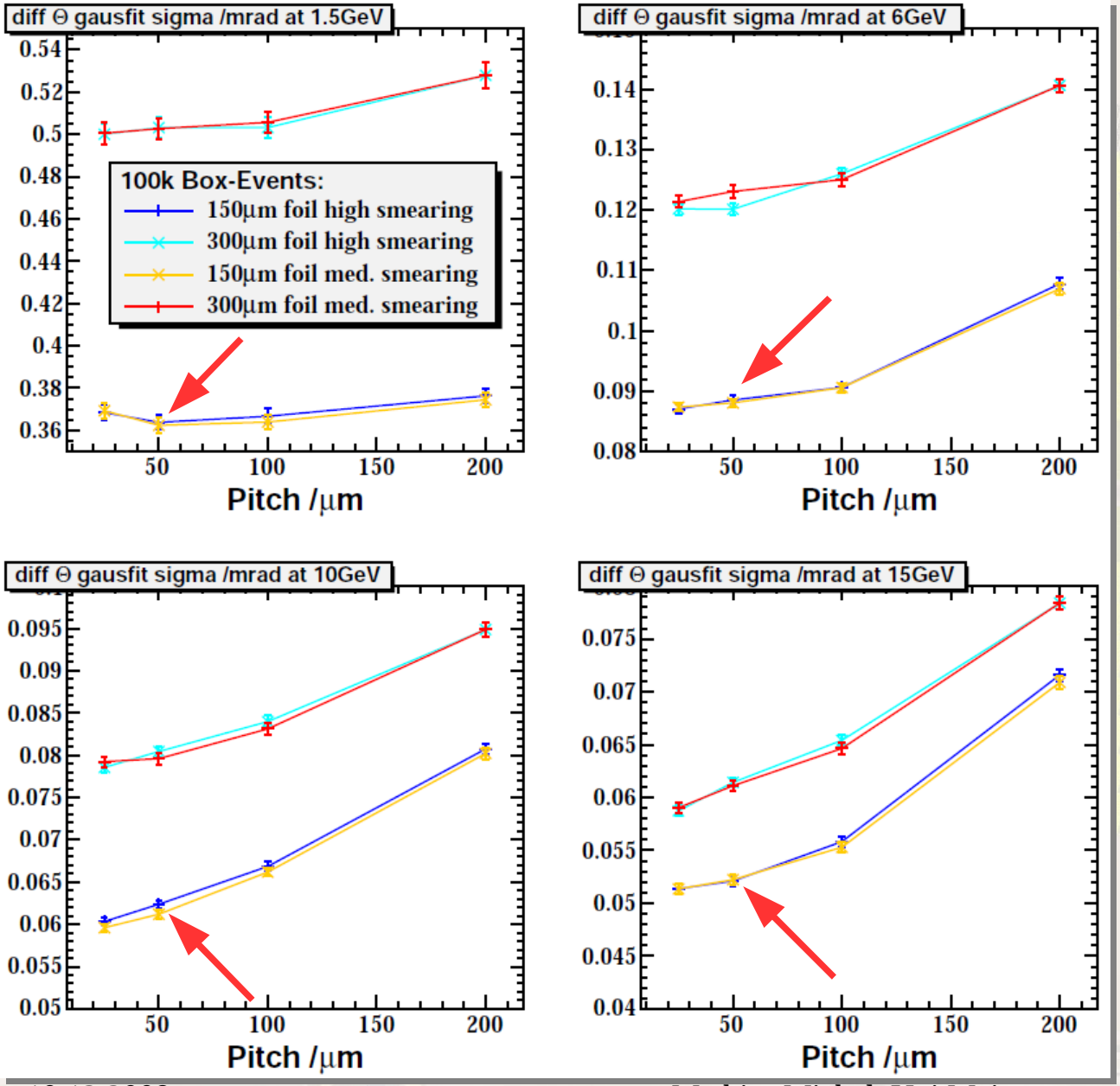

**Mean Theta-differ. Reco- to MC-Track**

nearly smearing independent

offset through low-angle-scattering

better resolution with thinner detector

# Theta-Resolution




150 µm thickness,
50 µm pitch:

1.5 GeV: ~ 362 µrad
6 Gev: ~ 88 µrad
10 GeV: ~ 62 µrad
15 GeV: ~ 52 µrad

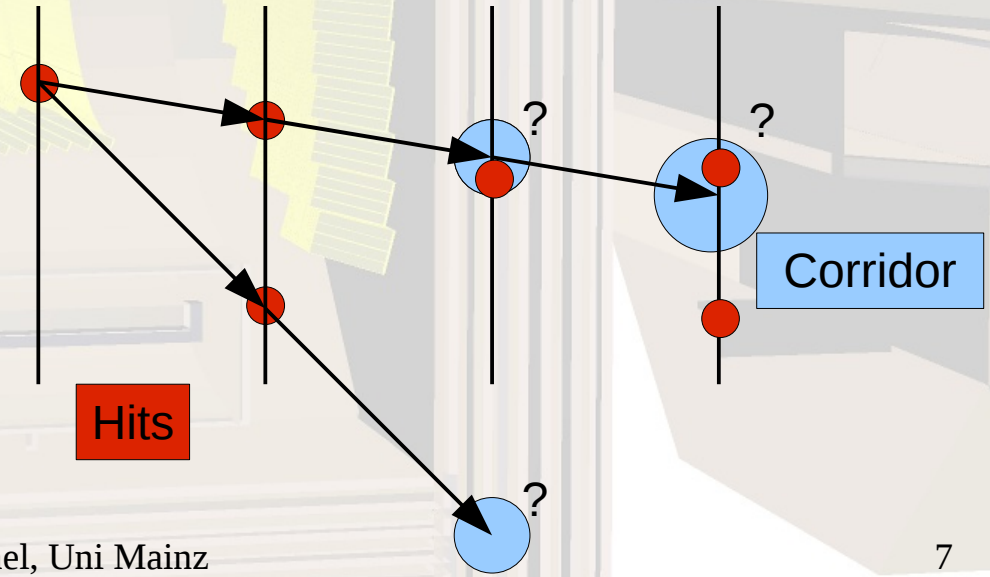
# Track-Reconstruction

## Algorithm

1. Sort hits
2. Create pseudo-tracks
3. Extension to other planes (corridor)
   => If hit: track-candidate found
4. 3D-Straight-Line-Fit of candidates

## Main Features

- works with any number of hits
- no limit of reconstructed tracks
- possibility of excluding hits



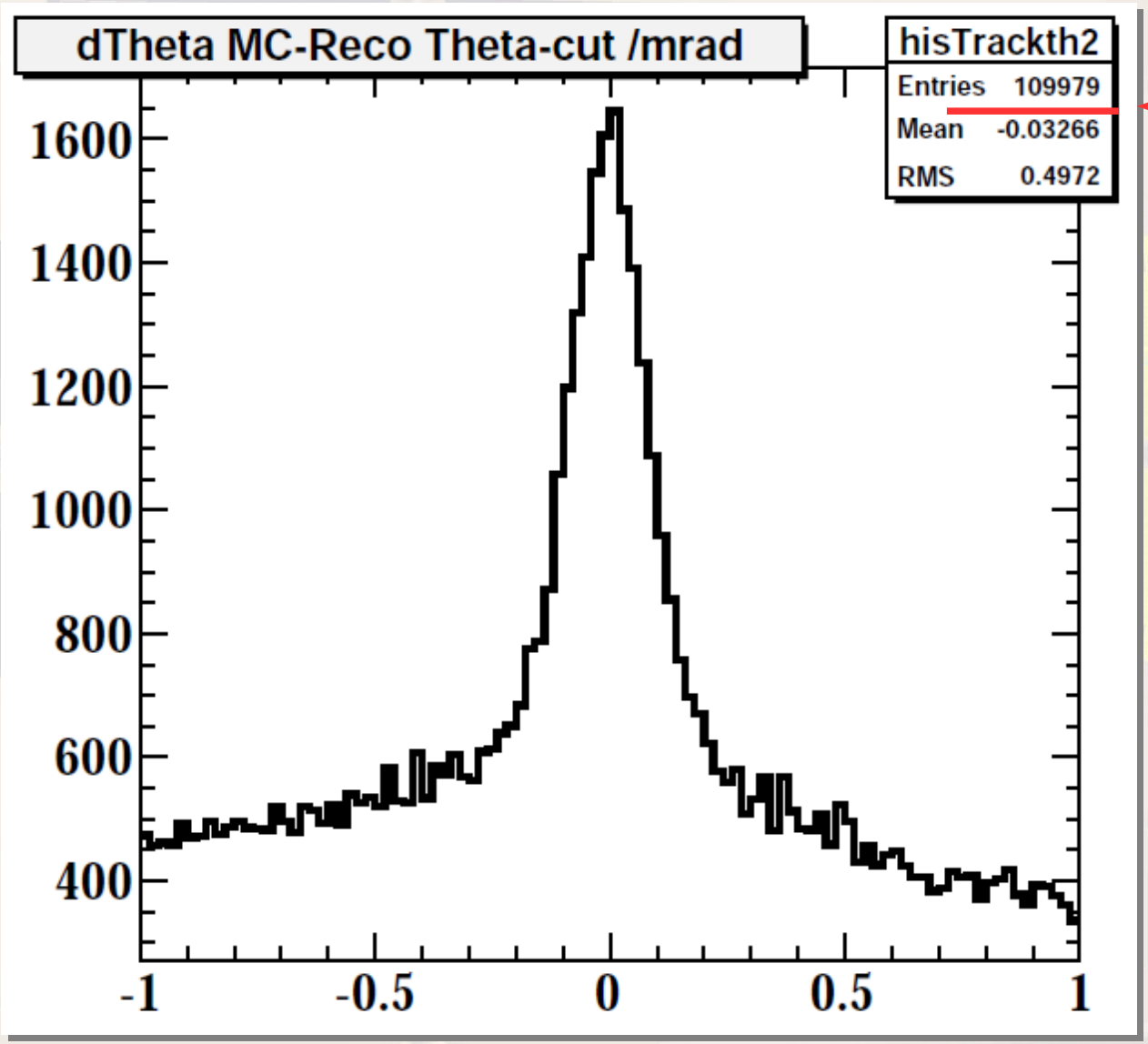
# Search-Corridor

## Configuration

- Antiprotons at 6 GeV with Box-Generator
- 4 Si-Discs 3-8mrad, 150 µm thick, 50 µm pitch, 10.7 m + 0.5 m
- no beampipe
- no magnetic fields

| radius / cm | % reconstructed tracks |
|---|---|
| 0.1 | 99 |
| 0.0707 | 94 |
| 0.0316 | 14 |

# Number of Tracks

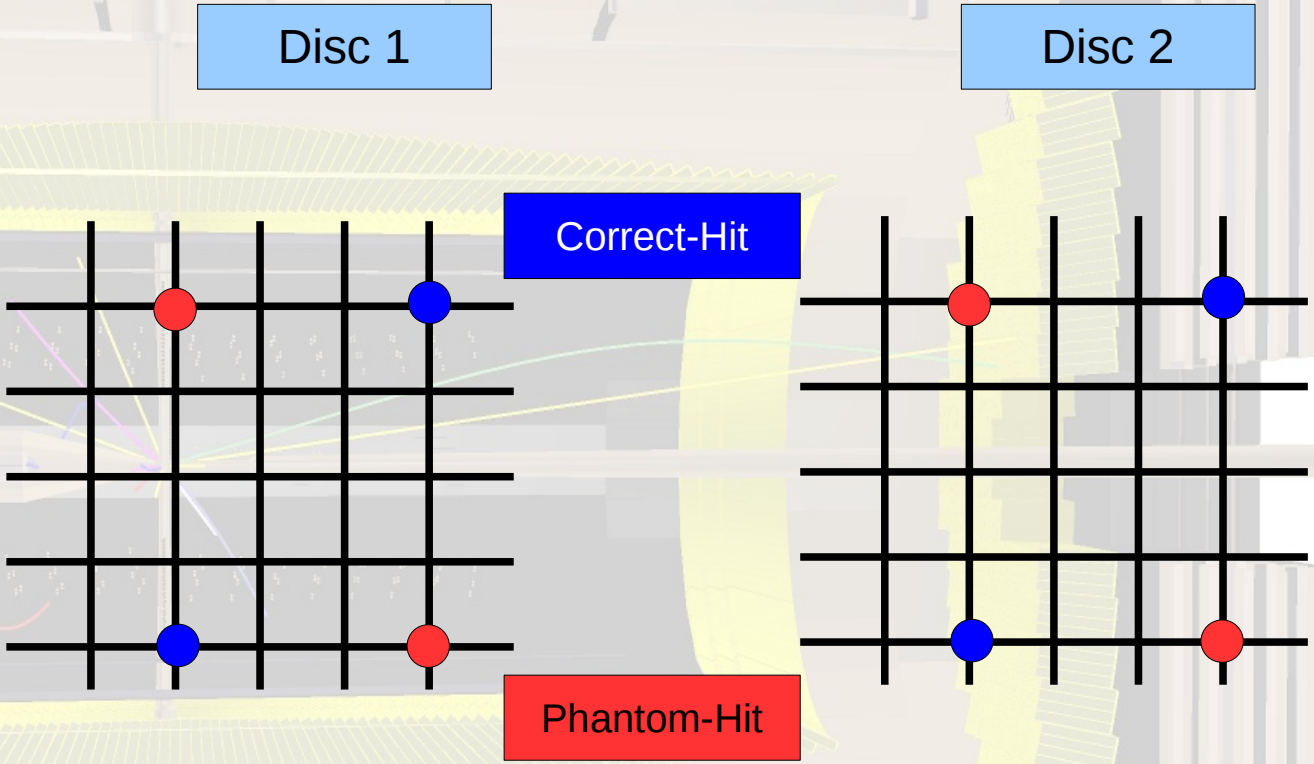



1000 Events
10 anti-p per event

10 000 tracks expected
100 000 reconstructed

**Why?**

# Ambiguities



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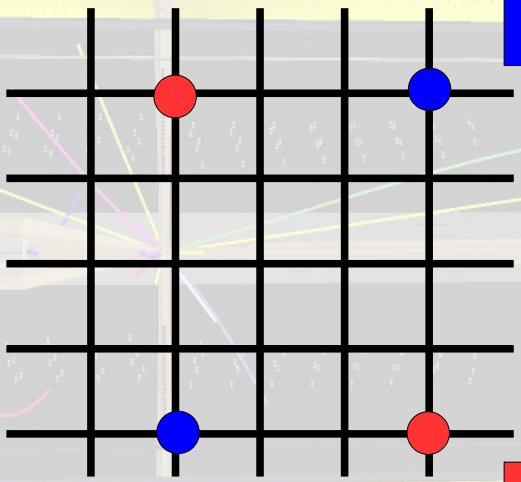


Disc 1

Disc 2

Correct-Hit

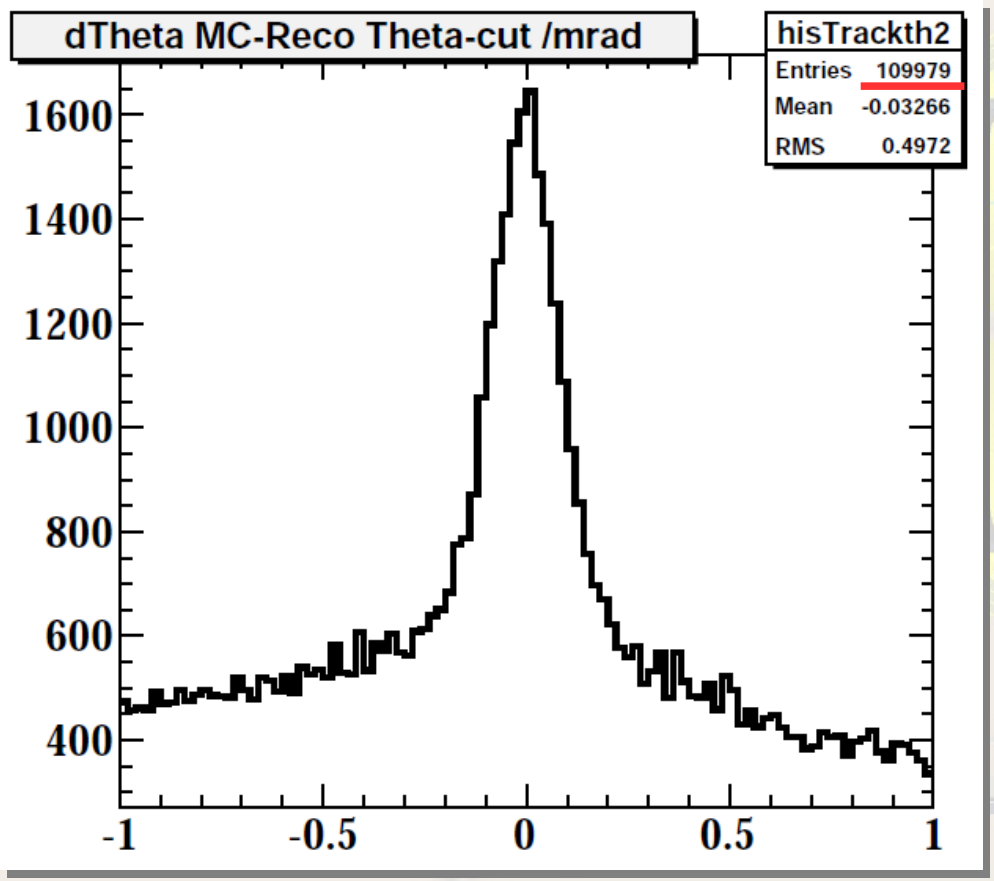
Phantom-Hit

old Ph.-Hit

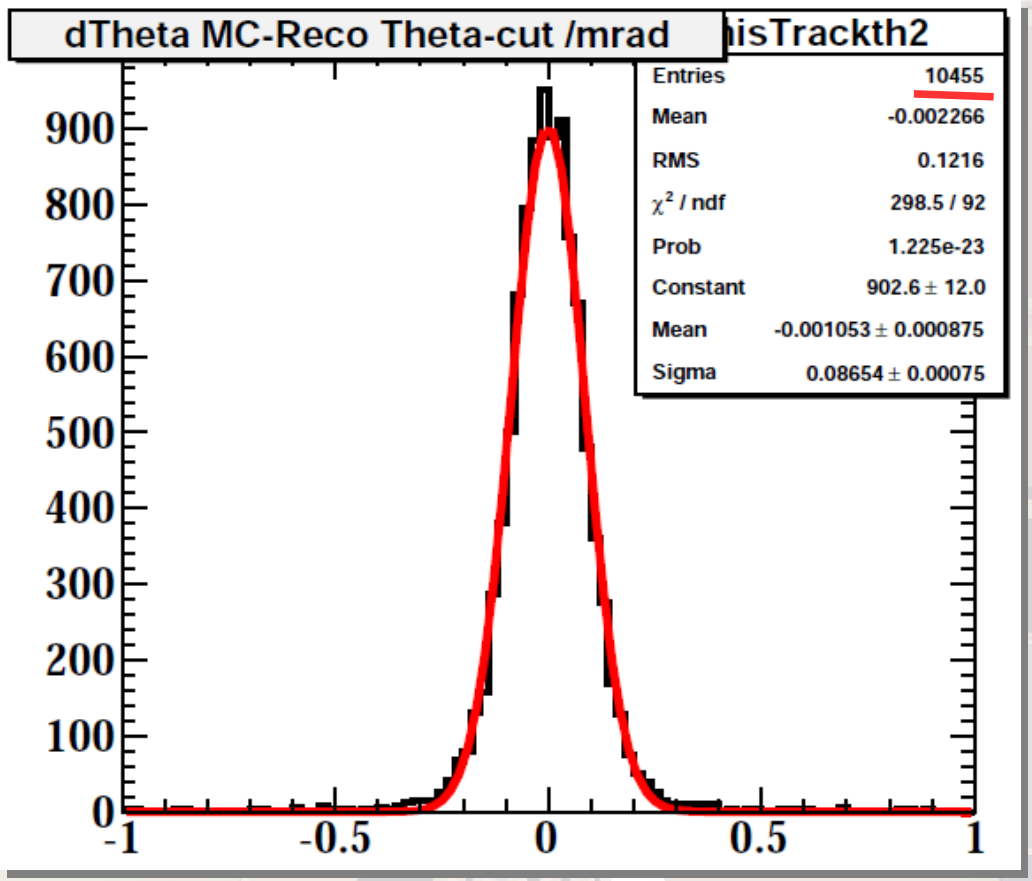
**=> rotate second disc**

# Number of Tracks

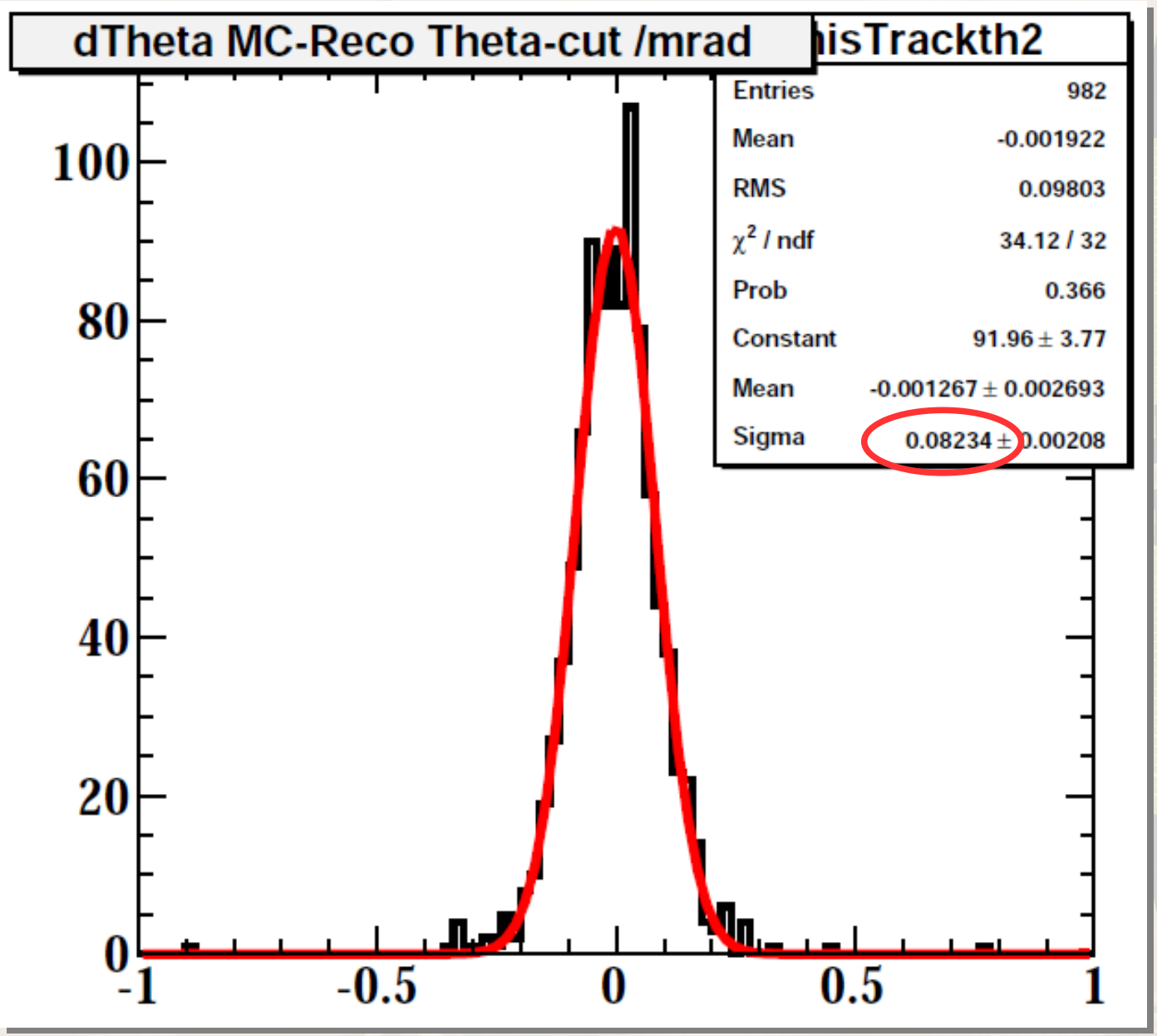
**unrotated**




**rotated**



# Resolution




1000 Events

1 anti-p per event

anti-p phi: 0° - 360°

anti-p theta: 0.18° - 0.45°

Cut <2.5 & >8.5mrad track

Resolution:

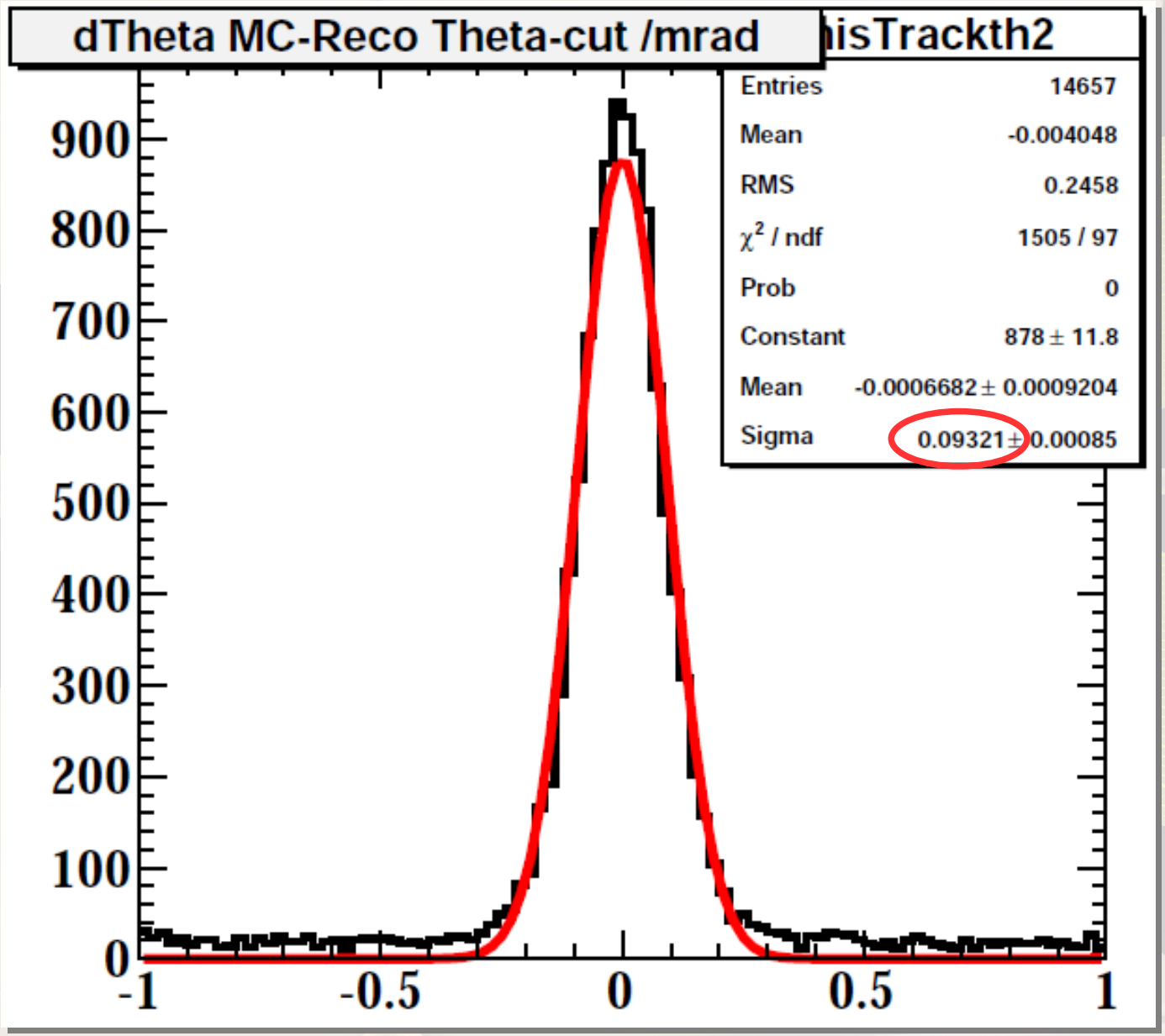
0.082 mrad

10 anti-p per event:

0.087 mrad (+6%)

6% more tracks

# Limitations




1000 Events

10 anti-p per event

anti-p phi: 0° - 90°

anti-p theta: 0.25° - 0.35°

= 1,75 mrad

Cut <2.5 & >8.5mrad track

Resolution:

0.093 mrad (+ 13 %)

About **50 %** more tracks:

a lot fake tracks

# Conclusion

**Results**

- low-angle-scattering

  => thin detector needed
- ~ 10 tracks per event feasible

**not included**

- noise hits
- scattered particles
- separated digitalization grids

**next**

- test various distances and thicknesses
- rotate every plane