Update on mean residuals

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Lepcol meeting

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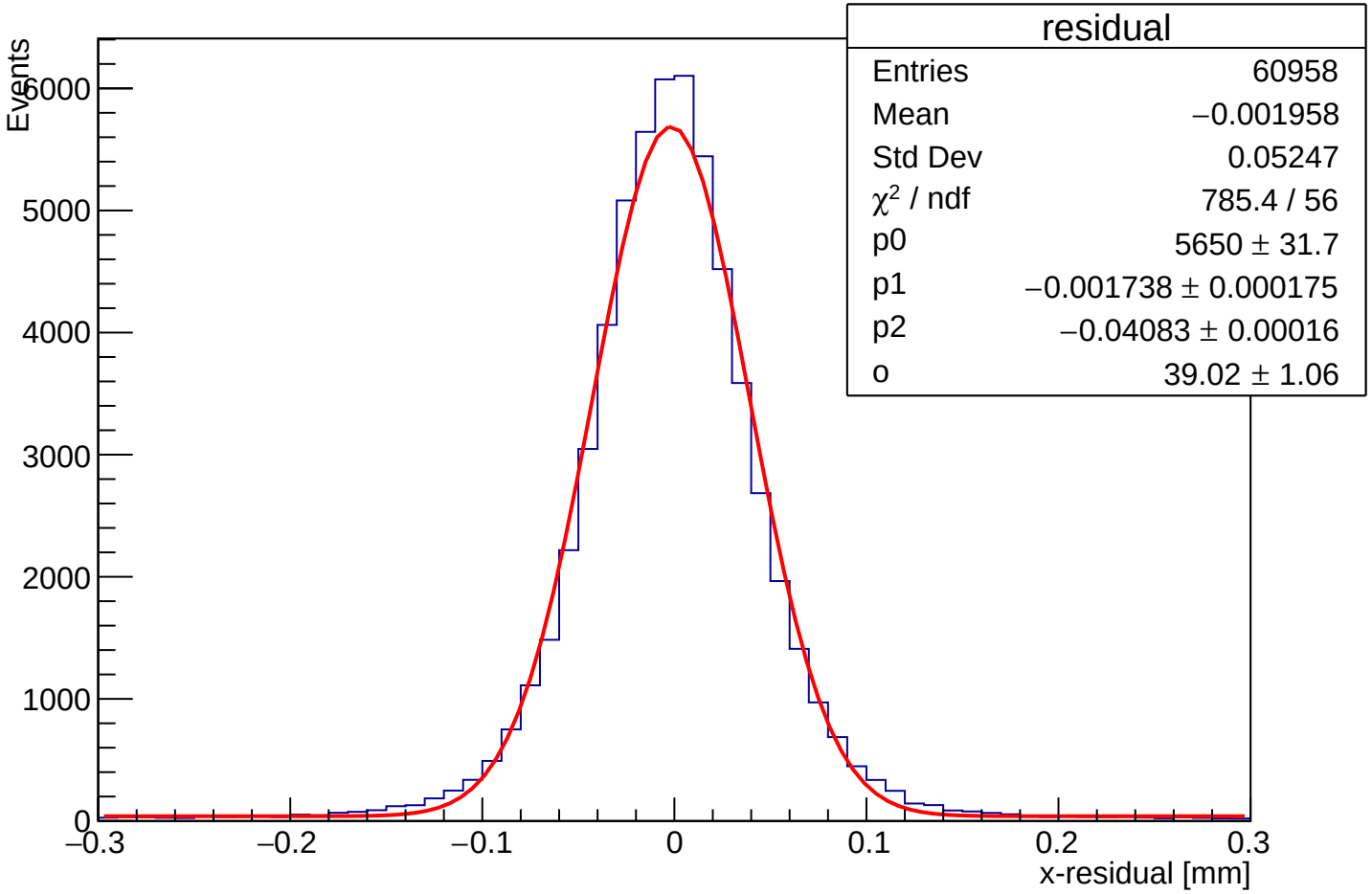
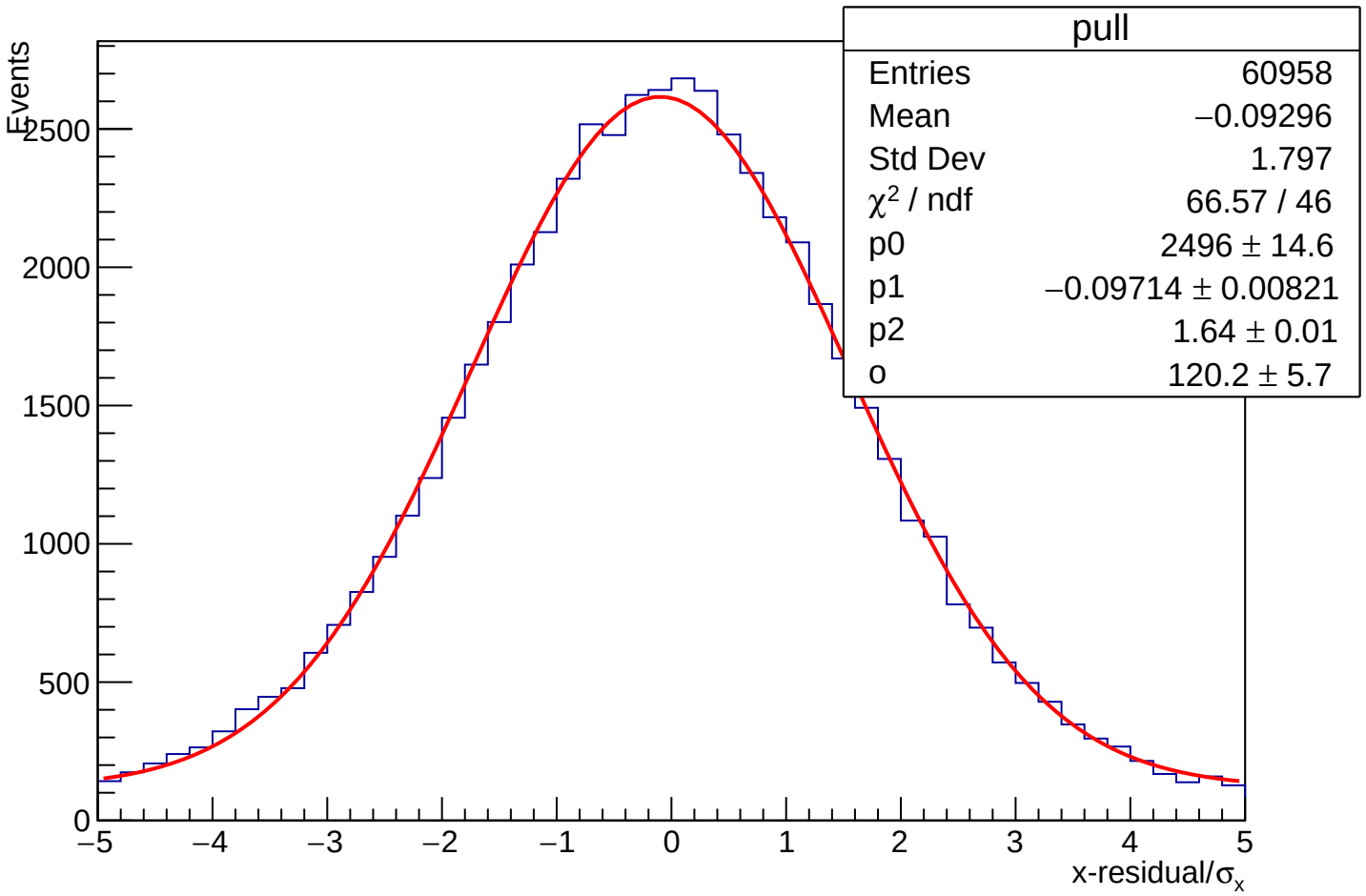
Quad residual



Residual of the mean of all quad hits, with respect to telescope track

Fitted with Gaussian + background offset

Quad pull



Quad pull with statistical error from quad (and telescope = 2 μm)
Fitted with Gaussian + background offset

Calculation of errors

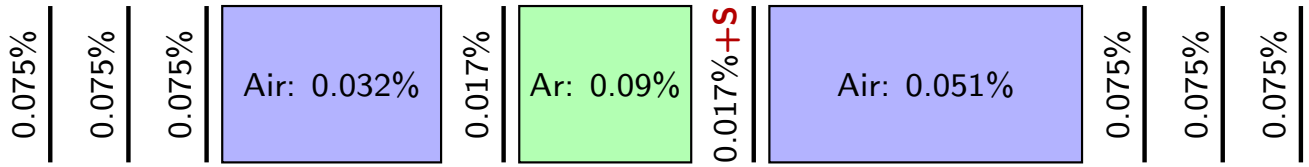
$\sigma_{\text{residual}} = 40.8\,\mu\text{m}$ and $\sigma_{\text{pull}} = 1.64$
Therefore $\sigma_{\text{unaccounted}} = \sigma_{\text{residual}}\sqrt{1 - \frac{1}{\sigma_{\text{pull}}^2}} = 32.3\,\mu\text{m}$ is unaccounted for

Multiple scattering

	X0	d	Thickness	mRad
Argon	117 m	10 cm	0.09 %X0	0.120
Kapton	286 mm	2×50 µm	0.035 %X0	0.071
Air	304 m	360 mm	0.12 %X0	0.140
		256 mm	0.084 %X0	0.088
Telescope per plane			0.075 %X0	0.108
Copper	14.35 mm	50 µm	0.35 %X0	0.253

Simple simulation

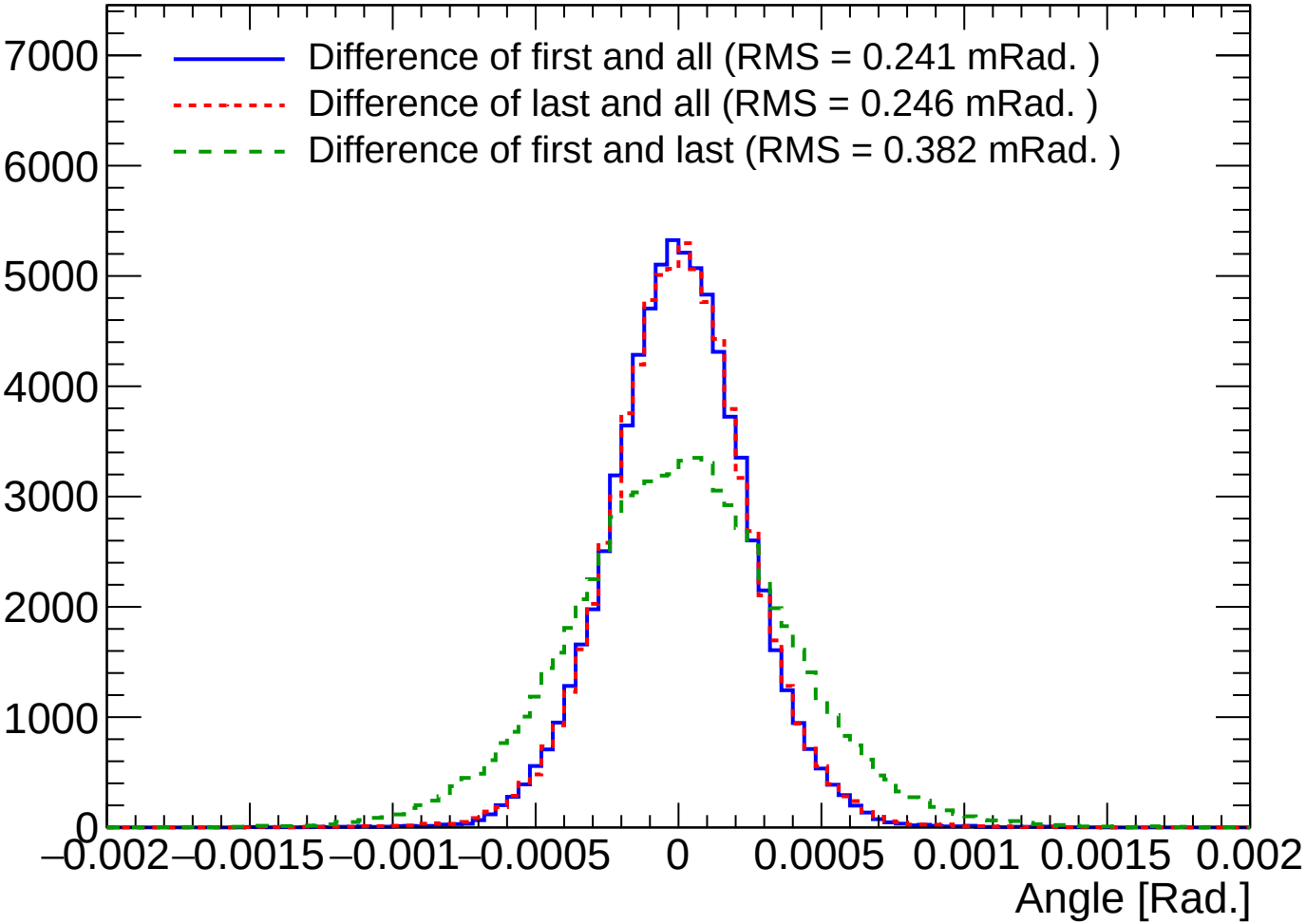
Use a simple simulation to estimate the effect of scattering



Where S is an additional scatter.
For scattering planes and volumes the PDGs suggested Monte Carlo approach is used

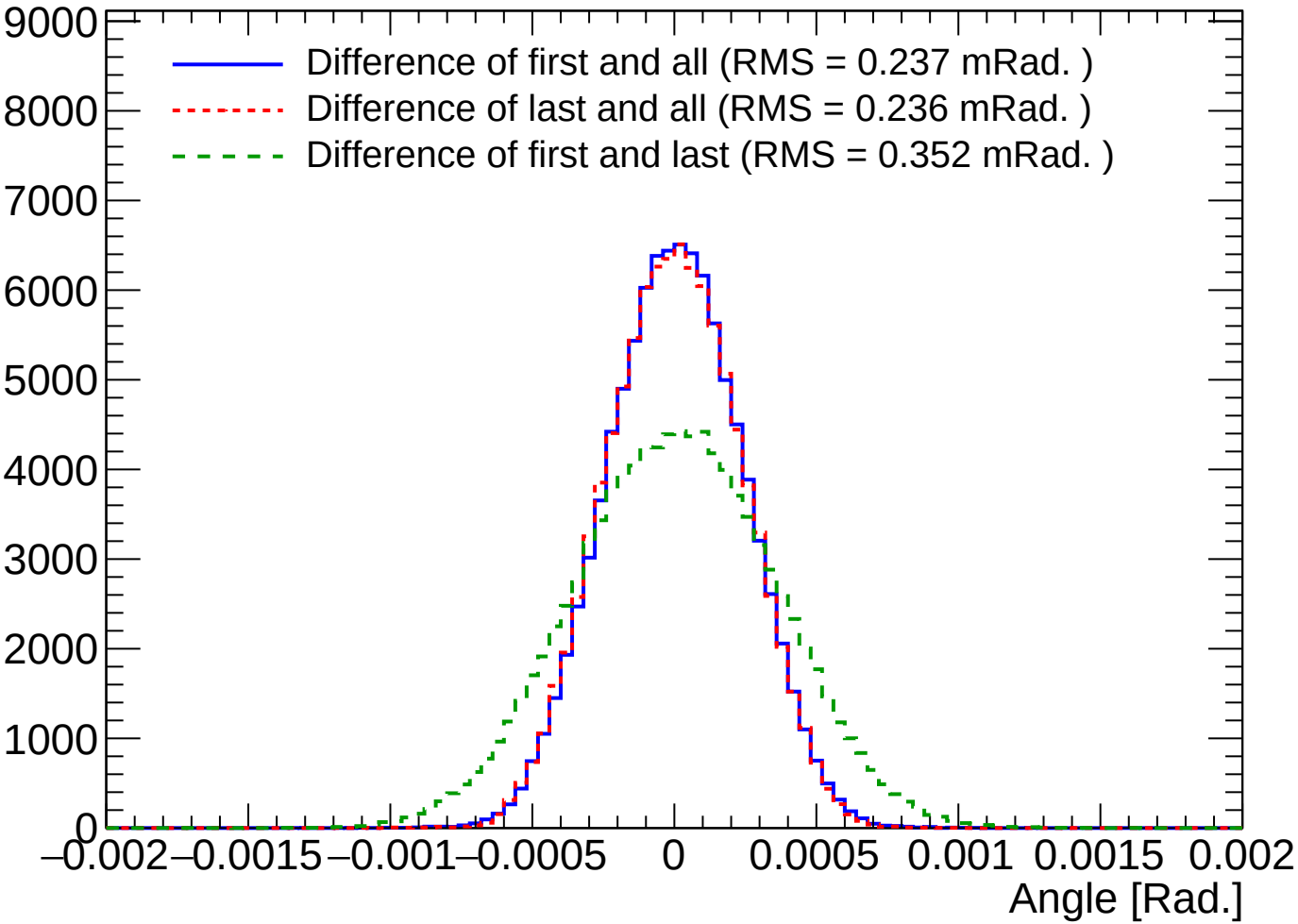
Angle differences

data



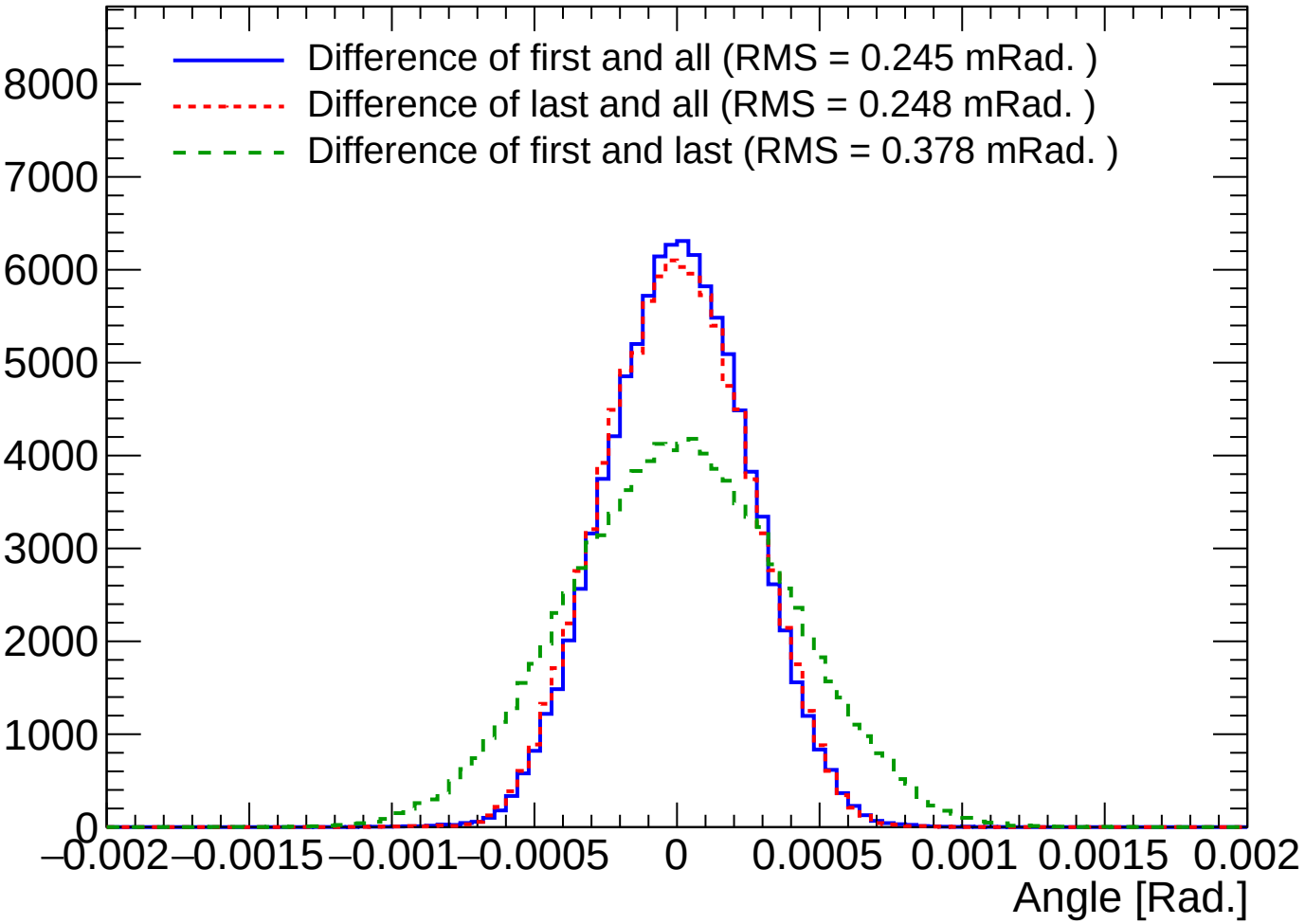
Angle differences

simulated: calculated values



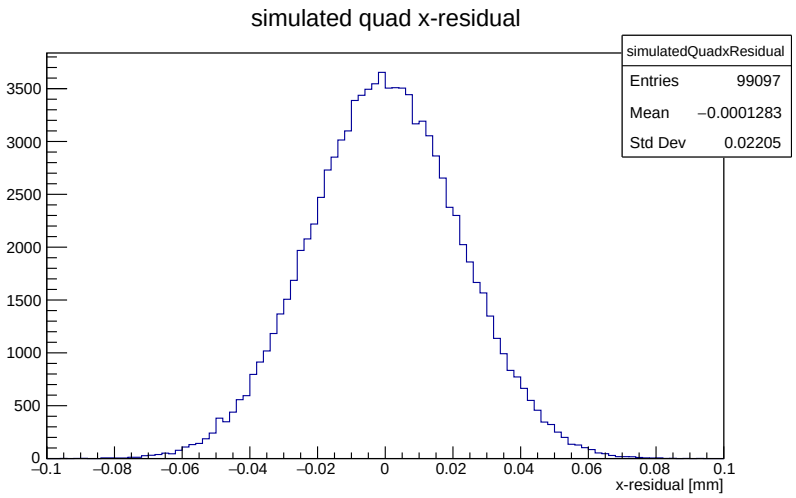
Angle differences

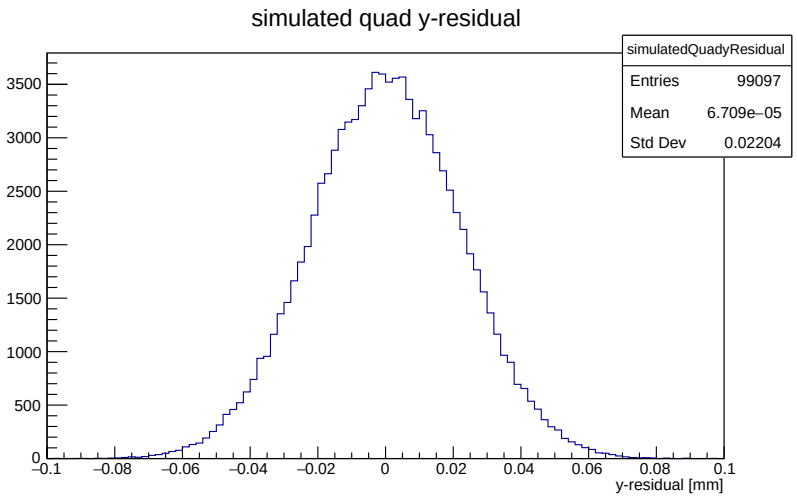
simulated: additional scattering



Extra scatter of 0.16 mRad or 0.15%X0 at quad exit window

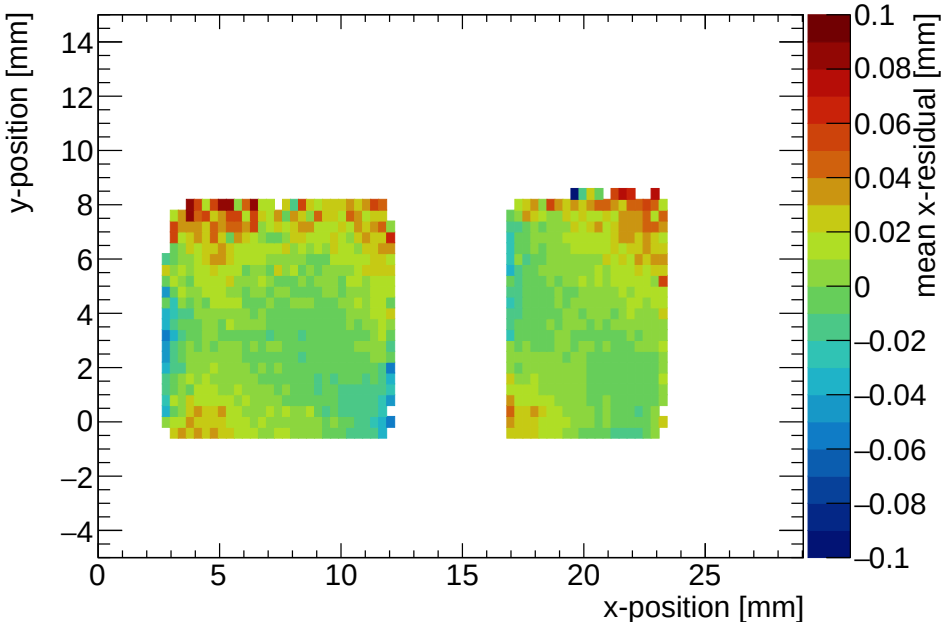
Quad residual due to multiple scattering

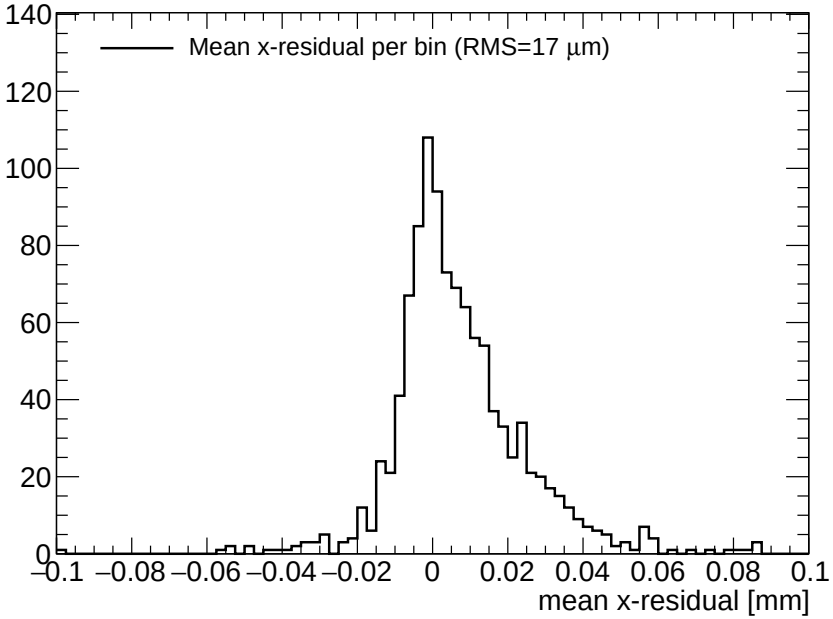




Residual is 22 µm including extra scattering at quad exit window

x-deformations in the drift direction

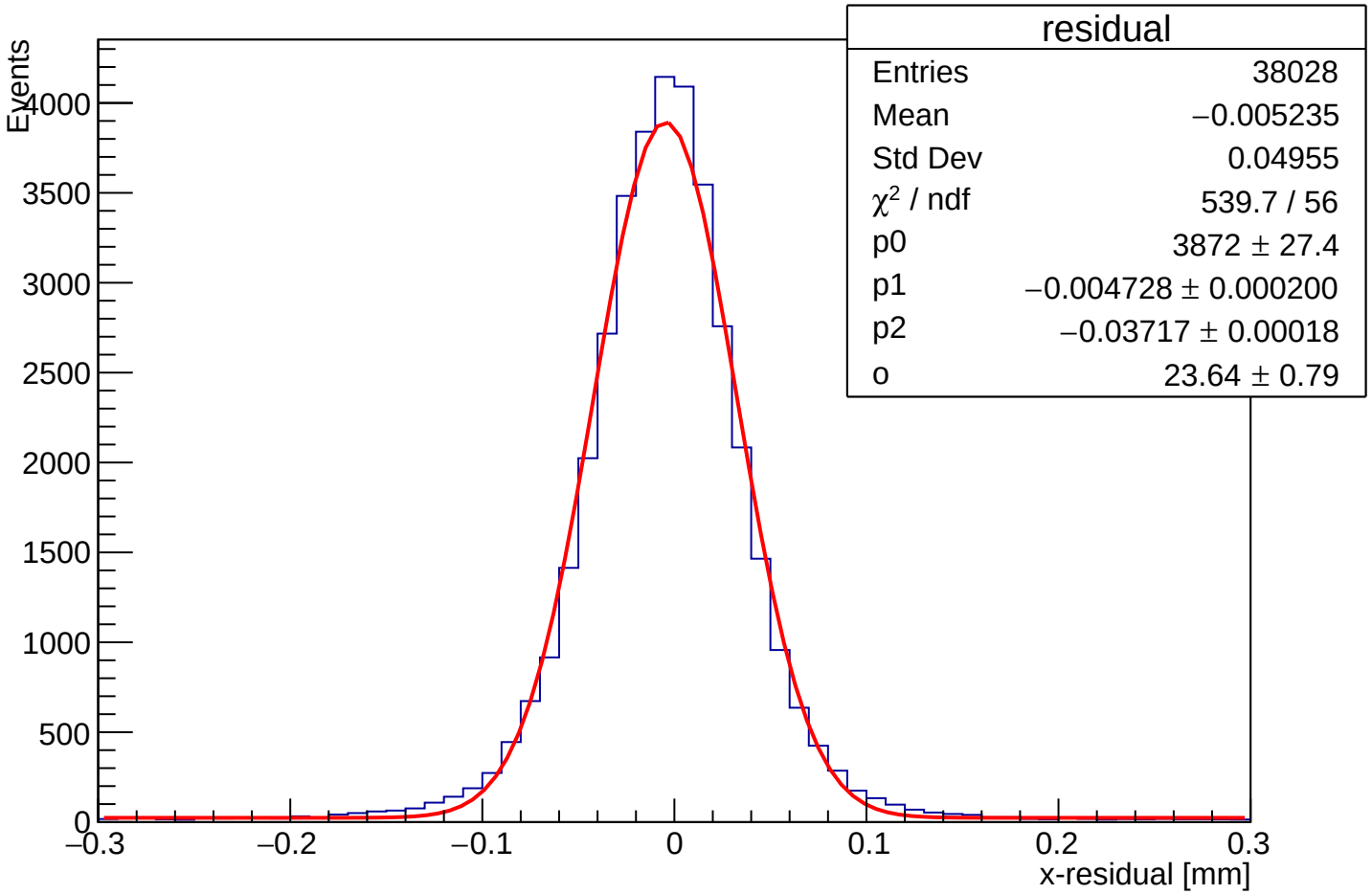




After correction for bins with more than 500 entries

Quad residual

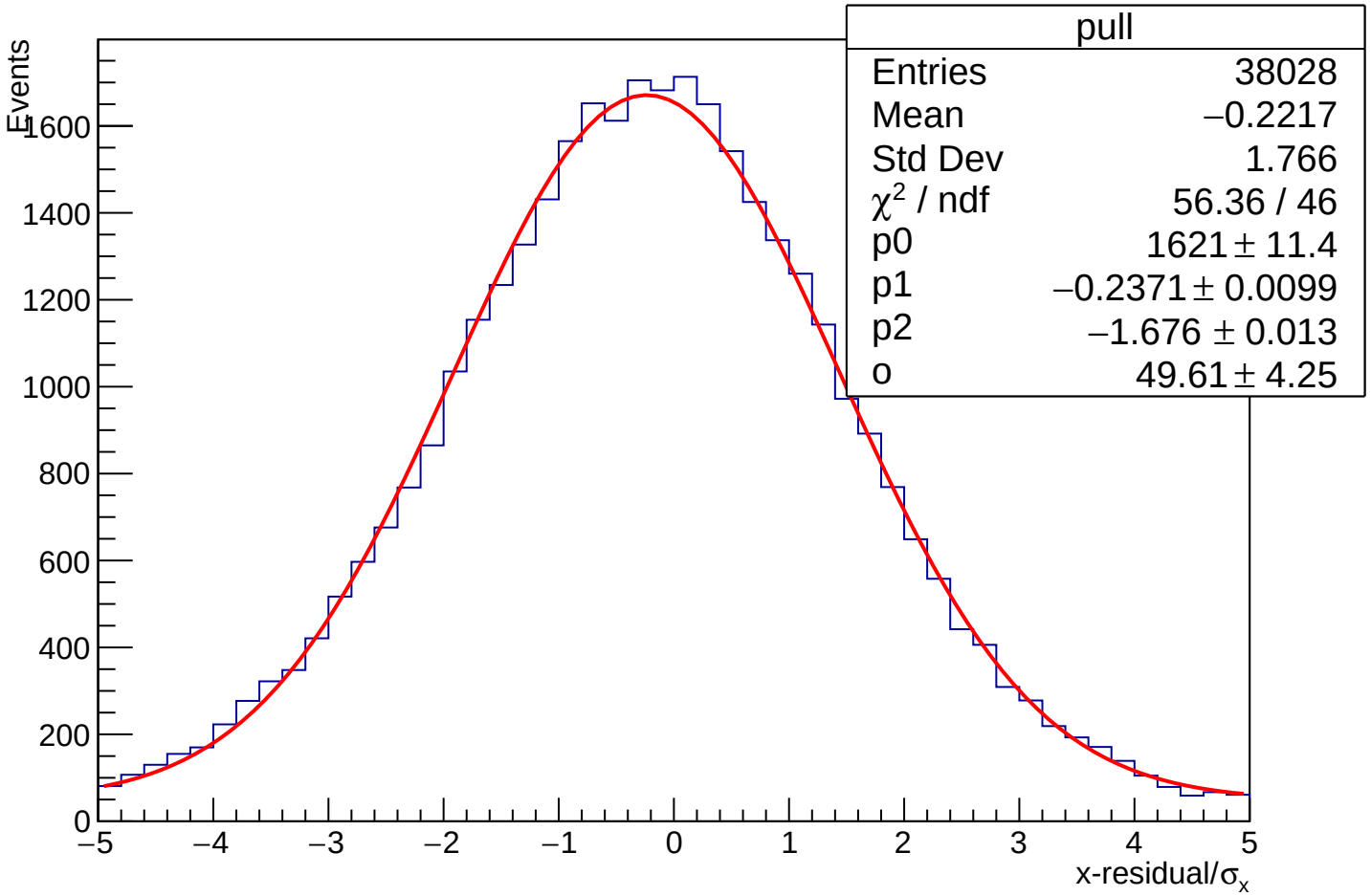
with extra z cut



4 mm wide *z*-window

Quad pull

with extra z cut



4 mm wide *z*-window

Calculation of errors

after extra z cut

$\sigma_{\text{residual}} = 37.2\,\mu\text{m}$ and $\sigma_{\text{pull}} = 1.68$
Quad residual improved to $22\,\mu\text{m}$
With extra cut $\sigma_{\text{unaccounted}} = \sigma_{\text{residual}}\sqrt{1 - \frac{1}{\sigma^2_{\text{pull}}}} = 29.9\,\mu\text{m}$ is unaccounted for
An improvement of $12\,\mu\text{m}$

Quad resolution

The demonstrated resolution in the test beam is 42 µm

- 25 µm from quad and statistical telescope error
- 32 µm from other contributions:
  - 9 µm from deformations in pixel plane
  - 17 µm from deformations in drift direction
  - 22 µm from multiple scattering
  - 14 µm from other sources?