

Time slice simulation and event reconstruction

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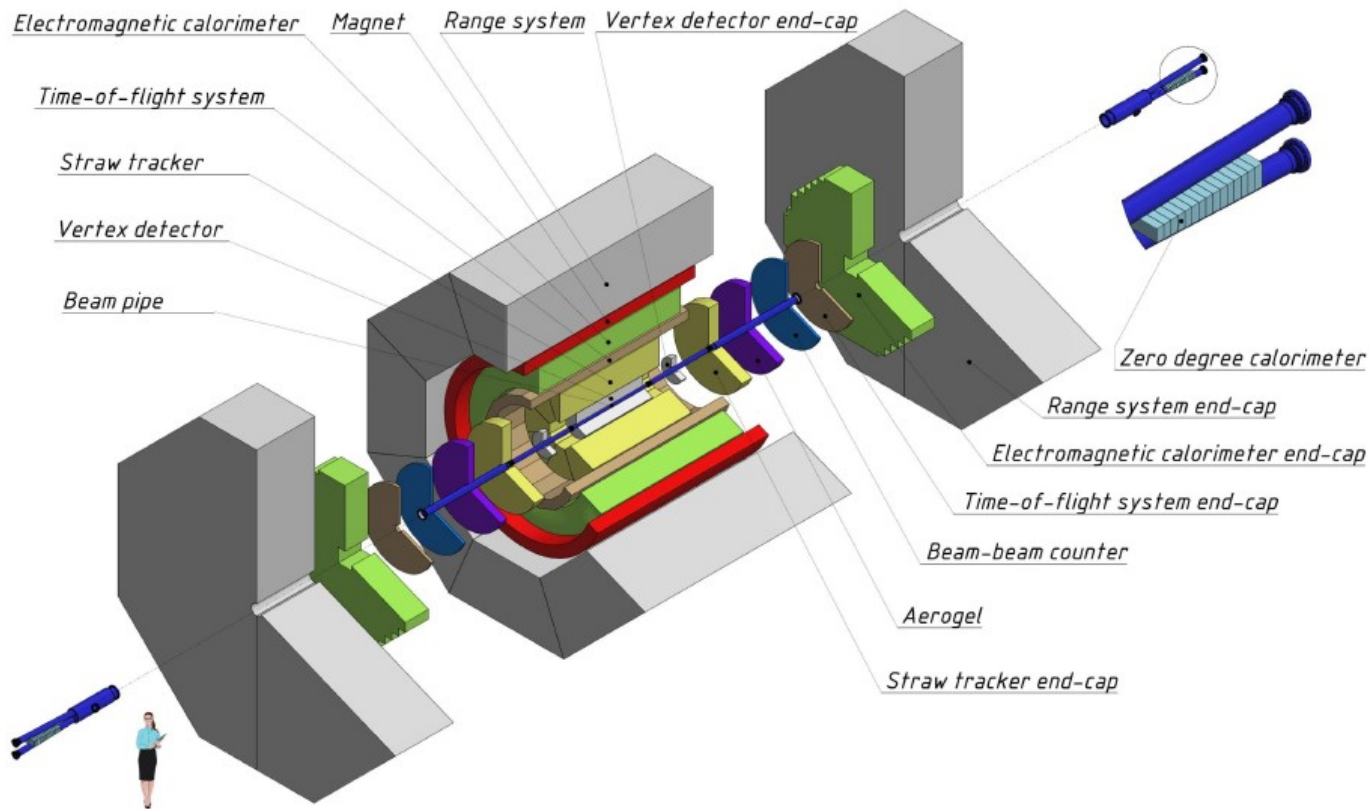
In collaboration with S.D. Morozova¹ and A.S. Zhemchugov²

SPD Collaboration Meeting, Oktober 23-27, 2023

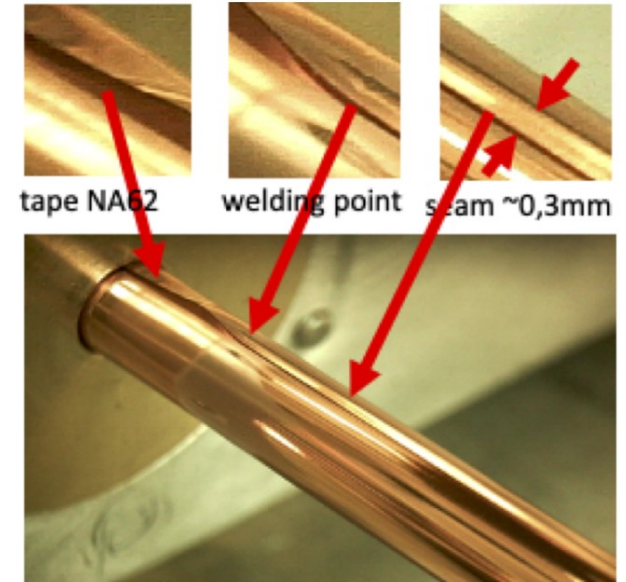
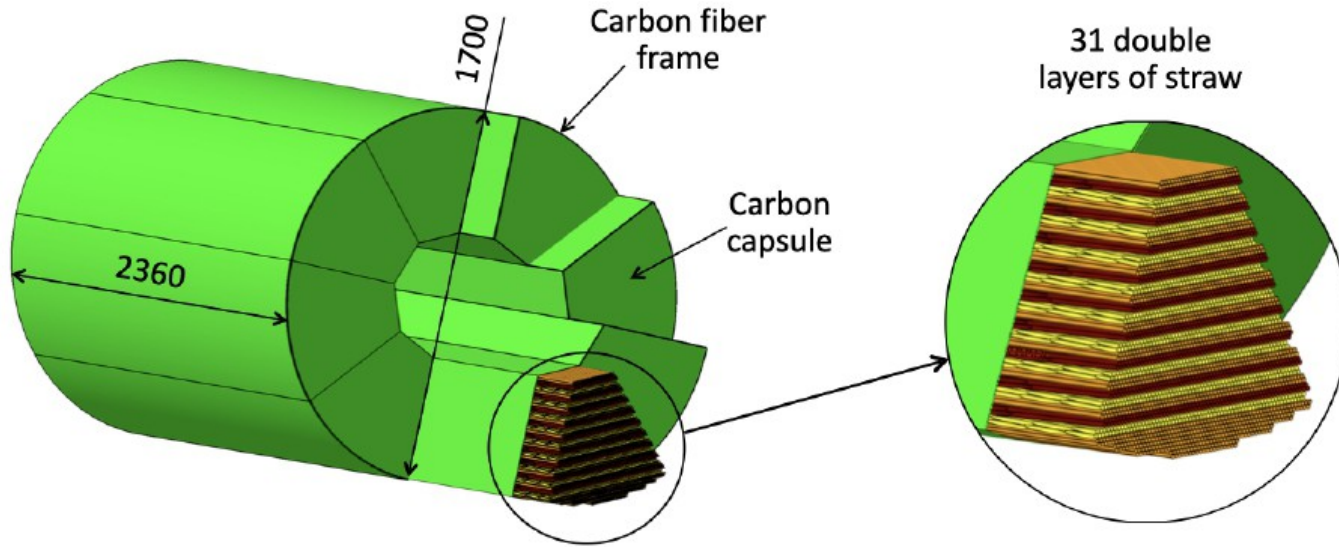
¹Samara National Research University

²Joint Institute for Nuclear Research

SPD detector

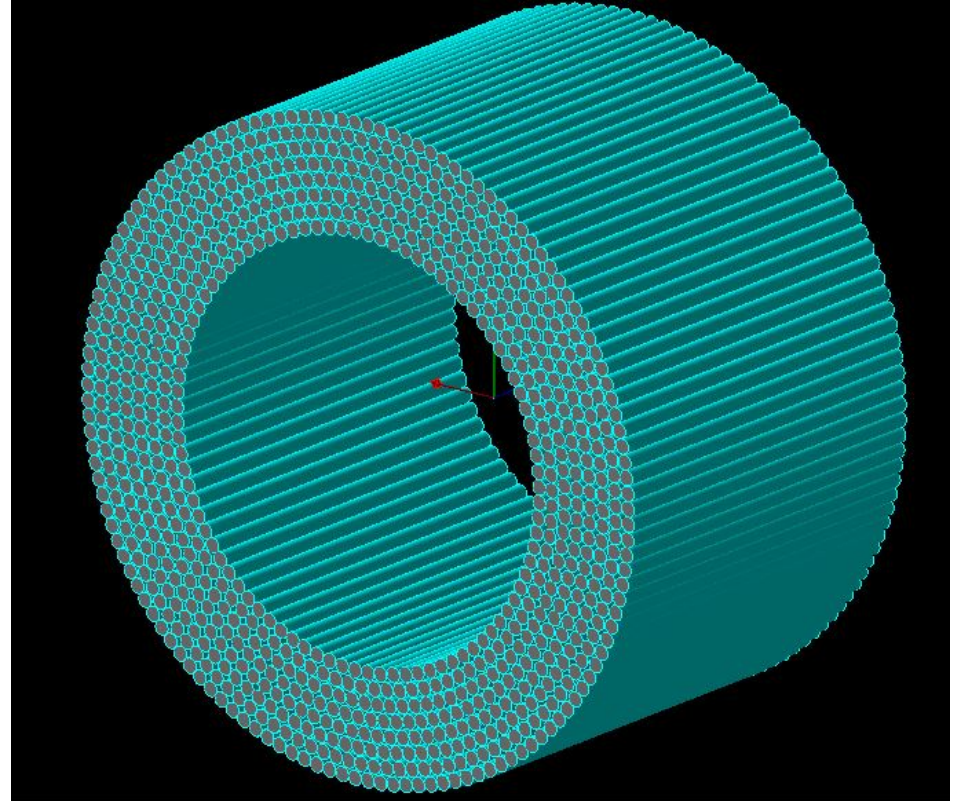
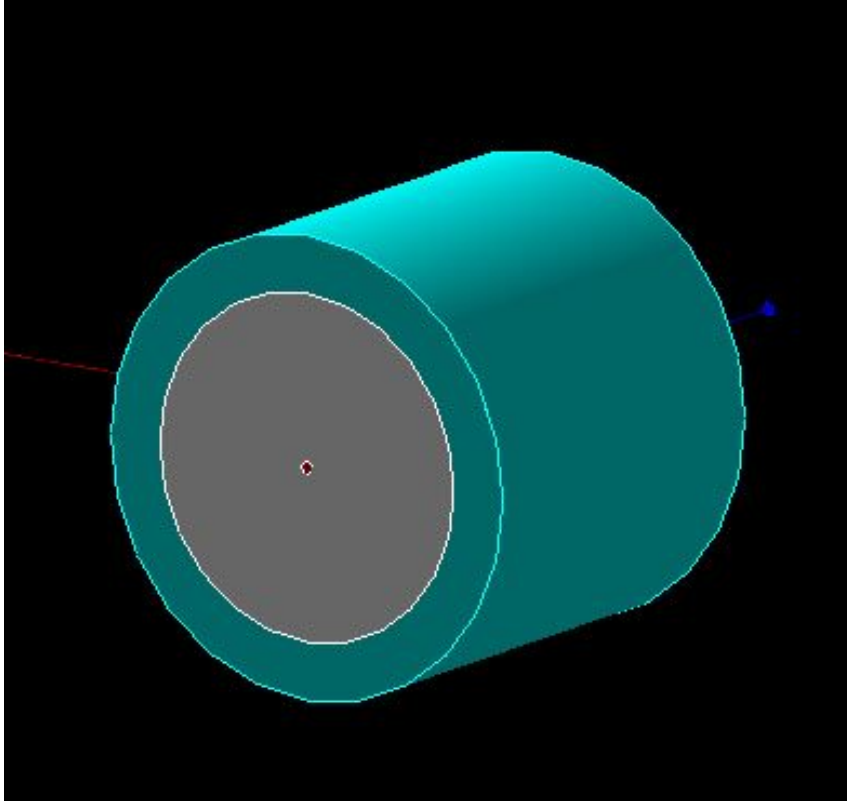


Straw tracker



25904 straw tubes
Nominal inner diameter: 9.8 mm
PET: $R = 0.036$ mm
Gas: CO_2 (30%) + Ar (70%)
Anode: Au-plated W, $d=0.030$ mm

ST geometrical model



Model parameters

- Time slice: 10 mcs

- p-p interaction: bunch crossing every 76 ns,
collision probability: $f(k) = \frac{\lambda^k}{k!} e^{-\lambda}$, $\lambda = 0.3$

- Position of the interaction point: $f(z) = \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{1}{2} \left(\frac{z-\mu}{\sigma}\right)^2}$, $\sigma = 30 \text{ cm}$, $\mu = 0$

- Model primary particles: μ -

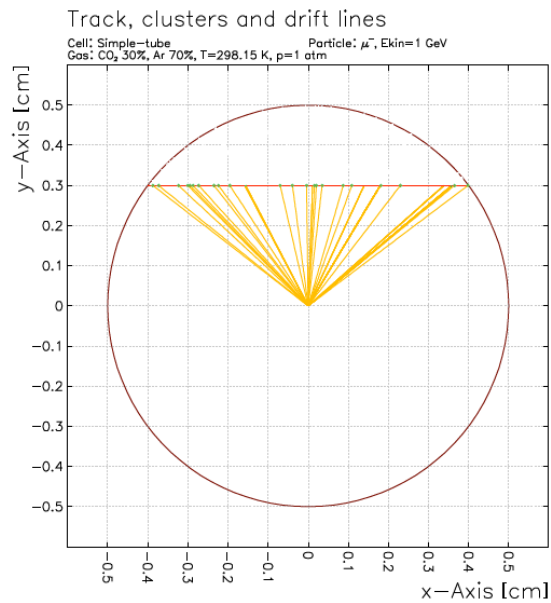
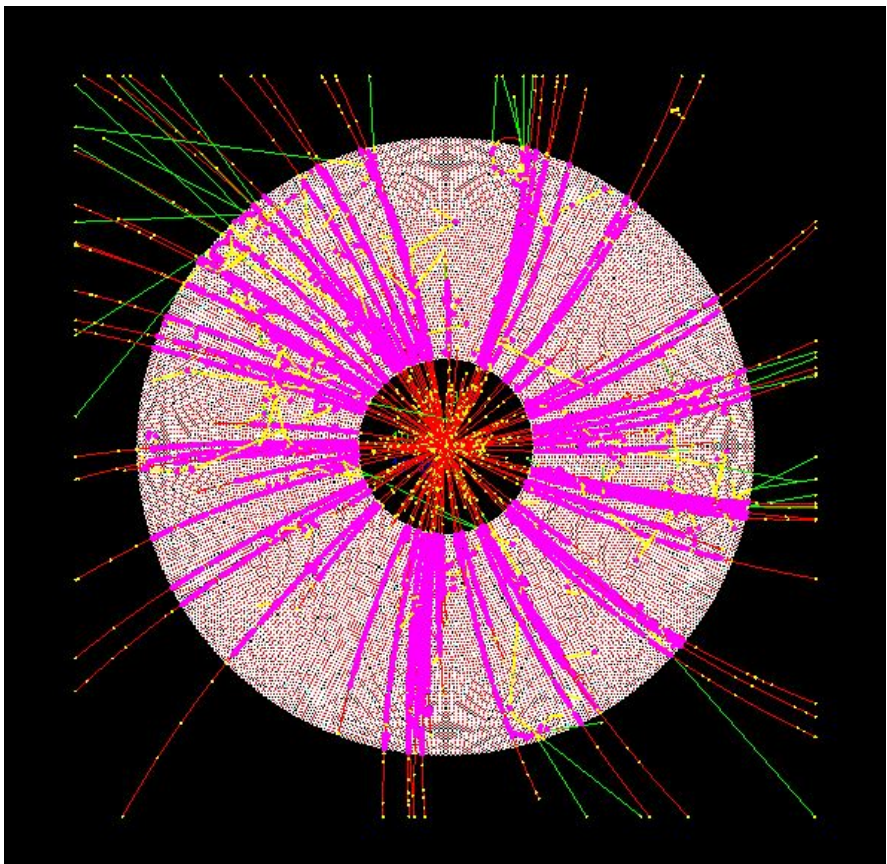
- Number of primary particles: $f(N) = \frac{\nu^N}{N!} e^{-\nu}$, $\nu = 7$

- Uniform random momentum distribution of primary particles

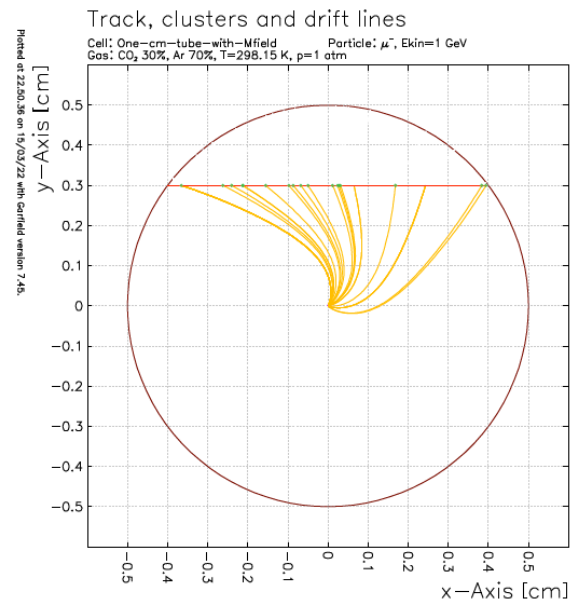
- $E_\mu = 1 \text{ GeV}$

- Magnetic field: $B_z = 1 \text{ T}$

Hits collections



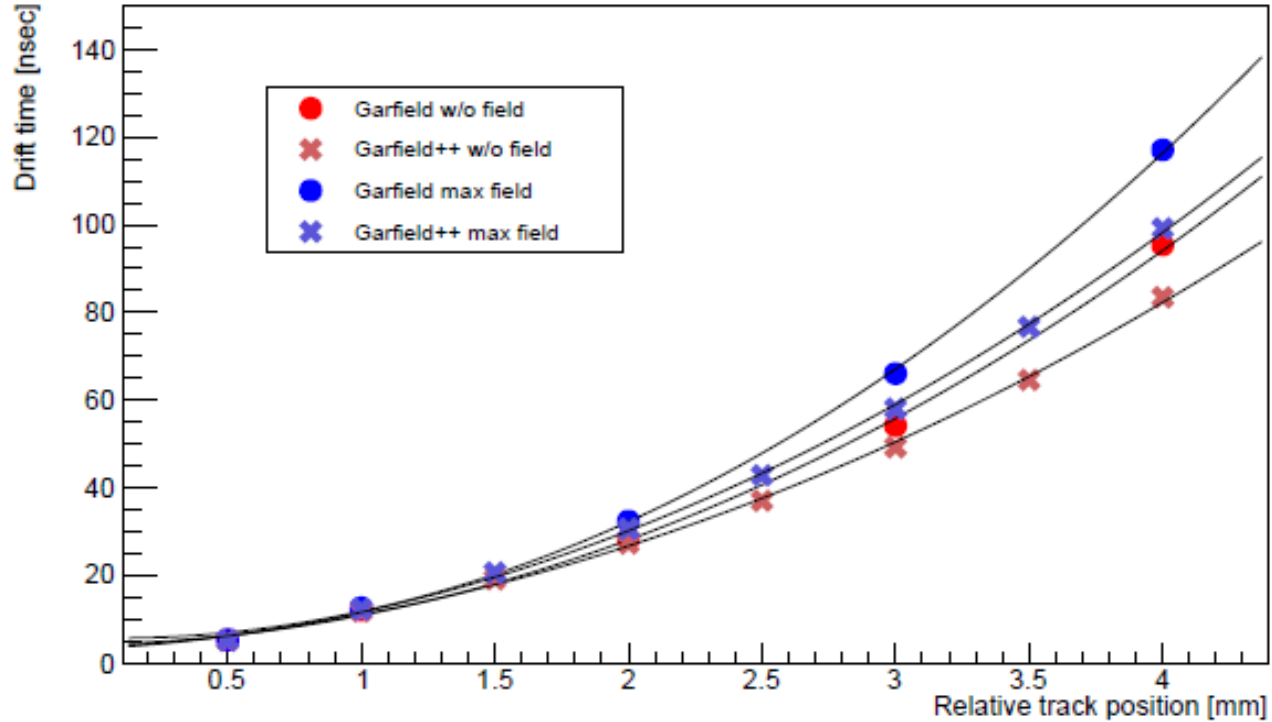
(a)



(b)

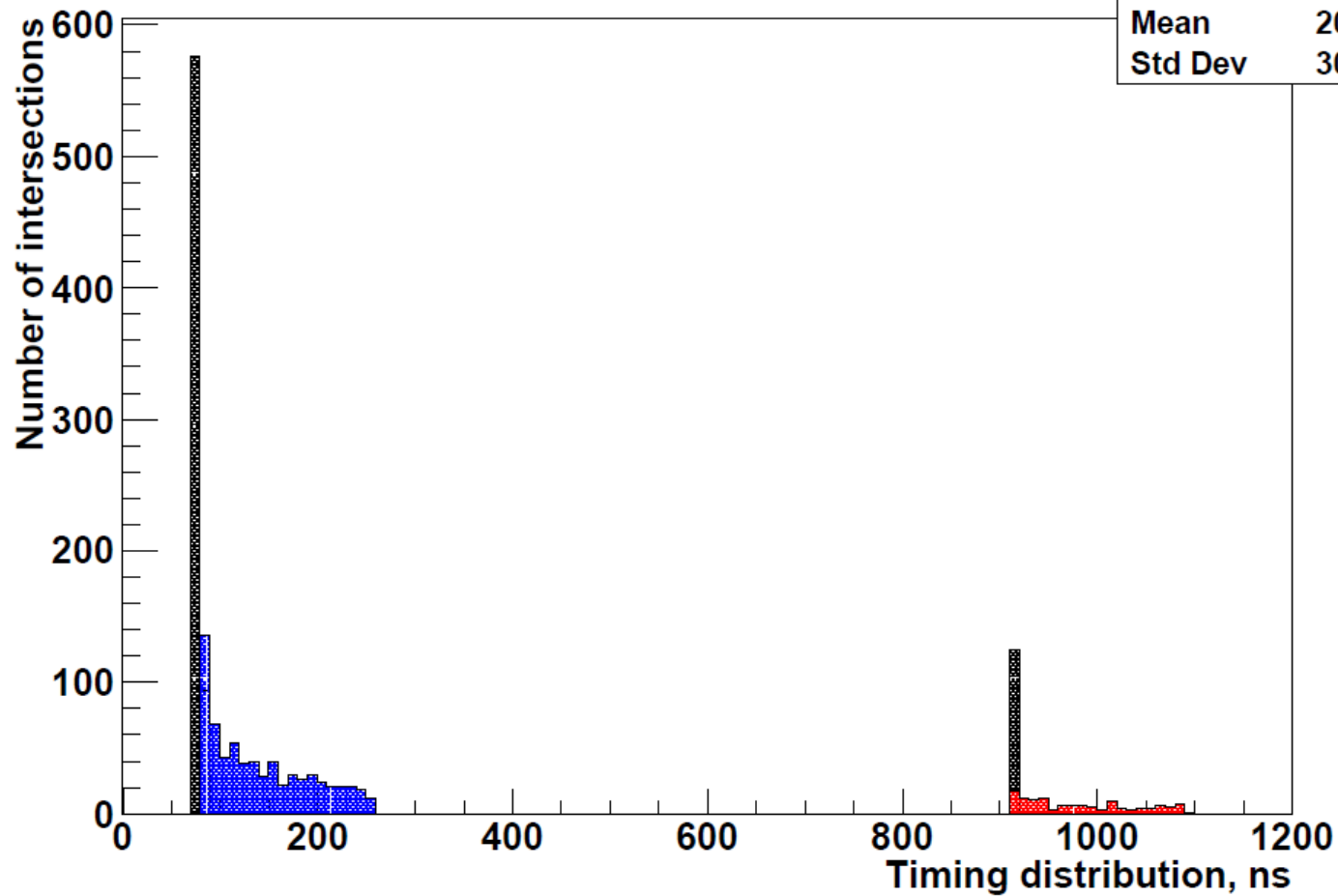
First cluster drift time

Landau MPV



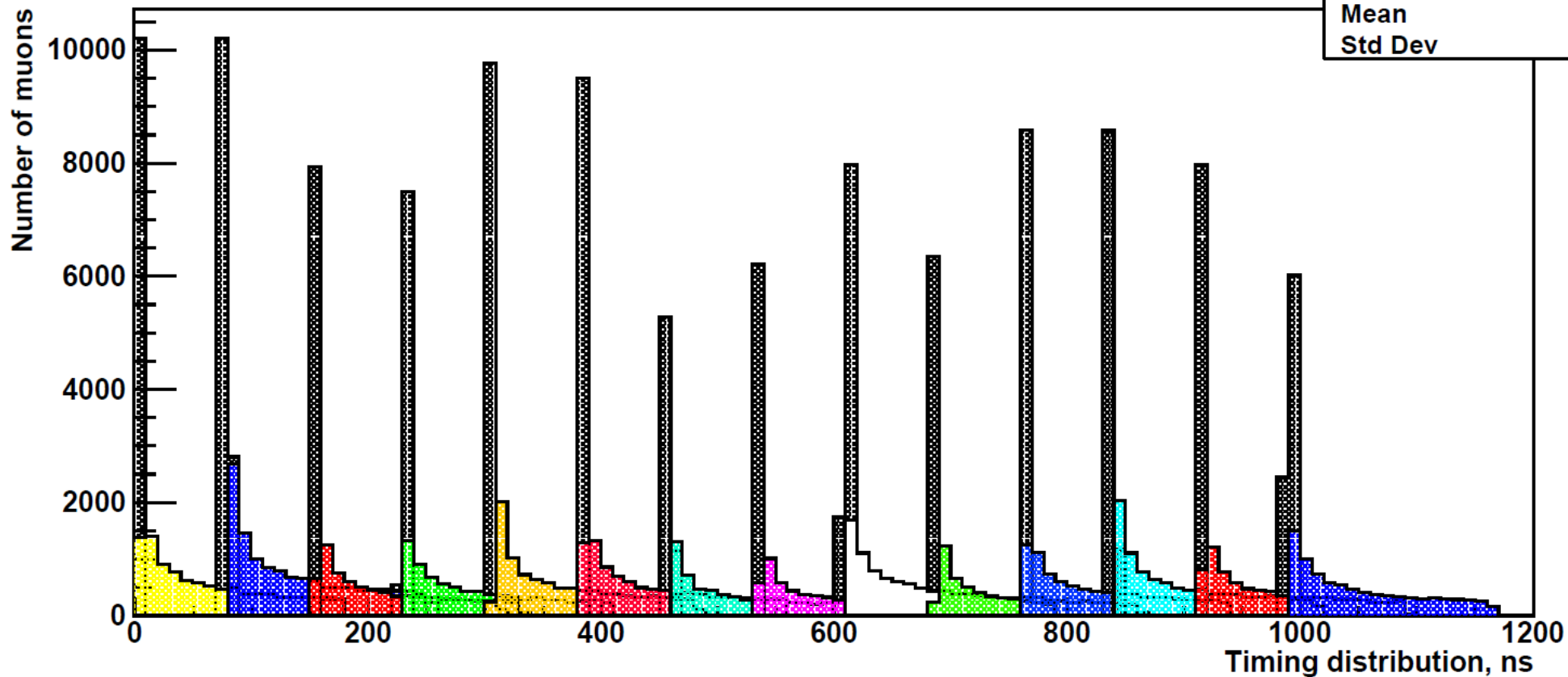
$$t(r) = 2.7101 + 1.2156 r + 6.8287 r^2$$

Timing distribution



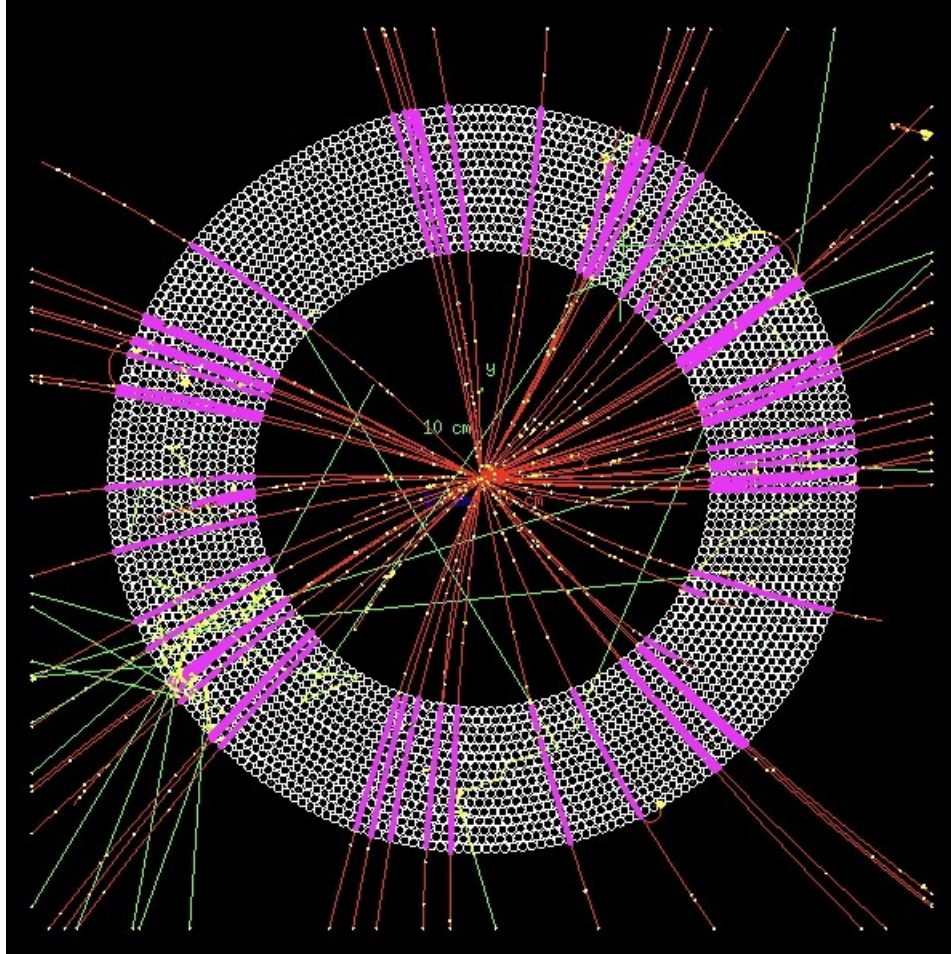
Start Time	
Entries	795
Mean	209.6
Std Dev	304.2

Timing distribution



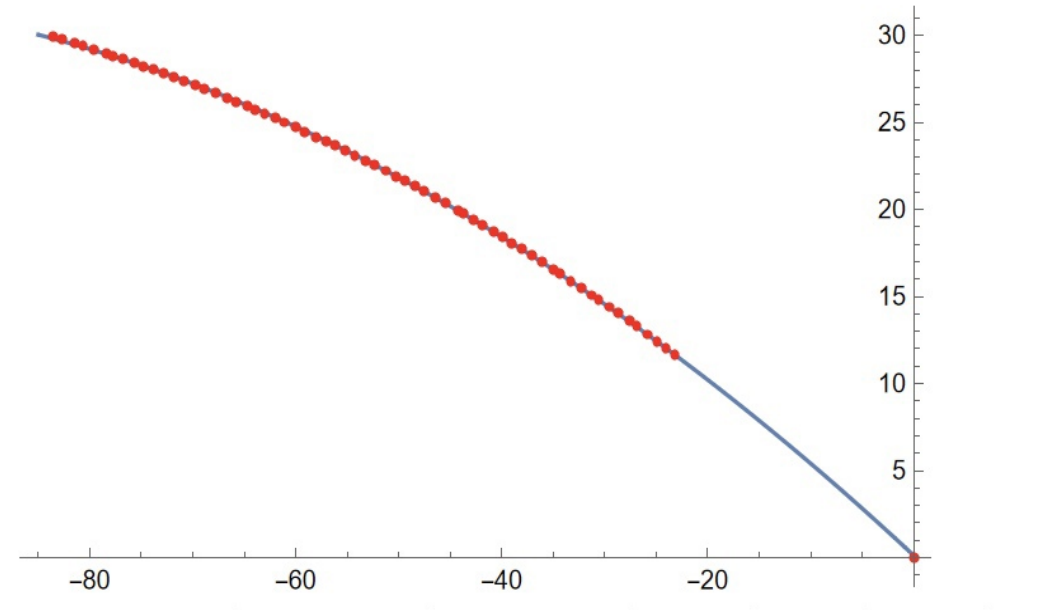
Start Time	
Entries	122098
Mean	473.1
Std Dev	316.9

Track approximation: XOY plane



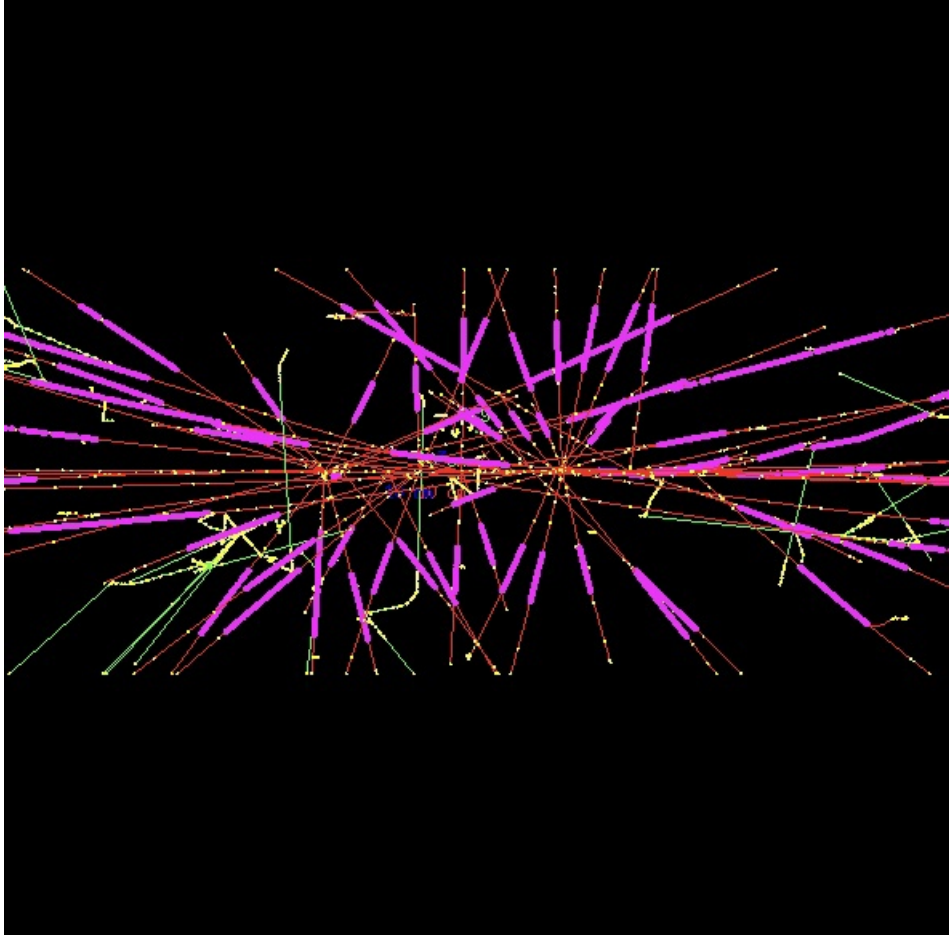
[показать] [график функции]

[диаграмма разброса] [стиль графики]



$$y = a_1 x^2 + a_2 x + a_3$$

Track approximation



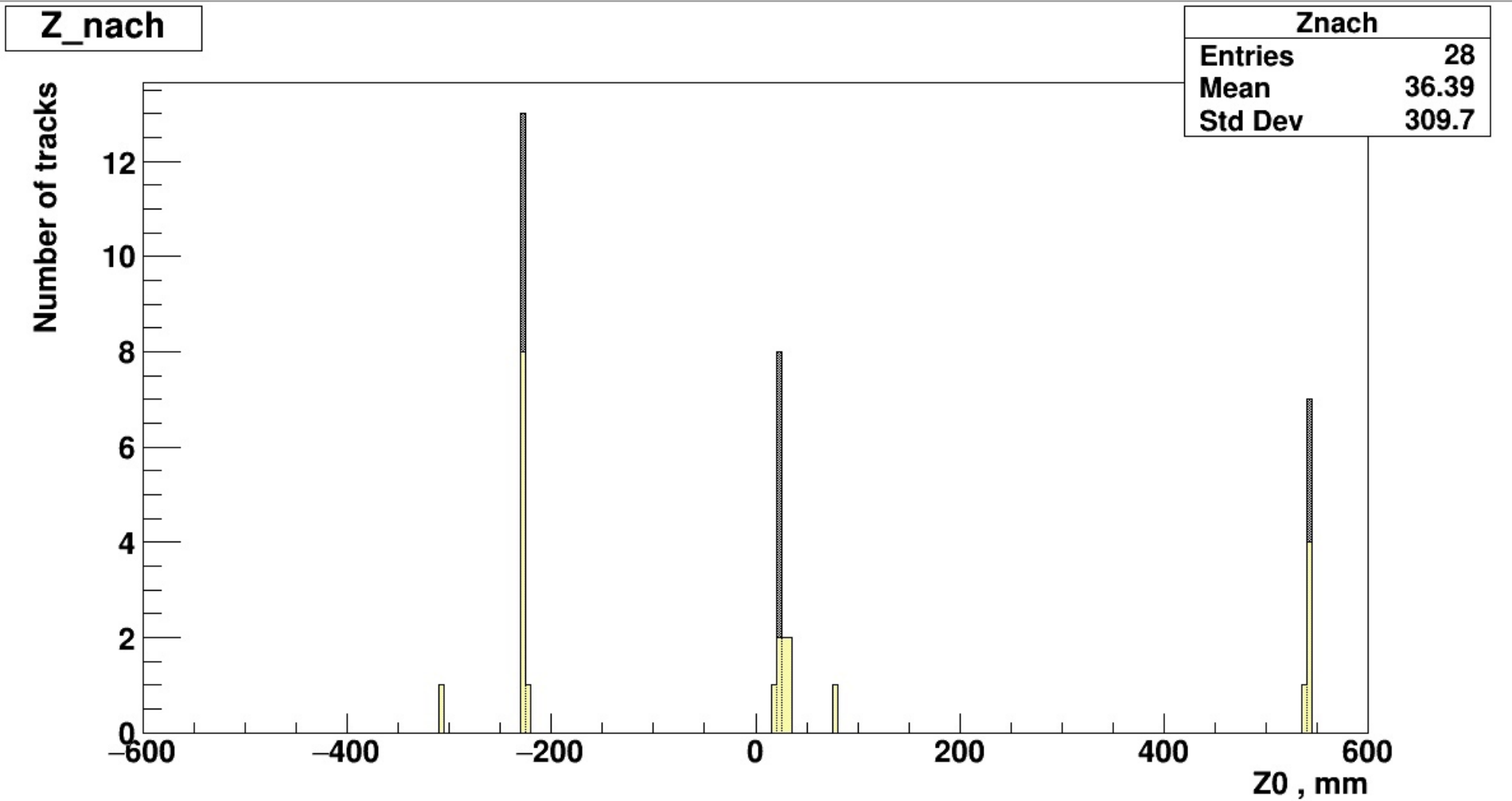
$$z = b_1 l + b_2$$

$$l = \int_0^x \sqrt{1 + (2a_1 x + a_2)^2} dx$$

Number of parabolic tracks: ~90%

Number of vertices reconstructed
within 1cm-interval around true position:
~60-70%

The single time slice

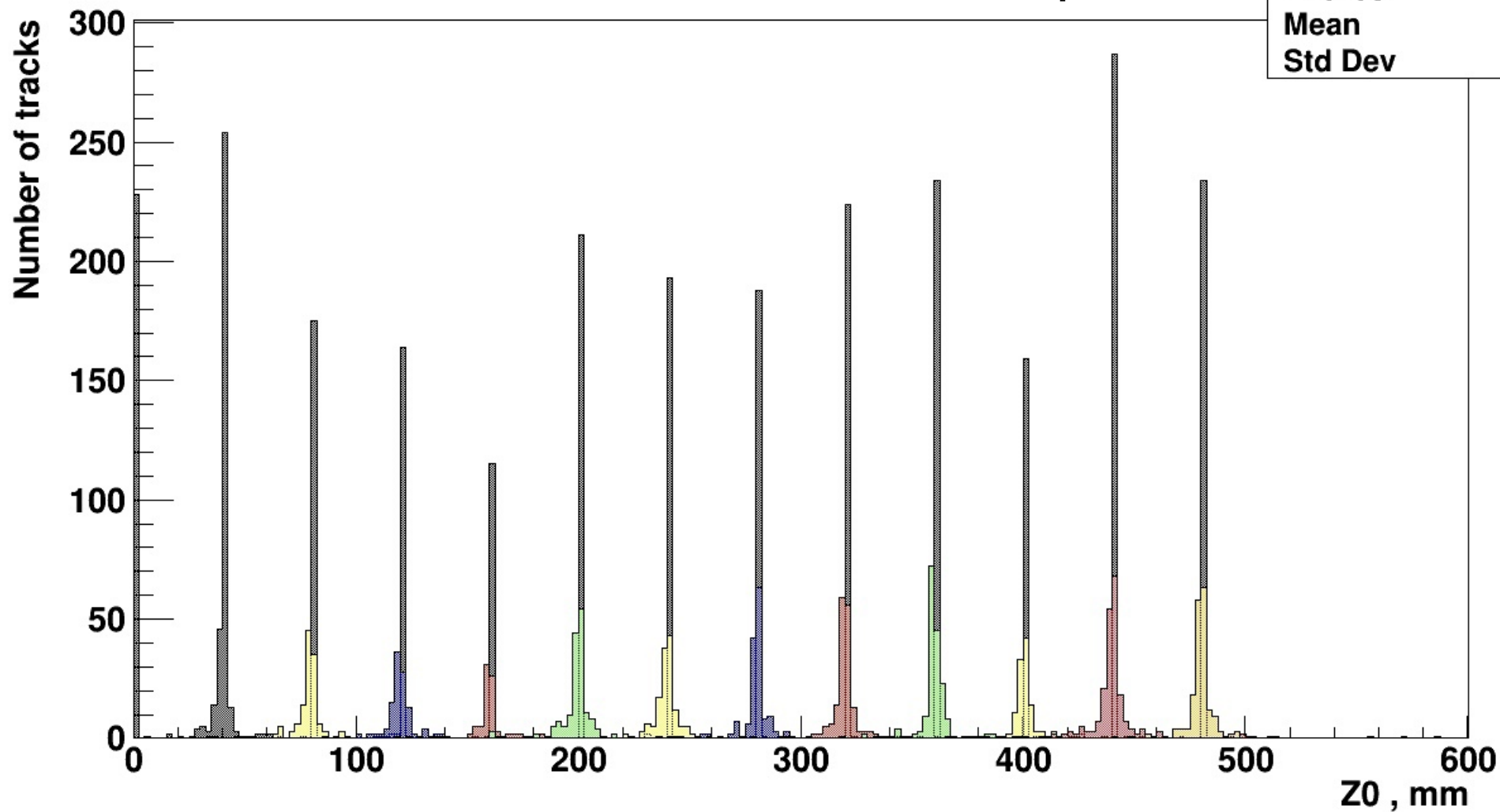


Z_nach

Time slices: fixed step

Znach

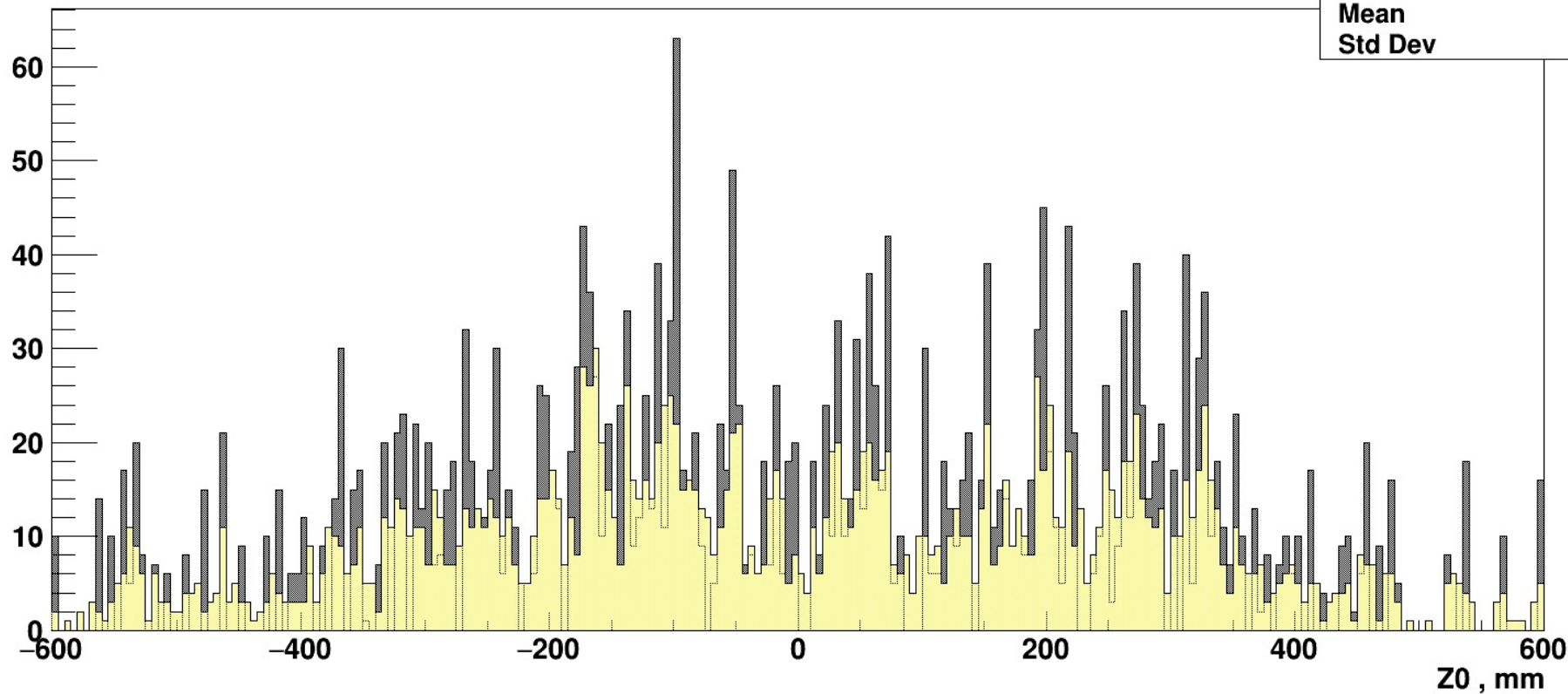
Entries	2772
Mean	240.3
Std Dev	158.4



100 time slices

Z_nach

Number of tracks



Znach

Entries	3000
Mean	-2.656
Std Dev	265

Thank you for your attention!