

Particle showers in ATLAS Forward Proton detectors

Aneta Bien, Patrycja Malinowska

Supervisor

dr Maciej Lewicki

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Goal of the project

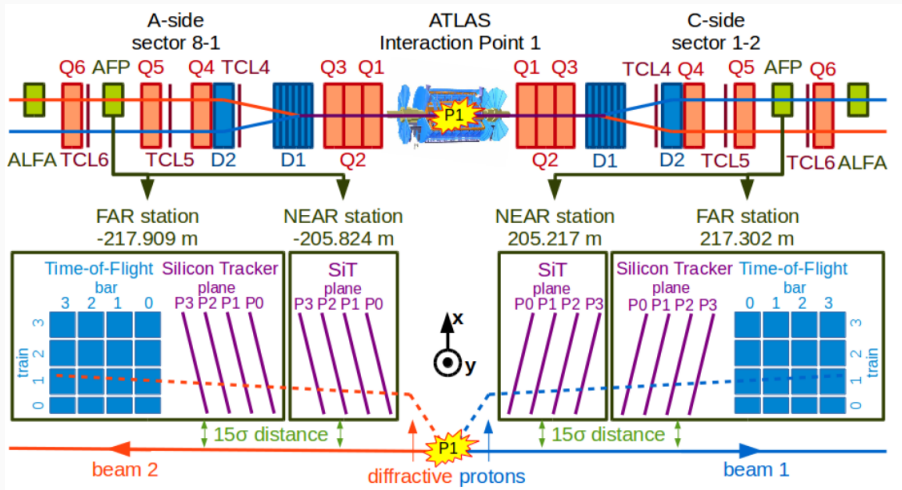
Analysis of measurements from the ATLAS Forward Proton detector

and

distinction between diffractive proton and particle showers.

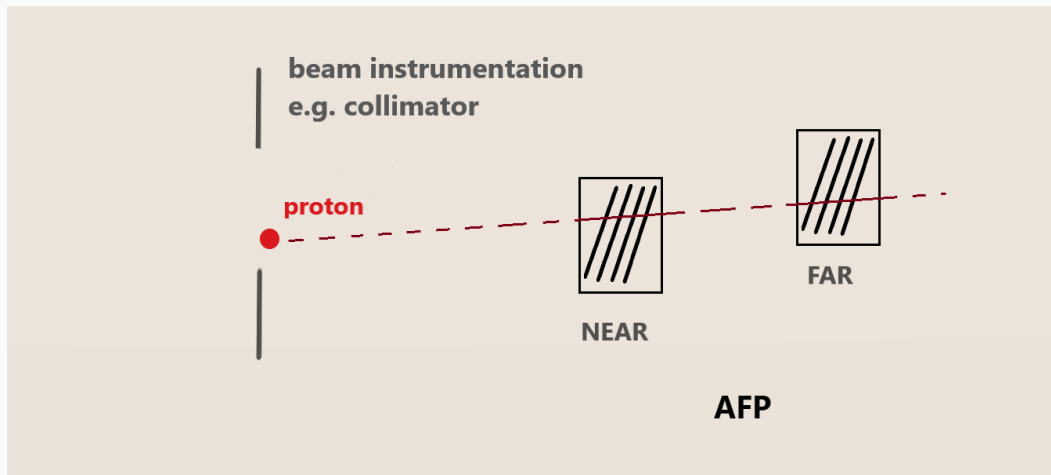
Analysis of the problem

Stations

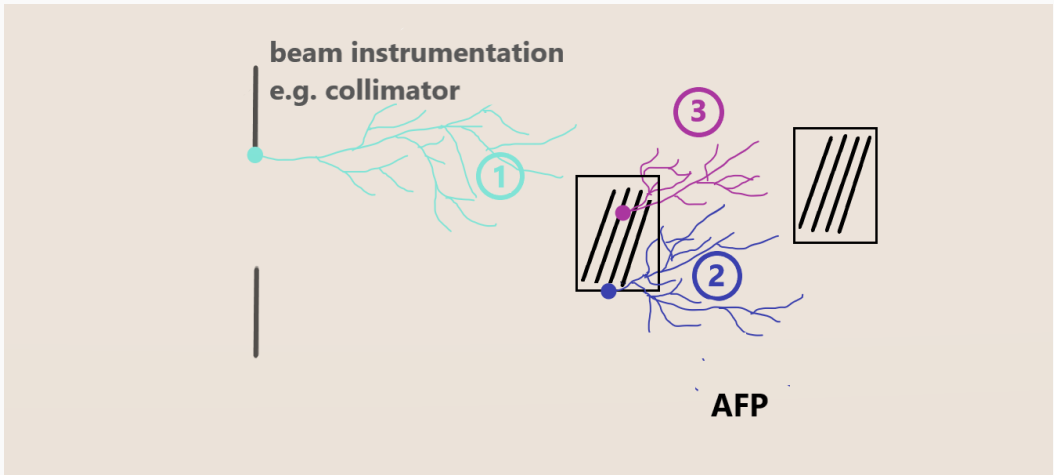


diffractive protons \equiv interact, but remain intact

Single proton event



Shower Production



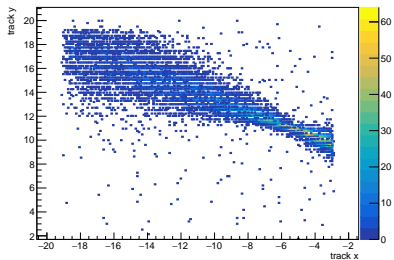
Cuts made on the number of the tracks.

Following cases will be presented:

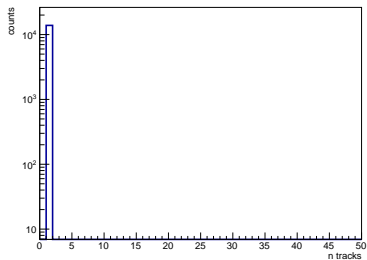
- Clean event: one proton without shower → Exactly 1 track in NEAR and FAR
- One proton with shower from roman pot floor → Exactly 0 track in NEAR and more than 1 in FAR
- Upstream shower → More than 10 tracks in NEAR and FAR

Exactly 1 track in NEAR and FAR

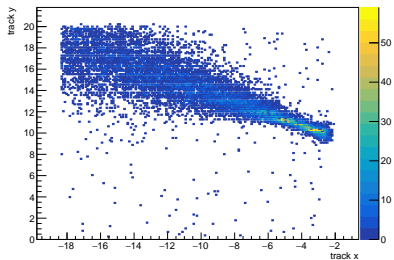
histogram for station 2



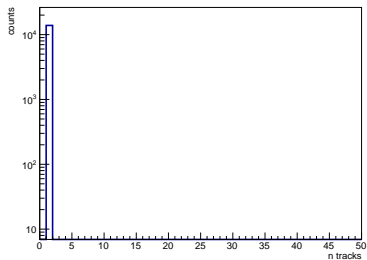
track distribution for station 2



histogram for station 3

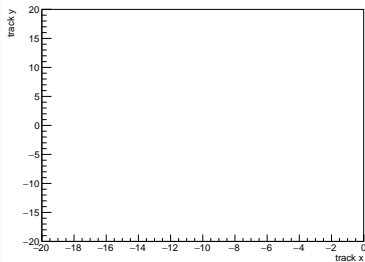


track distribution for station 3

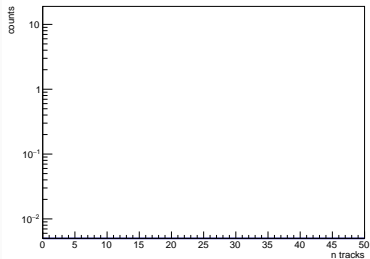


Exactly 0 track in NEAR and more than 1 in FAR

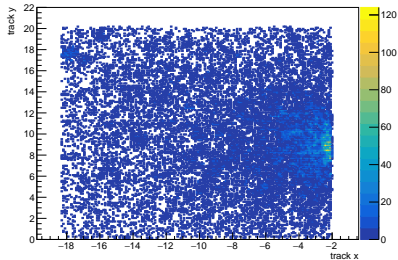
histogram for station 2



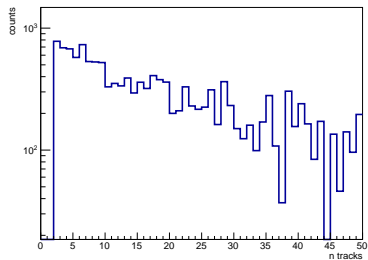
track distribution for station 2



histogram for station 3

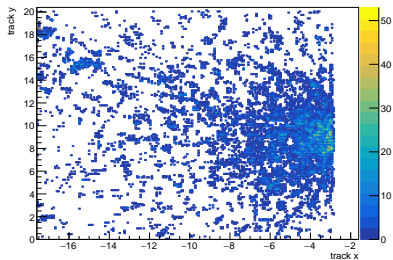


track distribution for station 3

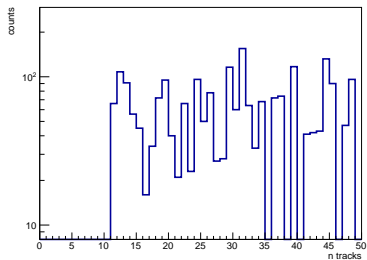


More than 10 tracks in NEAR and FAR

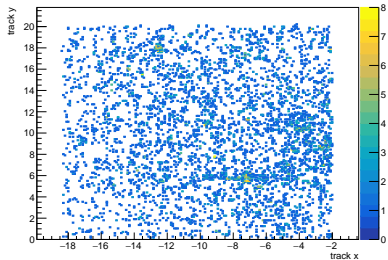
histogram for station 2



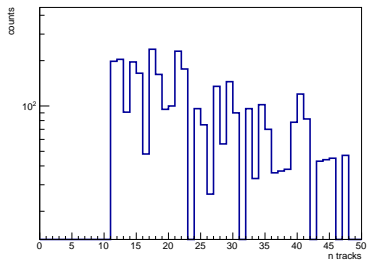
track distribution for station 2



histogram for station 3



track distribution for station 3



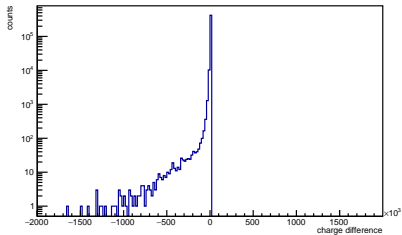
Applied methods

- charge
- fitting distributions
- cluster-track dependence

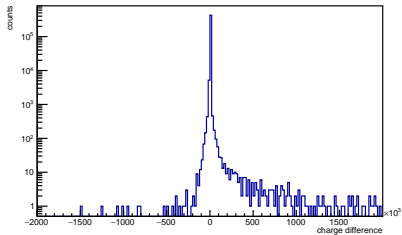
Charge

Changes in charge

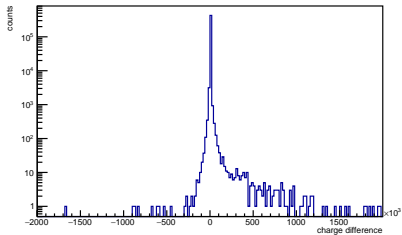
histogram of charge difference for station 0 and plane 0 and 3



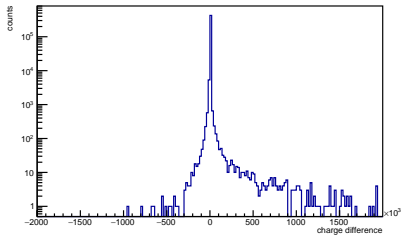
histogram of charge difference for station 1 and plane 0 and 3



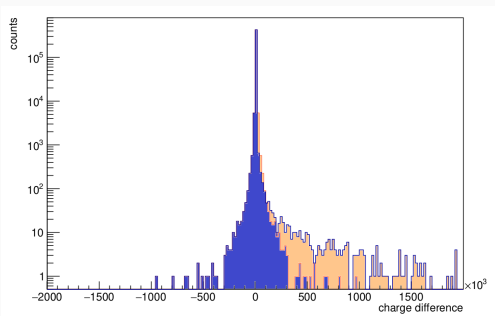
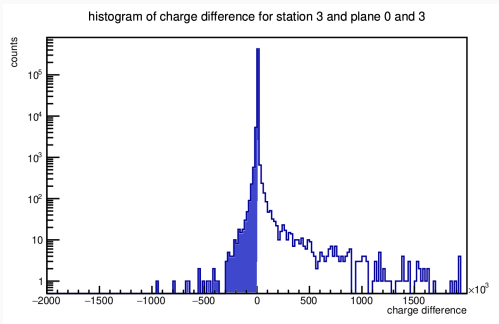
histogram of charge difference for station 2 and plane 0 and 3



histogram of charge difference for station 3 and plane 0 and 3



Changes in charge - Expected probability of showers



$$\text{probability of shower} = \frac{h_{\text{right}} - h_{\text{left}}}{h_{\text{total}}} \quad (1)$$

Changes in charge - Expected probability of showers - Results

Station	Probability of showers
FAR, SIDE A	<i>data not available</i>
NEAR, SIDE A	1,12%
NEAR, SIDE C	0,50%
FAR, SIDE C	1,10%

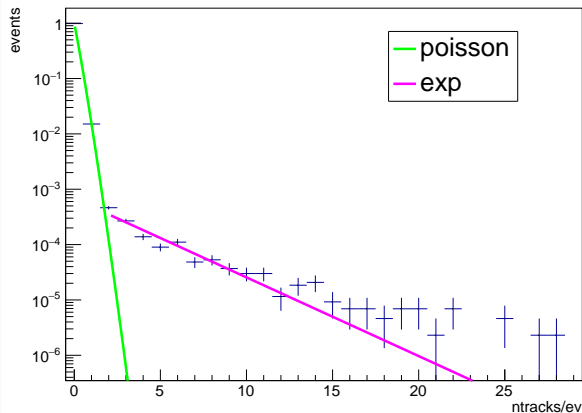
Changes in charge - Expected probability of showers - Results

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the probability of interplanes showers (for charge change analysis) is about 1%

Fitting the distributions

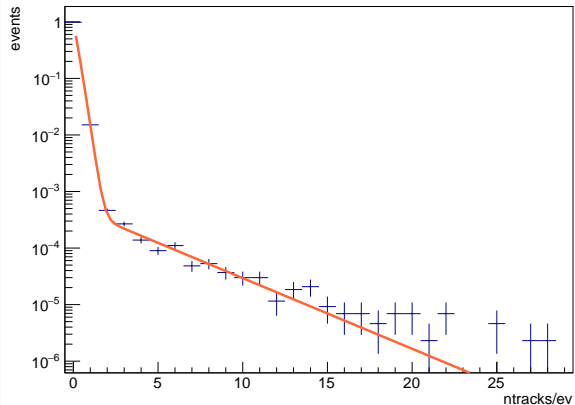
Fitting the distributions - single functions



$$P(x) = A_{poiss} \frac{e^{-\lambda} \lambda^x}{x!}$$

$$\exp(x) = A_{exp} e^{-x}$$

Fitting the distributions - combined function

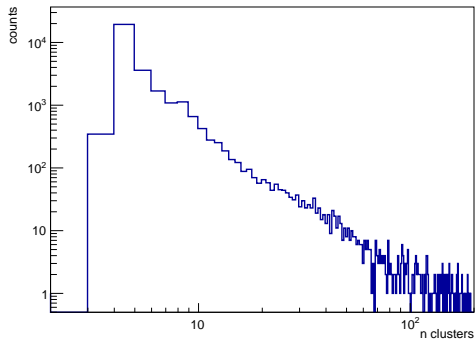


Questions? :)

Cluster - tracks dependence

Dependence of tracks on the number of clusters

cluster distribution for station 2 and 1 track



cluster distribution for station 2

