Event reconstruction chain in GEM detector of the BM@N experiment

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VBLHEP

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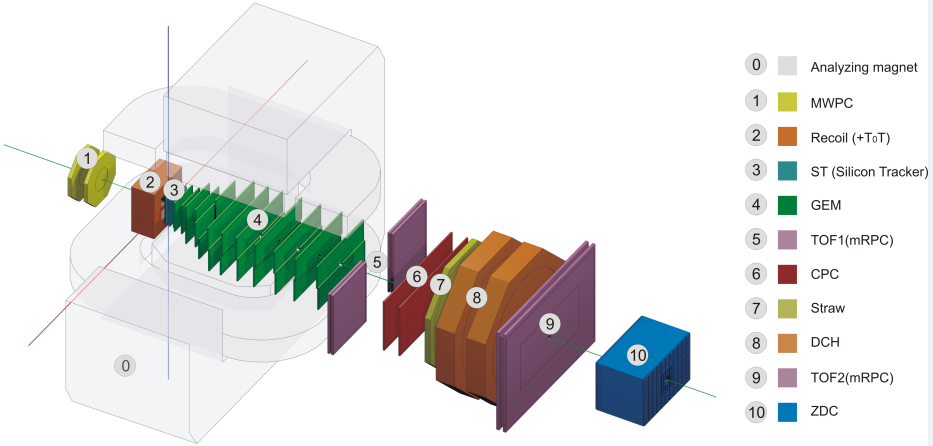
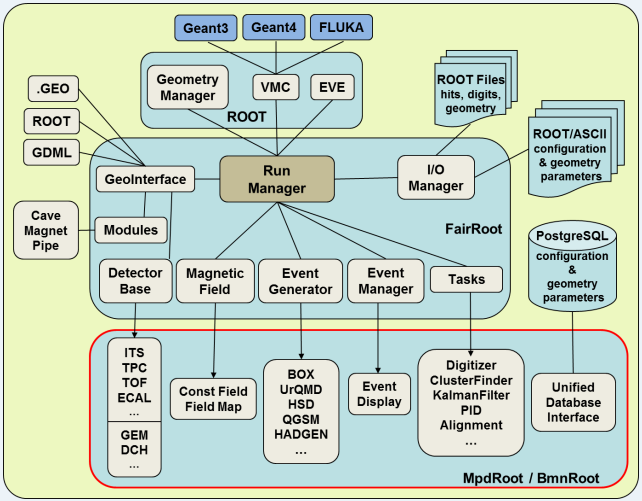
BM@N full configuration



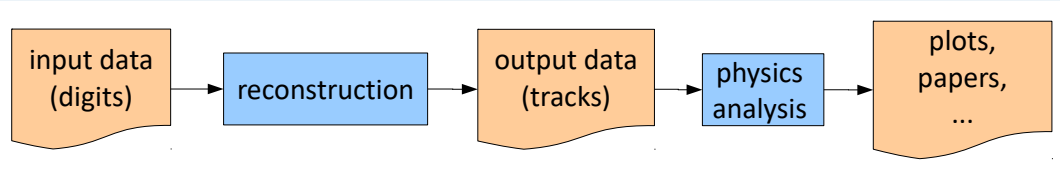
BmnRoot

- uses FairSoft external packages (ROOT, MillePede, Geant3/4, PLUTO, etc.)
- has a part inherited from FairRoot (GSI, Darmstadt)
- includes experiment-specific parts for each detector
- has flexible and scalable structure



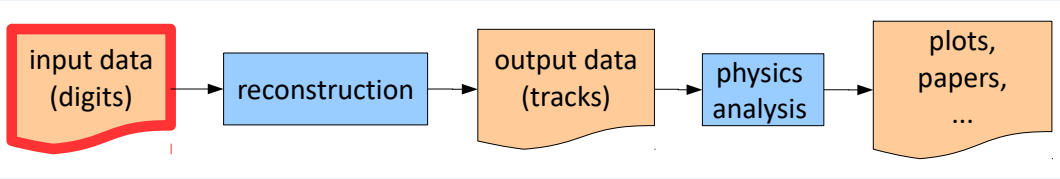
Common reconstruction chain

- Everybody knows how important are two procedures in blue rectangles
- But what about input data?

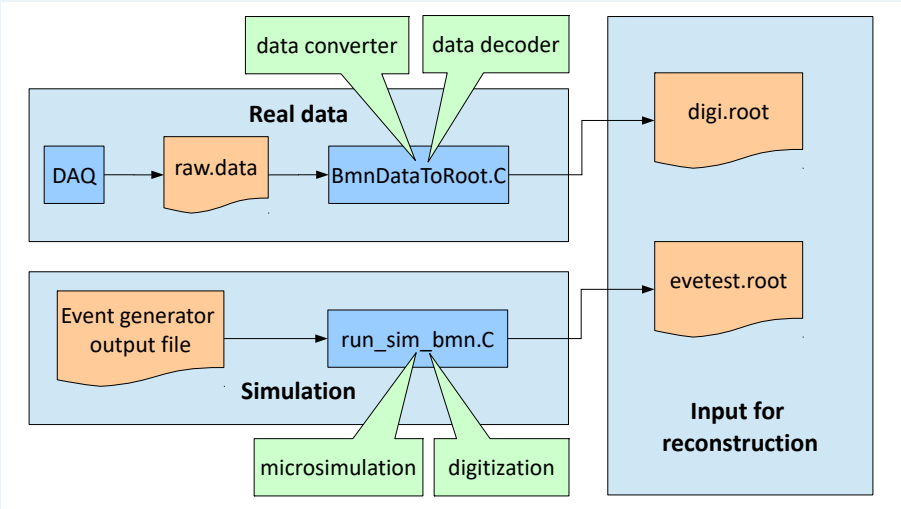


Common reconstruction chain. Input digits

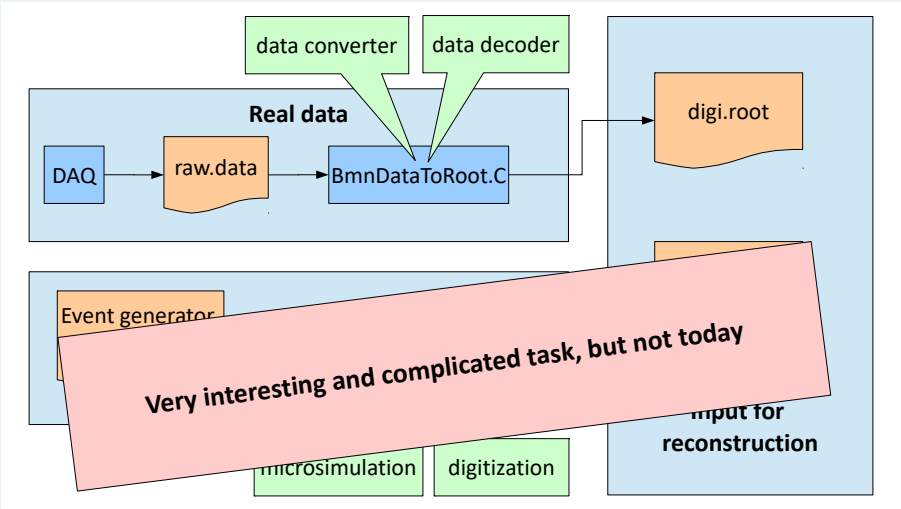
- Everybody knows how important are two procedures in blue rectangles
- But what about input data?



Where do we get data



Sorry, Monte Carlo



Experimental data converter and decoder

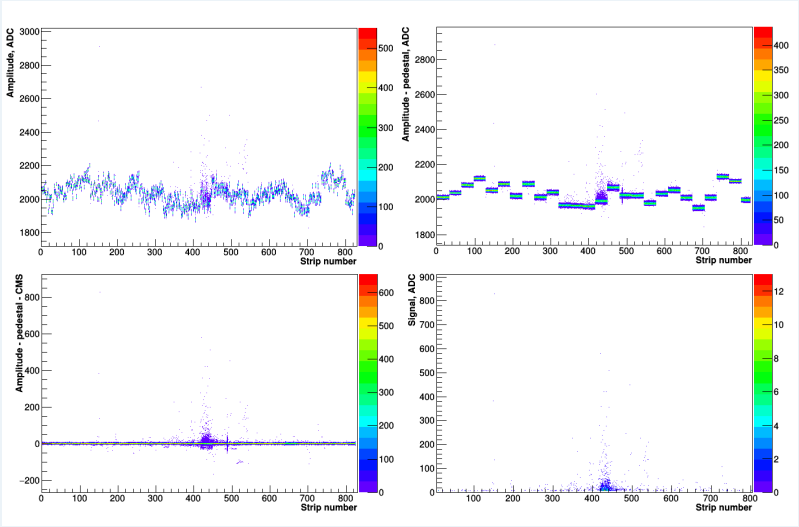
Converter

- takes binary data file and produces ROOT-file accordingly DAQ-data-format
- reads macro parameters (event number, run number, event type, etc.) and put them into DB on fly
- output ROOT-file contains tree with «DAQ-digits» (ADC, TDC, HRB, etc.)

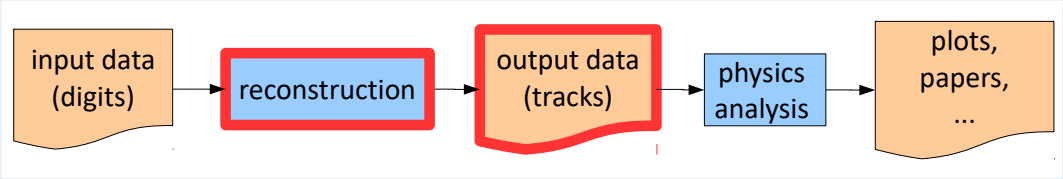
Decoder

- takes ROOT-file with DAQ-digits and decodes it into ROOT-file with detector-digits (BmnGemDigit, BmnTofDigit, etc.)
- connects to DB to read mappings (channel-to-strip)
- calculates pedestals and common modes of channels
- clears noisy channels

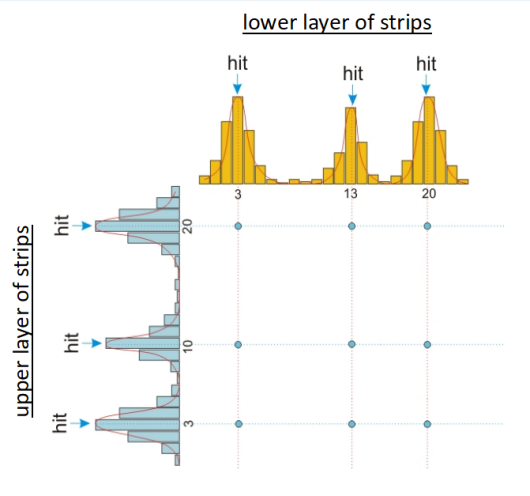
Digitization. Experimental data. Beam only



Common reconstruction chain

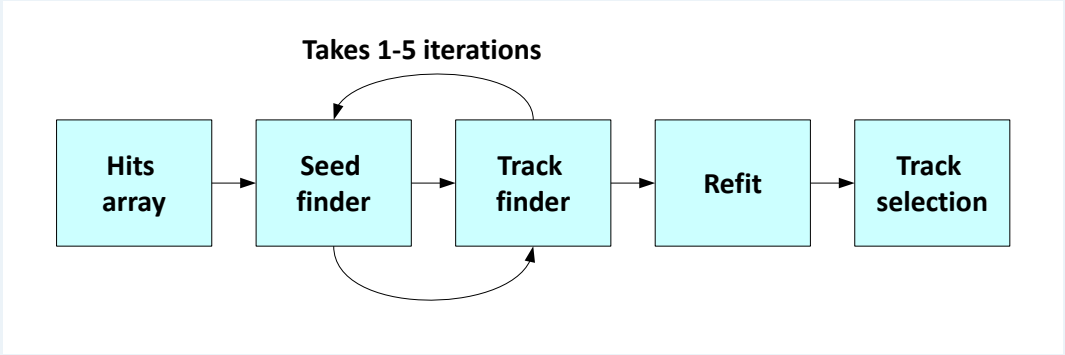


Hit reconstruction. Description

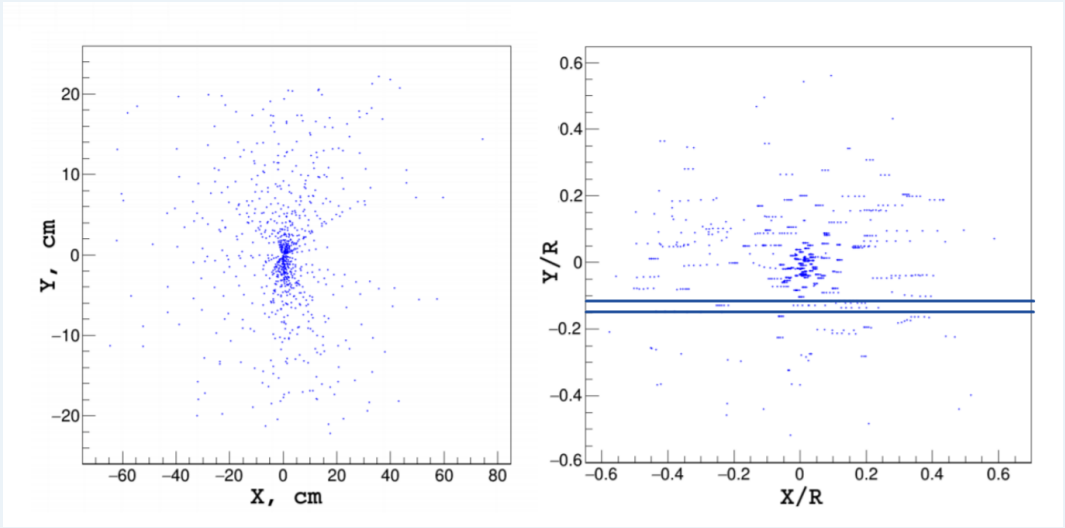


Hit reconstruction. Fake hits problem

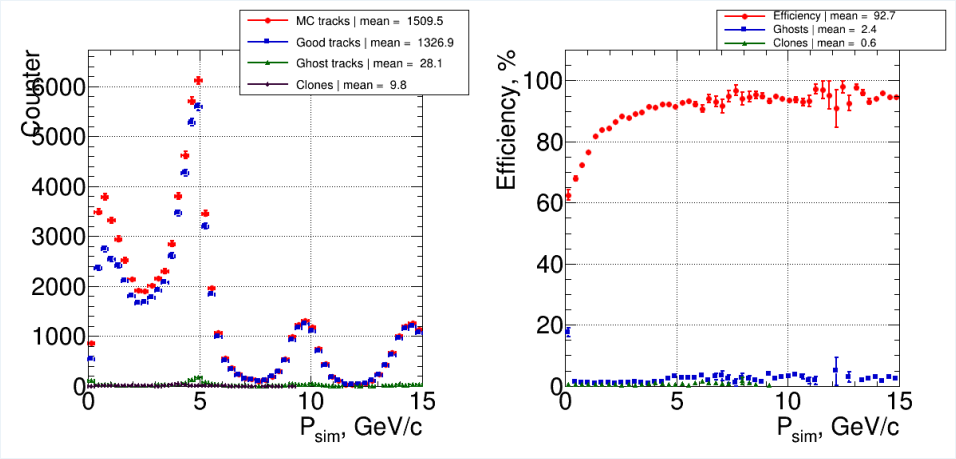
Tracking chain



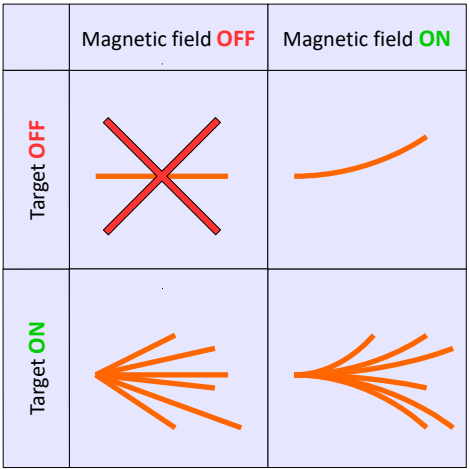
Seed finder



Tracking quality checking. Monte Carlo



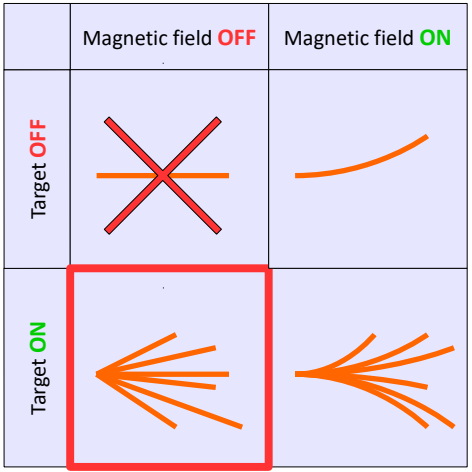
Results for experimental data



Possible classification of events

- Field-; Target- - not interested events
- Field-; Target+ - events for alignment
- Field+; Target- - events to estimate momentum resolution and test tracking
- Field+; Target+ - physics events

Results for experimental data. Alignment



Results for experimental data. Alignment

The package based on formalism of Millepede II with all its features and allows one to include / exclude different subdetectors from alignment (GEM, SI, MWPC, ...).

Generalized straight-line model of track:

$$u_i^j = x_0^j \cos\alpha_i + t_x^j z \cos\alpha_i + y_0^j \sin\alpha_i + t_y^j z \sin\alpha_i + \Delta u_i + (t_x \cos\alpha_i + t_y \sin\alpha_i)\Delta z$$

Chosen weights:

$w_i^1 = \cos\alpha_i$ – **shifts** (x_0)

$w_i^2 = z_i \cos\alpha_i$ – **shearings** (t_x)

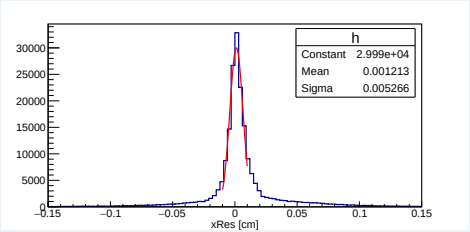
$w_i^3 = \sin\alpha_i$ – **shifts** (y_0)

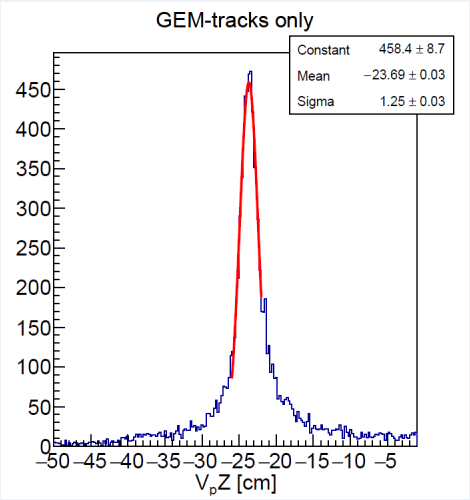
$w_i^4 = z_i \sin\alpha_i$ – **shearings** (t_y)

$w_i^5 = 1$ – **overall shift in Z**

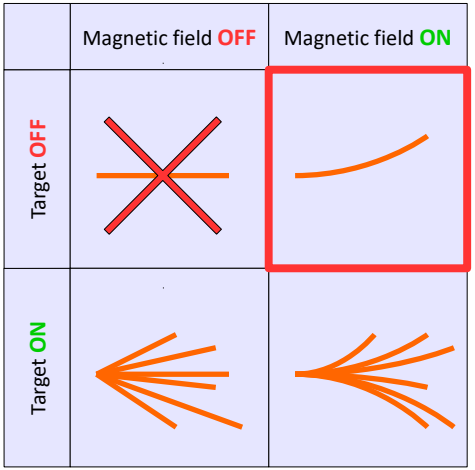
$w_i^6 = z_i$ – **scaling in Z**

Quality of alignment

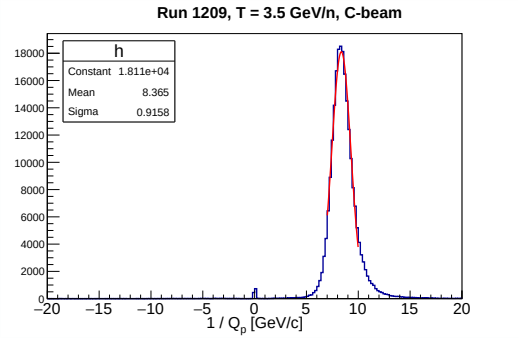


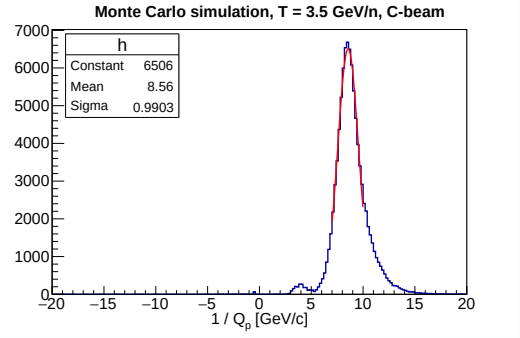


Results for experimental data

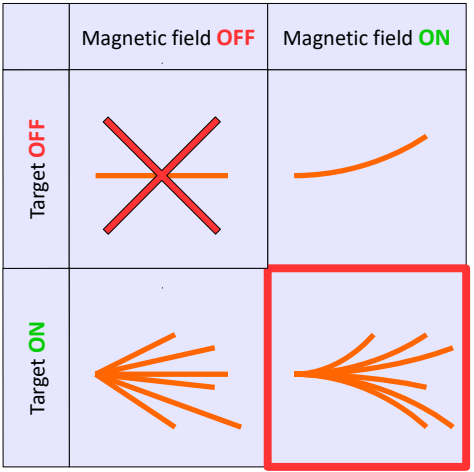


Results. MagField+, Target-

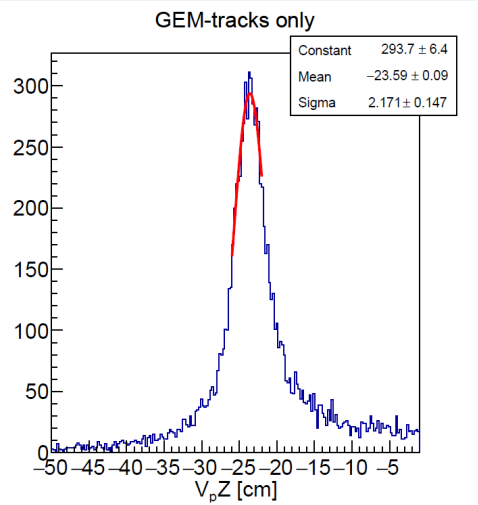


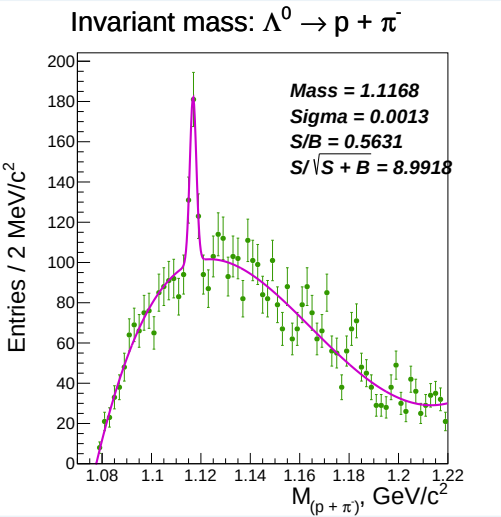


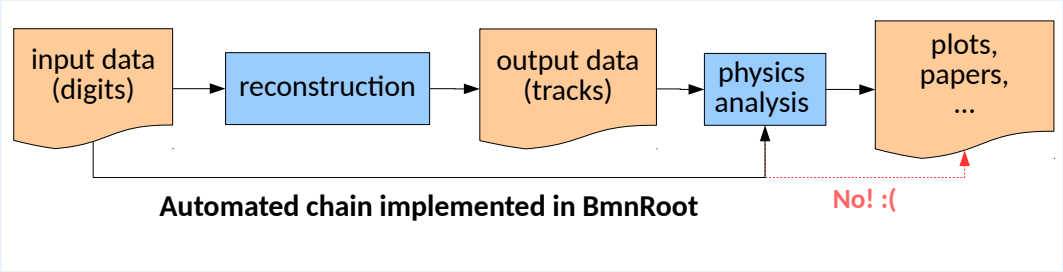
Results for experimental data



$\Lambda^0 \to \pi^- + p$, C-Cu @ 4GeV/n






input data
(digits)
reconstruction
output data
(tracks)
physics
analysis
plots,
papers,
...
Automated chain implemented in BmnRoot
No! :(

Thank you!