

# Development of Eutelescope alignment processor based on general broken line track model

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# Motivation

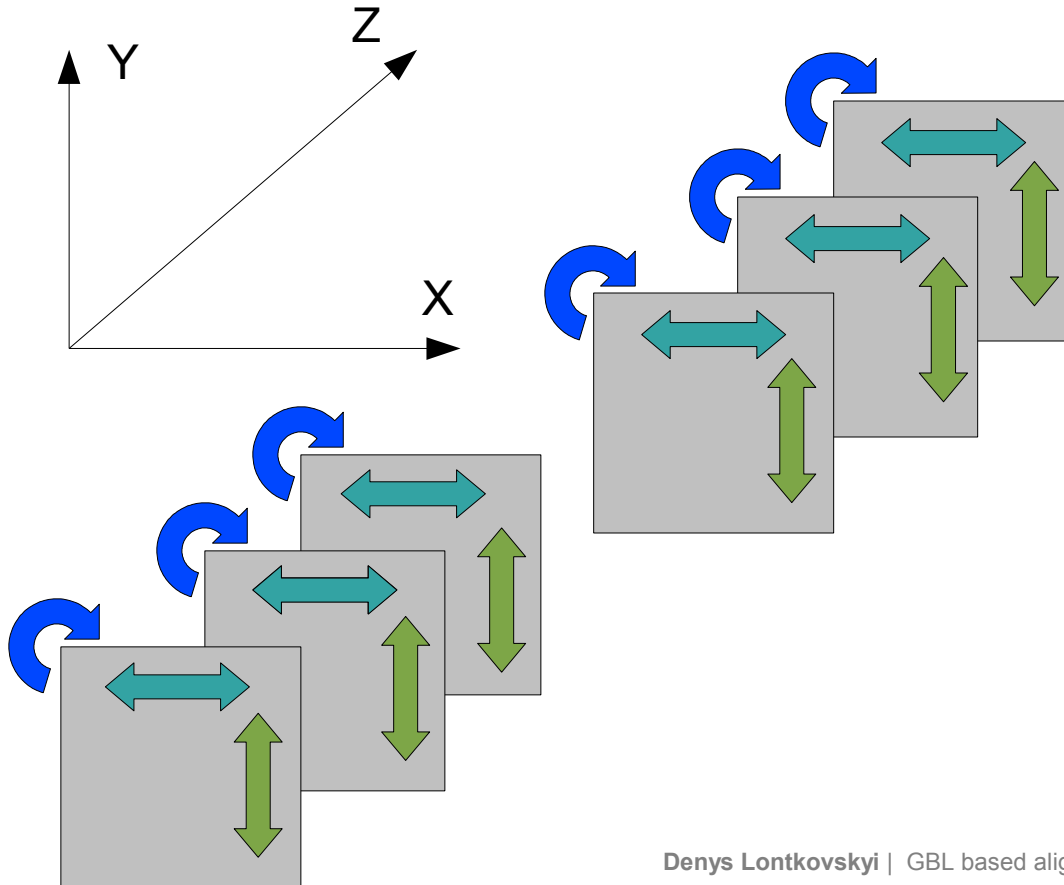
- > At DESY test beam low energy electrons are subjected to multiple scattering.
- > Multiple scattering is a limiting factor for precision tracking and has to be taken into account in track fits and during a track based alignment.
- > New Marlin processor is being developed in order to take into account multiple scattering.
- > Code architecture is being revisited to simplify usability.



# Alignment strategy

## Currently supported alignment degrees of freedom:

- > Rotations around Z-axis
- > Shifts in XY plane

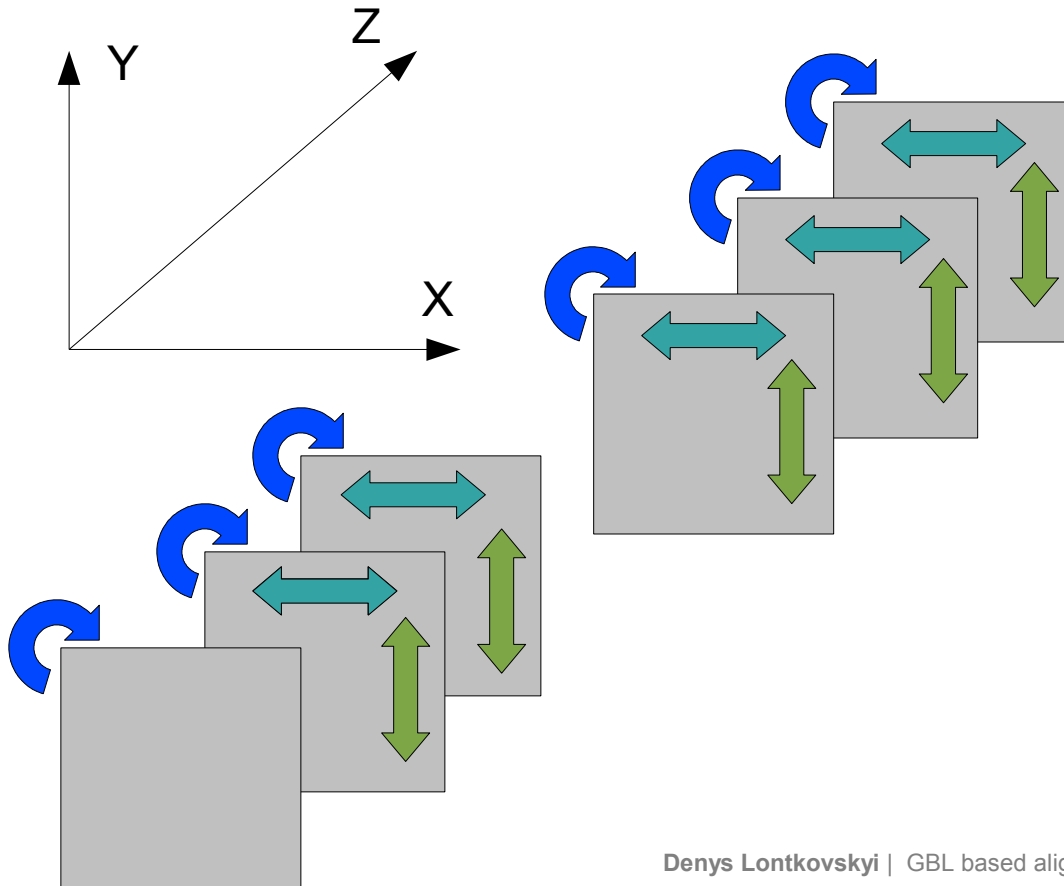


To perform the alignment of the telescope MILLIPEDEII + GBL tandem was used

# Alignment strategy

## DATA used to test new processor:

- > Taken in May 2012 test beam
- > Beam energy 3 GeV/c<sup>2</sup>



For the given run following parameters were determined:

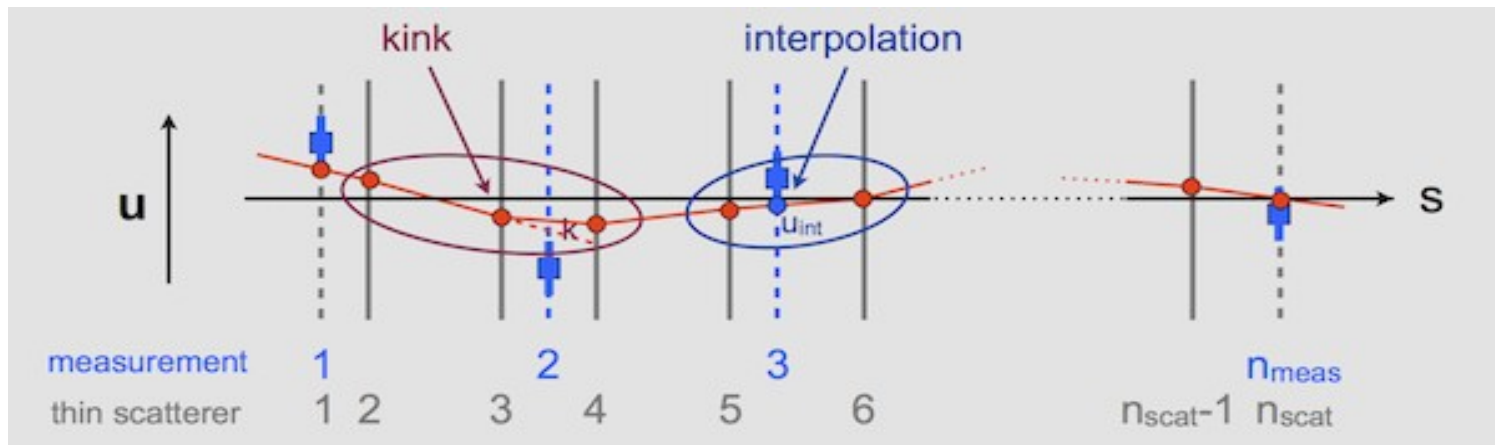
6 rotations with  
fixed overall rotation ( $0 = \sum \Delta\phi_{i \text{ plane}}$ )

5 x-shifts  
fixed overall x-shift ( $0 = \sum \Delta x_{i \text{ plane}}$ )

5 y-shifts with  
fixed overall y-shift ( $0 = \sum \Delta y_{i \text{ plane}}$ )

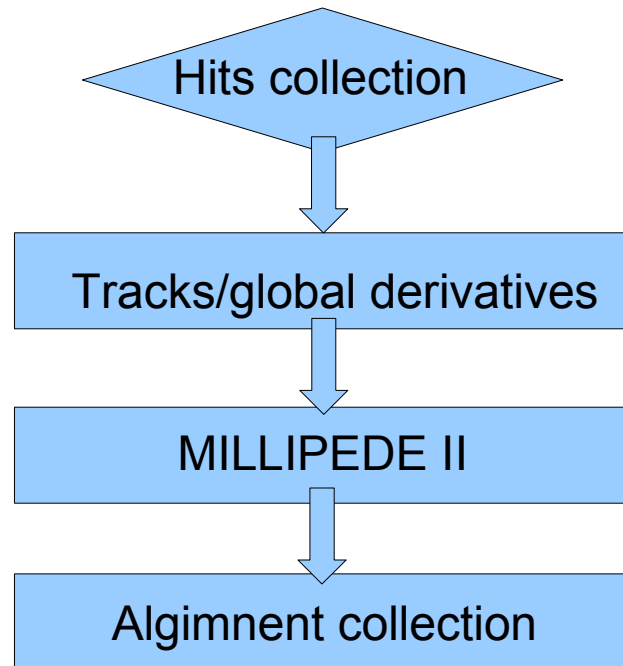
# Track model

- > Track model is based on general broken line algorithm
- > Scattering medium (per silicon plane):
  - 50  $\mu\text{m}$  of Silicon  $\rightarrow$  0.05%  $X_0$
  - 2\*30  $\mu\text{m}$  Polyamide film (Kapton)  $\rightarrow$  0.01%  $X_0$
  - 150 mm Air  $\rightarrow$  0.05%  $X_0$

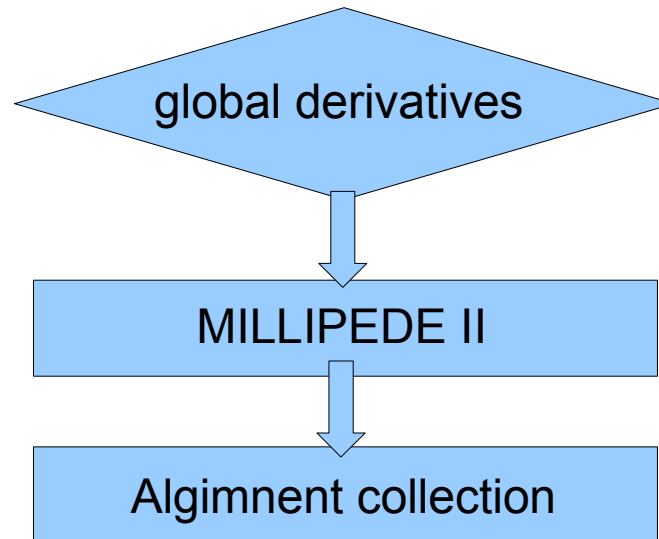


courtesy Claus Kleinwort  
[GBL manual]

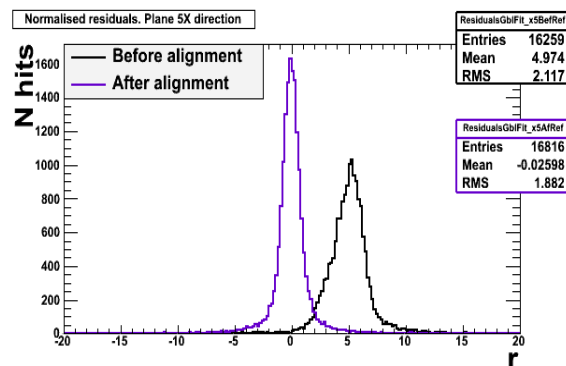
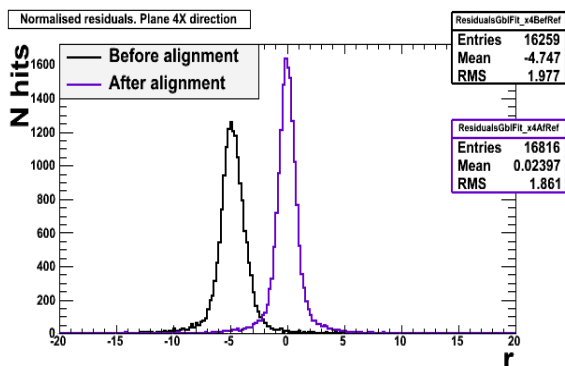
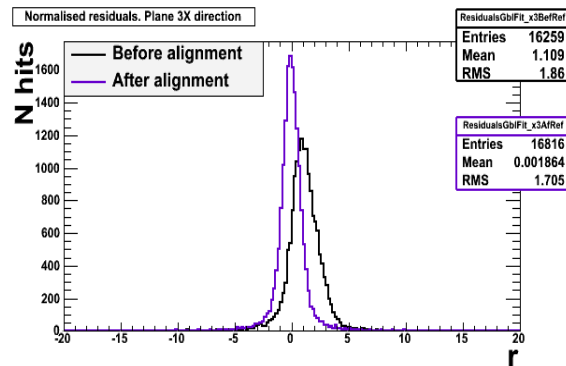
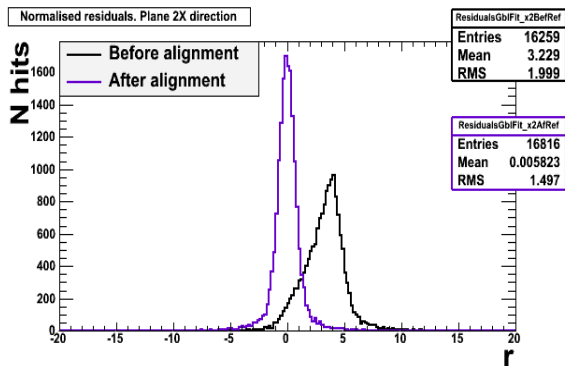
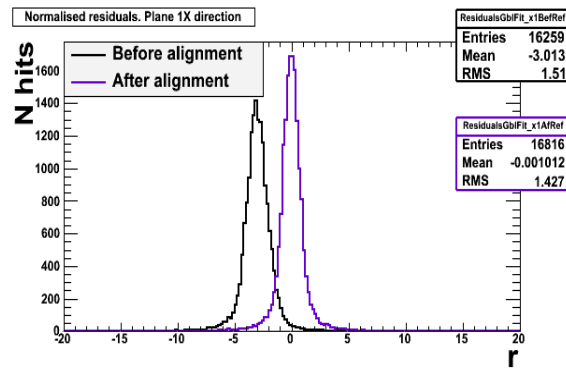
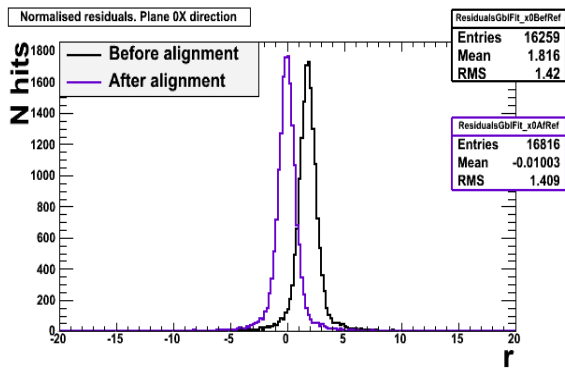
# Alignment processor pseudo-algorithm



# Alignment processor pseudo-algorithm

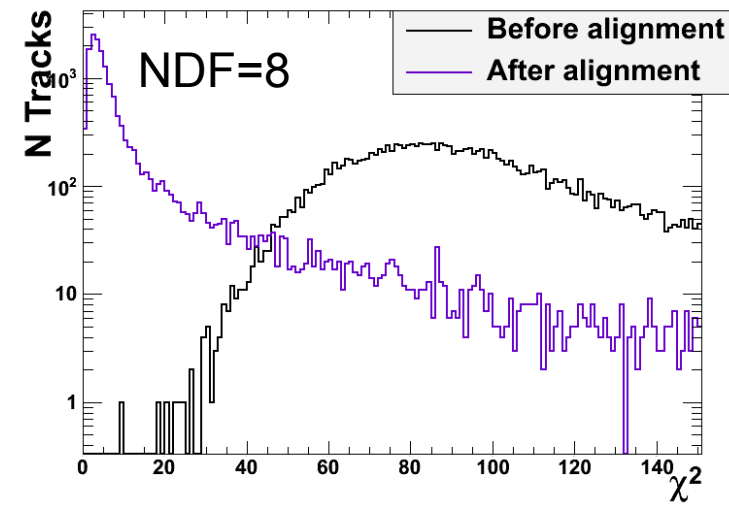


# Alignment quality checks



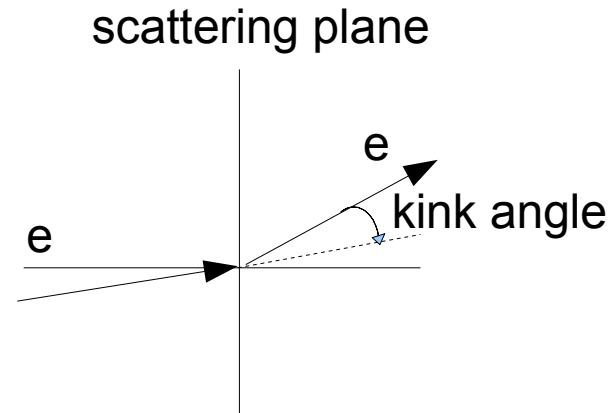
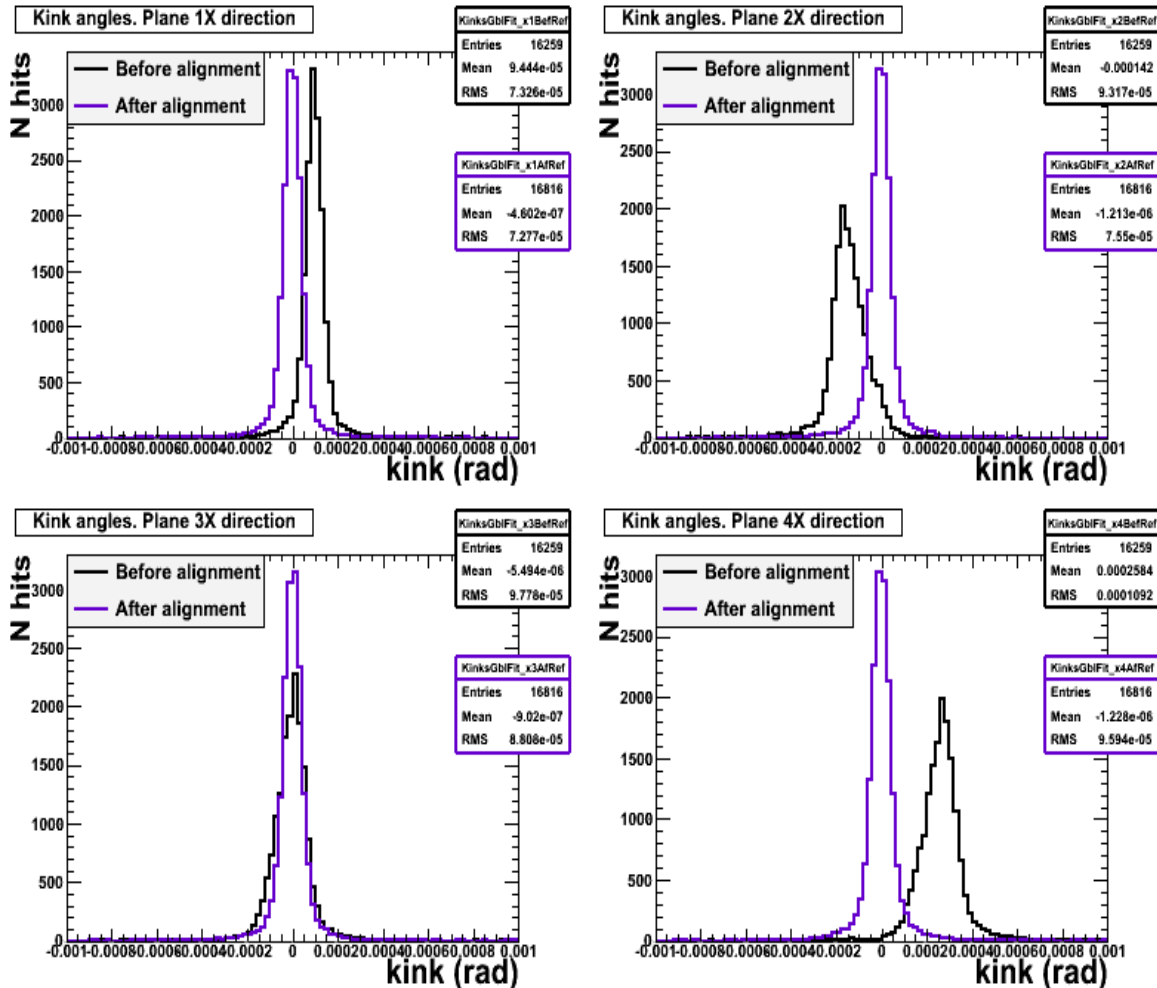
- After alignment residuals have gaussian core
- Corrections for misalignment significantly improve quality of the track fit

$\chi^2$  of track candidates





# Alignment quality checks



➤ Width of the gaussian distribution can be used for the determination of X0



# Summary and outlook

- > Basic functionality of the new EUTelMilleGBL alignment processor has been presented.
- > New processor incorporates multiple scattering into alignment step.
- > The processor was tested on real data.
  
- > Tests with simulated data are planned.
- > Cases with general geometries (arbitrary number sensor planes/DUTs, additional rotations) to be developed.



# Alignment quality checks

