

Alignment Status and Plans

Sergey Yashchenko (DESY)
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Outline

- > Alignment chain
- > Validation
- > Misalignment
- > Documentation
- > Alignment of the Outer Detectors

Alignment Chain

> Status

- VXD alignment with examples for the testbeam in the basf2 release
- General development in progress
- Details in Tadeas Bilka's talk

> Plans

- Finalize GBL interface with GENFIT
- Add CDC to the alignment chain
- Tests with misalignment

Validation

> Status

- Cosmic track split vertex fitting
- Event selection of $D^0 \rightarrow K3\pi$
- Details in Simon Wehle's presentation
- Internal Note about validation started

> Plans

- Include validation code and examples in validation folder of alignment directory in basf2
- Documentation: Internal Note to be included to the ATF Note, README files

Displacement, Misalignment, and Alignment

- > Discussed and agreed during the f2f tracking meeting in Prag
- > **Displacement**: differences from the design detector geometry will be stored in **displacement.xml** files or implemented in main geometry files and used in the detector geometry and in the reconstruction
- > **Misalignment parameters** will be stored in **misalignment.xml** files, added on **hit reconstruction level**, and used only in the **simulation** but not in the reconstruction
- > **Alignment parameters** determined by track-based alignment procedure will be stored in **alignment.xml** files and used in the **reconstruction** both for real and Monte Carlo data
- > **Residual misalignment** is the difference between alignment parameters and unknown misalignment in data, can be estimated as the difference between alignment and misalignment parameters in Monte Carlo data

Displacement, Misalignment, and Alignment

Real data

- > Prior alignment measurements
→ [displacement.xml](#) files or main geometry files
- > [Misalignment](#) is already present in data and unknown
→ [no](#) [misalignment.xml](#) files
- > Track-based alignment procedure
→ [alignment.xml](#) files
- > [Residual misalignment](#) unknown
→ estimations from Monte Carlo (and data)

Monte Carlo data

- > Prior alignment measurements
→ [displacement.xml](#) files or main geometry files
- > [Misalignment](#) is simulated according to track-based alignment results
→ [misalignment.xml](#)
- > Track-based alignment procedure
→ [alignment.xml](#) files
- > [Residual misalignment](#)
→ the difference between alignment and misalignment parameters

Misalignment Simulation in CDC and VXD

> Misalignment simulation on digitization/reconstruction level

> Misalignment for CDC

- Gravitational sag of sense wire in CDC full simulation
- One can assume misaligned wires and sags in reconstruction, i.e. assume different geometry from that in simulation
- Implemented in basf2

> Misalignment for VXD

- Shifts are applied to local positions of PXD and SVD RecoHits, based on misalignment parameters
- For methods that change sensor planes, code takes care of not applying the same transformation for each hit on a specific plane
- Will be implemented in official version of basf2 soon

Misalignment in CDC

- > How to use different CDC geometry in reconstruction from that in simulation (Hitoshi Ozaki's instruction)
 - Perform a job up to digitization, then save the job result on disk
 - Prepare a file containing misalignment (wire position and tension) data, and switch on misalignment flag in CDC.xml so that the misalignment is reflected in the containers of CDCGeometryPar
 - Perform reconstruction with a separate job, reading the job result from the disk
- > Remark: one cannot perform both simulation and reconstruction in the same job, since the CDCGeometryPar has only a single set of containers for the wire positions (and tensions)
- > Effectively it means reconstruction with alignment parameters on reconstruction level with a possibility to use misalignment on geometry level
- > In addition, we need to have misalignment simulation on reconstruction level, separate files for misalignment and alignment

What Is Needed in Addition for CDC

- > Misalignment simulation on hit reconstruction level
- > Separate xml files for displacement (if necessary), misalignment, and alignment
- > Ideally, a possibility to avoid 2-step simulation-reconstruction chain
 - Modifications in CDCGeometryPar class
- > VXD code as an example?

Documentation

- > Alignment TWIKI updated
- > Misalignment part added to ATF Internal Note
- > Note about alignment validation started

Alignment of the Outer Detectors

- > Can be done separately after alignment of tracking detectors (VXD+CDC) ready
 - Alignment of outer detector relative to VXD+CDC does not require many alignment parameters and high accuracy
 - Can be done using existing GENFIT extrapolation
 - Easy to implement
- > Claus Kleinwort proposed to include outer detectors to alignment procedure with Millepede II together with VXD and CDC
 - Automatic alignment procedure for the outer detectors
 - Reduction of weak modes for VXD+CDC alignment
- > What is needed for inclusion of the outer detectors
 - Possibility to fit all detectors together in GENFIT2 (Kalman+GBL or only GBL)
 - Selection of events in inner and outer detectors
- > Discuss this during this meeting and decide how to proceed