

# Detector Alignment by Reconstructed Tracks

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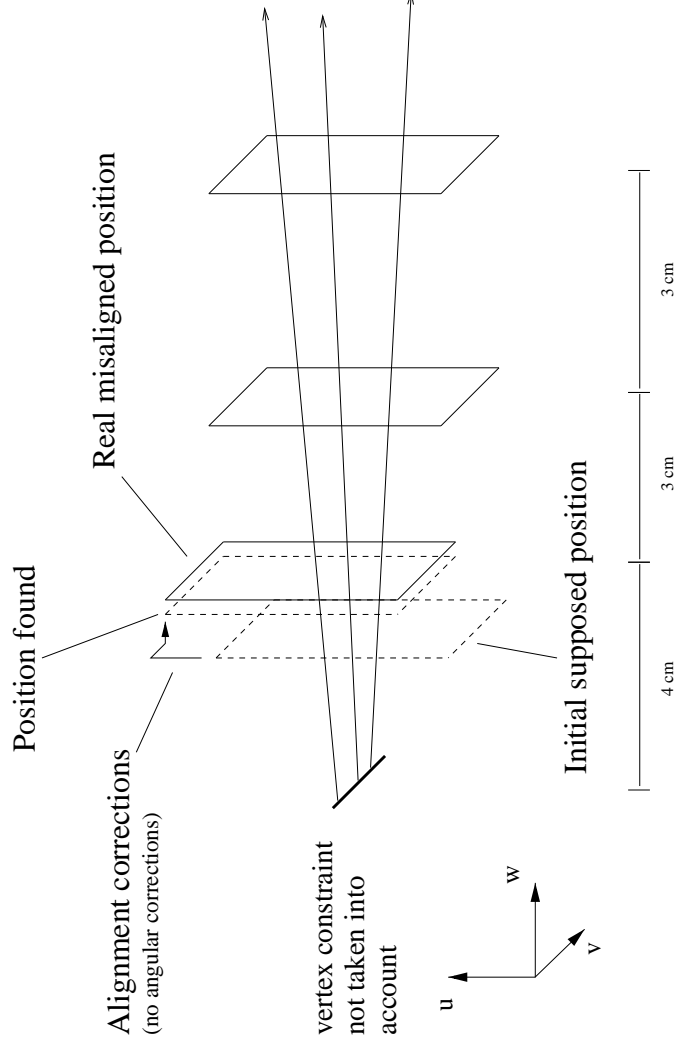
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b/ $\tau$  Workshop

Topics:

- ❖ Detector Alignment
- ❖ Alignment by Reconstructed Tracks
- ❖ Alignment studies with Toy Model of Pixel Barrel
- ❖ Alignment Status and Plans

## Detector Alignment

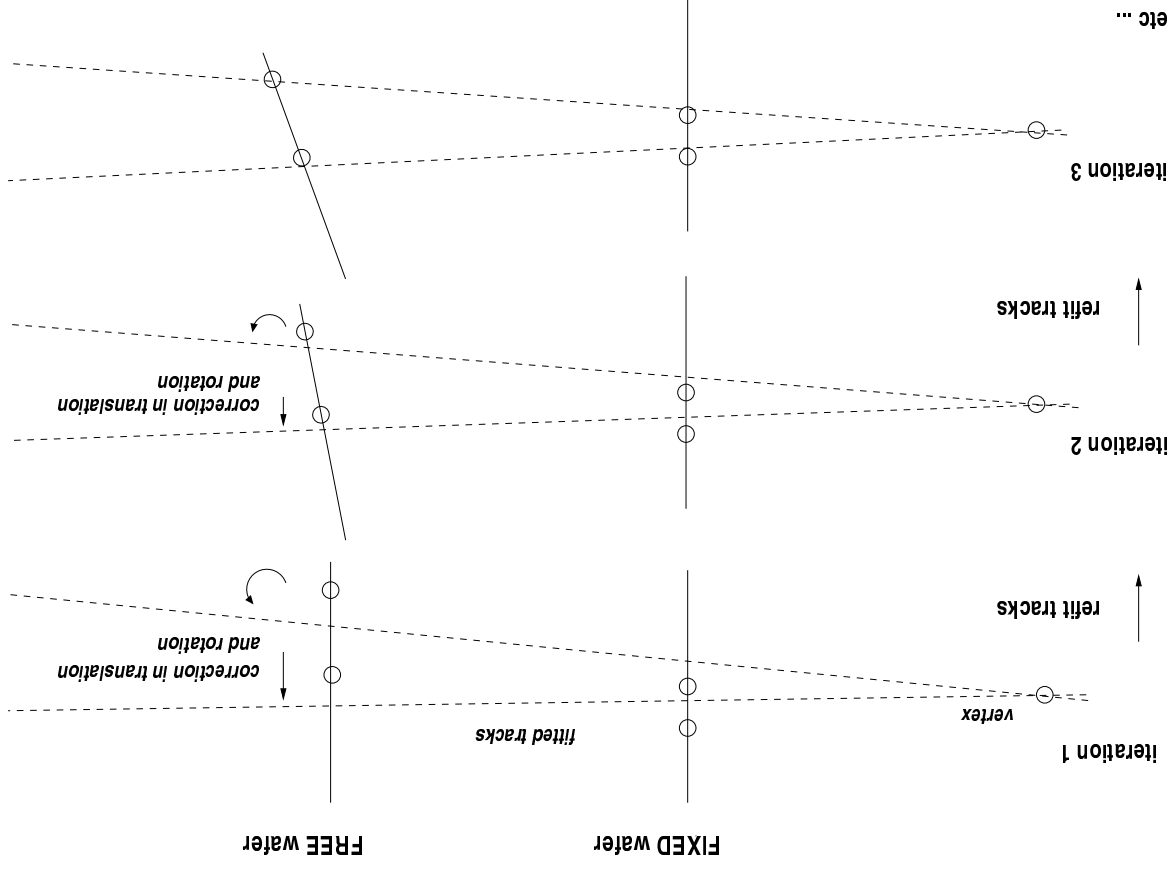
- ❖ Misalignment of detectors not critical to pattern recognition up to 1 mm / 1 mrad, but distorts track parameters
- ❖ position accuracy should be better than intrinsic accuracy
- ❖ Alignment can be carried out with
  - hardware (optical alignment in CMS), accuracy of  $\sim 100\mu\text{m}$
  - software (alignment with reconstructed tracks), accuracy of down to  $\sim 10\mu\text{m}$



- ❖ Sources of misalignment: Day 1, variations in temperature & humidity, switching on the magnet

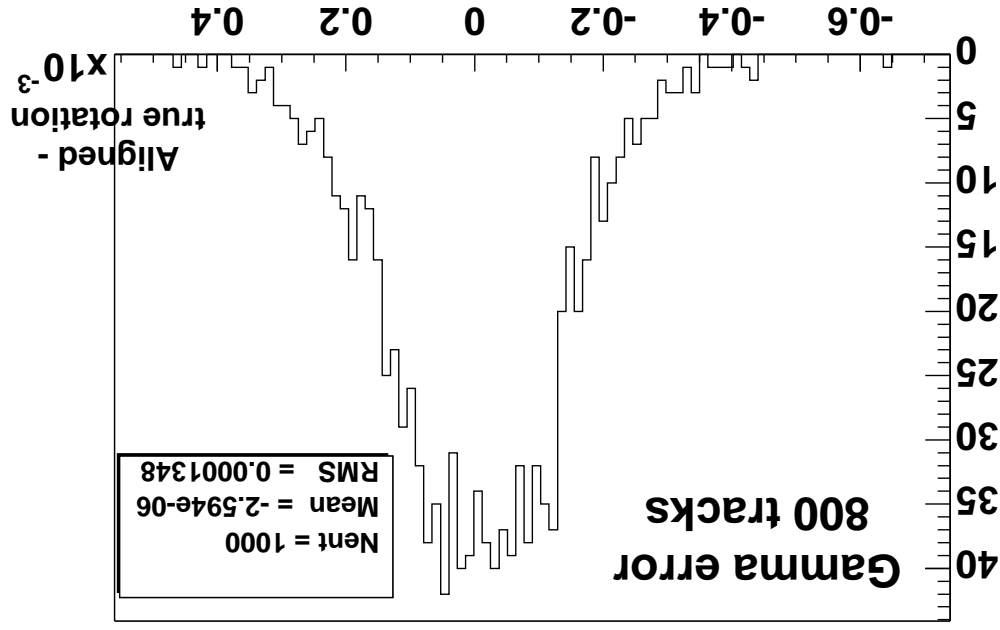
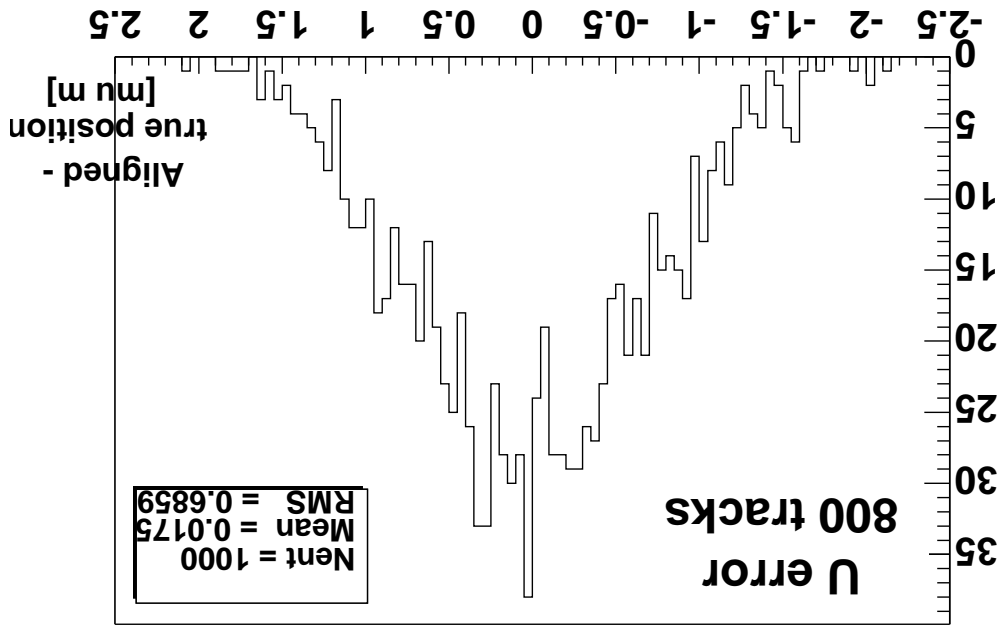
# Alignment by Reconstructed Tracks

- ◆ Detector Alignment - DALI
- ◆ Iterative algorithm which aligns detector planes with 5/6 degrees of freedom is studied for simulated SiBT and a toy model of Pixel Barrel
- ◆ Summary of the algorithm: track reconstruction and fit, alignment of sensor(s), track fit, alignment, etc.
- ◆ Algorithm repeated until convergence, i.e. corrections  $< 0.1 * \text{error estimate}$



# Alignment Studies with Toy Model of Pixel Barrel

- ◆ Initial offset in position and in rotation was  $100 \mu\text{m}$  and  $0.02 \text{ rad}$
- ◆ Good accuracy ( $1 \mu\text{m}$  or  $0.2 \text{ mrad}$ ) was achieved by the alignment procedure even without the vertex constraint



## Alignment Status and Plans

- ❖ Stand-alone programs for SiBT and Pixel Barrel Toy Model
- ❖ Algorithm itself will also be developed
- ❖ To be taken into account: curved tracks, correlations of alignment (i.e. sensors in the same rod)
- ❖ Development of the ORCA Misalignment tools: Pixel Barrel implemented and currently under validation
- ❖ Goal: Alignment tools to ORCA