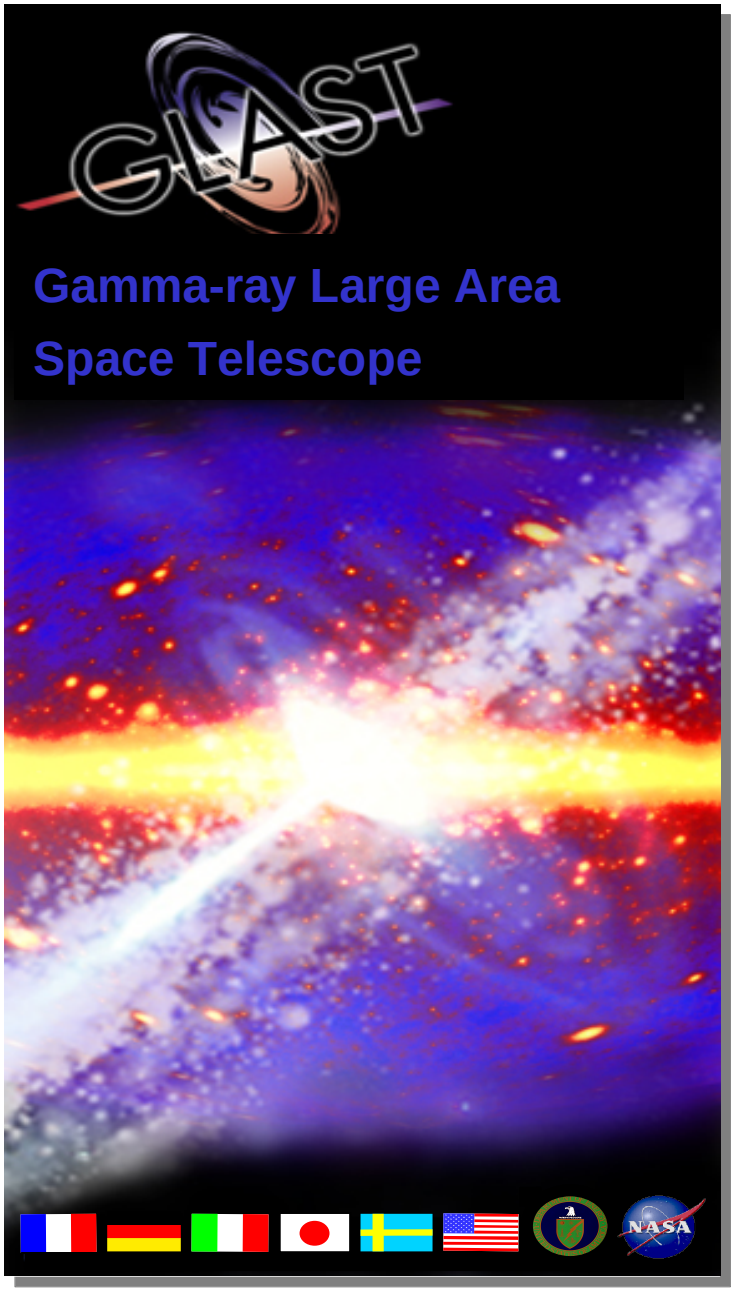


# CU06 Inter-Tower Tracker Alignment

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**Beam test meeting**

**vrvs**

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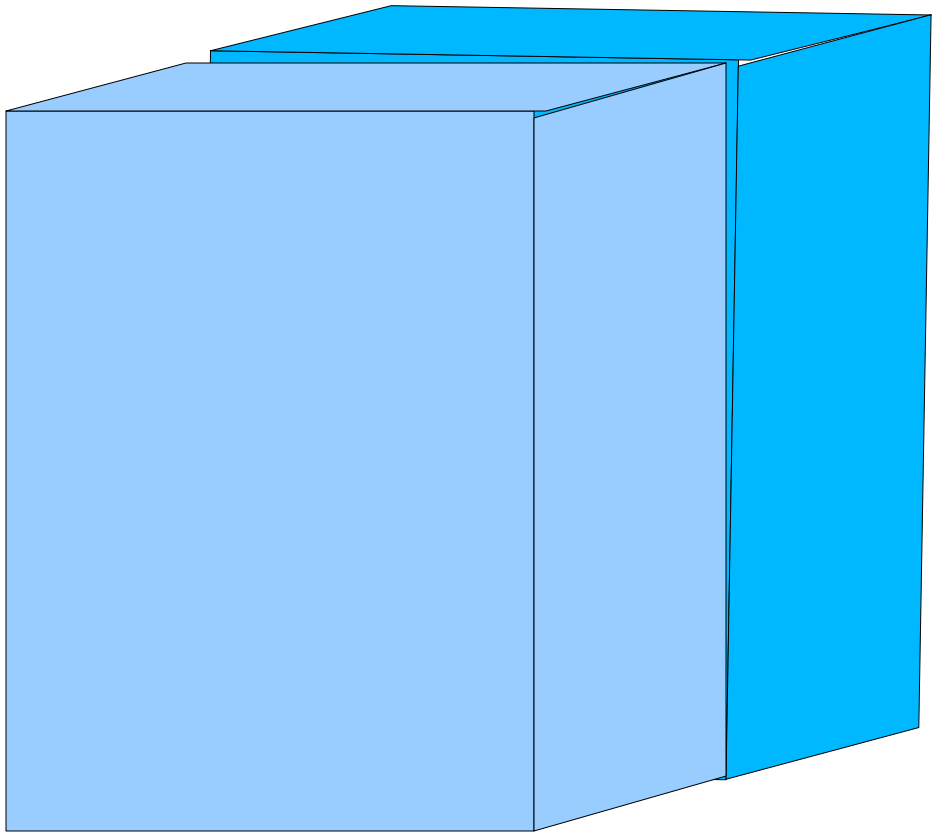
# The Problem

... one tower is rotated by ~ 1 mrad



# Software Packages

- LeaningTower (RootAnalysis v8r8p4): intra-tower alignment of single tower runs (check my talks at IAWS's 4 and 6)

- LeaningTower (my local copy): intra-tower alignment of multi-tower runs

- AlignmentContainer: intra- **and** inter-tower alignment! In progress (check Johann at IAG weekly meeting 53)! Ready soon???

# Measuring Rotation

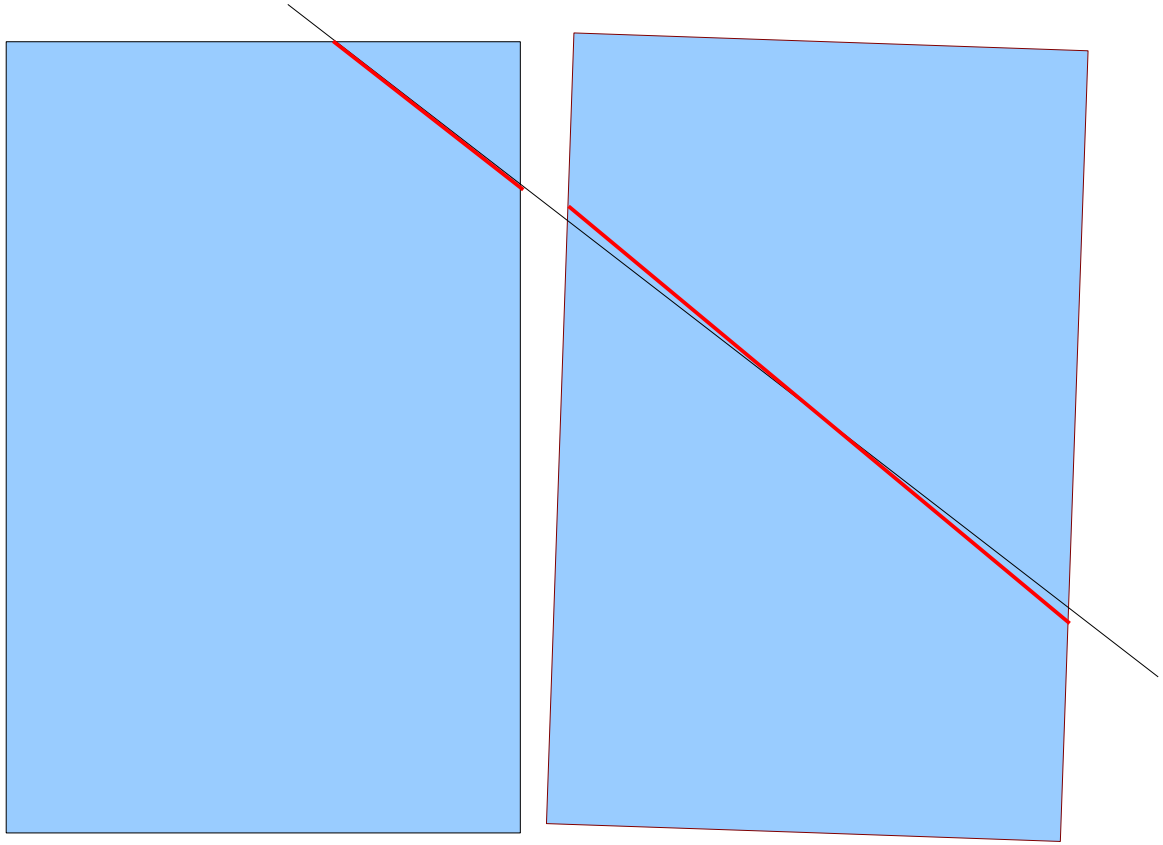
rotation matrix (small angles)

$$\begin{pmatrix} 1 & -rotz & roty \\ rotz & 1 & -rotx \\ -roty & rotx & 1 \end{pmatrix}$$

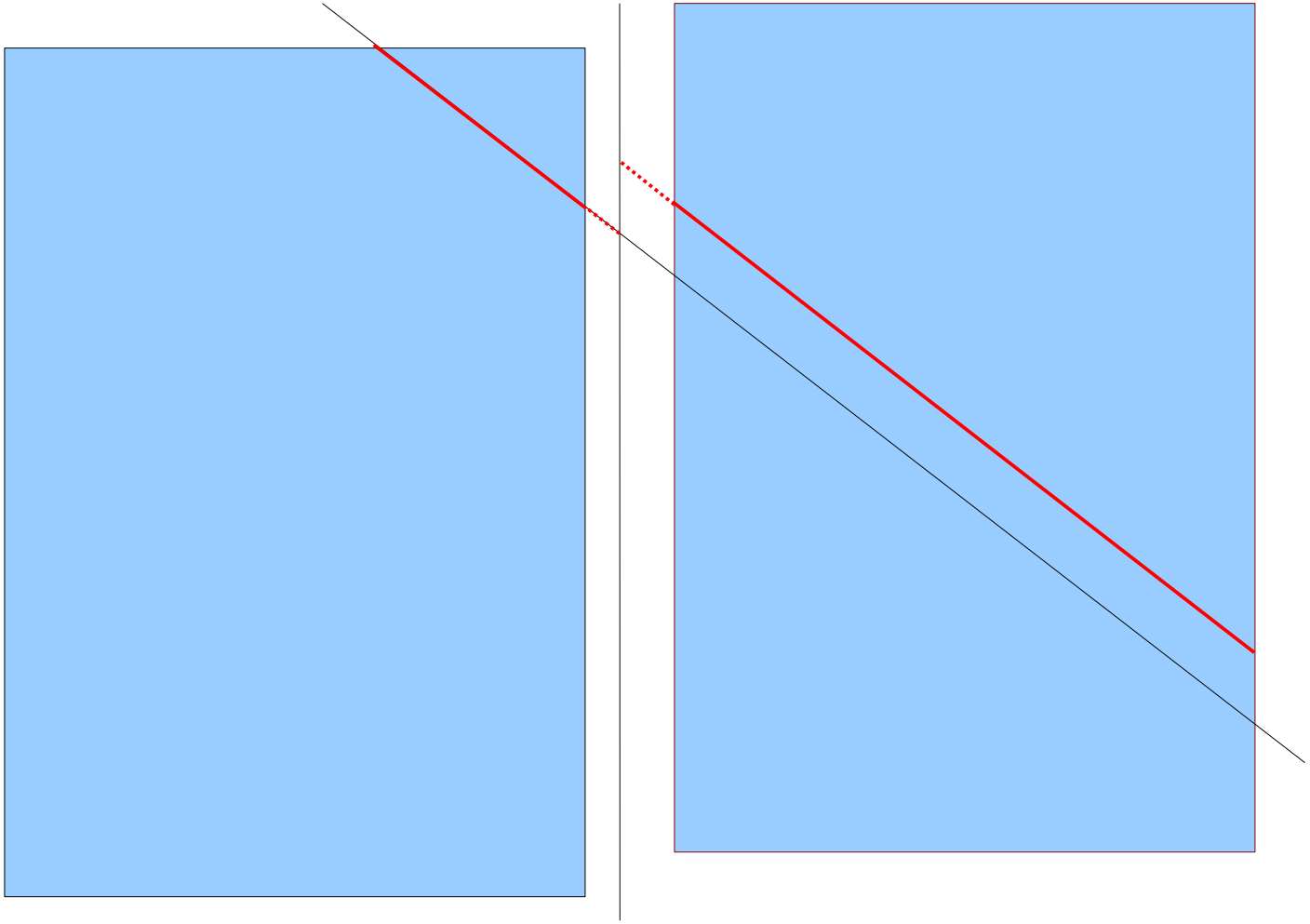
Attention: kink of track projection onto one plane doesn't give the rotation of this plane (at least event by event).
After some arithmetics, simplification, and thinking, one finds that:

$$rot_i = (B_{2,i} - B_{3,i}) / (1 + B_i^2)$$

B is the track slope, 2 and 3 the tower ids, i is x,y,z.

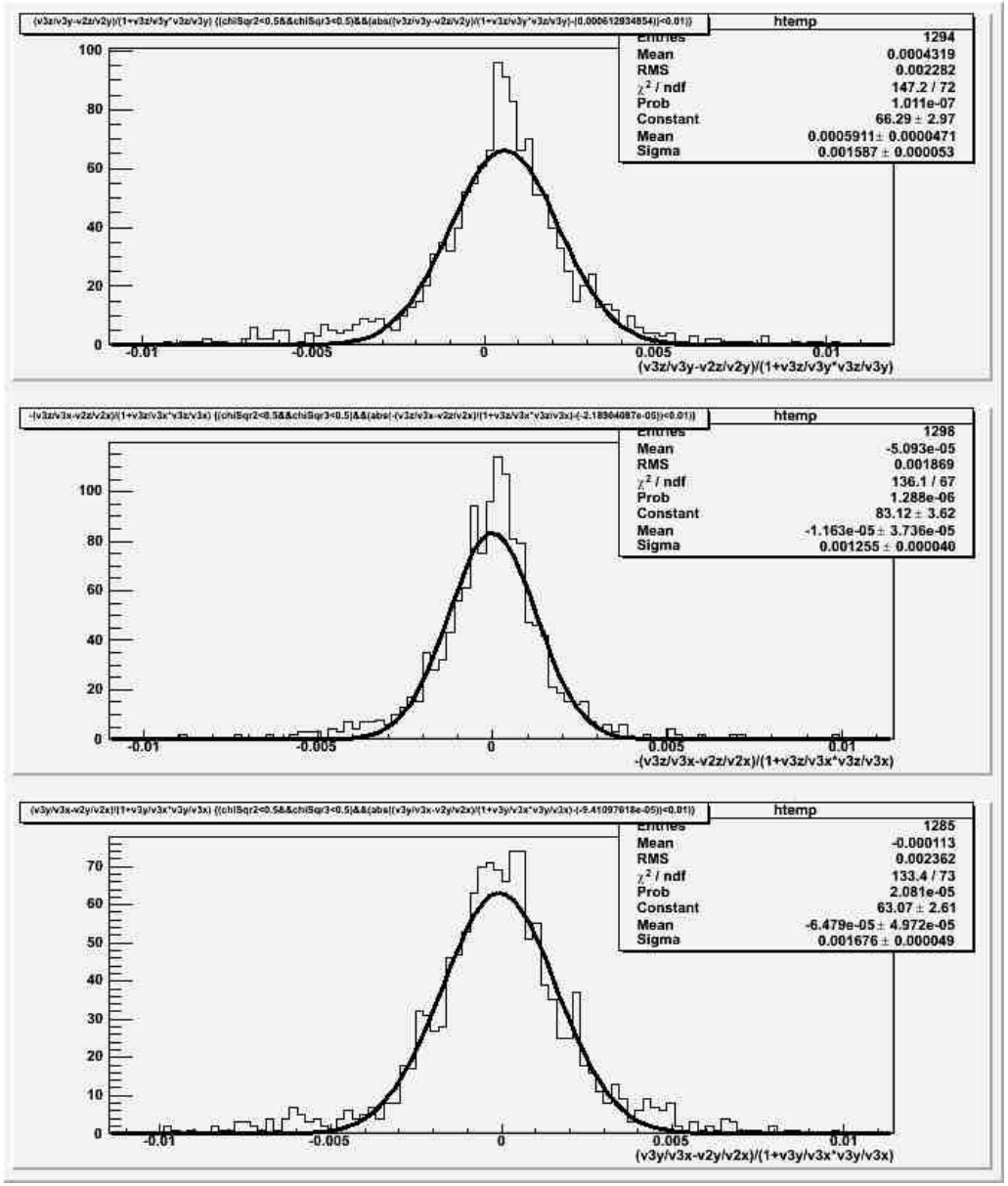


# Measuring Translation



project tracks on a plane (good choice symmetry plane between both towers), and plot correlation of $\Delta x|\Delta y\%\Delta z$ for different angles (like intra-tower alignment, and described there)

# Example Rotation

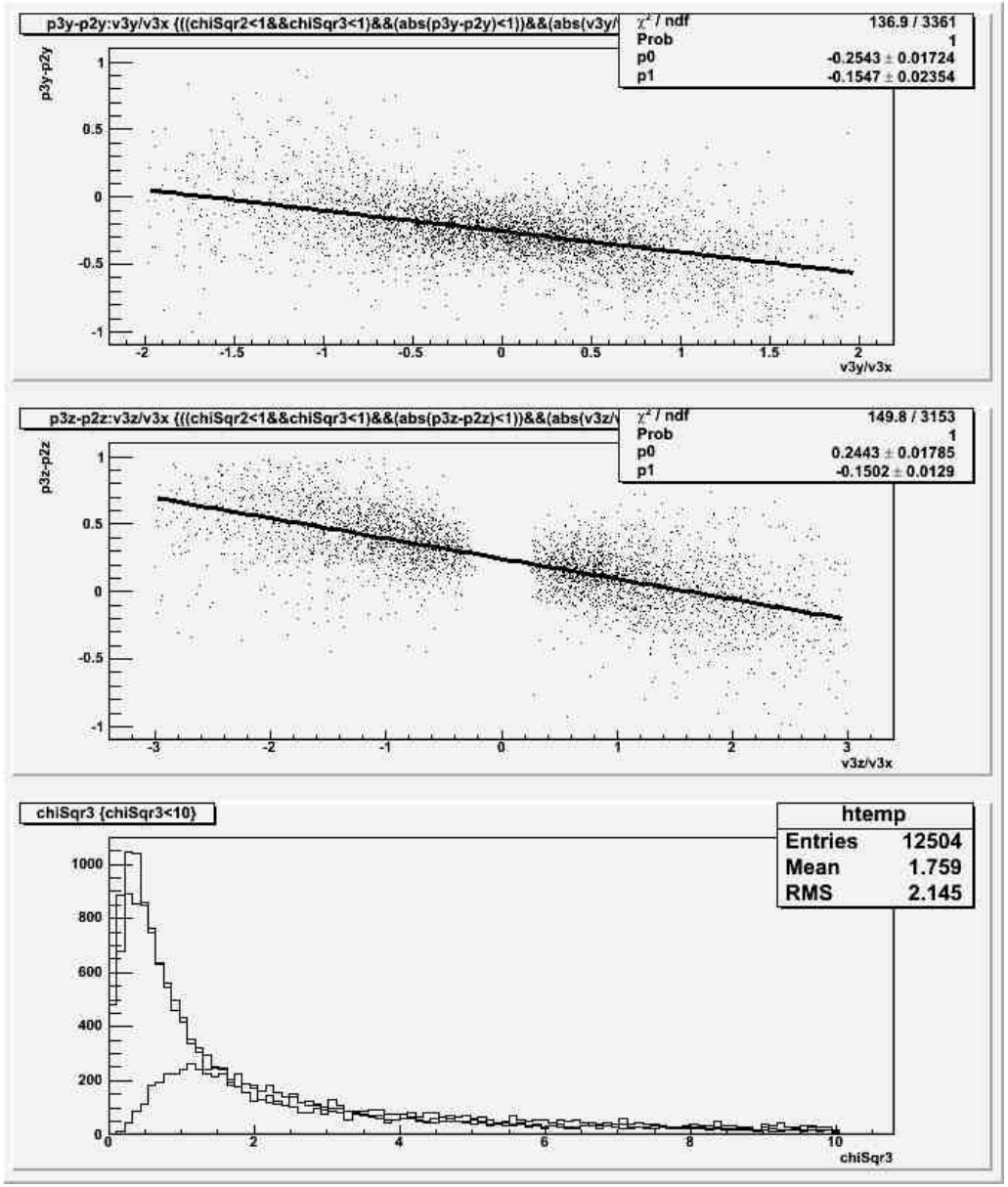



rotx += 0.59 mrad

roty += -0.01 mrad

rotz += -0.06 mrad

# Example Shift




dy += 254 um

dx -= -155 um

dz += 244 um

dx -= -150 um

chiSqr diagnostics plot

# Results

Everything is gaudi, test bed is called users/kuss/AlignmentHack
Intra tower alignment of TkrFM16 (tower 2) and TkrFM8 (tower 3) done with LeaningTower (long time ago).

Result for CU06 inter tower alignment (tower 3 as reference):

```
tower 2    164   -957    255     2.03   -0.01   -0.17
```

I didn't really trust my method. I simulated surface muons, ca. 250k trigger, with these misalignments. Result:

```
tower 2    166   -970    253     2.01   -0.00   -0.13
```

Not bad!