Alignment Status

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- **Update**
- **Simulation**
  - No field
  - With magnetic field
- **RealData (no field)**

- **Choice of the fixed detectors**

After studying the influence of fixing different detectors, the detectors that give a best alignment results with a choosen statistics are:

$$[\text{station, gap}] = [0, 0] \text{ and } [1, 0]$$

- **Cuts on the alignment output**

Even if the alignment seemed to be converging pretty well, we saw no improvement of the track chi square for real data. This was may be due to a little number of poor alignment output for some isolated detectors which would influence badly the global alignment.

We decided not to use the output of the alignment program when:

1. The number of tracks in the detector is less then 50 because the algorithm do not have enough input to calculate an accurate result.
2. The error of the algorithm output is too big (the limit for each parameter was choosen looking at the error distribution in MC);

   for the mutr: $|error\_w| < 0.15$ and $|error\_phi| < 0.0015$, and $|error\_z| < 0.5$

   for the muid: $|error\_w| < 0.55$, and $|error\_phi| < 0.0025$, and $|error\_z| < 2$

Results on Simulation

Status

- The simulation gives good results when alining without magnetic field the Mutr and the MuID together. The program find quiete well the misalignments that were input by hand.
- However for the MuID, it seems that there is a problem with the founding of the phi misalignments: *The bug has not been found yet.* It should be why the number of tracks is lowering after the second reconstruction when aligning the Mutr with the MuID. *Is it linked to a phi w correlation?*

Actions to be taken

- Check the geometry update when introducing MuID misalignments, or the output alignment of millipede to see if there is not a prob with the orientations. .
- Then, try again with misalignments (not soo big) and the muid to see if it is improving.

Status

- The alignment simulation is OK when aligning the Mutr without misalignments input.
- A strange systematic effect was noted in the last station when trying to align with misalignments: founding of wrong misalignments.
- May be it is due to some correlations between w and phi when the tracks are too close to the beam axis. We tried a cut on theta to see is cutting those tracks would improove the alignment with field on.

Actions to be taken

- Test the improvement of the track quality with a theta cut ON:
  1. Try without field first, with misalignments
  2. Try with field then with and without misalignments.
- Understand the systematic offsets of the last station.

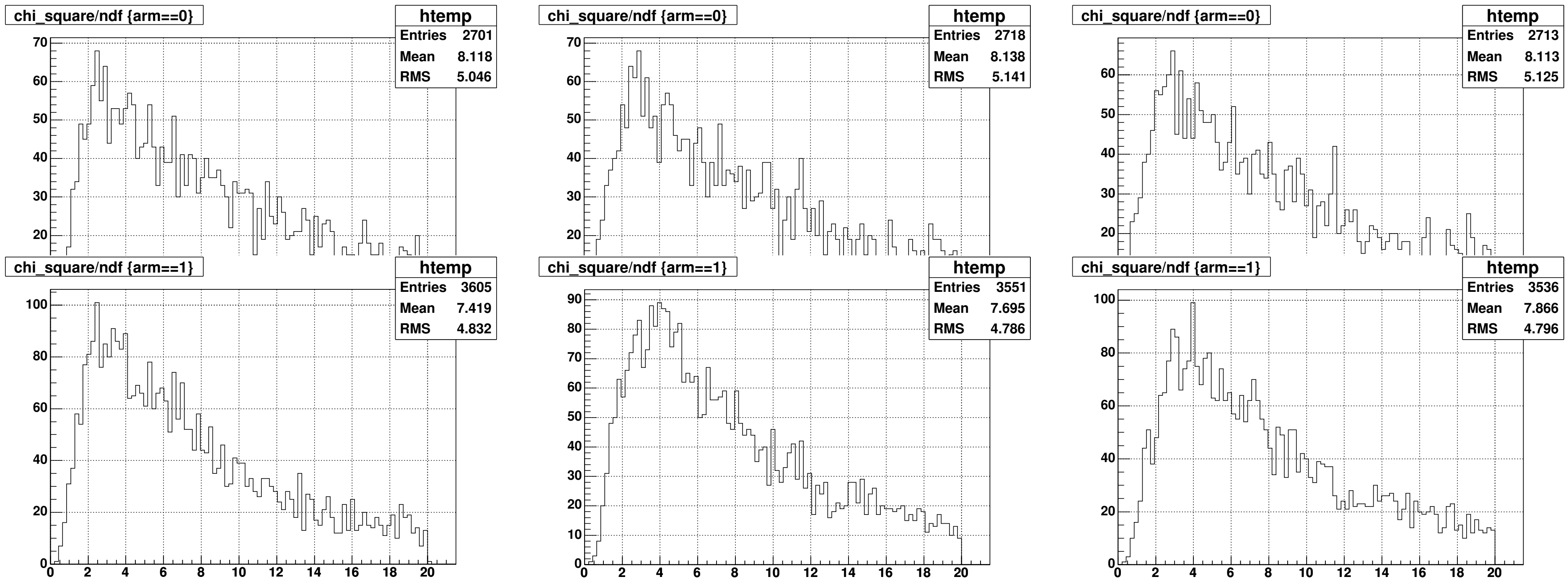
Results on RealData

Results on RealData

If the aligment of the MuTr was working well, we should see an improvement in the track chi-square from the 1rst reconstruction to the second one.

South Arm

North Arm



First reconstruction | Second reconstruction | Third reconstruction

- After the second reconstruction, the track chi square shows increasement of the number of tracks for the south arm (positive result). Howerver we loose 50 tracks in the north arm (the alignment did not improve the quality of the tracks).
- We turned a third reconstruction to see if it would converge towards a better track chi square for both arm. Unfortunatly, the third reconstruciton shows worse results, for both arm.
- Something is strange with the realdata alignment, since it should improve like the simulation but does not.In fact, it looks like it doesn't affect the tracks much to align or not: no real changes in the tracks...
- We tried to lower the time for running the reconstruction with the alignment in order to be able to have more statistics.

Simulation

No Field

No misalignment

- Mutr OK.
- Loosing tracks because of the MuID.
- *Work on the MuID alignment.*

With misalignments

- Mutr OK.
- Muid

  Problem with the muid finding the misalignments.

  Work on the MuID alignment

  A third reconstruction showed that it converges. May be the first misalignments were a little bit big.

  For most detectors, the residuals seem to improve.

With Field

No misalign

- Mutr

  Slight systematic offsets not understood

  Globaly convincing
- Mutr and Muid: globally ok

With misalignments

- Mutr

  The program converges towards a wrong walue.

  Try less misalignments to help the algorithm to converge. Try to iterate. Try without the z alignment.
- Mutr and Muid

  We tried to add a cut on theta to limit the influence of the correlation between w and phi

Real data

- The program seems to align. However the tracks quality does not improve.
- *Trying each parameters independently* showed that when aligning w and phi at the same time, it damages the traks quality more than improoving it.
- I am trying to run more stat now.