

Analysis - Feature #1724

Tracker to solenoid alignment

29 July 2015 15:40 - Rogers, Chris

Status:	Open	Start date:	29 July 2015
Priority:	Normal	Due date:	
Assignee:	Rogers, Chris	% Done:	0%
Category:		Estimated time:	0.00 hour
Target version:			

Description

Desire to understand the alignment of the tracker to the solenoid, based on data taken on Thursday 23rd July. Plan is to:

- Run modified pattern recognition in order to get a first estimate of alignment
- Probably find a better way to do it using "some fancy algorithm" which might include Kalman fits
- Throw tracks from upstream tracker to downstream tracker and wiggle the magnets until tracking agrees with data

History

#1 - 29 July 2015 16:00 - Rogers, Chris

Analysis based on run 07290 only. For cuts I require exactly 5 space points in TKD but I have no other cuts included so far (not TOF nor number of clusters per space point). I make a linear least squares fit, allowing the linear least squares to make a track by track adjustment to the fit proportional to distance along the tracker (i.e. tilt the helix). I histogram those track-by-track tilt angles (*theta_residuals.png*). I note a mean of the fit of 2.8 mrad +/- 1 mrad (I have cut the tails in a statistically suspect way, however).

I also attach the residuals of the least squares fit; they look okay - I note *tracker_1_station_3* has a slightly significant residual (about 1 RMS).

Compare with JHC,

<https://indico.cern.ch/event/374187/session/6/contribution/29/attachments/745674/1022924/Mapping-CM42s.pdf>

penultimate slide (32), which shows (roughly)

The physical bore:

$x_0, z_0 = -3.9, 17650$
 $x_1, z_1 = 2.3, 20300$
gives tilt 2.3 mrad

The magnetic axis:

$x_0, z_0 = -8.3, 17400$
 $x_1, z_1 = -8.7, 20300$
gives tilt -0.1 mrad (not significant I expect)

So the two numbers are consistent. Note that I need to check the sign...

#2 - 29 July 2015 16:02 - Rogers, Chris

- File *theta_residuals.png* added

- File *residuals.png* added

Here are the plots:

[theta_residuals.png](#)

[residuals.png](#)

#3 - 29 July 2015 18:54 - Rogers, Chris

- File *residuals.tar* added

I attach data for run 07288, 07289, 07290.

I added requirement that we have exactly three clusters per space point and exactly one space point in TOF1 and one space point in TOF2. I looked at making a TOF cut but it doesn't seem necessary.

07288 and 07290 are consistent with the result outlined in note 1. 07289 shows a theta y (nb this is the rotation angle around the y axis) of 4 mrad +- 1 mrad. I will try making a chi2 cut next (with luck tomorrow) - I hope this will remove events in the tails, which are e.g. not small angles any more so the fit is incorrect.

I also note the feature that in all instances the downstream plane, station 4 (and to a lesser extent station 3) has worse residuals than the others. I don't understand this, will mull it over tonight.

#4 - 13 August 2015 13:06 - Rogers, Chris

- File *2015-08-13_tracker-to-solenoid-alignment.pdf* added

Attached current status of the analysis; note also (historical) slides from 2015-07-30 analysis meeting

#5 - 21 September 2015 10:59 - Rogers, Chris

pdf updates attached to following wiki pages:

[PC-2015-09-10a](#)

[PC-2015-09-03a](#) - and presented at VC

[PC-2015-08-27a](#)

[PC-2015-08-13a](#)

[PC-2015-07-30](#)

#6 - 23 September 2015 12:14 - Rogers, Chris

- File *34.png* added

We took more data last night and the night before, with SSU only. Note M1 currents were screwed up last night, see attached plot.

Files

theta_residuals.png	38.8 KB	29 July 2015	Rogers, Chris
residuals.png	34.1 KB	29 July 2015	Rogers, Chris
residuals.tar	74.7 MB	29 July 2015	Rogers, Chris
2015-08-13_tracker-to-solenoid-alignment.pdf	1.01 MB	13 August 2015	Rogers, Chris
34.png	89.5 KB	23 September 2015	Rogers, Chris