As discussed last Friday, let's first concentrate on the current code, implemented by Tracy:

- Separate refit of the reference tower stub
- Then, Minuit call to fit the hits in the tower to be realigned

Tracy checked his code against permutation of the two towers, and stability.

- on carefully chosen MC muons: as soon as the track is not pristine, problems in the fit appear....
- Also checked that inputting misalignment params, the algorithm retrieves them.
- The artillery to simulate misalignment, and to load an alignment file and correct at reconstruction is there.

So let's try on the data!

- muon selection
- check on stability when permutting tower
Muon Selection

- Input: MC surface muons with muon hypothesis

/nfs/farm/g/glast/u11/InstrumentAnalysis/MC/EngineeringModel-v5r070305p4/MuonHyp/Muon_Surface_muons/

Black: all events
Red: > 1 GeV

Tkr1KalEne > 1000 but not == 2000 and Tkr1KalThetaMS < 0.004
I did the plotting, Leon did the thinking

• Bunch of events with McEnergy>1000 but Tkr1KalEnergy ~ 150
  - due to a piece of code in Track/FitUtils::computeMSEnergy which tried to deal with particles 'ranging out' (last cluster being too wide). The code seems to 'trigger' on normal events.....So bug

• The spike at KalEnergy=2000
  - This is an initialization problem : if ComboFindTrackTool.MinEnergy = 2000 (as is the case per setting of Anders) and if CalEnergy is less, then initial value of KalEnergy is set to 2000, and if the calculation fails later on, this value is not updated.....

• Both caveats need further studies

• For our purpose : Tkr1KalEnergy>1000 & Tkr1KalEnergy!=2000 & Tkr1KalThetaMS<0.004 seem good enough to keep straight tracks of energy >1GeV in the muon sample (at least one can hope)
Same plots with the data

- Runs 135005345-135005369 with muon hypothesis (here 135005345)
Inter-Tower Alignment preliminary tests

- First check: align twr5 against twr6 and vice versa, and check consistency

<table>
<thead>
<tr>
<th>align 5</th>
<th>align 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>dX</td>
<td>-2.8 +/- 0.2</td>
</tr>
<tr>
<td>dY</td>
<td>27.6 +/- 0.3</td>
</tr>
<tr>
<td>RZ</td>
<td>-0.424 +/- 0.002</td>
</tr>
</tbody>
</table>

- Note: the run actually crashed at 40% (ROOT issue not understood yet), but the finalize method seems to be correctly called and that is where the fitting occurs....

- Clean run (putting fewer runs to avoid the exception):

<table>
<thead>
<tr>
<th>align9</th>
<th>align 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>dX</td>
<td>24.2 +/- 0.2</td>
</tr>
<tr>
<td>dY</td>
<td>14.7 +/- 0.3</td>
</tr>
<tr>
<td>RZ</td>
<td>-0.176 +/- 0.002</td>
</tr>
</tbody>
</table>
What next?

- **A question**: what is the impact of the intra tower alignment on the inter tower procedure? Maybe that is the problem.... Or the track selection is not good enough.
- **first check**: look at subsample to check errors
- **second check**: loading the intra tower alignment constant and redo.
- **A pledge**: Can we get the intra tower alignment used please!