

Weak Mode Alignment Update

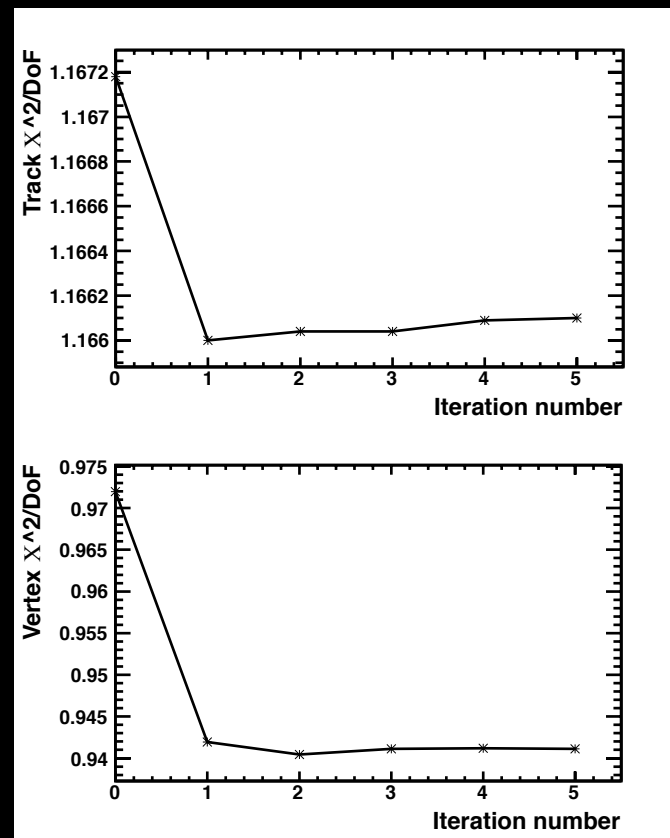
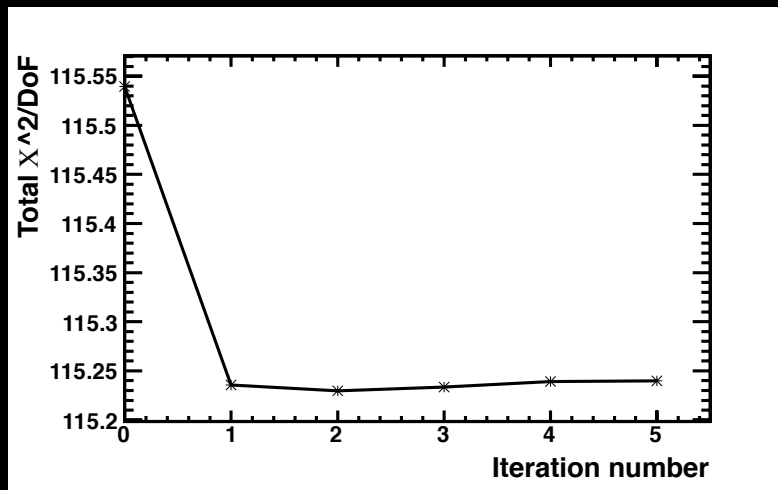
29/03/2012

Where things are now

- Upgraded to Alignment_v8r0, still getting seg faults on 4th iterations and up but early signs seem to indicate we get convergence after 3 iterations so not a problem
- Doing Kalman runs on metrology and a moderate twist scenario (10 μ rads/mm in z)
- Have implemented the new Survey constraints to replace our previous constraints which were not working properly (but we still get problems, more on that later).
- Have some results on 3 test data runs on equal amounts of p-p (Lc->pKpi) and Hydrogen beam 1 tracks (approx. 170k tracks of each type used per iteration).
- Still some problems needing ironing out...

Convergence checks

- Checking the track, vertex and total χ^2/NDoF to make sure we converge and that 3 iterations are enough...
- Have checked on one of the old metrology jobs that *pretty much* worked over 6 iterations, with some minor constraint problems.
- Seems ok over 3 iterations!



New options

Alignables:

```
elements.VeloRight("TxTyRxRy") #"None")
elements.VeloLeft("TxTyRxRy")
elements.VeloModules("TxTyRxRyRz")
elements.VeloPhiSensors("TxTy")
elements.VeloRSensors("None")
```

SurveyConstraints:

```
surveyconstraints.XmlUncertainties += ["Module(PU|).. : 0.02 0.02 0.0001 0.0002 0.0002 0.0002"]
surveyconstraints.XmlUncertainties += ["Module00 : 0.0001 0.0001 0.0001 0.000001 0.000001
0.000001"]
surveyconstraints.XmlUncertainties += ["Module01 : 0.0001 0.0001 0.0001 0.000001 0.000001
0.000001"]
surveyconstraints.XmlUncertainties += ["Module10 : 0.0001 0.0001 0.0001 0.000001 0.000001
0.000001"]
surveyconstraints.XmlUncertainties += ["Module11 : 0.0001 0.0001 0.0001 0.000001 0.000001
0.000001"]
surveyconstraints.XmlUncertainties += ["Module40 : 0.0001 0.0001 0.0001 0.000001 0.000001
0.000001"]
surveyconstraints.XmlUncertainties += ["Module41 : 0.0001 0.0001 0.0001 0.000001 0.000001
0.000001"]
```

Further Constraints:

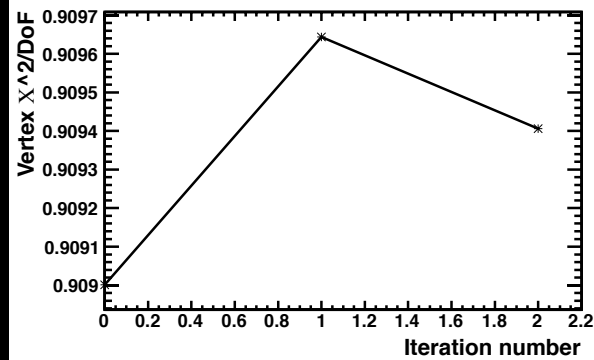
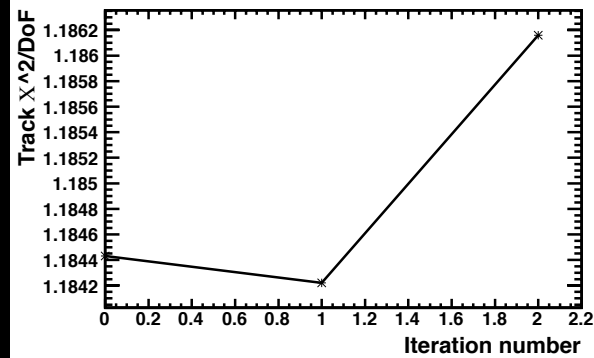
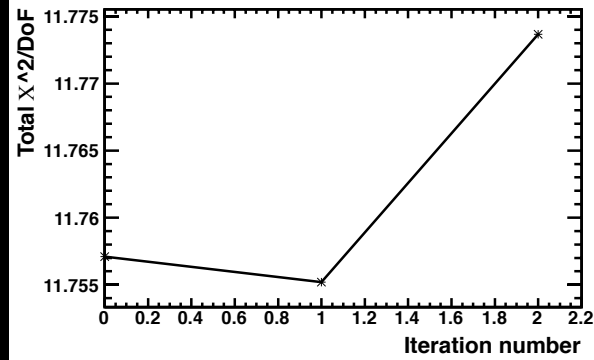
```
constraints.append( "VeloHalfAverage : Velo/Velo(Left|Right) : Tx Ty Tz Rx Ry Rz : total" )
```

New Convergence checks

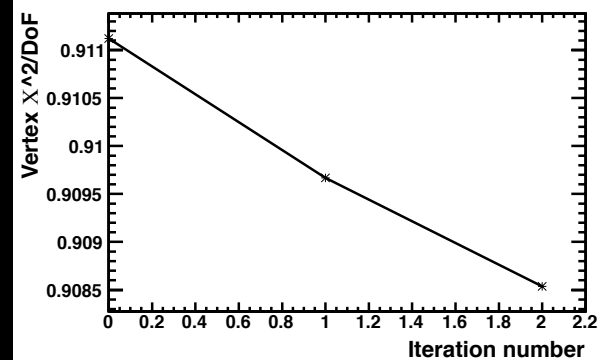
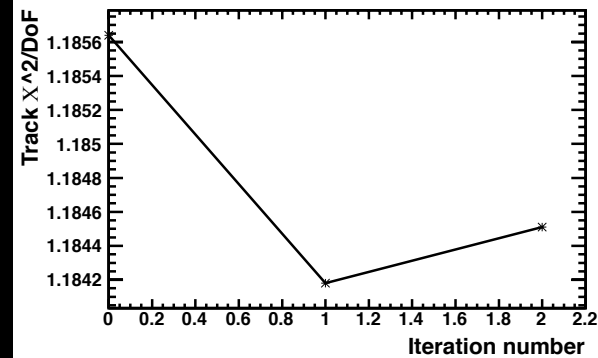
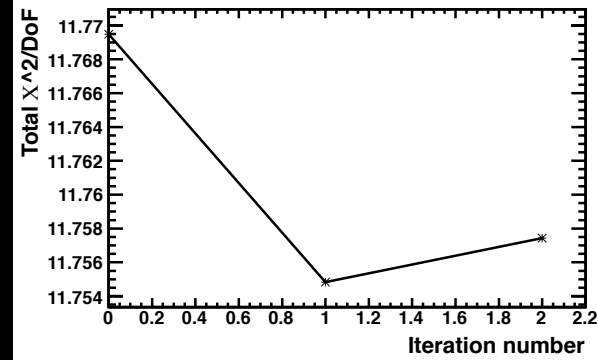
- Plots on next page for both tags, not sure what to make of them...
- The Chi^2 s alternate but do so over a *very* small range, can't really tell if more iterations would be needed.
- What do you think?

New Convergence checks –

- Metrology

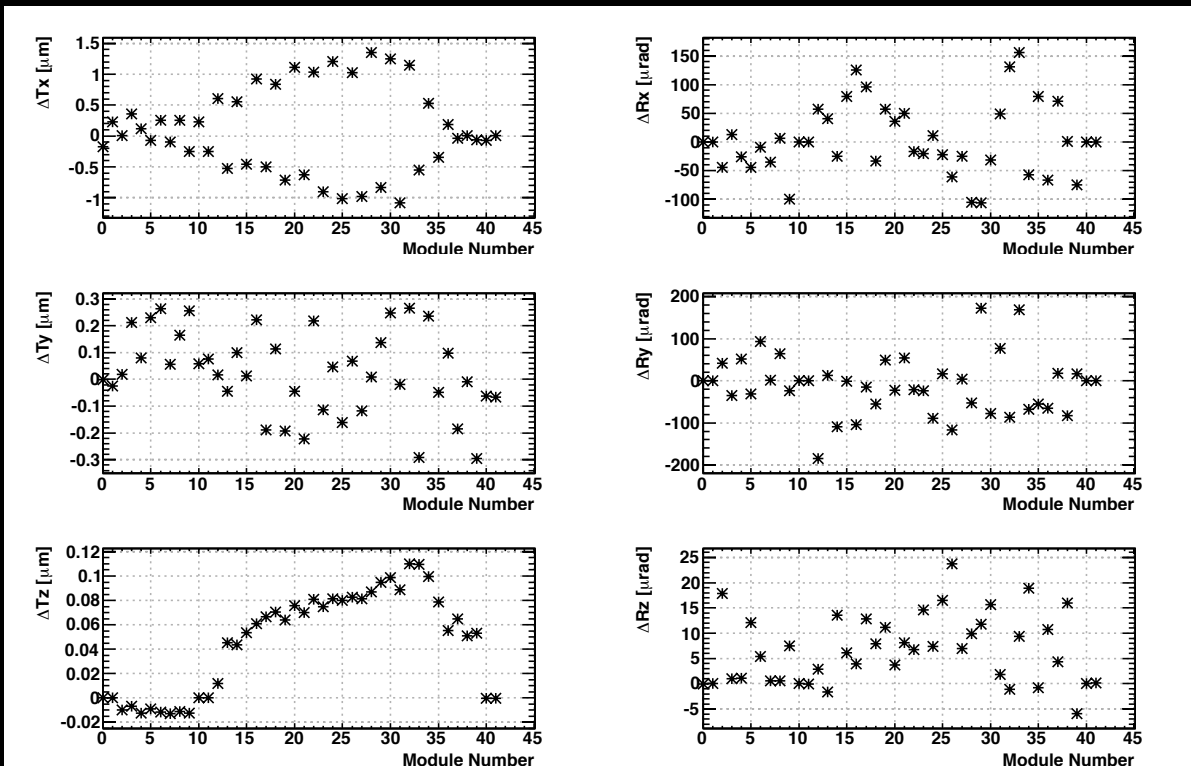


- zrot10urad/mm



New Survey Constraints

- Seem to work on 2/3 datasets I've run on but are defunct for the 1 in 3 for the metrology and zrot...
- Shown next are the metrology runs showing the change in module position for each of the three runs (not averaged over the datasets), you can see in the third the constraints on the first, middle and last modules are not functional...

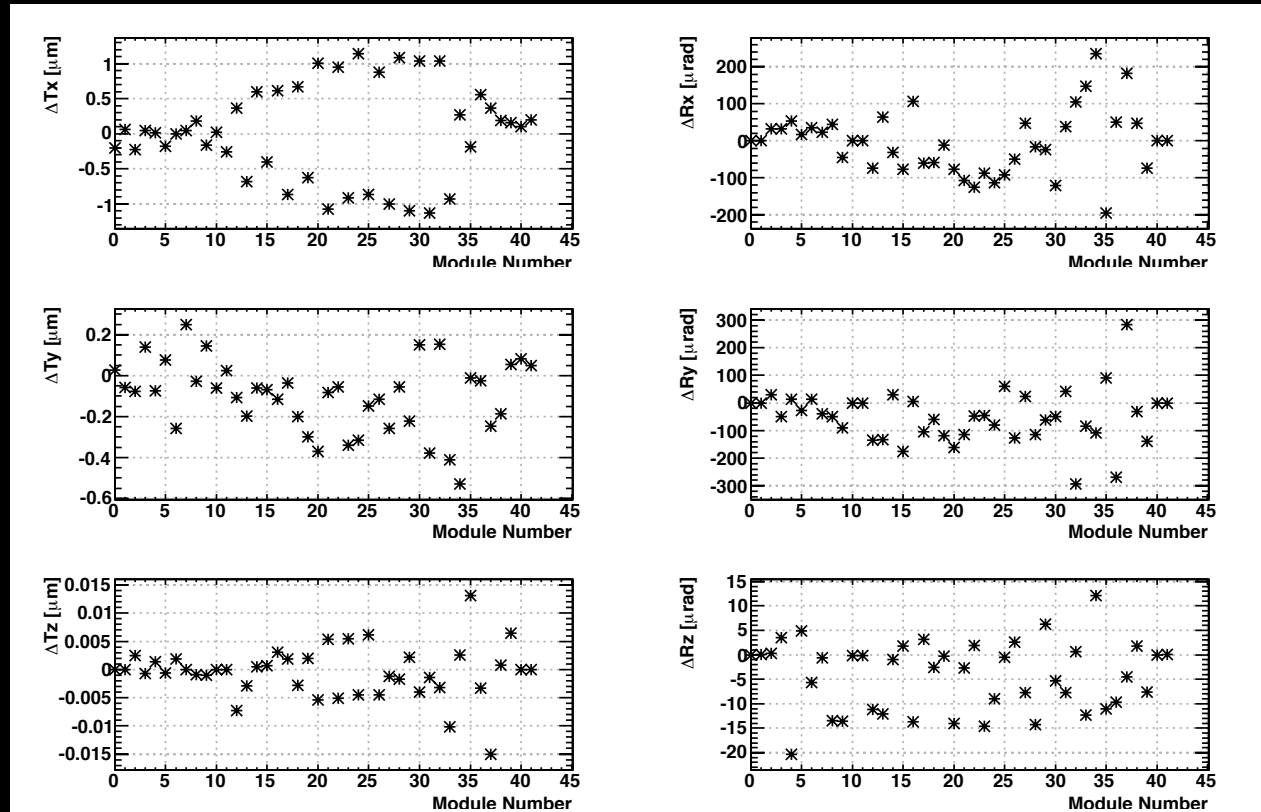


RUN 1

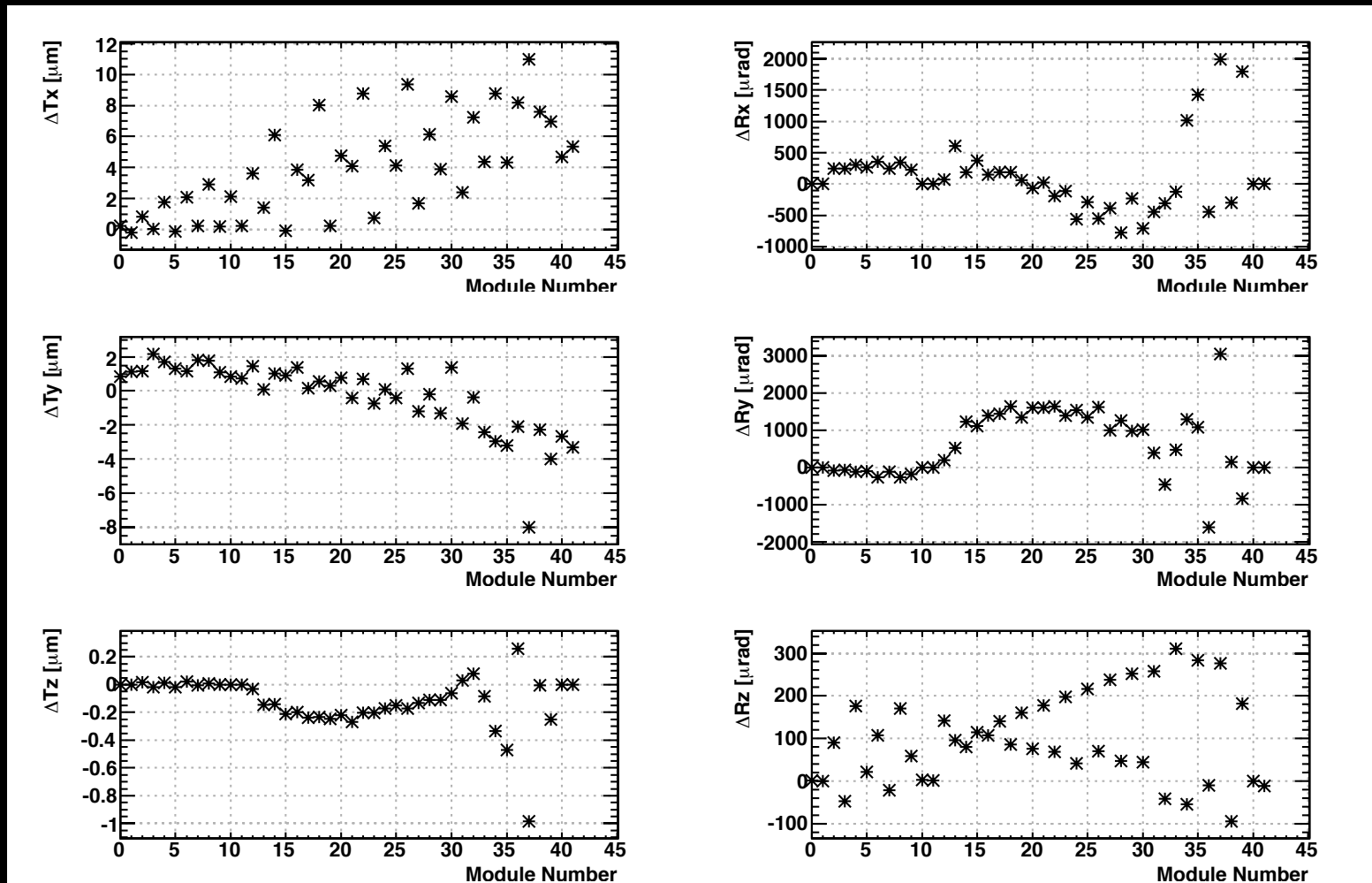
Can see here the constraints generally work but some problems, eg. T_z still being minorly changed and constraints for modules 10,11 in T_x not working properly (exceeding 0.1 μm difference). Also some structure emerging that looks a bit suspect.

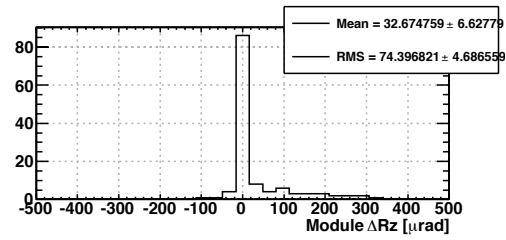
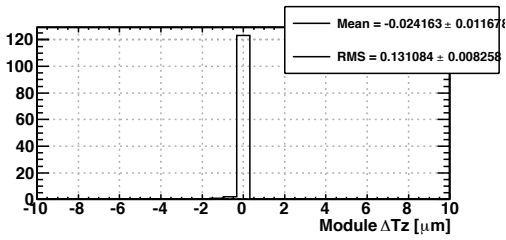
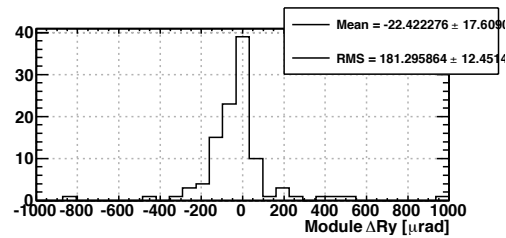
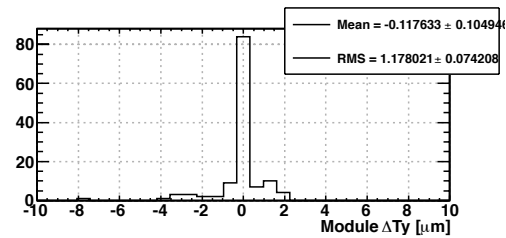
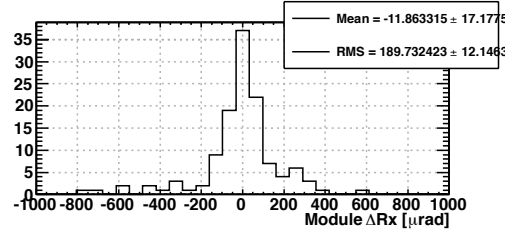
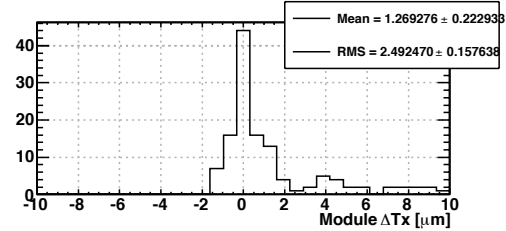
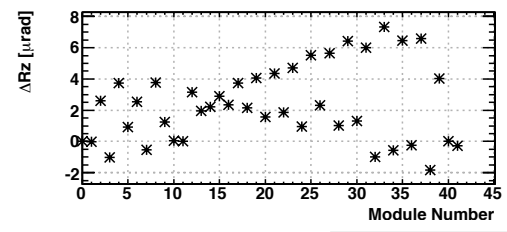
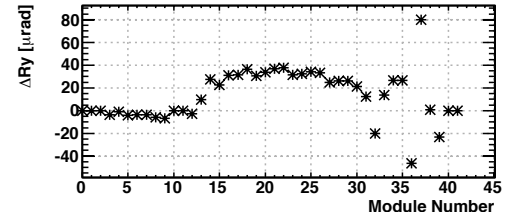
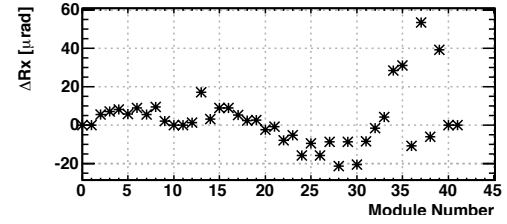
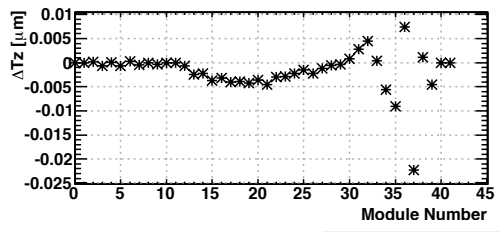
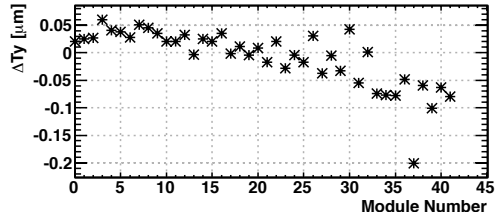
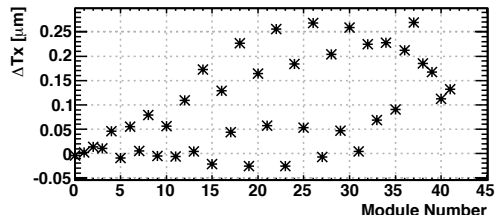
BUT nothing outrageously bad...

- Run 2, looks good but I'm wary of the structure emerging in Tx again...



- Run 3 a bit more problematic, the constraints break down entirely on Tx/y. The only thing that changes is the dataset used, the job options are kept the same in each run so not sure what's going on here...

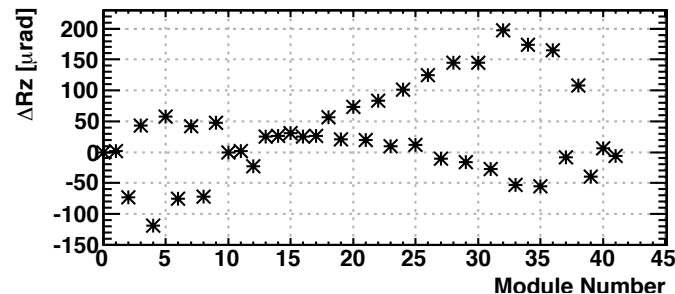
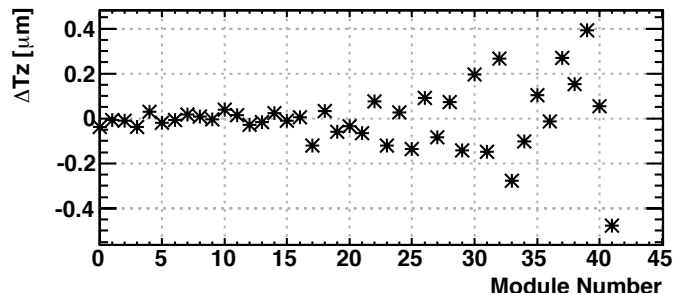
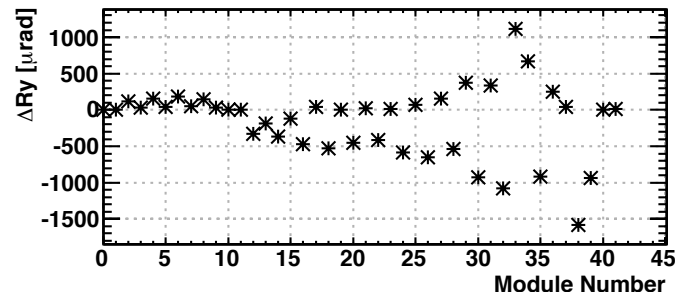
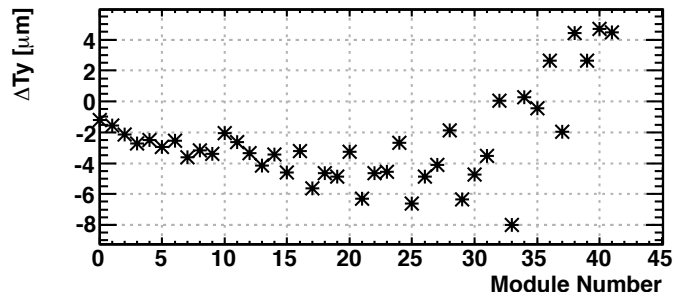
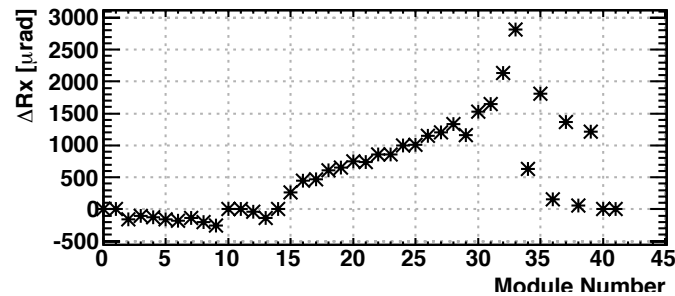
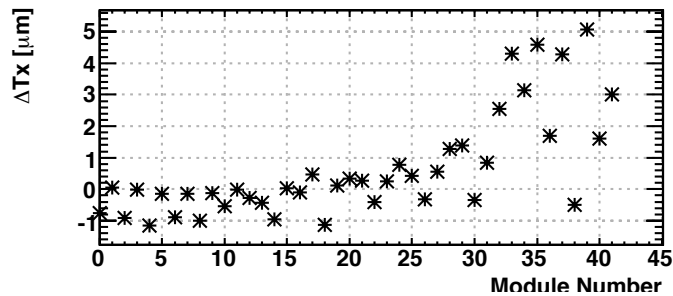




- Shown here: average differences in DoFs across the 3 runs and histogram of the differences.
- The constraints are keeping most of the crazy behaviour out but I'm worried about the constraints sometimes failing...
- Tail in Tx distribution is explained by the bad run 3 but this could be a pain if a few bad runs wind up biasing our results...

zrot 10ur/mm

- Similar case with the metrology, the constraints generally work but sometimes fail BUT on different datasets. Shown are module delta DoFs from the first run and the same Tx/y constraints fail...



What now...

- Currently running 10 datasets per tag to get a better idea of how frequently the constraints break down.
- If possible fix these constraint problems.
- Then I can start testing how different constraints respond to the simulated twists and see if adding more exotic constraints (such as Lagrange constraints) makes Kalman any more sensitive to the presence of weak modes.