A Number of Different Items

K Graham

~~ECG~~ Meeting – November 12, 2003

Intent

- Reconstruction Offset in ^{16}N
- Detector Response from ^{16}N Central Runs
- ^{16}N QC Comments
- Laser MC/NCD Optical Calibration
- ^{16}N NCD MC
- PMT-to-PMT Variations for ^{16}N
- Calibration Plans
- Publication Plans

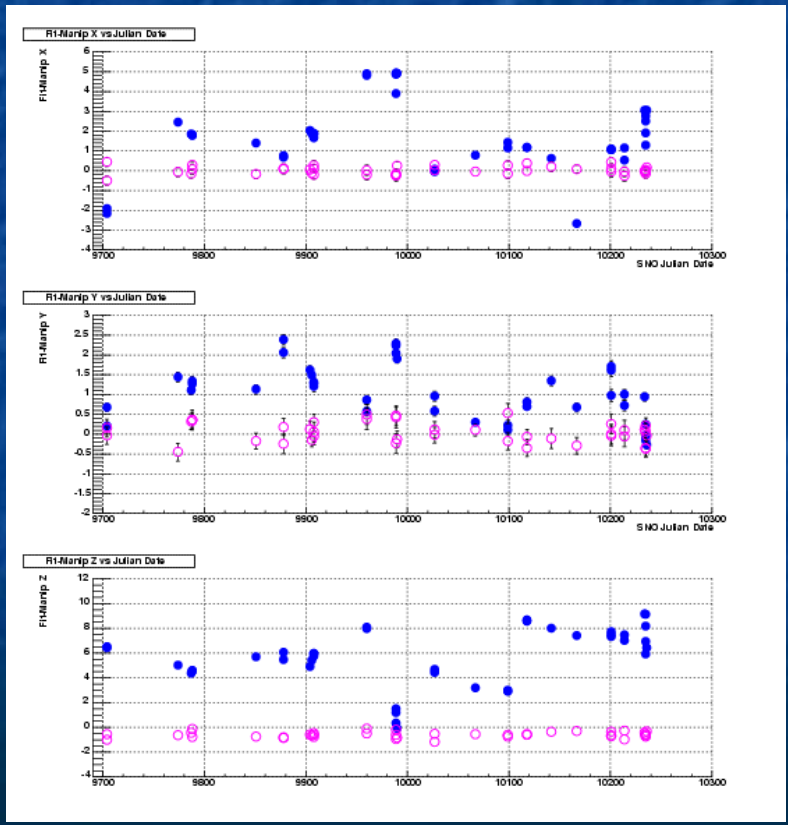
Where are we now?

Pure D2O	Dominant Uncertainties
1.76 +/- .06 +/- .09	E scale/res, vertex
5.09 +/- .44 +/- .46	Ncapture E scale/res, vertex
Salt Un-Constrained	
1.59 +/- .08 +/- .08	Isotropy, vertex, energy
5.21 +/-.27 +/- .38	energy, N capture, isot, vertex
Salt Constrained	
1.7+/- .07+/-.1	energy, vertex, isotropy
4.9+/-.29+/-.29	vertex,energy, isotropy

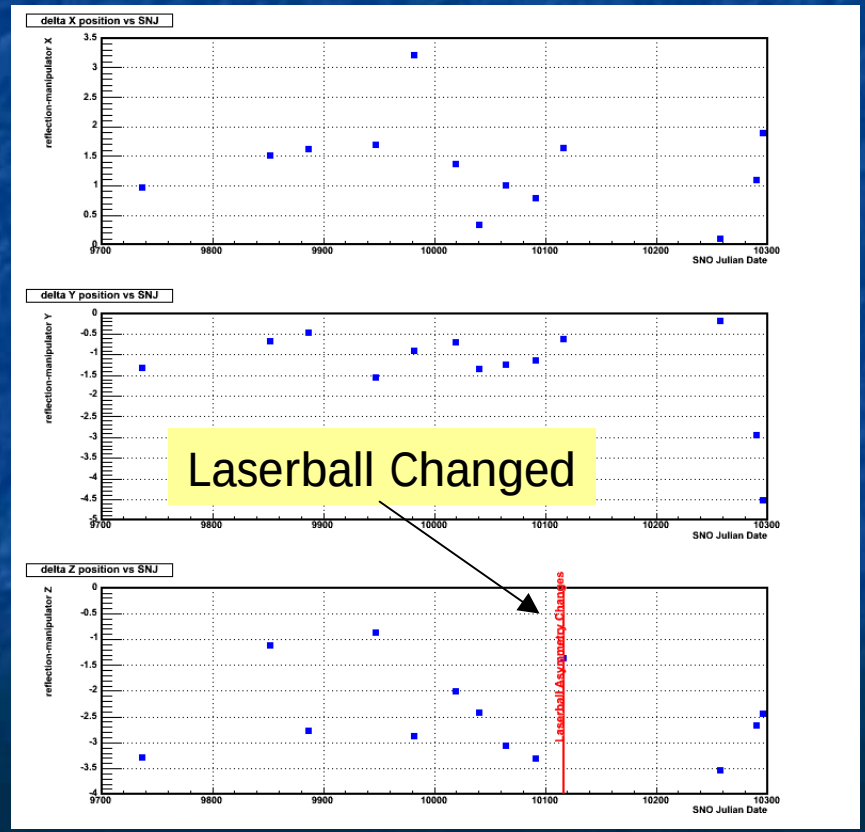
Reconstruction Offset

- Time Dependent Discrepancy between manipulator and fit position
- Some offset seen in PCA → timing calibration problem?

Mean Fit – Manipulator
^{16}N Central Runs

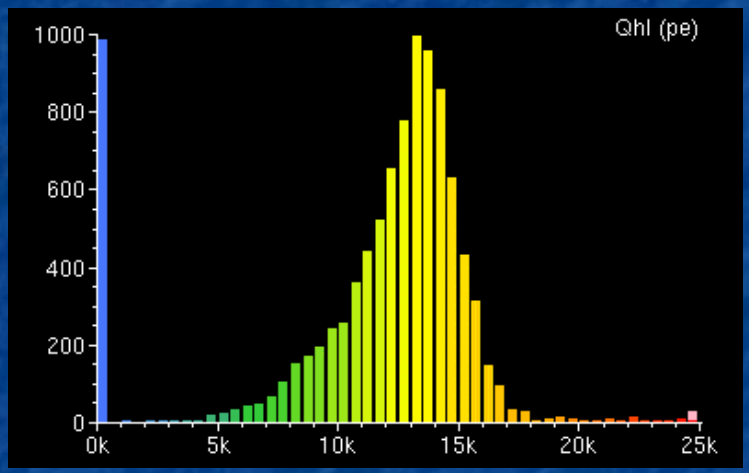


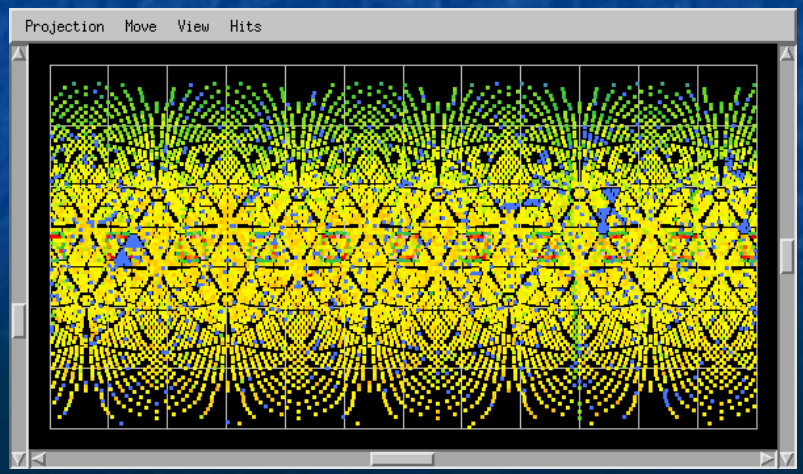
Reflect Fit – Manipulator
Laser PCA runs



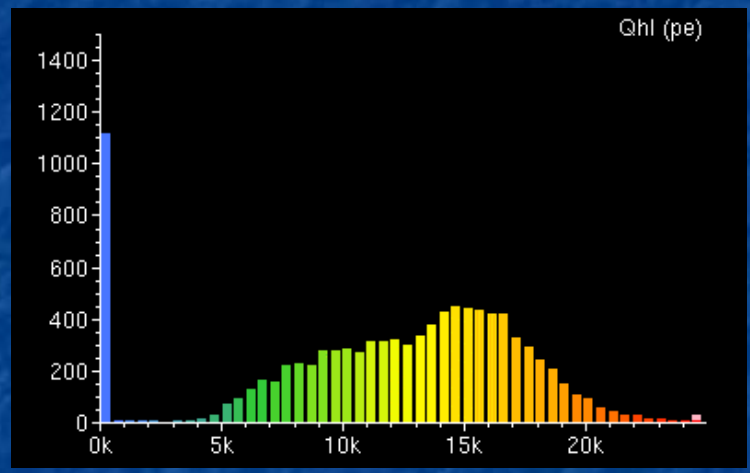
Up/Down Asymmetry Changed

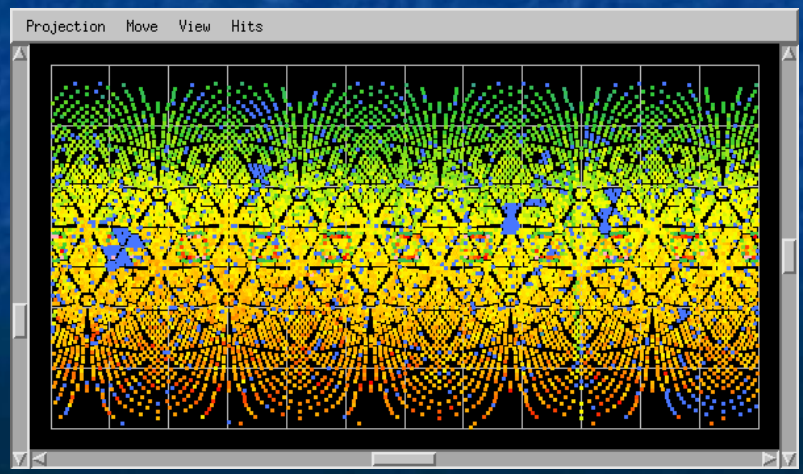
PCA 26410





PCA 26715

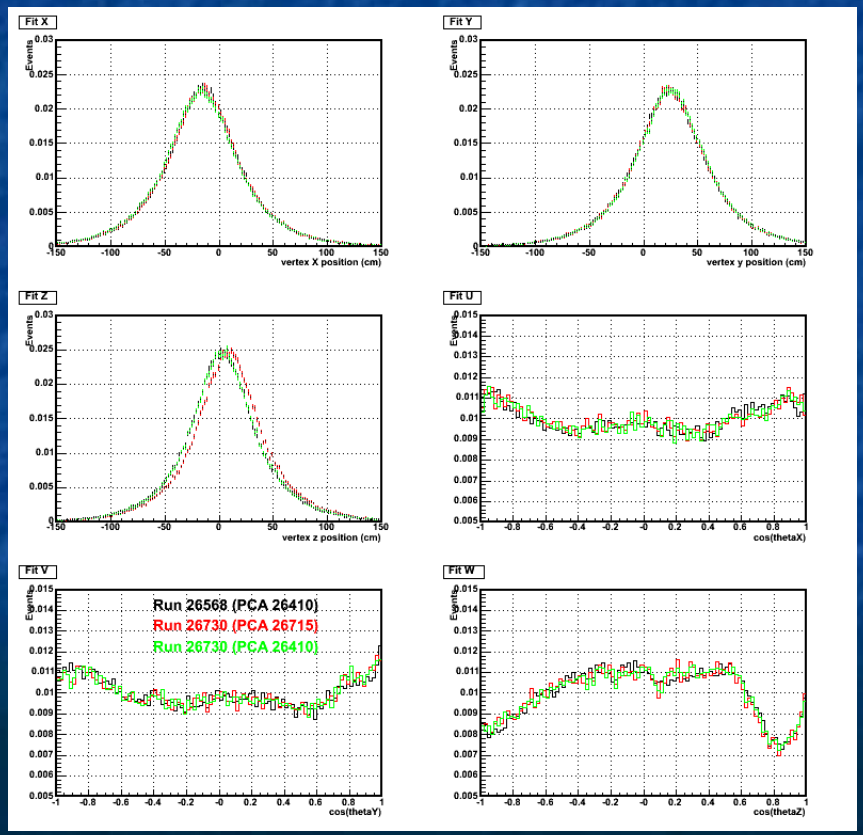


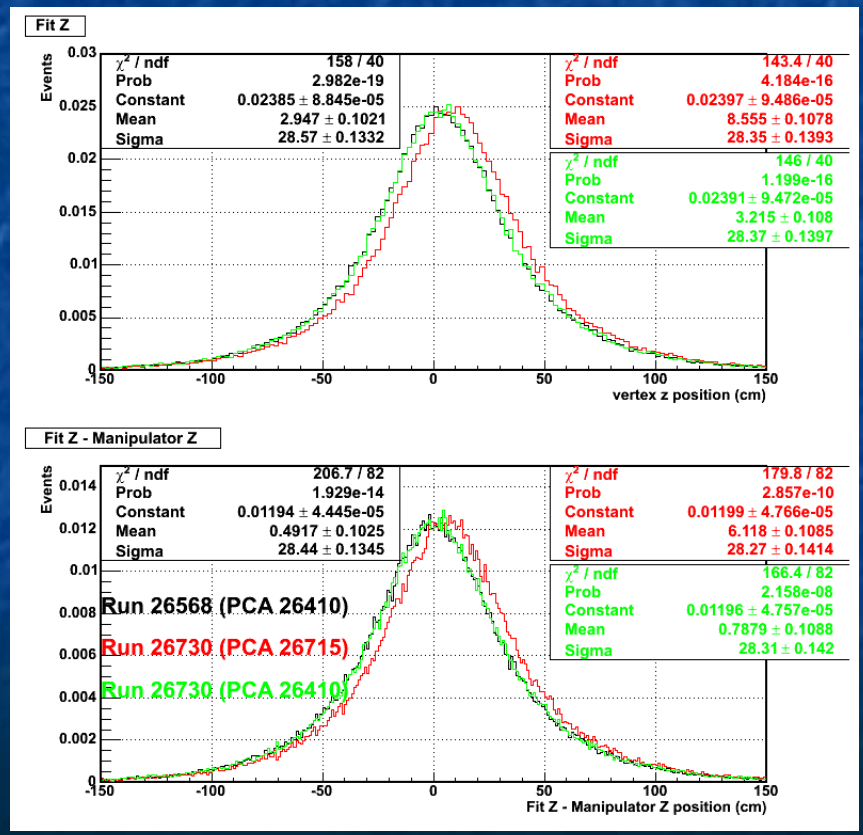


^{16}N Before and After Change

- Only offset in Z
- Reprocess with previous PCA
- Does not change energy

- 6cm shift removed
- also take out correct manip offset
- source at centre

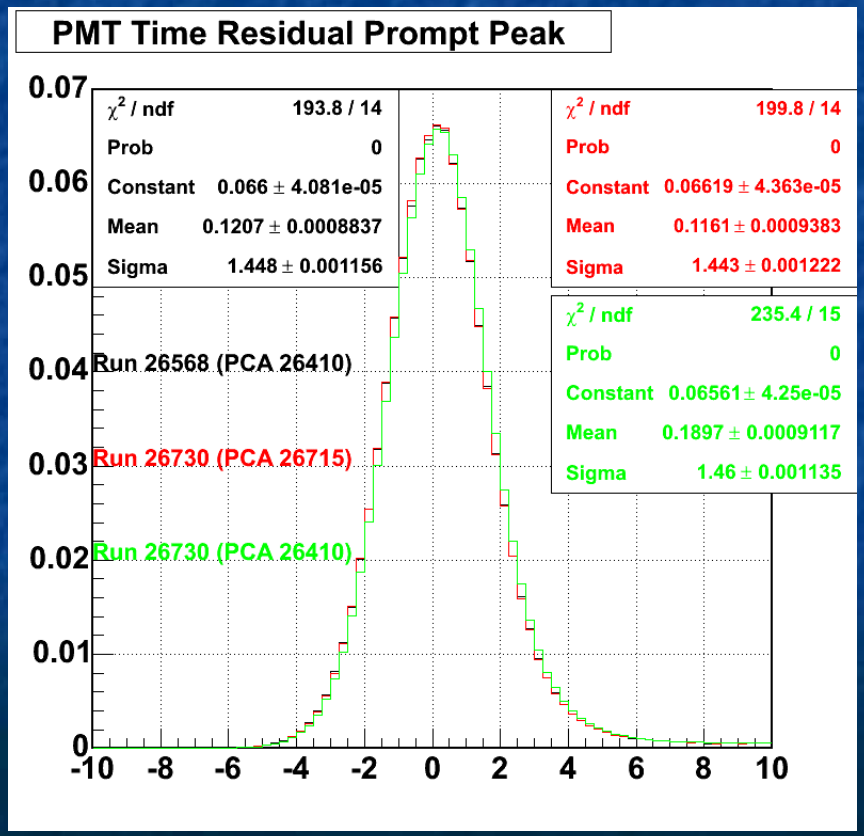


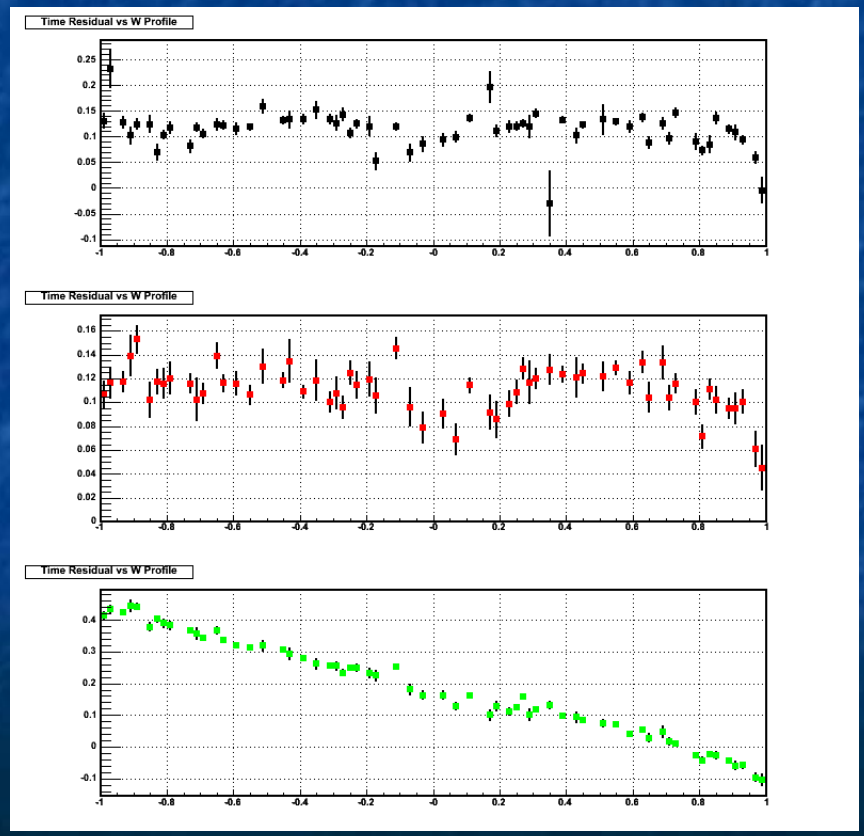


But what happens to timing?

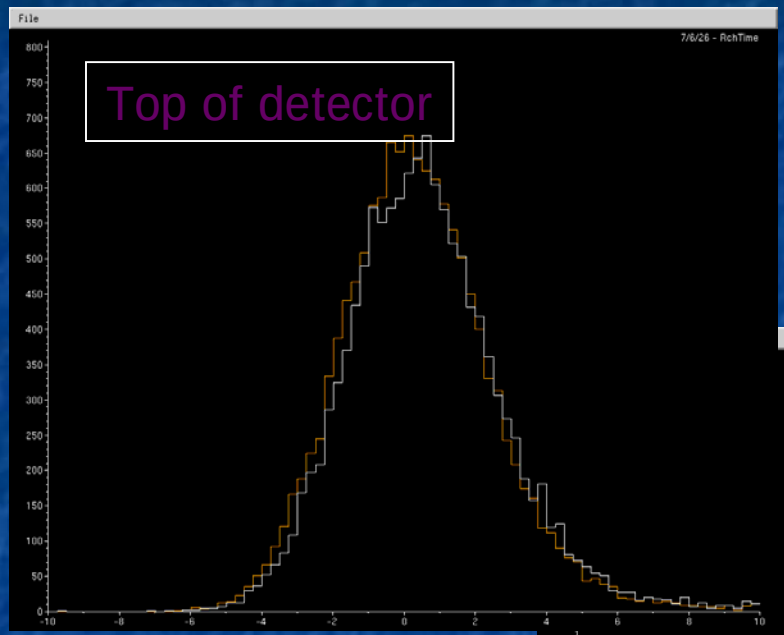
Time residual shifted

Have introduced z timing asymmetry

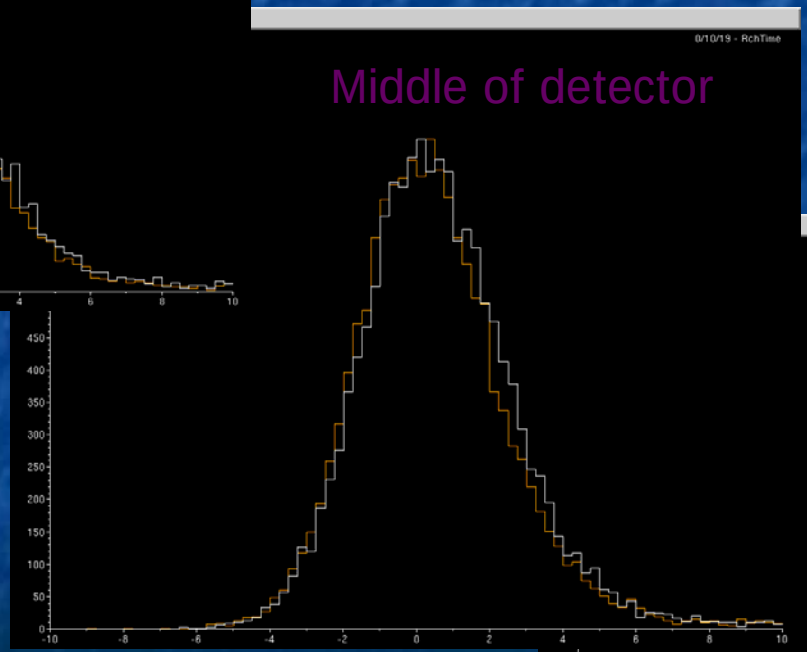


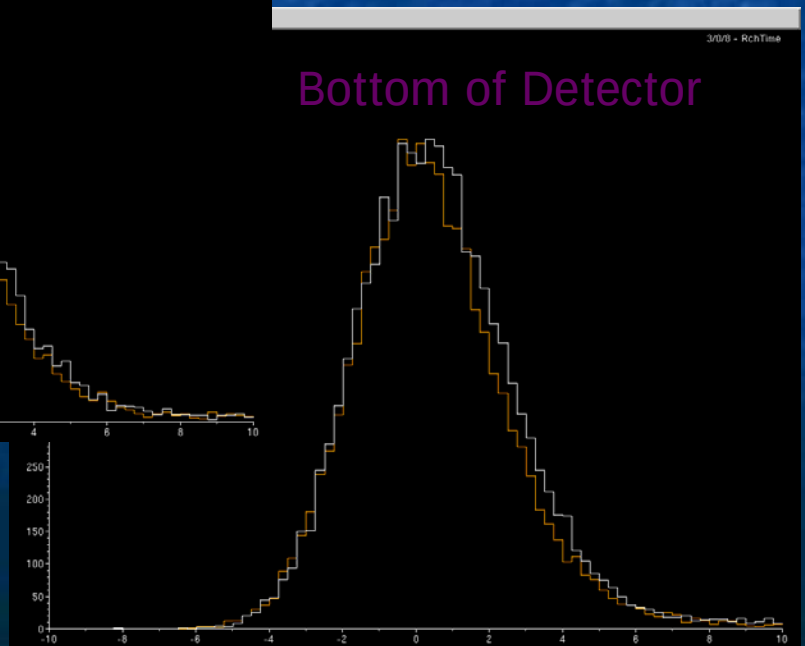


Compare PCA Times (rch file)



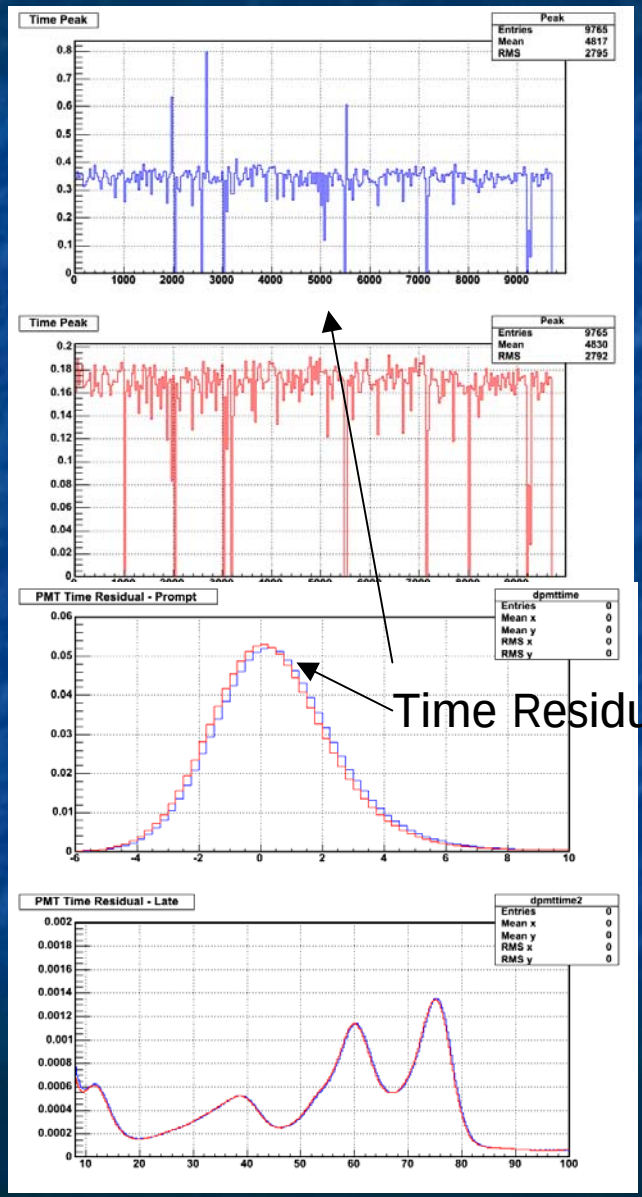
- Tube times clearly different
- Calibration problem?
- Shape of peaks?

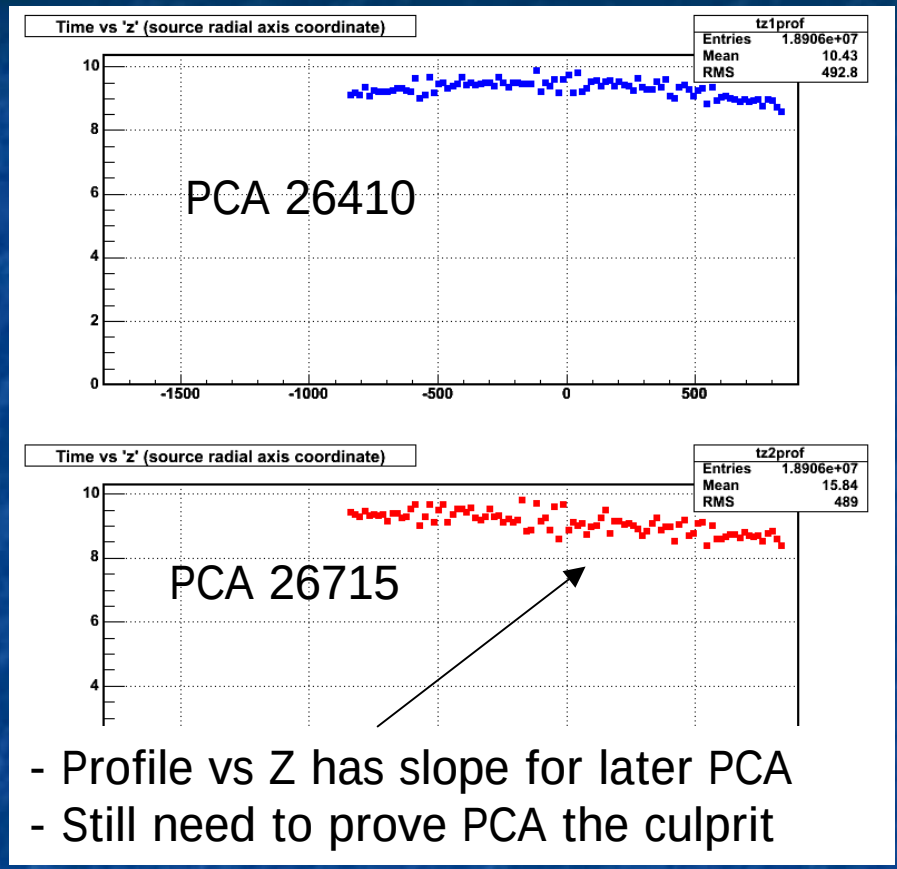




Need to check uncalibrated times?

Inconclusive: PCA Suspicious



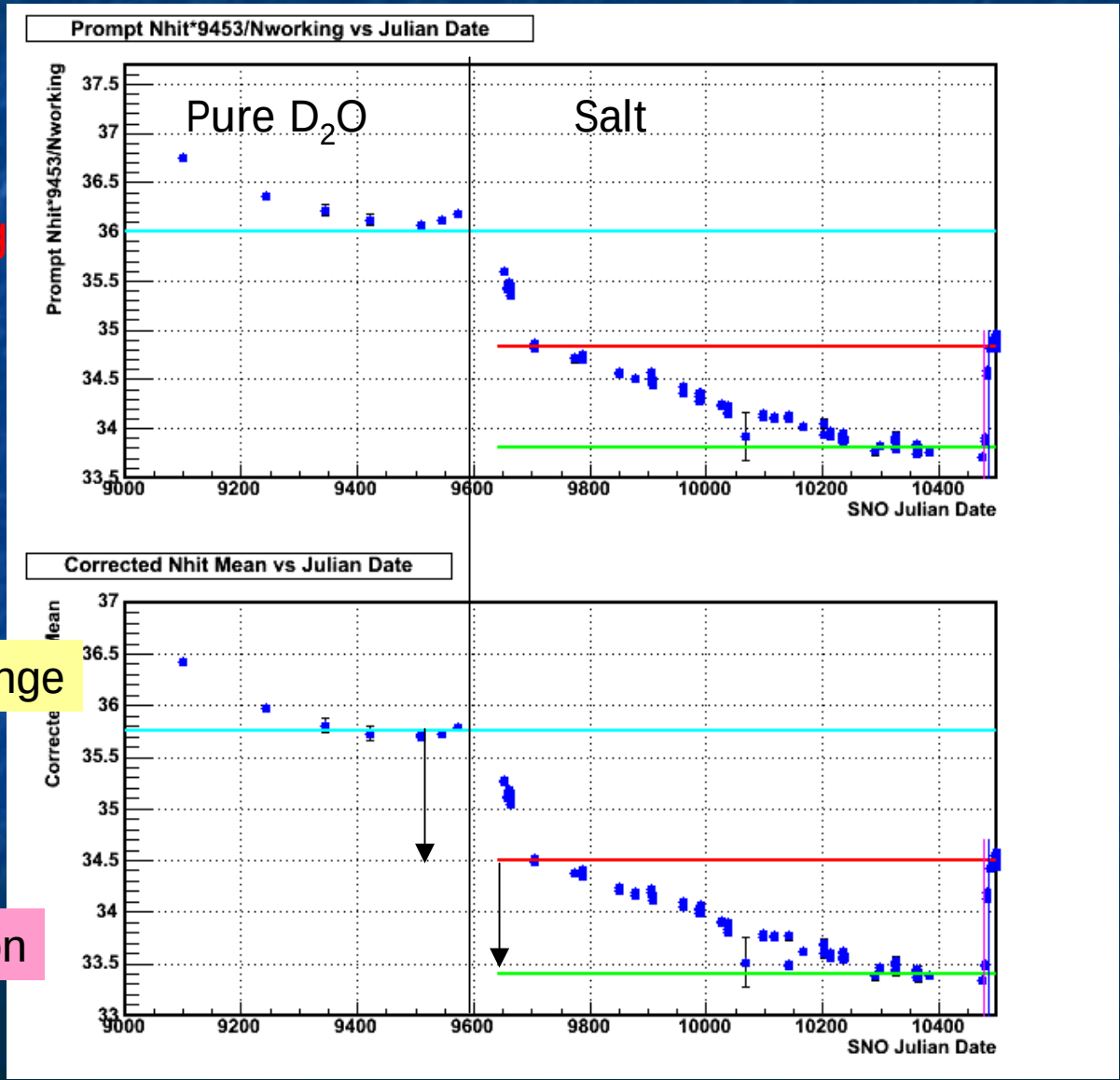


- Profile vs Z has slope for later PCA
- Still need to prove PCA the culprit

- Check ^{16}N raw times
- Check PCA calibrated times
- Examine additional ^{16}N/PCA

Detector Energy Response to Date

Good overall Understanding
Of detector running sate



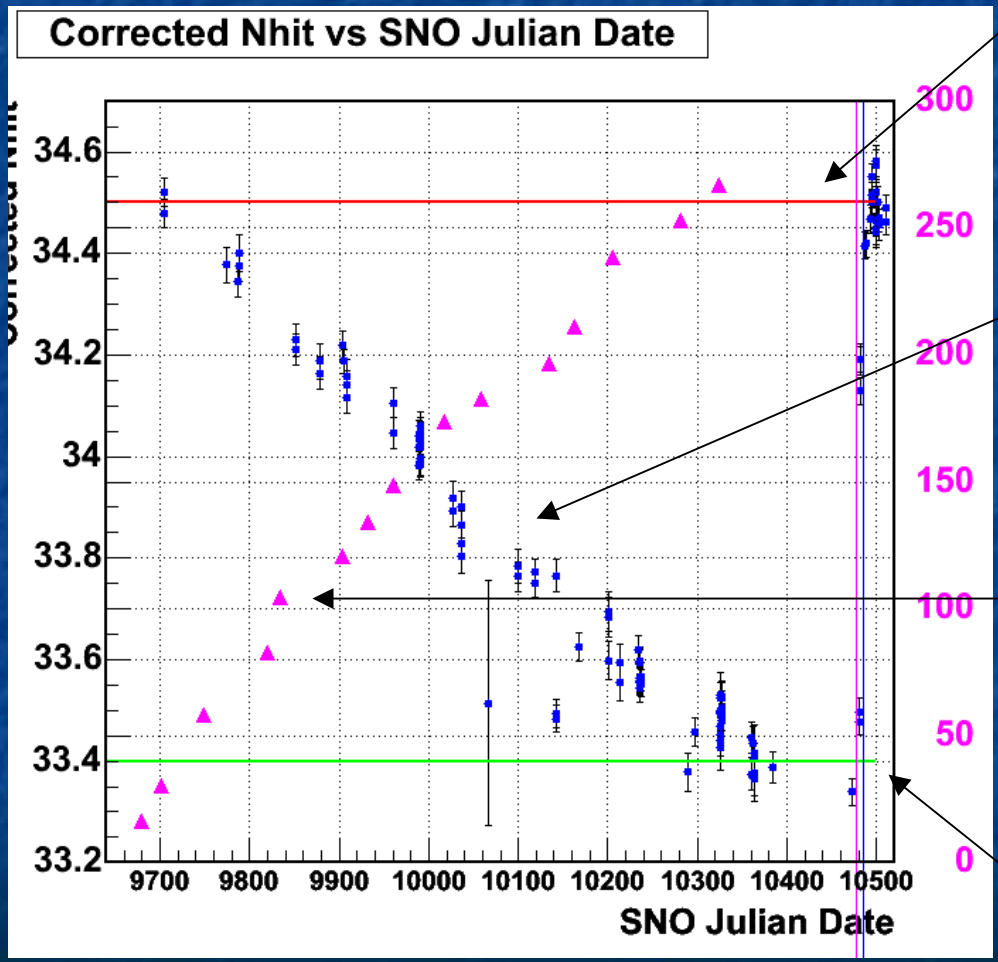
Do Not Understand Initial Change

~3.5% Drop → Reflectors

~3% Drop → D_2O Attenuation

Salt Phase Well Understood

^{16}N Central Runs in Salt



Response for 20674
(9704 = July 26, 2001)

~2% slope consistent with
Measured attenuation change

MnOx assay
(circulation time)X(columns used)
Contaminated D_2O

Response at end of salt running

Flat response after April 11, 2003 (~10325)

Response After Salt Removal

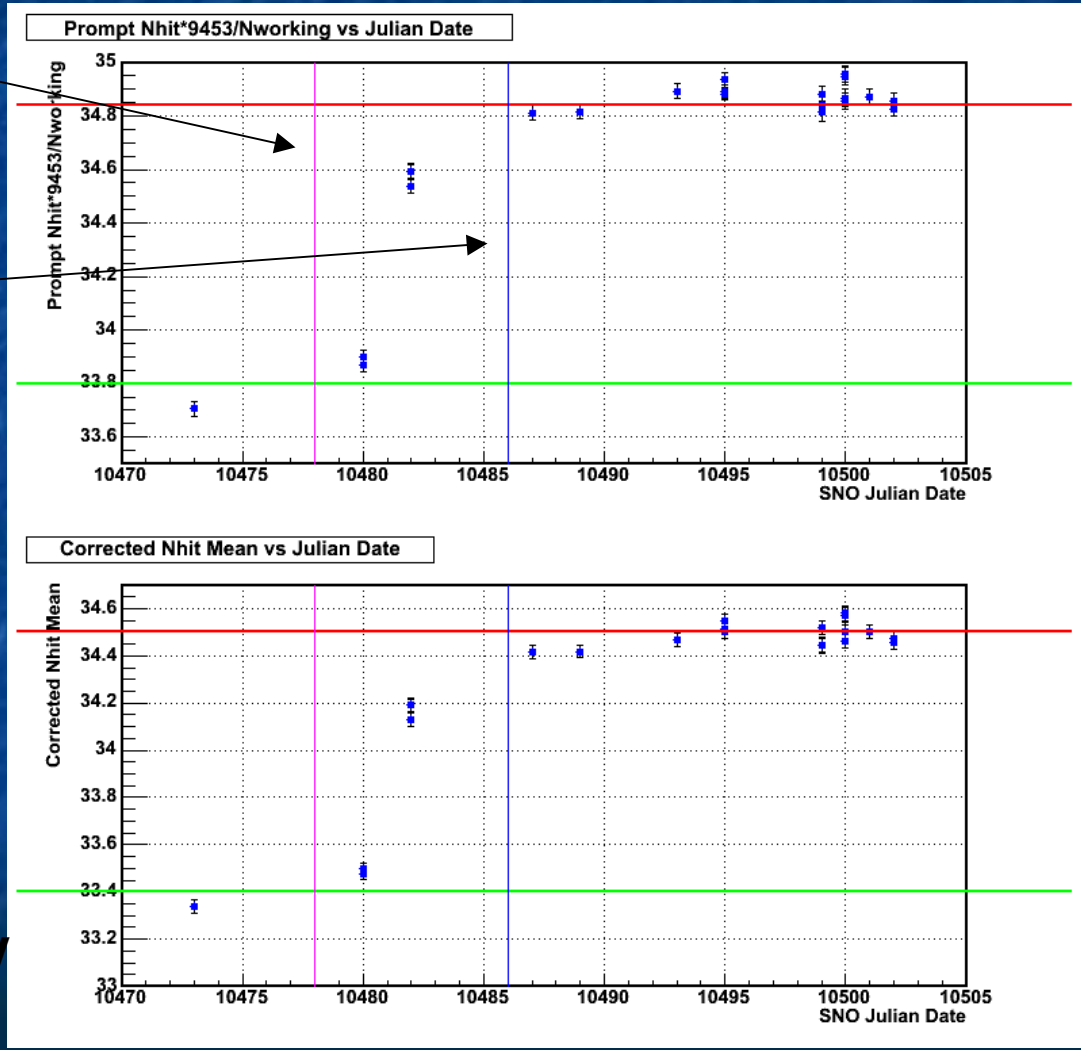
Beginning of salt removal

Completion of first pass

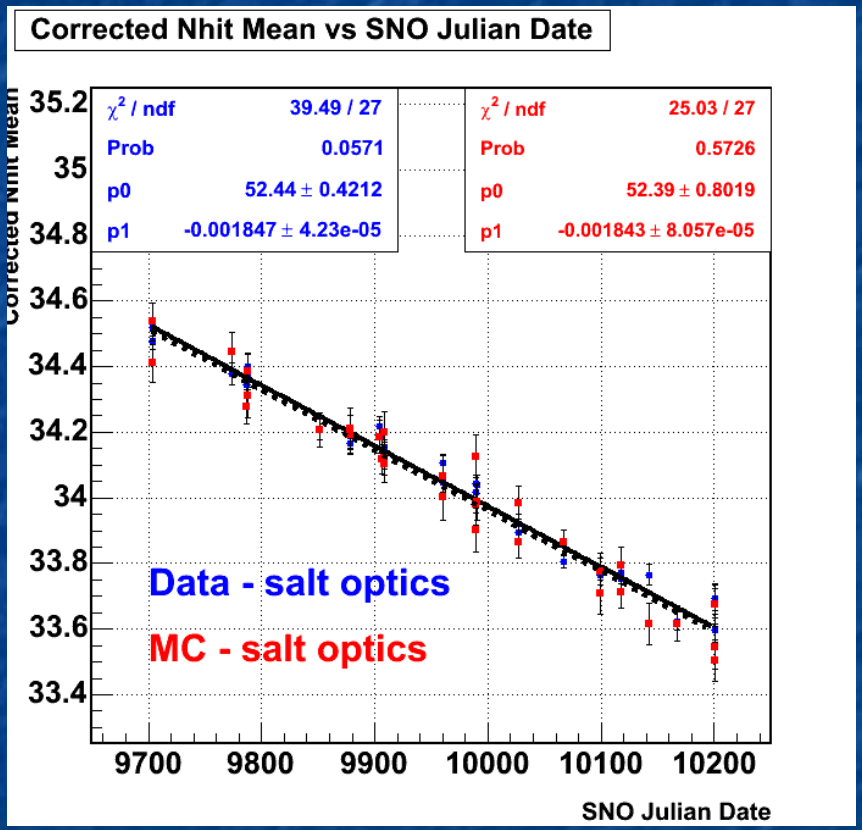
Response has returned to pure D_2O attenuation level (consistent with optics and contamination measurments)

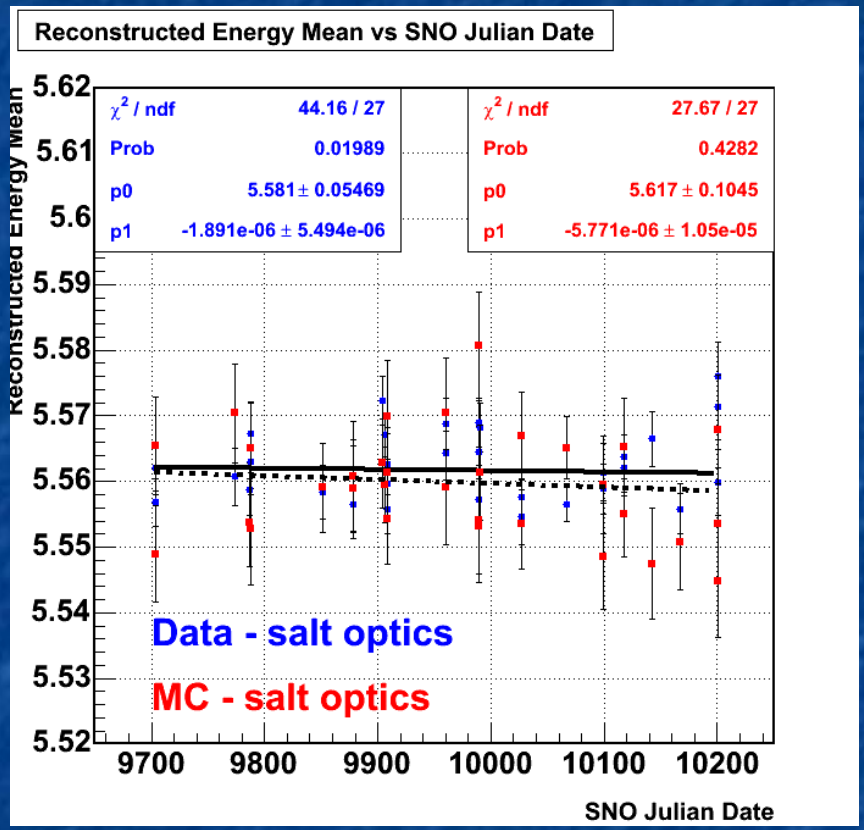
PMT angular response unchanged from salt

Still need to better understand reflector change and prevent another occurence



Response Over Published Dataset





Many improvements will be made
Need to get ready for NCDs

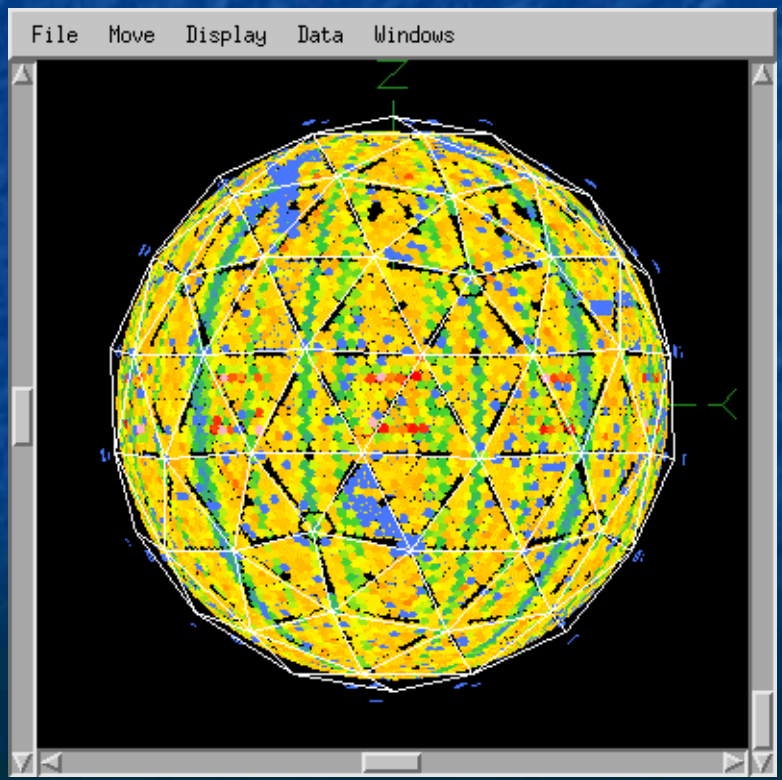
^{16}N QC Module

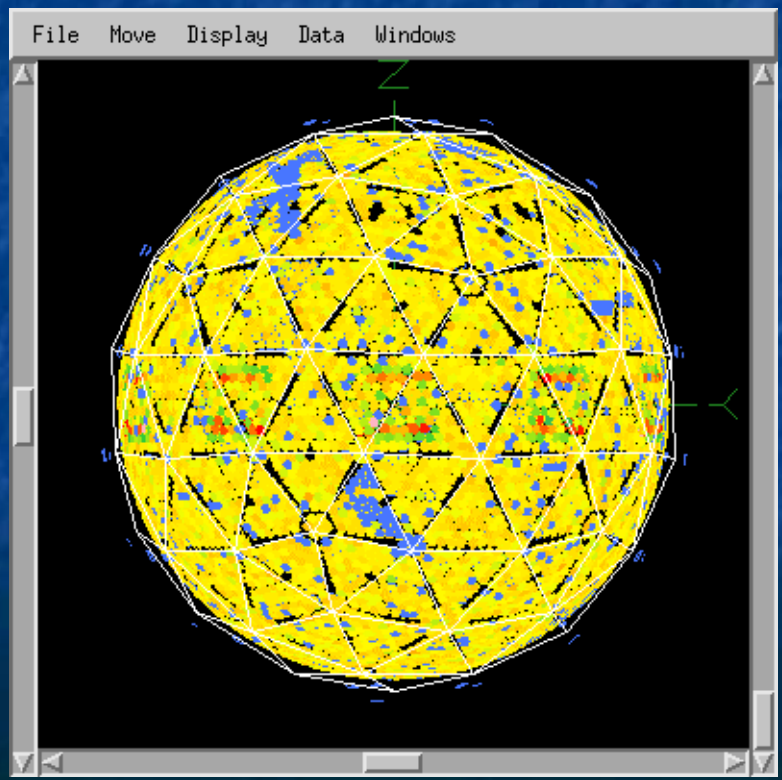
- We have taken 1000 runs since start of salt (500 in pure D2O)
- Autsno module 75% written
- 551 runs processed
- Generates root file of histograms and html file
- Energy, position, direction, time residual, isotropy…
- Plots, information, warnings in html file linked from autsno page
- File size ~3 MB so 2000 runs ~6 GB (QTree files are > 0.5 TB)
- Will submit in next couple of weeks

Optical Calibration in NCD Phase

- NCDs will shadow PMTs
- Need to upgrade qoca to handle new configuration -> shadow function
- Generate MC to test/tune new procedure (should test fitting anyway)
- Also determine whether 2-point PCA necessary

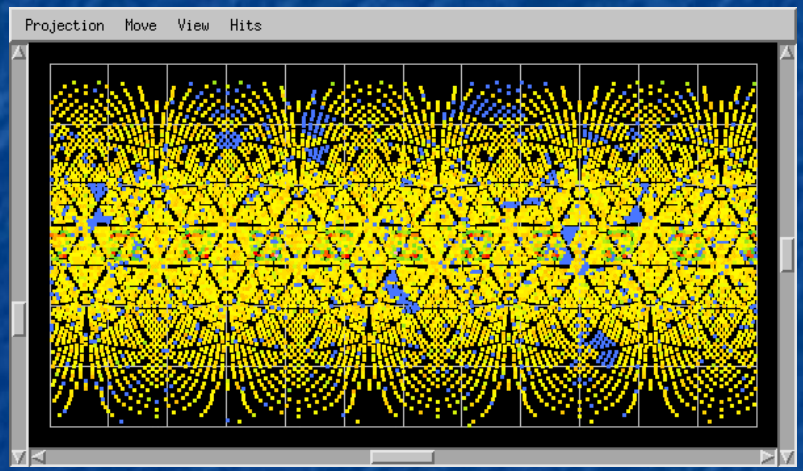
- Have generated salt and NCD MC laser scans (420 nm)
- Will turn into autosno module soon

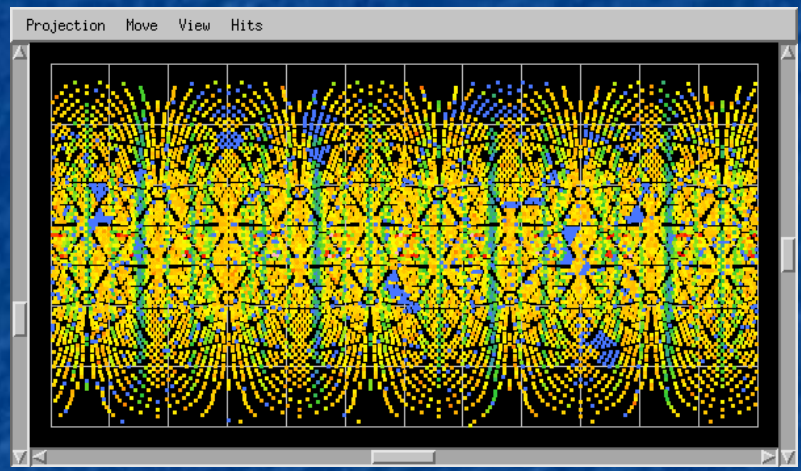




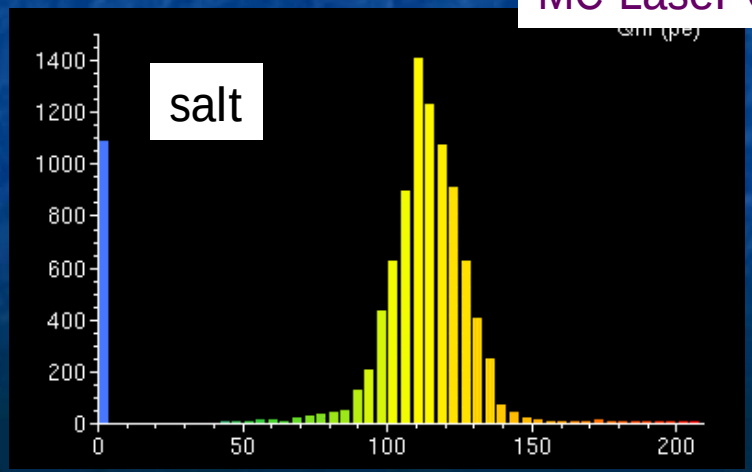
PCA Change Unecessary?

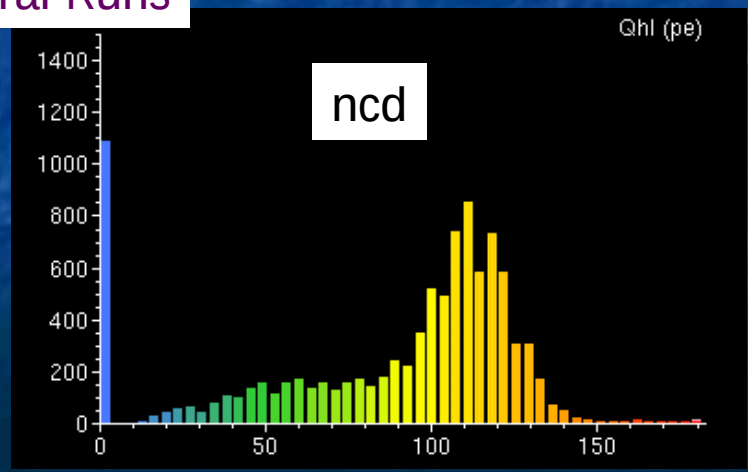
- Statistics for these runs 1/10 of laser scan runs and much less than PCA
- Most tubes appear to have sufficient occupancy for timing measurement





MC Laser Central Runs





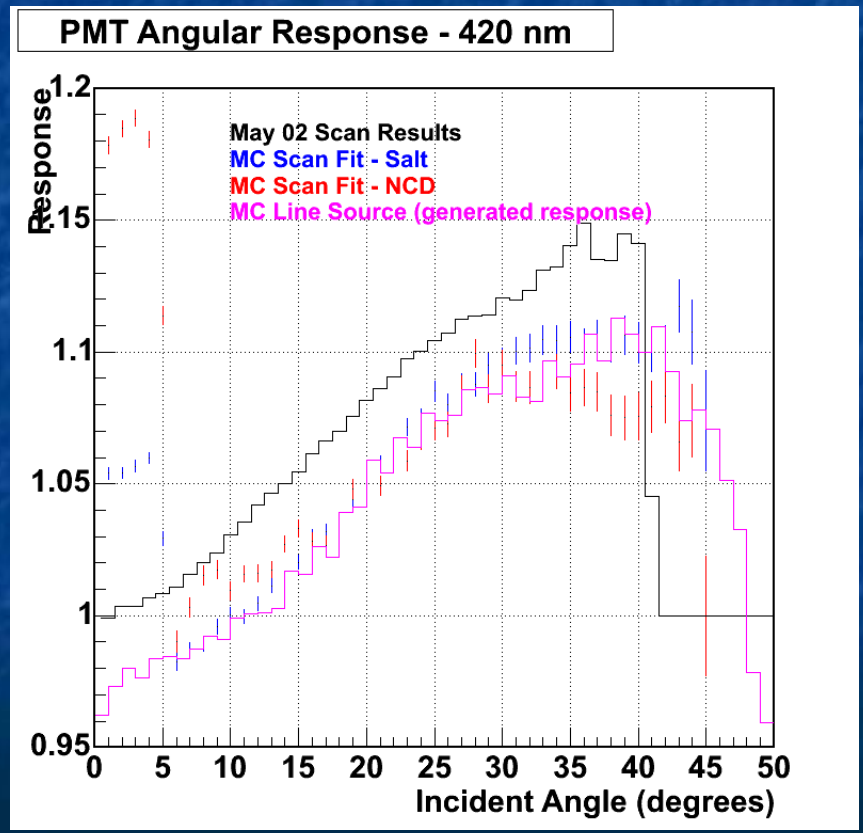
Have Tried to Fit MC Scans

- Problems with fits but results not crazy
- Shadow funtion almost ready
- Have mc fits fixed in a couple of weeks

Attenuation Results

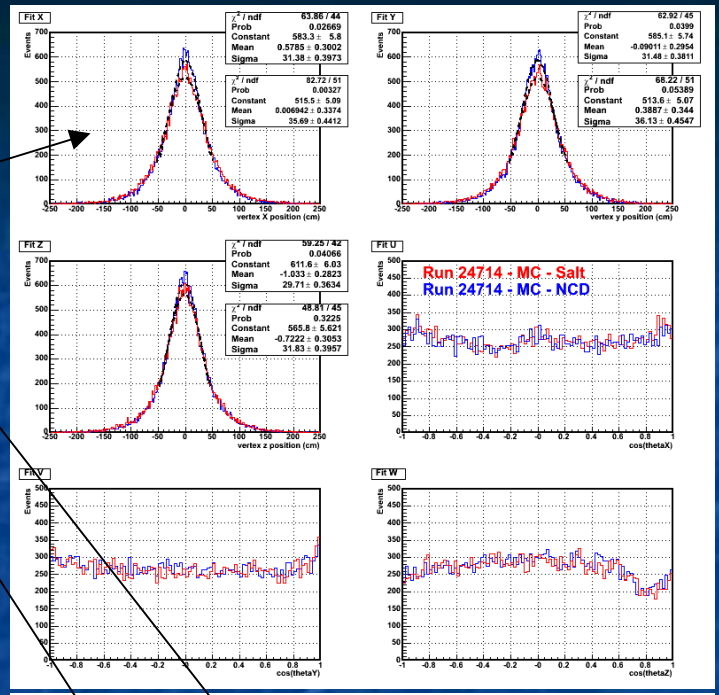
	D_2O	AV	H_2O
Atten	1.14e-4 (1.13e-4)	7.59e-3	3.07e-4
Ray	0.30e-4		0.32e-4
Ext	1.44e-4	7.59e-3	3.39e-4
Salt MC	1.66e-4	7.70e-3	5.4e-4
χ=0.88			
NCD MC	3.29e-4	7.7e-3	2.33e-4
χ=2.20			

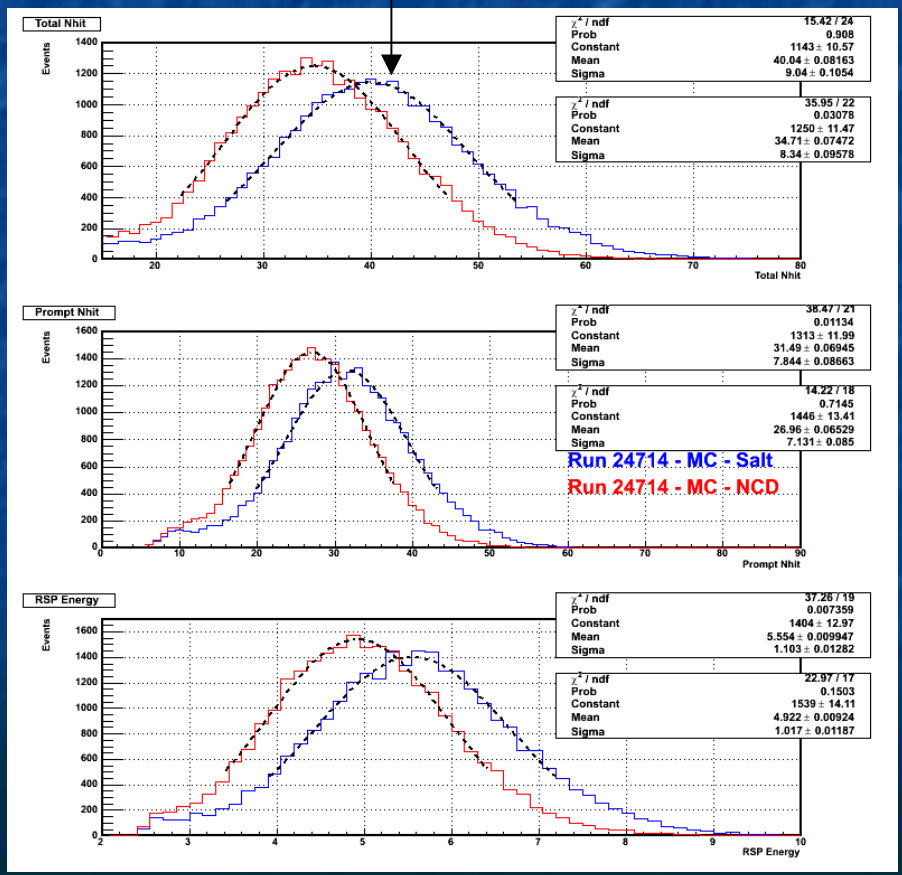
Angular Response Results

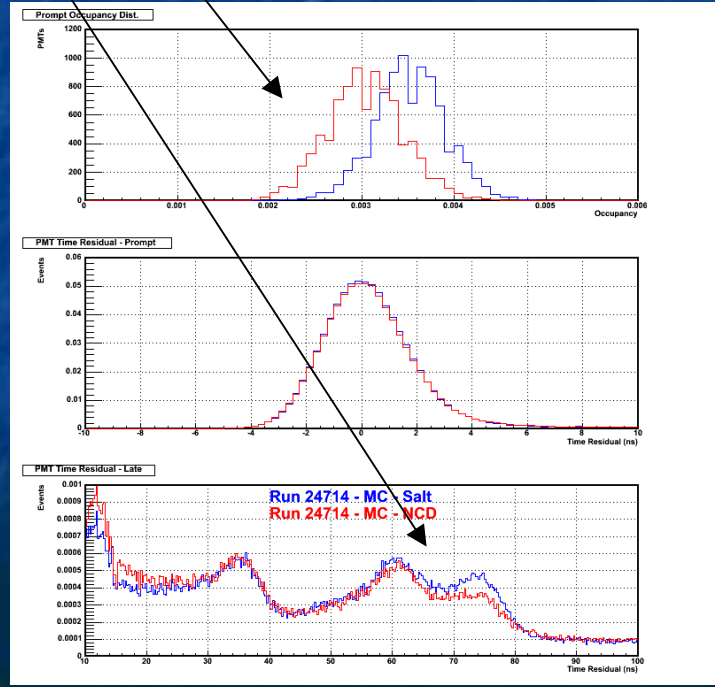


R=0 cm ^{16}N Run with NCDs

Spatial disitributions broader
Occupancy drops
Time residual reflection drops
Energy response drops ~10-15%
Shape not severely distorted

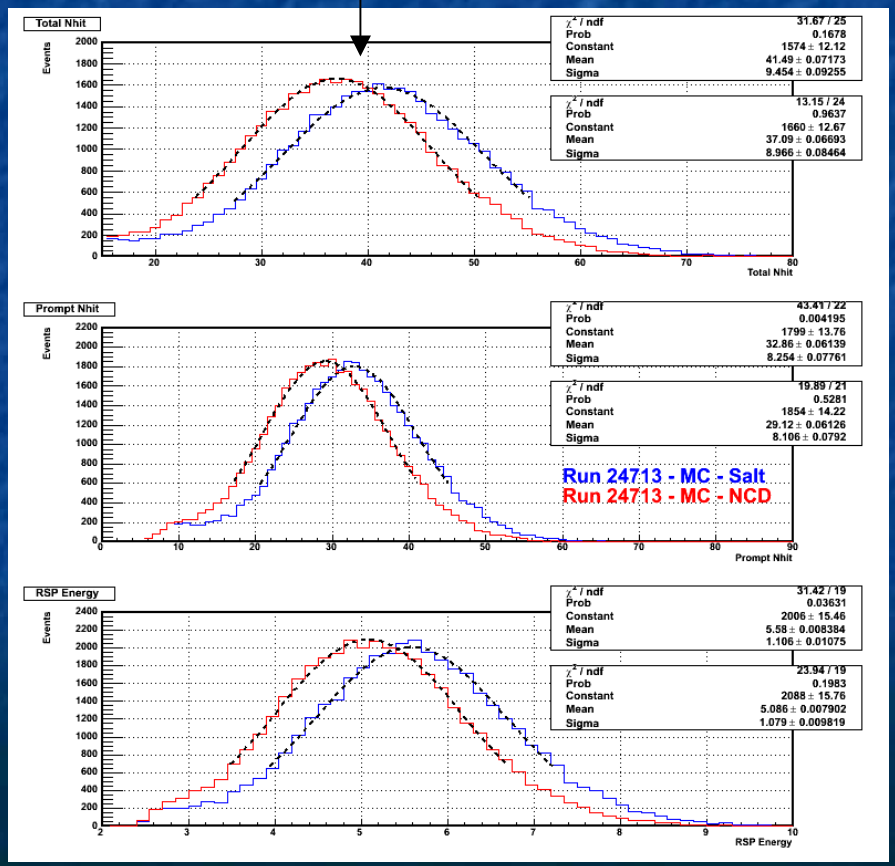


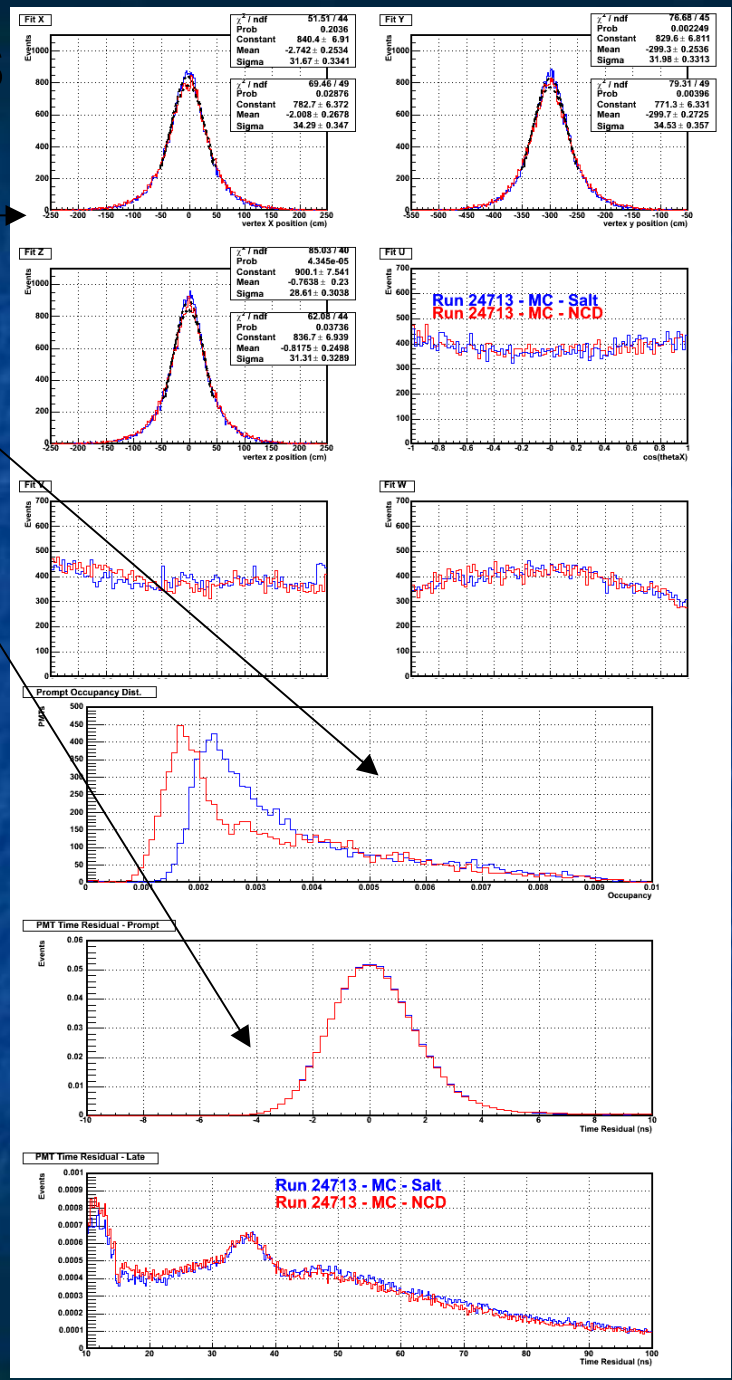




R=300 cm ^{16}N Run with NCDs

Spatial disitributions unchanged
Occupancy drops
Time residual unchanged
Energy response drops ~7-10%
Shape not severely distorted

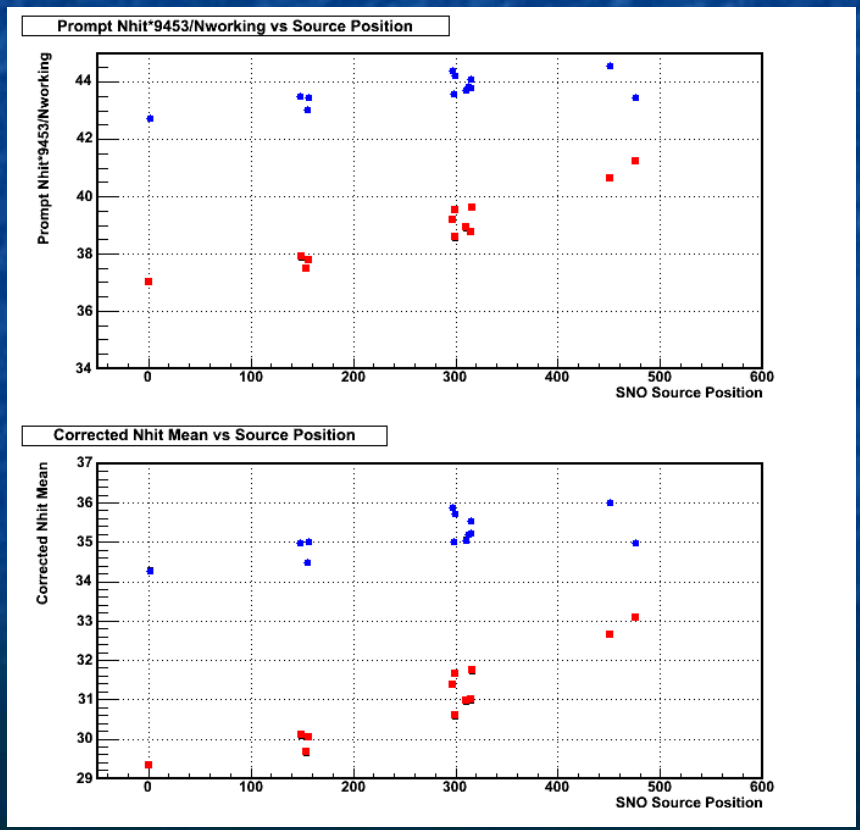




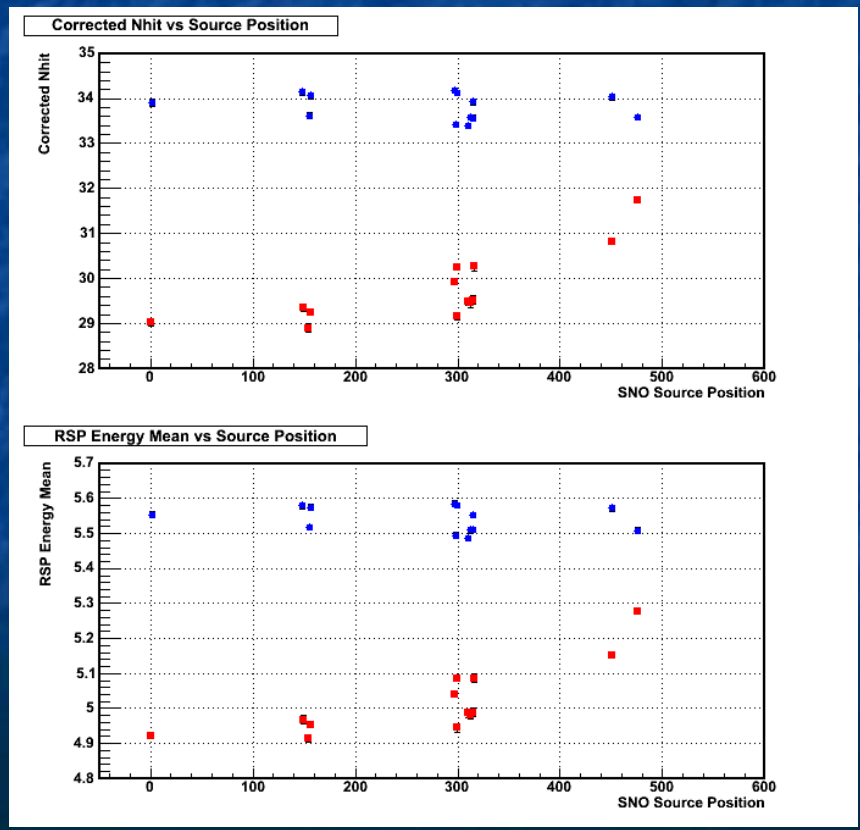
^{16}N NCD MC Response vs Radius

- Response at centre down by 10-15%
- Variation at given R may increase
- Need updated RSP to handle NCD phase → Local variation code + mask function

Total and Prompt Nhit

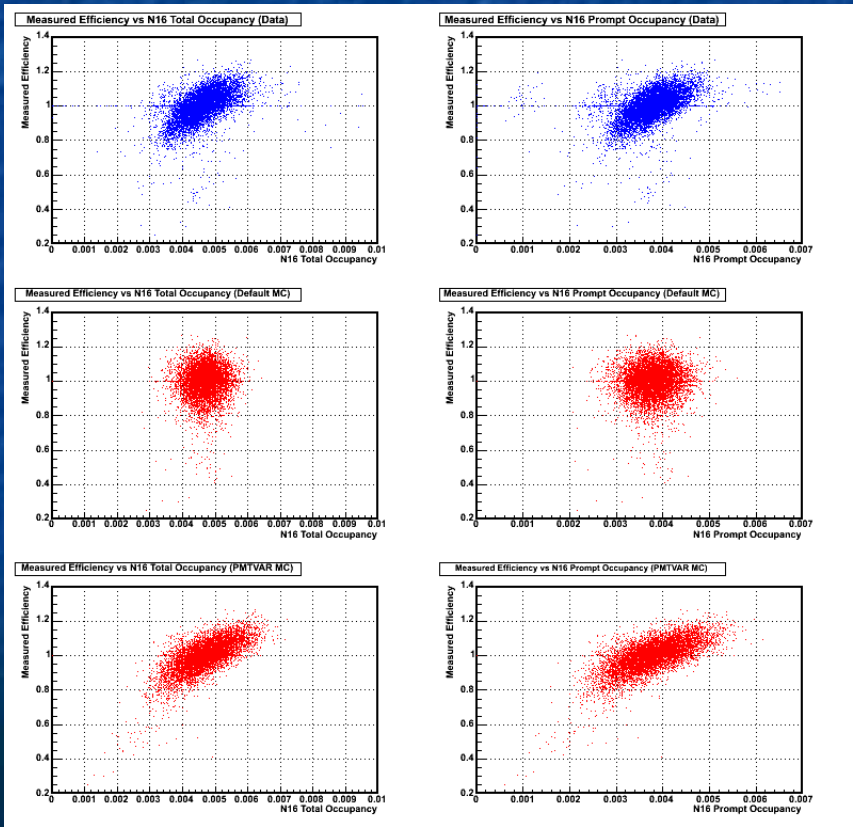


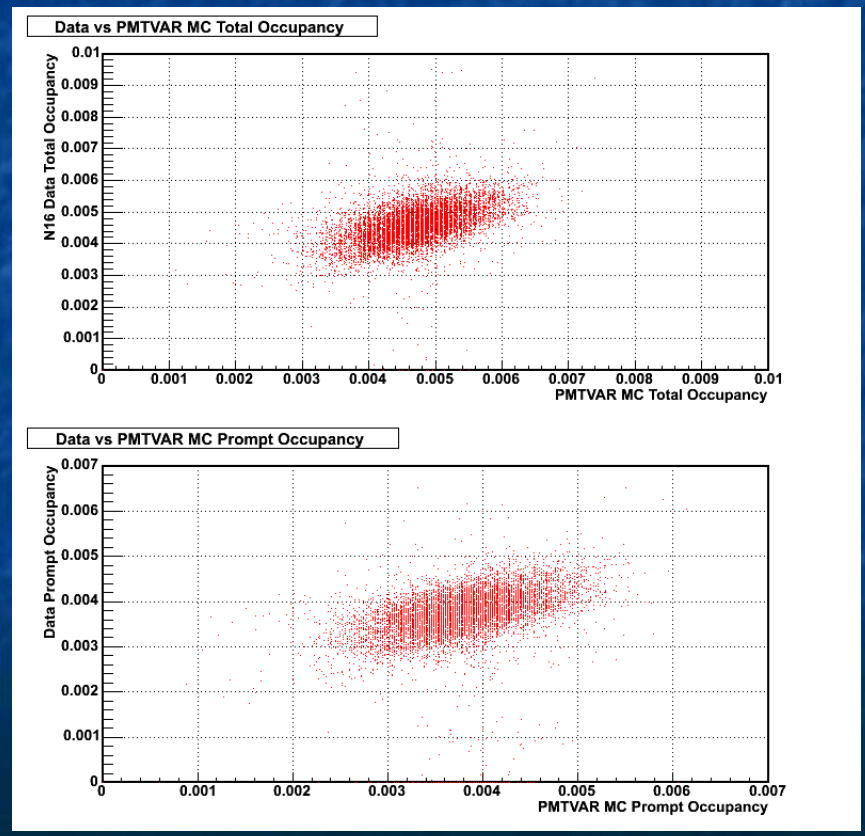
Corrected Nhit and Energy



PMT-to-PMT variations

Measure relative PMT efficiencies from laserball data (Christian)
Compare PMT occupancies for ^{16}N central run to table
Generate MC with PMT-to-PMT variations turned on
→Reduce energy resoluton difference between data and MC (1.5%)

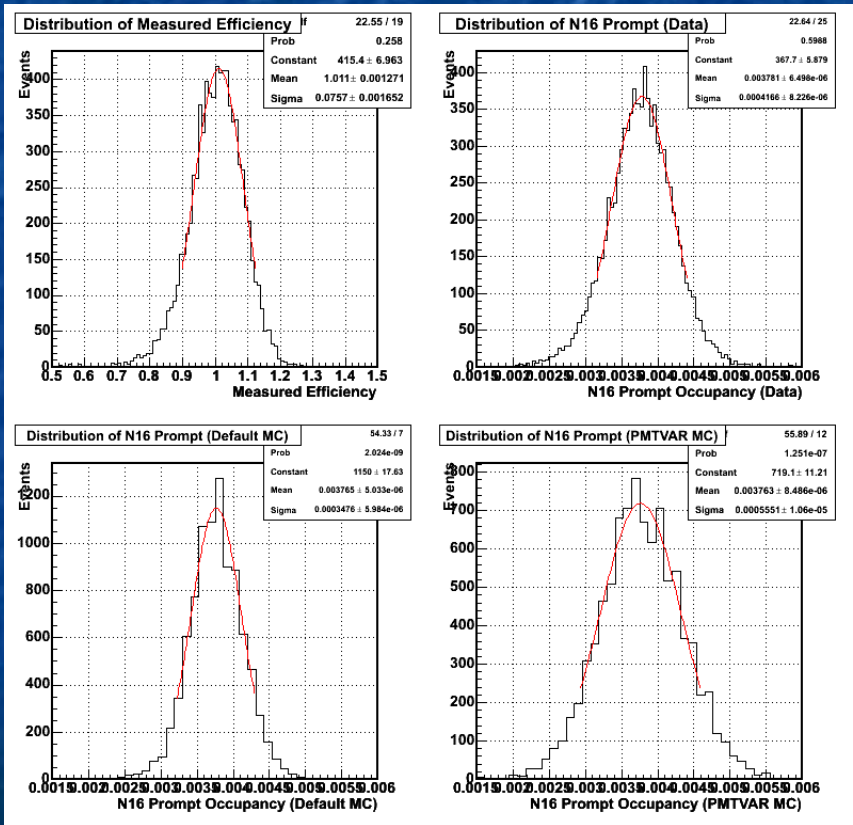


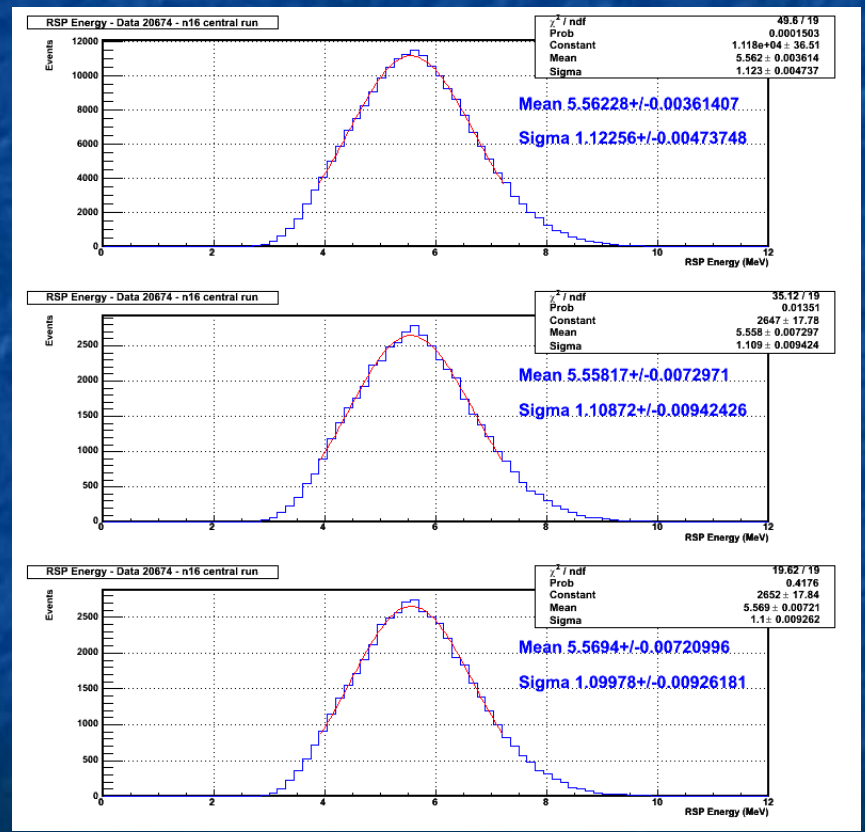


^{16}N Occupancy and Energy Distributions

Occupancy broadens ~right amount

Insufficient statistics to see energy





Calibration Plans

Calibrating for Next Paper

- CHCS banks to end of salt (Peter + backup...Peter is back Monday)
- optics constants (Ranpal: ready)
- drift correction (Kevin: reprocess with above)
- systematics estimates from optics constants/3dpmt model?

Upgrading Calibration for Future Papers

- re-calibrate and re-process complete dataset (and MC)		
- add PMT-to-PMT variations	(done)	1.5% E Resolution
- local corrections in RSP	(Ryan)	Asymmetry uncertainty
- fix/upgrade 3dpmt model	?????	2% radial bias in MC
- turn on cross-talk cut	(done)	Improve E REsolution
- improved noise model	(done?)	
- fix MP correction bug for E>20MeV	(done)	Primarily HEP analysis
- new source/physics uncertainties estimates	?????	Dominant uncertainty
- improve ^{16}N modelling	?????	" "
- calibrate light water response	?????	Push out in volume+
- response close to AV (AV reflections)	?????	Bkg measurements

NCD Calibration

- Generate laser MC scans
- Include laserball in simulation
- Fit out salt and NCD optical constants
- Derive mask algorithm -> re-fit and demonstrate reliability

- Is a two-point PCA necessary?

- Generate ^{16}N NCD MC
- Upgrade RSP processor (coupled to local correction above and mask)

- Optimize laserball and ^{16}N scan procedures

- Optical neutron calibration with NCDs???

- Calibration run plans (^{16}N, Laser, Cf/AmBe, other…)

- Did well for salt phase but can do better in NCD phase (and likely need to)

Next Salt Paper Plans

Analysis Schedule

- no upgraded analyses...use same tools as for first salt paper
- calibrate last portion of dataset and reprocess
- re-generate energy uncertainties for full dataset
- backgrounds, isotropy, selection,...
- D/N specific analyses
- energy spectrum -> differential systematics?

Paper Content

- same energy and fiducial volume cuts as first paper
- include integrated fluxes, D/N measurement, spectrum, eccentricity
- what else?
- longer paper (20-30 pages say)
- need to publish early in new year