

Target Stability Over Time

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① Introduction

② Basic Setup

③ Summary

④ Chamber Wire Comparison

Source and DAQ

- Located at the Oak Ridge National Laboratory (ORNL) in Tennessee
- 60 Hertz pulsed spallation source
- 49 time bins per pulse for Clean DAQs
- 144 chamber wires to read out.
- 1624 time bins per pulse for dirty daq (spin flipper and beam monitor)
- One M1 Monitor

Method

- Identify 10 beam on + 1 beam off run over data taking period
- Form pulse average for each pulse in run for each wire in chamber and M1

$$x_{j,i} = \frac{1}{N} \sum_{k=1}^N s_{j,i}(k) \quad N = 49 \text{ or } 1624$$

where x is the averages of the i th pulse in the j th run.

- Average pulse averages and form standard deviation for run averages

$$Avg = \langle x_j \rangle = \frac{1}{25000} \sum_{i=1}^{25000} x_{j,i} \quad Stdev = \sqrt{\langle x^2 \rangle - \langle x \rangle^2}$$

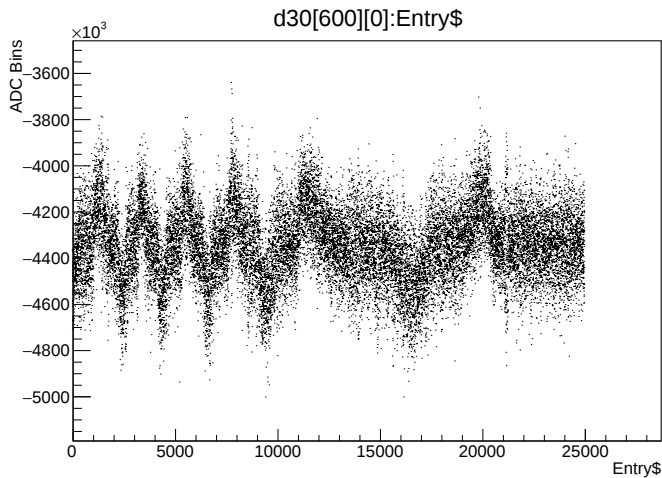
- Plot run averages for M1 and select wires
- Plot wire run Averages divided by M1 run averages for comparison

Run Numbers Looked At

Run Criteria

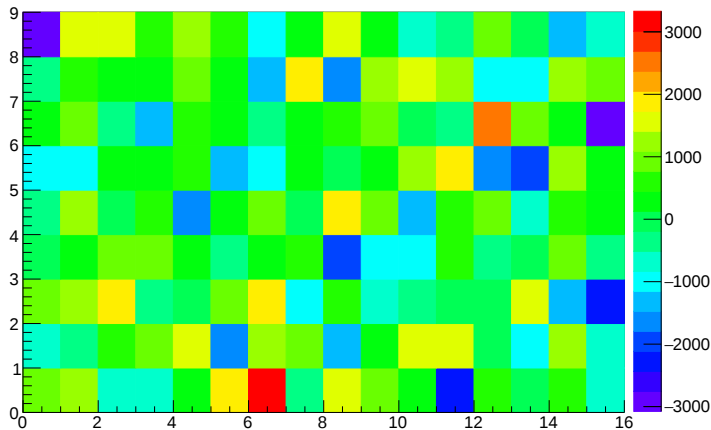
- beam on
- relatively stable
- every 4000th run approximate
- 19484 (pedestal)
- 18014
- 22014
- 26014
- 29914
- 34014
- 38024
- 41914
- 46014
- 50014
- 54014

Pedestal Data - M1

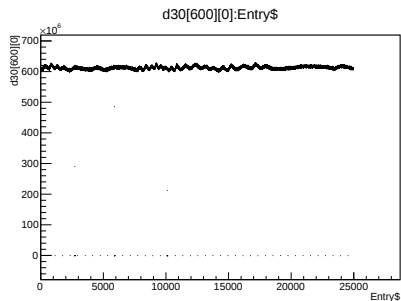
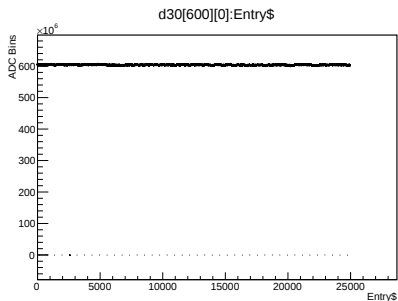


Pedestal Data - Wire Chamber

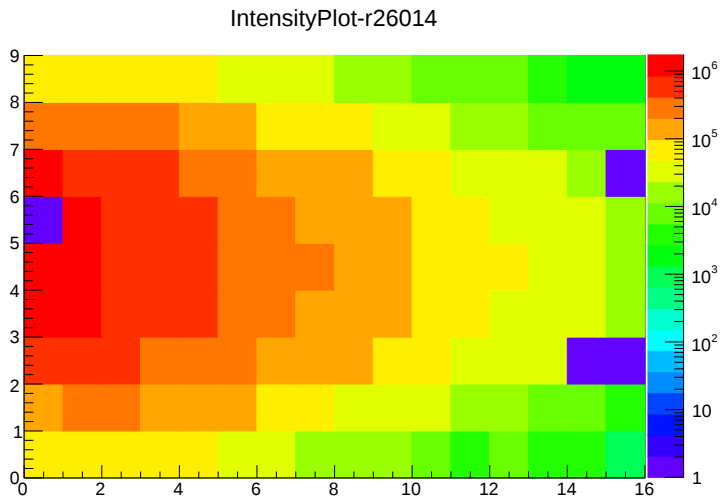
IntensityPlot-r19484



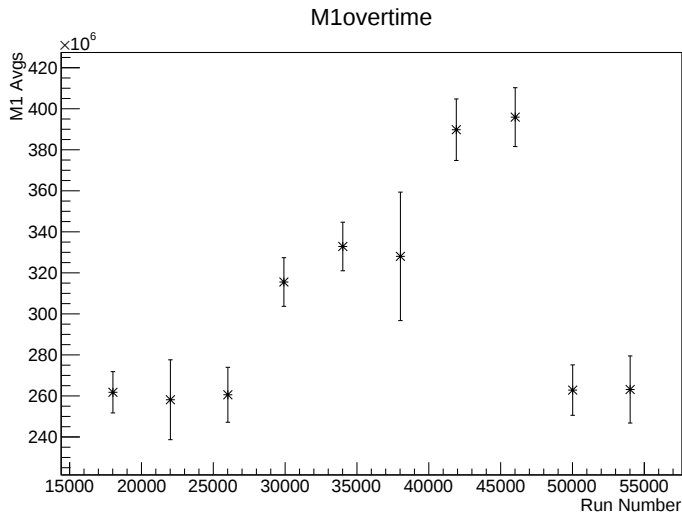
Stability Comparison



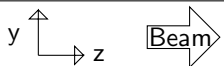
Intensity Plot - run 26014



Neutron Beam Power Variations



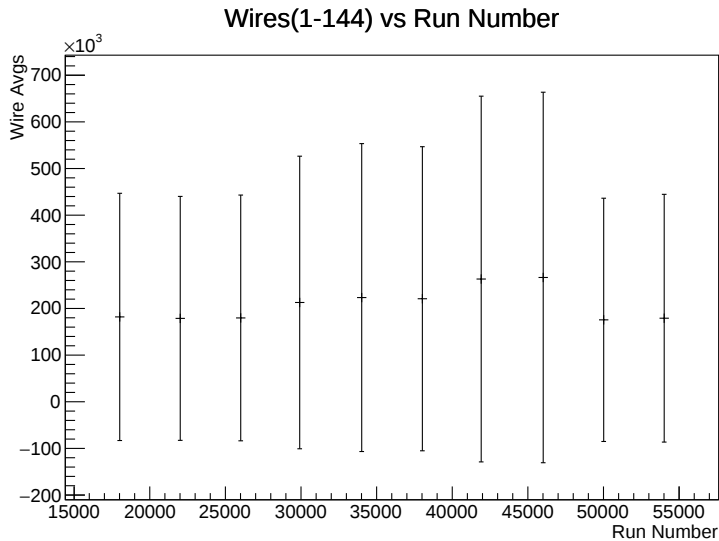
Wire Indices



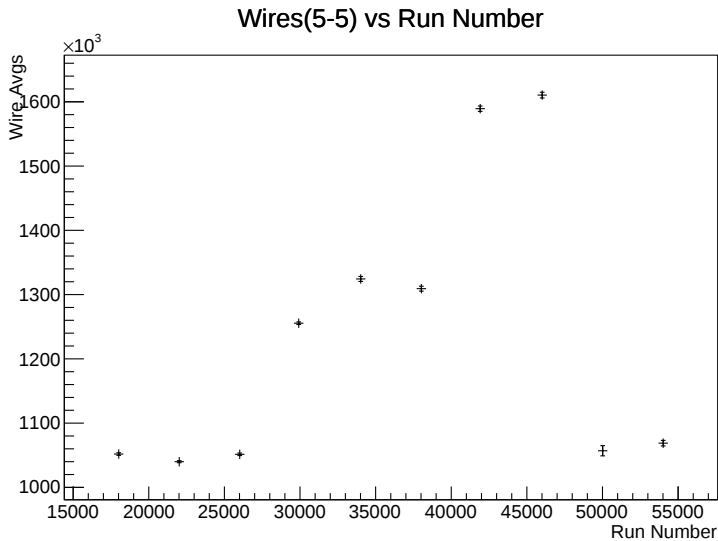
i	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144
h	8	17	26	35	44	53	62	71	80	89	98	107	116	125	134	143
g	7	16	25	34	43	52	61	70	79	88	97	106	115	124	133	142
f	6	15	24	33	42	51	60	69	78	87	96	105	114	123	132	141
e	5	14	23	32	41	50	59	68	77	86	95	104	113	122	131	140
d	4	13	22	31	40	49	58	67	76	85	94	103	112	121	130	139
c	3	12	21	30	39	48	57	66	75	84	93	102	111	120	129	138
b	2	11	20	29	38	47	56	65	74	83	92	101	110	119	128	137
a	1	10	19	28	37	46	55	64	73	82	91	100	109	118	127	136
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16

- HV 17 HV Frames with 8 wires each
- Signal 16 signal Frames with 9 wires each

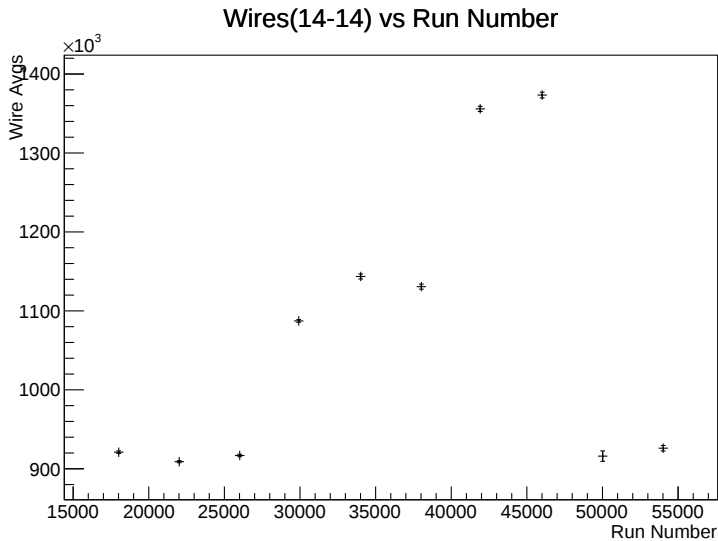
Wire Average - All Wires



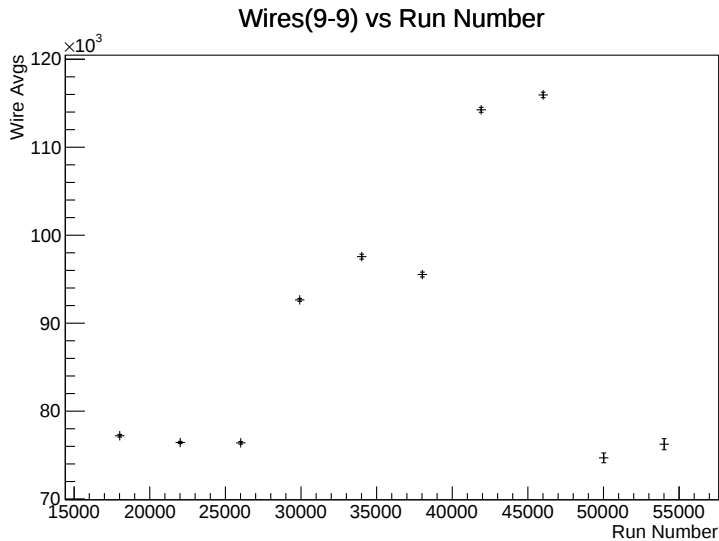
Wire Average - Wire 5



Wire Average - Wire 14

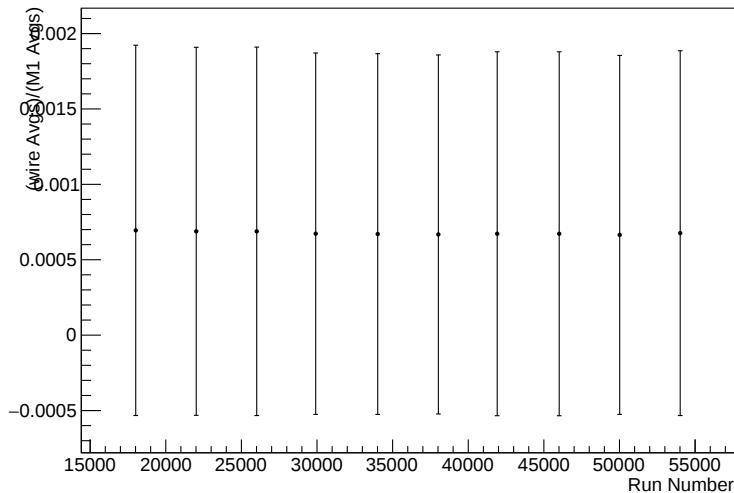


Wire Average - Wire 9



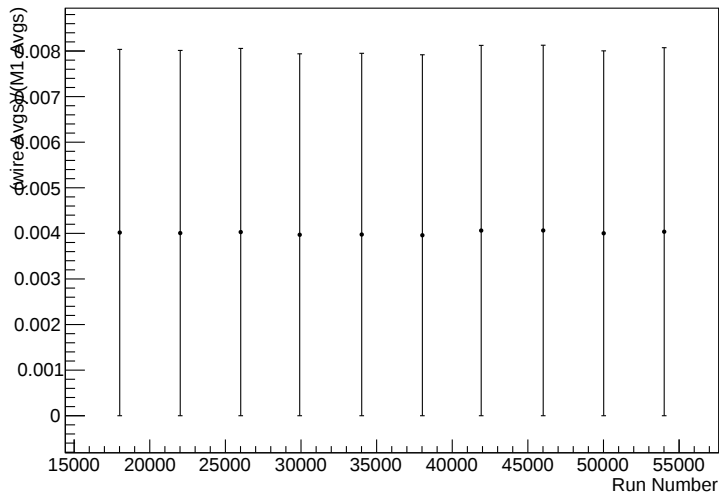
$(\text{Wire Average})/(\text{M1 Average})$ All Wires

ChangeAvgOverTime-wires(1-144)



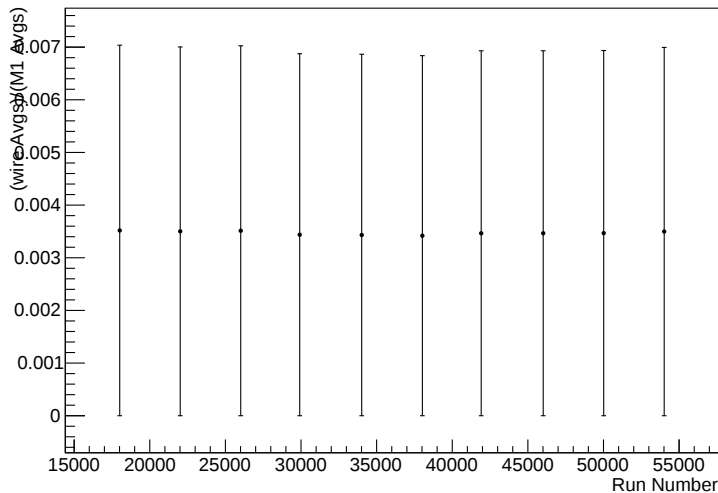
$(\text{Wire Average})/(\text{M1 Average}) - \text{Wire 5}$

ChangeAvgOverTime-wires(5-5)

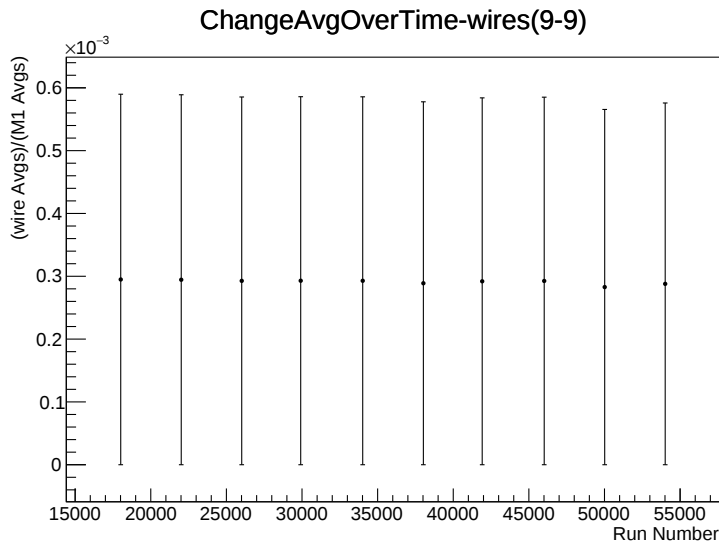


$(\text{Wire Average})/(\text{M1 Average}) - \text{Wire 14}$

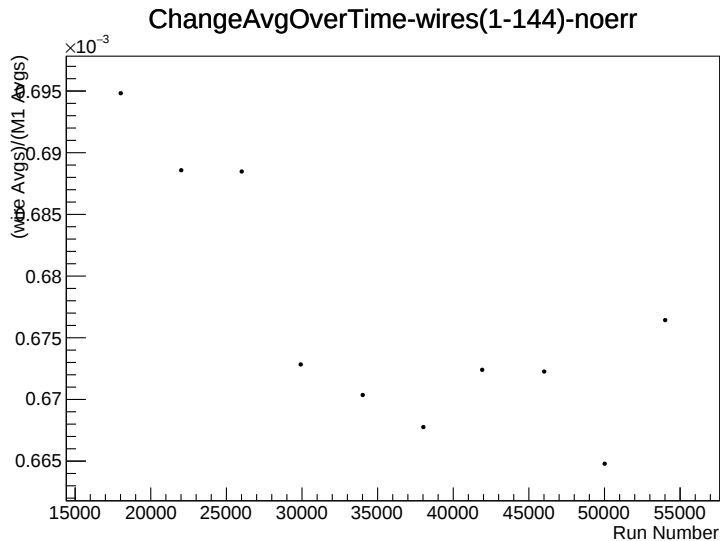
ChangeAvgOverTime-wires(14-14)



$(\text{Wire Average})/(\text{M1 Average}) - \text{Wire 9}$

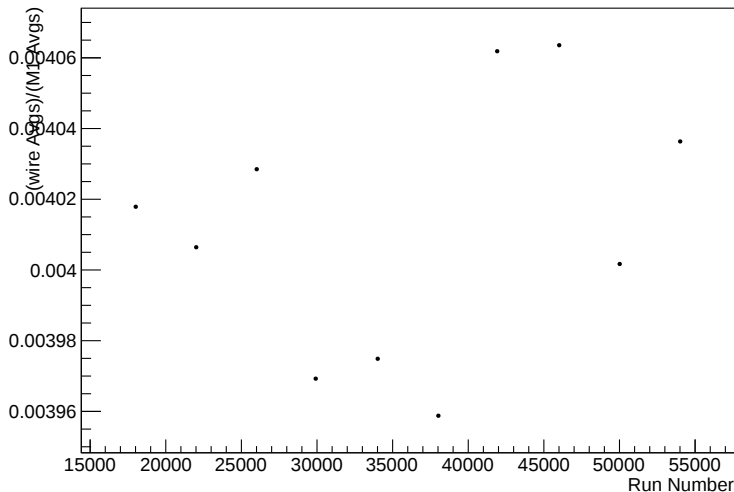


$(\text{Wire Average})/(\text{M1 Average})$ All Wires - no error bars



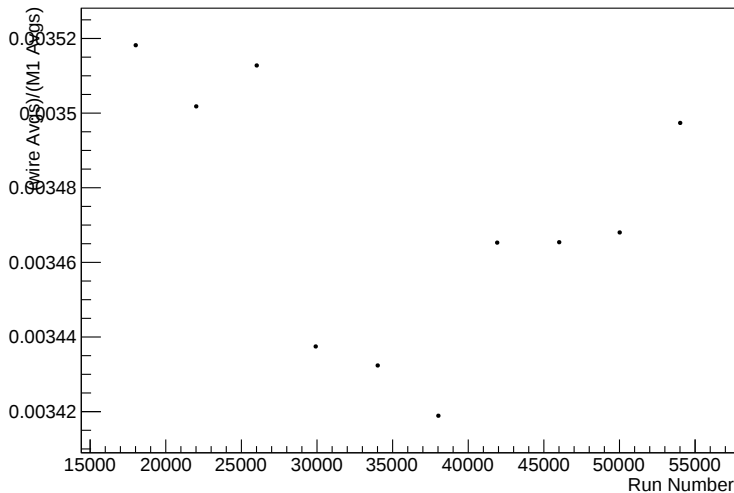
$(\text{Wire Average})/(\text{M1 Average}) - \text{Wire 5} - \text{no error bars}$

ChangeAvgOverTime-wires(5-5)-noerr

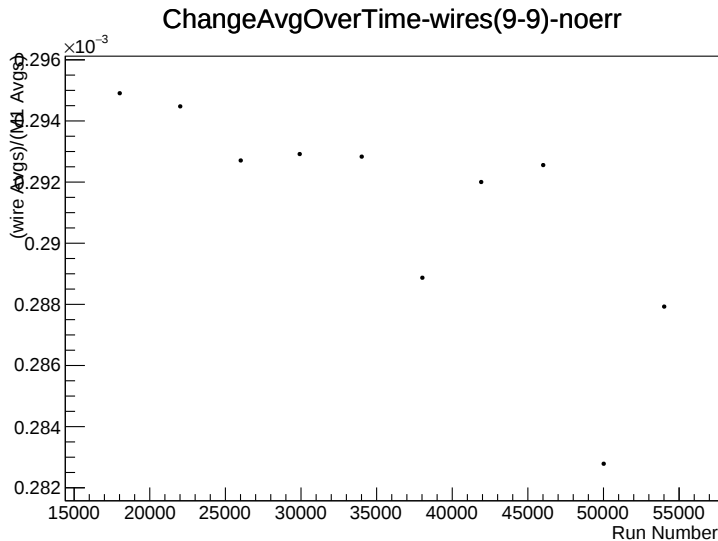


(wire Average)/(M1 Average) - Wire 14 - no error bars

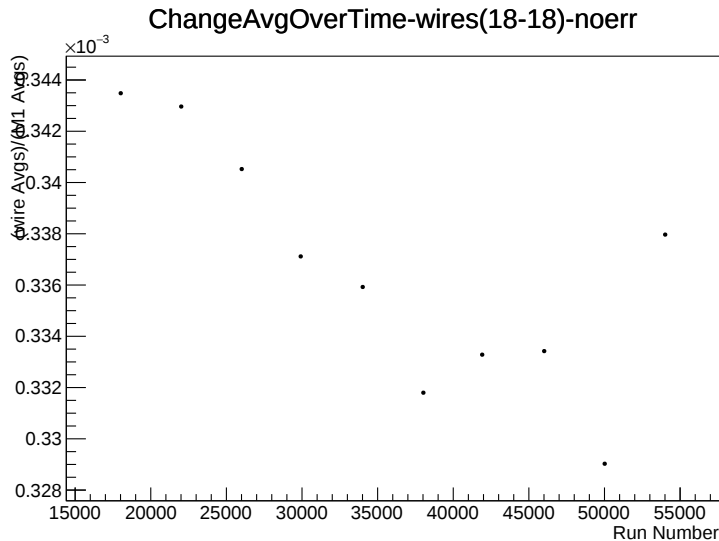
ChangeAvgOverTime-wires(14-14)-noerr



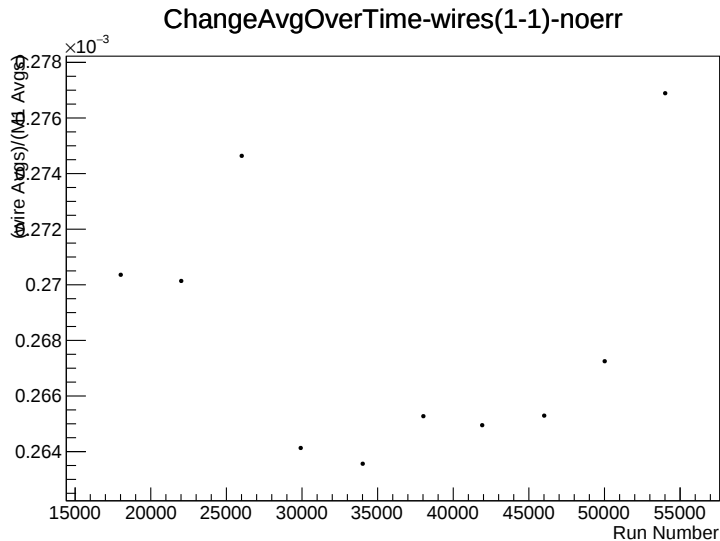
$(\text{wire Average})/(\text{M1 Average}) - \text{Wire 9} - \text{no error bars}$



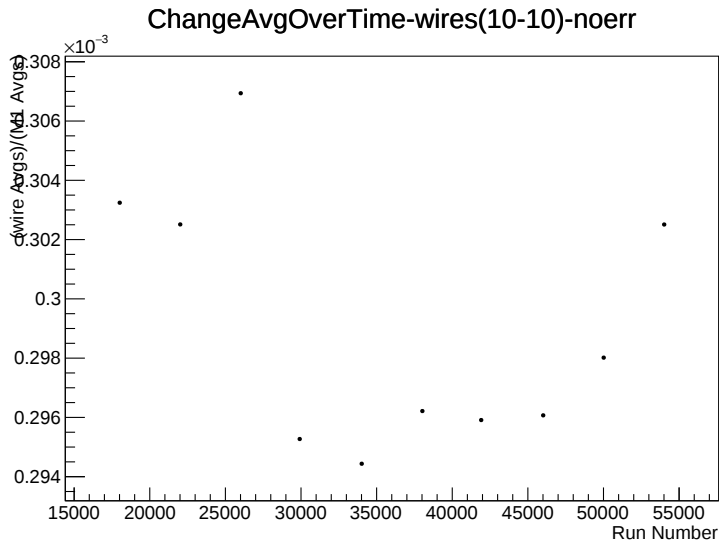
(wire Average)/(M1 Average) - Wire 18 - no error bars



(wire Average)/(M1 Average) - Wire 1 - no error bars



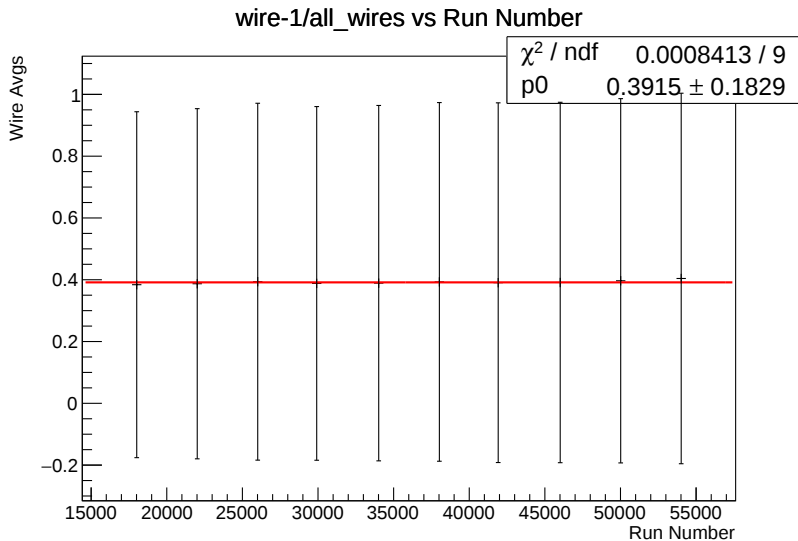
(wire Average)/(M1 Average) - Wire 10 - no error bars



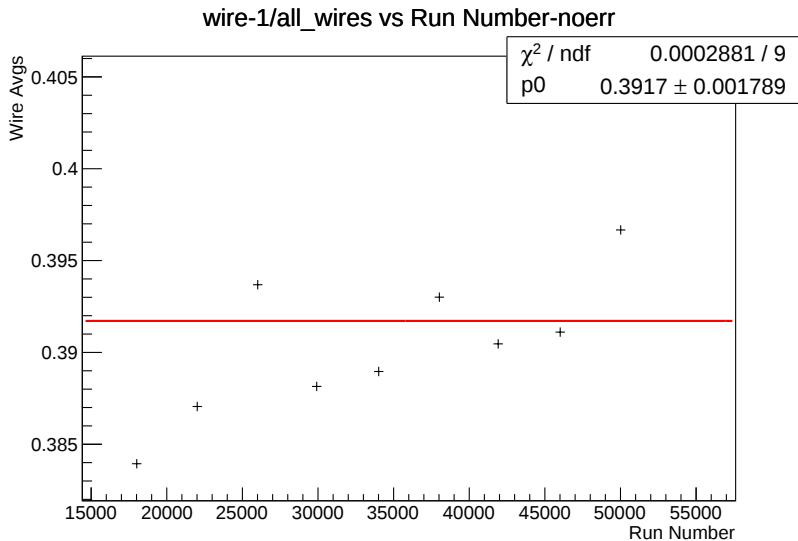
Summary

- Sampled 10 runs over the course of the experiment
- One beam off run from near the start chosen as pedestal
- Examined runs with $200 - 400 \times 10^6$ ADC bins for M1 run averaged
 - approximate factor of 2 in neutron beam power
- changes in wire Average / m1 Average are 2-5% of ratio
- uncertainties are of order 100% of value
- Chamber seems stable relative to M1 monitor over time.

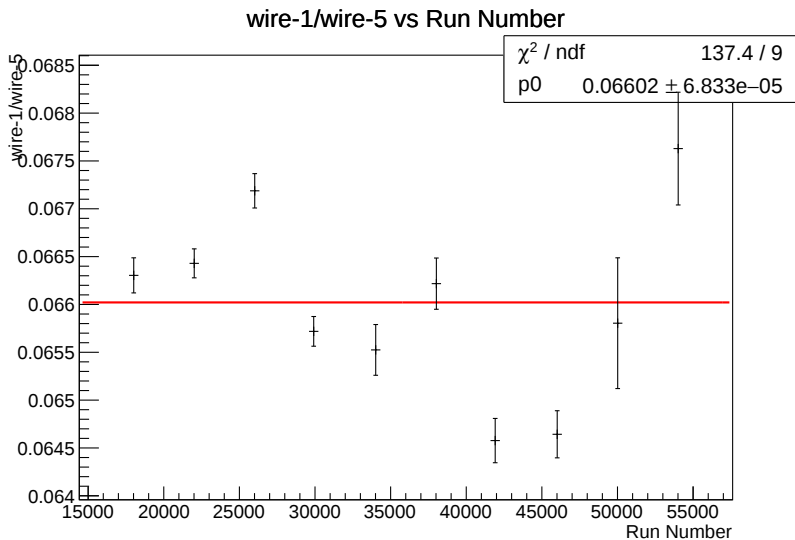
Wire to Wire Comparison - wire 1 over all



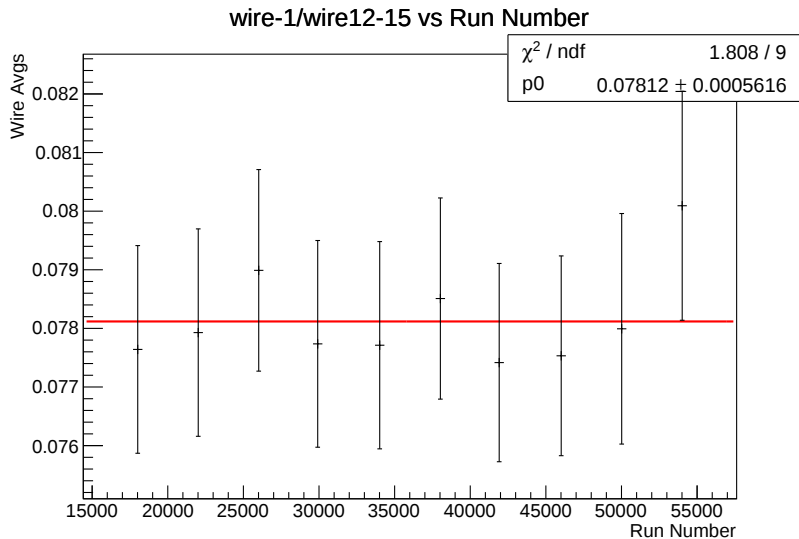
Wire to Wire Comparison - wire 1 over all-no error bars



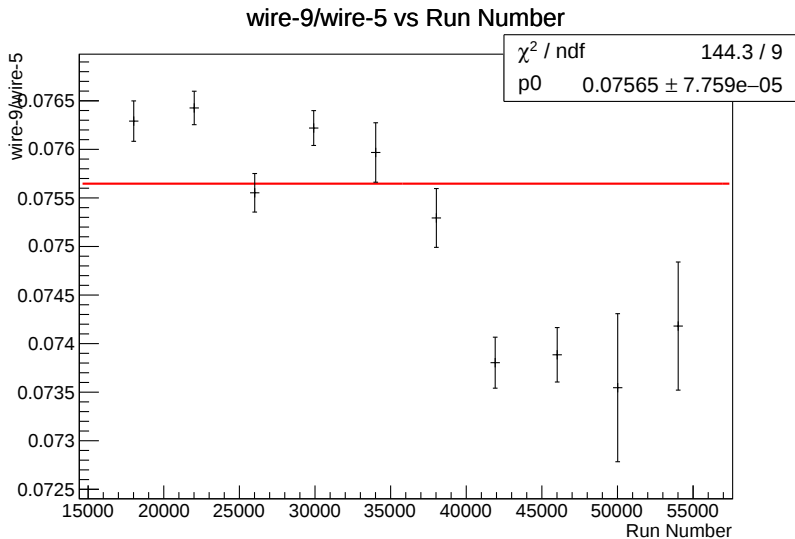
Wire to Wire Comparison - wire 1 over 5



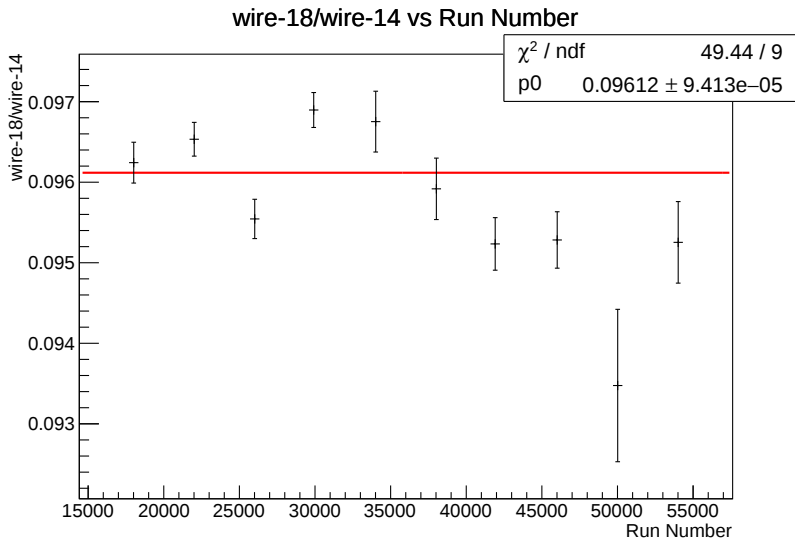
Wire to Wire Comparison - wire 1 over 12-15



Wire to Wire Comparison - wire 9 over 5



Wire to Wire Comparison - wire 18 over 14



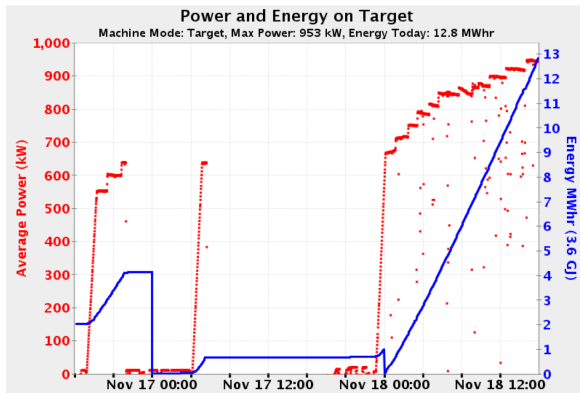
Summary

- error bars are large when averaging over whole target chamber
- dividing outer wires by inner wire in plane, or small group of inner wires in plane has similar patterns.

Future Plans:

- future plan to compare directly to proton power
- working with Paul on this

Beam Power Ramp



SNS Beam Info

As of 14:34:43 on November 18, 2015
To: Target, MPS1 mSec
Manual Beam Switch Turned On
MPS Allows Beam
Continuous Shot Mode
Power on Target: 948 kW
Charge to Target: 16.81E-6 C
Proton Energy: 939.5 MeV
Ring Frequency: 1.047 MHz
Beam Rate: 60 Hz
Beam On Turns: 890
Chopper Pulse Width On: 33