

TLMs at Pbar/Muon Progress since 8/25/11

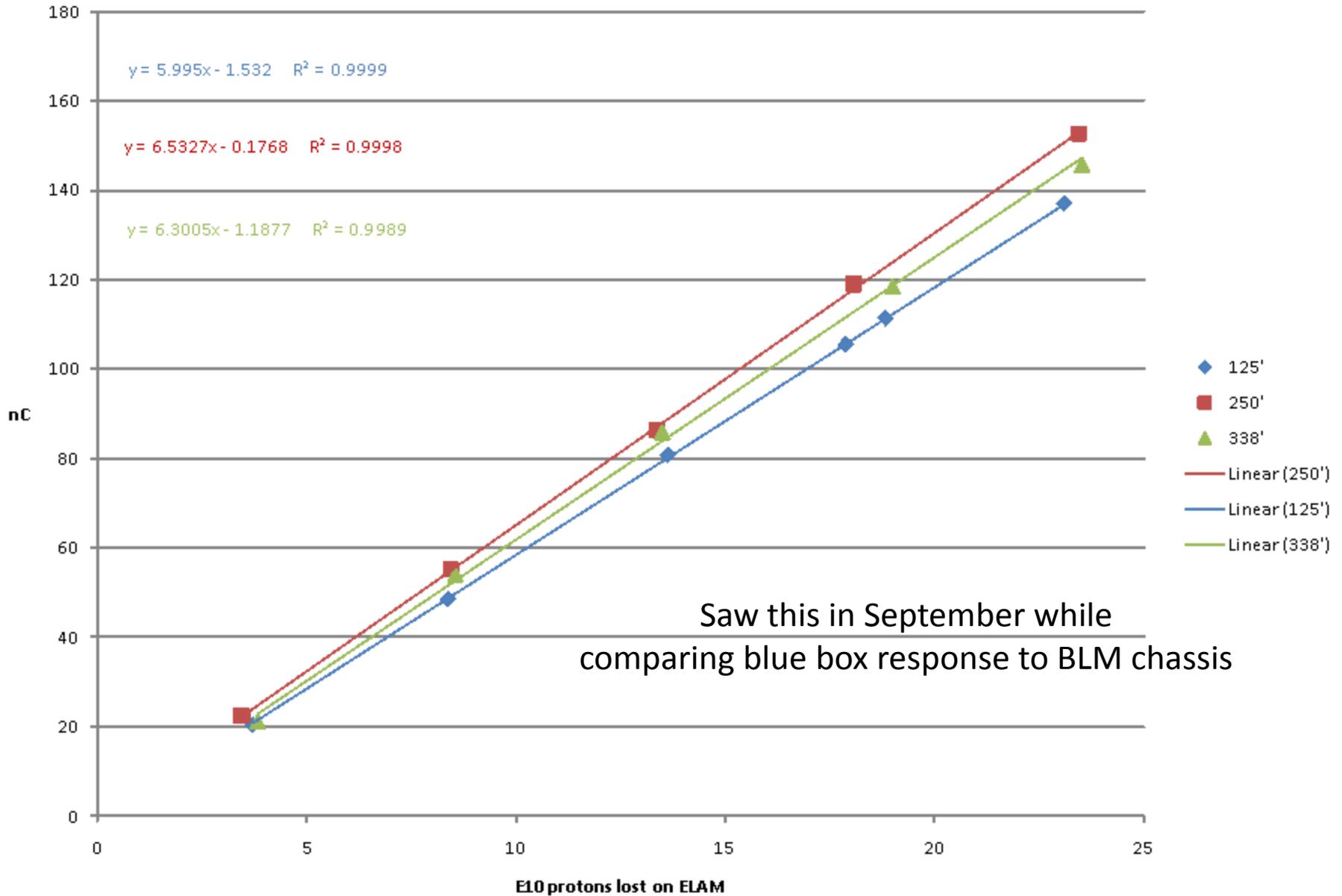
Meeting #4

December 15, 2011

TLMs History at Pbar/Muon

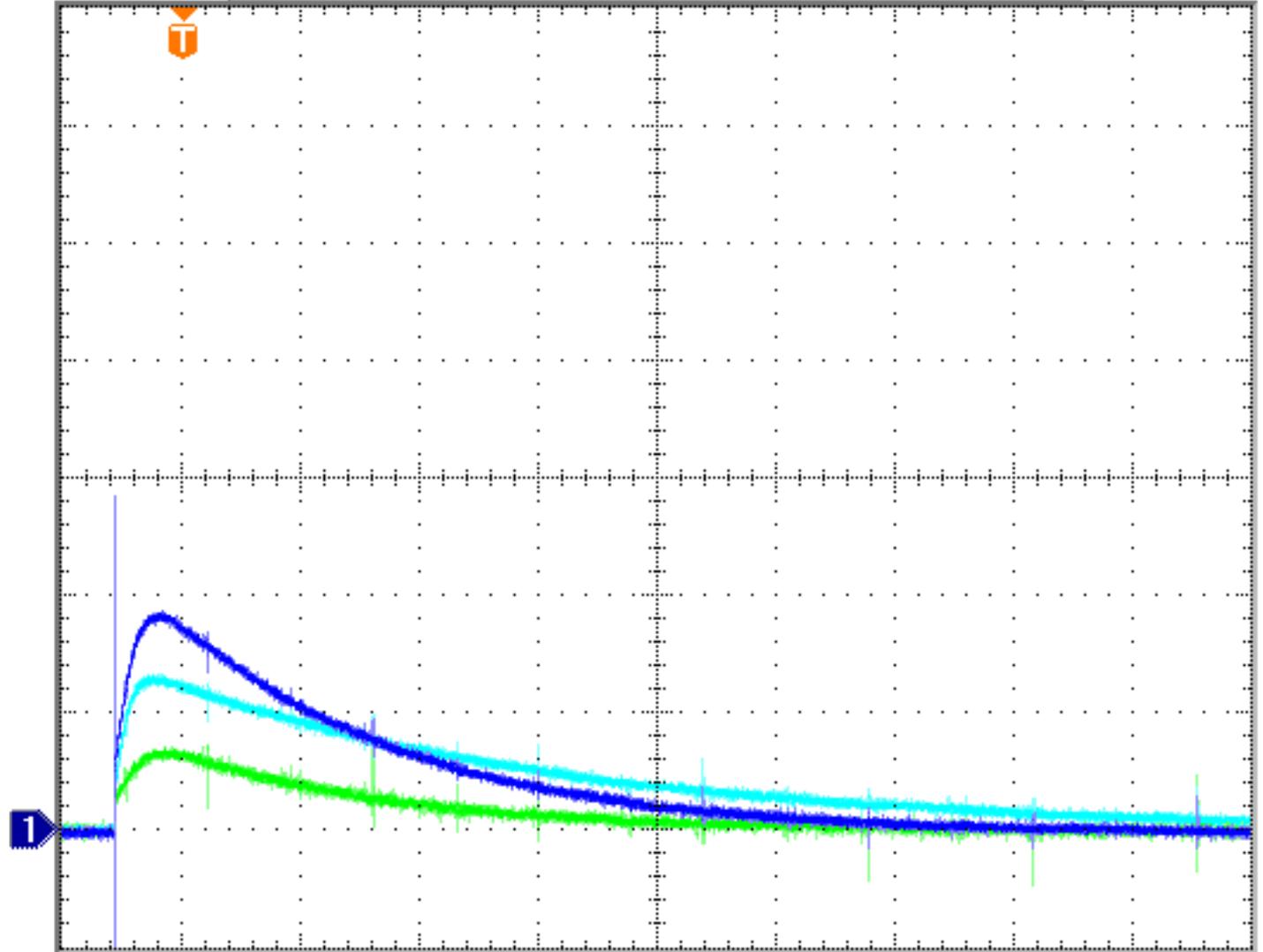
- 5/4/2011 - Director's review for mu2e
- 6/16 - first TLM meeting
- 6/29 - first 2 TLMs installed with 6 decade rate BLM cards
- 7/14 - first TLM signal
- 7/19 – second meeting
- 7/19 – first BLM integration cards installed
- 8/18 - Chipmunk digitizer circuit installed (Blue box)
- 8/25 – third meeting
- 8/26 - Installed 16 bit VME scalar for higher counting rate from blue box (1 kHz)
- 9/1 - Installed third TLM of different length 103 m (338')
- 9/2 - Standardized ACNET TLM responses on all electrometers to nC
- 9/13 – changed to 32 bit VME scalar
- 10/6 – Tried to pressurize TLMs – 6 psig 0.1 lpm
- 10/11 – reverted to unpressurized TLMs – 0.05 lpm
- 10/14 - Meeting with ES&H Section to get turnover for blue box construction
- 10/18 – Strategy for setting trip levels becomes apparent
- 10/26 – installed 1' TLM at A2B7
- 10/31 – begin plateau measurements – suggested by ES&H section
- 10/31 – Established remote operation of TLM HV supply
- 11/18 – sequencer driven data collection for plateaus established
- 11-21 – low and medium intensity plateaus completed
- 11/23 – TOR910 rescaled for high intensity
- 12/8 – Marv provides 6517B electrometer for high intensity plateaus – suggested by ES&H section
- 12/8 – ES&H Section requests charge collection time measurement (TLMS on scope terminated in to 50 Ω)
- 12/15 – 4th meeting

TLM response to known beam loss on ELAM measured by blue box



Tek Run

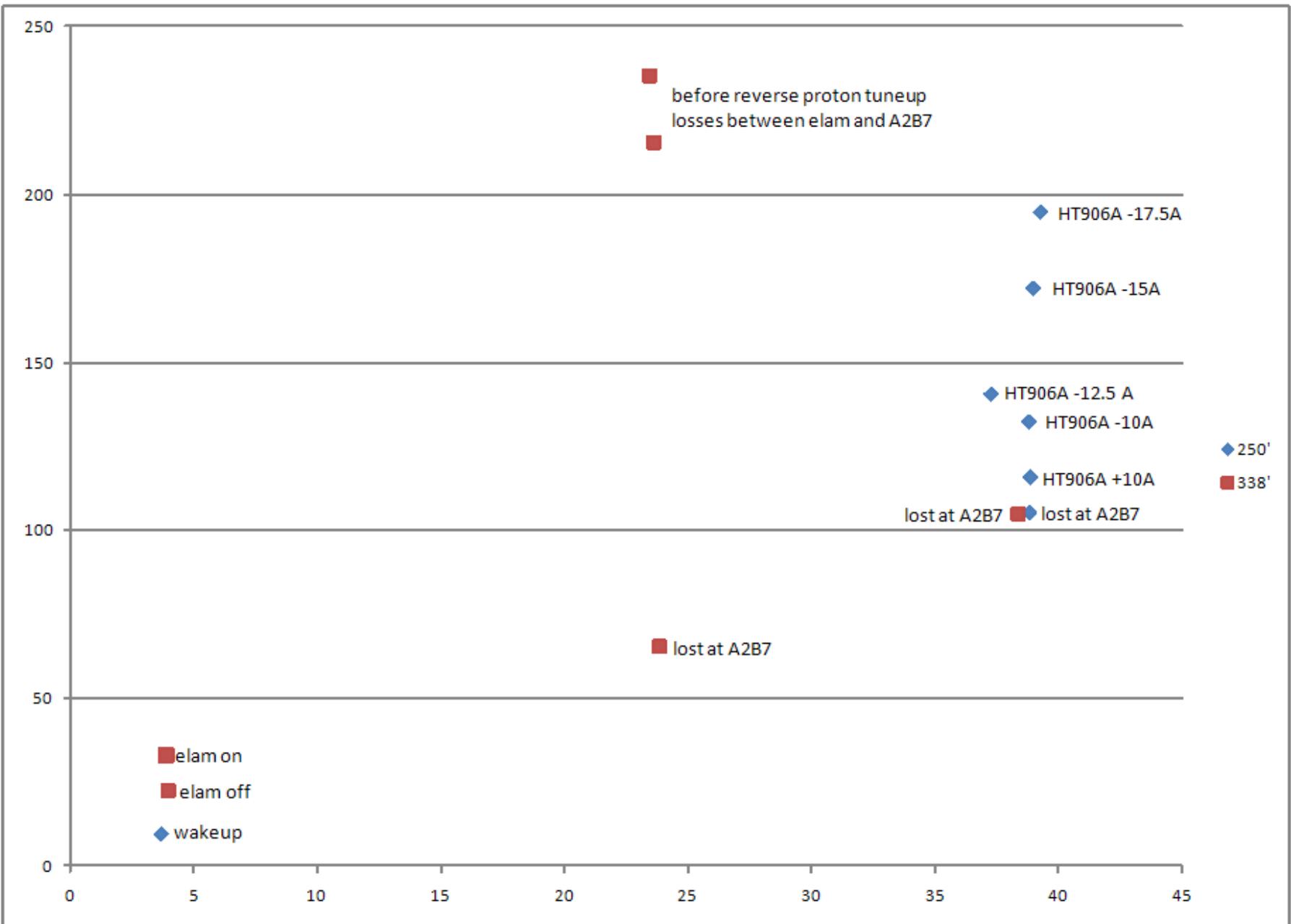
Trig?



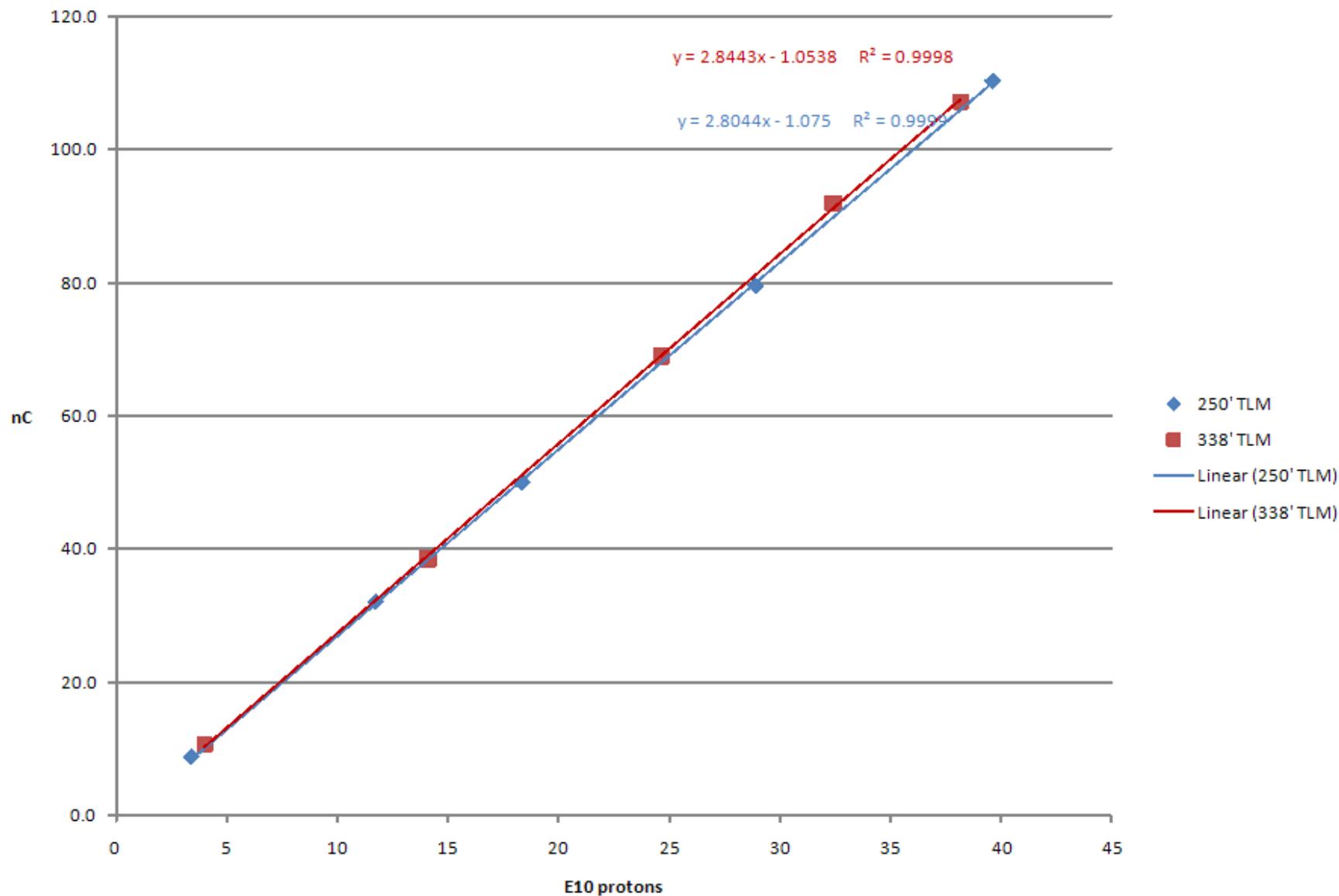
Ch1 – 125'
Ch2 – 250'
Ch4 – 338'

Ch1 2.00 V Ch2 2.00 V M 2.00ms A Ext 200mW
Ch4 2.00 V
10.20 %

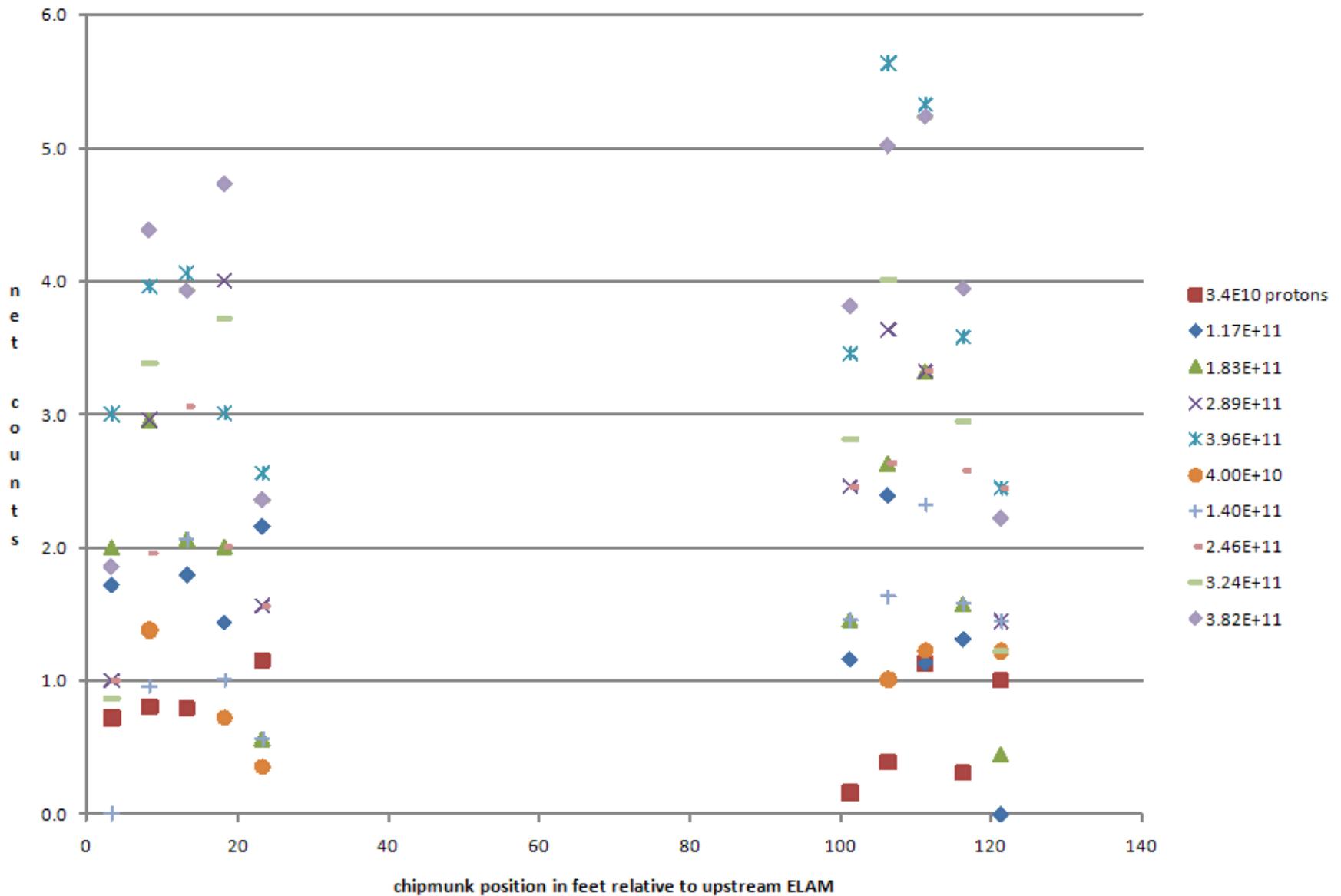
20 Sep 2011
10:53:31



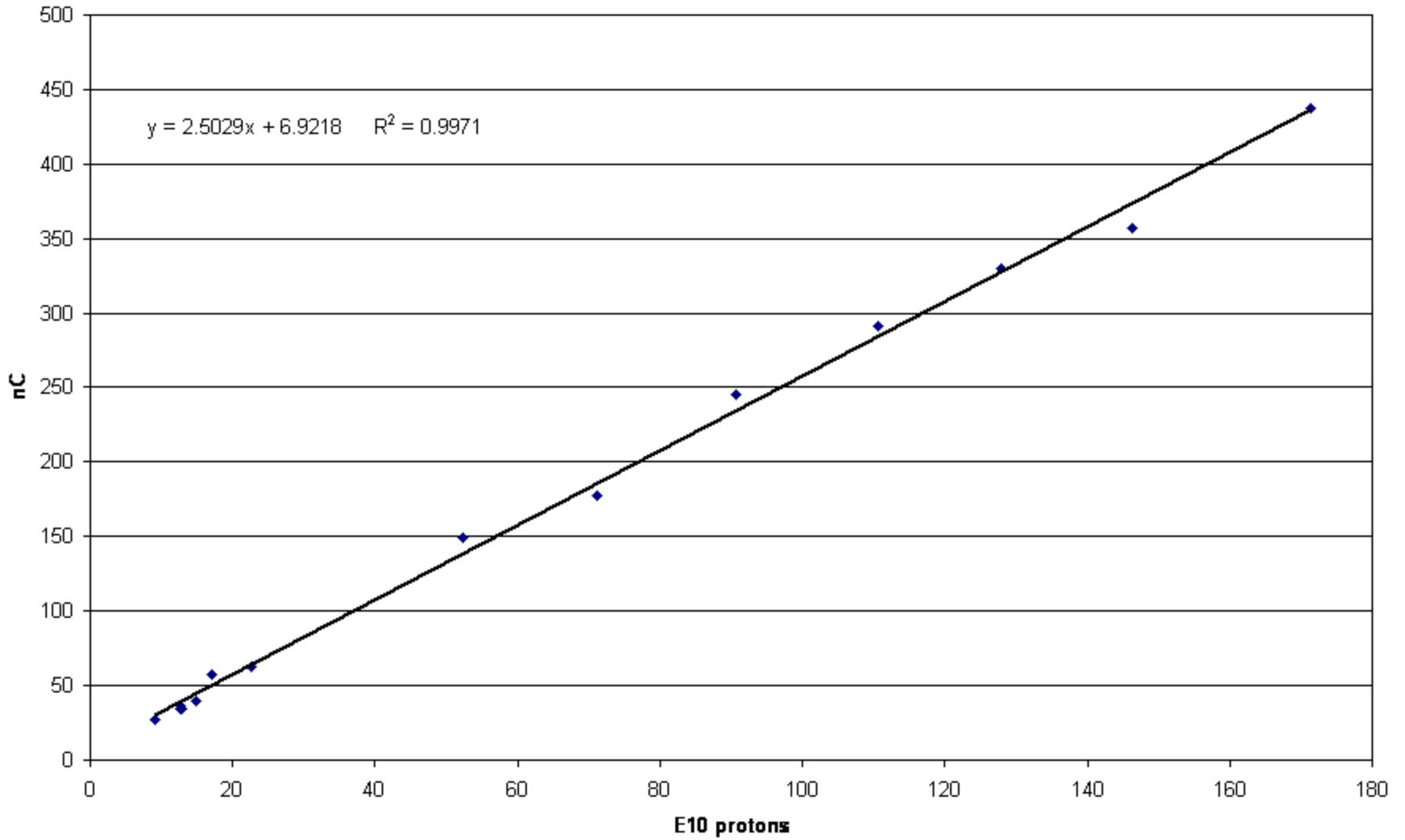
250' & 338' TLM response for beam lost at A2B7



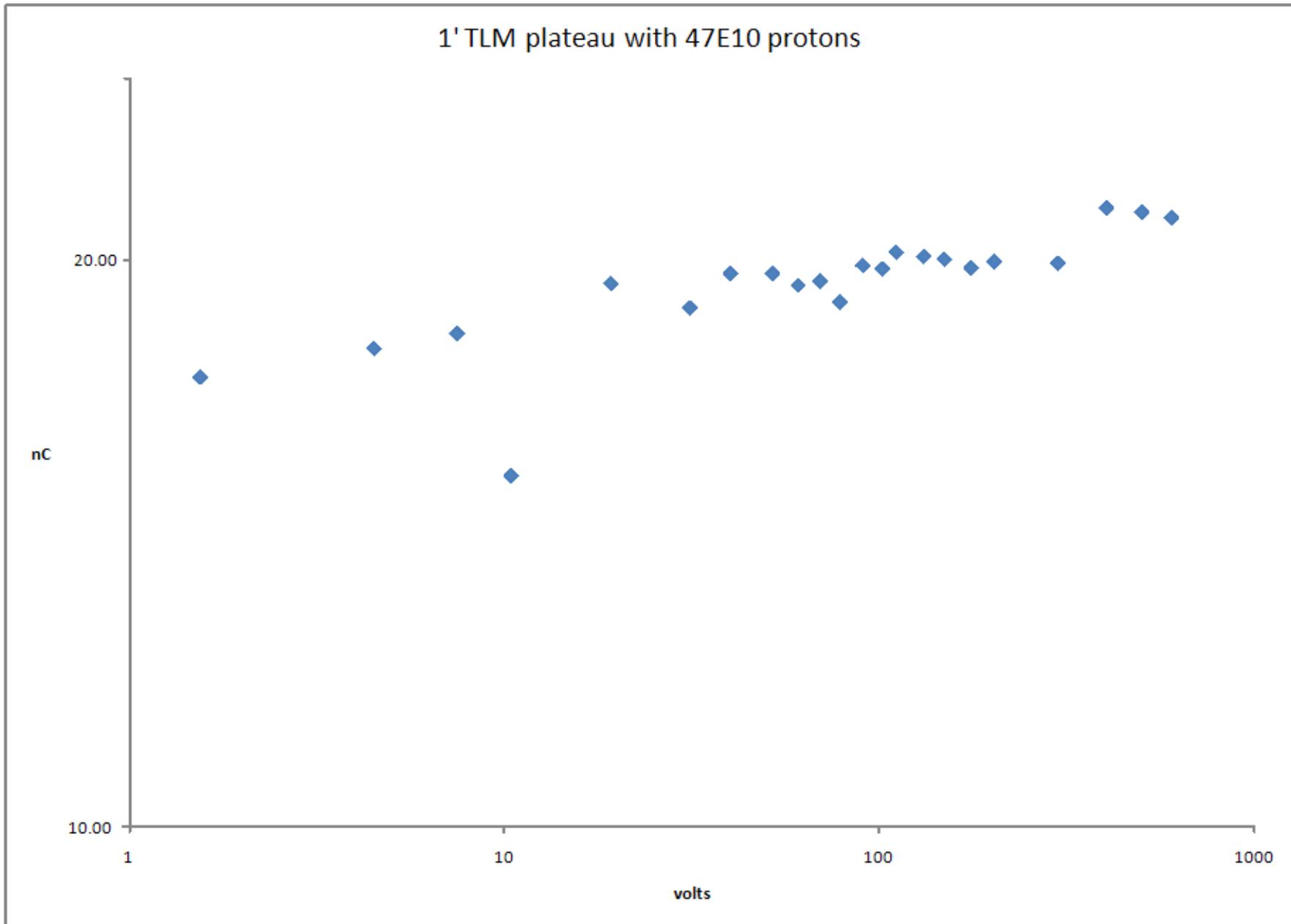
chipmunk net counts by position for beam loss at A2B7



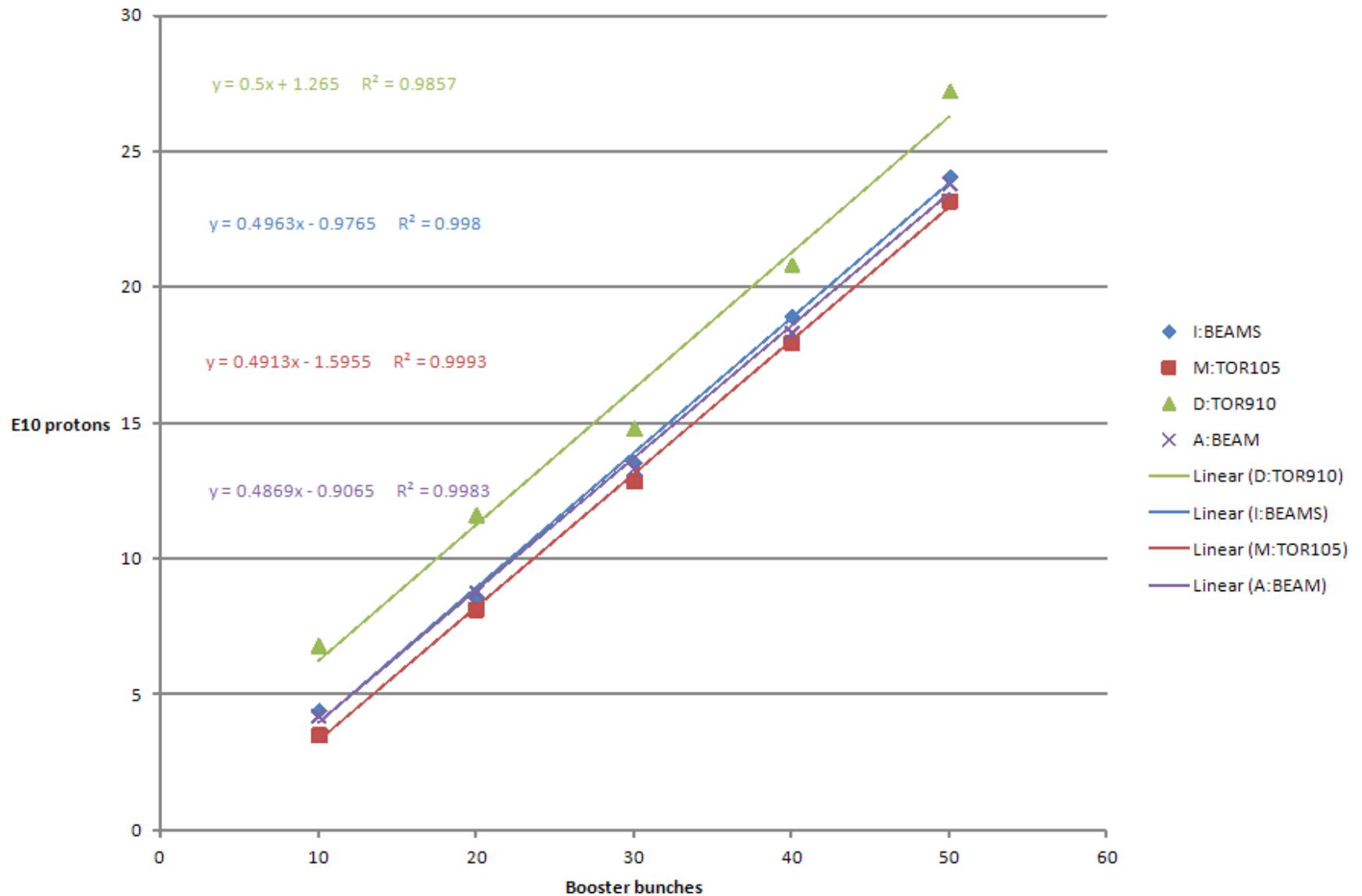
Blue box response to multipulse losses at A2B7



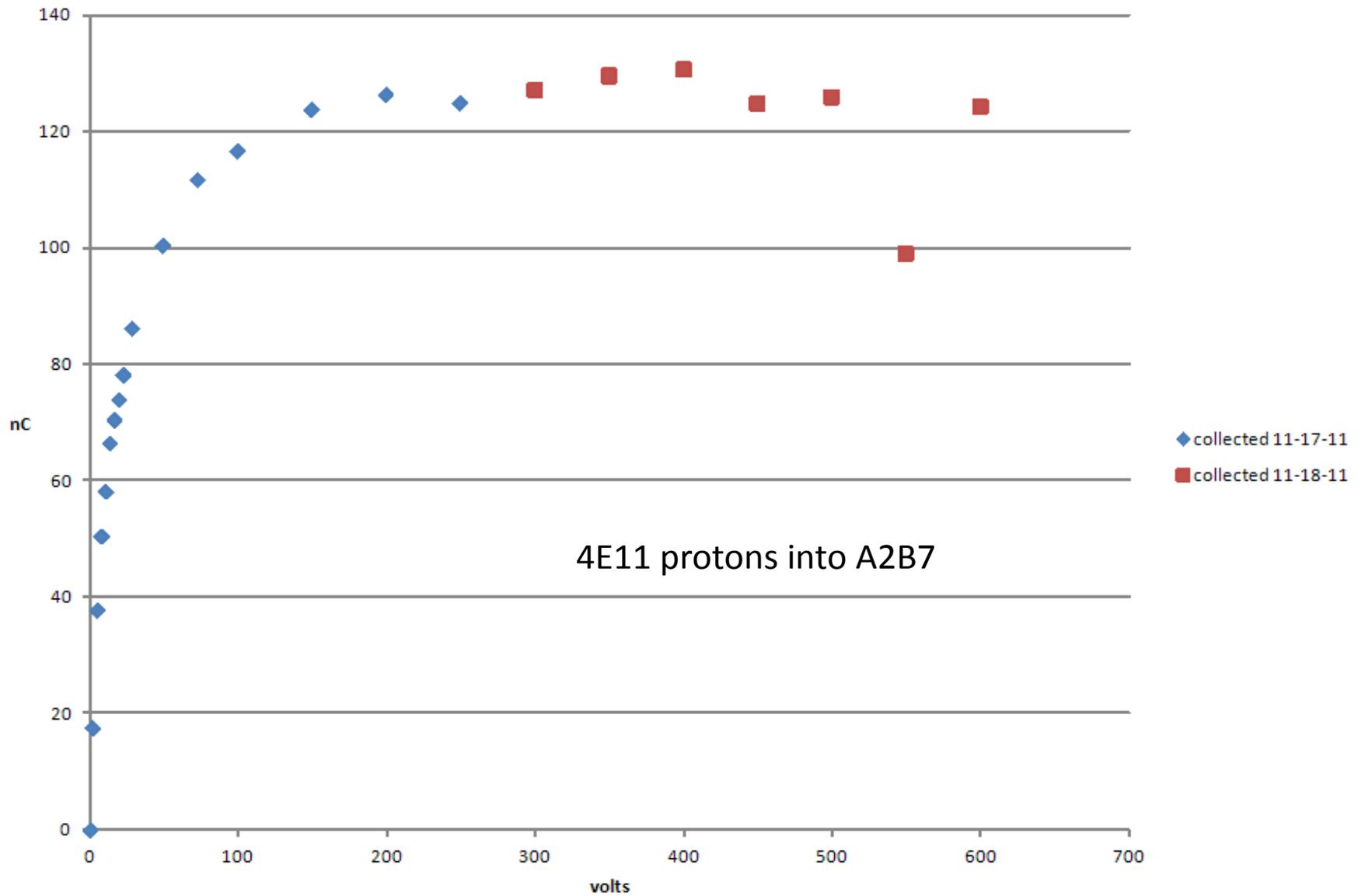
1' TLM plateau with 47E10 protons



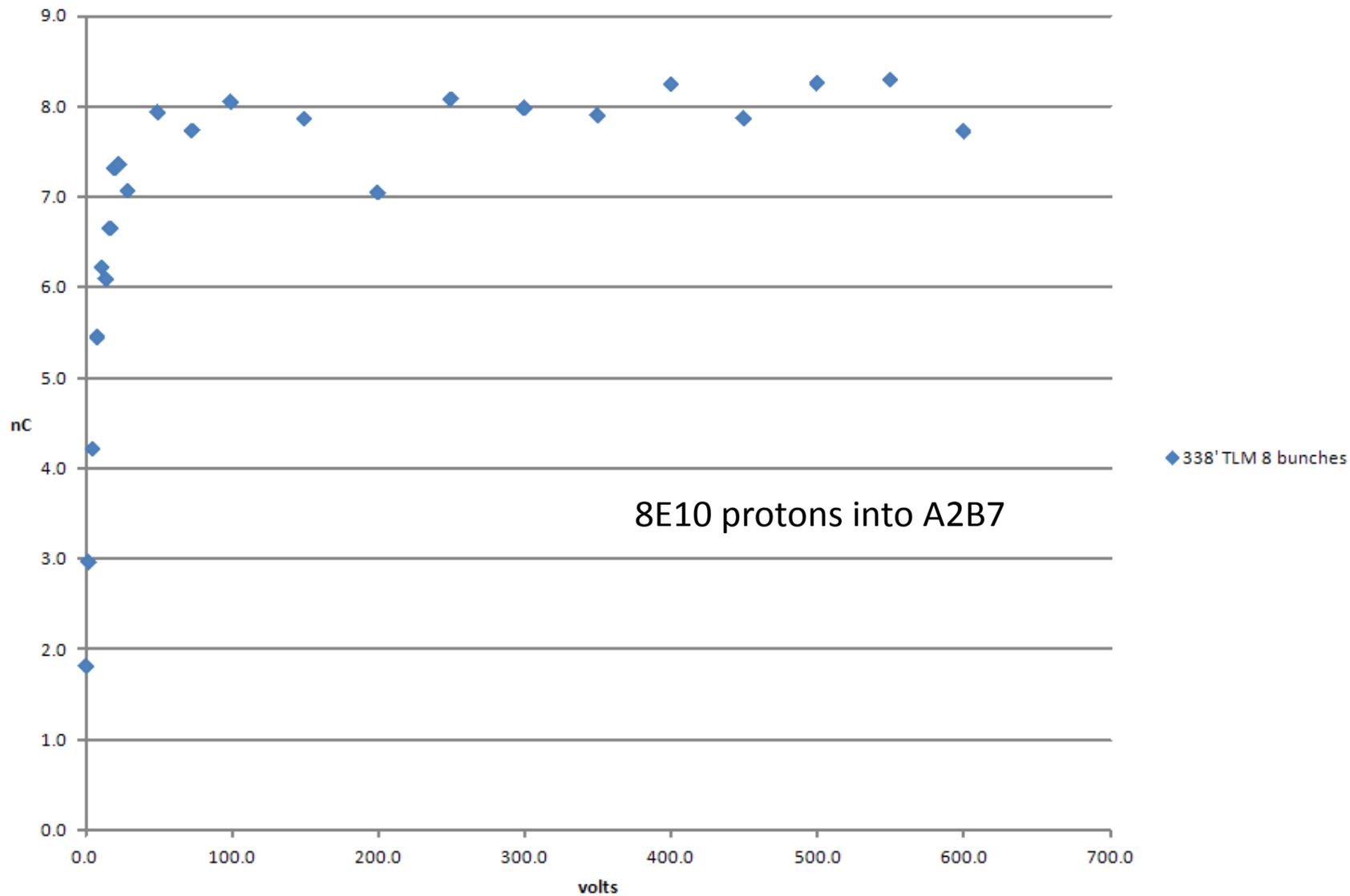
Toroid responses for reverse proton injection to Accumulator



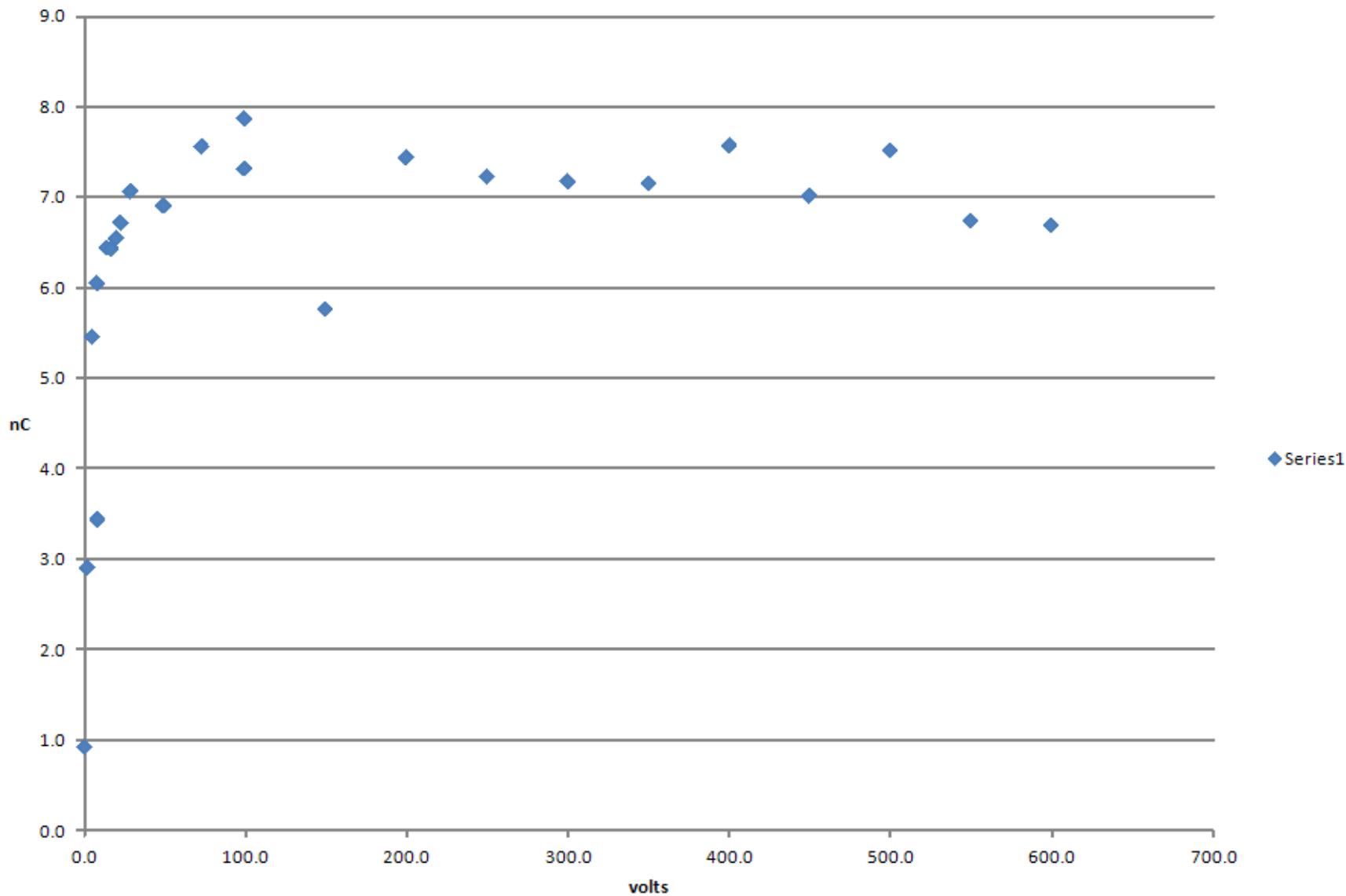
338' TLM plateau



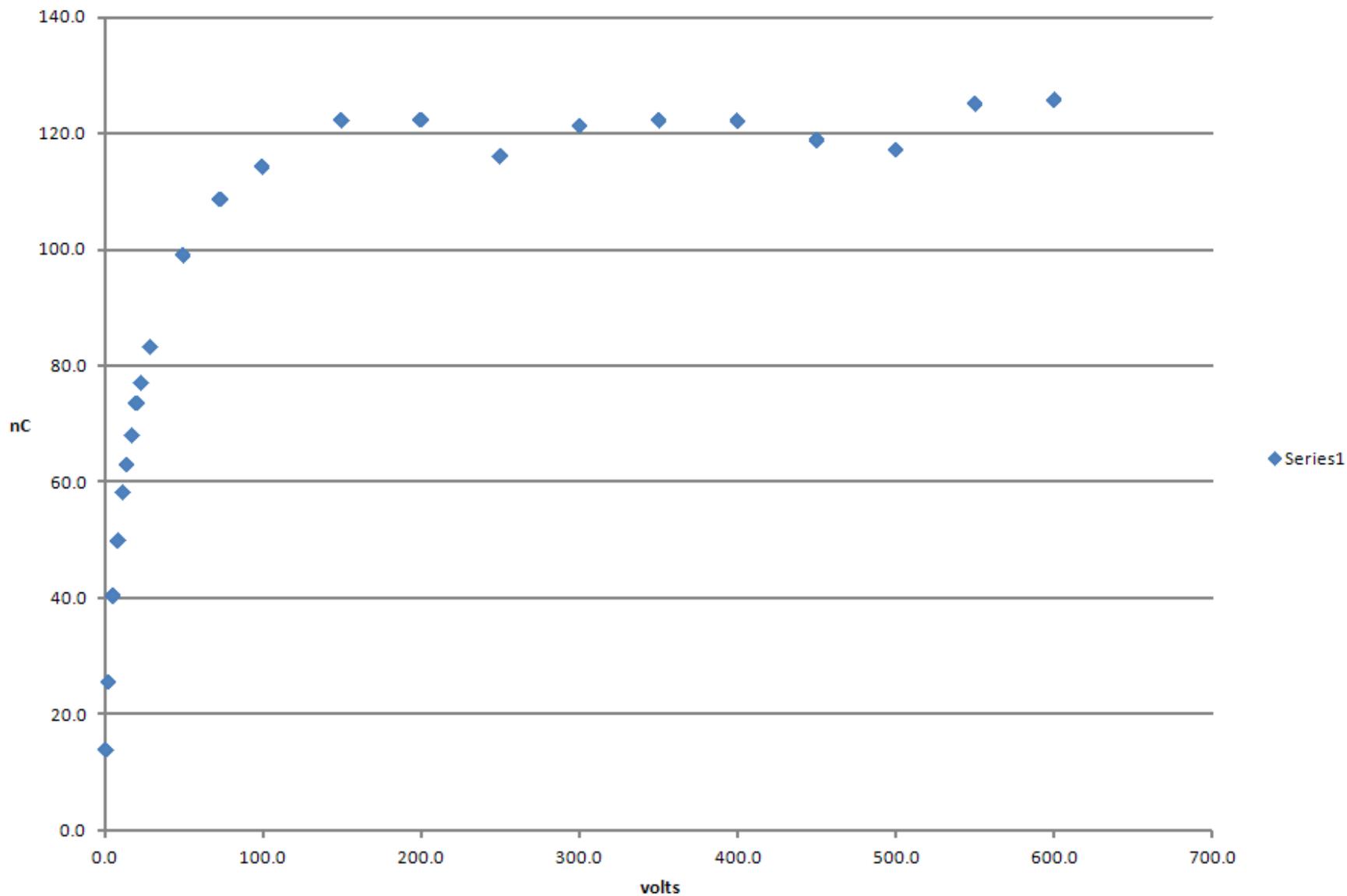
338' TLM 8 bunches



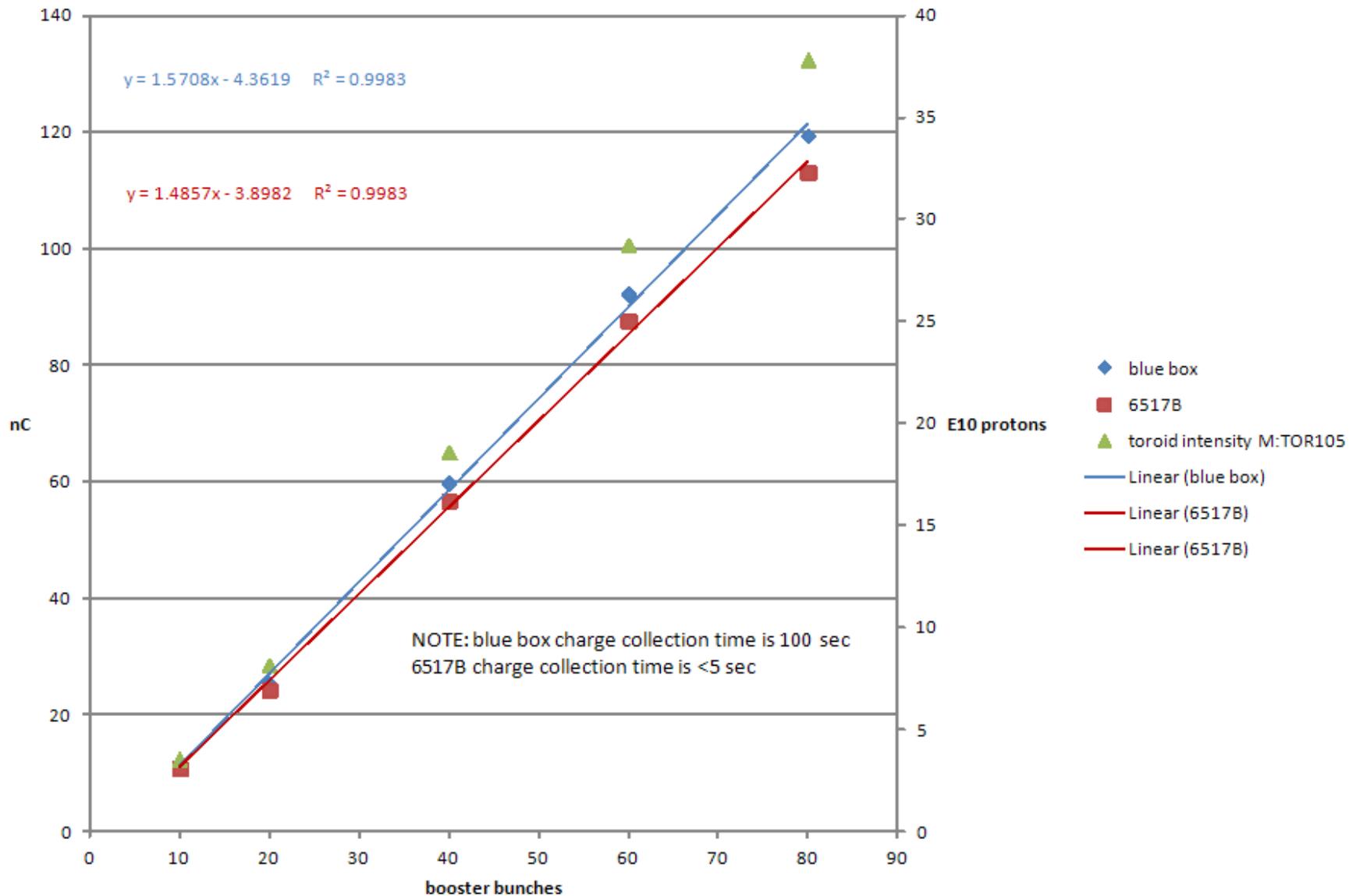
250' TLM 8 bunch plateau



250' TLM 80 bunch plateau



Blue box and 6517B comparison



Next steps

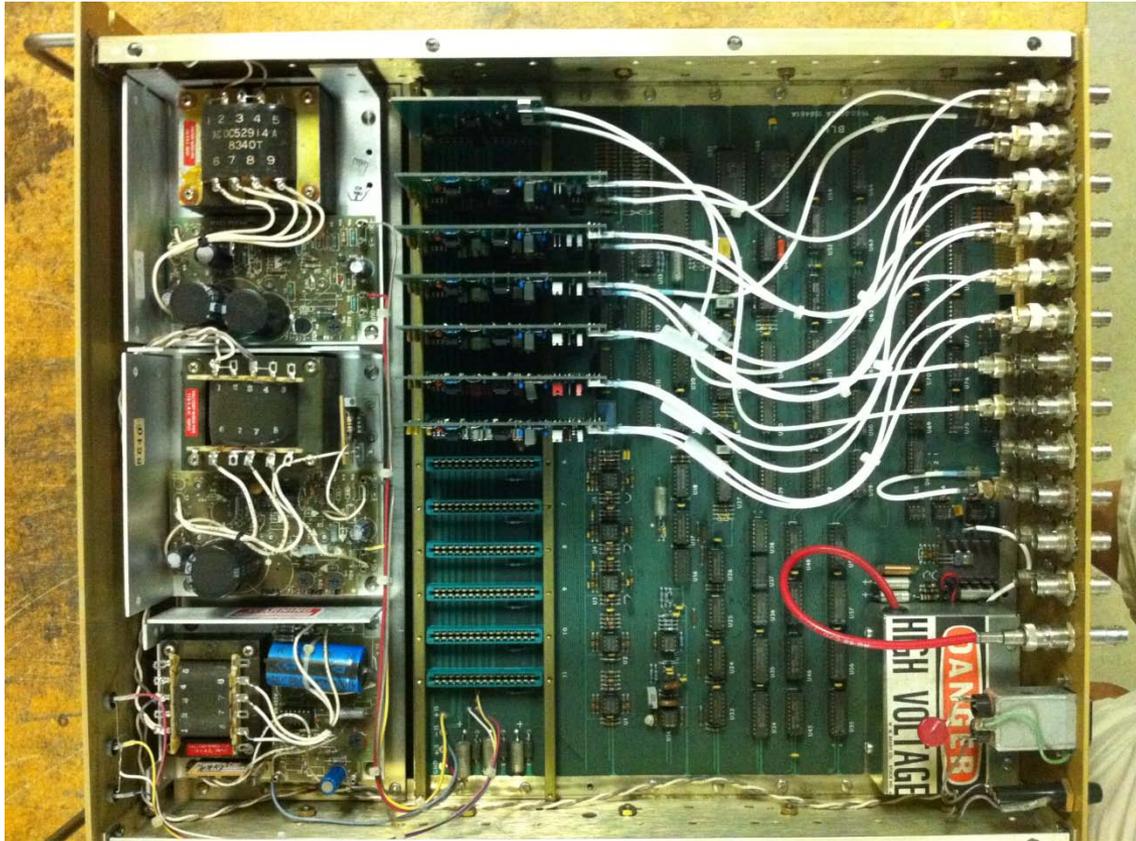
- Finish charge collection time measurement
 - Probably requires max intensity to get a signal
- Do high intensity plateaus for 250' and 338' TLMs
 - Use 6517B for one and blue box for the other
 - Then switch
 - Look for roll off in blue box response

TLM electronics development resources

- Management
 - EE?
 - ES&H?
- M&S
 - Probably need a budget for this
 - First, need an estimate?
 - Funded by users?
 - ES&H
 - Mu2e
 - Pixie
 - Others
- Resources
 - ES&H files
- Labor
 - Marv
 - Others?

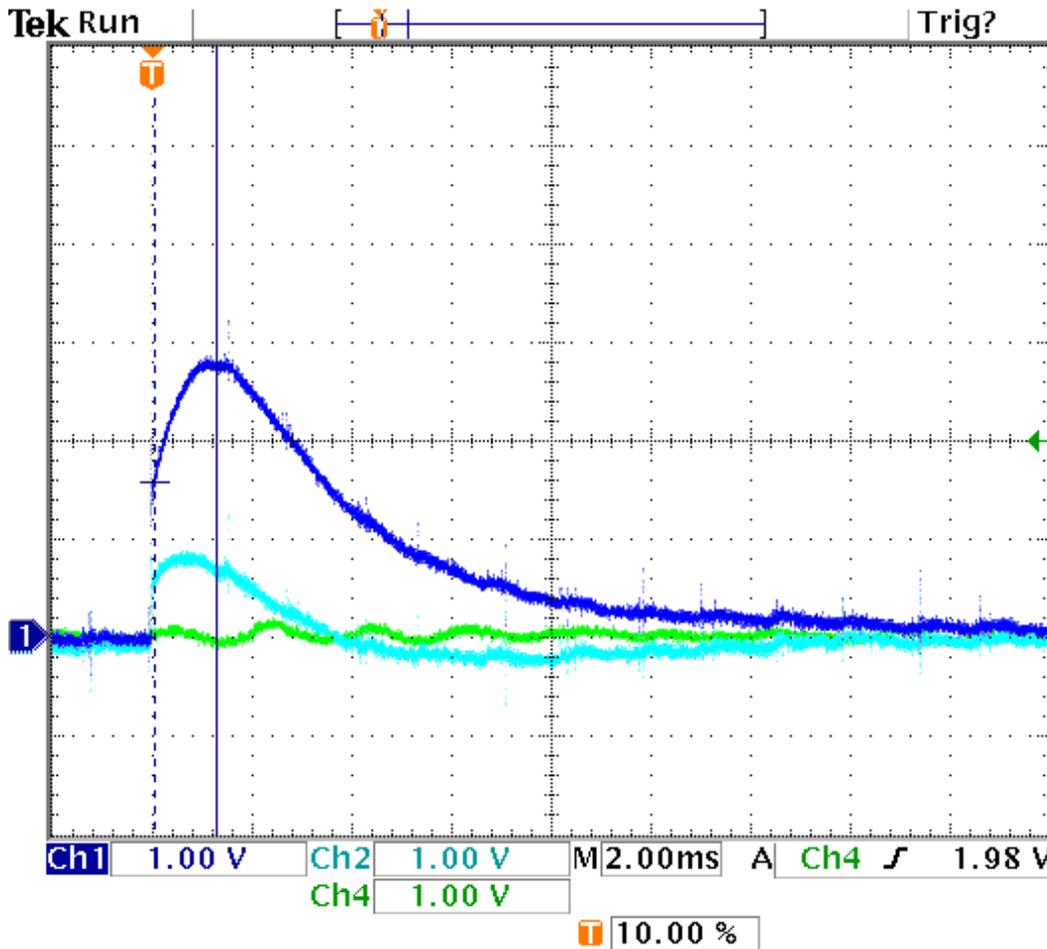
Backup slides

Since the last meeting



Current BLM chassis contains:
6 decade log rate cards
0.014 RADS
0.14 RADS
1.4 RADS
14 RADS

Scope pictures



Δ: 1.16 V
@: 2.72 V
Δ: 1.24ms
@: 1.28ms

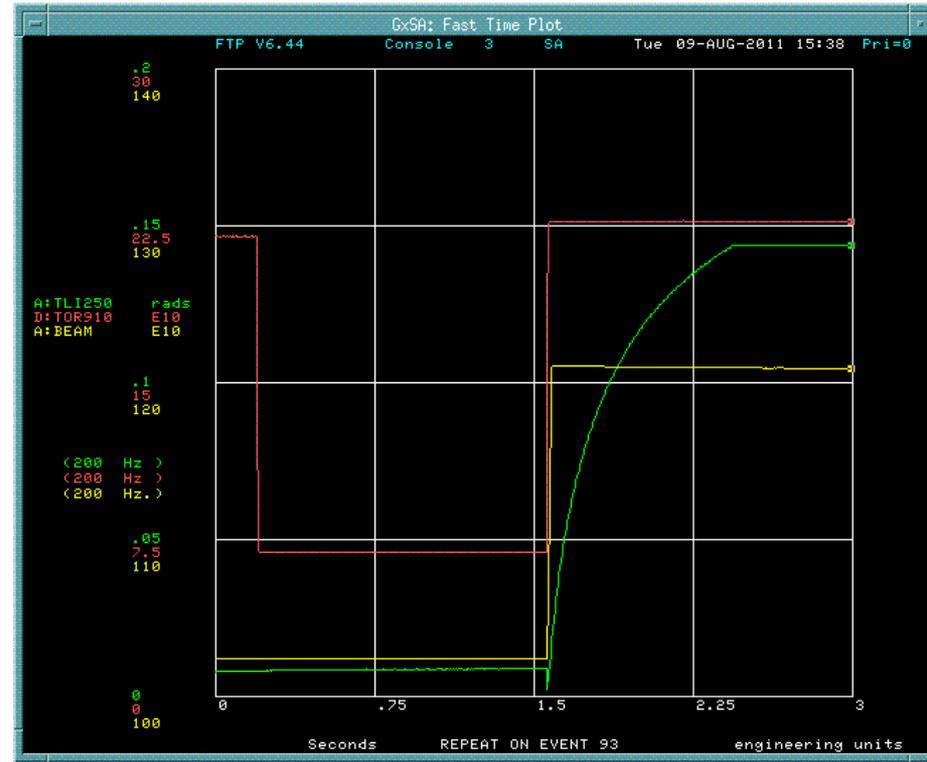
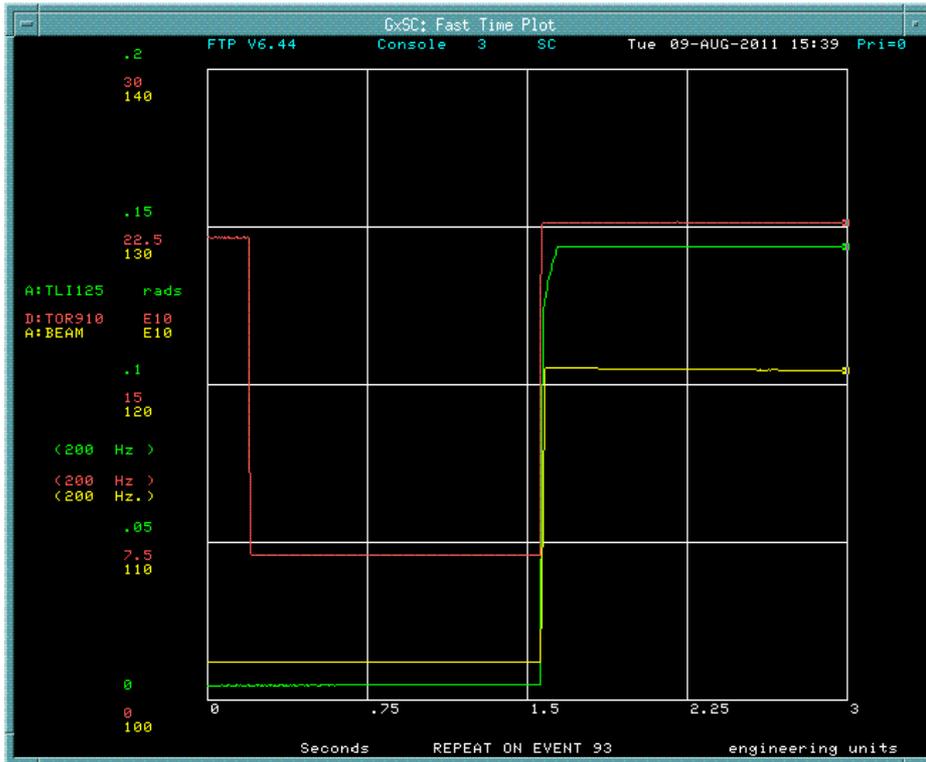
Ch1 Max 3.20 V 125 foot response

Ch2 Max 1.24 V 250 response

50 Booster bunches
Partial scraping loss on elam

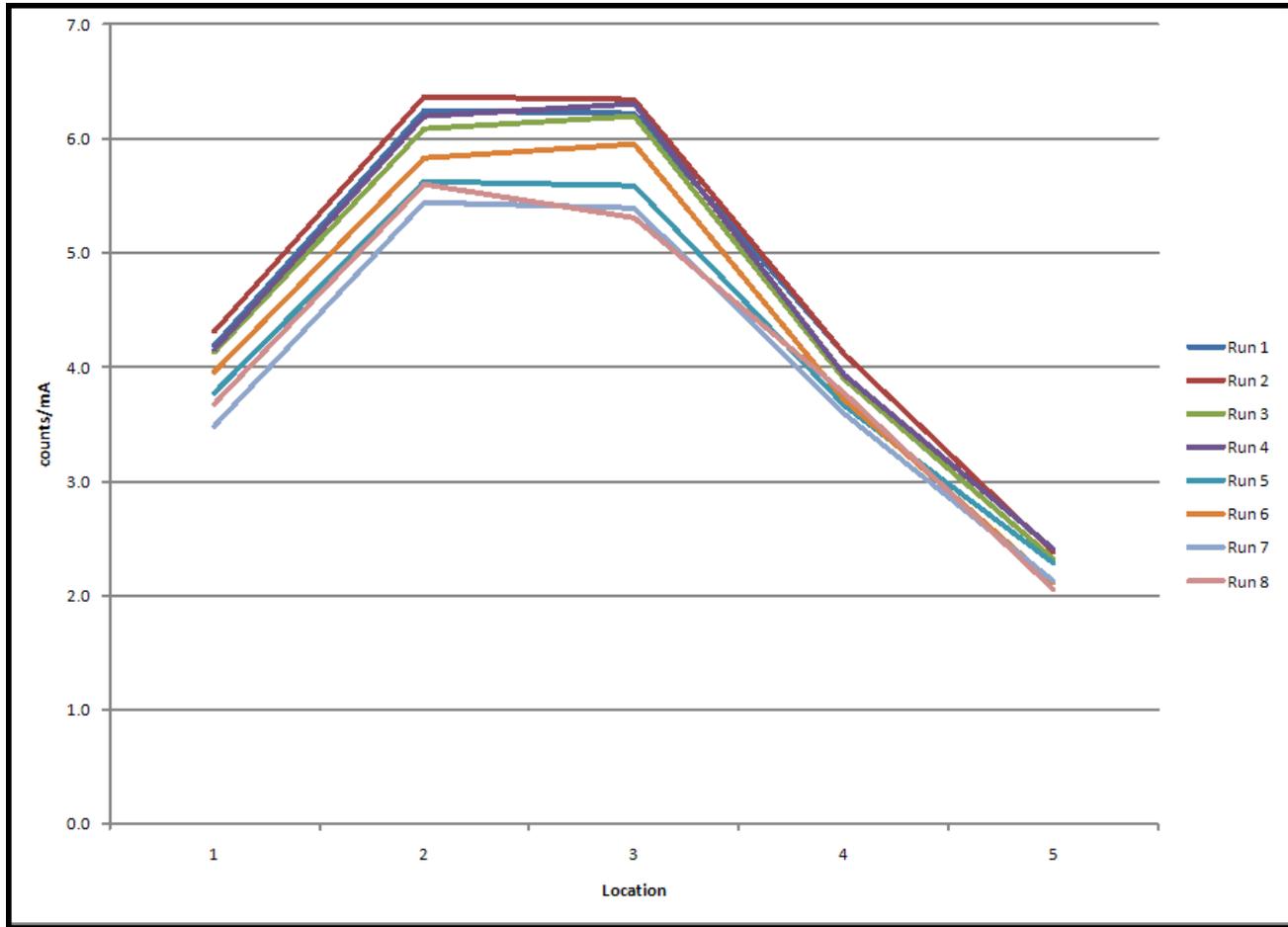
9 Aug 2011
14:38:26

0.14 RAD cards saturate



Partial scraping loss on ELAM
50 Booster bunches
D:HT906A + 10A

Repeated 2000 Pbar SA measurement

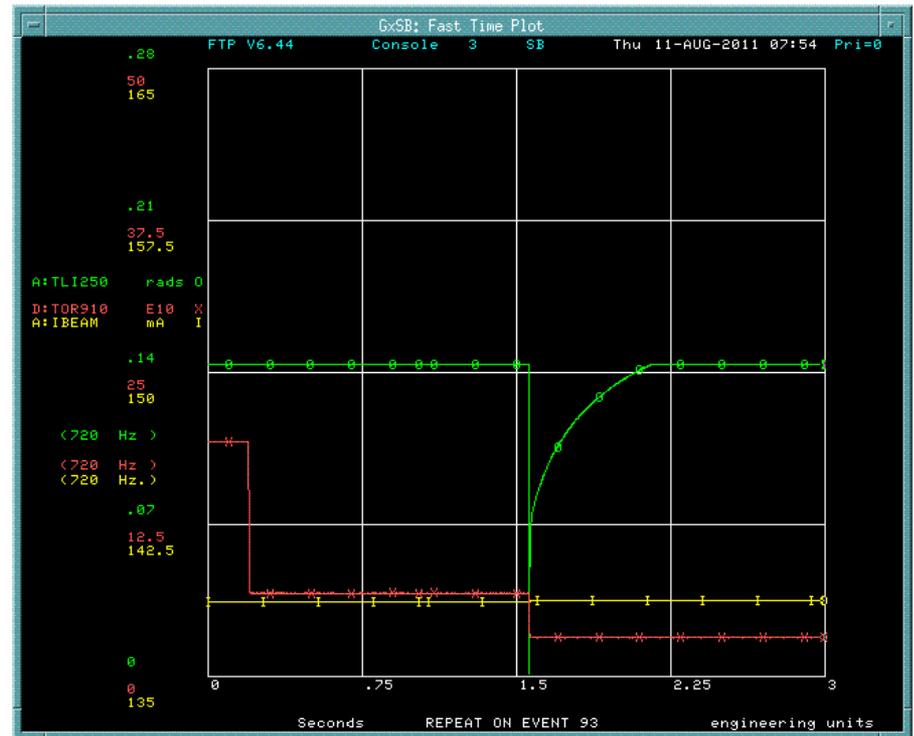
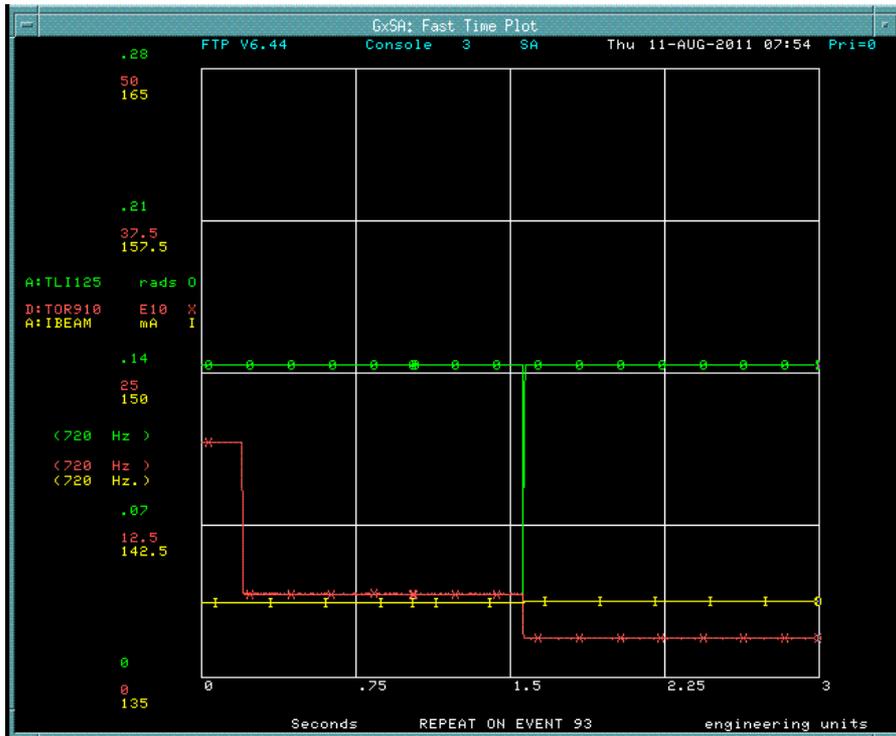


Counts per mA lost

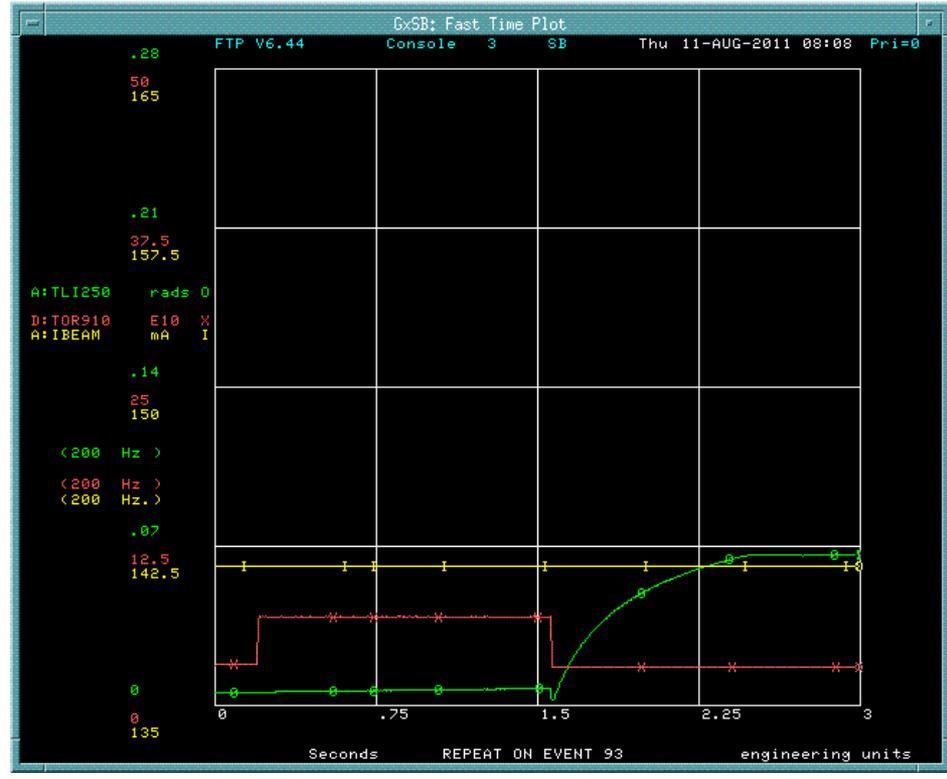
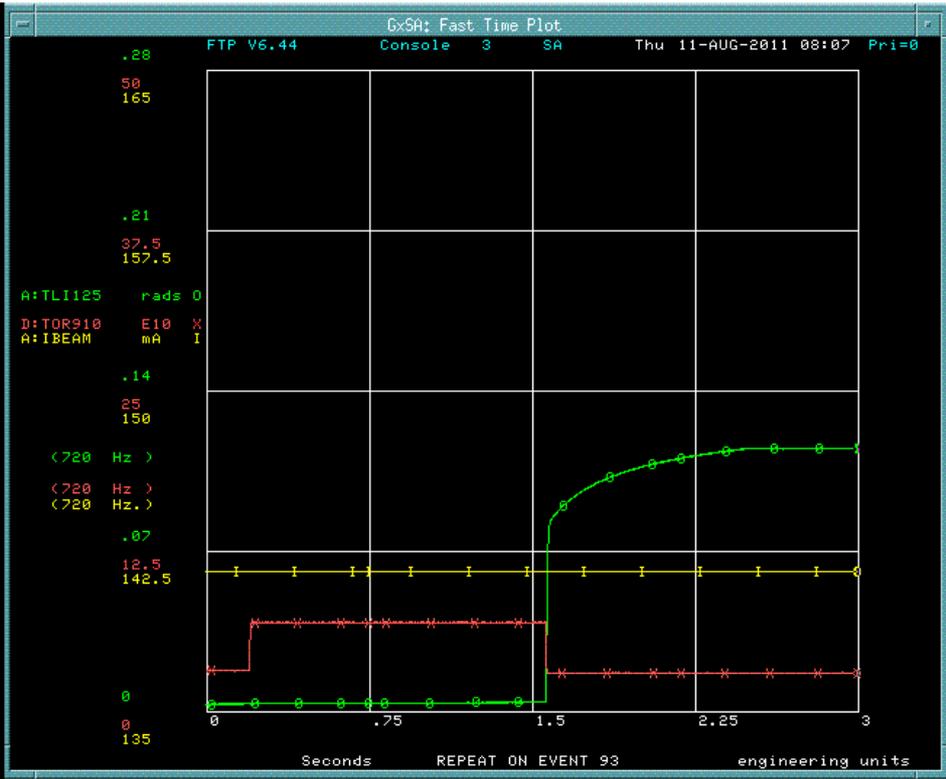
Expected these curves to be consistent

Demonstrates that scraping loss is unreliable technique to establish response

Single resets do not clear BLM cards in all cases

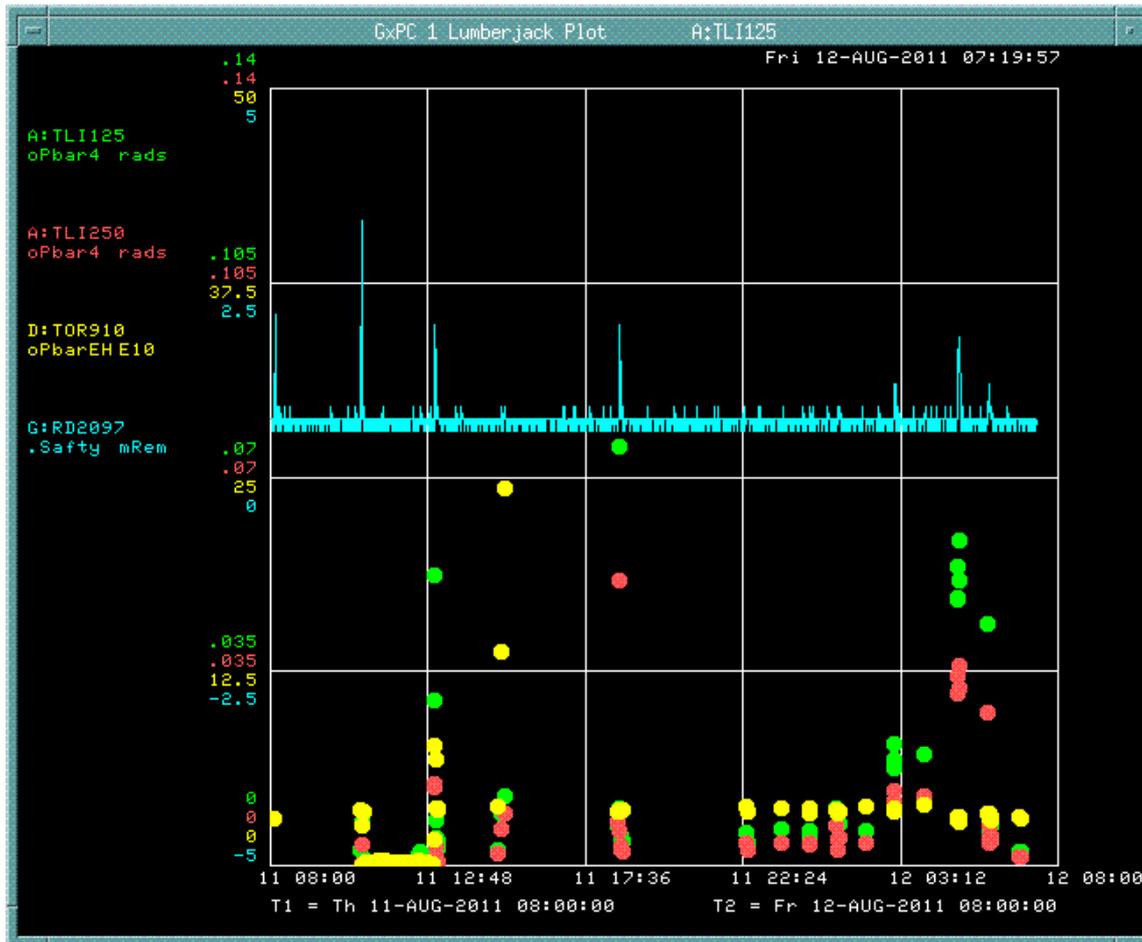


Clear on 00 event and 93 event



Used reset at beginning of transfer timeline to clear integrator

TLMs samples on 93 reverse proton tuneup event



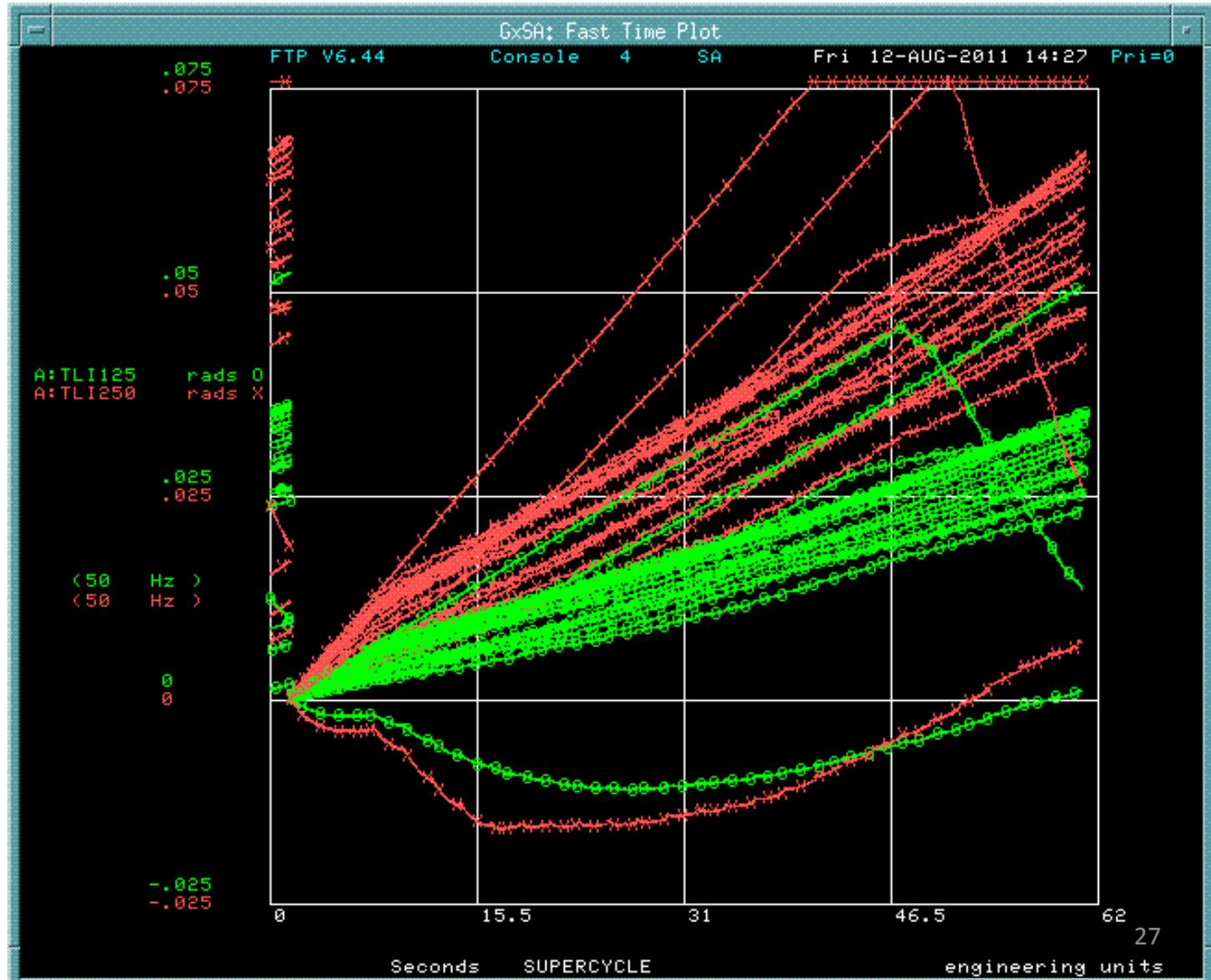
Transfers over 24 h period

TLM response coincident with chipmunk response outside of shielding

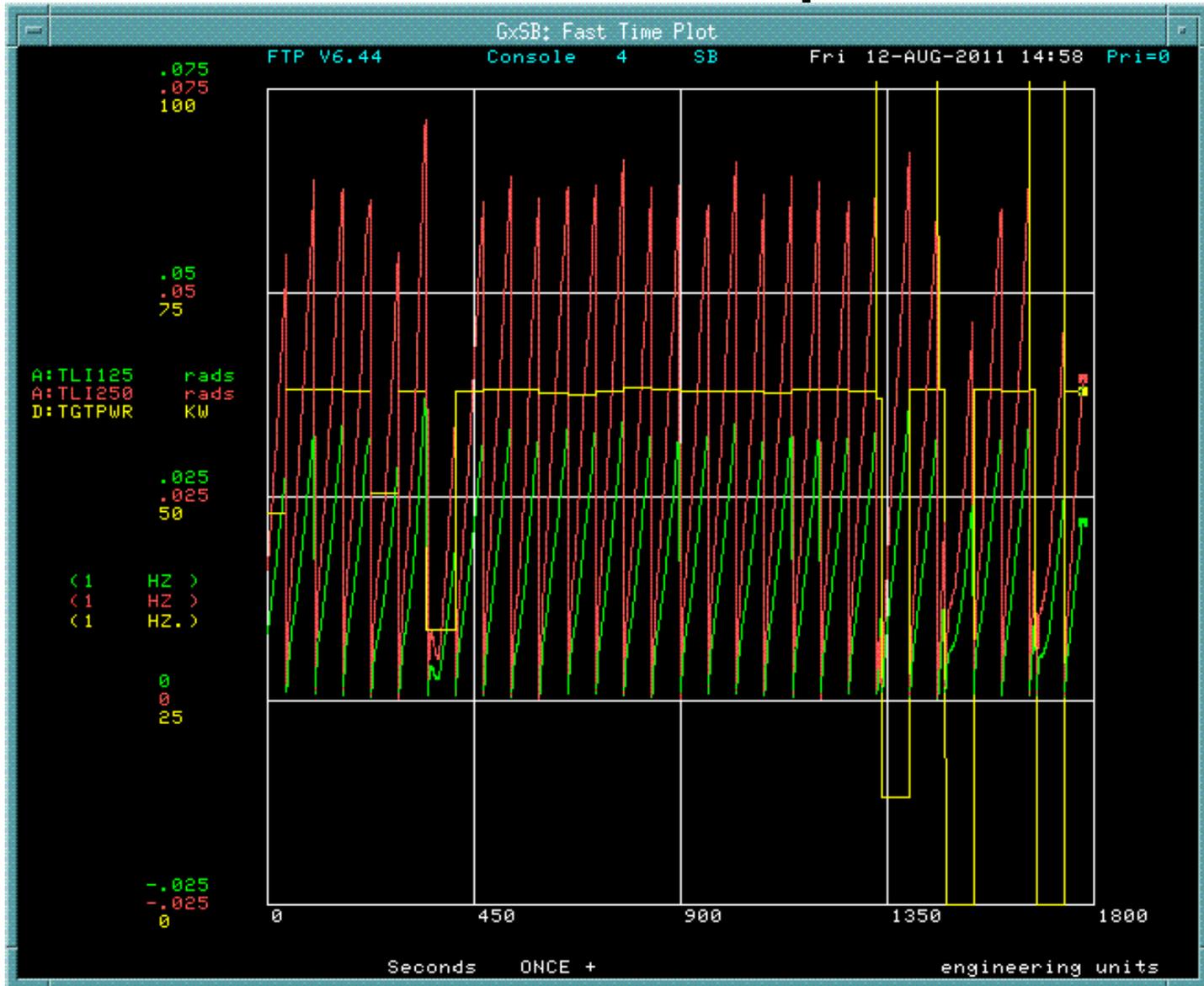
Small negative currents occur

e.g. when
beam goes away

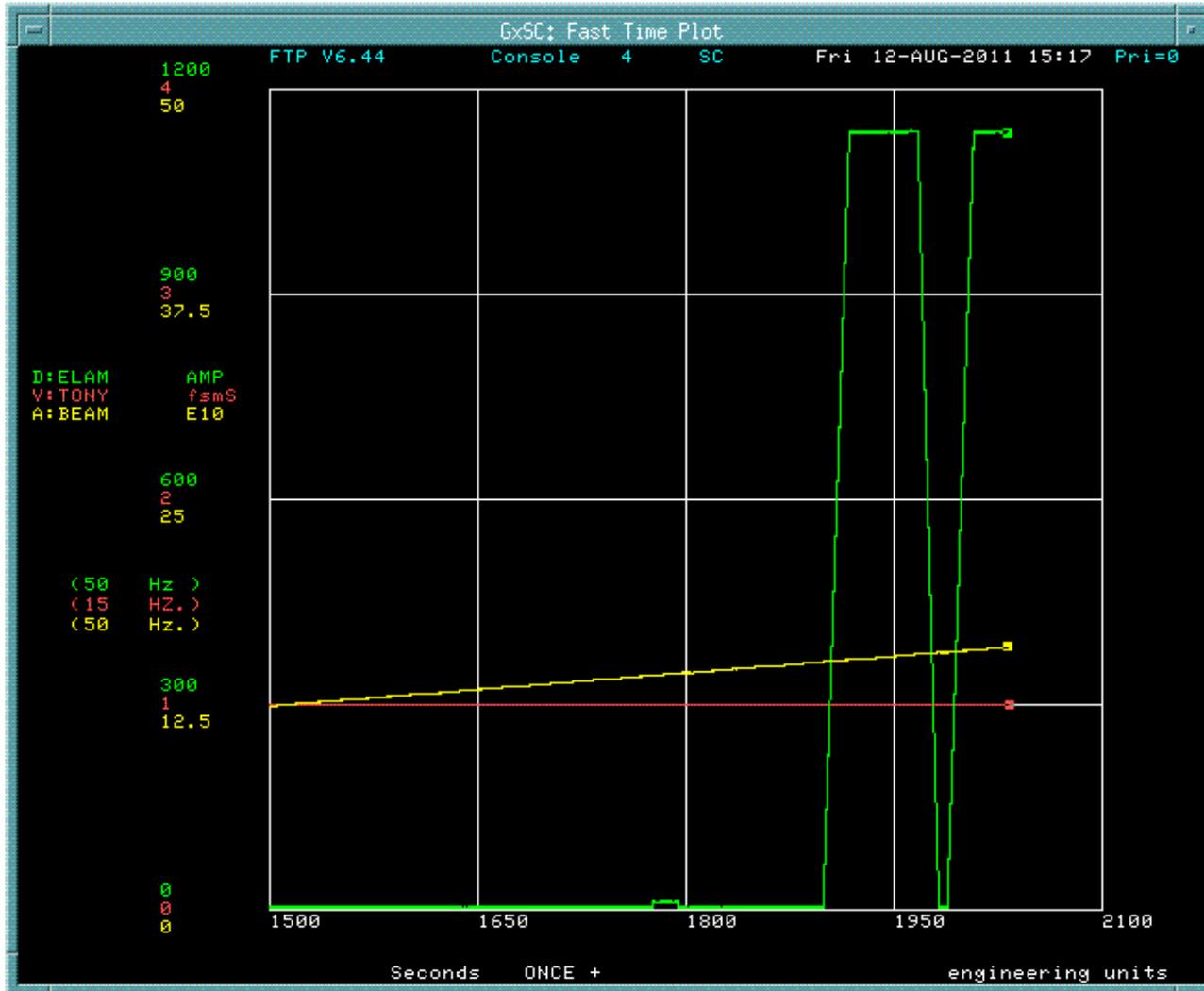
Chipmunks
have Cs-137
source to
drive
current



Some minutes of operation

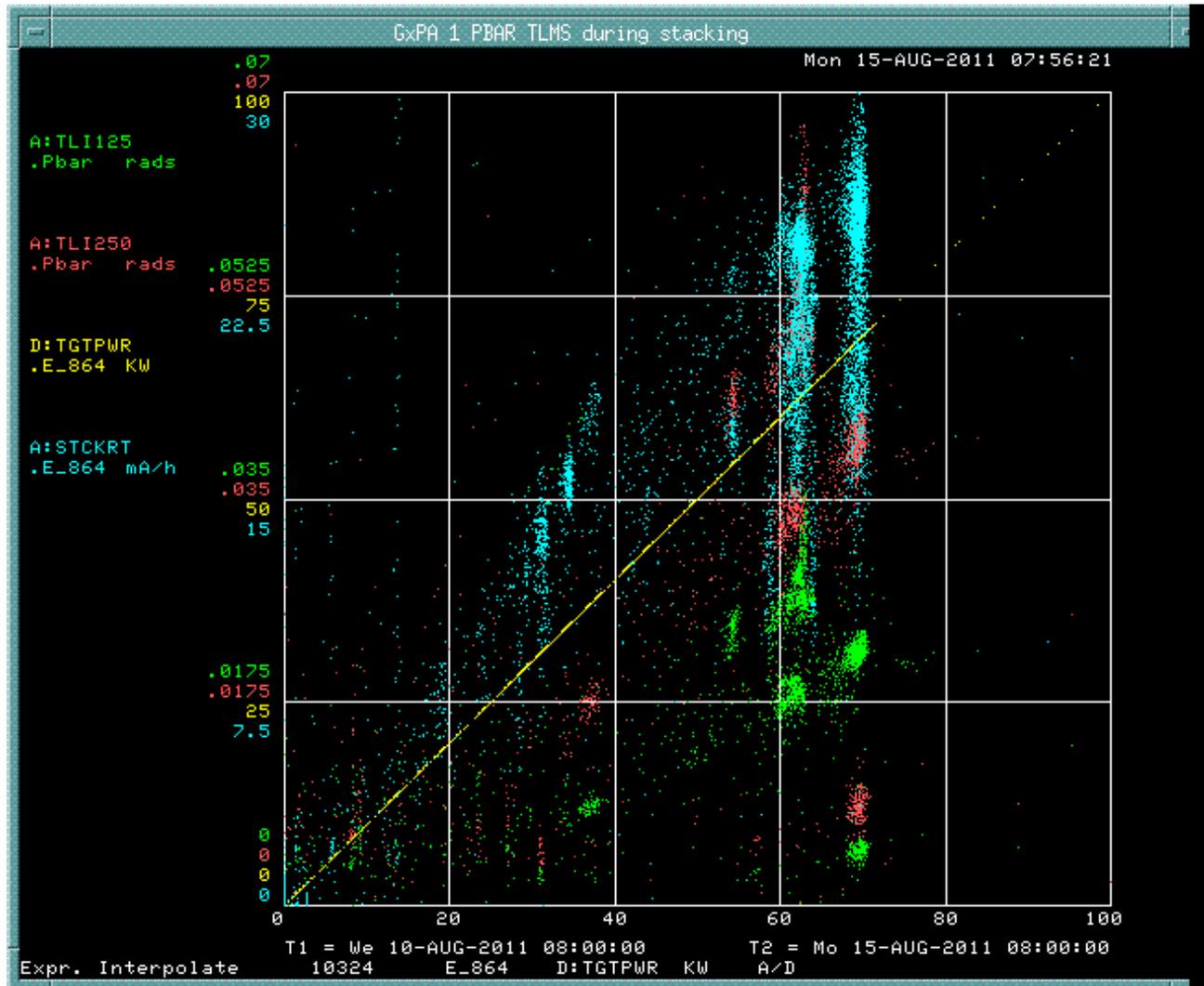


Script has been written to ramp elam simplifies beam loss studies

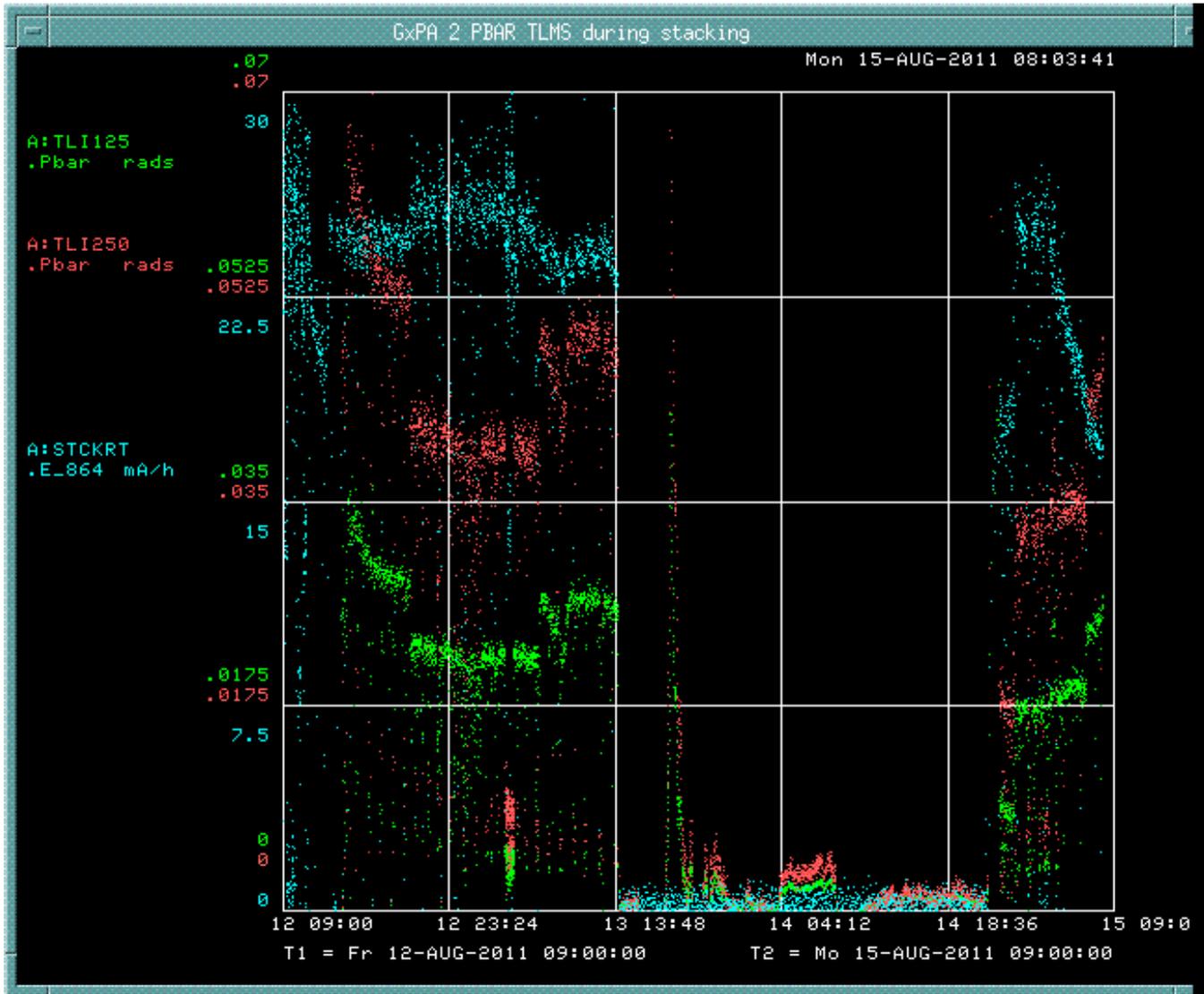


Script by DVM

TLM response correlated with beam power on target by timeline variation



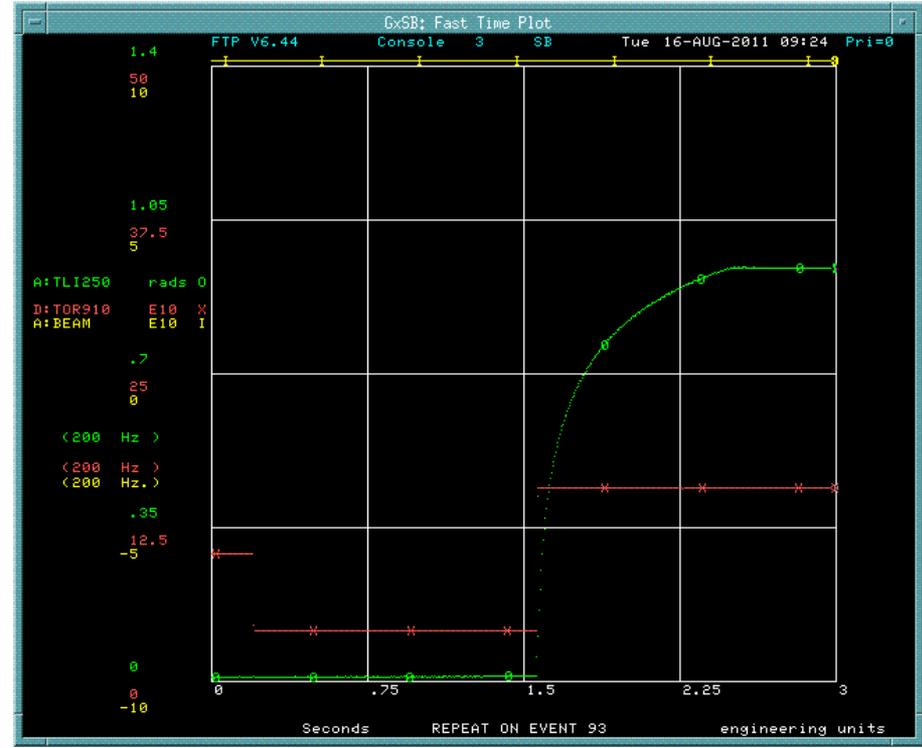
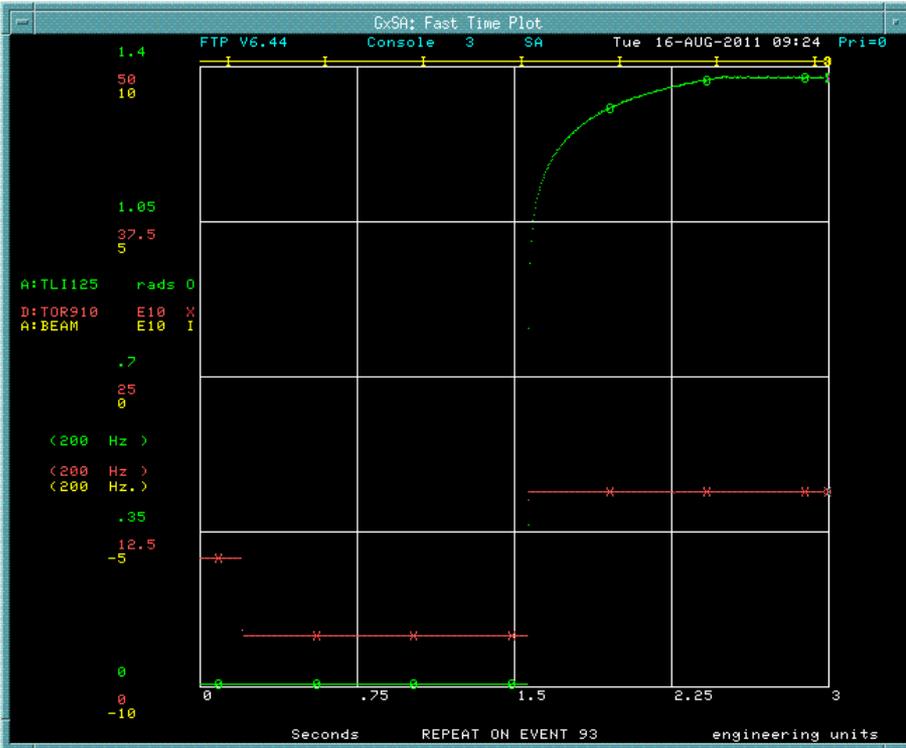
TLM response correlated with stacktail performance



TLM response to very subtle effects

Suggests good sensitivity

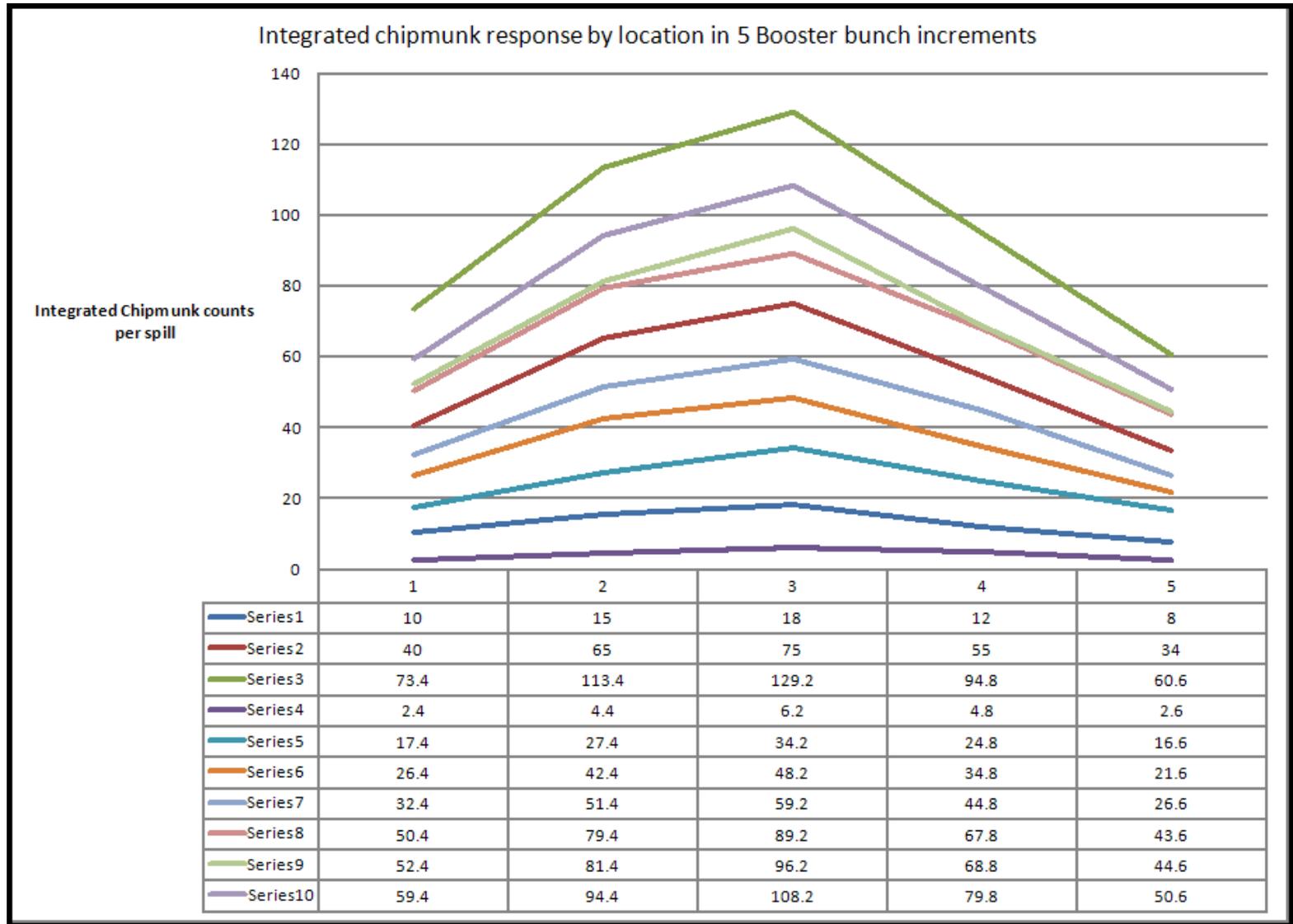
A series of measurements have been variable beam loss



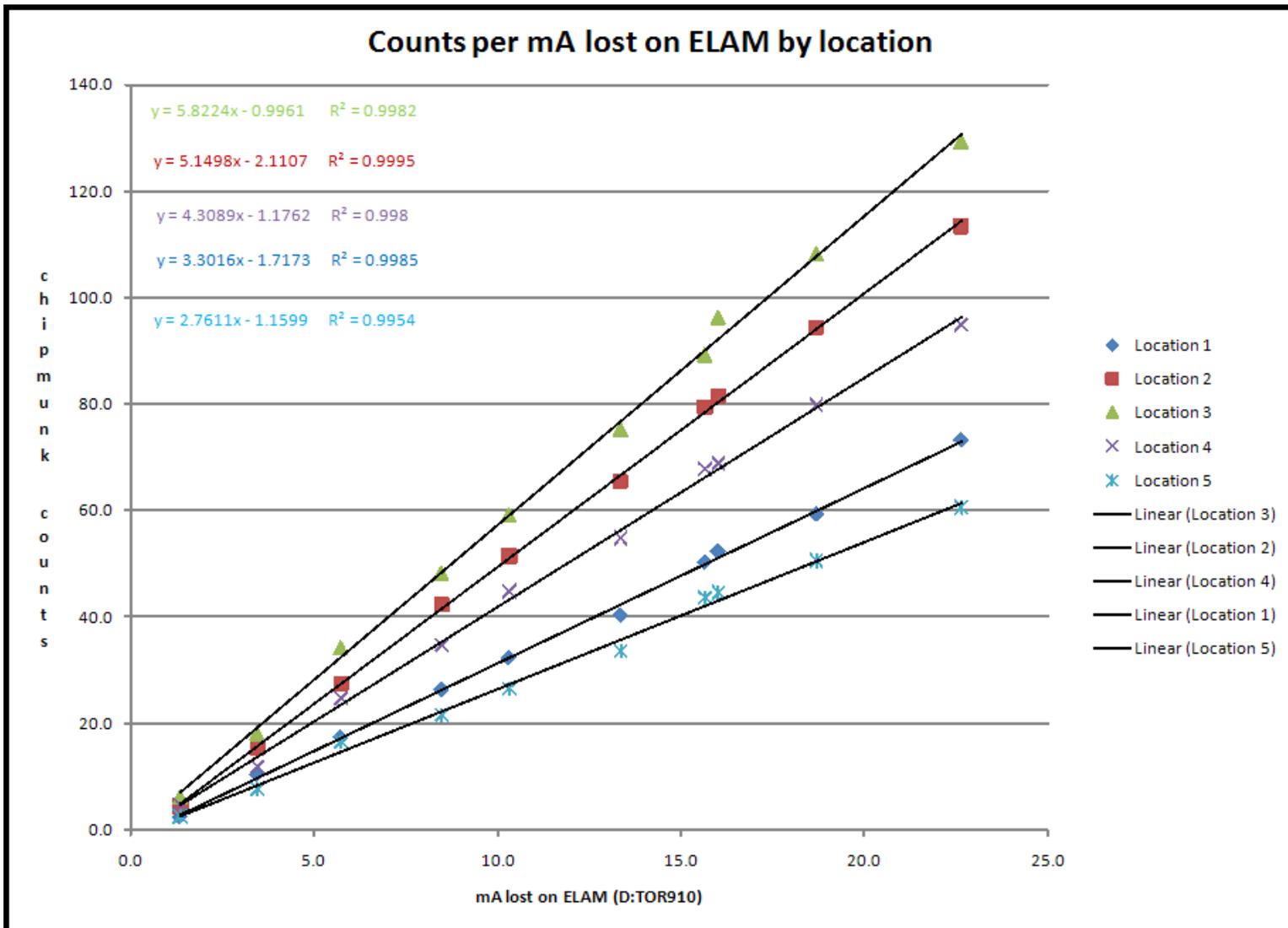
35 Booster buckets - $15.7E10$ protons

Others in 5 bucket increments from 5 to 50

Recorded response of 5 chipmunks

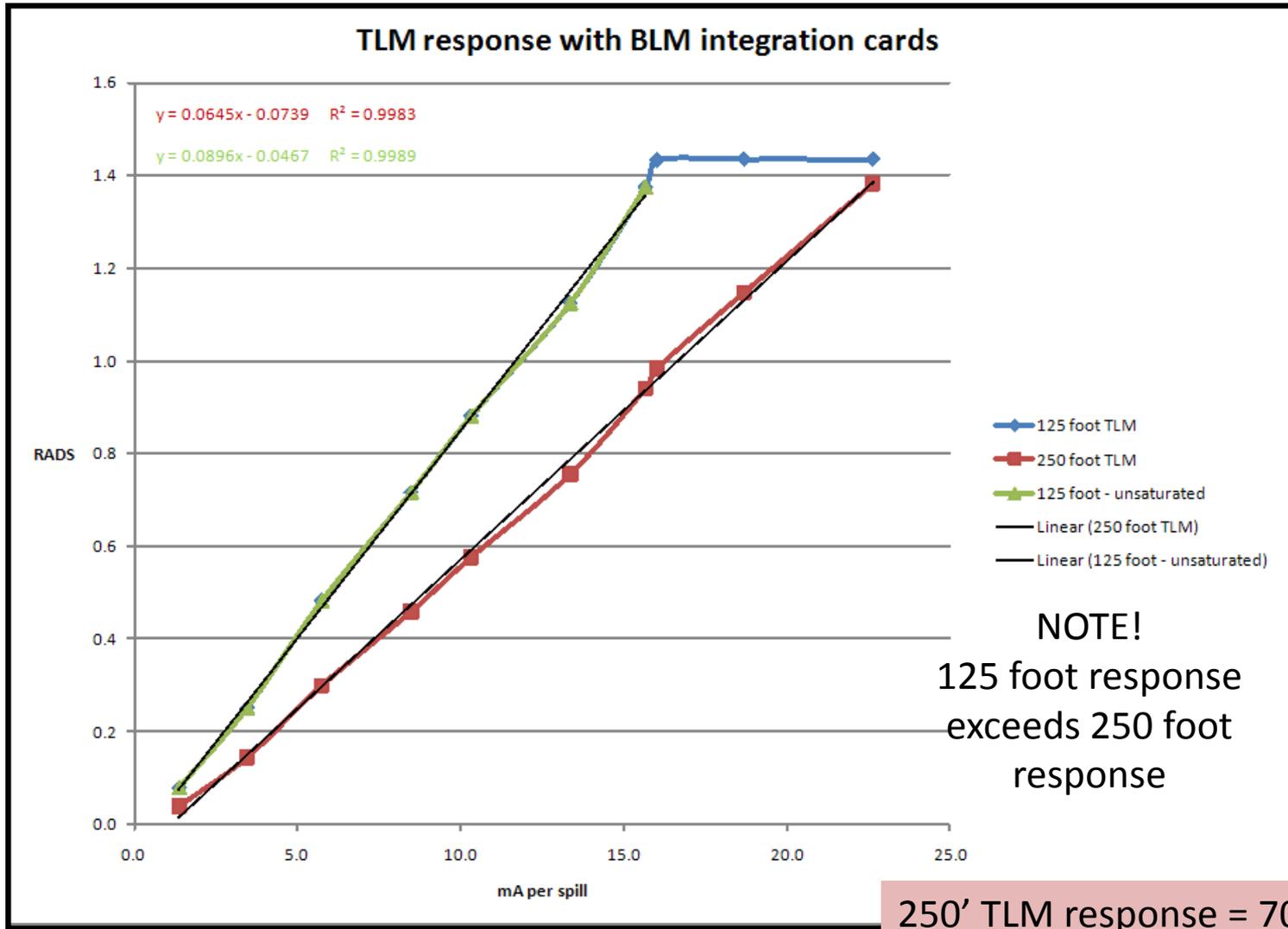


Chipmunk response is linear with number of protons lost



An expected result

TLMs also have linear response!



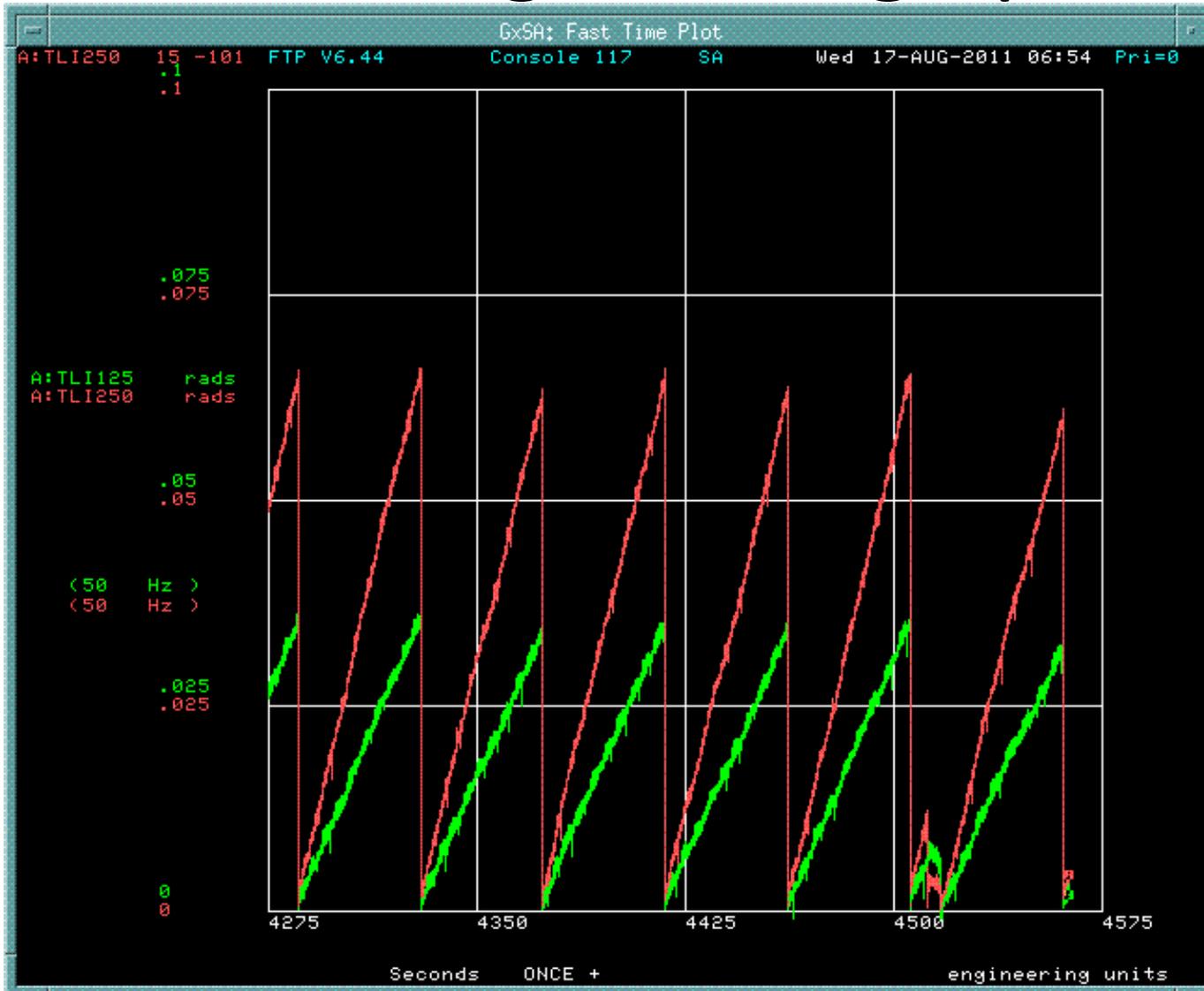
A required result

250' TLM response = 70%*125' response

TLM response as a function of length

- Need another TLM installed to determine this!

During stacking operations

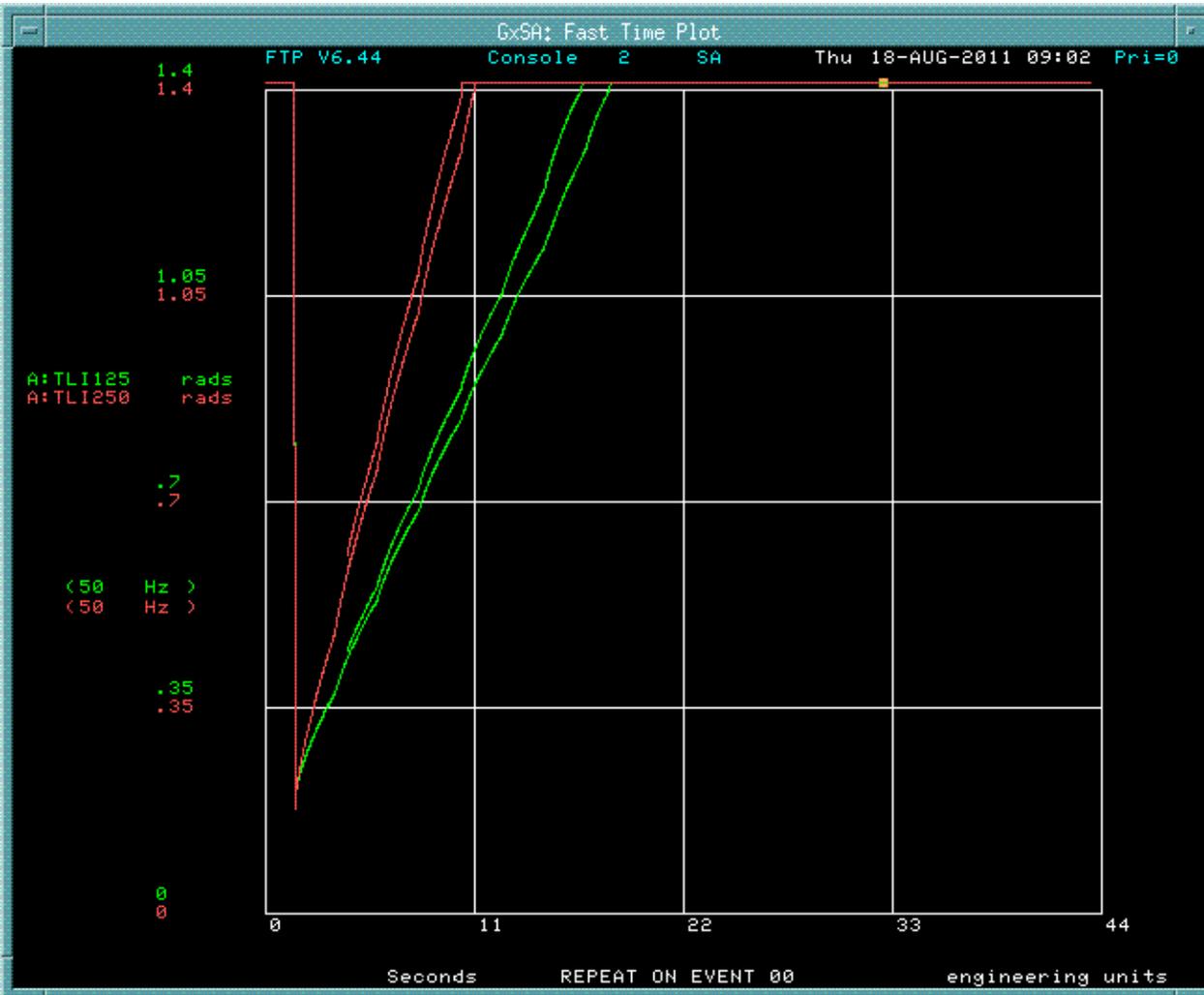


250' cable response exceeds 125' response during normal stacking operations

Could be losses in the second half of 250' TLM not seen by 125' TLM

A reverse proton cycle mixed in with stacking cycles

Tried reversing HV and signal roles of the TLM cable



Huge apparent increase
in sensitivity

Perhaps should be
repeated – ensure
conductors are
grounded before turning
on HV

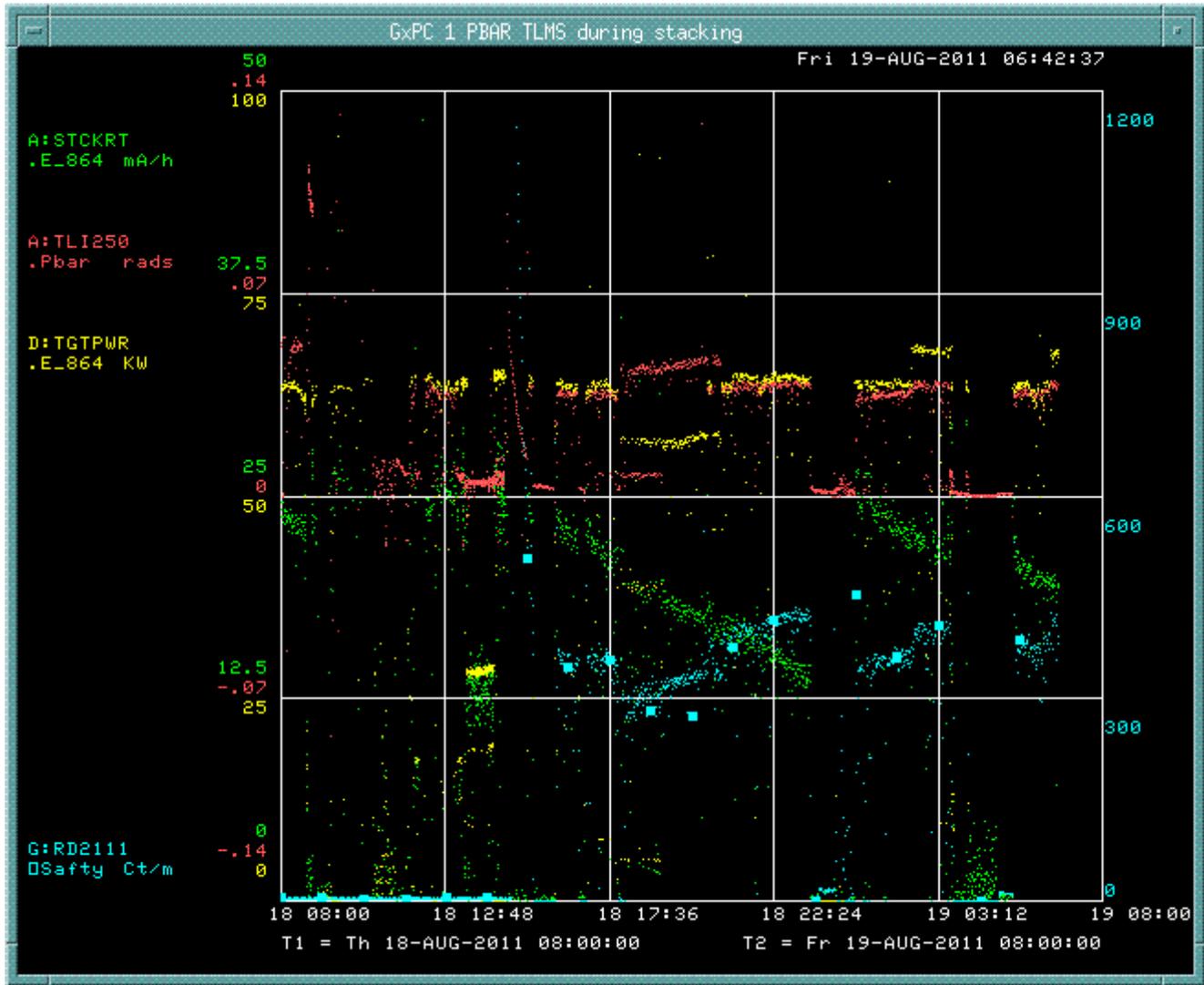
Blue box is in service connected to
125' TLM



Blue box is in service connected to
125' TLM



Blue box is in service connected to 125' TLM



5 pC/count

Follows BLM
card response on
250' TLM

Next steps (1 of 3)

- Install VME scalar for higher counting rate from blue box (1 kHz)
 - MUX good for 70 Hz
 - VME scalar good for 15 kHz
- Repeat series of measurements with blue box and BLM chassis two ways
 - Blue box/125' & BLM chassis/250'
 - Blue box/250' & BLM chassis/125'
 - Determine dynamic range requirement for digitizer circuit for TLM application

Next steps (2 of 3)

- Install third TLM of different length 103 m (338')
 - Determine TLM response as function of length
 - Can't do this with just 2 cables
 - Repeat measurements (5 Booster bunch increments)
- Determine how AD instrumentation can make additional blue boxes
 - In collaboration with ES&H Section
 - Would help to speed up development of this resource

Next steps (3 of 3)

- Distributed loss study
 - e.g., Scrape at ELAM with Accumulator bend bus off (October 2011?)
- Determine blue box trip levels for 14 TLM cables required for mu2e
 - Needed to finalize radiation safety plan for mu2e