Testbench and CERN 07 analysis reloaded

LPNHE SiLC team

SiLC 2008

CERN, July 2nd, 2008

Outline:
Testbench studies Nov. 2007-April 2008
CERN testbeam Oct. 2007

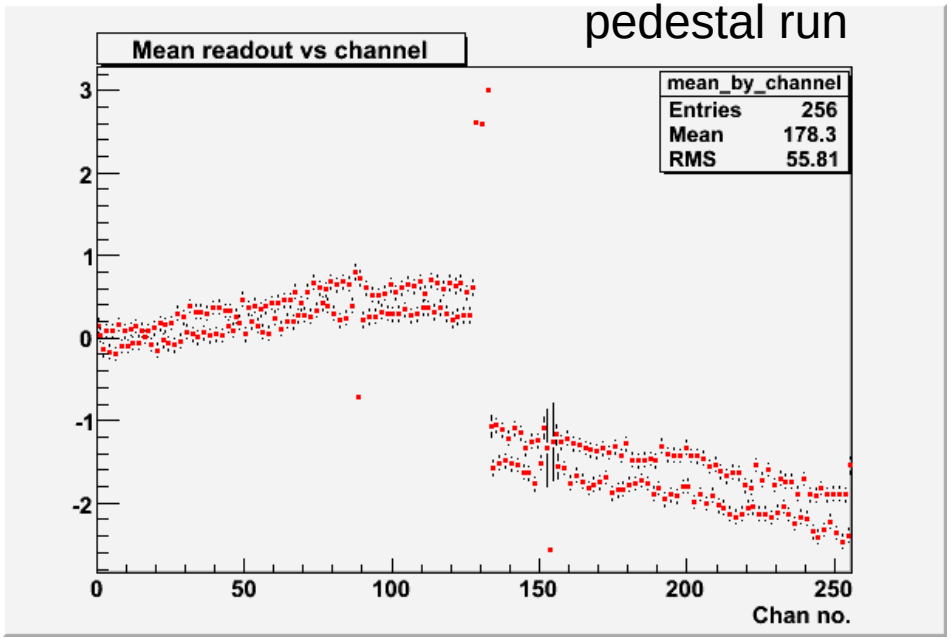
Introduction

- New testbench tests (with source)
- New analysis software
  - Simple analysis code written by Catalin available on the internal page
    - Couldn’t figure out the old code so wrote a new one
    - Extra work=bad, Independent cross-check = good
  - More OO-evolved analysis code (GUI and all) written by Alexandre and to be embellished by me will replace the above
- More detail about testbench hardware in Jacques David and Alexandre Charpy’s talks
- This talk:
  - Testbench and CERN testbeam VA1
  - Testbench and CERN testbeam 130 nm (cms) 130 nm (hpk)

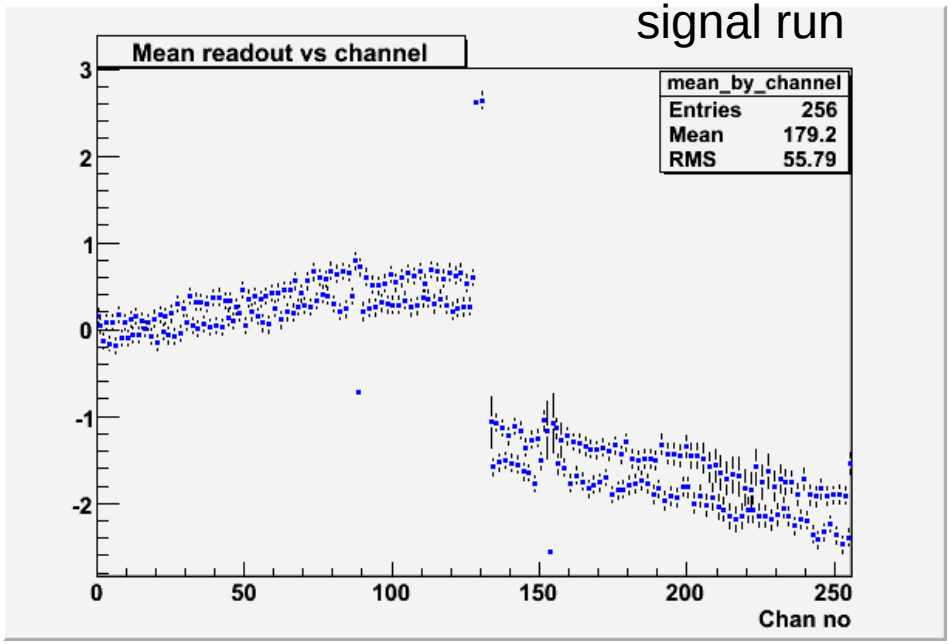
Testbench VA1

- At the minimum, the analysis code should
  - Plot the mean readout for all channels
  - Pedestal and common-noise subtraction
  - Signal/Background for each channel
  - S/N versus channel
- At the maximum, the analysis should show correlation among multiple detectors as tracks pass them through.

pedestal run

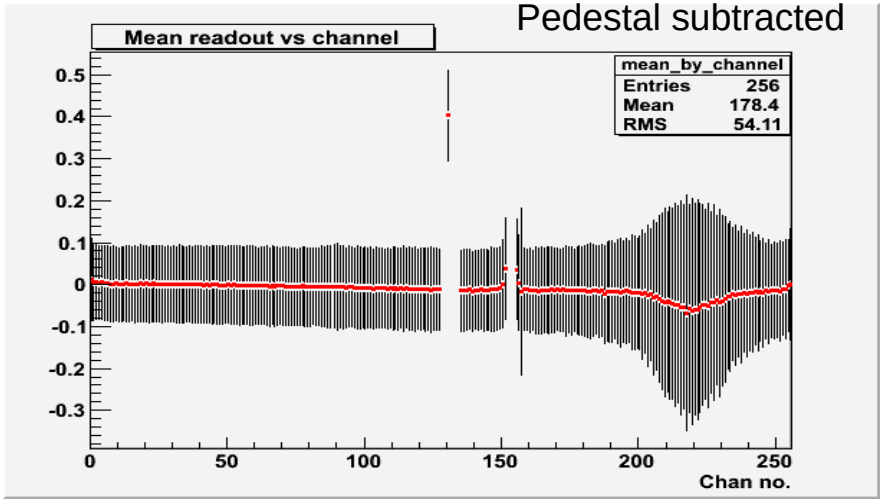


signal run

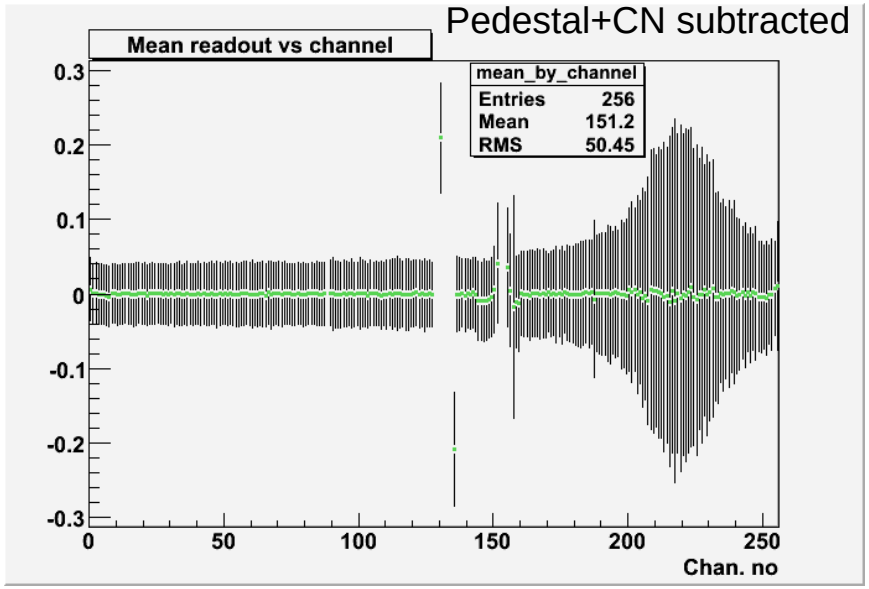


Testbench VA1 (cont'd)

- Take every signal run event and subtract average pedestal

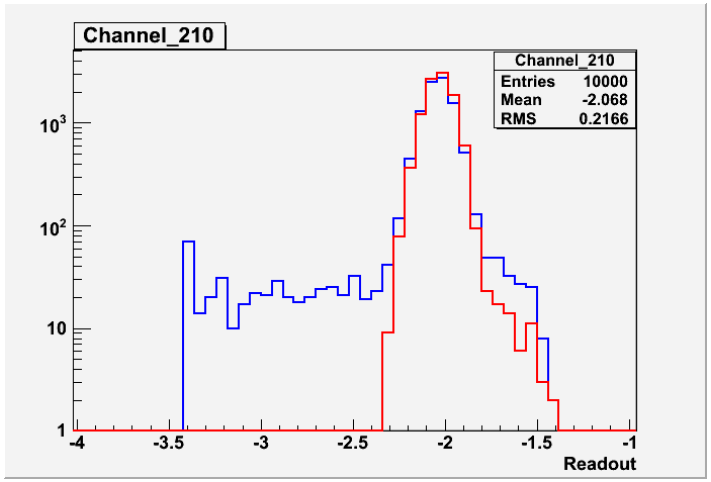


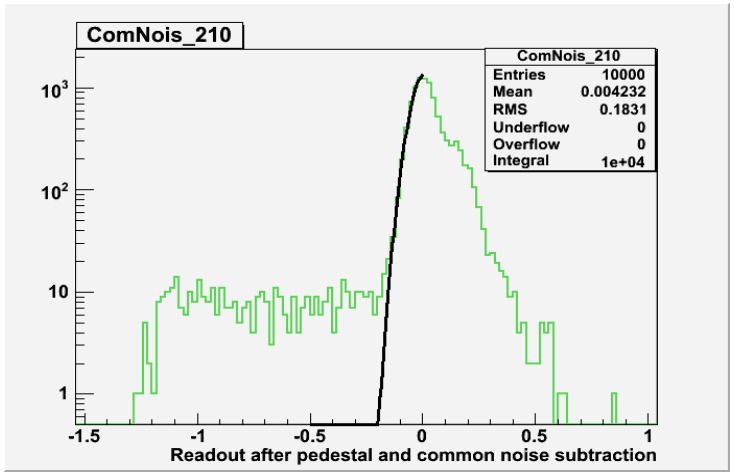
- Take every signal run event and subtract average pedestal+CN



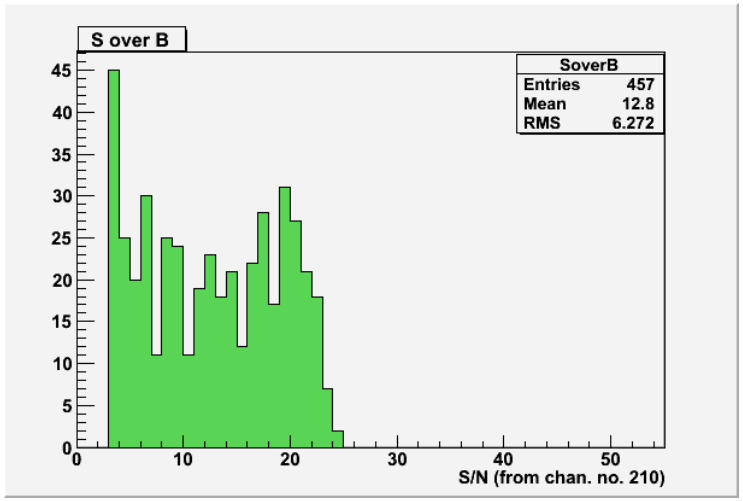
Testbench VA1: S/N?

- Take a channel (say 210). Plot the readout red = ped. blue =sig.
- Plot the pedestal+CN subtracted readout, use a Gauss fit



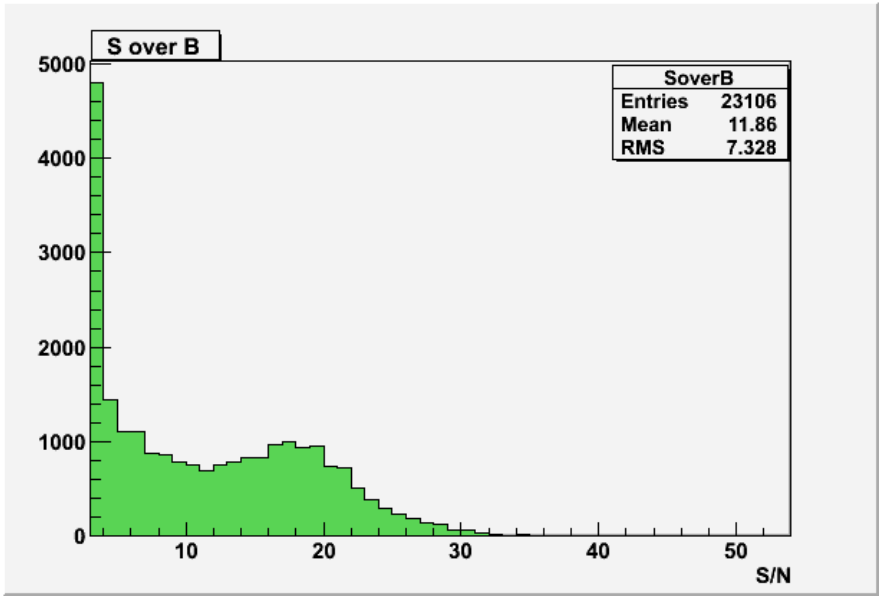


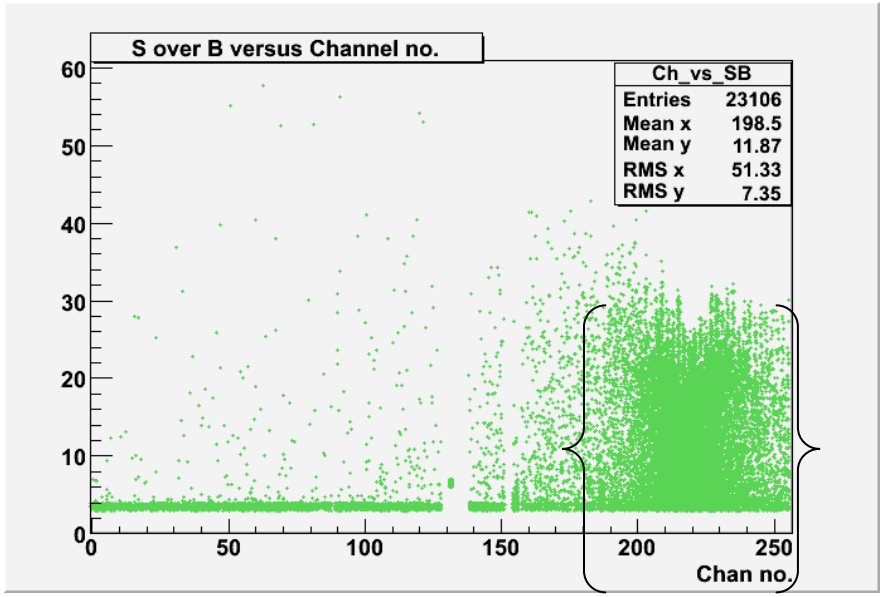
- For every event which falls outside the Nσ interval from the Gauss mean, compute (readout-σ)/(σ/2). Histogram it and plot it.



Testbench VA1: S/N?

- That was for one channel (210). Now do the same for all channels:





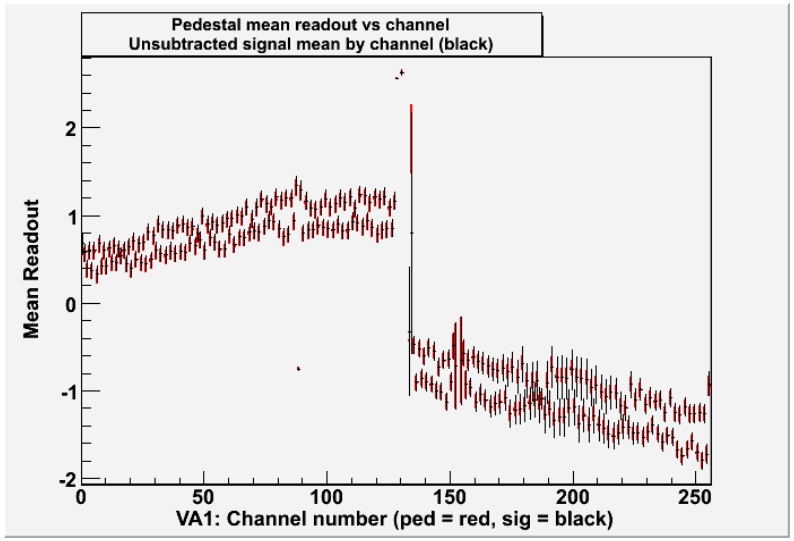
- Conclusion: S/N ≅ 18

{ } = channels closer to source

- Great. How about testbeam data?

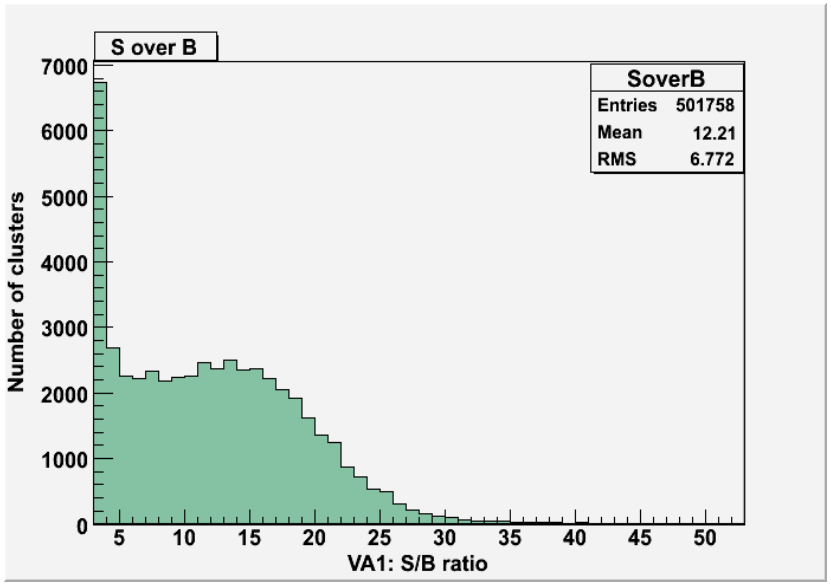
Oct 2007 Testbeam VA1

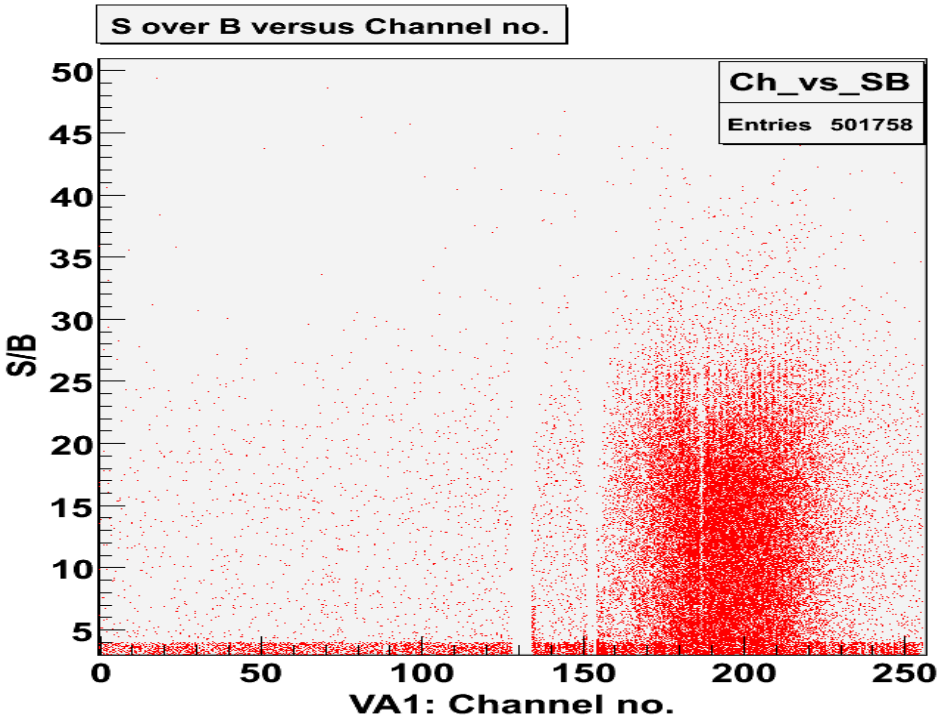
- Same analysis template (recipe)



All analysis results compare well with the testbench results.

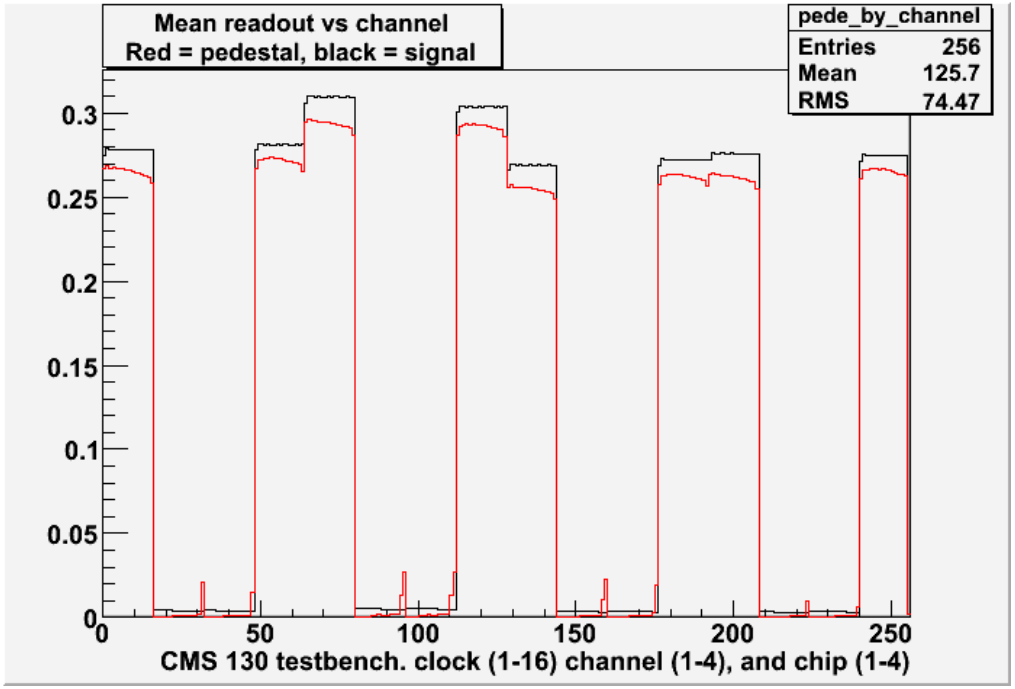
- Signal / Noise – all channels





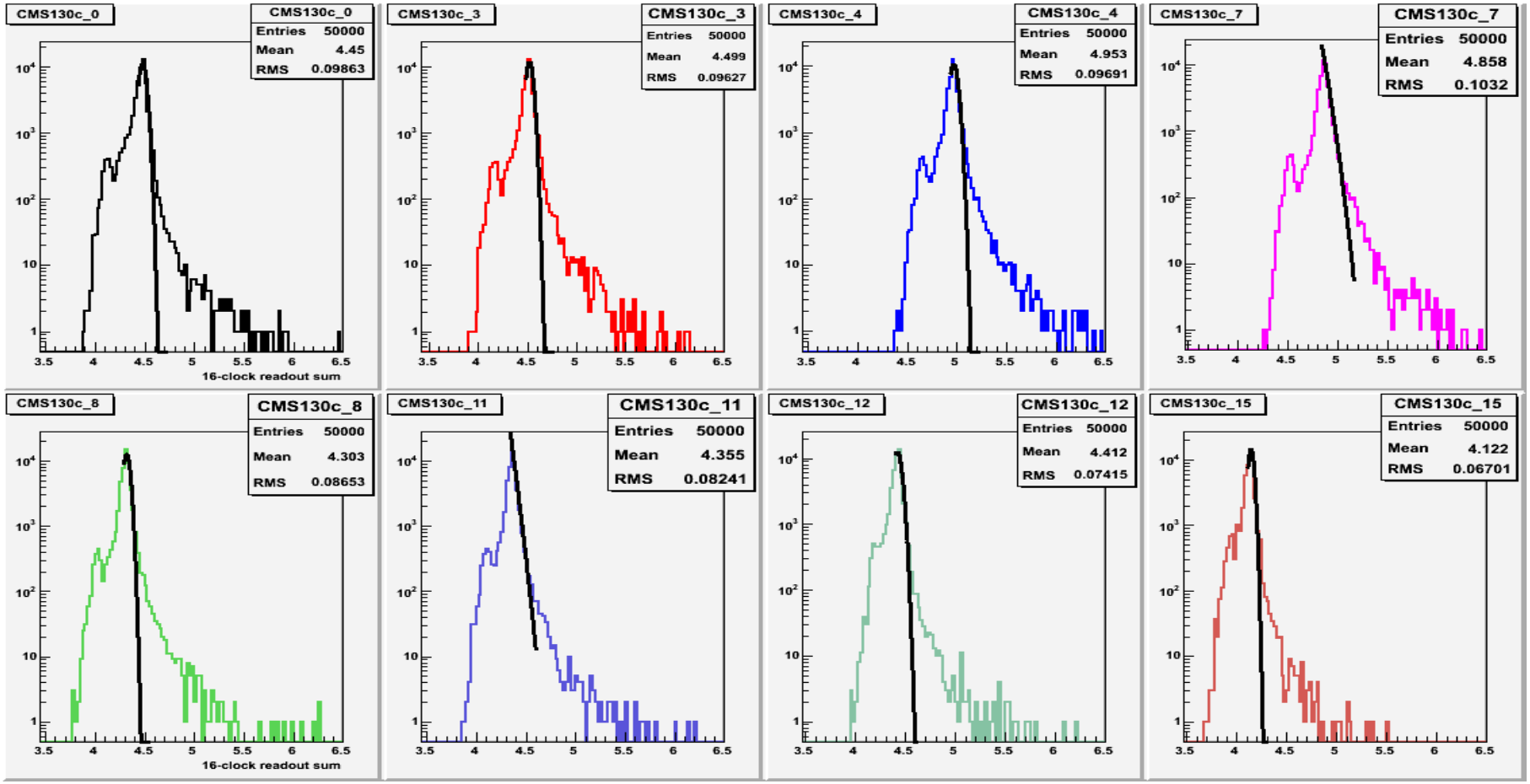
Testbench 130 nm + “cms”

- Four chips of four channels each:
  - Two channels unwired per chip leave 8 working channels
- Readout from each chip sampled 16 times (16 “clocks”)
  - 4 chips x 2 chan x 16 clocks = 128 readout values / event
- Plot the pedestal / signal run mean readout vector



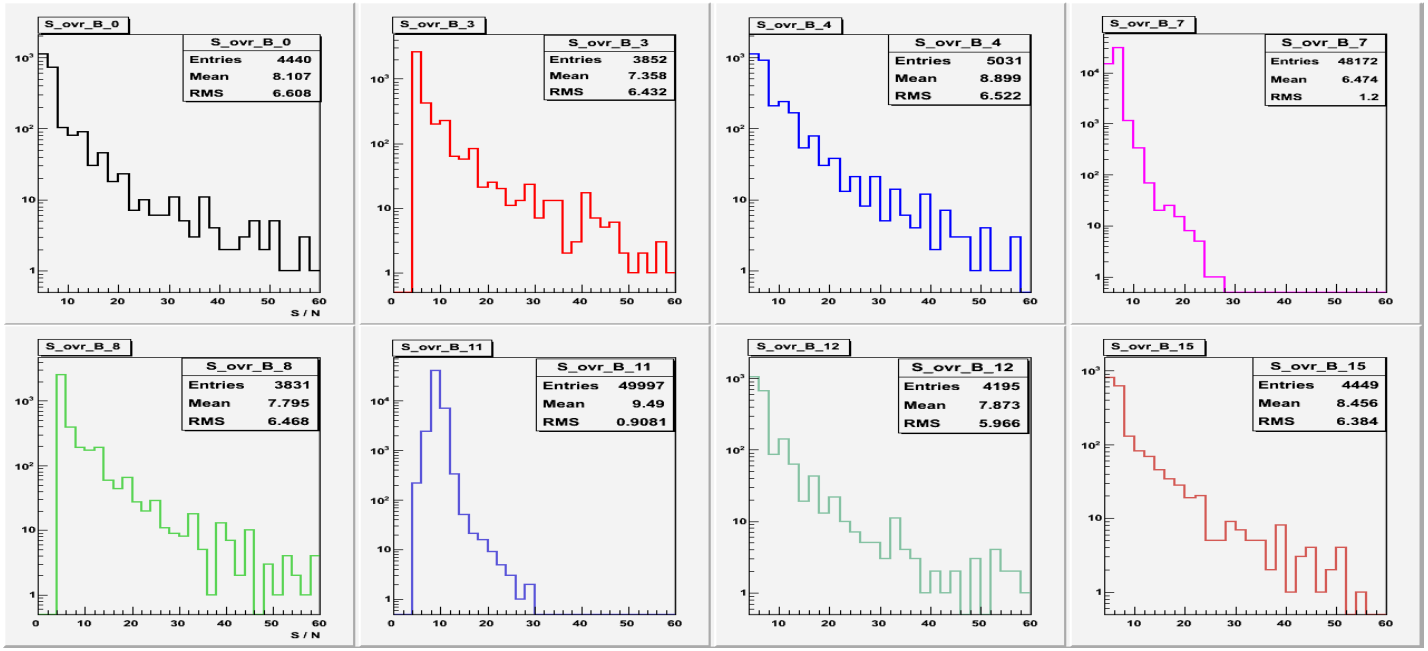
Testbench 130 nm + “cms”

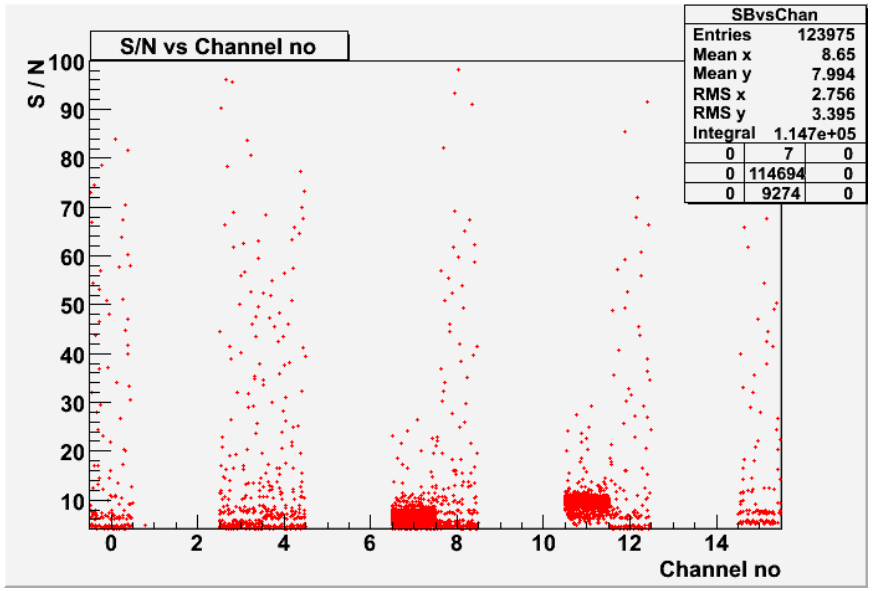
- 16-clock sum (mean) readout distributions for each channel
- Comparable across the 8 channels (4.1 – 4.9 range)
- Fit *unsubtracted* readout high tails with Gaussians



Testbench 130 nm + “cms”

- Signal to noise distributions by channel



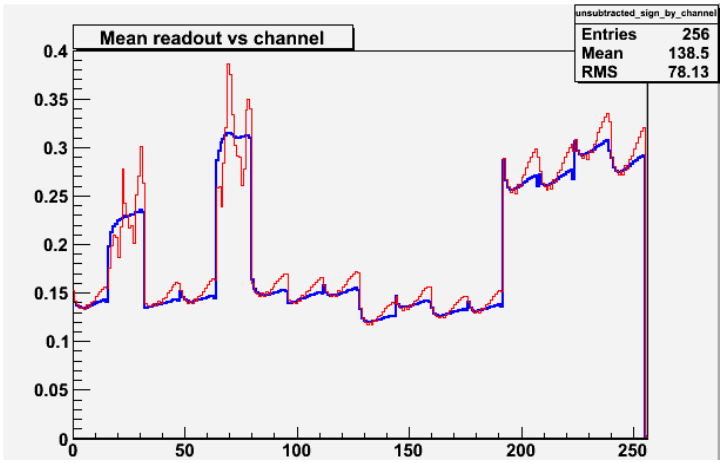


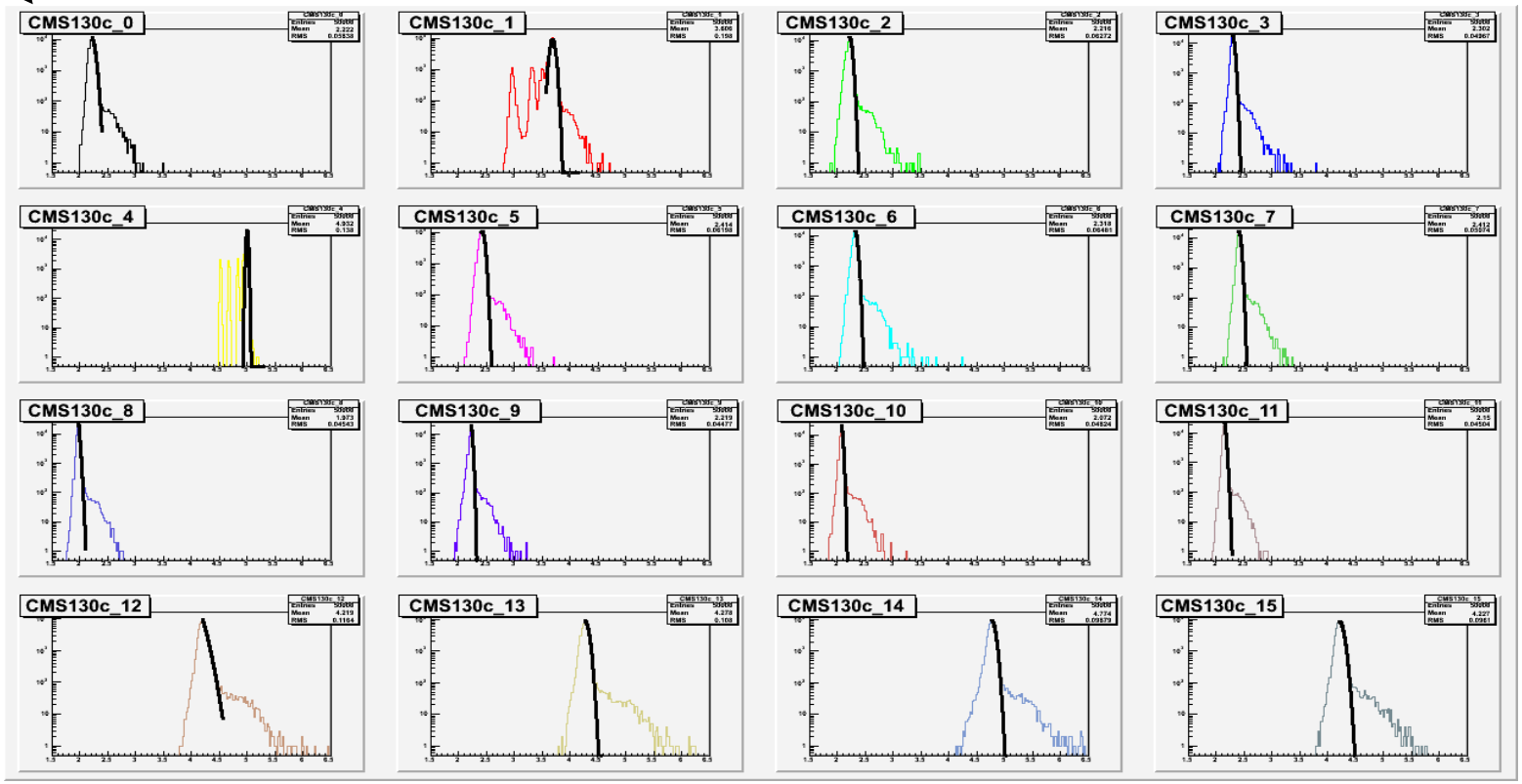
Testbench 130 nm + “hpk”

- All channels wired in:
  - 4chip x 4chan x 16clk = 256
- Look at mean(sum) readout

For each channel of each chip

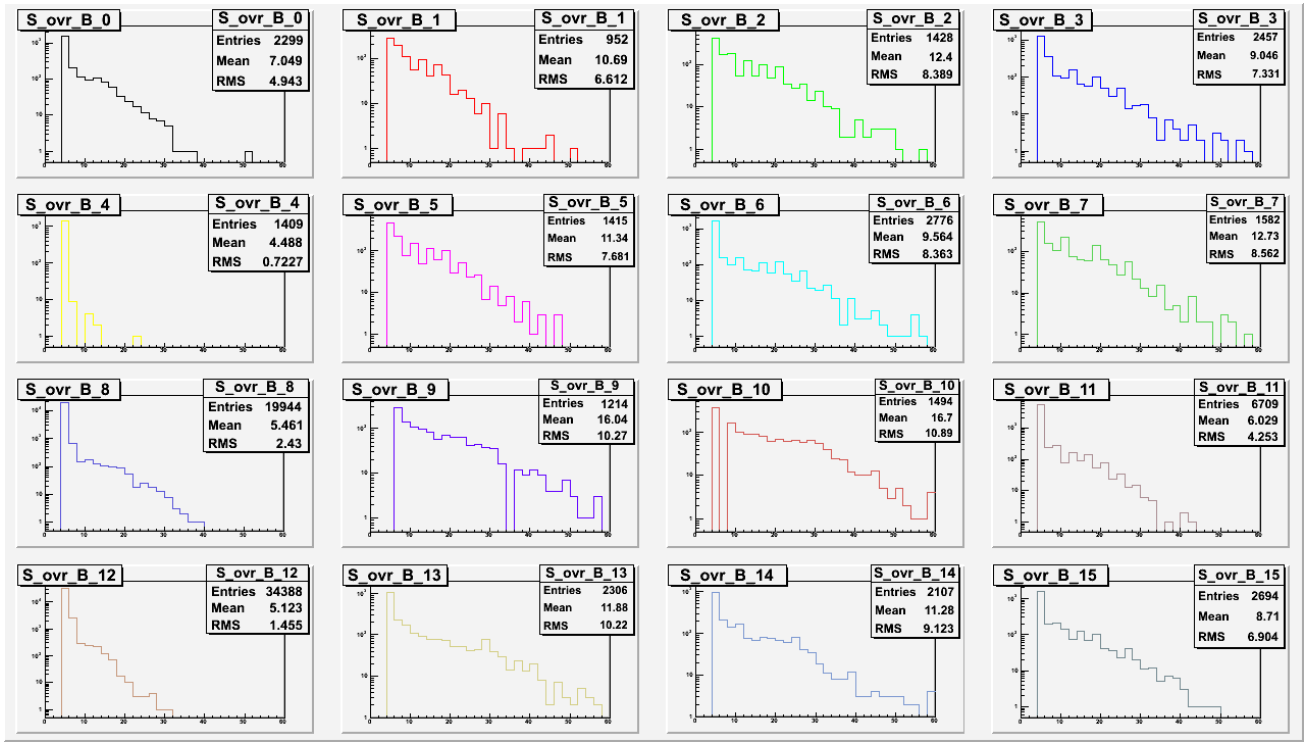
Labels are wrong! cms ->hpk

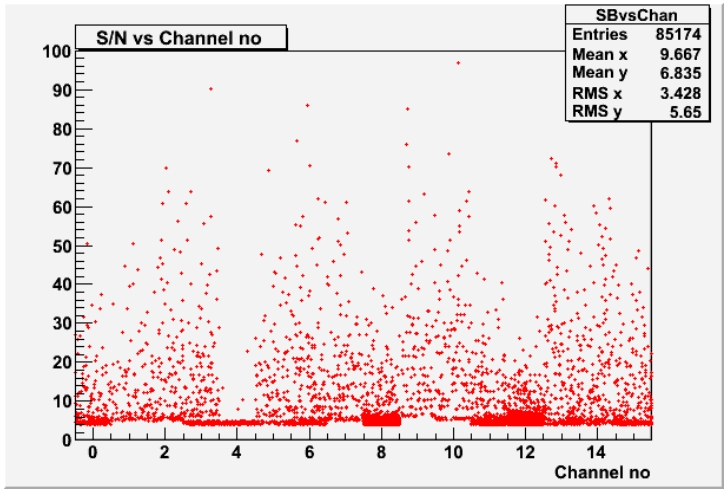




Testbench 130 nm + “hpk”

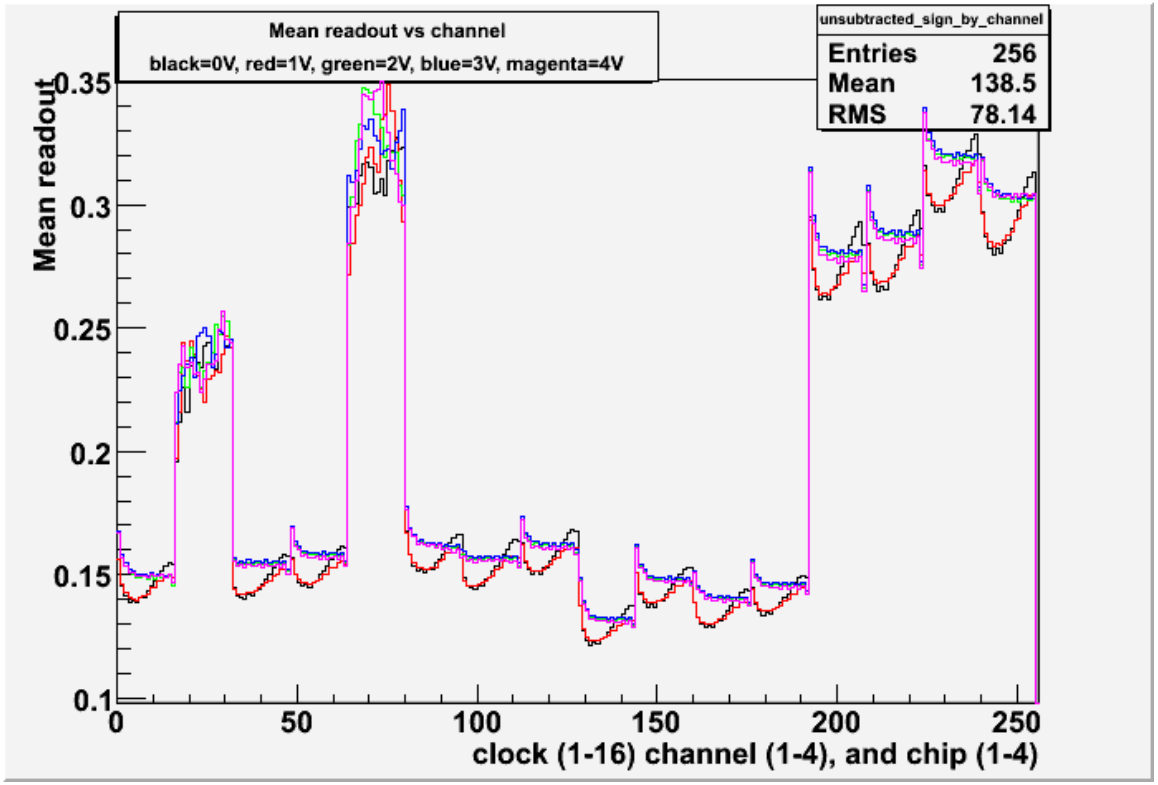
- Signal to noise distributions by channel





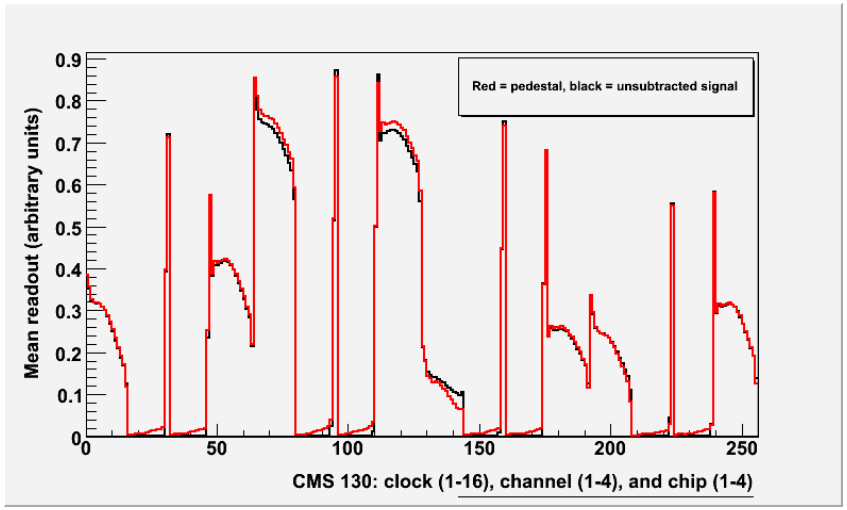
Use shape info?

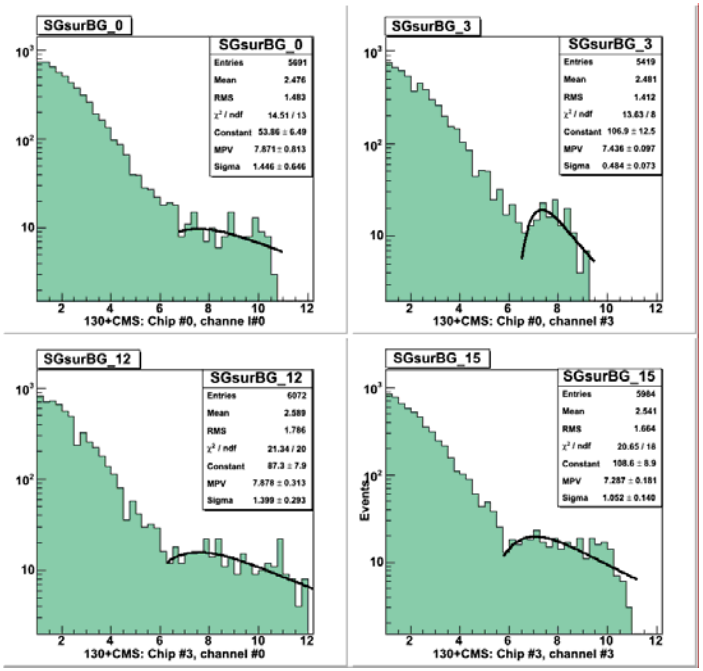
Possible to use the signal shape to improve noise rejection
Opted not to do this as the CERN data show similar shapes for S and B

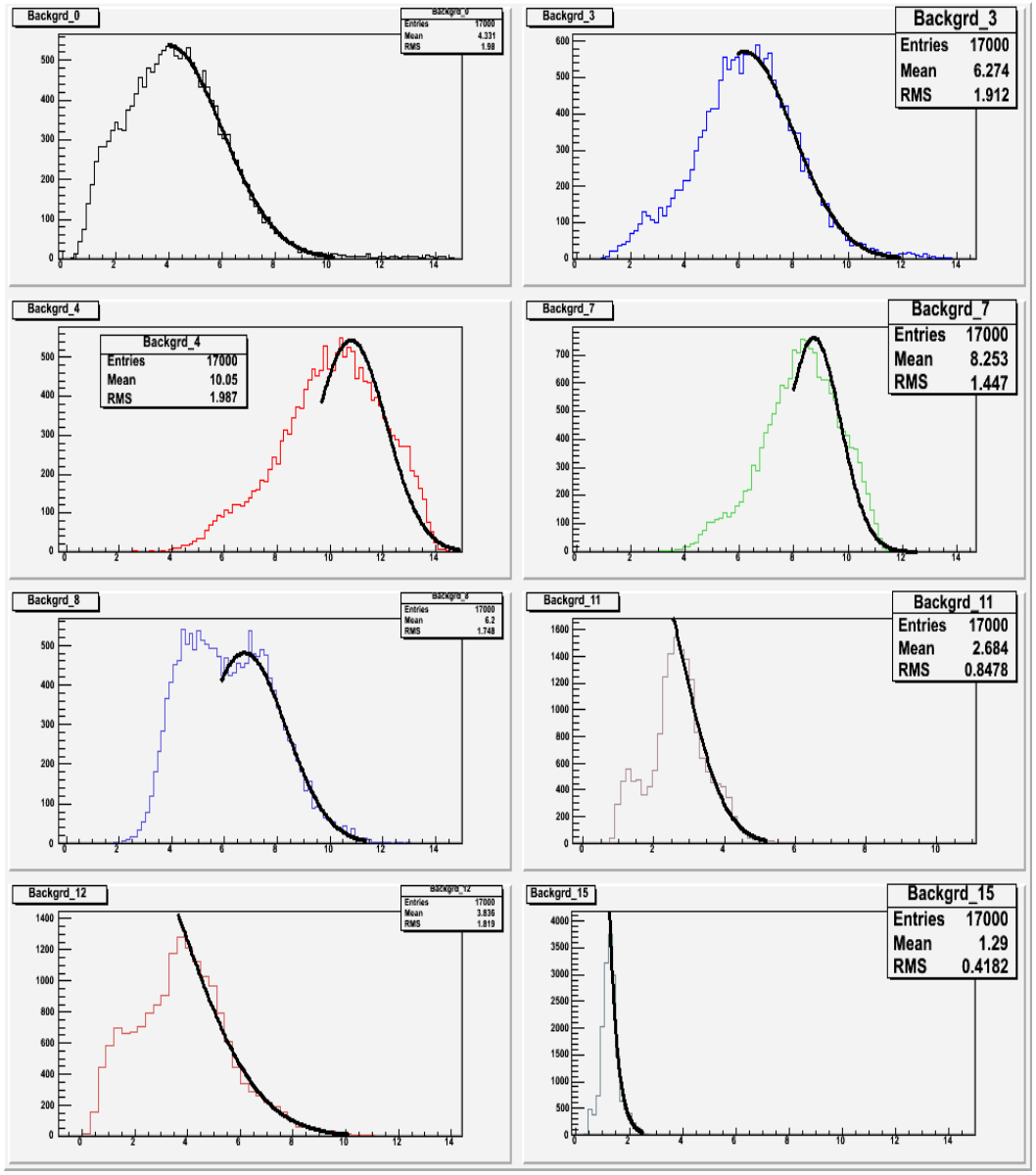


CERN 07 testbeam (130 nm+cms)

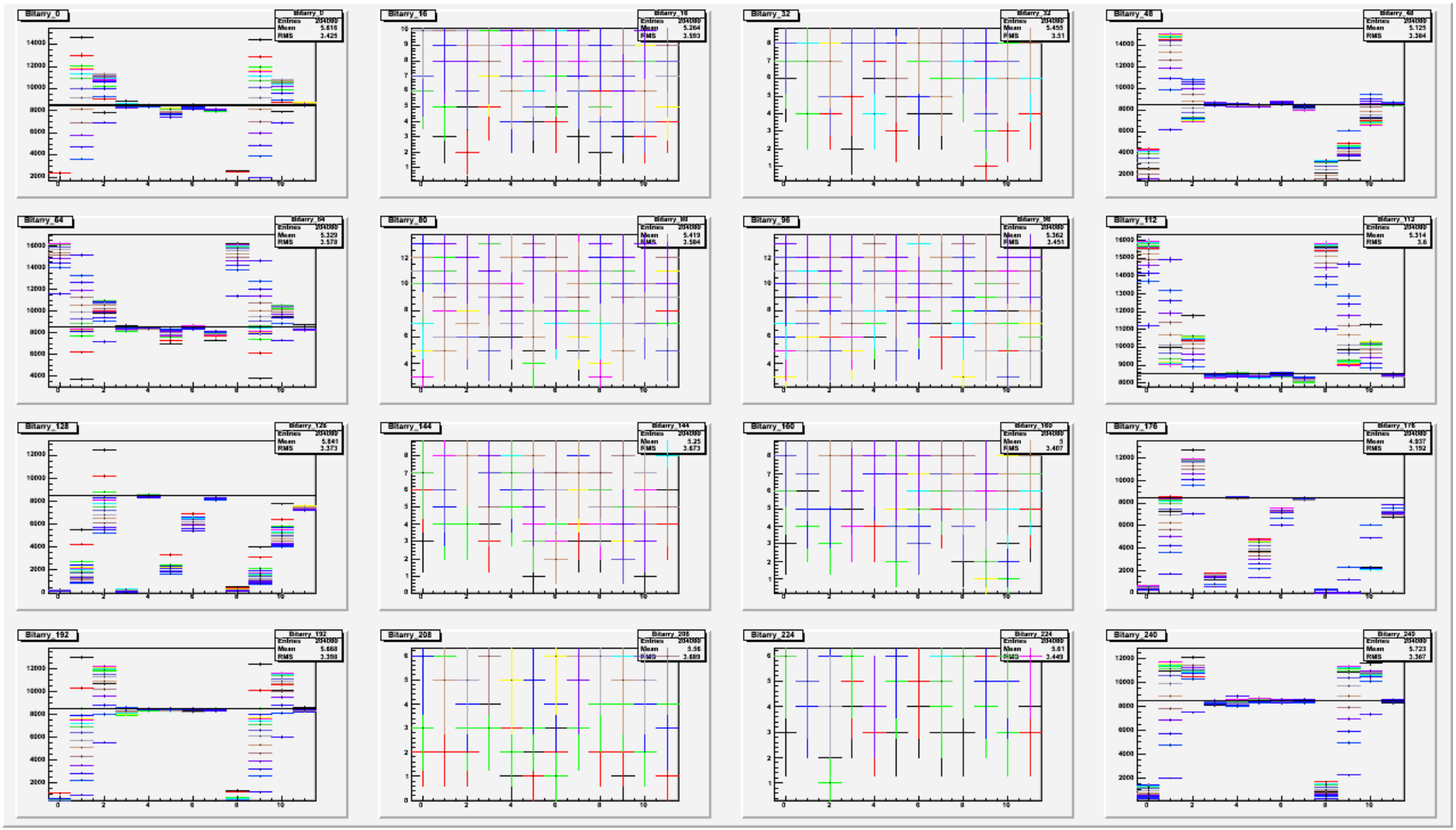
- Follow the usual steps



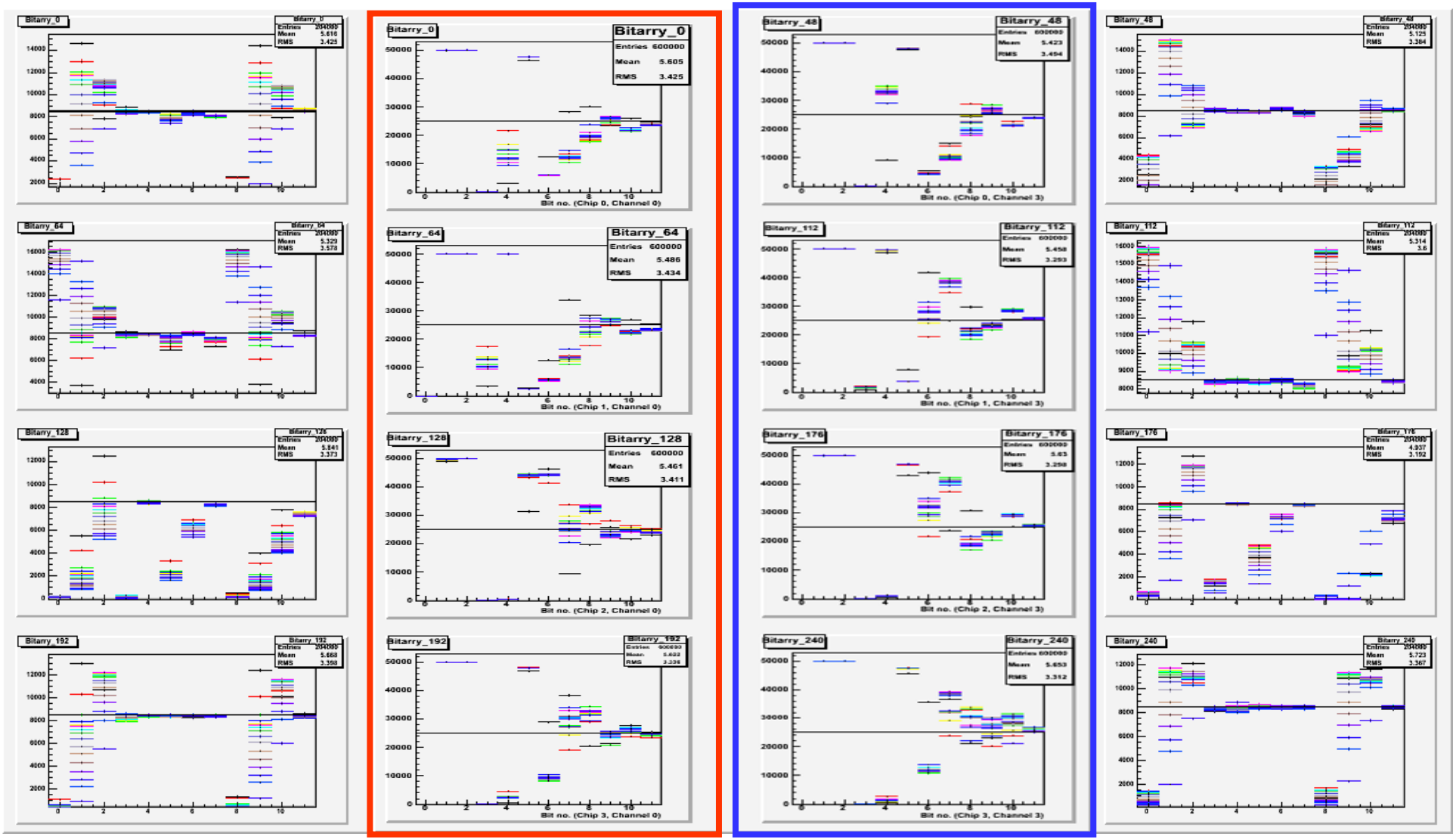




Why lower S/N?


Bitarry_0
Bitarry_16
Bitarry_32
Bitarry_48
Bitarry_64
Bitarry_80
Bitarry_96
Bitarry_112
Bitarry_128
Bitarry_144
Bitarry_160
Bitarry_176
Bitarry_192
Bitarry_208
Bitarry_224
Bitarry_240

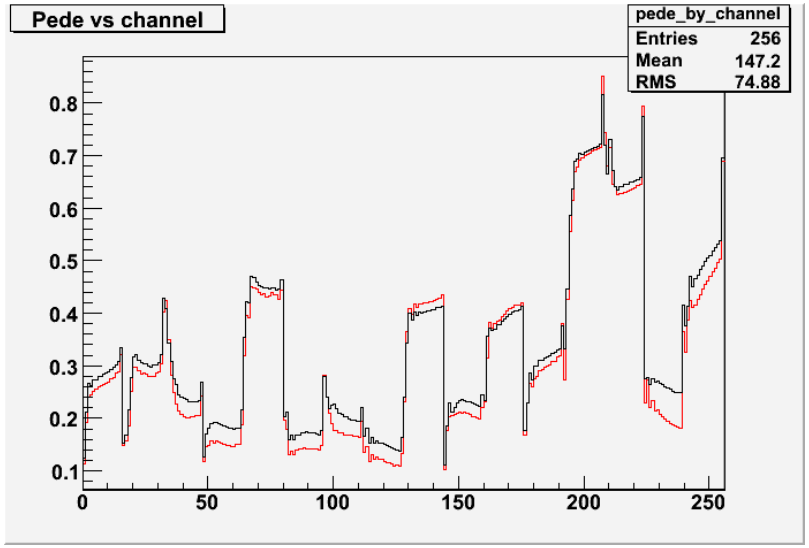
Why lower S/N?

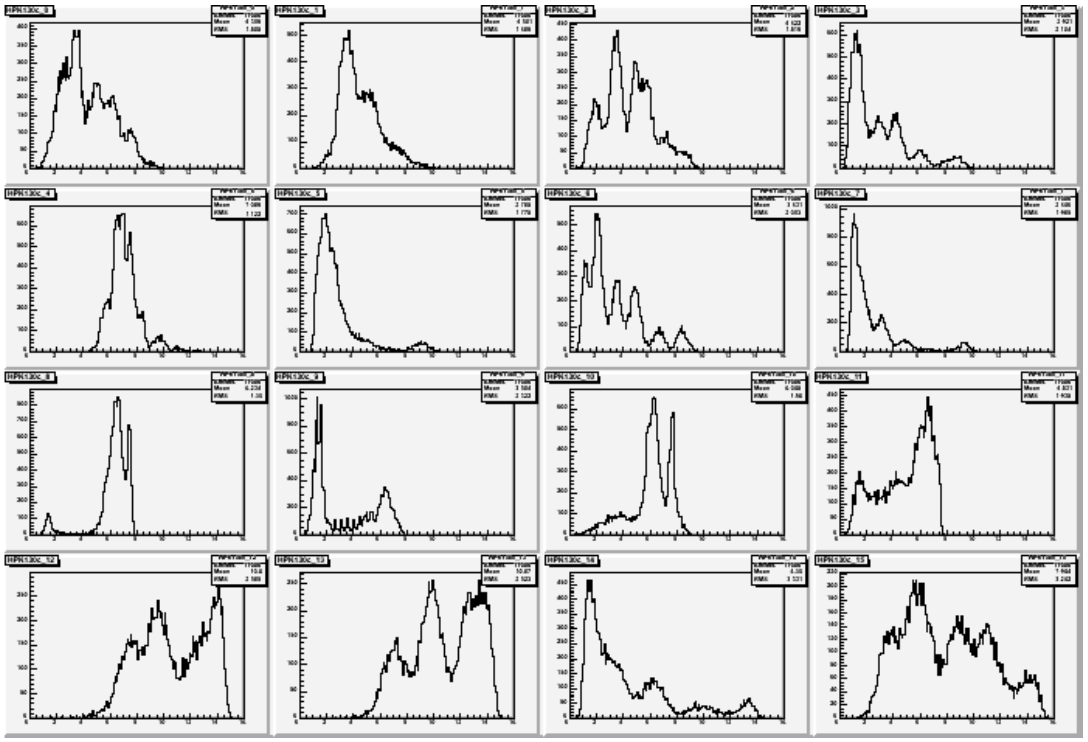


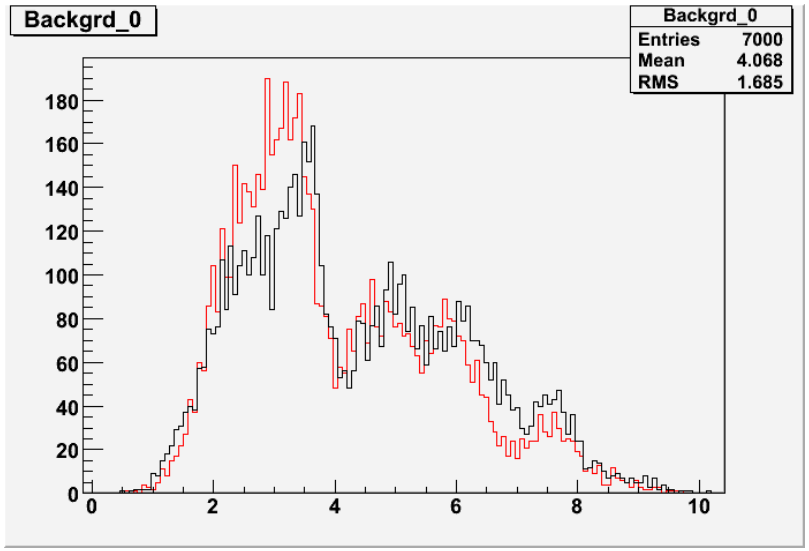
testbeam testbench testbench testbeam

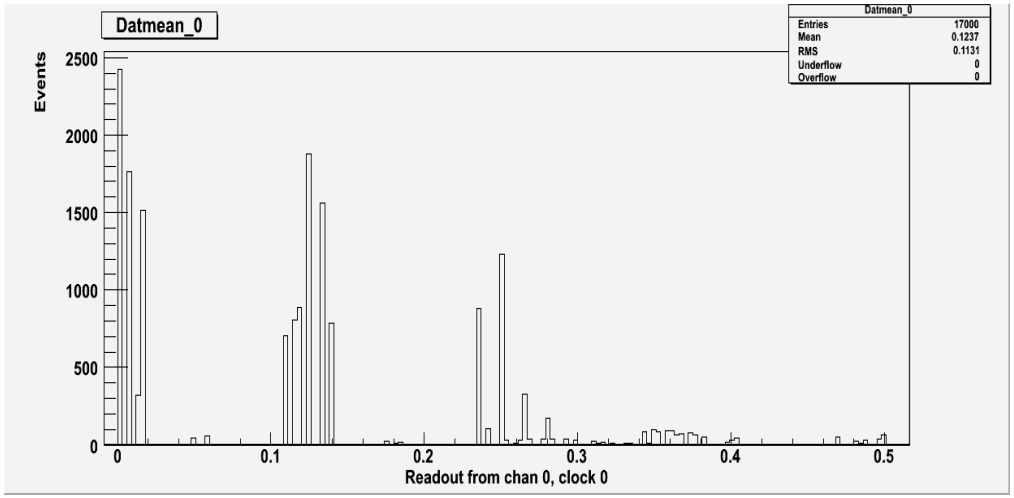
CERN 07 testbeam (130 nm+hpk)

- Usual steps

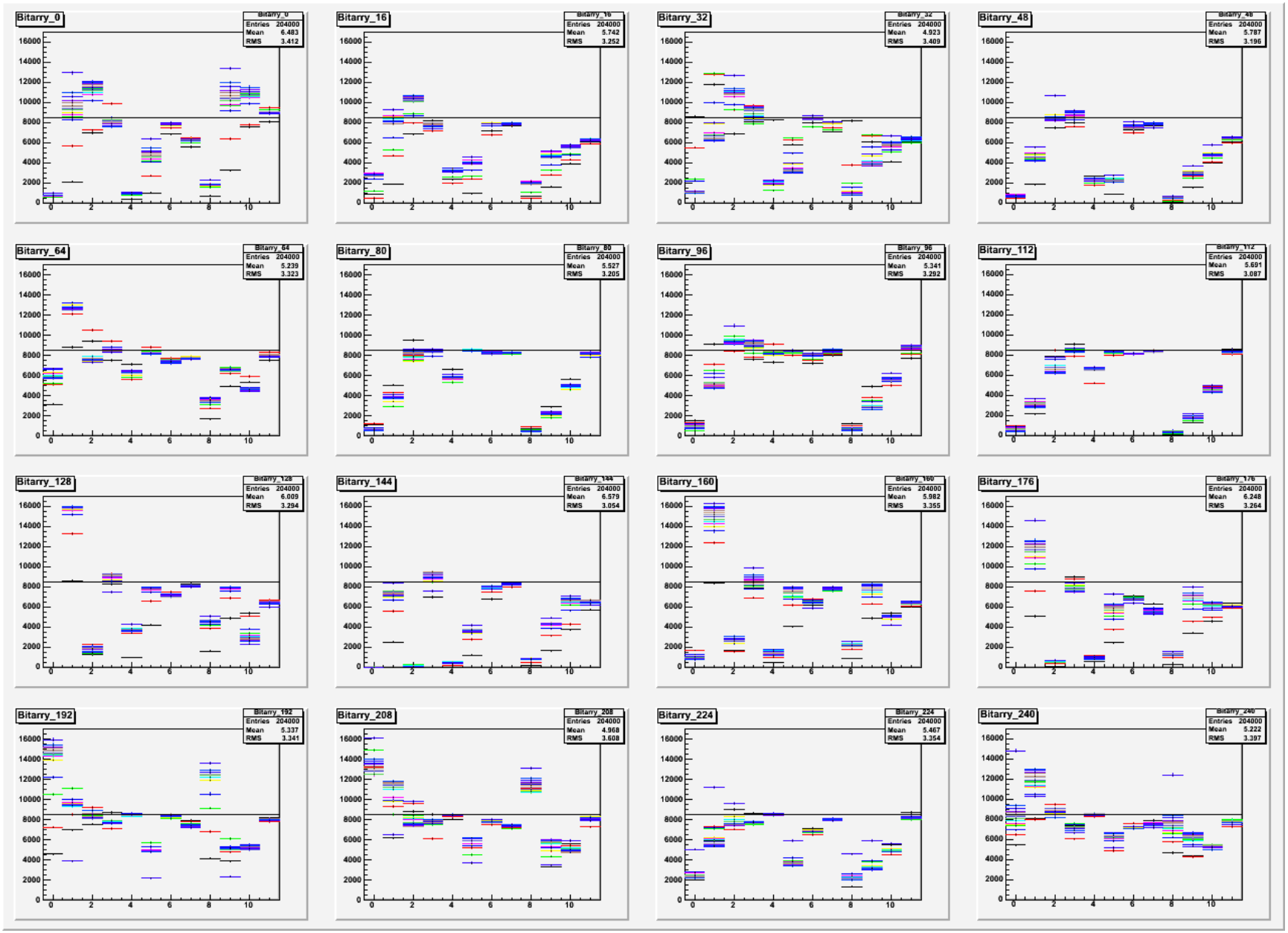




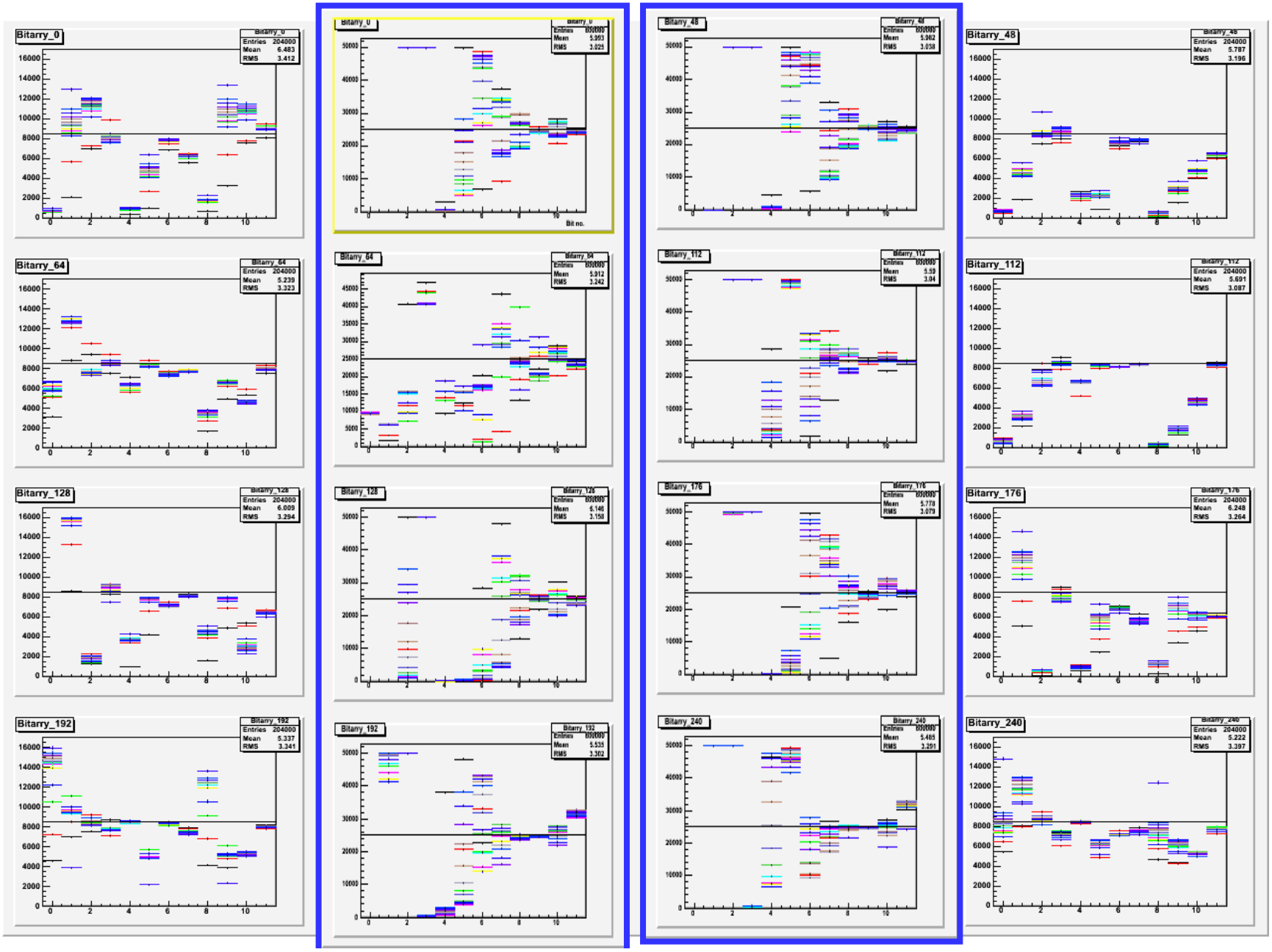




CERN 07 testbeam (130 nm+hpk)

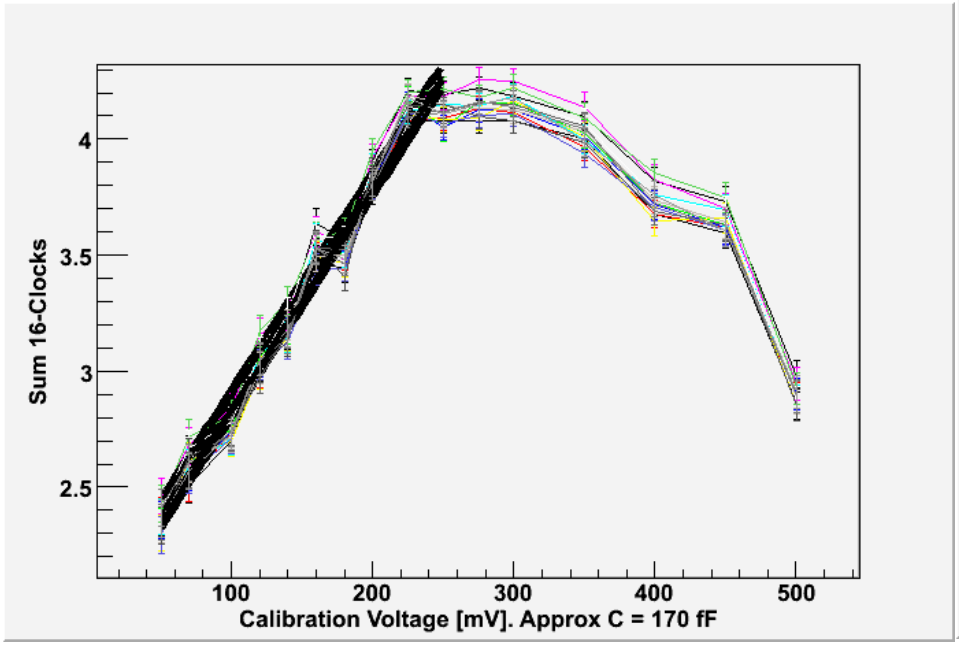


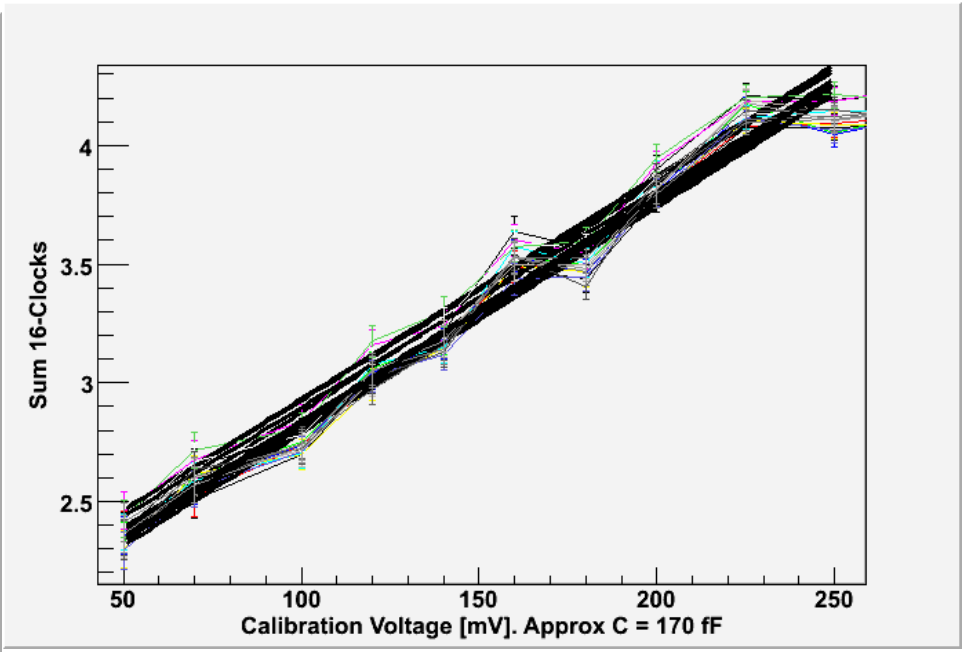
CERN 07 testbeam (130 nm+hpk)



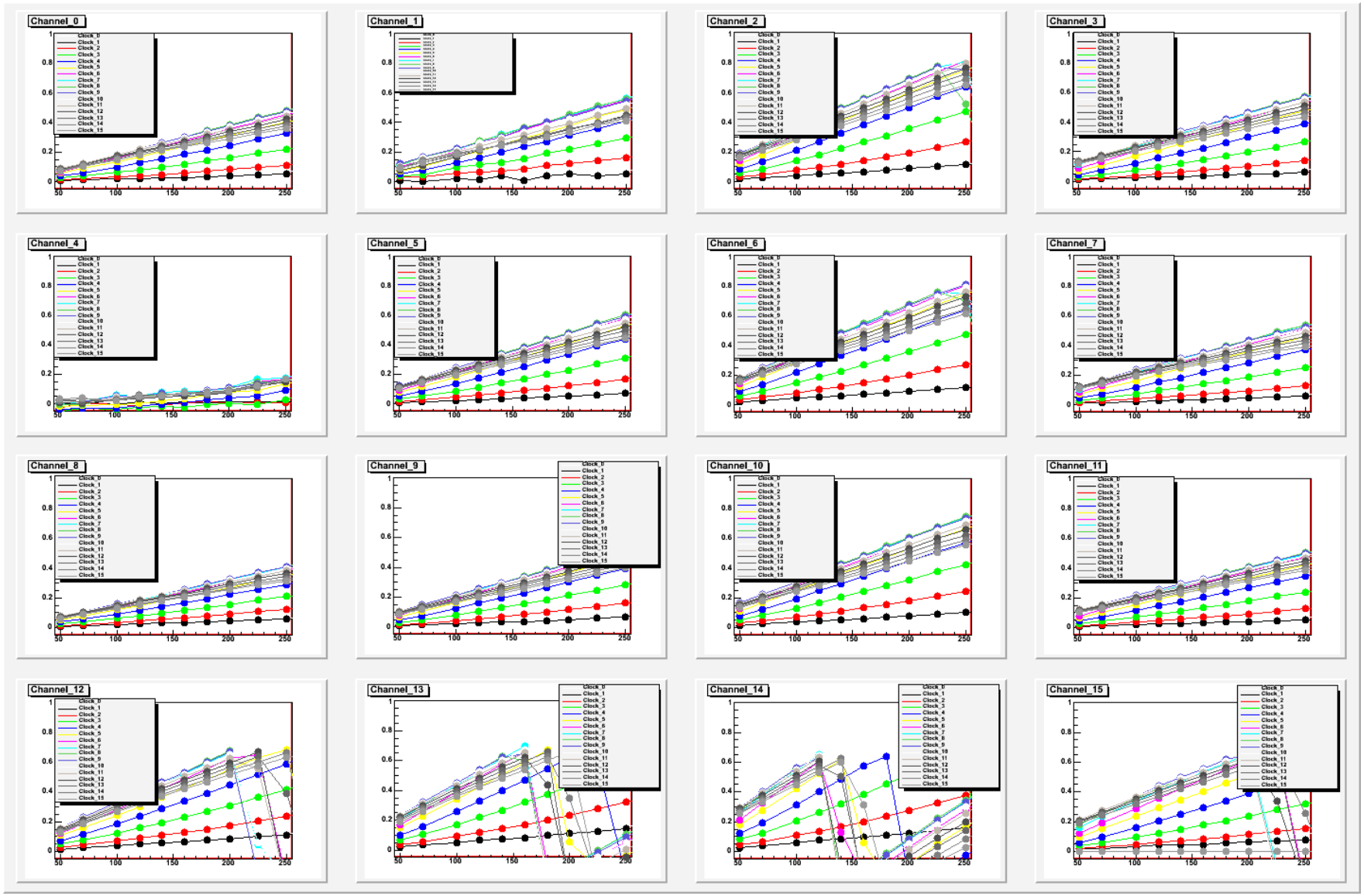
Calibration studies 130 hpk

Testbench system
Varied Calibration voltage nd monitored the readout (16-clock sum)
Linearity up to ~250 mV, at which points the chip saturates

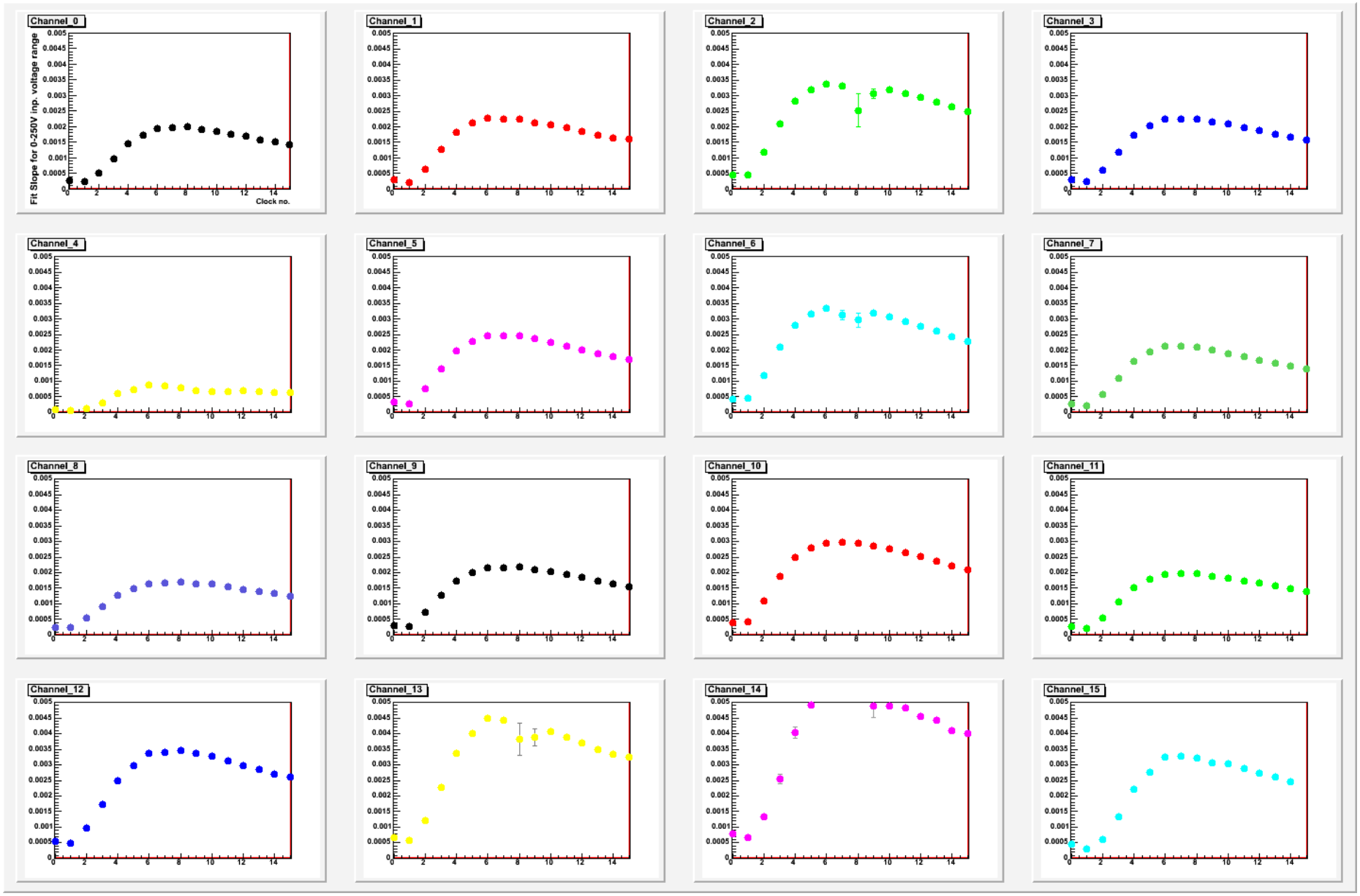




Calibration – fit vs channel view



Calibration – slope vs channel view



Conclusions

- New analysis of testbench and CERN data
- Simple now, more complex (yet user-friendlier) to come
- Calibration, testbench results check out well
- Mixed success, but good progress on CERN data
  - VA1 checks out
  - 130nmcms slightly better than 130nmhpk
    - Only a subset of the events can be recovered, different events for different channels.
- Deploy the new code so everybody gets to try it out:
- lpnhe-lc.in2p3.fr/internal/

SenteriLC-insider
tar-xzvf …
root
.L apple_tree.c+
readit2(4)

Bit analysis