(Partial) Results from the CMS Counting Room

- **Andy Haas (ATLAS, NYU)**
  - Summer undergrads: Silas (Columbia), Tiantian (NYU Abu Dhabi)
- Chris Hill (CMS, OSU)
  - Postdoc: Wells Wulsin
  - Grad student: Kent Talbert
  - Undergrad: Ariel Wilson
- Albert De Roeck (CMS, CERN)
  - Adi (CERN summer student)
- Martin Gustal (CERN) (CMS-area help)

- June 24 - July 4, 2015, plus data through August 14th
- Scintillators with tubes in "old counting room"
  ~25m from CMS interaction point, behind ~7m of concrete
- Goal: see what backgrounds (if any) are caused by beam collisions in this area

Surface tests (building 10)

Surface tests (building 10)

Setup

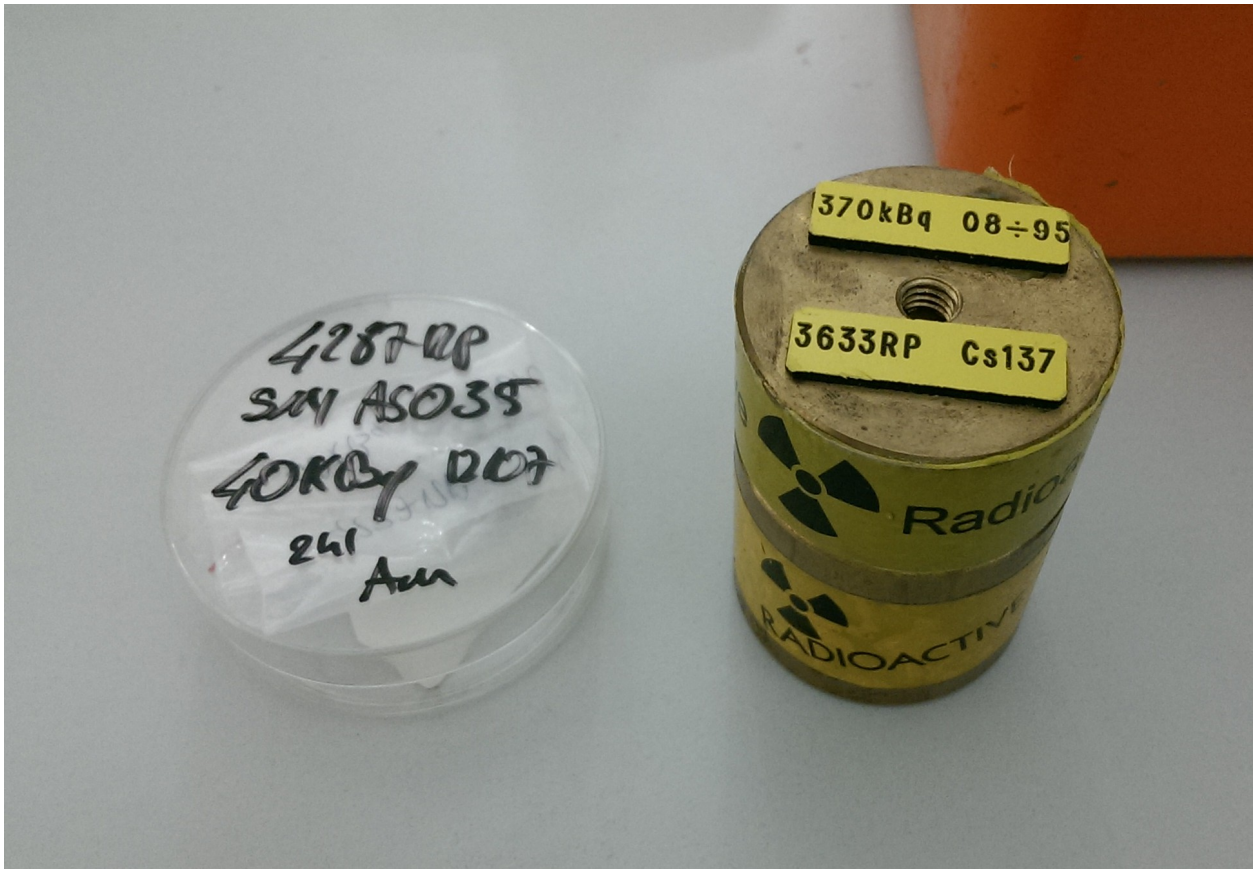
- Two setups (NYU and OSU)
- Both using "eMorpho" readout (80 MHz sampling digitizer) (about $1500 each)
- HV supplies from CERN electronics pool (1 CHF/month)
- Both setup with LED "pulser", flashing at 10-40 Hz, driven by *NYU* emporho (so pulses are in sync)

- NYU:
  - 3" Hamamatsu h2431 (borrowed from old BNL Brahms exp.)
  - First had large OSU scintillator, but found to be inefficient – switched to 3" diameter, 2.25" long BC412
- OSU:
  - 2" Hamamatsu R787
  - Large unknown scintillator :)

Safety training

Setup in the "old counting room"

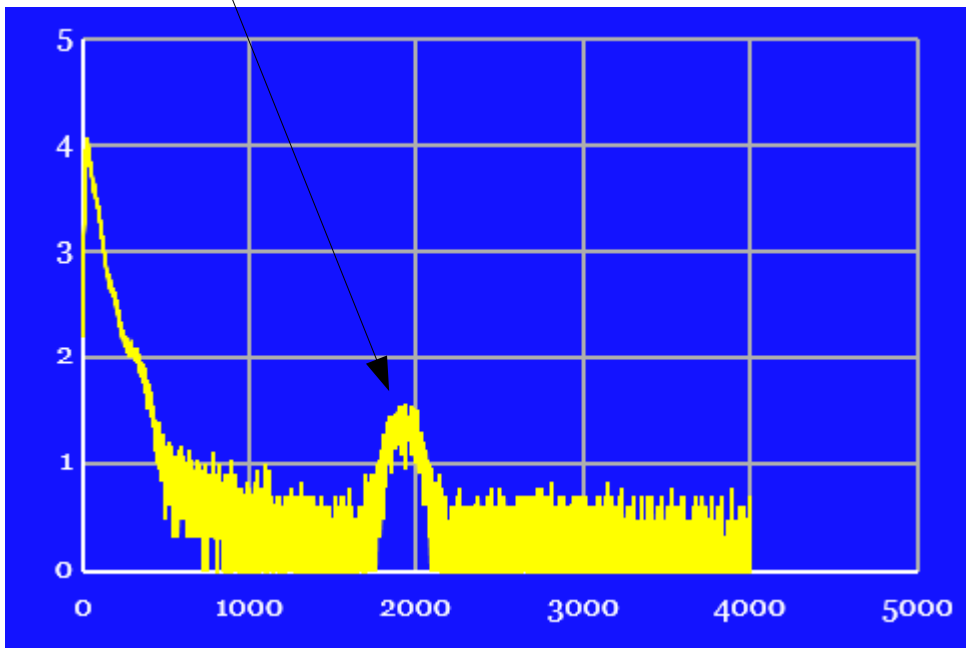
Radioactive sources (for calibration)



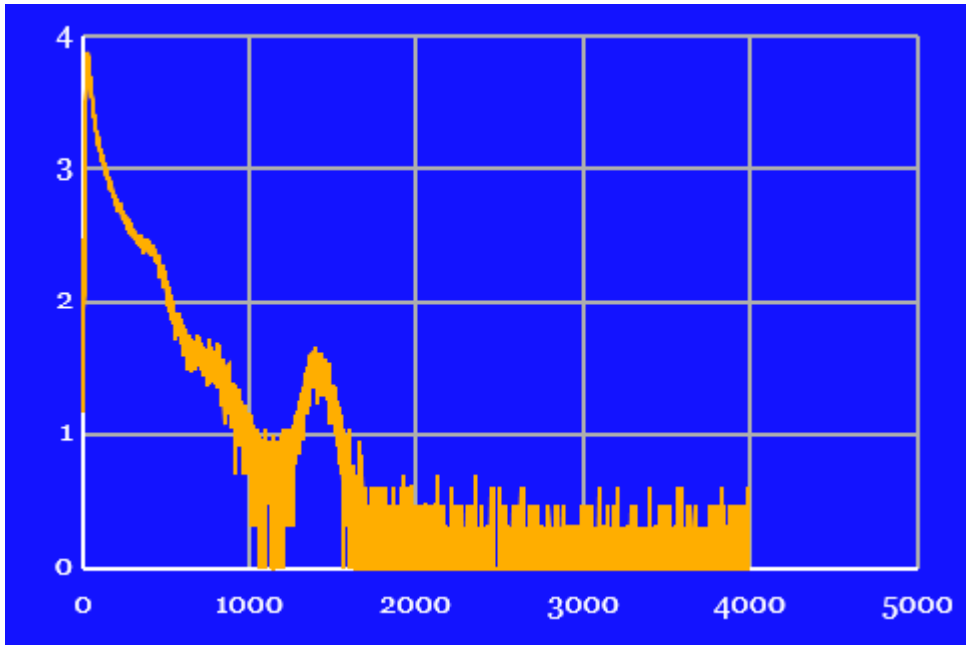
The dosimeters do work

Measurements

- On the surface
- LED pulser



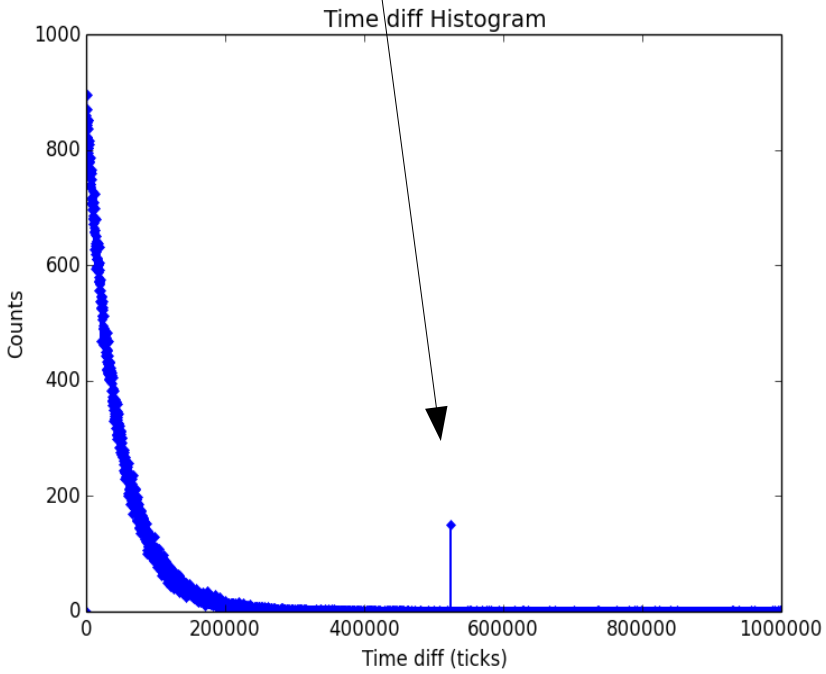
NYU setup

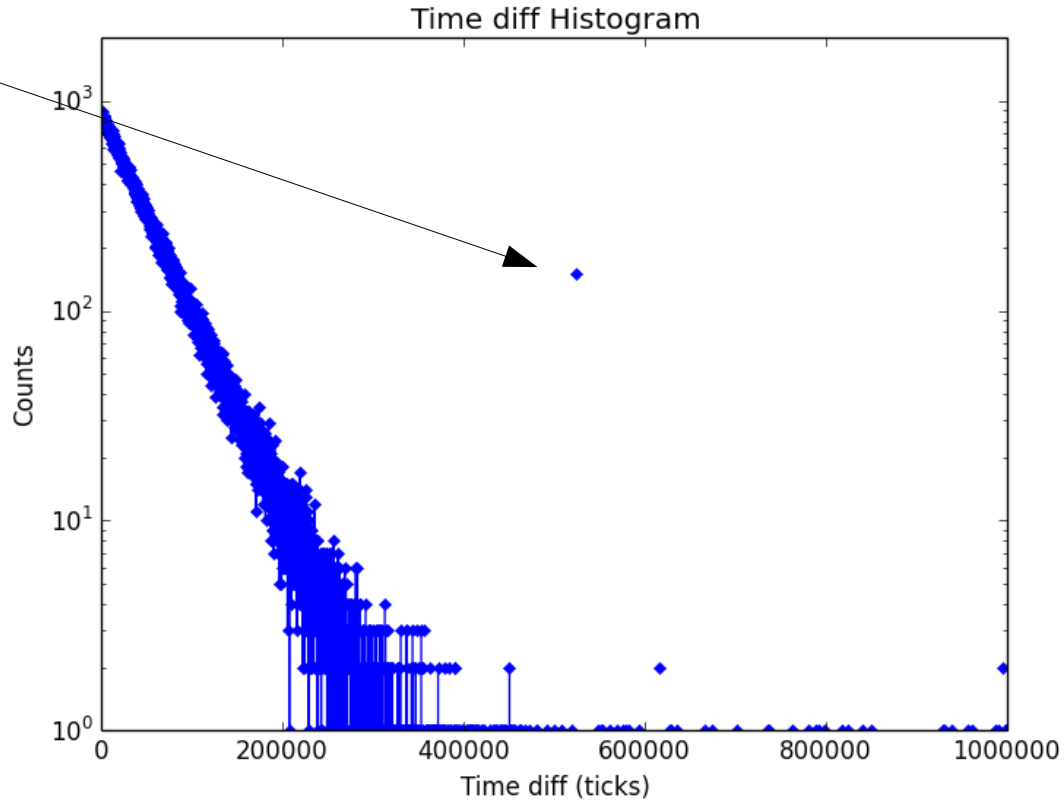


OSU setup

Measurements

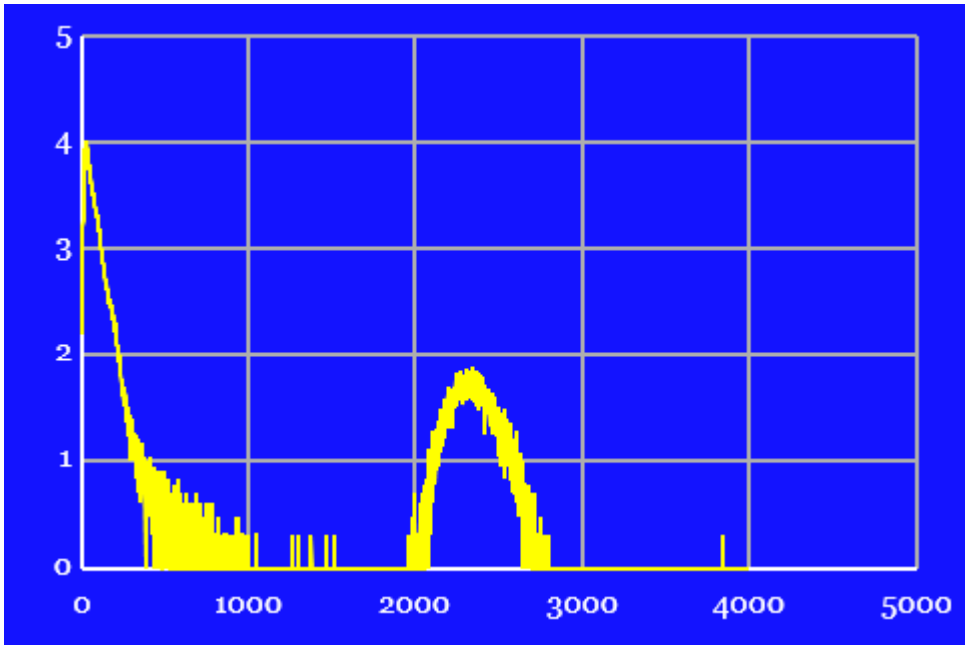
- Time structure is random (Poisson)
- (LED pulser)



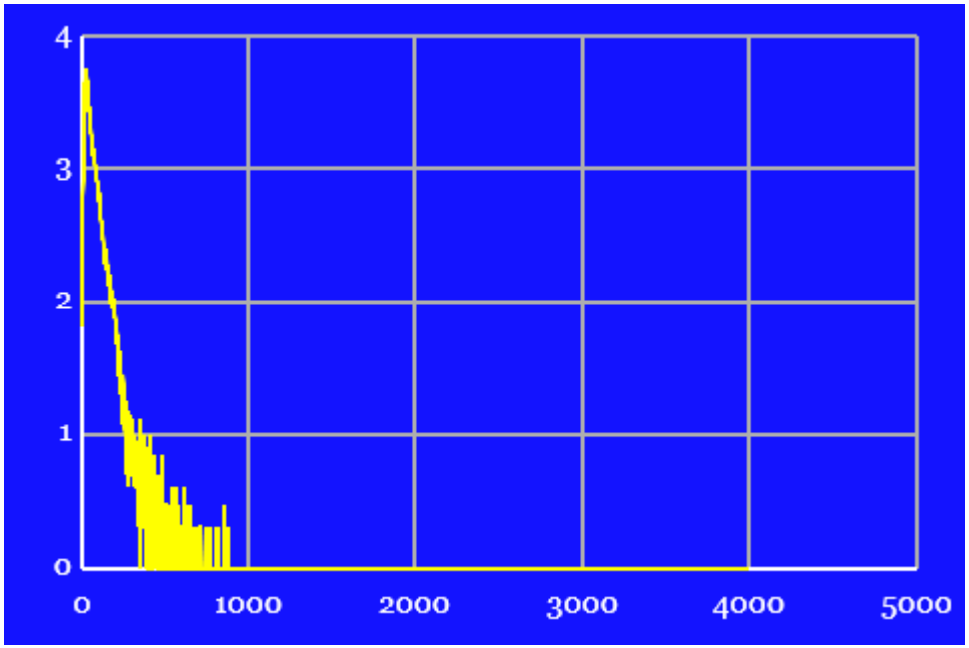


Measurements

- In "old counting room", underground 100m
- Cosmics are mostly gone!

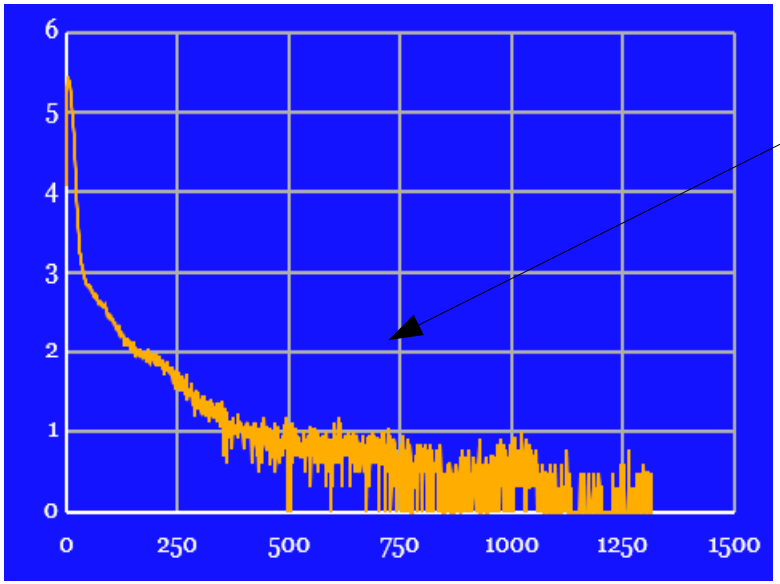


With LED pulser



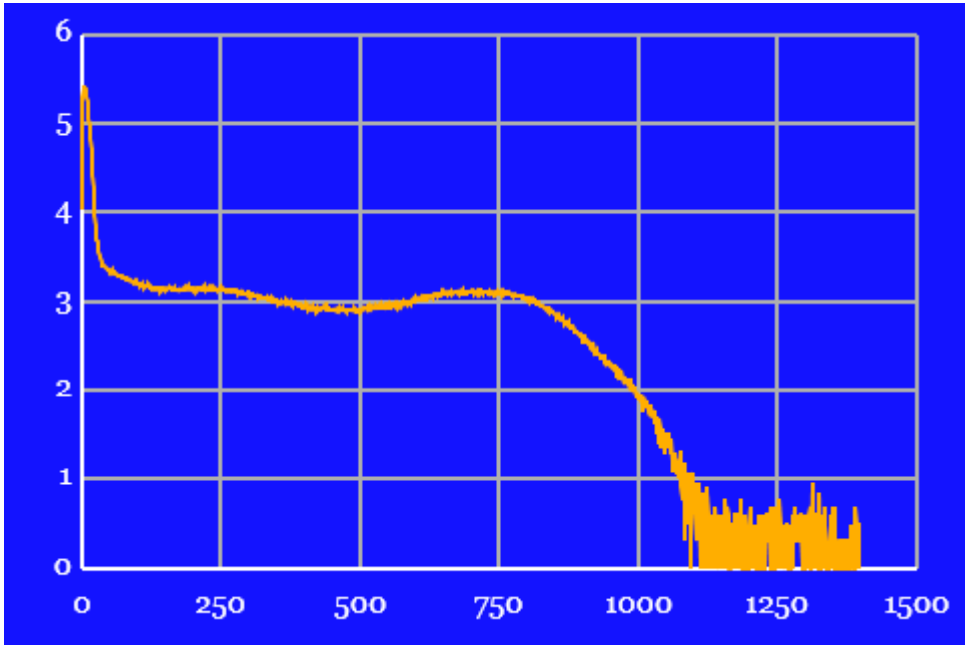
Without pulser

Calibration

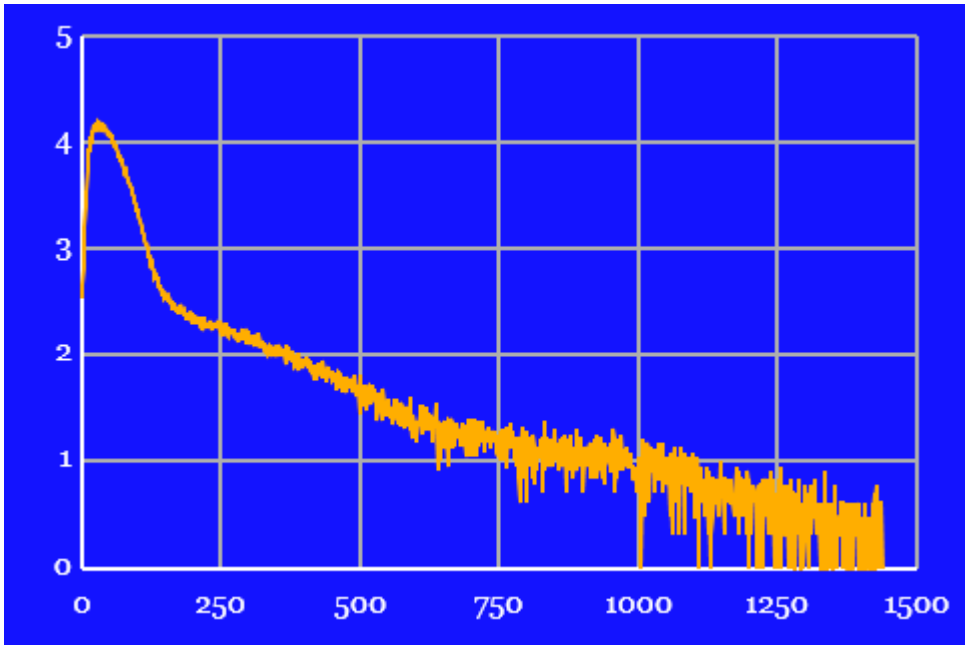


With no sources

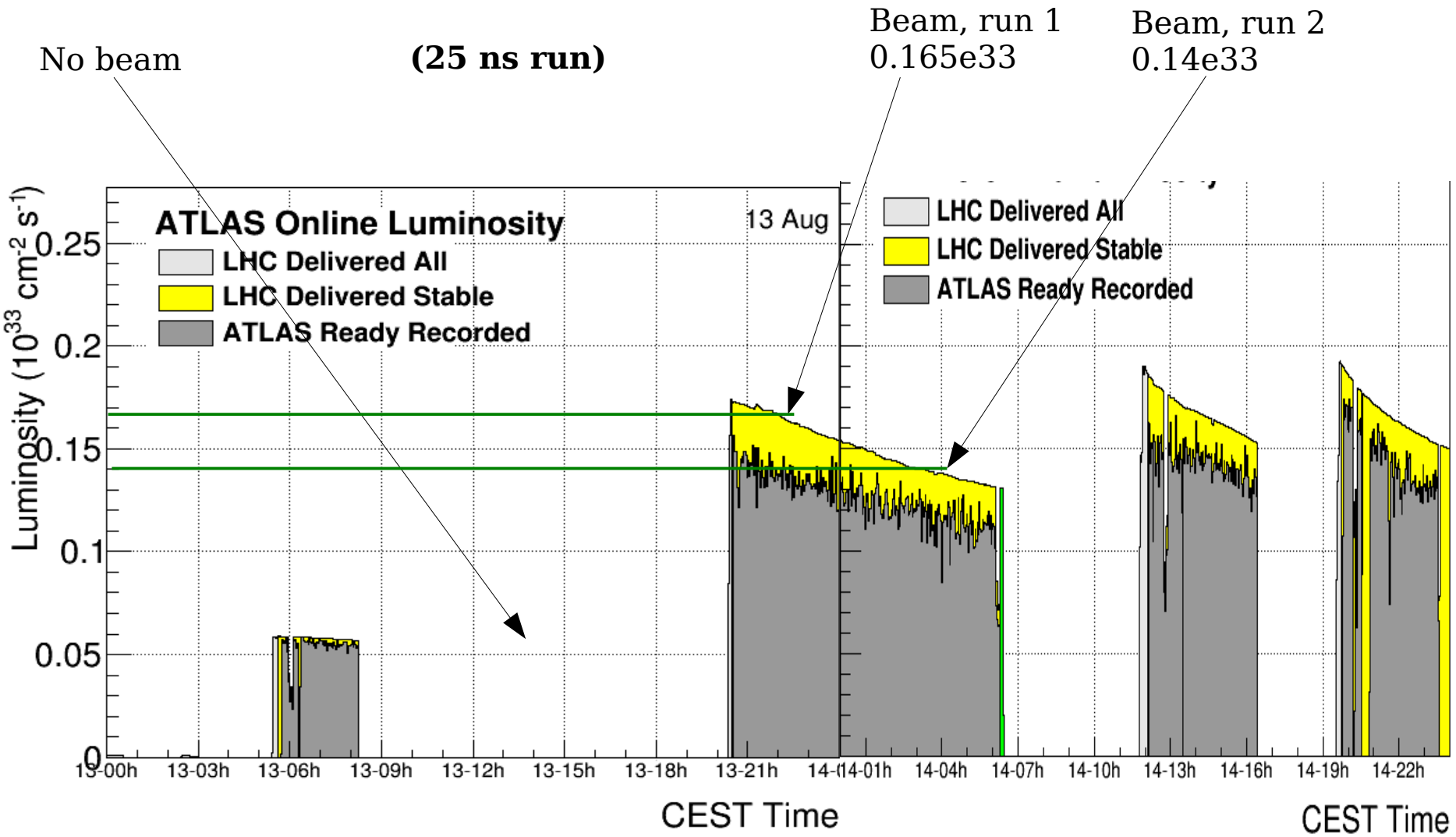
With Cs137 source
(660 keV gamma)



With Am241 source
(60 keV x-ray)

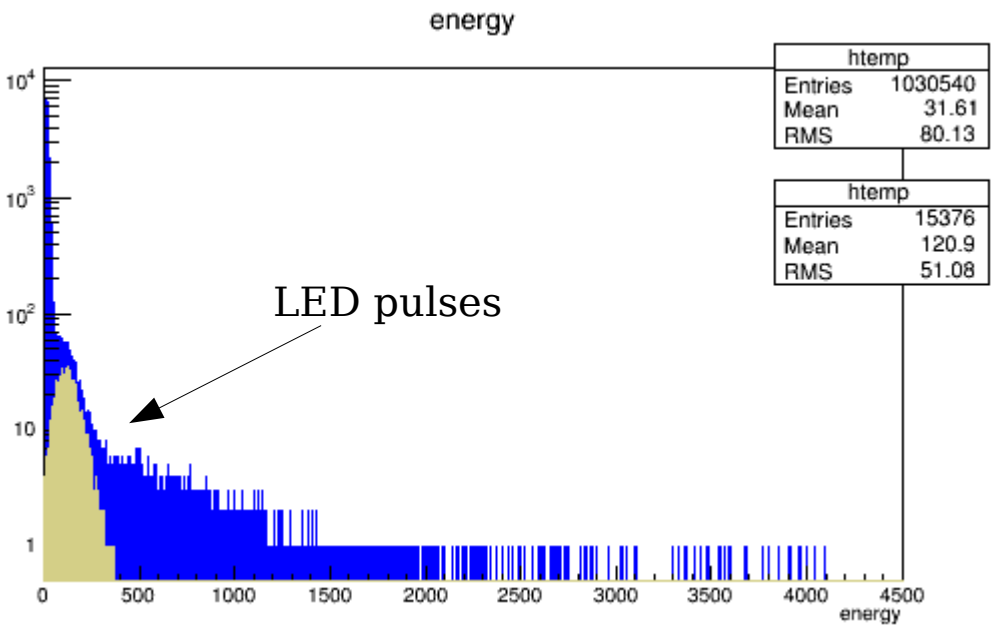


Background Measurements on Aug 13

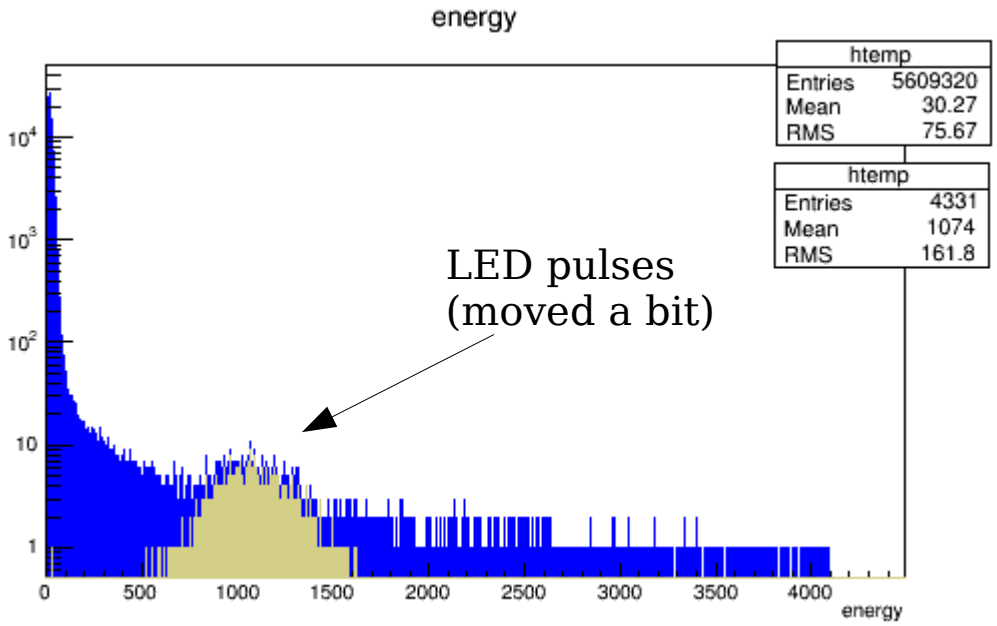


MilliQan Background Measurements

No beam



Beam, run 1
0.165e33

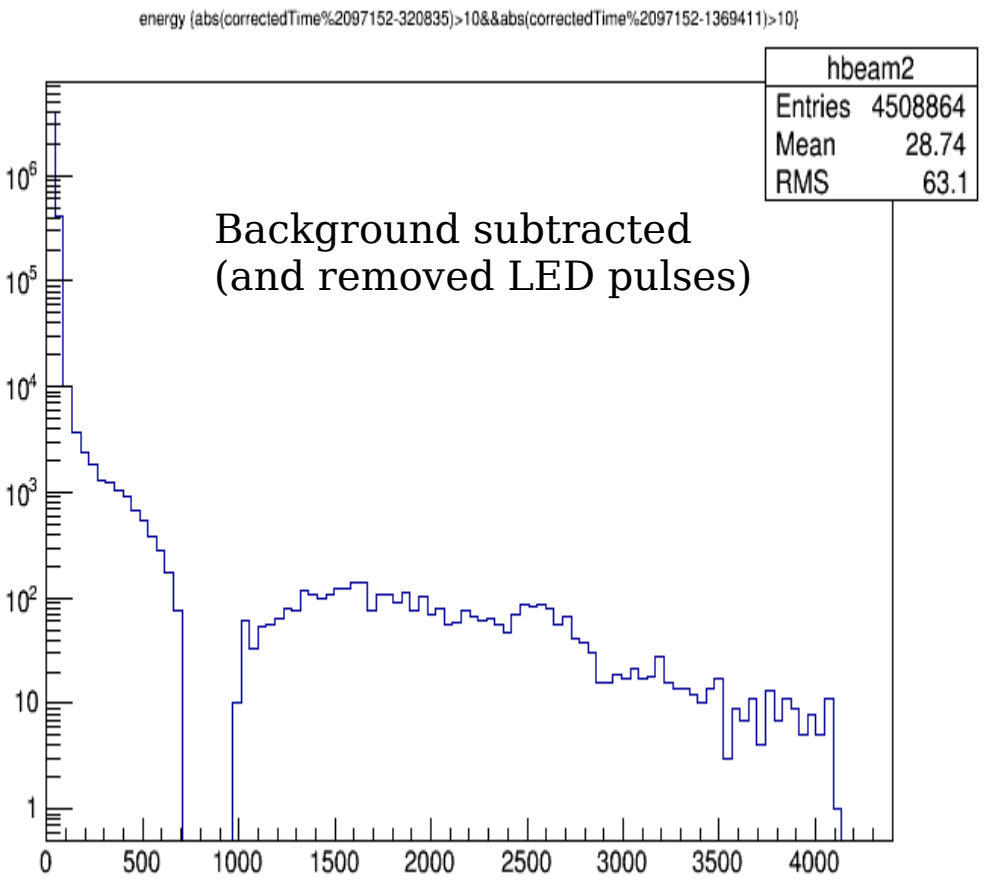


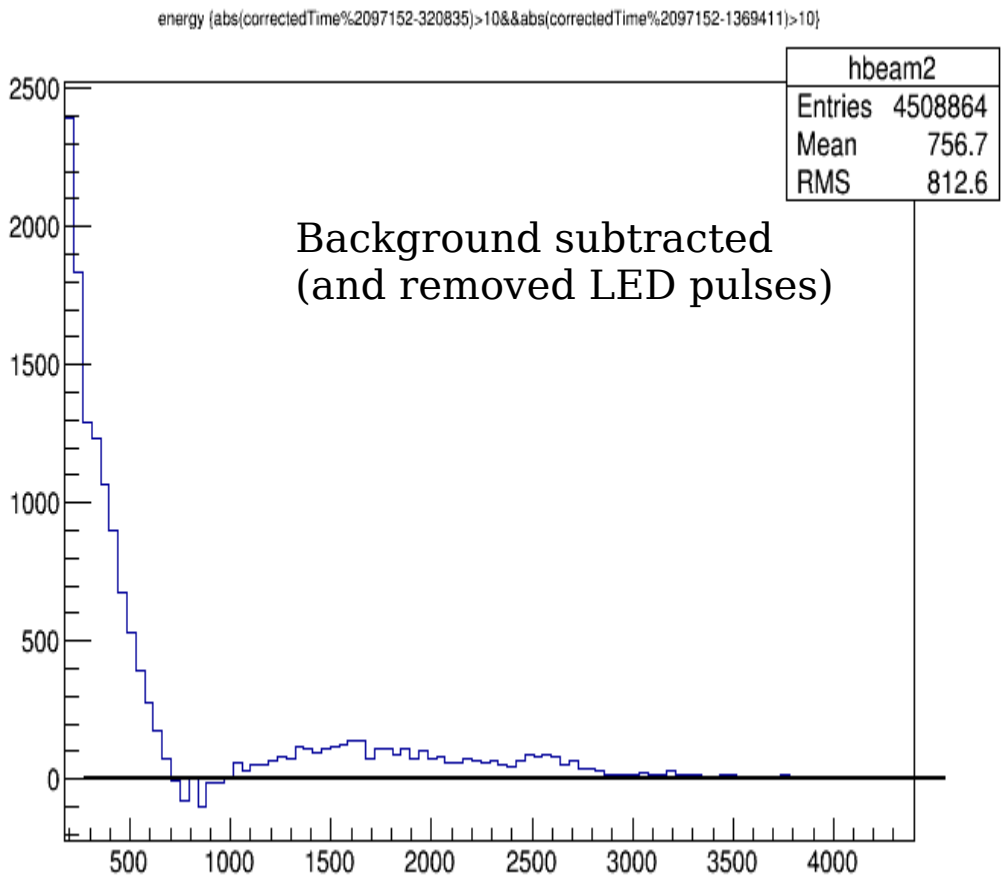
Overall rate is ~5x higher…

Only looking at data from NYU tube 1405 so far…

MilliQan Background Measurements

Beam, run 1
0.165e33

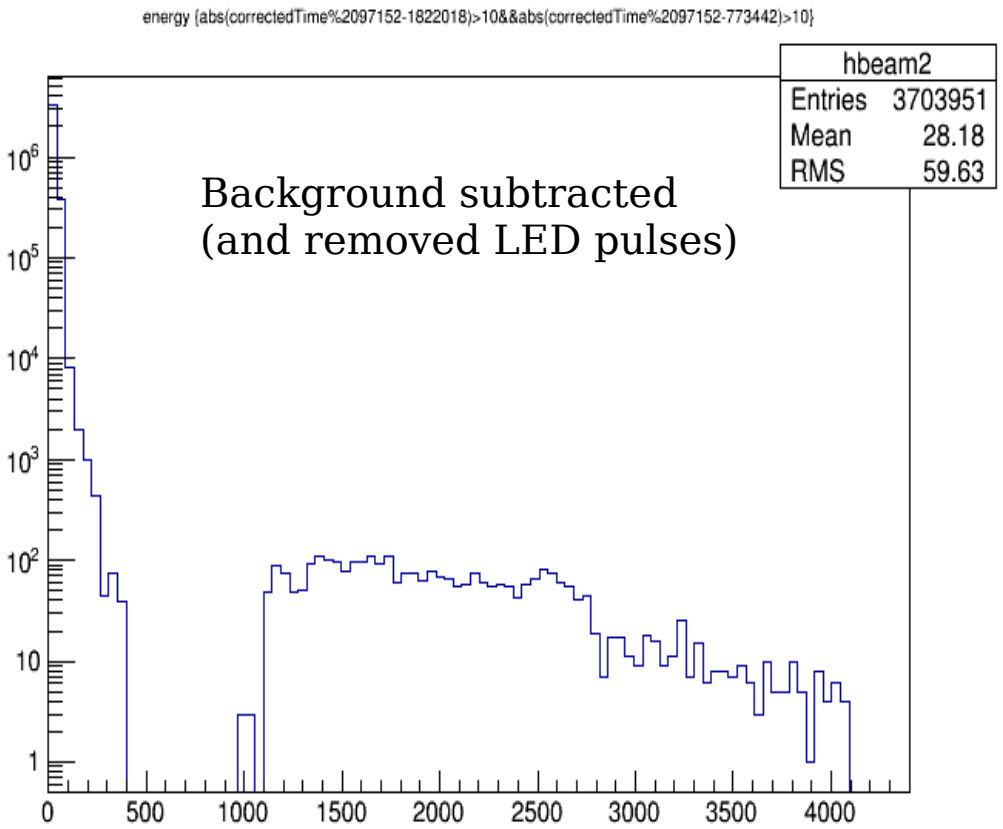




Additional 4.5M counts in 1000s (4.5kHz)

MilliQan Background Measurements

Beam, run 2
0.14e33



Overall rate increase of ~18% from run2 to run1.
(4.5/3.7)

Overall lumi increase of ~21% from run2 to run1.
(1.65/1.4)

Consistent!

Additional 3.7M counts in 1000s (3.7kHz)

Conclusions

- There is more background with beam on...
  - The total rate is about 5x larger at these luminosities (0.15e33), and does scale roughly linearly with luminosity.
  - The spectrum shows the increase mainly at low energies, x-rays of about ~100 keV.
    - This is consistent with "cavern background" - low energy neutron/gamma "haze".
- We should try shielding the tubes with lead bricks
  - CMS's supply was "out for painting" over the summer...
- Would be good to see how the rate changes over a wider range of luminosities, to see that it remains linear.
  - Now up to 3e33 (20x higher!)
  - Rate (if linear) would be ~20kHz without shielding!