Runs with scintillator trigger: Hit multiplicity

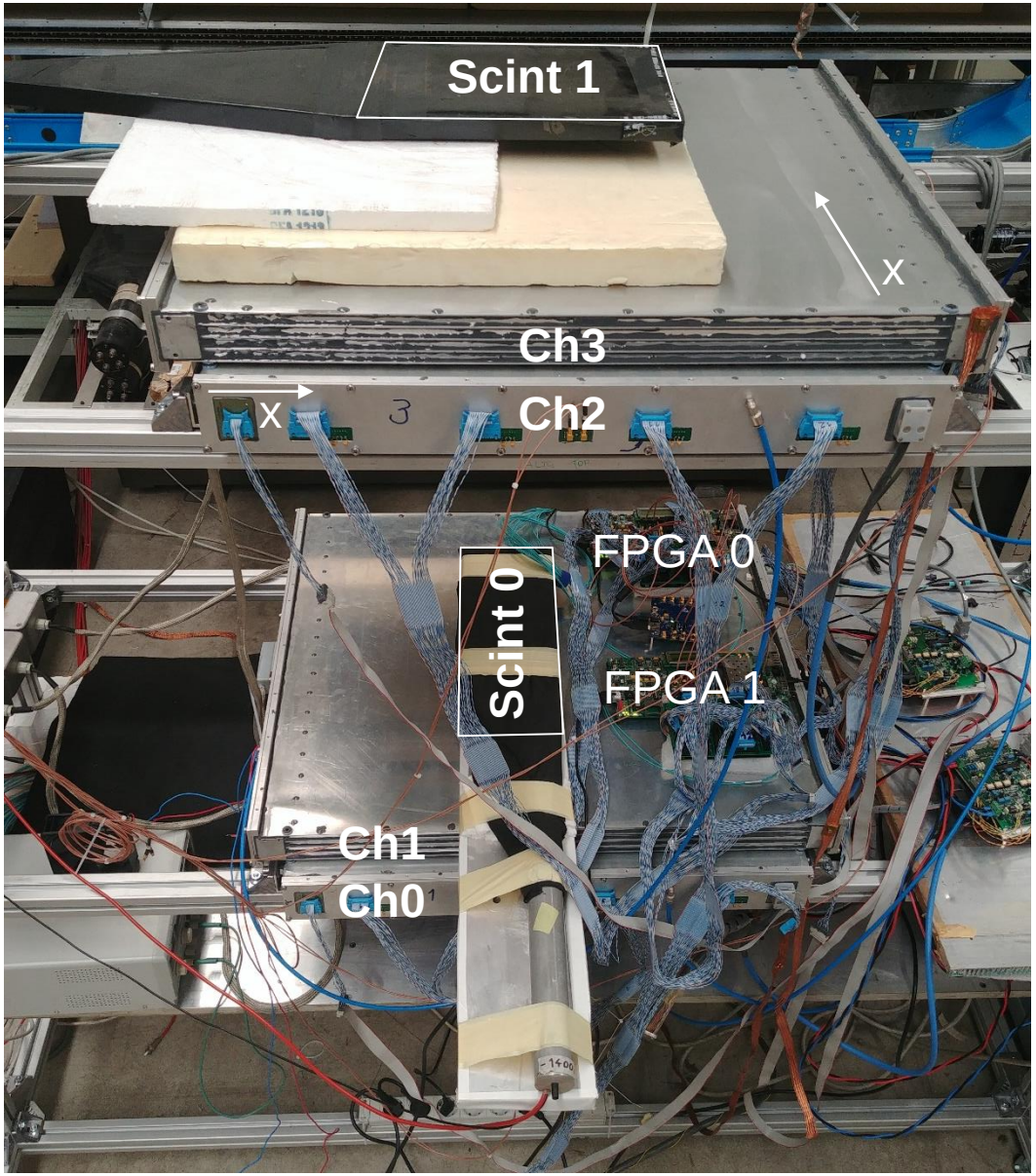
24/6/2019

Run 617: Setup

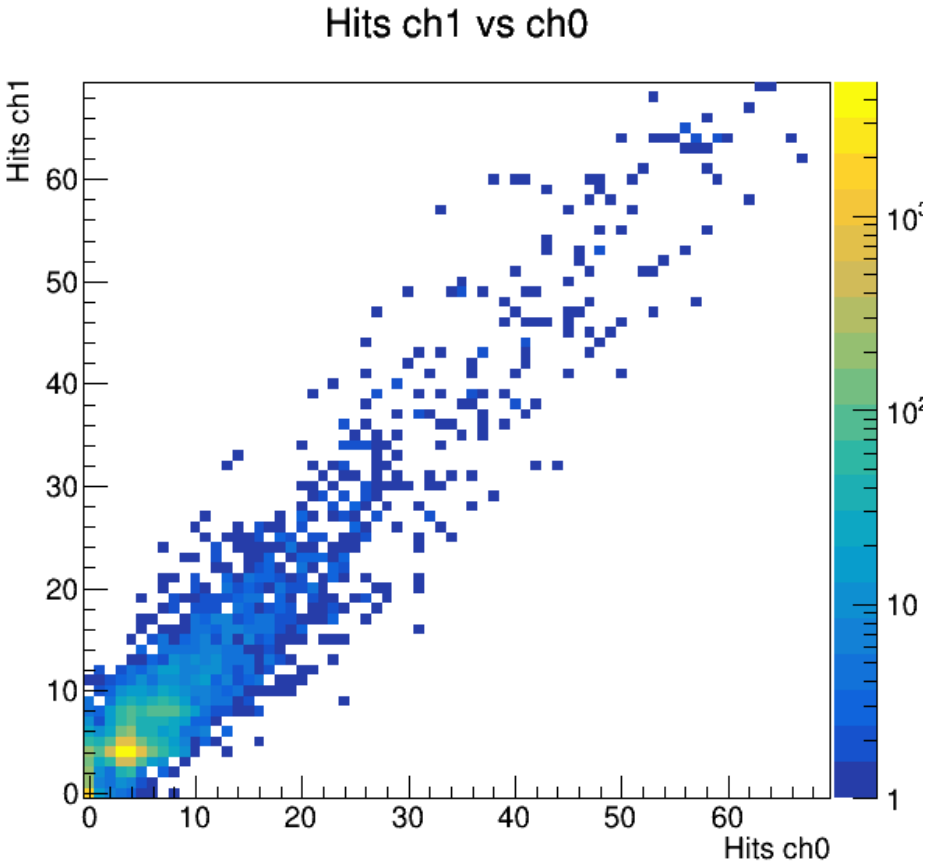
Coincidence of
SCINT 1 && SCINT 0 to (1,129)

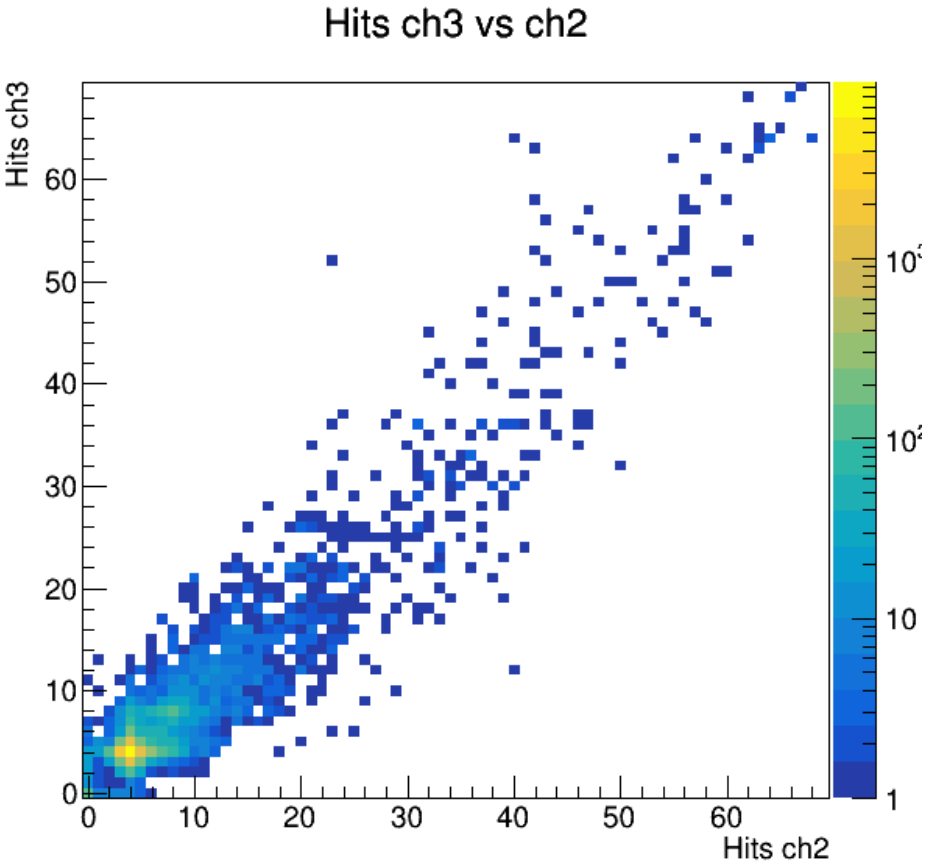
Read out by FPGA 1

Read out by FPGA 0



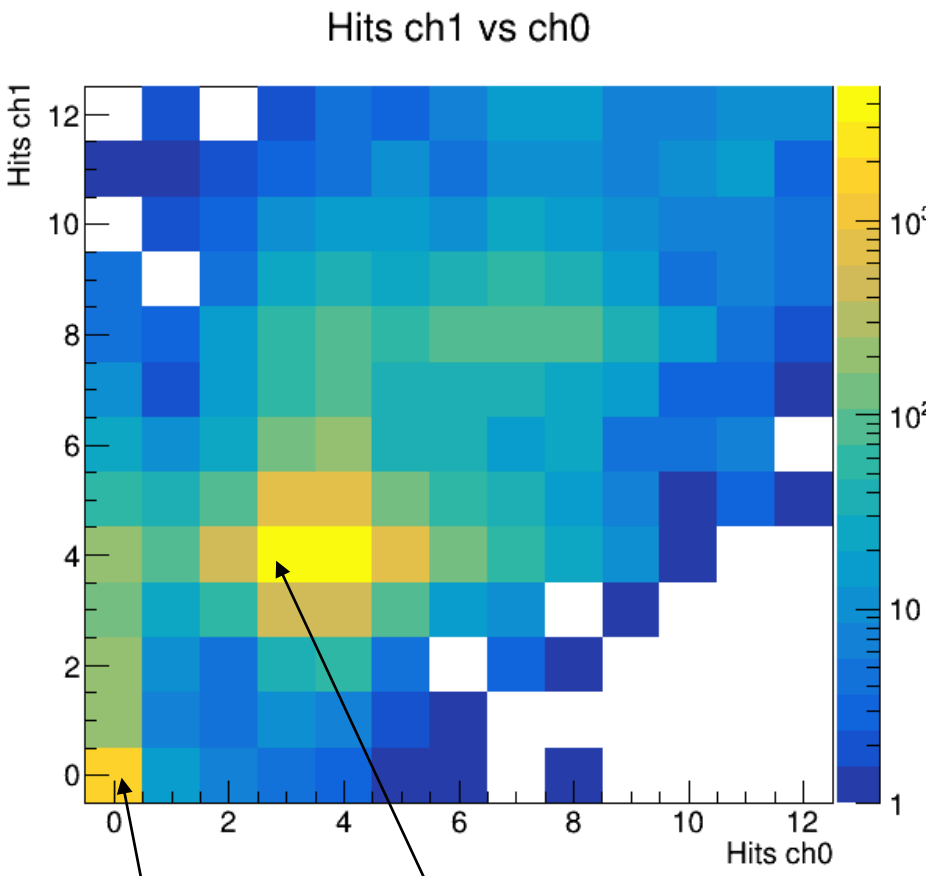
#hits per chamber





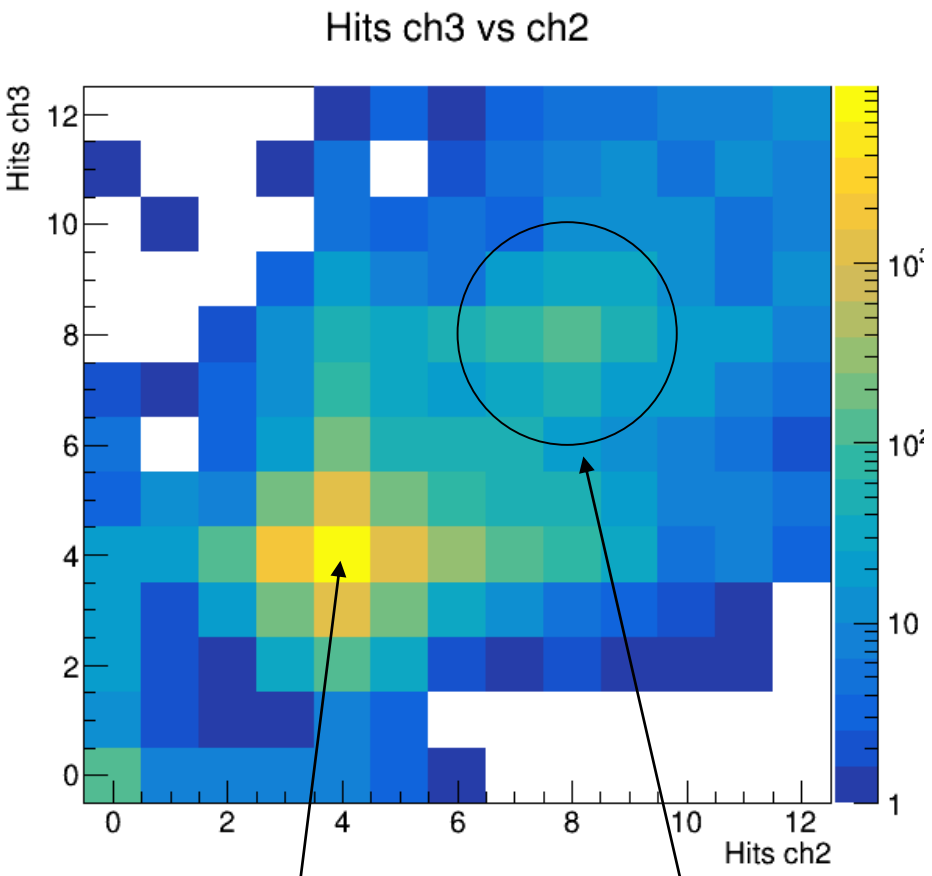
- Note: counting hits within **-5 ns < tdc < 380 ns** after calibration
- Nice peaks at ~4 hits/chamber
- 'showers' well correlated (more on this later)

#hits per chamber (zoom)



1 hit often missing in ch0
(several dead channels)

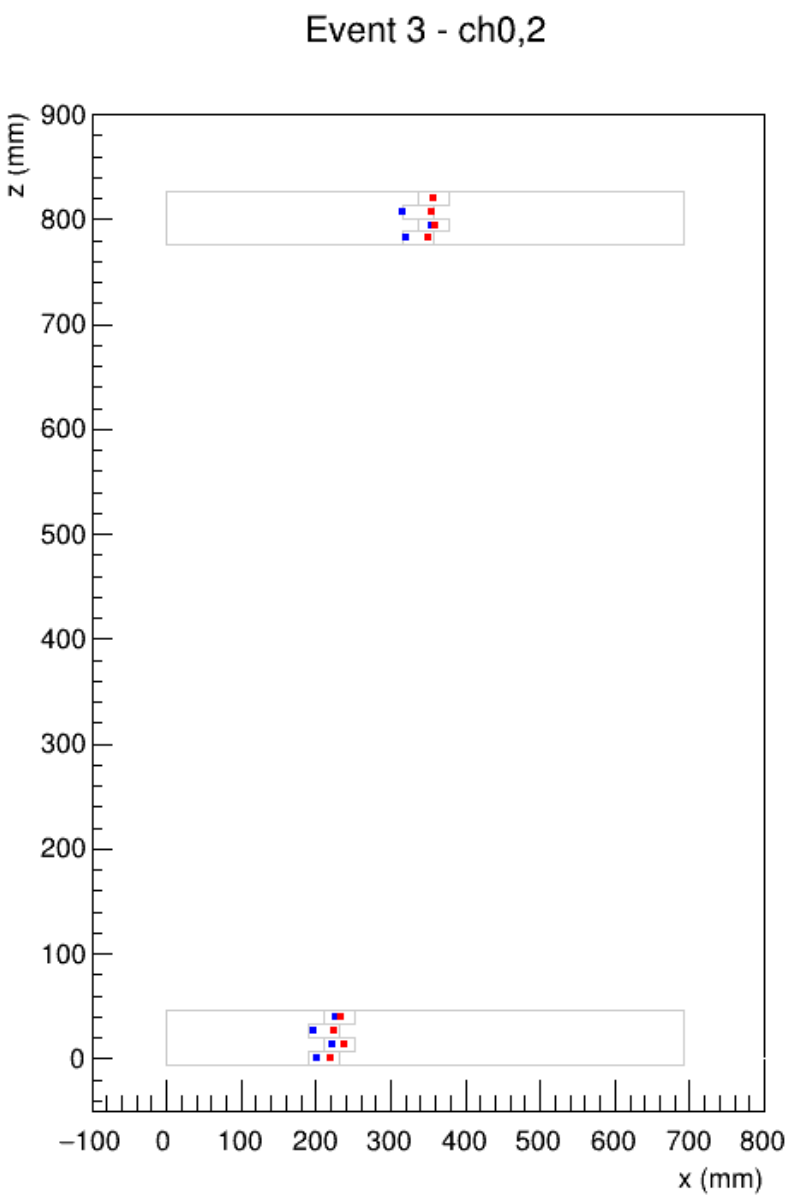
No data from FPGA0!
(more on this later)

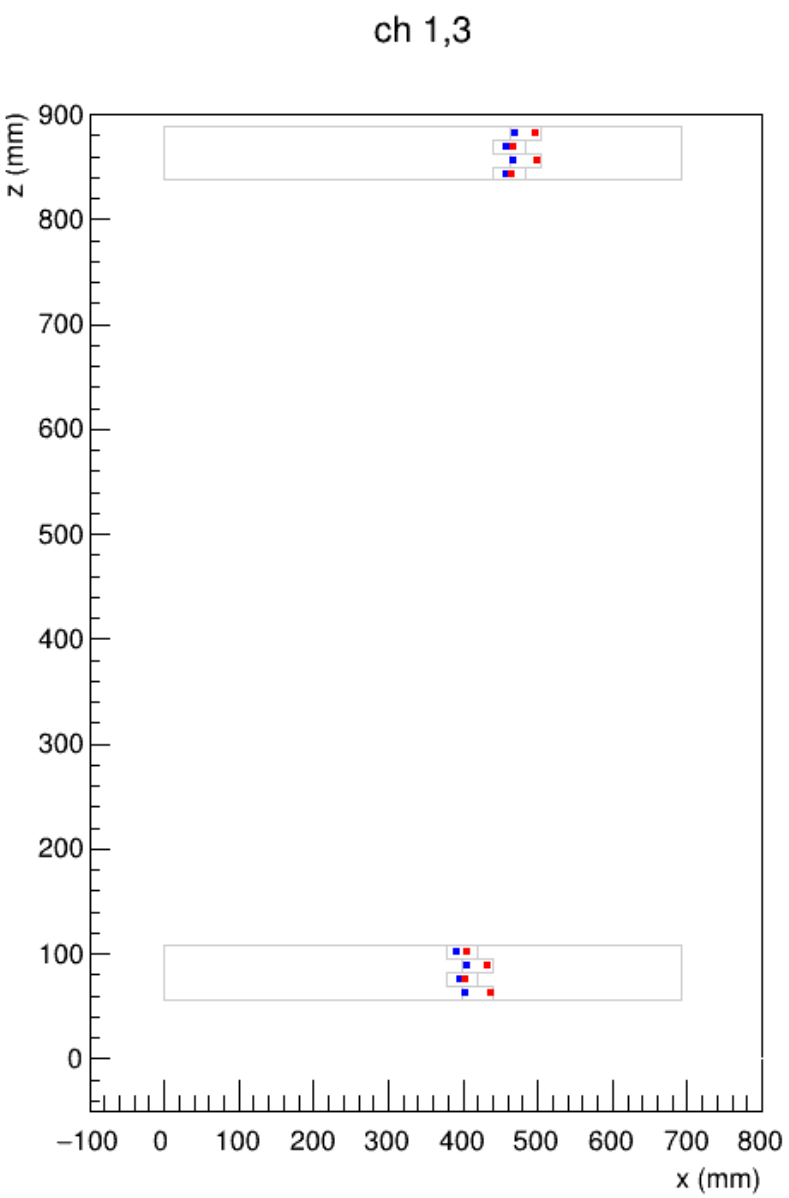


The good ones

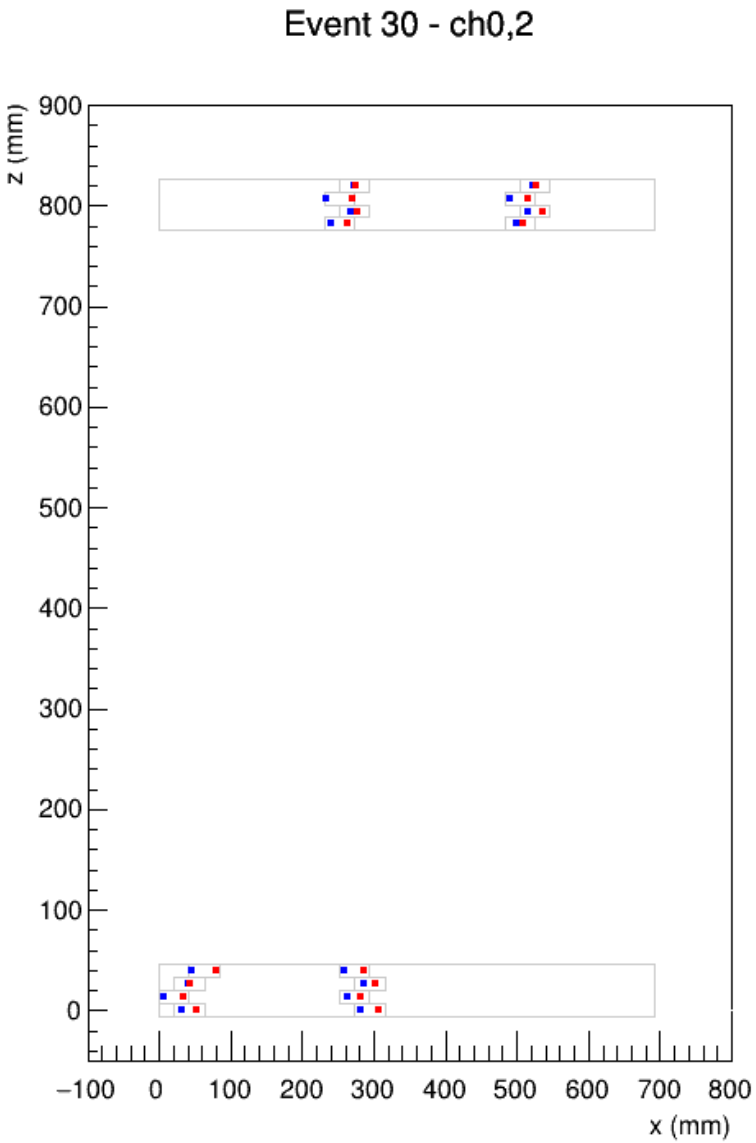
2 muons in
the same event!

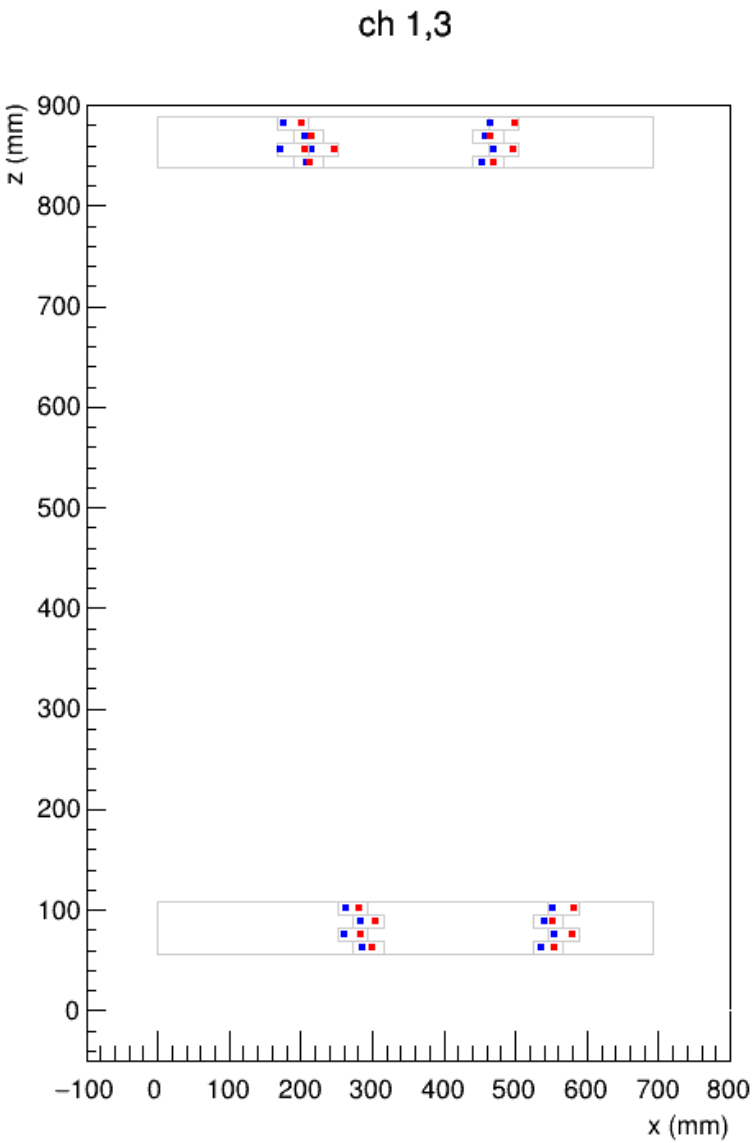
Gallery: good events





Gallery: 2-muon events





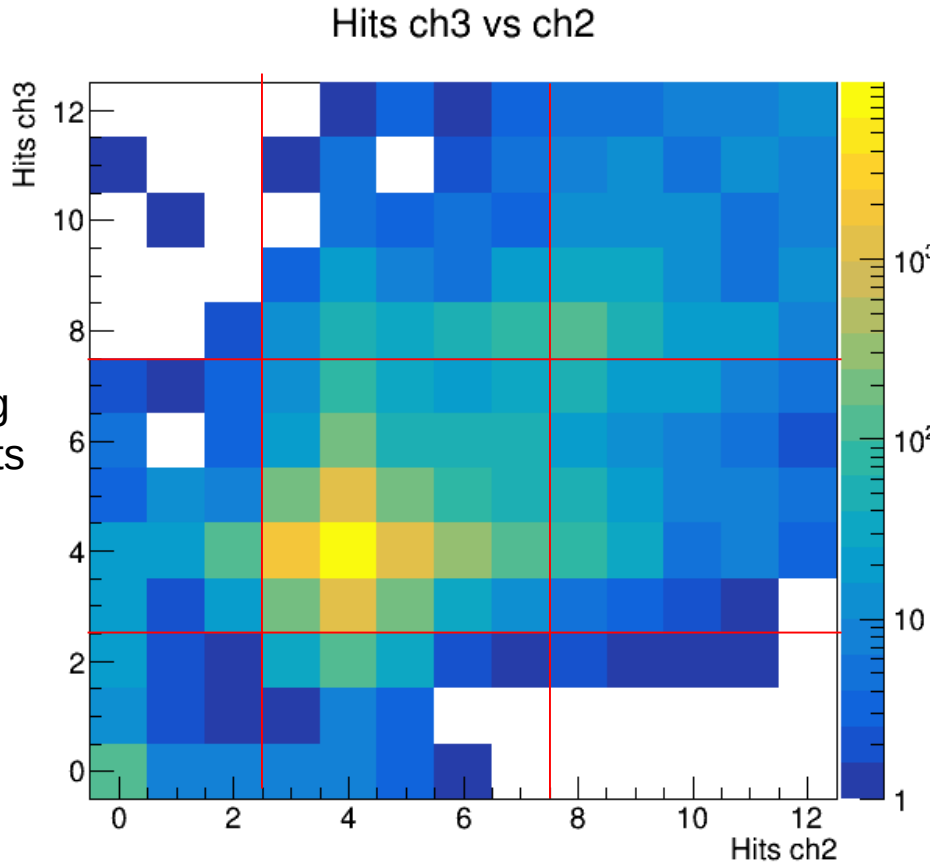
Nice; not too rare…

'Efficiency' for 'good' events

- Define 'good' chamber ≡ **3<=nhits<=7**

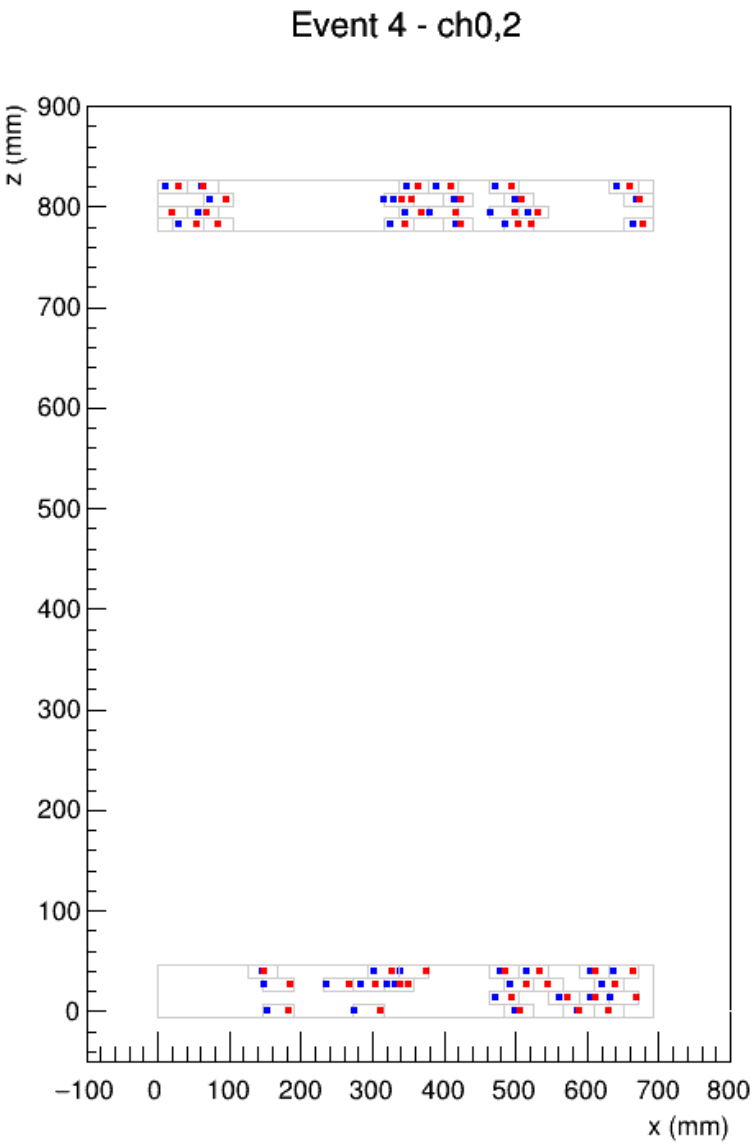
- 'Efficiency', using neighbour chamber as a tag (to avoid counting showers and 2-muon events in the denominator):
  - good_ch0 | good_ch1 : **91%**
  - good_ch1 | good_ch0 : **94%**
  - good_ch2 | good_ch3 : **97%**
  - good_ch3 | good_ch2 : **97%**

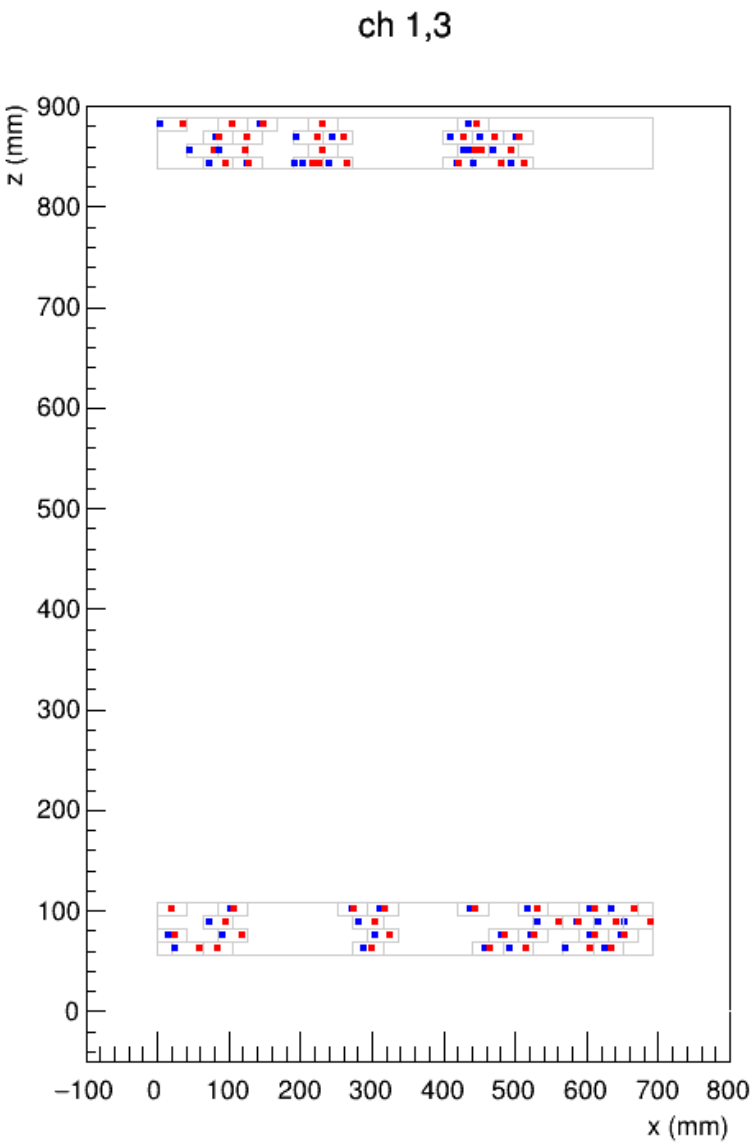
  Not bad…



- "Showers" (≡ >10 hits in chamber):
  - 3.4% of triggers in ch0&&ch1
  - 3.2% in ch2&&vh3
  - 2.2% in all 4 chambers

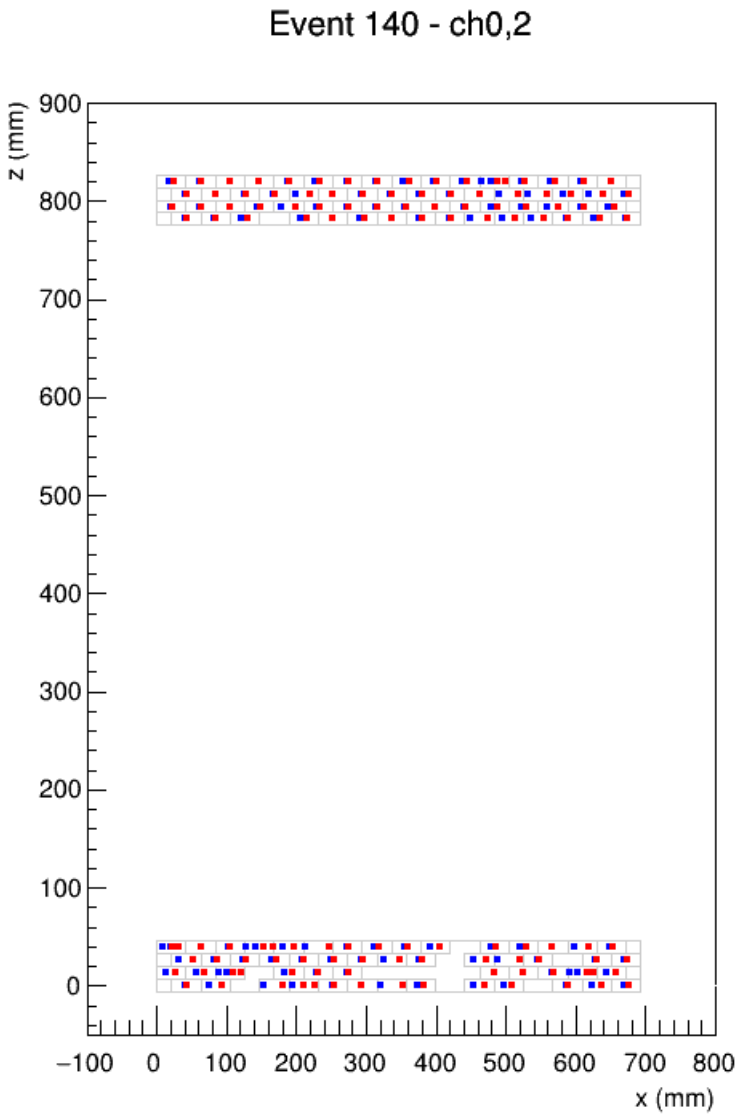
Gallery: 'shower'

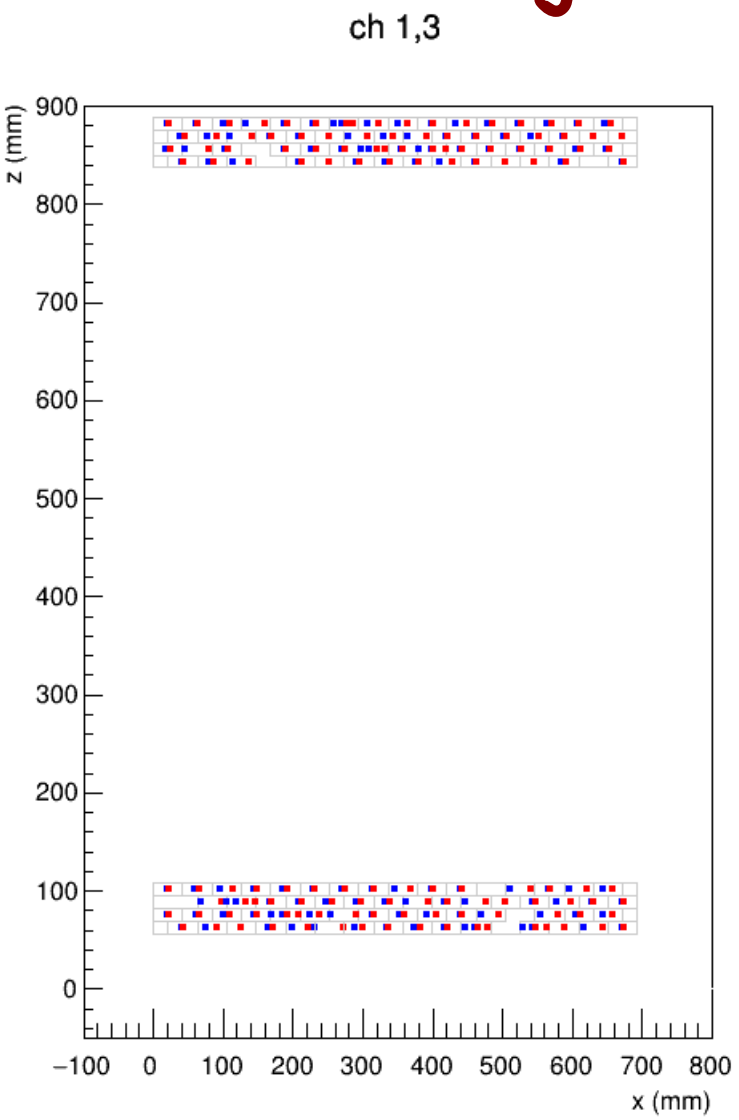




Some are apparently physical (track patterns visible)…

Gallery: 'shower'



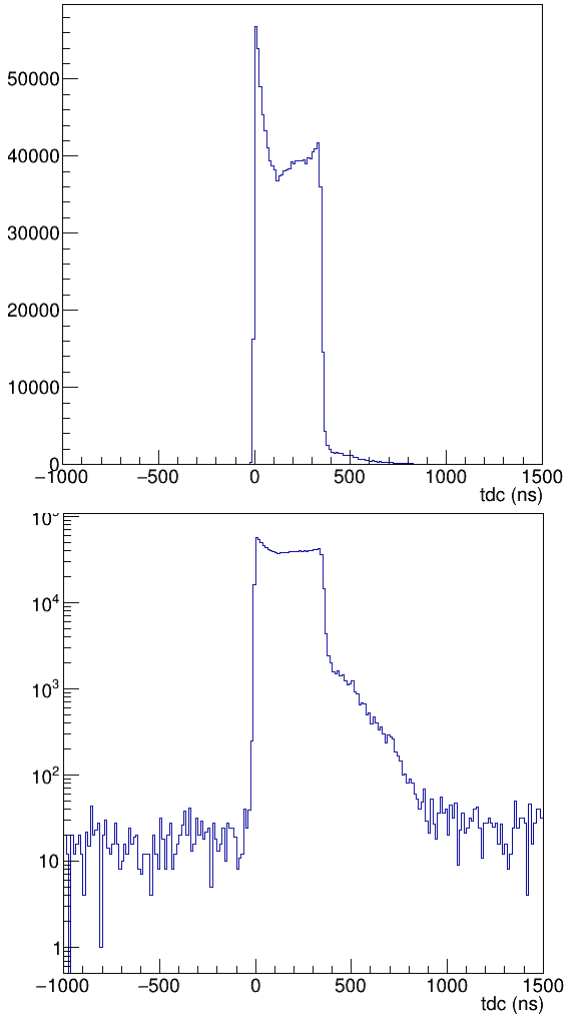


Some are suspect:

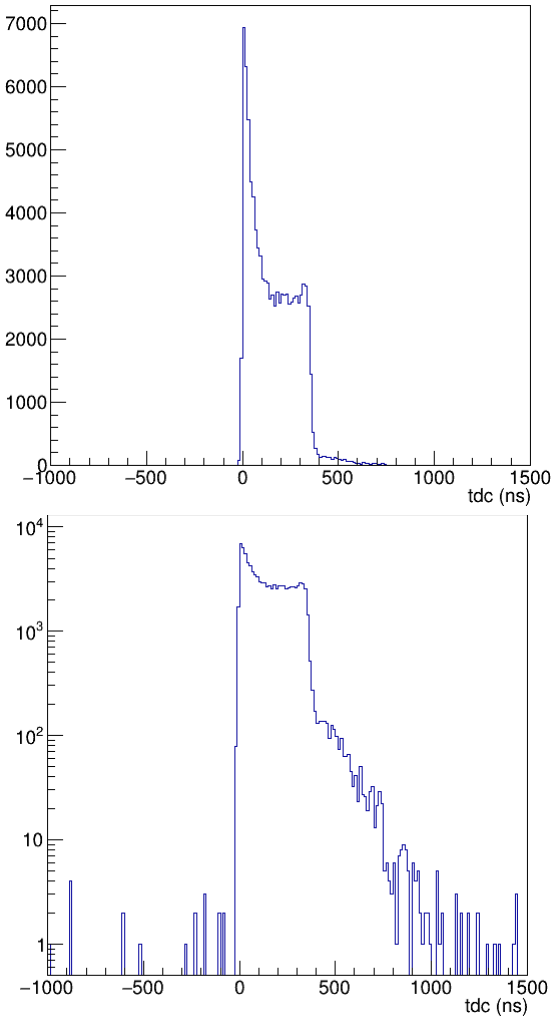
- Strange patterns (hits close to the wire in several diagonal rows of cells)

Showers

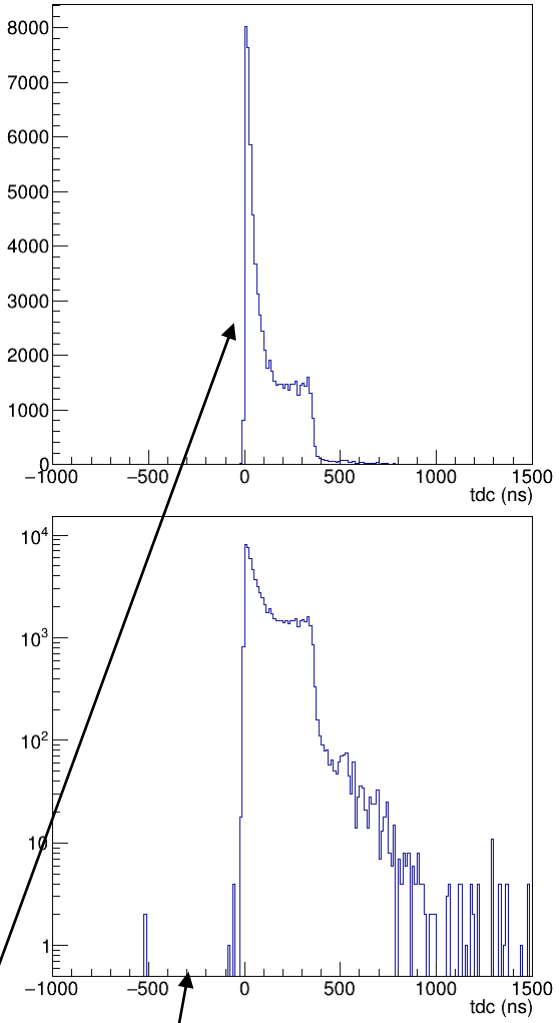
Chambers with < 10 hits



Chambers with 20 < hits < 40



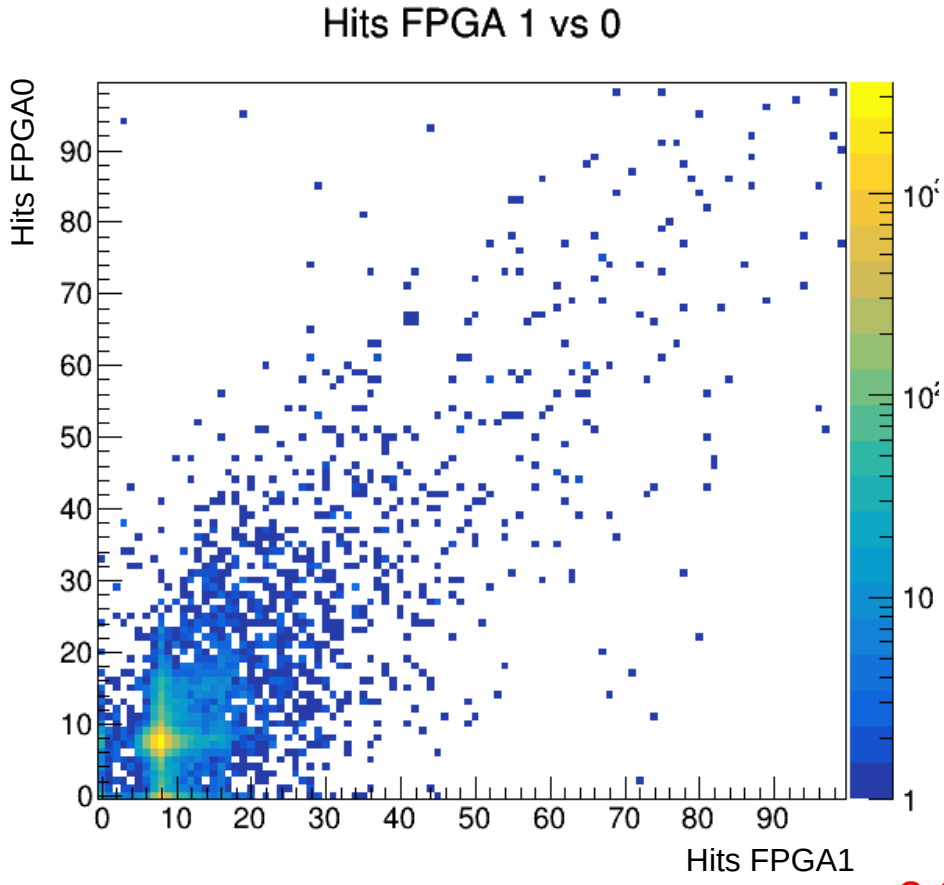
Chambers with > 40 hits

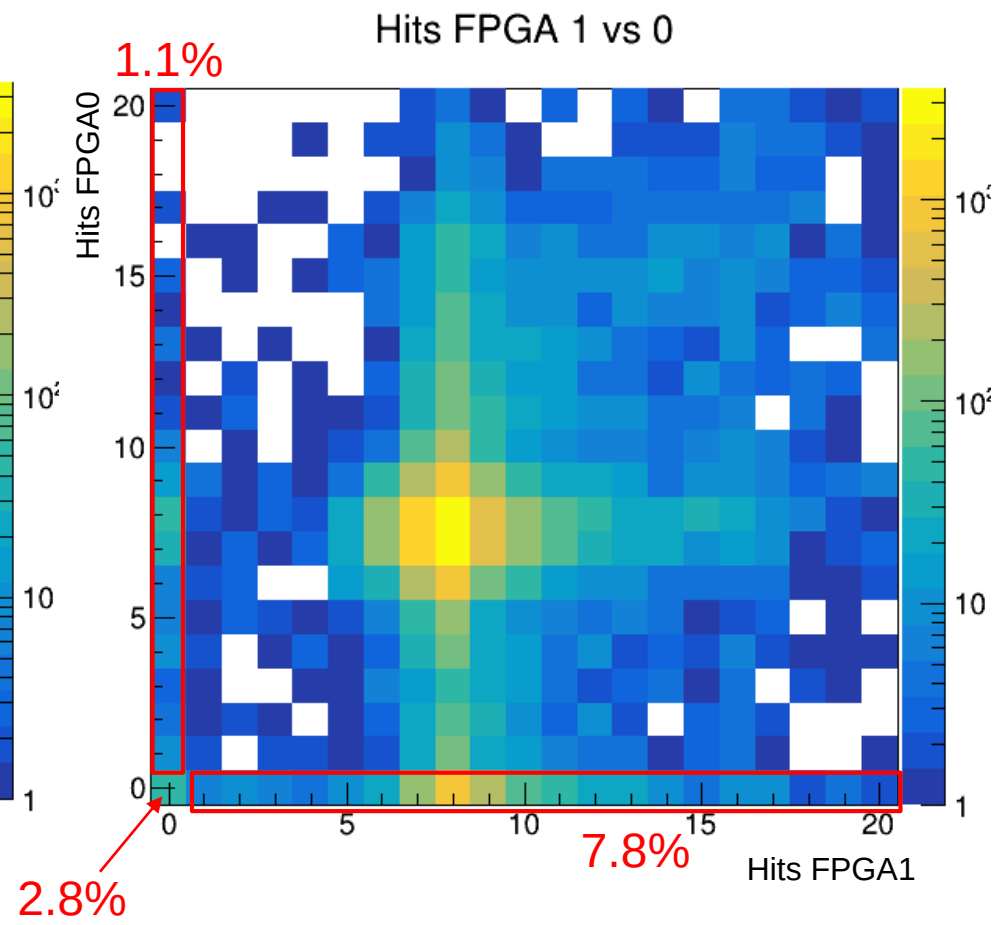


at large occupancies, many hits with very small drift times …

- fully correlated with the trigger (no special tails outside the time box)
- could be noise affecting both trigger and signal channels?

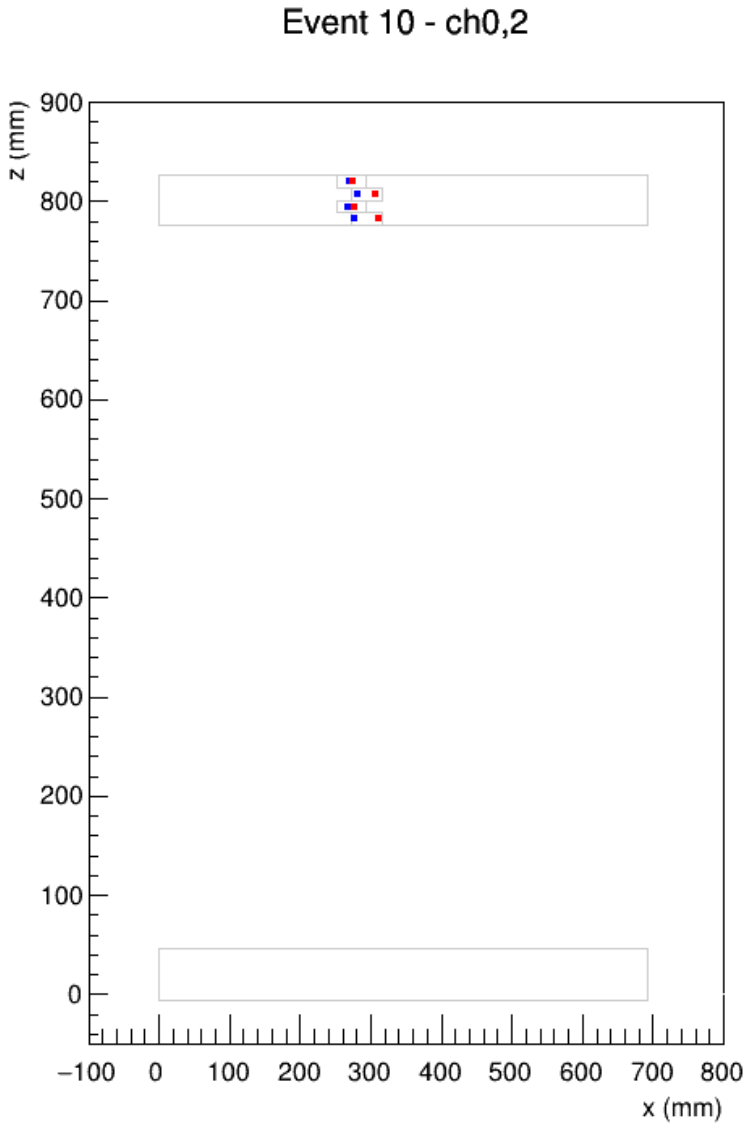
#hits per FPGA (pair of chambers)

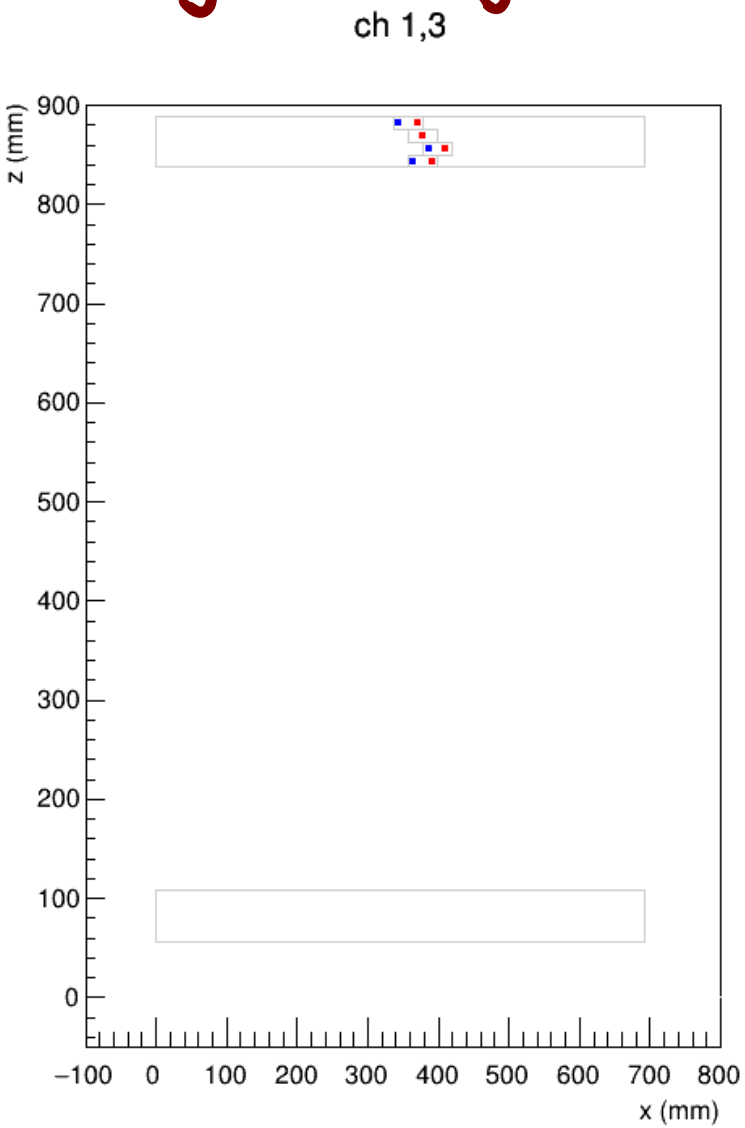




- "missing FPGA 0" in **7.6**% of triggers
- Apparently not correlated to occupancy, showers…

Gallery: 'missing FPGA 0'

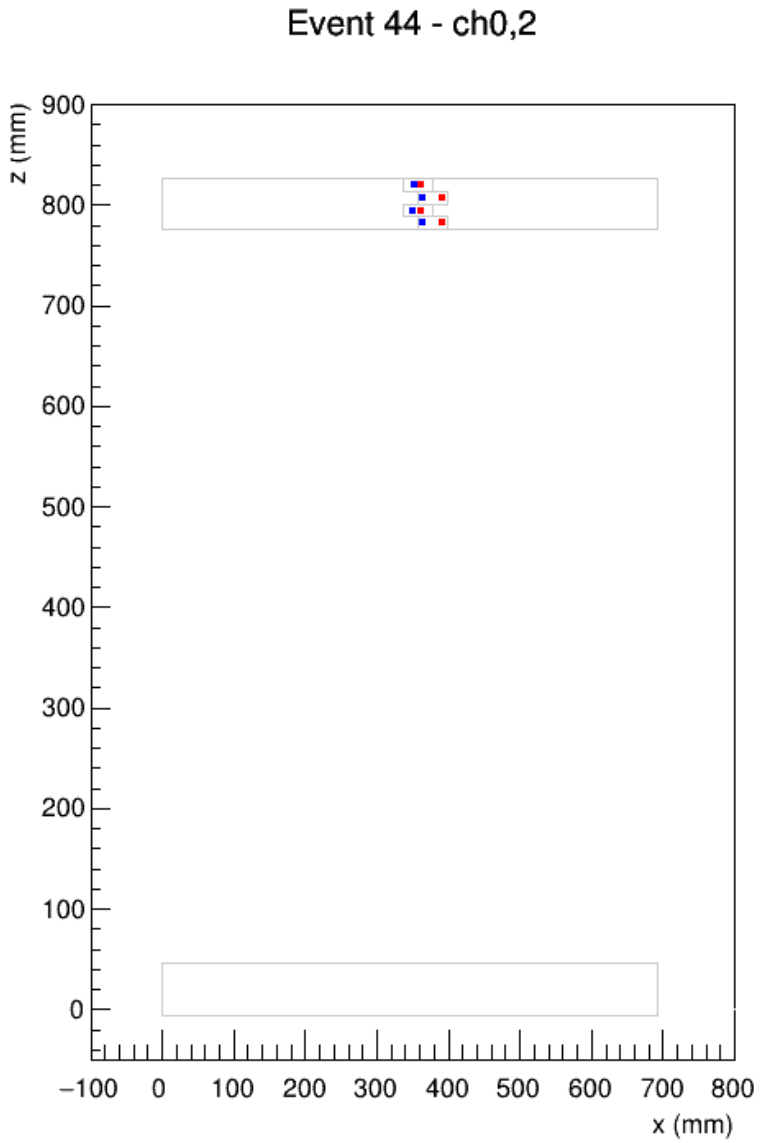


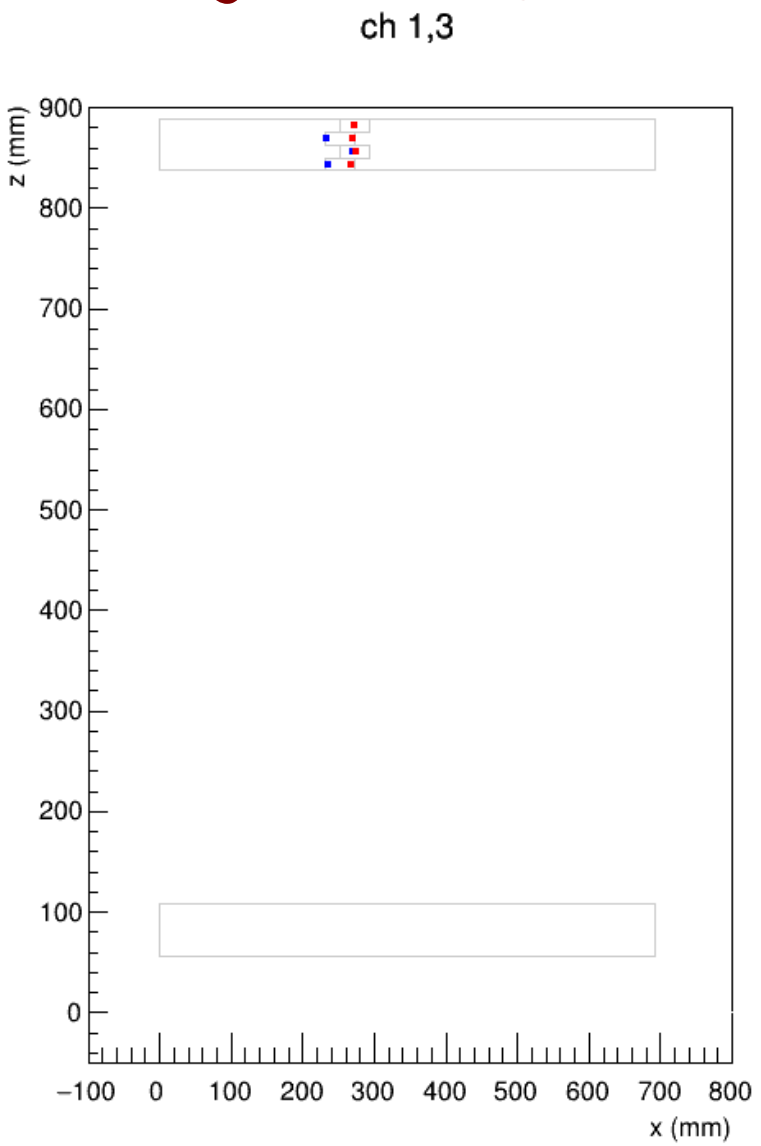


Track seems to be off-pointing in ~3/4 of the cases, like here

- not always clear why the trigger fired; in some (but not all) cases could be signal from the light guide of bottom scintillator

Gallery: 'missing FPGA 0'





in pointing events only, FPGA 0 is missing in about ~2% of the cases
Should check more accurately with extrapolation from top chambers

Conclusions

- Chamber ‘efficiency’ for single-muon events looks good
- ~3% events with very large hit multiplicity
  - Some are probably showers, others look somewhat suspect
- Good fraction of “Missing FPGA0” events are due to non-pointing muons
  - To be rechecked with extrapolation from other chambers
  - Not always clear why trigger fired; room for improvement in the set-up of external scintillators for accurate quality measurements