GRINCH REPORT

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From last collaboration meeting:

- In order to understand the GRINCH set-up with Cosmics, we prepare a 3x2 PMT array which can be comprised more efficiently between two scintillator paddles.
- The array was connected to the DAQ as normal, i.e. NINO → LVDS2ECL → VETROC, and the paddles similarly to the previous cosmic set-up with the whole array.
Reminder

Cosmic tracks from the GRINCH PMT array

Understanding the TDC spectra from the detector was not clear:
- The timing (ROL) was improved, but the TDC spectra seems to be noisy.
- ADC information was not available.
- Trigger info (jitter) not available.
Debugging hardware

- Using the small set-up:
  - HV channels in GUI were not correlated to the expected channels in the HV boxes
    - The cables used were assembled for particulars HV boxes. It was a matter to find the corresponding cables to the boxes we have.
- The small array was the only HV channel powered of the whole array, BUT the GRINCH array was connected in the DAQ as normal (again, not powered).
  - Running cosmic, shows signals in the PMTs NOT POWERED!
    - It was found that the work in the nearby workshop, cause EM “coupling” in the PMTs.
    - In order to have clean signal, the DAQ can only run during the nights or weekends
Sample of TDCs with PMT HV Off

Cable signal from PMT unplugged
Cosmic timing

Full Weekend run ~53k events  \( \sigma \approx 4.2-4.0 \text{ ns} \)
Corrections

• The final DAQ will not have full ADC information, and what will have (max 64ch) will be used for debugging and gain match.

• For the small array, the ADC information has been used to justify the cuts using pure VETROC information.
The PMTs used are part of one of the gain grouped tubes by G. Nicolescu → the HV applied is the same for all tubes
ADC v ToT

ToT = LE - FE

25 ns
ADC v Fall Time

Fall time is jitter corrected.

415 ns 415 ns
Fall Time v ToT (no cut)

ToT<25 ns & FT> 415 ns
Fall Time v ToT (cut and linear fit)

Walk correction from ToT info → J. Annand, SBS Coll. Meeting 5th June 2013
J. Annand, SBS Meeting 8th July 2014
Fall Time v ToT (corrected)
Fall Time (Jitter + Walk)

σ~3.1- 2.4ns
Without jitter information, using with LED it was achieved similar resolution, BUT the system was not well debugged.

\[ \sigma \approx 2.4\text{ns (FE)} \]

CA, SBS weekly meeting, 9\textsuperscript{th} January 2019
Summary

- A small set-up of 3x2 PMTs has been tested making use of the GRINCH DAQ.
  - Besides the goal of test the DAQ, it allowed to debug some hardware issues, probably not easy to find with the whole detector.
    - HV channel GUI – PMT group uncorrelated
    - EM coupling to the PMTs from power tools and welding from the nearby workshop
- The ADC was set (16 channels due to delay cables)
- ToT info used to walk correct the Fall edge time
- A resolution of 2.4 ns was achieved (comparable with a previous test with LED, in December)

Move back to the GRINCH array DAQ.