



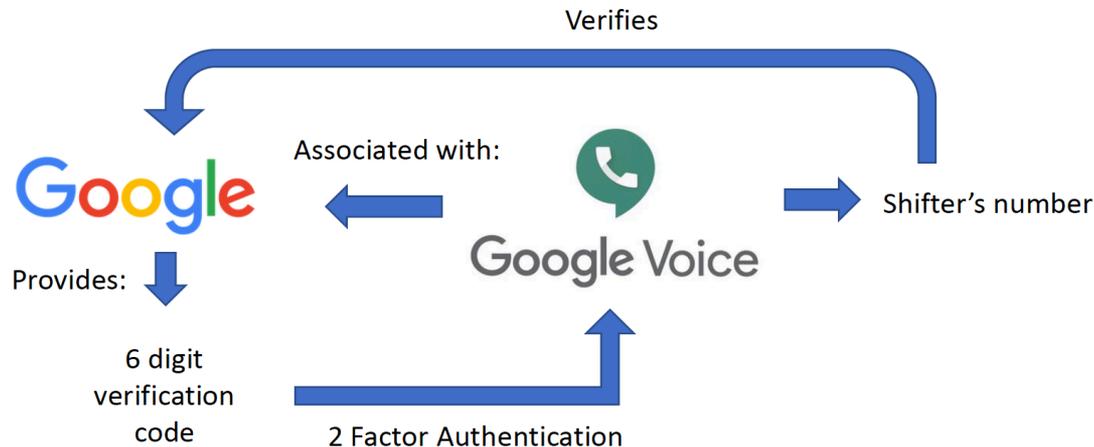
Status of ICARUS commissioning

A. Fava

PMG/AEM 02/04/2021

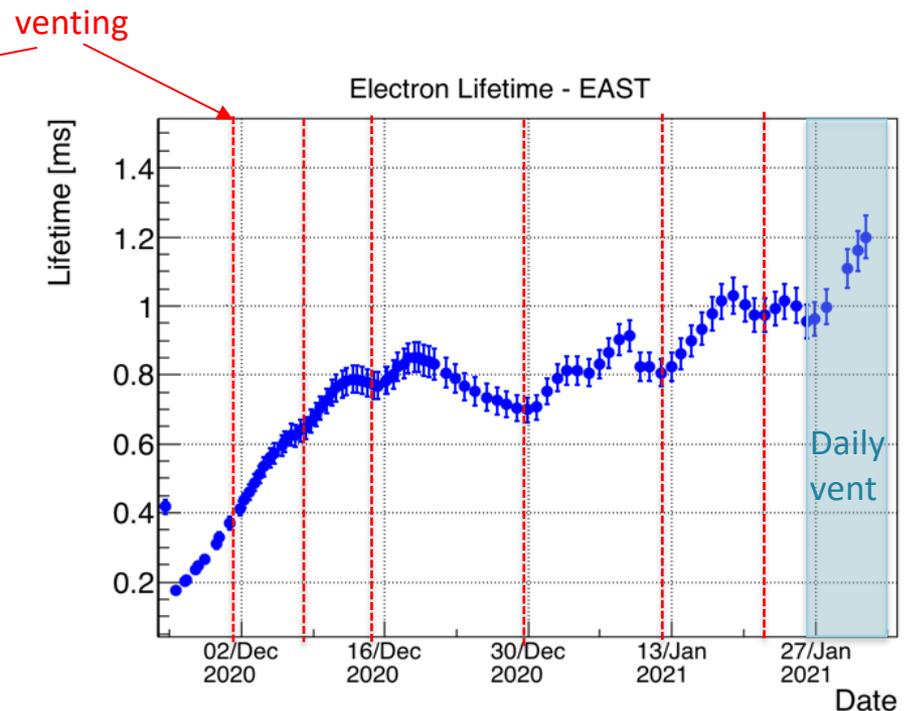
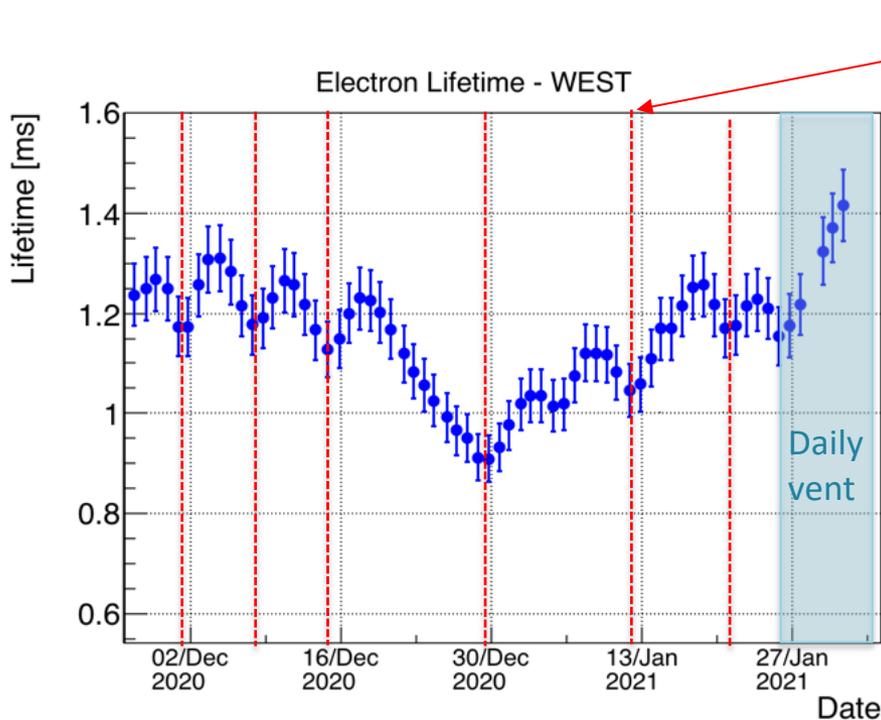
Report on Google Voice usage

- Verification issues for two weeks, probably related to several simultaneous connections worldwide without 2-factor authentication.
- GV number now associated to Google account and 2-factor authentication enabled. Similar to MicroBooNE setup, but with Google account instead of RunCo number.
- New shifters without previous authentication are requested a 6-digit verification code that can be provided by:
 - previous shifter logged in GV;
 - shifter helper on shift (Slack);
 - anybody in the forwarding message chain.



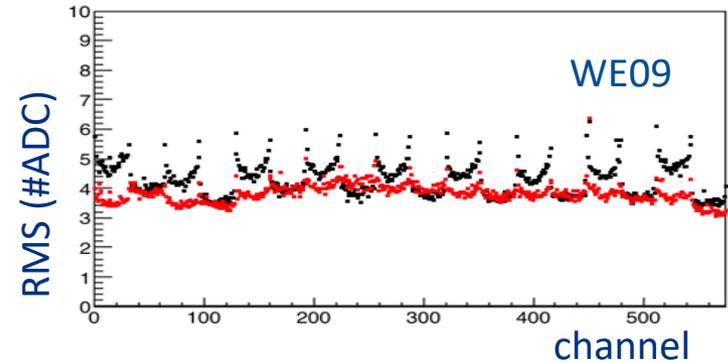
Cryogenics and electron lifetime

- Cryogenic system overall stable and operational, except South-East condenser presently being modified (intervention started in mid-January). Plan to adjust set point to increase gas recirculation if this intervention successful.
- Venting procedure (temporary mitigation) daily for 15 minutes since Jan 26th, previously every 3-4 days for 30 minutes. Electron lifetime constantly and slowly improving in both cryostats since then, up to 1.4/1.2 ms in West/East cryostat

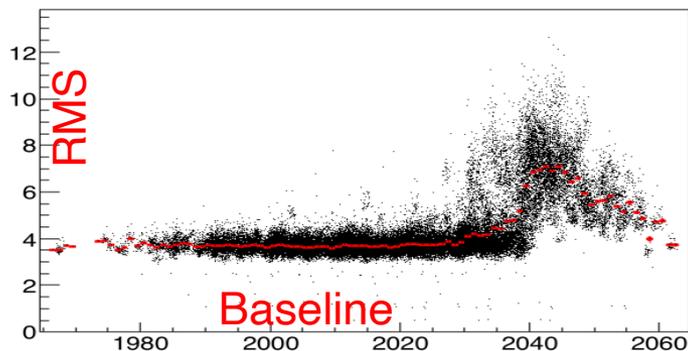


Updates on TPC noise mitigation _ West cryostat

- Main results of the Dec 2020 noise mitigation campaign on West cryostat:
 - Improvement in 9 (of 36) readout units with installation of 2 x 100 Ohm resistors on readout boards.
 - Improvement in 1 readout unit with connection of a missing ground strap.
 - Identification of some interference with ancillary cryogenic instrumentation.



- After deep studies of results, understood that when baseline is 2048 and when this DAC offset value is exactly matched, the ADC crosses a conversion value (2048) where all the bits are flipped. This is the cause of the observed noise.



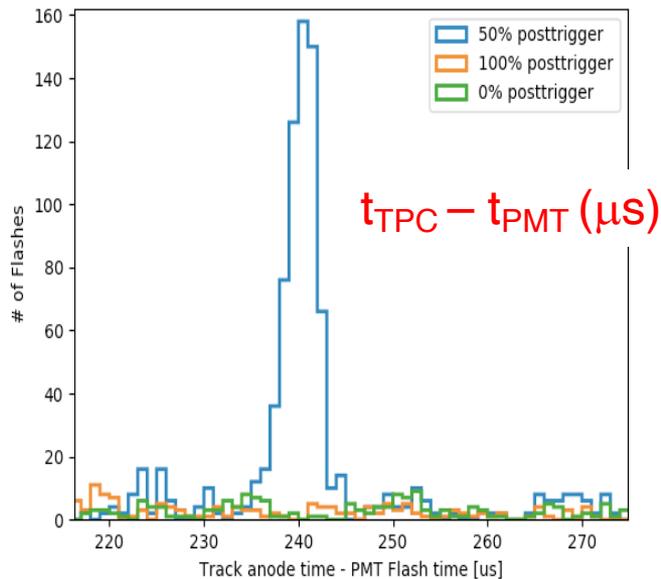
- Same effect reproduced in the lab but one order of magnitude smaller (< fraction of bit).
- Systematic survey to be continued but hard with pandemic. Effort to reproduce the situation in a test stand in Padova (Italy).

DAQ updates

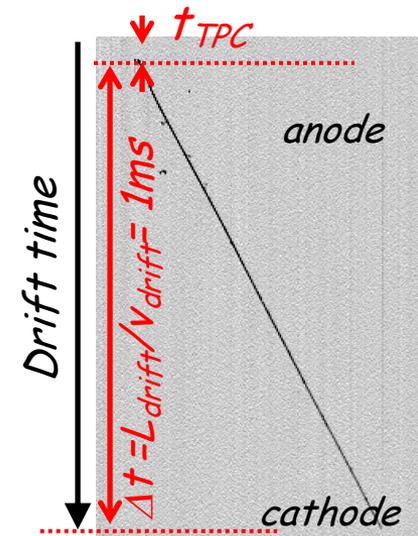
- Thanks to help from SLAM, SIS (Scientifics Server Infrastructure), Networking, and the artdaq team, fixed a major issue in system configuration that was making non-optimal use of networking.
Since then, DAQ and online systems much better/cleaner operation.
- Now fully using the artdaq configuration database and an upgraded online software suite (more robust for handling larger CRT rates and exploiting time synchronization with the trigger for event building).
- DAQ and trigger groups have been commissioning the trigger and supporting studies for readout of beam spills and verifying neutrino timing.
These studies have already fixed some event synchronization issues and will help finalize commissioning of DAQ pieces.
- Updated online monitoring suite includes live measurements of the electron lifetime in the detector as part of running. Initial studies show operation is stable, processing ~100 tracks in the detector every 15-20 minutes.

Initial Trigger system activation

- Data collected by triggering on the BNB extraction signal (gated-BES) in East cryostat used to check the timing/read-out of both TPC and PMTs signals and the PMT timing w.r.t. the gated-BES signal, a prerequisite for the trigger deployment.
- Anode-to-cathode cosmic μ tracks with unambiguously measured crossing time in the TPC image t_{TPC} have been found to match the corresponding time of PMT light signal t_{PMT} .
Clear $\sim 2 \mu\text{s}$ peak in $t_{\text{TPC}} - t_{\text{PMT}}$ confirming the correct relative TPC - PMT timing.



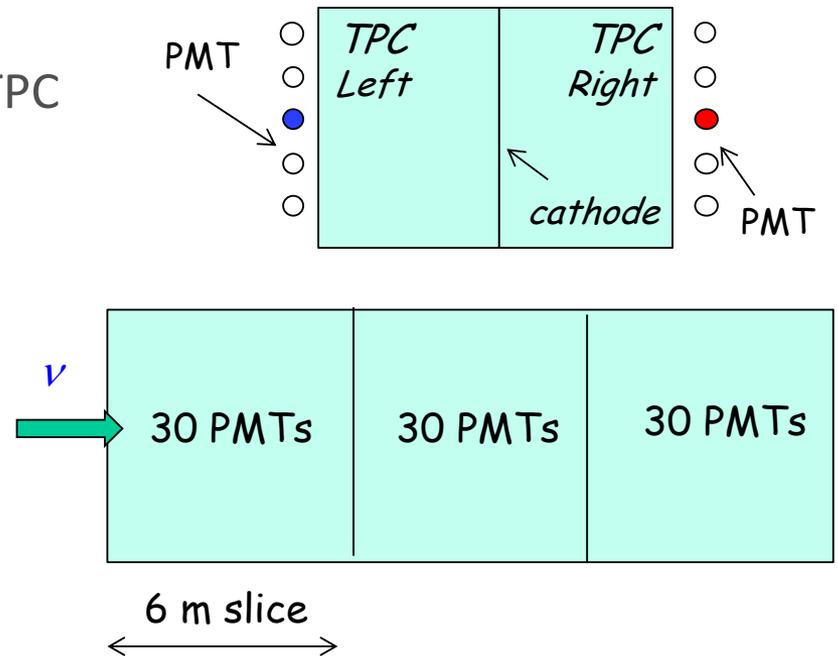
Anode to cathode μ track



Present trigger system status and next steps

- After completing the commissioning of timing/read-out of both TPC and PMTs signals w.r.t. the beam spill, a trigger logic based on a fired PMT majority in coincidence with the BNB extraction will be implemented in the East cryostat:

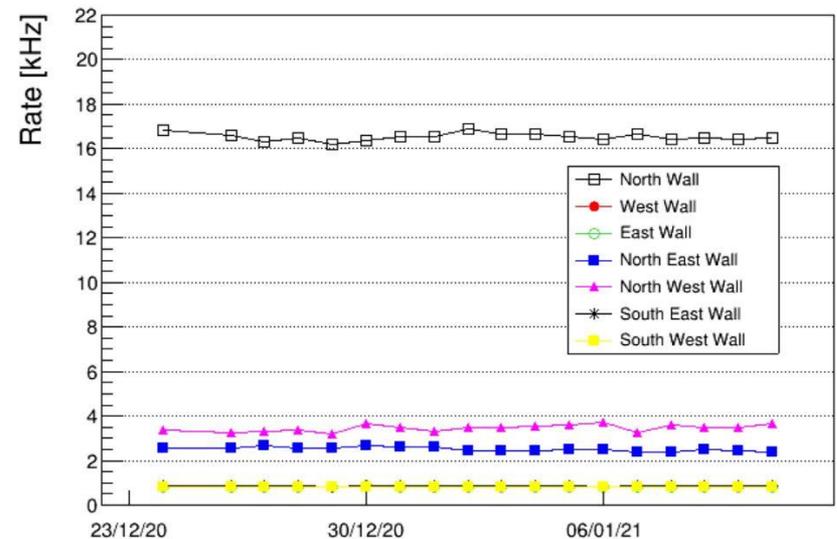
1. Measurement of multiplicity/rate for 30 PMTs in 6 m detector slice in one TPC wall as a function of PMT threshold.
2. Production of a trigger signal by PMT majority inside one 6 m slice in coincidence with BNB beam spill.
3. Extension of the PMT majority logic to 2 others 6 m detector slices of East cryostat and then similarly for the WEST cryostat.



- This procedure would allow also recognizing first neutrino interactions in ICARUS with just few hours data taking with the EAST T300 module.
- Studying the impact of BNB going away 6 weeks earlier than planned for.

Other January updates

- **PMT** commissioning.
 - Recording of counting rates for different threshold and logic combination of PMT digital signal, for trigger application.
 - Data taking with several configurations of the PMT acquisition window, for studying synchronization with the TPC.
 - Data taking with laser to improve timing equalization.
 - Upgrades of the PMT slow control system.
- **CRT** commissioning.
 - Available CRT walls included in standard data taking.
 - North wall higher noise under investigation, probably related to cryogenic equipment.



CRT rate with cosmic rays