

First observation of tracks in protoDUNE

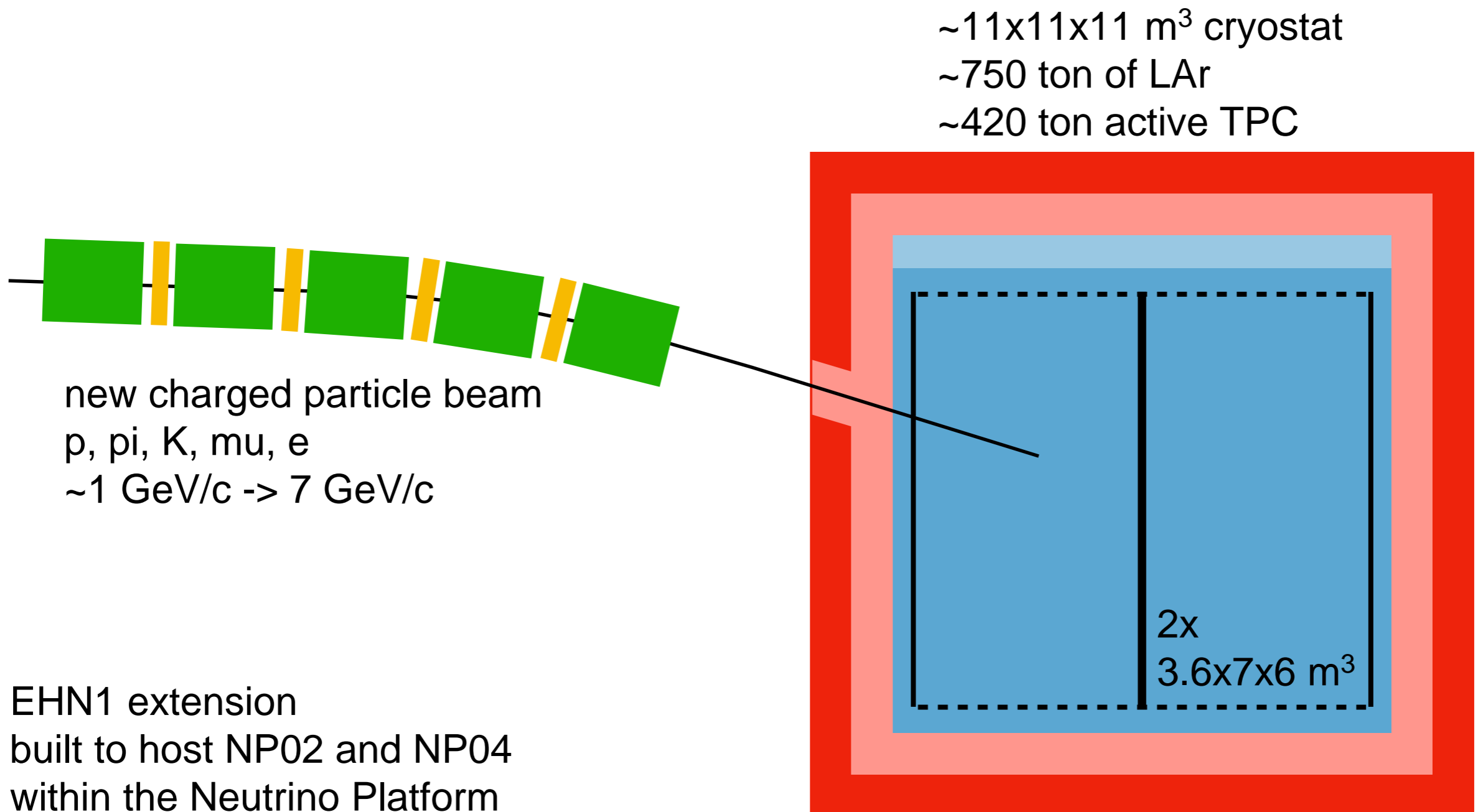
Filippo Resnati (CERN)
on behalf of DUNE collaboration

Why ProtoDUNE

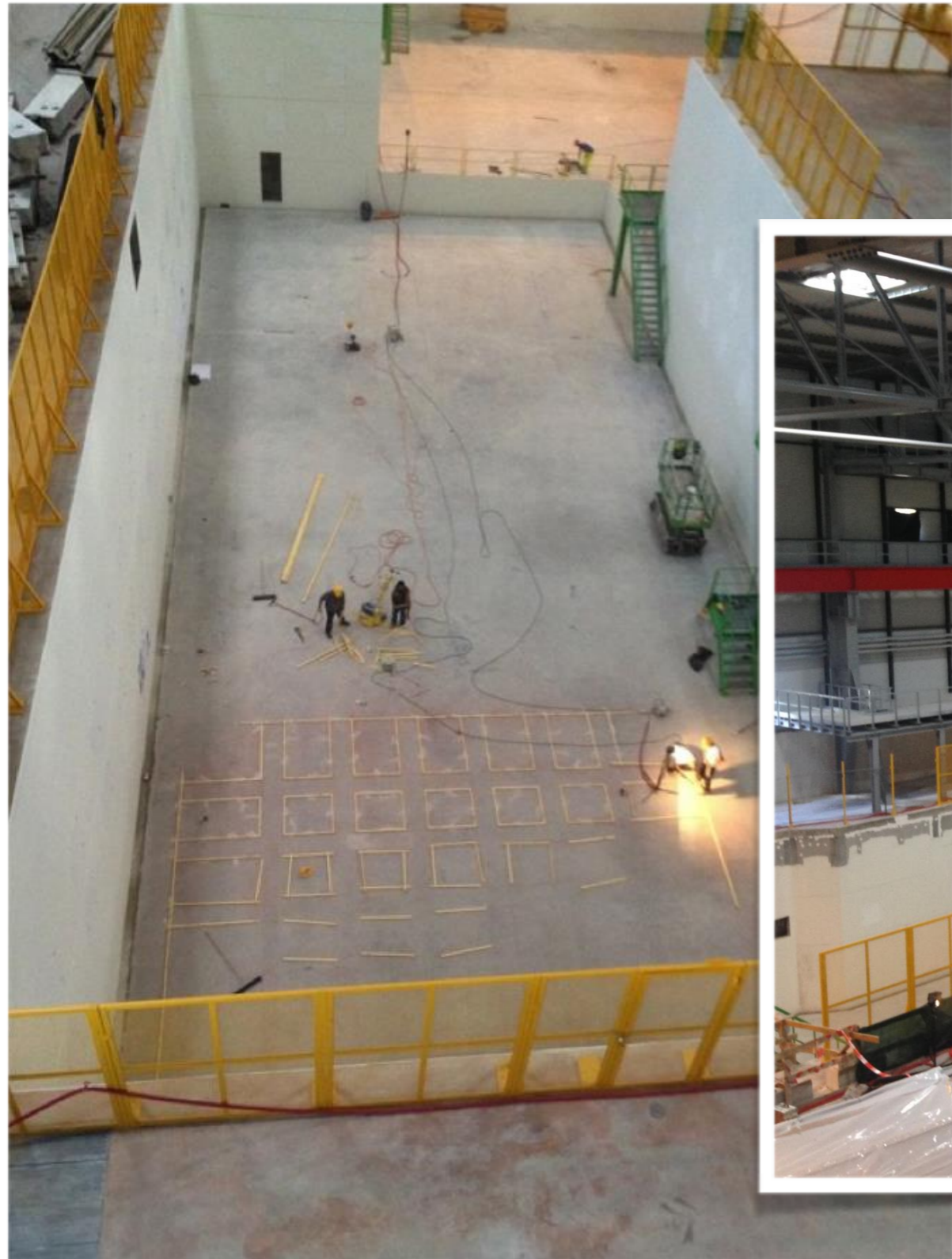
ICARUS: the largest LAr TPC ever built and operated till now.
Several **new challenges** to scale from ICARUS to DUNE.
Need **prototypes** to develop solutions **scalable** for DUNE:

- R&D on critical aspects, like cryostat, LAr purity, VHV, cold electronics, detector ground isolation, ...
- Test full scale detector elements that will be used in DUNE
- Consolidate installation sequence and test procedures
- Validate long term operation stability
- Perform hadrons argon cross section measurements
- Benchmark reconstruction performance
- Study space charge effects, dQ/dx recombination, low energy calibrations with Michel electrons, ...

NP04: ProtoDUNE-SP



Summer 2016

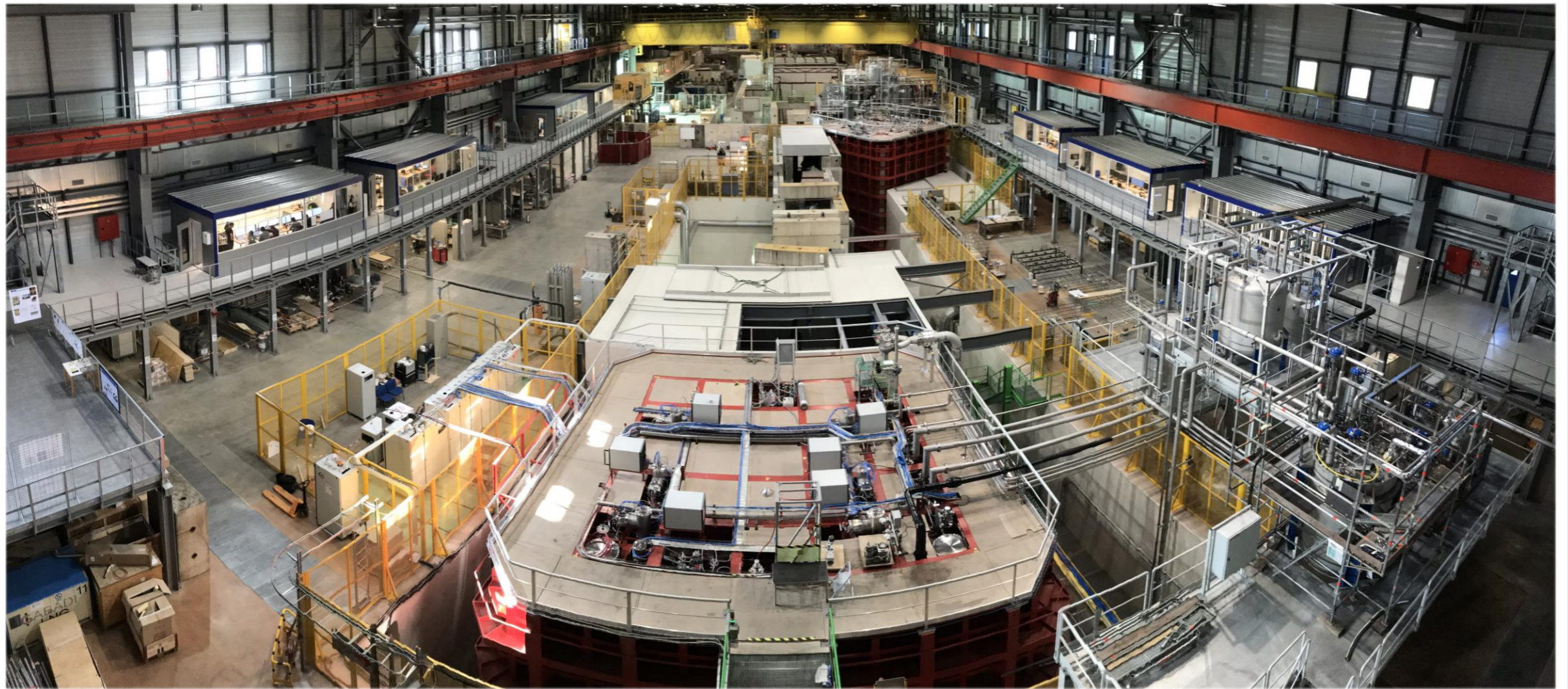


Extension of EHN1
building 887 at CERN Prévéssin site



Today

Extension of EHN1
building 887 at CERN Préveessin site



NP04 timeline

Sep. 2016

Jan 2017

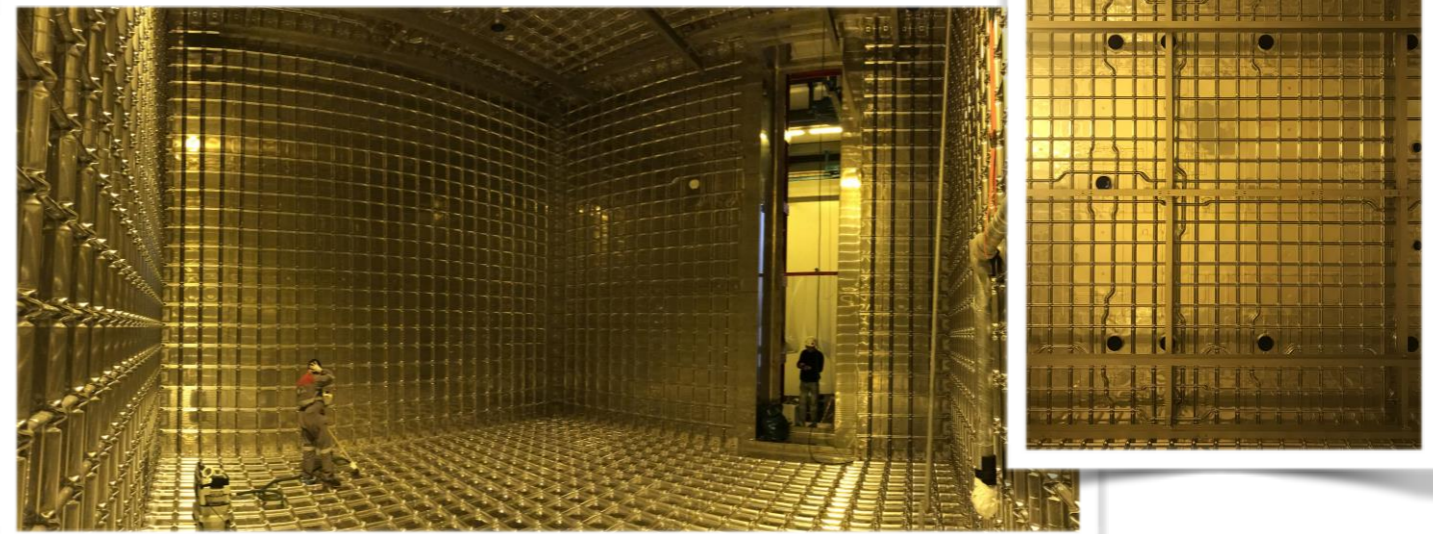
May 2017

Sep. 2017

Construction of the outer structure



Construction of the inner cryostat



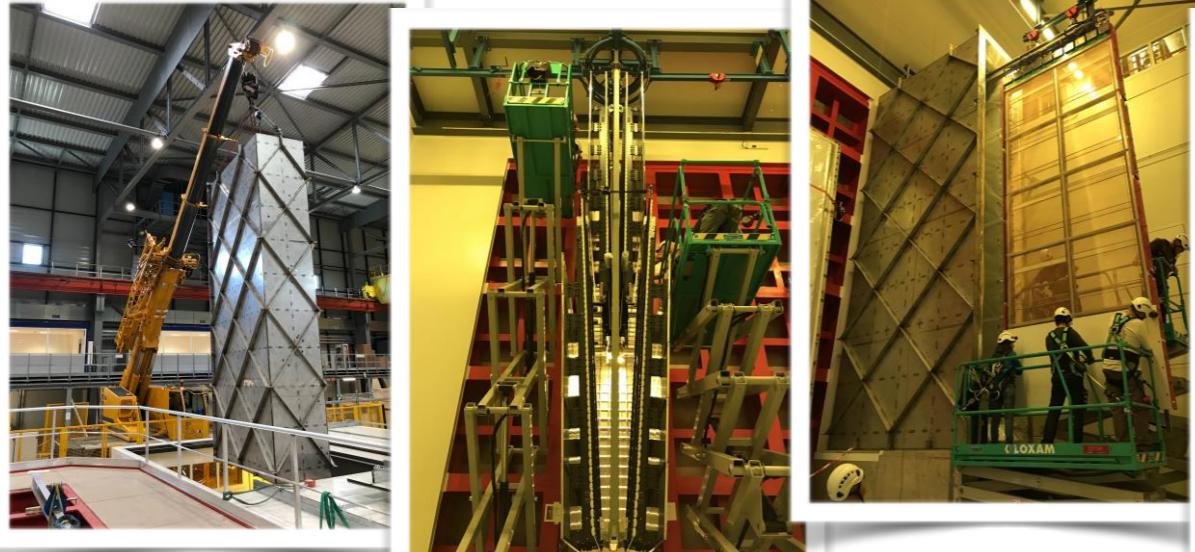
Sep. 2017

Jan 2018

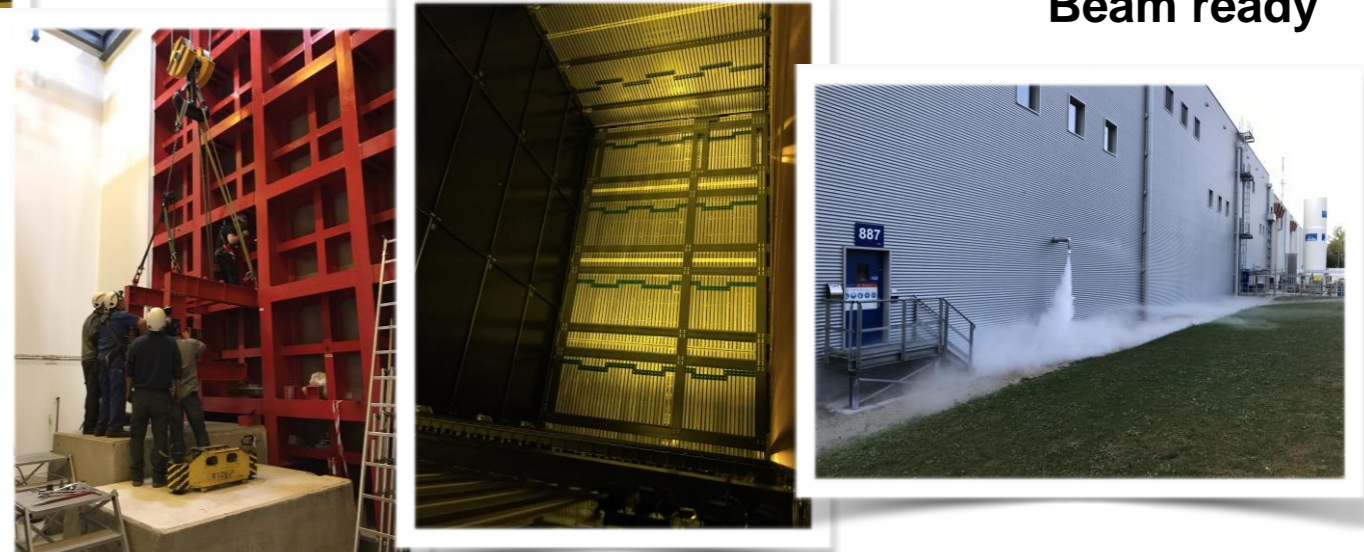
May 2018

Sep. 2018

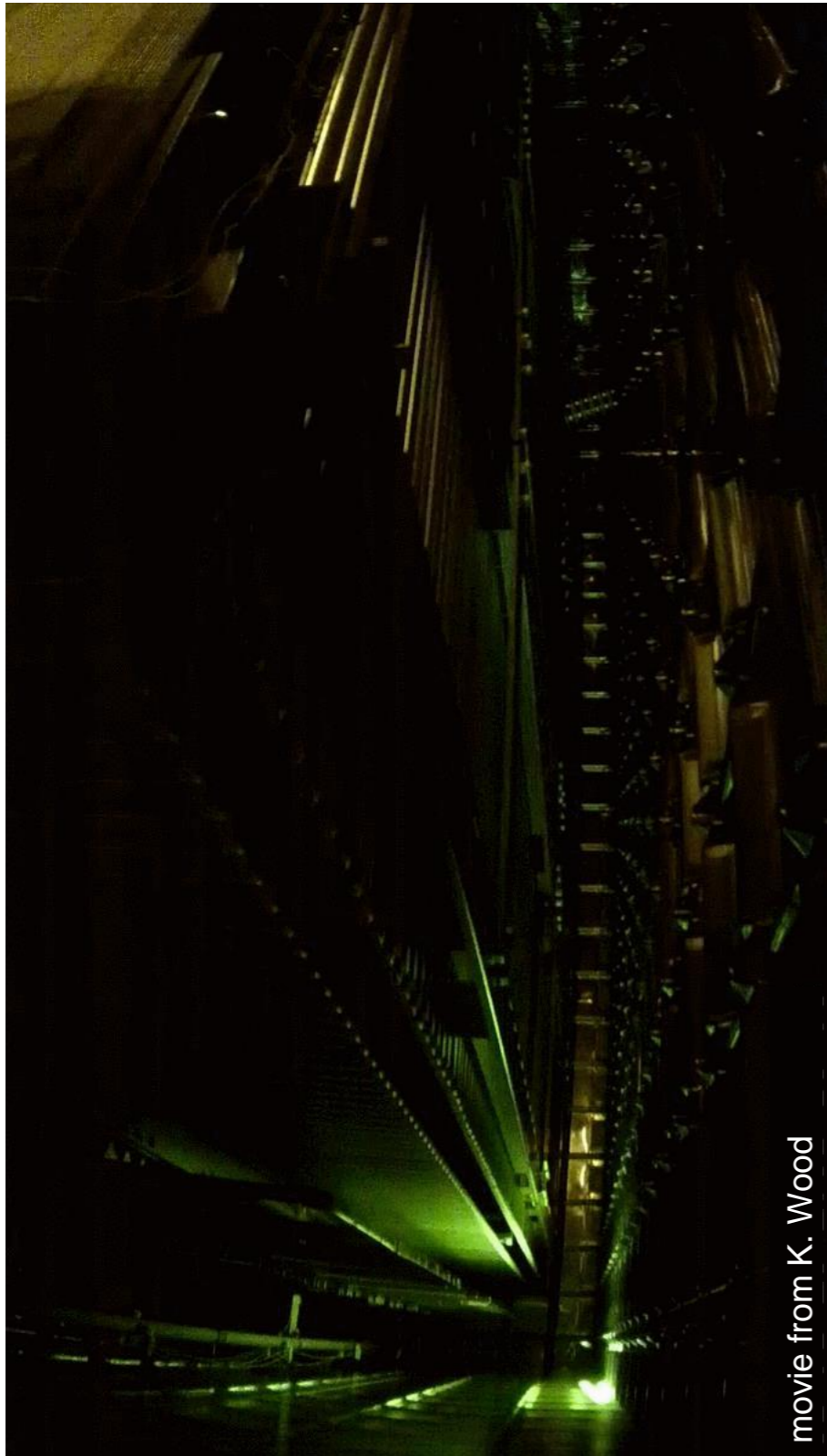
Test and installation of the TPC



Purging cooling and filling Beam ready

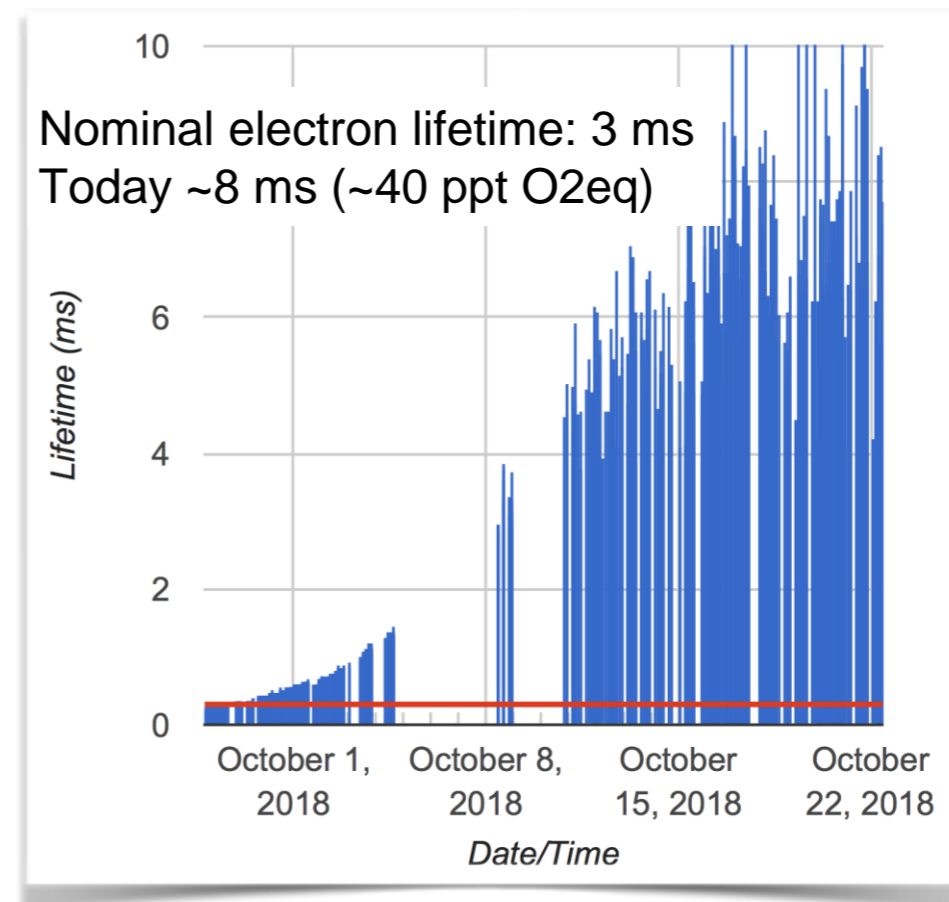


Filling & purification



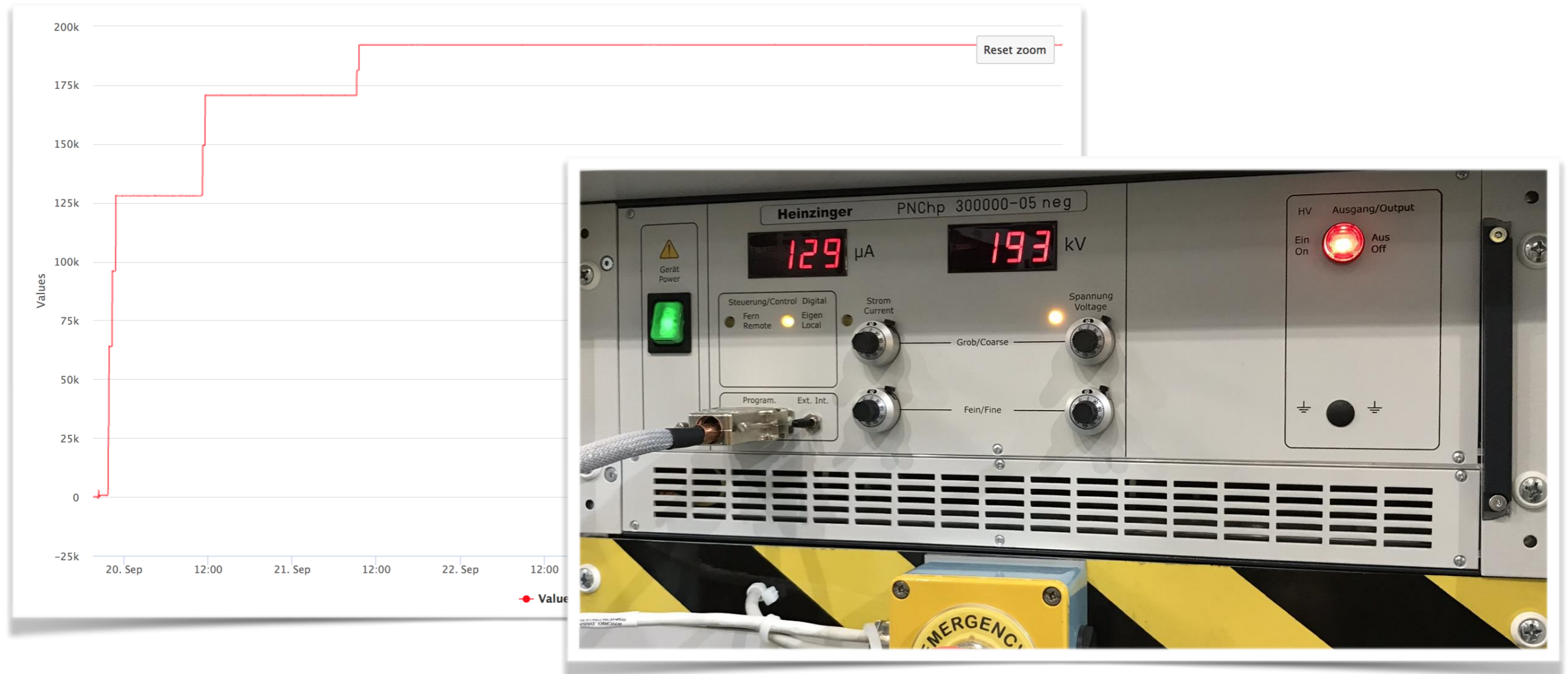
Start filling: August 8th
End of filling: September 13th
About 750 ton of pure liquid argon

Start purification: 18th September
Continuous purification during operation
About 7 ton/h constantly purified



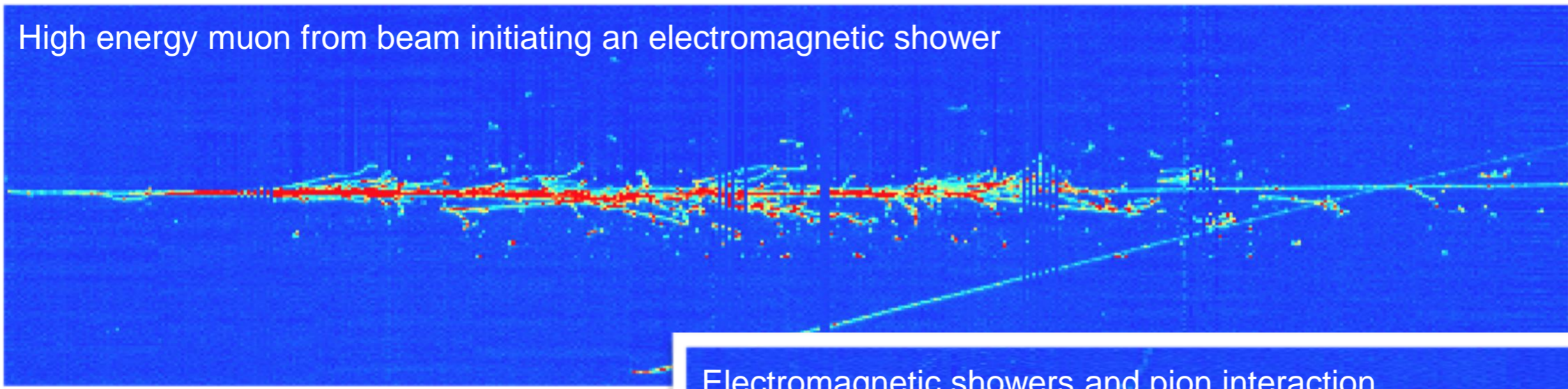
Cathode HV

Since 21st of September
Voltage set to -180 kV at the cathode (-193 kV at the supply)
in ultra pure argon with contaminations less than 100 ppt.
VHV system does not affect the noise on the cold electronics.

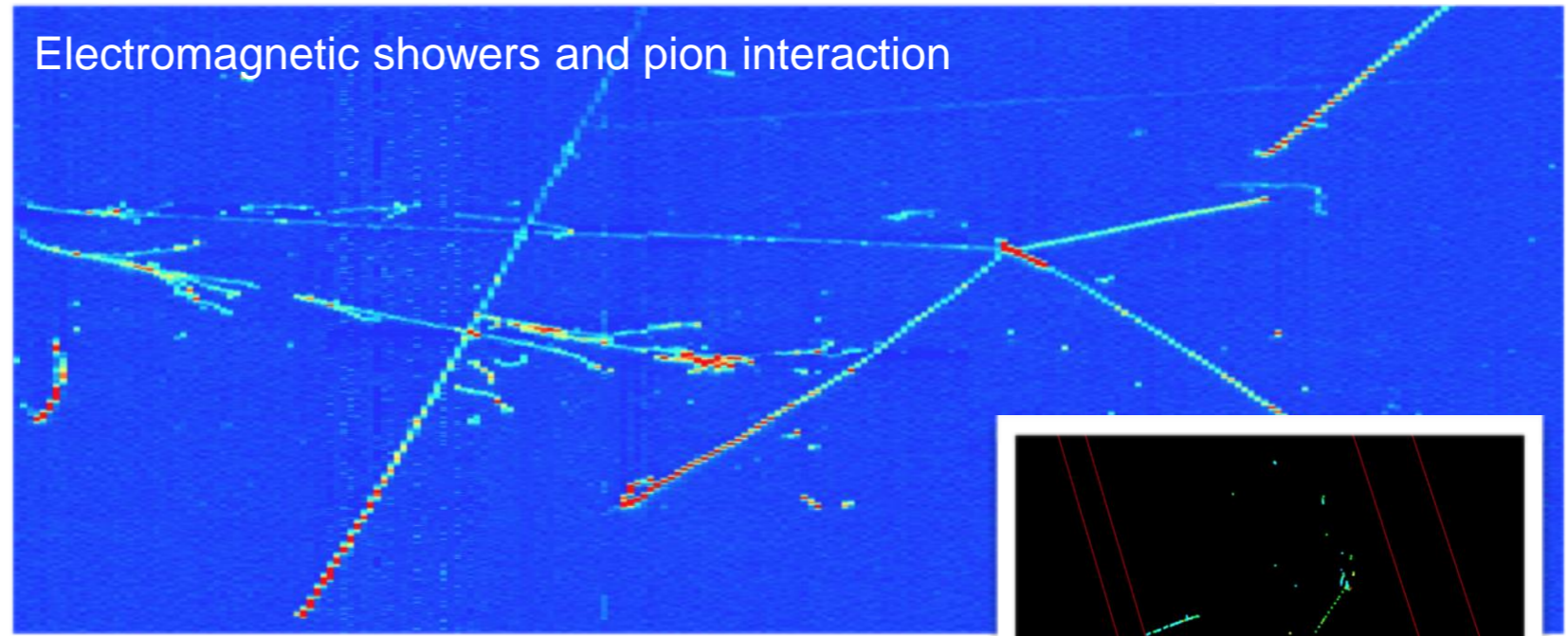


Some early events

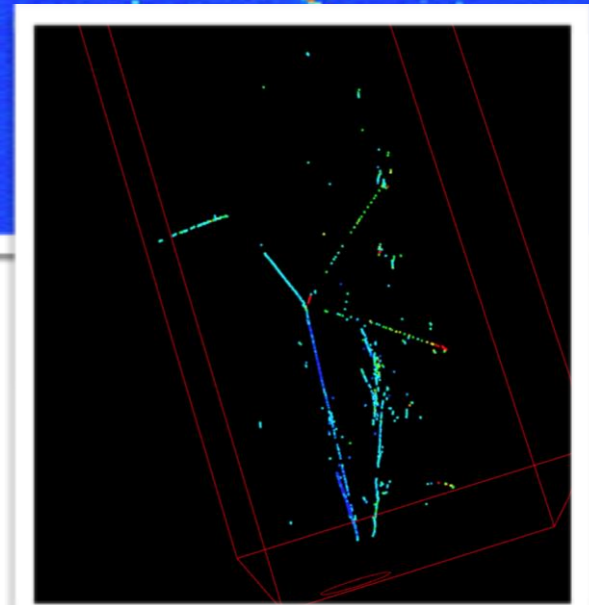
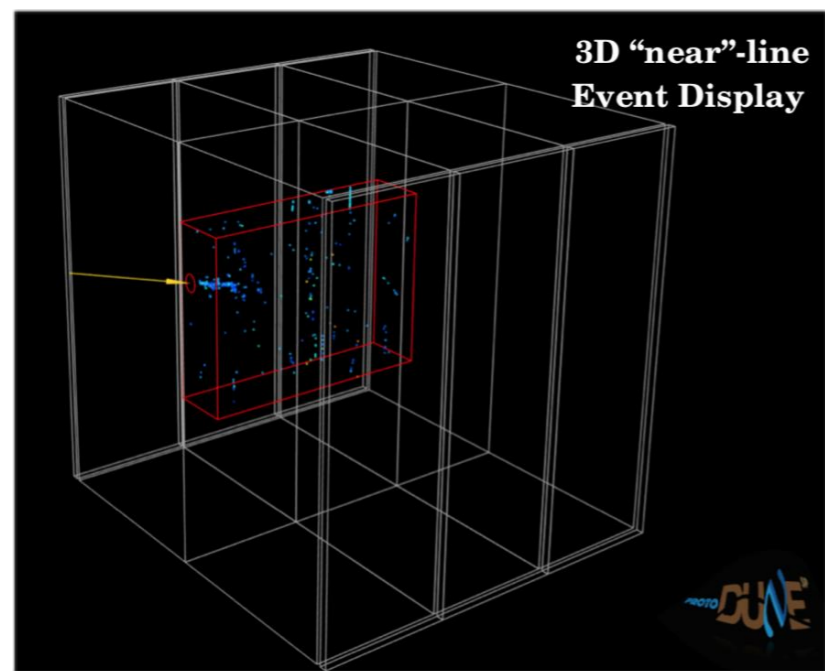
High energy muon from beam initiating an electromagnetic shower



Electromagnetic showers and pion interaction

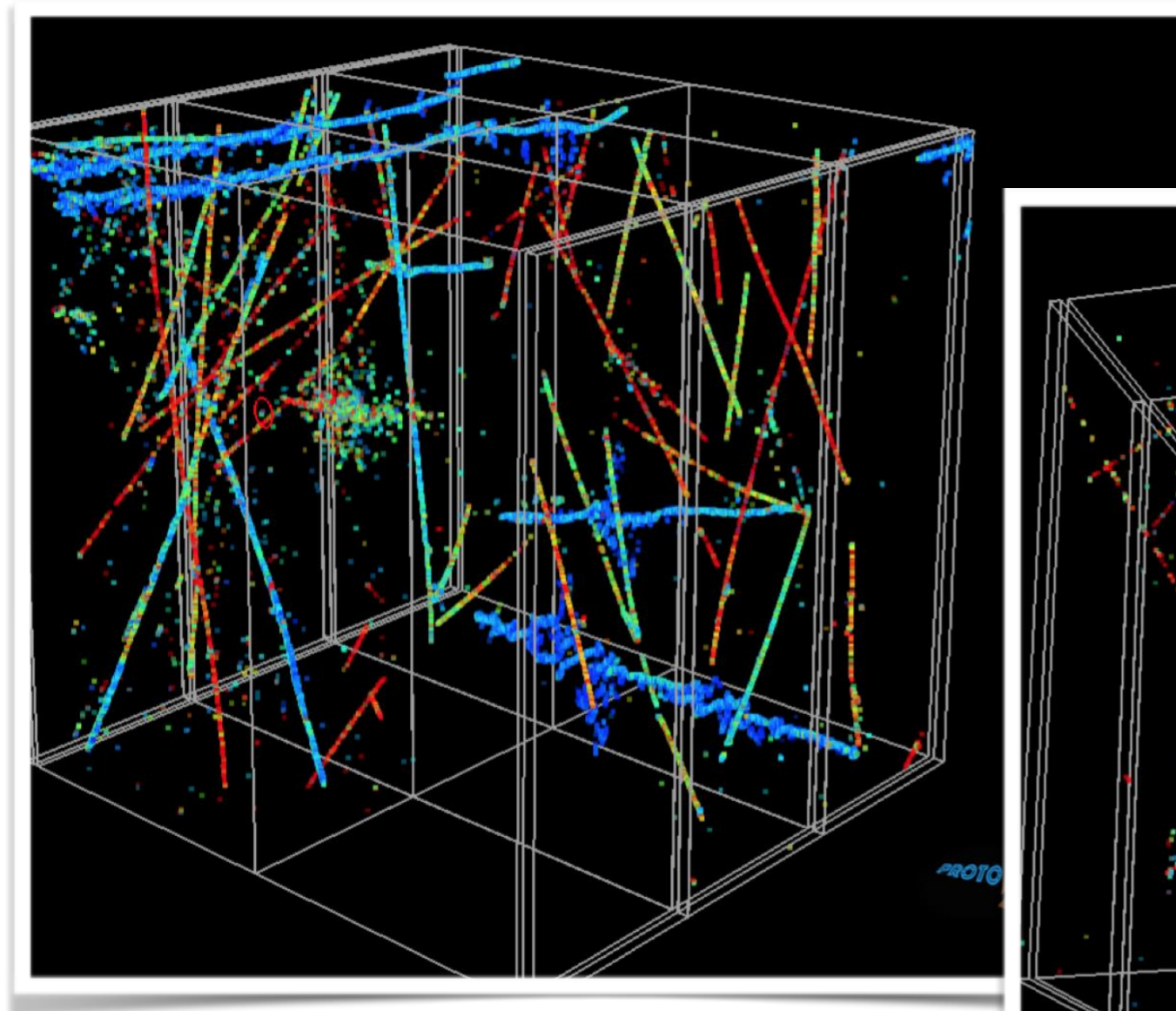


First electron event from the beam

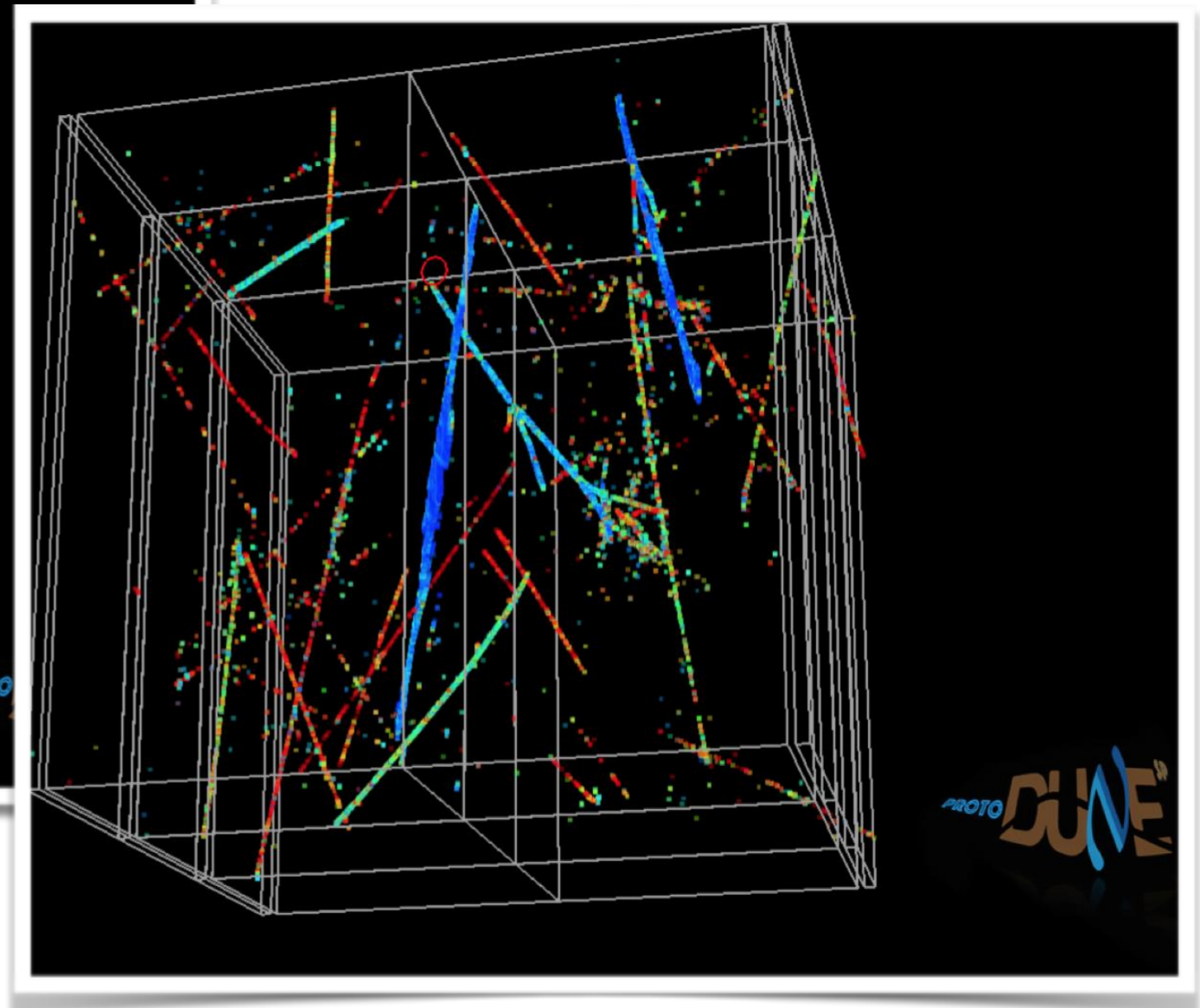


For more details refer to a recent presentation at NuInt18 by R. Acciarri
https://indico.cern.ch/event/703880/contributions/3157146/attachments/1733593/2809619/Acciarri_-_NuInt18.pdf

3D reconstructions

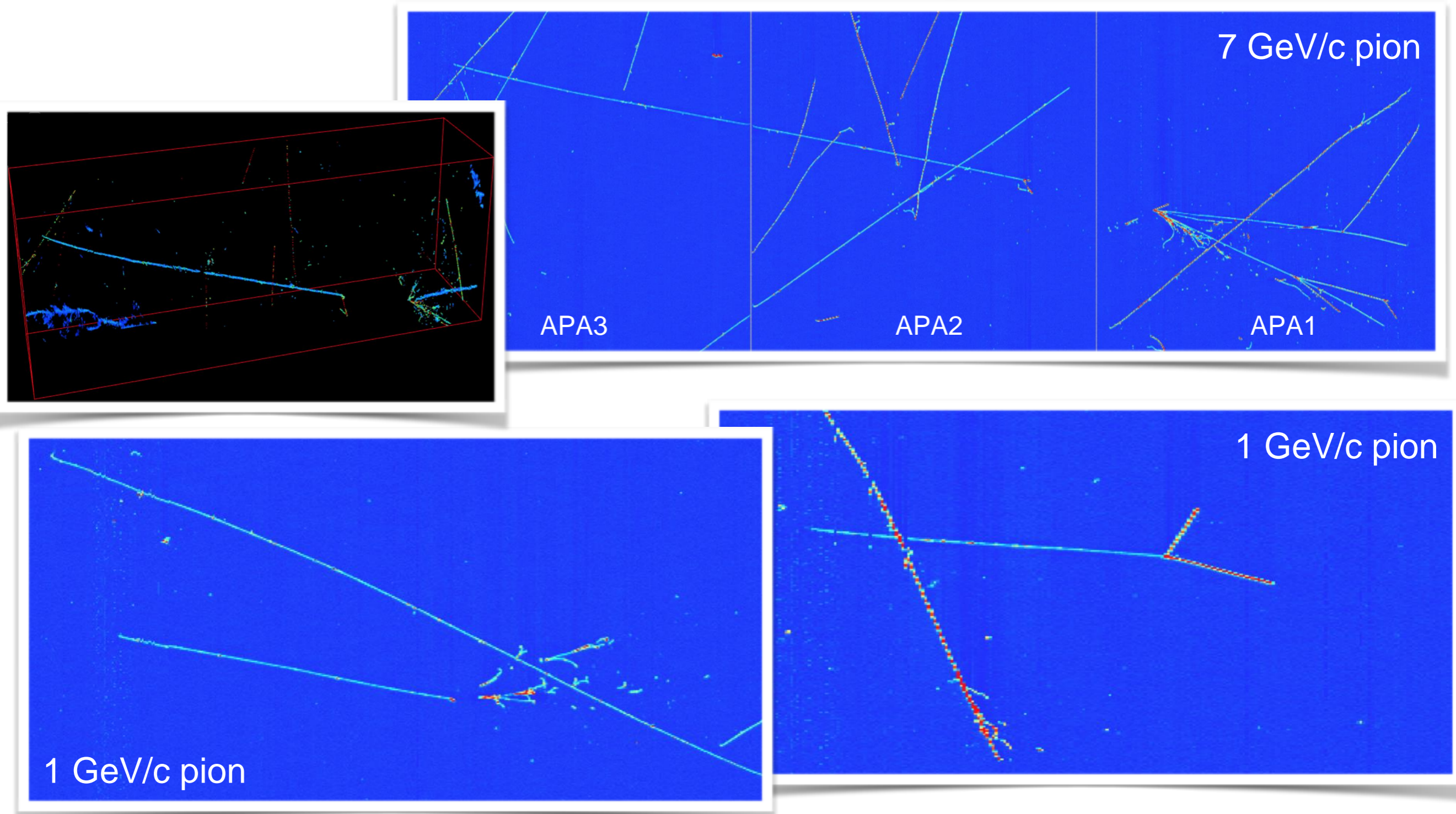


Beam events and cosmic muons



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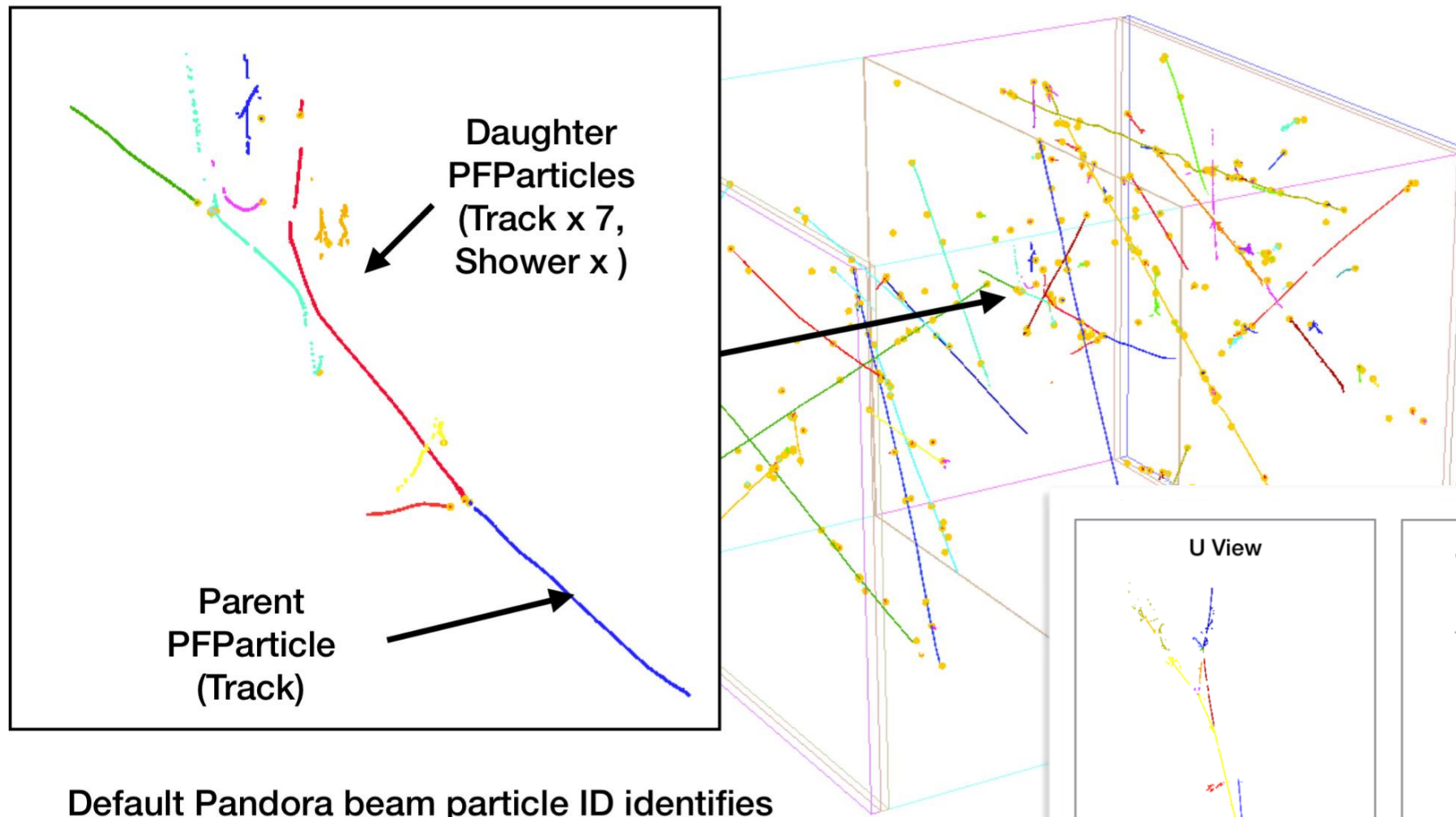
Pions from the beam



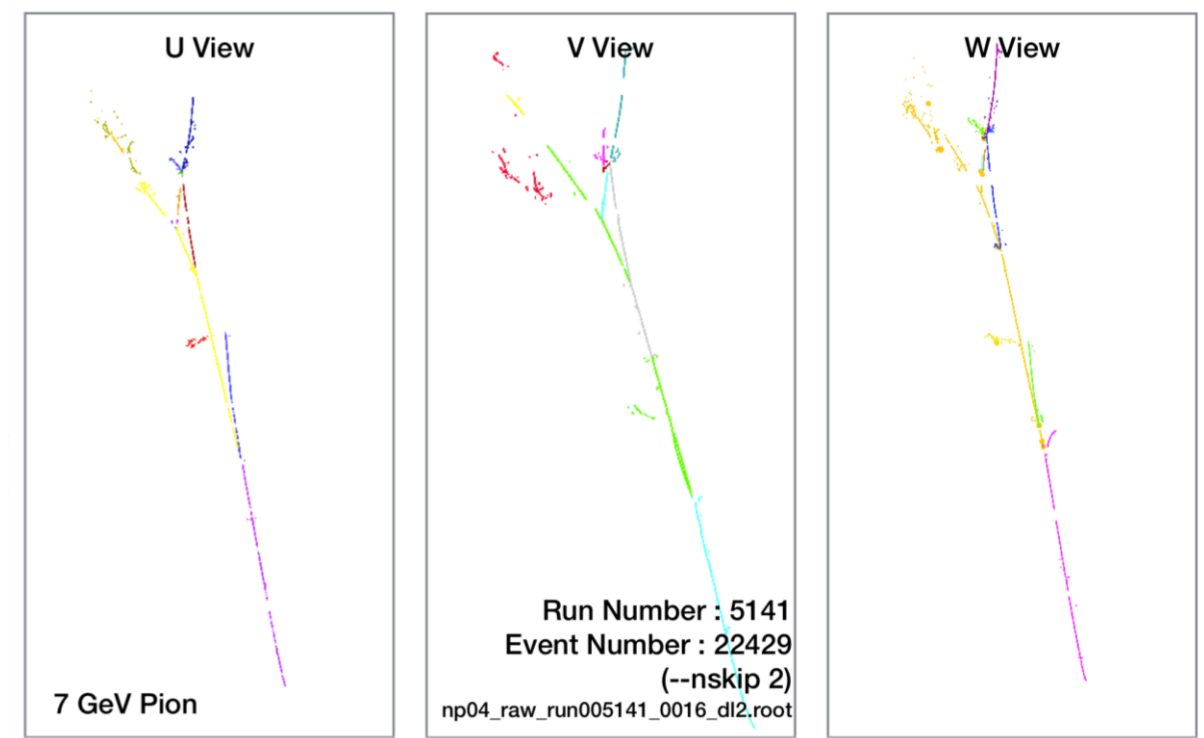
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Pandora on real data

Full 3D Reconstruction



Default Pandora beam particle ID identifies this particle as a test beam pion automatically.



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Summary

Good quality data taking with sable beam

@ 1 GeV/c ~280000 pi, + p and e

@ 7 GeV/c ~290000 pi, 100000 K, + p and e

@ 2 GeV/c ~180000 pi (ongoing)

- Very stable operation from the cryogenics point of view
- Operating the TPC with the cathode at -180 kV
- Drifting electron lifetime of 8 ms and still improving
- Very good signal to noise and therefore image quality
- 3D reconstruction and analysis on real data ongoing

Several lesson learned till now directly applicable to DUNE
More and more to learn while operating the detector