AIDA innova

Advancement and Innovation for Detectors at Accelerators

WP9: Cryogenic Neutrino Detectors
(2nd Annual Meeting)

Dario Autiero (CNRS-IP2I) and Andrzej Szelc (Edinburgh)

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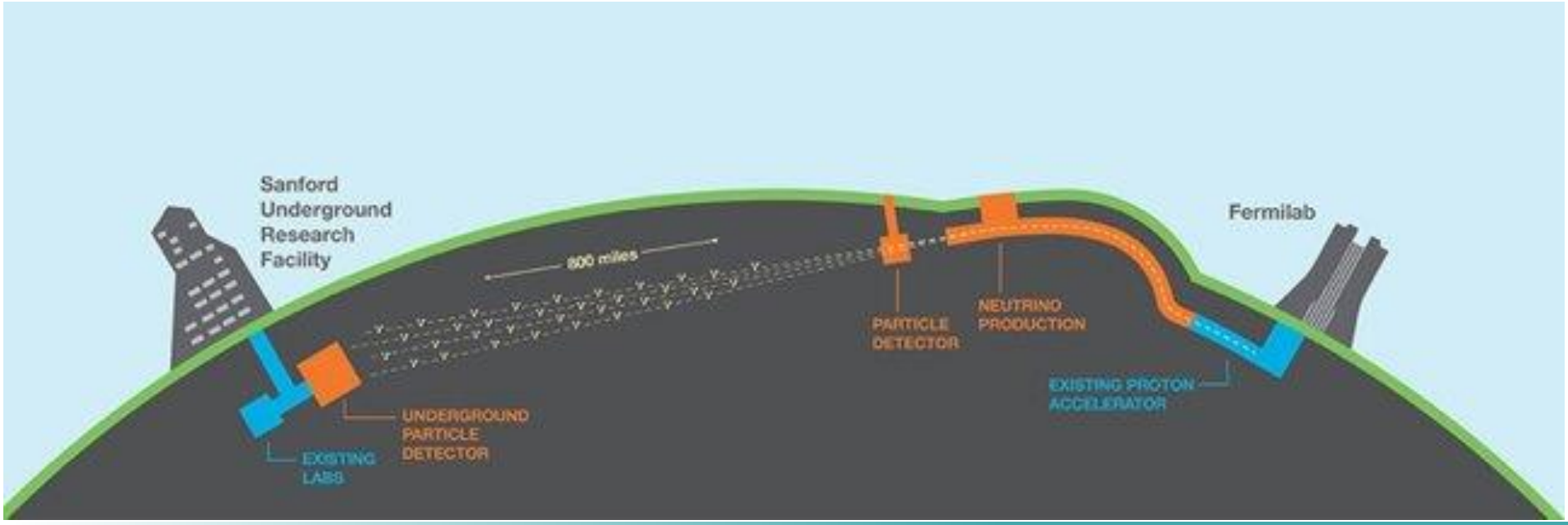
WP9: Cryogenic Detectors

- **WP9: Cryogenic neutrino detectors**
- Focus on innovative developments in large cryogenic detector readout:
  - Charge readout with pixels
  - Charge readout with vertical-drift detectors
  - Readout of scintillation light.
- Applications geared towards DUNE and large-scale DM detectors.



Work Packages and objectives

- Task 9.1: Coordination and Communication (CNRS-IP2I, Edinburgh)

- Task 9.2: Pixel Charge Readout (Manchester, Bern)
  - Optimized pixel tile pattern for the DUNE LAr far detector
  - Design and prototype for large scale tile-based anode plane

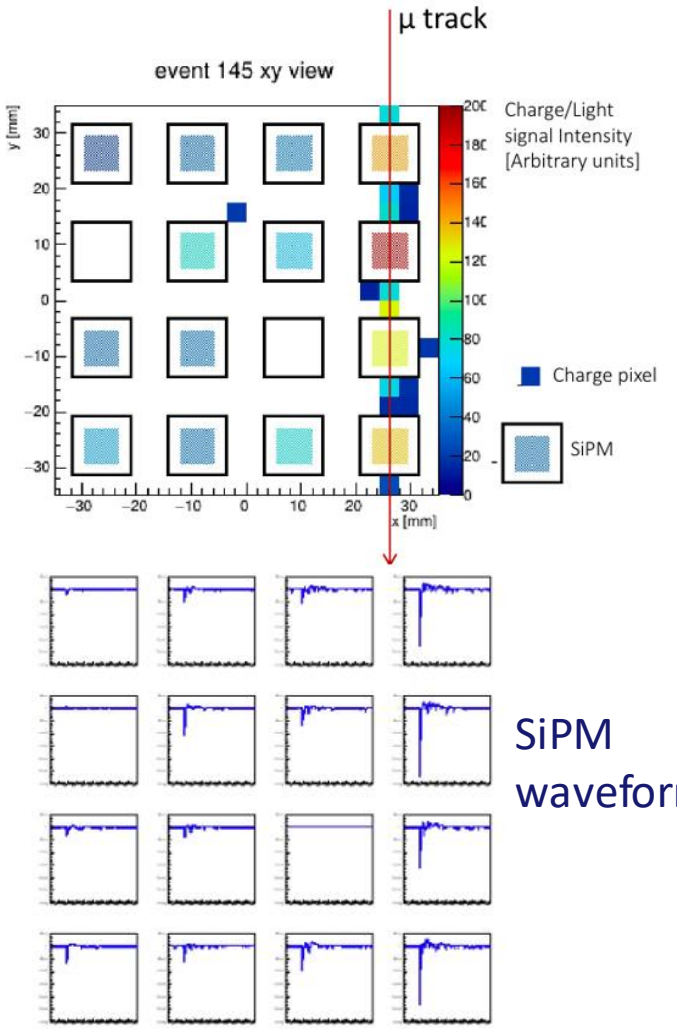
- Task 9.3: Vertical Drift Charge Readout (CNRS-IP2I, CNRS-IJCLab, CNRS-LAPP)
  - Novel Vertical Drift perforated anodes charge readout design evolving from the dual-phase charge readout stack
  - Development and tests of novel design of the Charge Readout Plane (CRP) integration surface of the Vertical Drift perforated anodes
  - Developments and tests of integrated cold electronics, new feedthrough chimneys design
  - Developments in associated digitization hardware and online data treatment

- Task 9.4: Light Readout (CIEMAT, INFN-MIB, Edinburgh)
  - Characterization of new photon detection methods, calibration devices and readout electronics
  - Implementation and characterization of a more efficient light collection system in NP02/ProtoDUNE phase II (Xe doping and Wave-Length Shifting (WLS) combined with reflective foils)
  - Dissemination of R&D results and NP02/ProtoDUNE II light-collection performance (web site)

Pixels charge readout [T:9.2] (UNIMAN, UBERN)

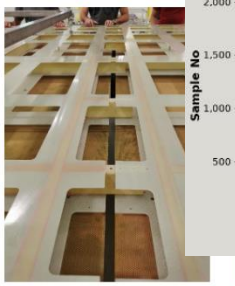
- First SoLAr dual-pixel readout Protoype at Bern
- Dimensions of the TPC: 12cmx10cmx5cm
- Active area of readout plane 7cmx7cm
- Drift distance ~5 cm

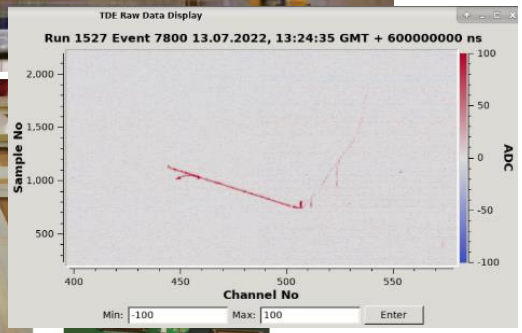
Tied to deliverable D9.1, M44

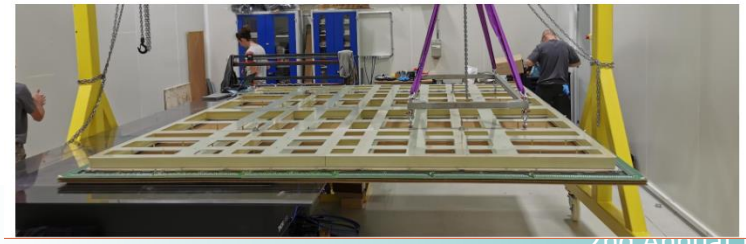


SiPM waveforms

Vertical Drift charge readout [T: 9.3] (CNRS-IP2I, CNRS-IJCLab, LAPP)







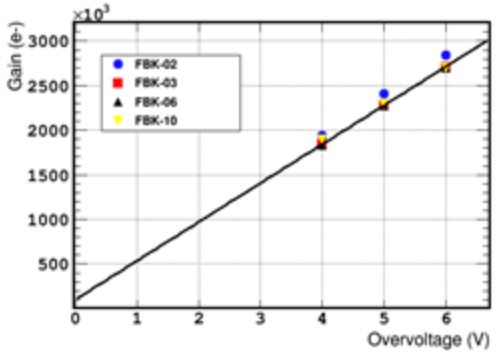
Vertical Drift Charge Readout Planes (CRPs) with perforated anodes have been successfully constructed and tested at the CERN Neutrino Platform

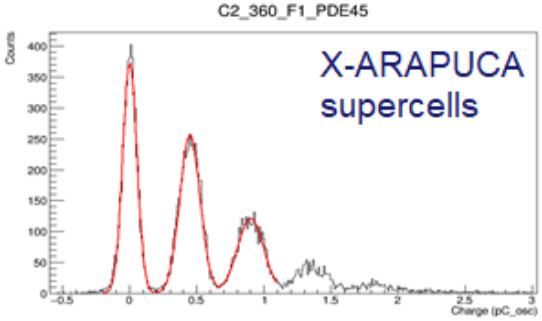
Intensive test program: first Vertical Drift CRP successfully tested in 2021. Continuation of the program as originally scheduled in 2022 with the characterization and validation of two top-drift CRPs (CRP2 and CRP3) in their final design

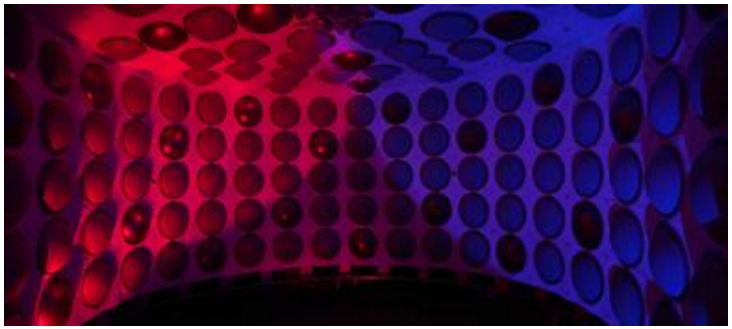
FD2-VD Cold Box	2021			2022				2023		
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Cold Box										
CB Refurbishment										
CB Dry Run										
CRPs										
CRP #1 production								Anode (48,0,90) T/B electronics		
CRP #1 installation										
CRP #1 operation										
CRP #2 production								Anode (+30,-30,90) T/B electronics		
CRP #2 installation										
CRP #2 operation										
CRP #3 production								final anode strips full top CRP/electronics		
CRP #3 installation										
CRP #3 operation										
CRP #4 production								final anode strips full bottom CRP/electronics		
CRP #4 installation										
CRP #4 operation										
Module-0							constr.	inst.		ops

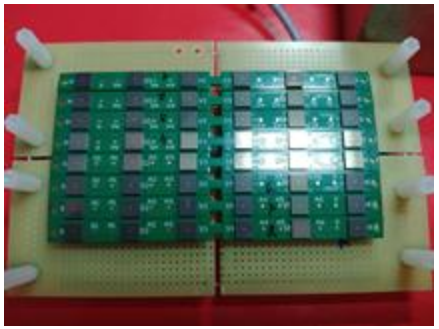
Light Readout [T:9.4] (CIEMAT, INFN-MIB, UEDIN)

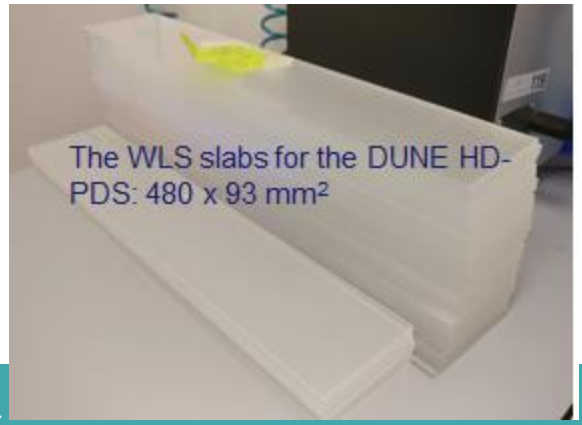
- Progress on cryo-tests of X-ARAPUCA supercells
- Characterization and development of new SiPM types and upgrades to XA design
- Dichroic filter tests
- Studies for VD geometry
- Developing large scale wavelength-shifter + reflectors surfaces











Milestones and Deliverables

Milestones

MS #	Milestone Name	Lead beneficiary	Due Date (in months)	Means of verification
MS36	Pixel optimisation	40 - UNIMAN	23	Report (Task 9.2)
MS37	Status report on chimneys	8 - CNRS	22	Report (Task 9.3)
MS38	Status report on CRPs	8 - CNRS	23	Report (Task 9.3)
MS39	Status report on digitisation	8 - CNRS	33	Report (Task 9.3)
MS40	Large-scale WLS surfaces and SiPMs Tested	21 - INFN	22	Report (Task 9.4)

Deliverables

D #	Deliverable Name	Lead beneficiary	Type	Due Date (in months)
D9.1	Large-scale Pixel Anode	40 - UNIMAN	Report	44
D9.2	Vertical Drift chimneys, digitisation, CRPs	8 - CNRS	Report	46
D9.3	R&D in LAr optical readout	29 - CIEMAT	Report	45

WP9 at this meeting

Parallel Session (now)

Plenary talk tomorrow at 9:20 am.

Enjoy seeing all the progress and have a nice meeting!