

INTENSE

Particle physics experiments at the high intensity frontier, from new physics to spin-offs. A cooperative Europe-US-Japan effort



Secondments from



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<https://clever-operation.com/>

RISE MidTerm Review Meeting,
Pisa, 28 Nov. 2022



European Commission

MSCA - RISE scheme

- *"Promotes international and inter-sector collaboration through research and innovation staff exchanges and sharing of knowledge and ideas from research to market (and vice-versa) for the advancement of science and development of innovation."*
- *"Fosters a shared culture of research and innovation that welcomes and rewards creativity and entrepreneurship and helps to turn creative ideas into innovative products, services or processes."*

[The European Commission: 2014-2015 Work Programme]



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Clever Secondments at CERN: 2019-2020

Transfer of Knowledge (ToK): EU Open Science to Open Innovation in Particle Physics

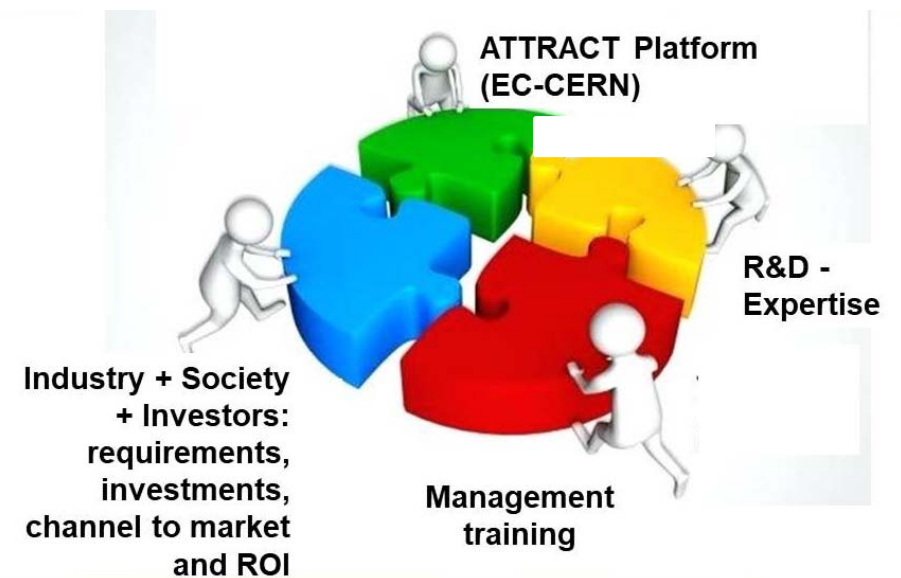
From CLEVER to CERN :

Expert insights in applying innovative breakthrough technologies to fields other than HEP.

→ the Maxi-ATTRACT initiative (EC-REA)

From CERN to CLEVER

- Modalities of Technology Transfer to the industrial sector.
- Technologies : MediPix, TimePix ...
- Empowering young scientist: training on Design Thinking...
- Empowering female scientists (Women in Technology ...)





Support to the Planning, Preparation and Management of CERN Open Days

- Taking advantage of the “long shutdown”, CERN opened its doors on 14-15 September 2019 to about **75 000 visitors** from the public.

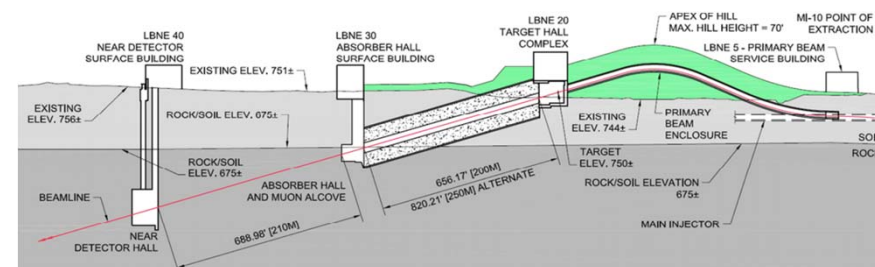
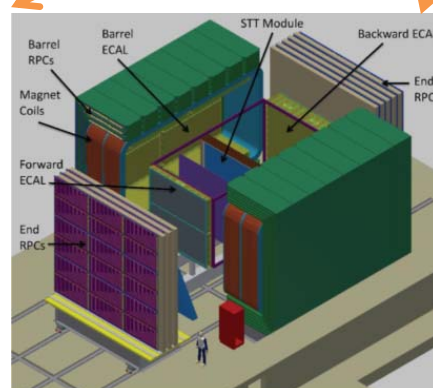
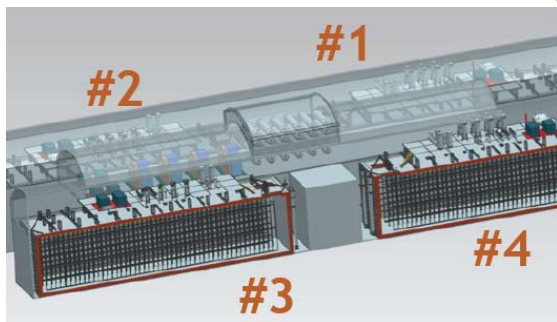
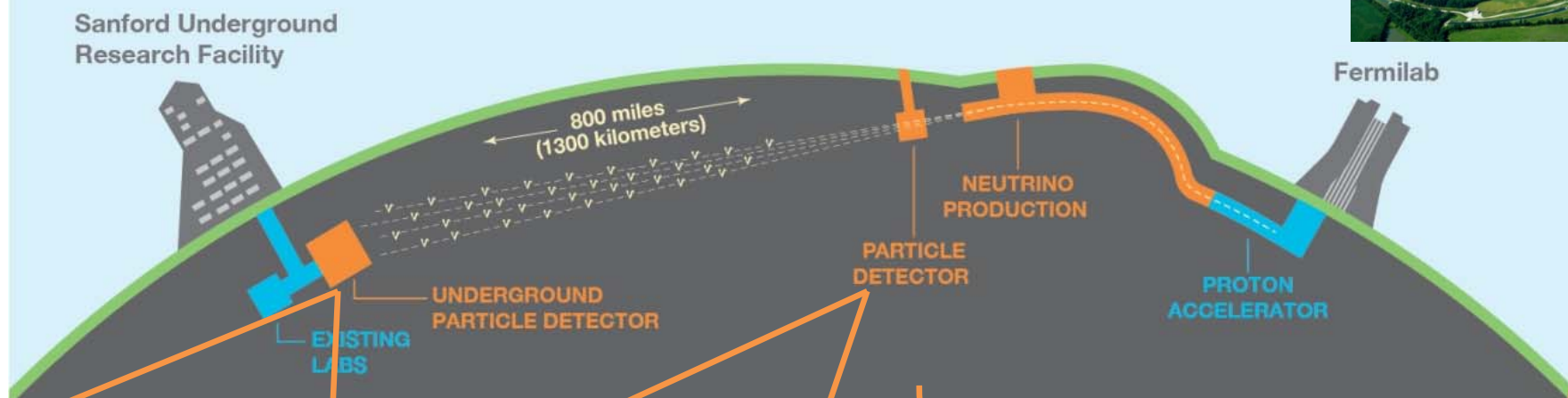


- Outreach Activities included visit points to the site's facilities, both underground and on the surface, including the EHN1 Hall of the Neutrino Platform (NP) ; experimental workshops and performances.

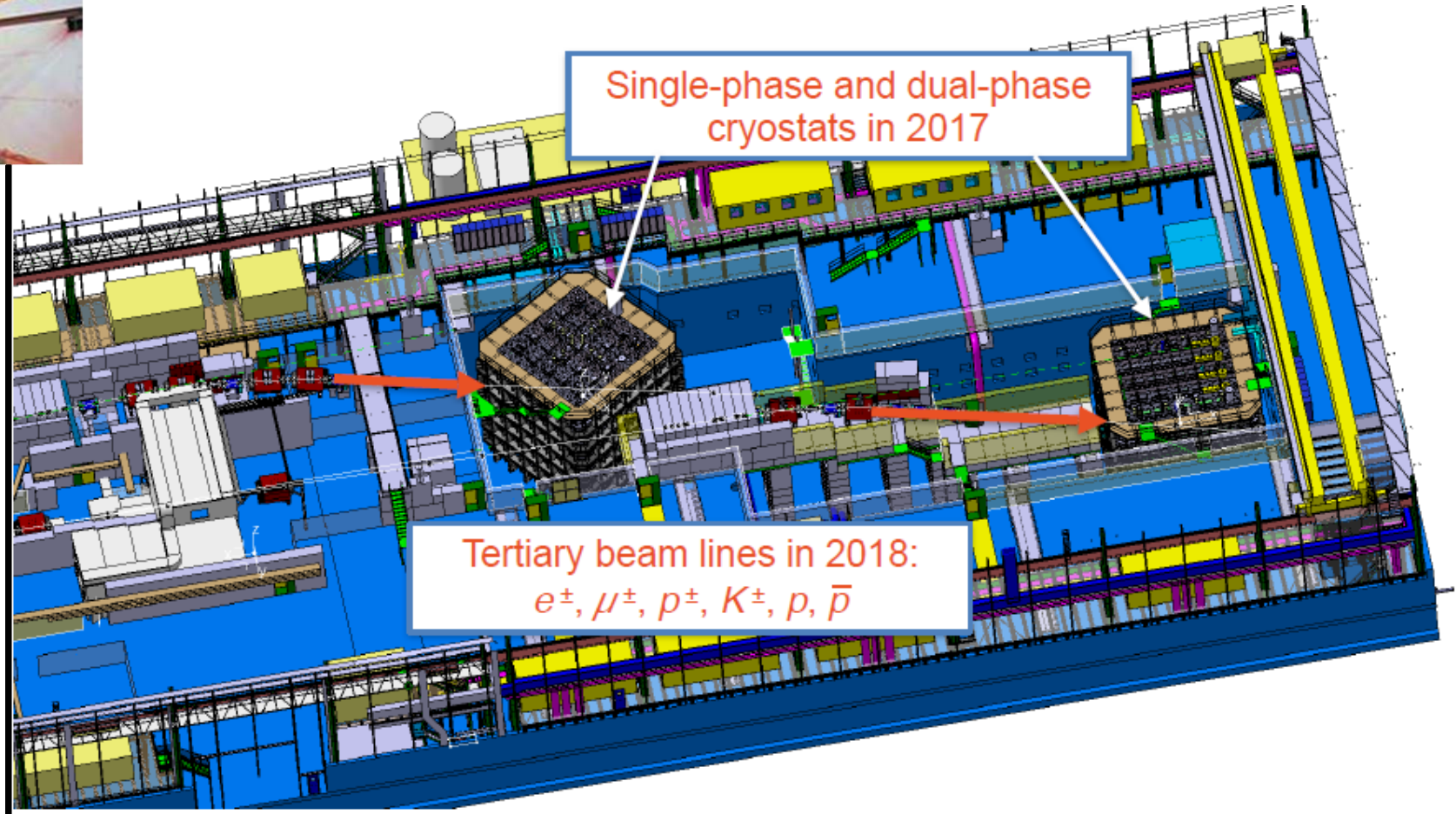
Introduction to Neutrino Detectors : The DUNE Experiment @ FNAL (I)



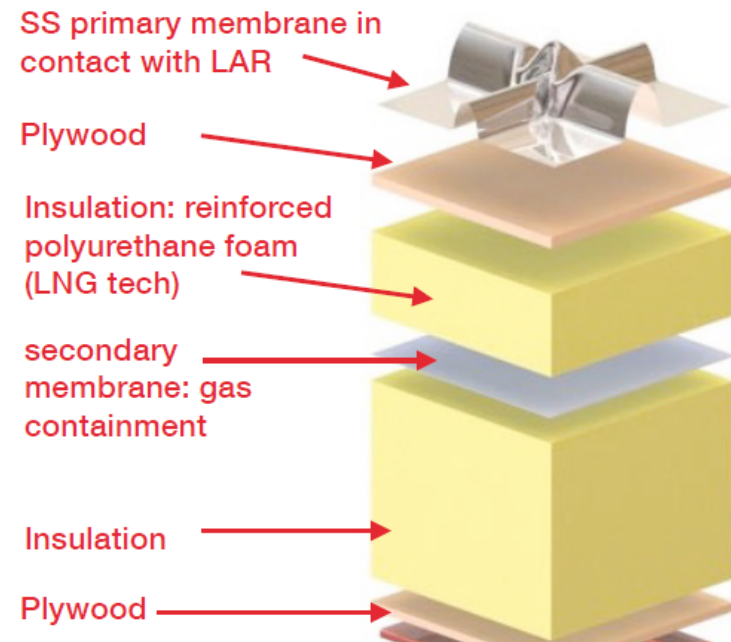
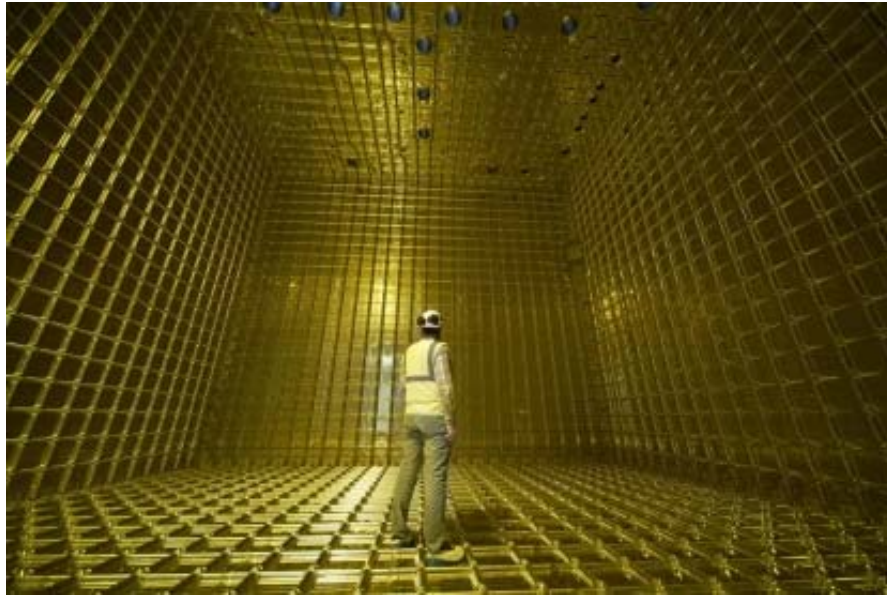
Observe ν_e appearance and ν_μ disappearance at long baseline using a wideband beam to measure MH, CPV, and neutrino mixing parameters in a single experiment.



The Neutrino Platform (NP) @ CERN - the EHN1 hall (II)

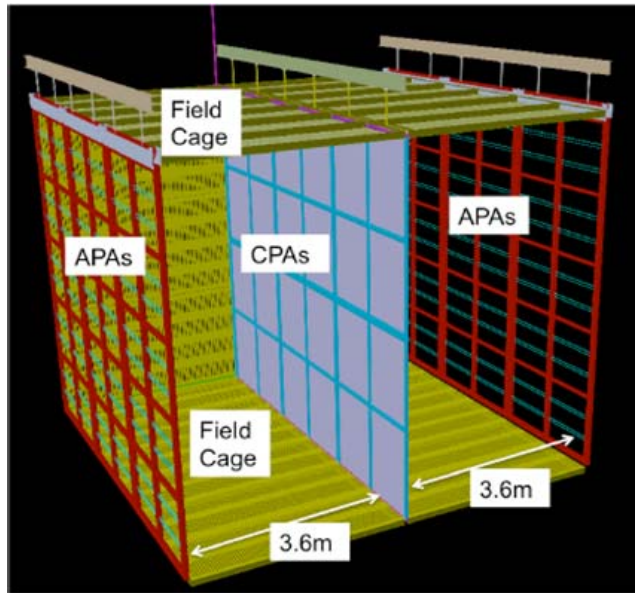


Neutrino detector technology (III)



- Liquid Argon Time Projection Chambers (LAr-TPC),
- Neutrino interaction in LAr → particle tracks → 3D image created through a series of parallel wire planes.
- New concept of cryostats: significant dimensions + membrane technology developed for LNG transport ships (GTT) and adapted for LAr-TPC.

Dune Single Phase - SP (IV)



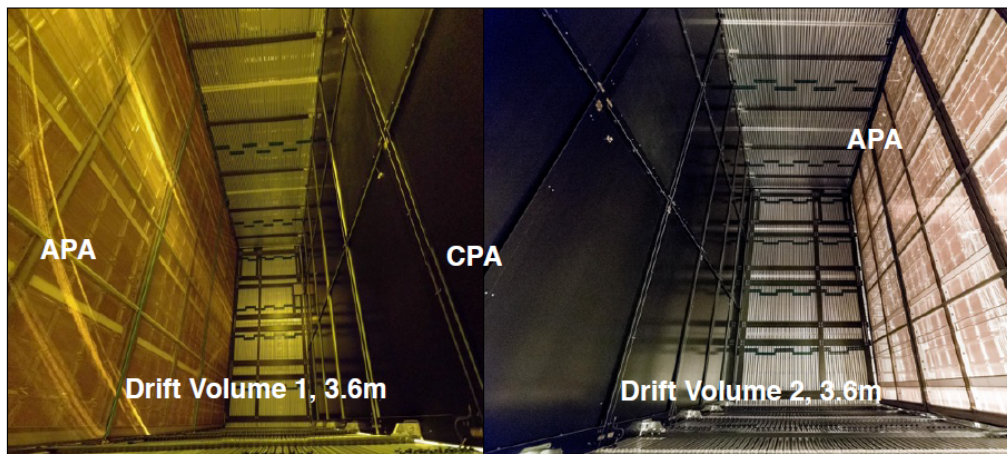
LAr TPC:

- Cathode Plane Array (CPA) in the middle
- Electrons drift horizontally towards APAs (Anode Plane Arrays).

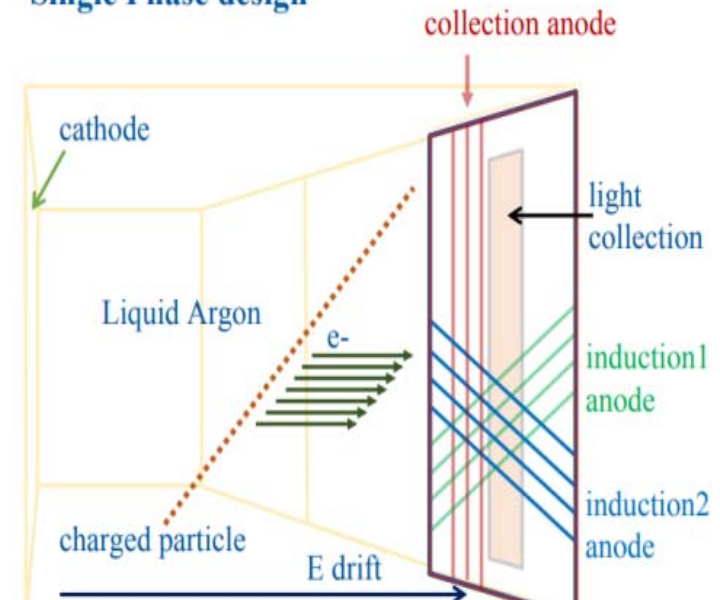
6 x Anode Plane Assembly

Cathode Plane Assembly

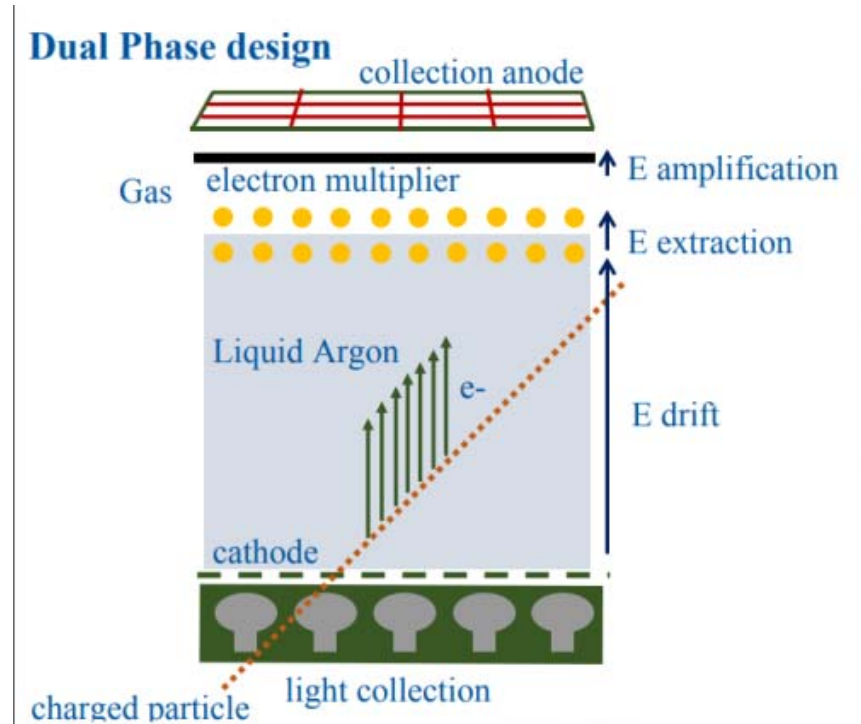
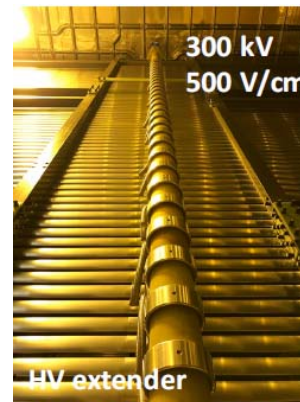
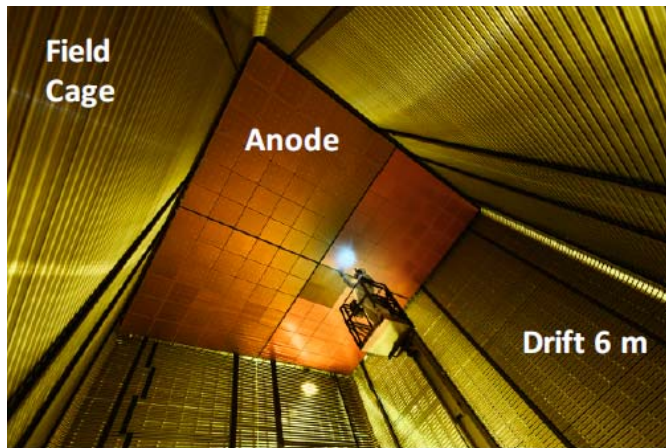
Photon Detection



Single Phase design



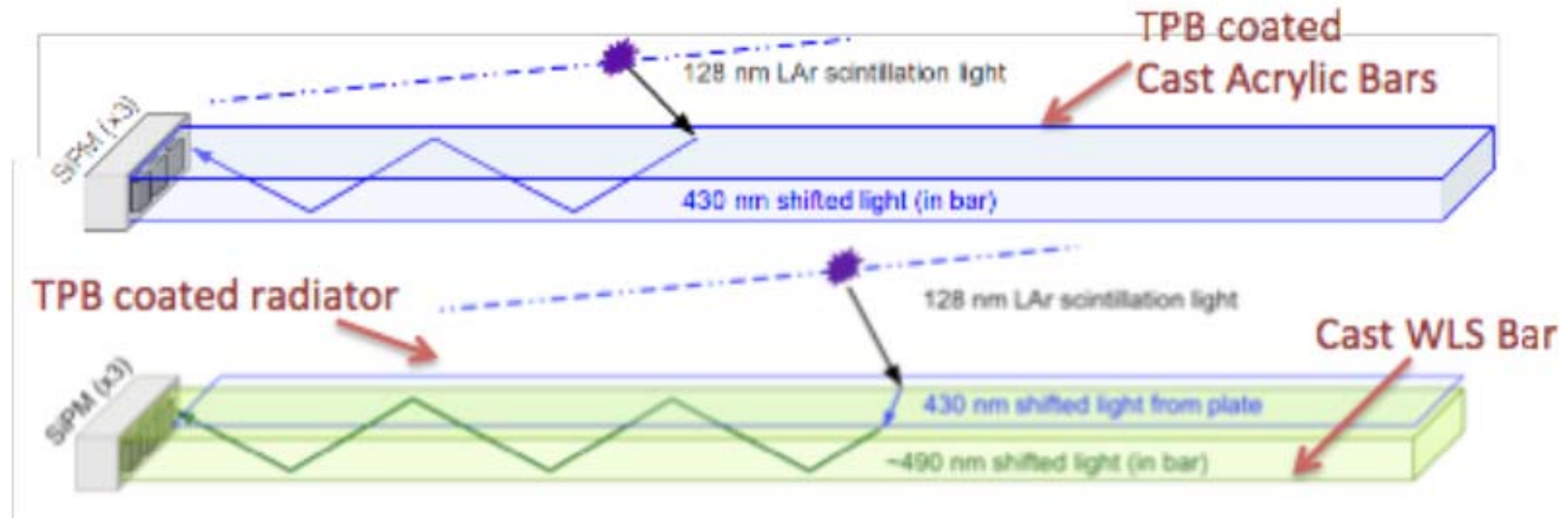
Dune Double Phase - DP (V)



LAr LEM (Large Electron Multiplier) TPC:

- Electrons drift upward to deposit charge on charge readout planes (CRPs);
- Signal amplification in gaseous argon above the volume of LAr.

DUNE SP - Photon Detection (VI)



- Scintillation light detected → determine event's time and position
- LAr - 24 K photons/MeV @ 128 nm → wavelength shifting + SiPM in the APAs

SYNERGIES between experiments, Benefit to society (other applications) & Upcoming secondments

- Scintillator technology is:
 - Needed for most HEP experiments : Mu2E, DUNE...
 - Essential for many applications such as HomeLand Security: the detection of illicit nuclear materials at the ports of entry (borders)...
- Large sizes needed while prices could be limiting for HEP experiments
- Extruded scintillators being fabricated at FermiLab.
- Performance limited by factors requiring investigation studies and mitigation measures.
- Studies planned at CERN in collaboration with FermiLab
- Upcoming secondments at CERN on some of these studies as well as on Neutrino experiments.





We remain available to young researchers of the consortium for trainings on :

- Application of particle physics detector technologies in other fields: medical, nuclear industry, space missions, security and defense, research and education ;
- From R&D to Technology Road-Mapping and Development ;
- Support in project management: technical, strategic, reporting, financial, HR and career development...
- State of the Art analyses and comparisons : competitive technologies, main providers and key players...





Acknowledgement

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European Commission



<https://clever-operation.com/>

References:

- EC-REA Horizon 2020 MSCA RISE Guidelines
- Publications and presentations of the Corresponding HEP collaborations,
- Private communications with members of the collaborations.