Light detection in DUNE Dual-Phase

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Lepton-Photon 2019

9th August 2019

Deep Underground Neutrino Experiment

DUNE is a long-baseline neutrino oscillation experiment. It will detect a beam of neutrinos 1,300km away.

It has a rich physics program:

- **CP violation** and **neutrino mass** ordering using neutrino oscillations.

- **Proton decay searches** and **neutrino astrophysics**.

4 x LAr TPCs of 12x12x60m^3 10kton fid. mass. each.
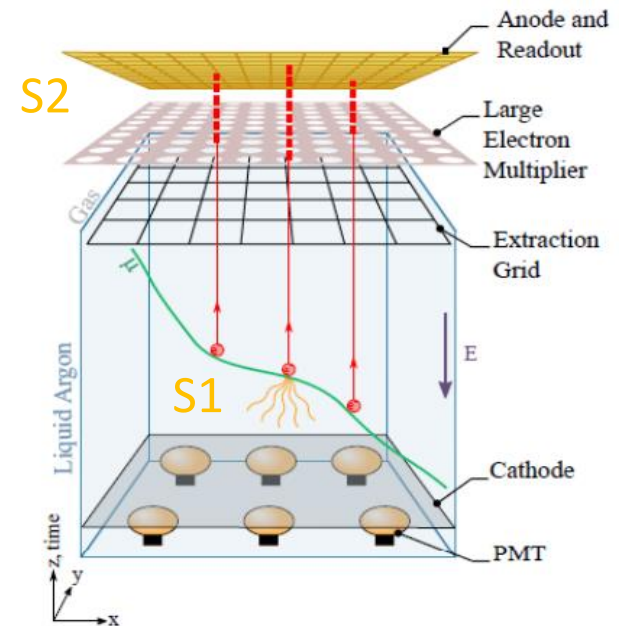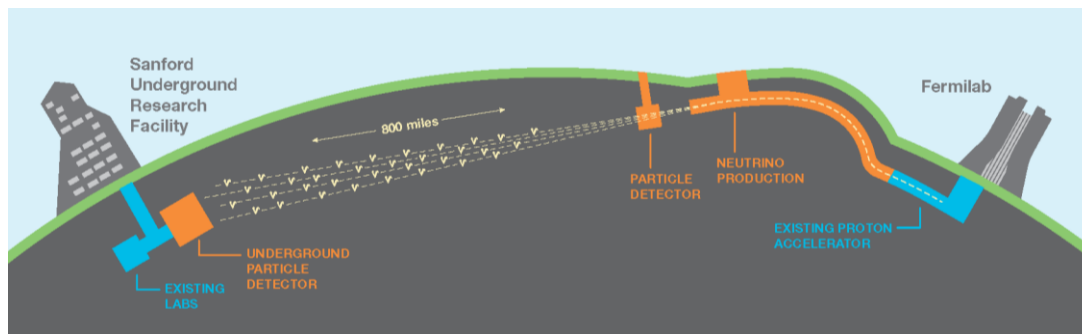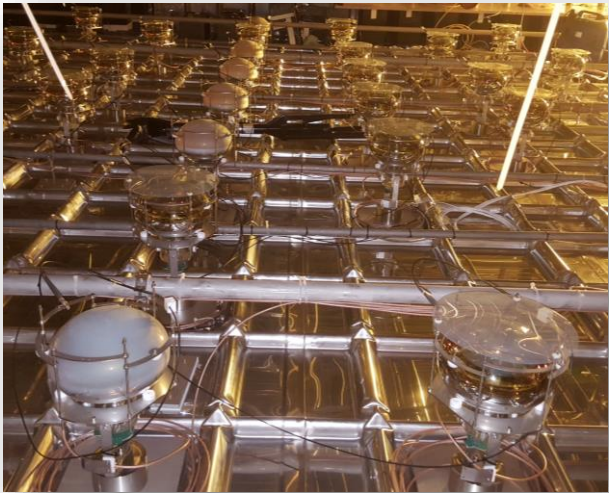

Dual Phase module:

12m drift distance.

Argon gas layer in the top to amplify the charge signal.

Light Detection System of DUNE Dual-Phase

LDS of protoDUNE Dual-Phase

The Light Detection System will provide:

- Event time reconstruction (needed to do 3d reconstruction in non-beam events).

- Trigger for non-beam events.

- It can contribute to calorimetric reconstruction.

It consists on:

- 720 8'' Hamamatsu PMTs coated with TPB.

- A LED-based fiber light calibration system.

- Reflective foils in the top part of the detector "walls".
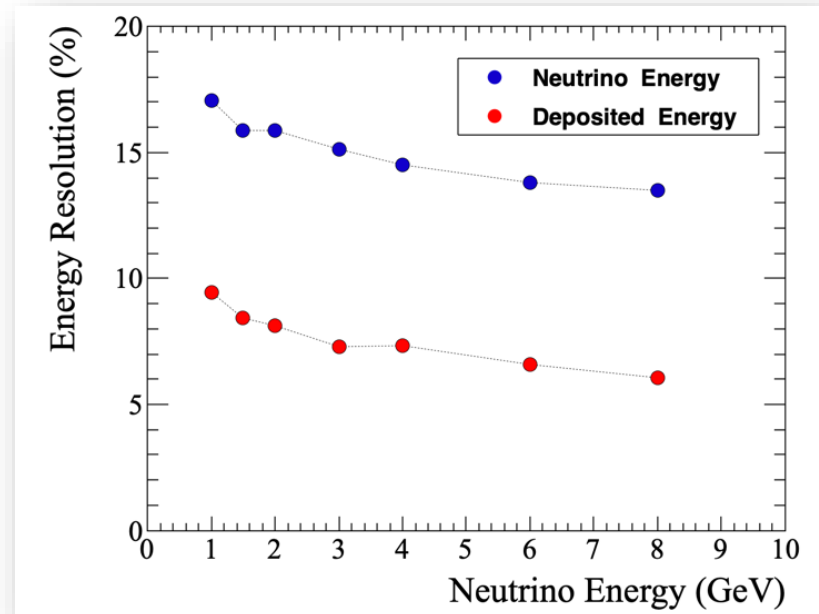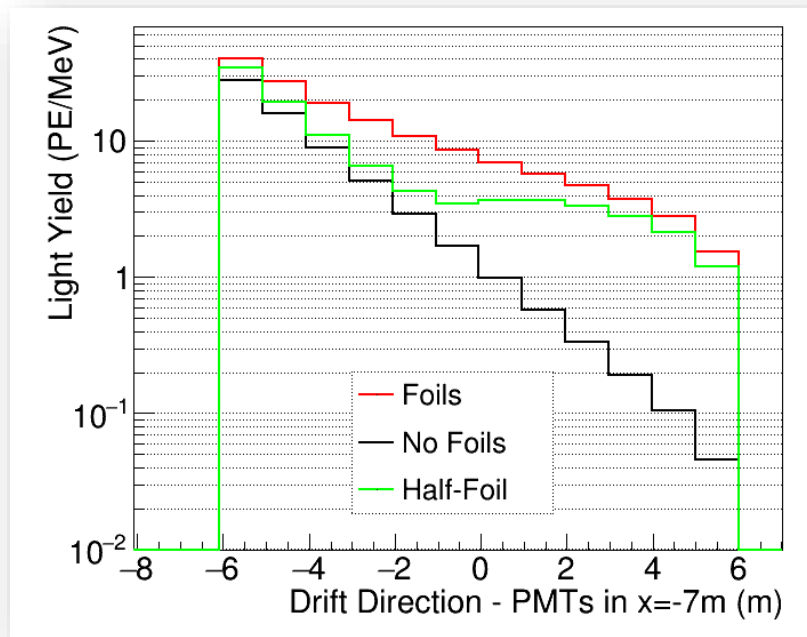
Ciemat DUNE
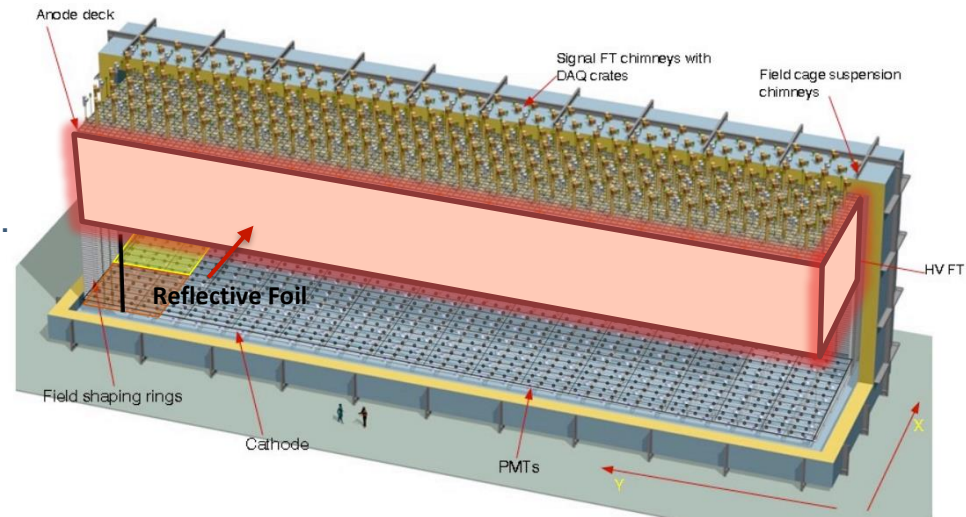
Performance of the system with simulation studies

To validate the system, several Monte Carlo simulation studies have been performed:

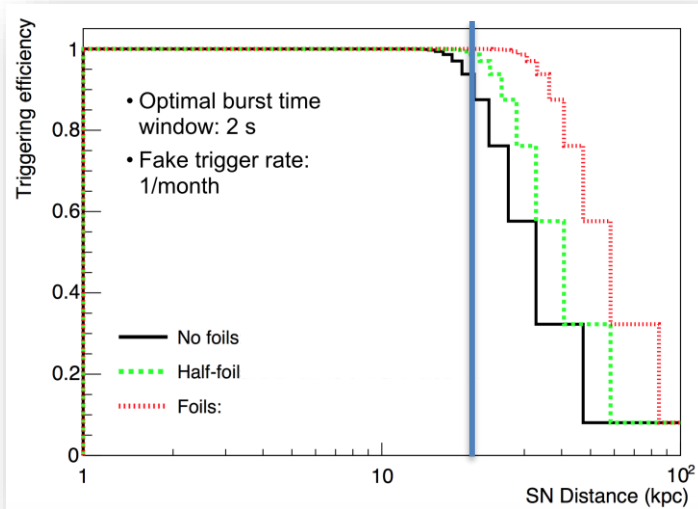**Detected photo-electrons per MeV of deposited energy**

Light yield > 1PE in the worst case, 12m away from the PMTs.

Beam energy reconstruction

Deposited energy resolution below 10%, and total energy resolution below 18% for ν_eCC interactions at different energies.
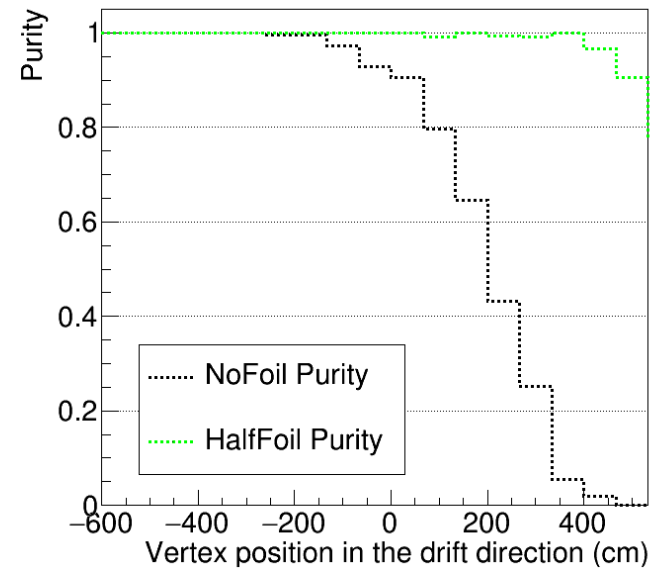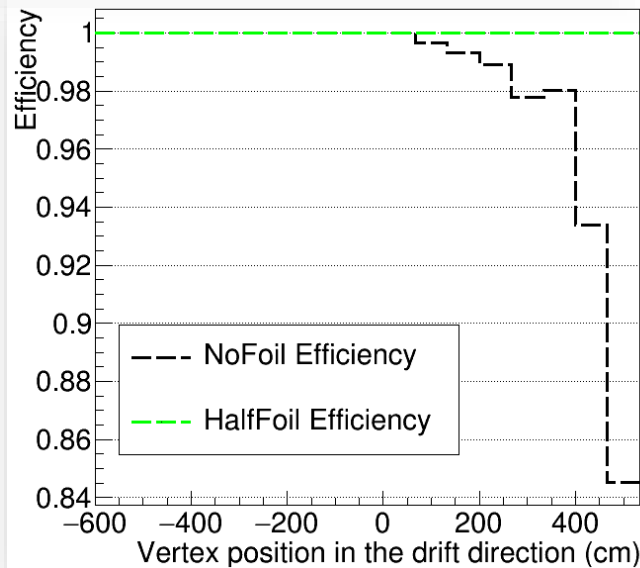
Performance of the system with simulation studies

Supernovae neutrinos light trigger

>95% triggering efficiency on a Supernova Burst at 20 kpc, the far side of the galaxy.

Proton decay searches

>90% time reconstruction efficiency and purity at all fiducial volume.

… stay tuned!

- Dual-Phase technology is being tested at large scale at CERN.

- **ProtoDUNE DP finished its filling this morning and data taking will start in the forthcoming weeks!**

Inside of protoDUNE DP during the filling on July 7th 2019.