

Cryogenic Power over Fiber for fundamental and applied physics at Milano Bicocca: the Cryo-PoF project.

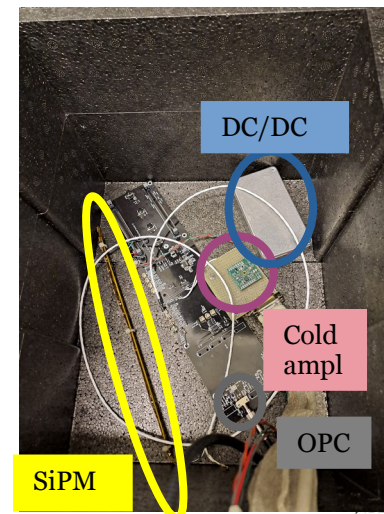
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Poster EX-18

- **Cryo-PoF:** Cryogenic Power over Fiber.
- It is founded by “CSN5 Young Researcher Grant” from Istituto Nazionale di Fisica Nucleare (INFN, Italy) from February 2022 for 2 years; PI: M. Torti; Institutions: Univ. Milano-Bicocca and Univ. Milano Statale.
- **Cryo-PoF’s main goal** is to power, at cryogenic temperature, both SiPM and cold amplifier, using a single Power over Fiber line and to tune SiPM bias with the laser power.
- The **Power over Fiber** (PoF) technology delivers electrical power by sending laser light, through an optical fiber, to a photovoltaic power converter, in order to power sensors or electrical devices.
- This project arose from the **DUNE Vertical Drift** module, in which the Photon Detection System has to be placed on the high voltage cathode surface.



- **GaAs laser source** 808 nm;
- **Graded index multi mode optical fiber** with black plastic sheath;
- **Optical Power Converter**, $V_{\max} = 6$ V, 30% efficiency in LN;
- **Cold amplifier** MiB for DUNE, $V_{\text{in}} = 3.3$ V;
- **DC/DC** boost converter INFN Mi, to give bias to SiPMs, possibility to tune SiPM bias as a function of laser power;
 - $V_{\text{in}} \sim 5$ V, $V_{\text{out}} \sim [40, 50]$ V.
 - placed in a metallic box to reduce noise.
- **Hamamatsu SiPM**, 1 flexi board with **20 SiPMs** in parallel.

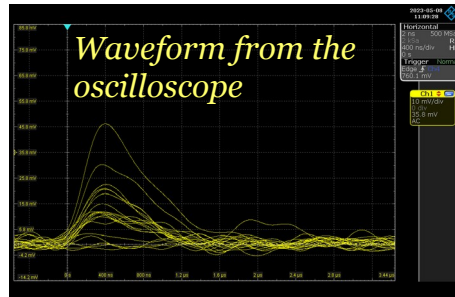


Tests in LN (T = 77 K)

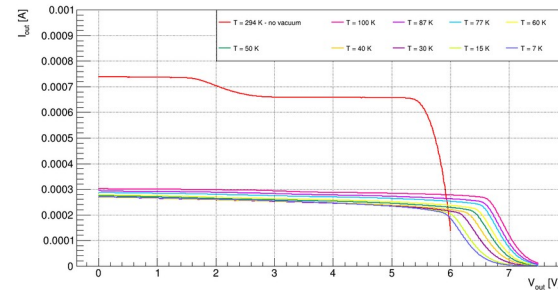
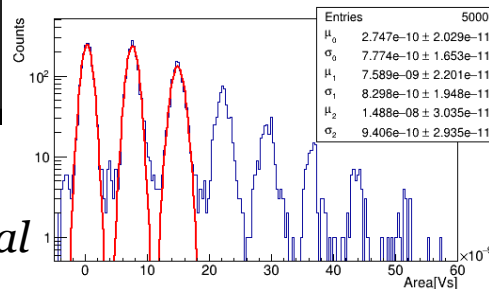
- **20 SiPMs** in parallel, **three SiPM bias** tested : 45 V, 46 V, 47 V (3, 4, 5 V ov);
- evaluation of the **Signal to Noise Ratio** (SNR);
- The performances of the PoF are comparable with the copper cable ones.

Test at temperature lower then 77 K

- I-V curves of the **OPC** in a cryostat **till 7 K**;
- The system was in vacuum; the temperature was fixed and controlled by means of an heater and a thermometer.
- The laser power at the OPC was ~ 5 mW (there was a large power loss in the feedtrough).
- The device works till 7 K with $P_{\max} \sim 15\% P_{\text{in}}$.



PoF charge integral



OPC I-V curves