dRICH and temperature

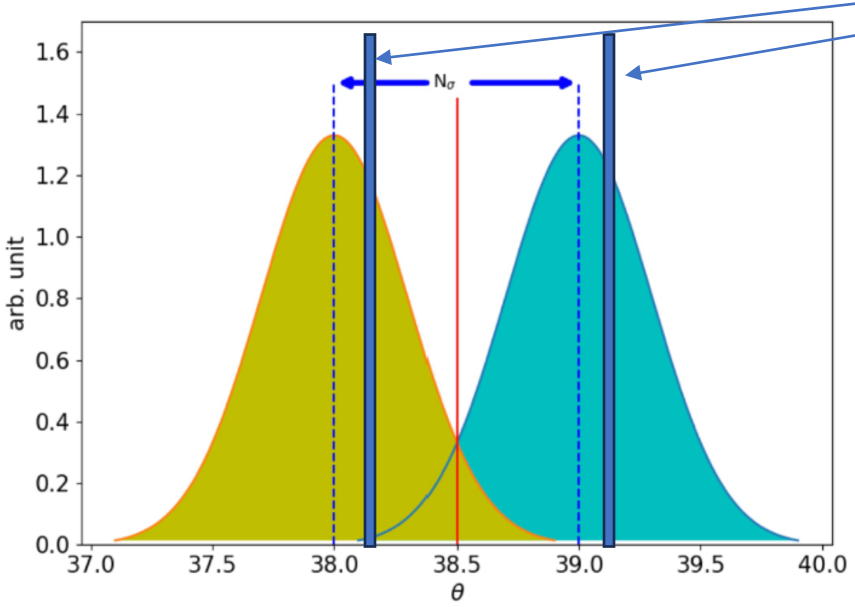
S. Dalla Torre
May 5,2024

Some considerations (using COMPASS RICH parameters)

- **Effect of 1 ‰ variation of (n-1)**

0.1 % variation of (n-1)	theta_Ch	Delta theta_Ch	sigma theta_Ch (measured)
	(mrad)	(mrad)	(mrad)
1490 x 10^(-6)	54.56		
1488.5x 10^(-6)	54.53	0.03	0.3

But the peaks are here!



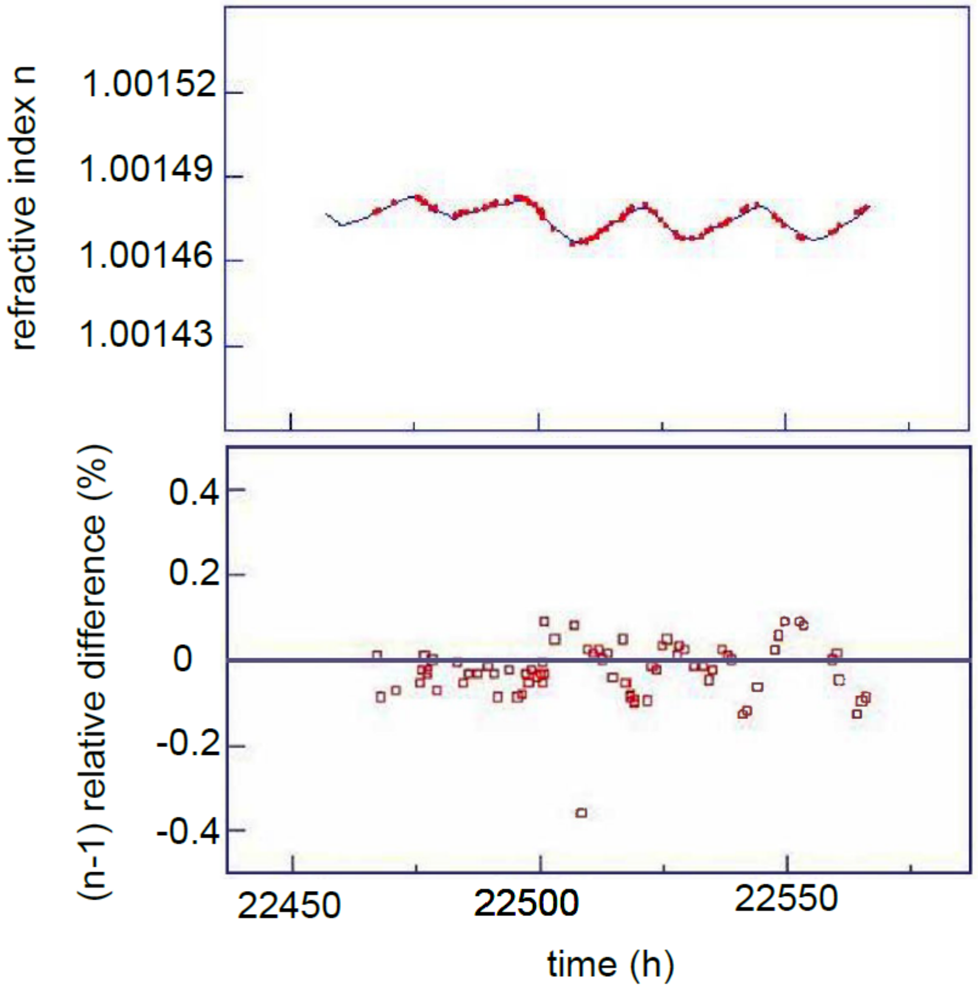
What can produce a 1 ‰ variation of (n-1) ?

- (n-1) ~ P
  - At atmospheric pressure, 1 mbar

- (n-1) ~ 1/T
  - At room temperature, 0.3 degrees
  - Note: a 3 degree variation would result in a shift of 1 sigma !

  - if there is a T field in the detector, not a global shift but angular dispersion

Can this effect be measured, corrected for?



- Red squares: n from the data
- Black line: n evolution from P, T measurements
- The two approaches match at the 1 ‰ level

The active temperature screen (from literature)

Grant Agreement No: 101004761

AIDAinnova

Advancement and Innovation for Detectors at Accelerators

Horizon 2020 Research Infrastructures project AIDAINNOVA

MILESTONE REPORT

IDENTIFICATION OF A GAS MIXTURE FOR NEUTRINO PHYSICS IN AN OPTICAL TPC

Authored by	D. González-Díaz J. Martín-Albo Simón	IGFAE IFIC	17/02/2024

2.2. ACTIVE CRYOSTAT

A temperature of -25ºC is not alien to the operation of silicon-based photosensors [20] and, with due precautions, it is high enough so as not to expect strong tin pest effects on the auxiliary electronic boards. Although several cooling strategies are possible, we discuss briefly a simple implementation that avoids the use of large vacuum vessels, and that might be practical when targeting operation near a pressurized system, at a modest power consumption. Given the necessity to avoid temperature gradients in the TPC, a combination of passive insulation and a mild active heating of the external window surface is proposed. Passive insulation could be enabled by 5 mm of pressurized Ar gas and a 20 mm-thick PMMA window, coated with an indium-tin-oxide (ITO) conductive film on its external surface, as shown in fig. 18 (top). The presence of a second PMMA window at the cathode plane ensures a buffer gas region for homogenization of residual temperature gradients over the windows. Fig. 18 (bottom) shows the experimental results for a 10 cm-diameter cryostat designed according to these principles, and cooled down to -20 ºC through an ethanol chiller. Upon applying a voltage across the ITO film (≃12V), marked with an arrow as 'ITO on', the internal cooling power can be balanced and the system returned to stationary conditions, with a power consumption of about 100 W/m^2. Over the entire photosensor region, this would amount to a modest 750~W (to which the electronics power needs to be added). The stationary values of the temperatures as well as the power per unit area are well matched in a 1D simulation. A detailed study is currently underway in order to model the temperature profile over the window, outside the axial region (Fig. 19).

The active temperature screen (from literature)

Grant Agreement No: 101004761

AIDAinnova

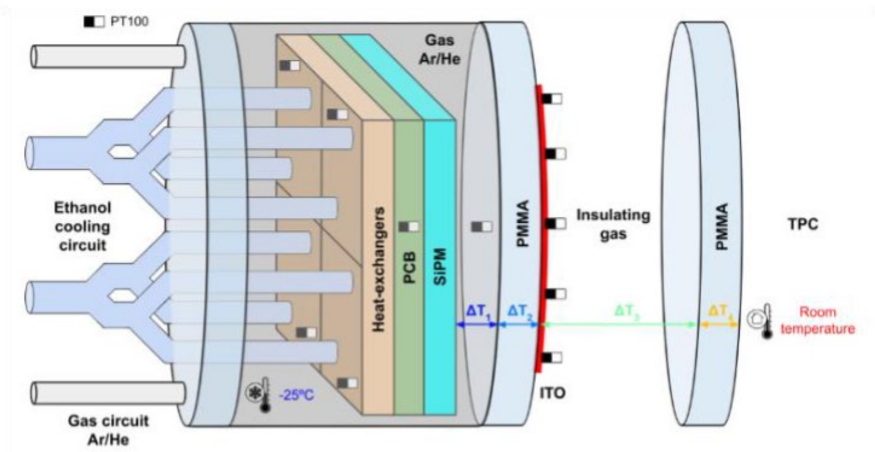
Advancement and Innovation for Detectors at Accelerators

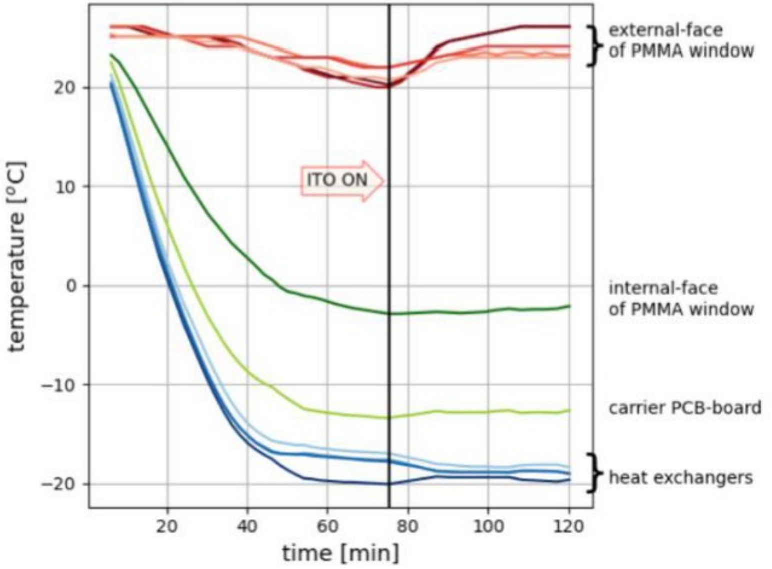
Horizon 2020 Research Infrastructures project AIDAINNOVA

MILESTONE REPORT

IDENTIFICATION OF A GAS MIXTURE FOR NEUTRINO PHYSICS IN AN OPTICAL TPC

Authored by	D. González-Díaz J. Martín-Albo Simón	IGFAE IFIC	17/02/2024

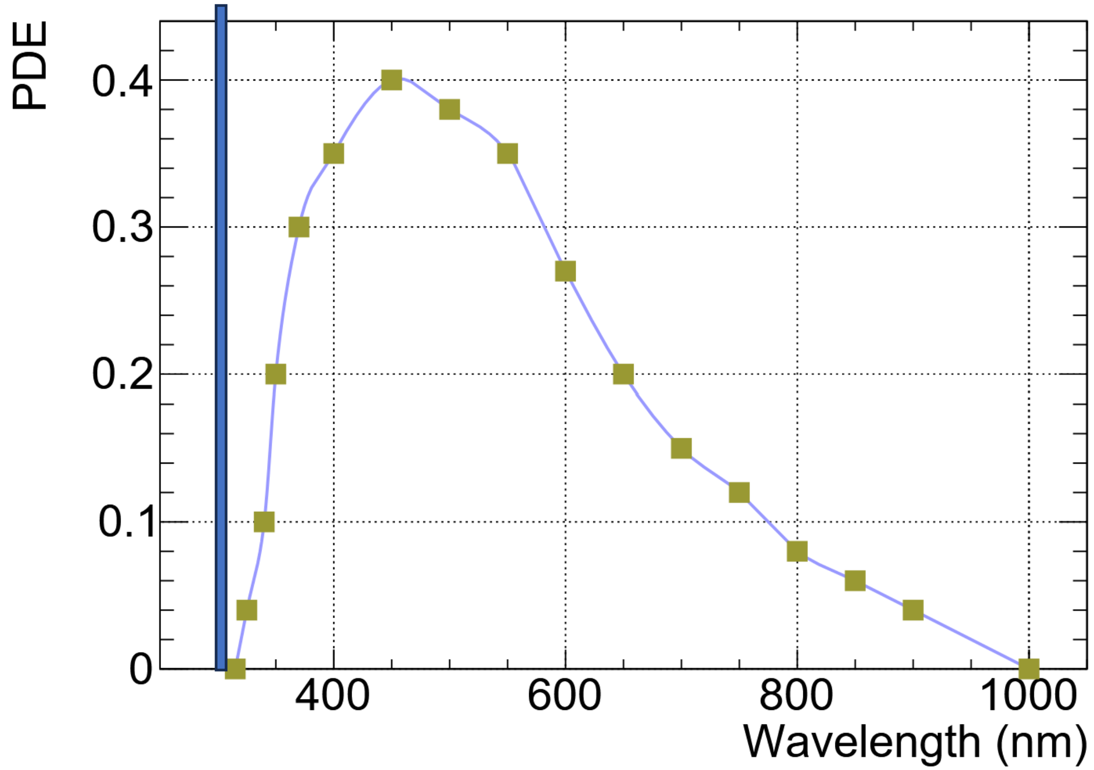


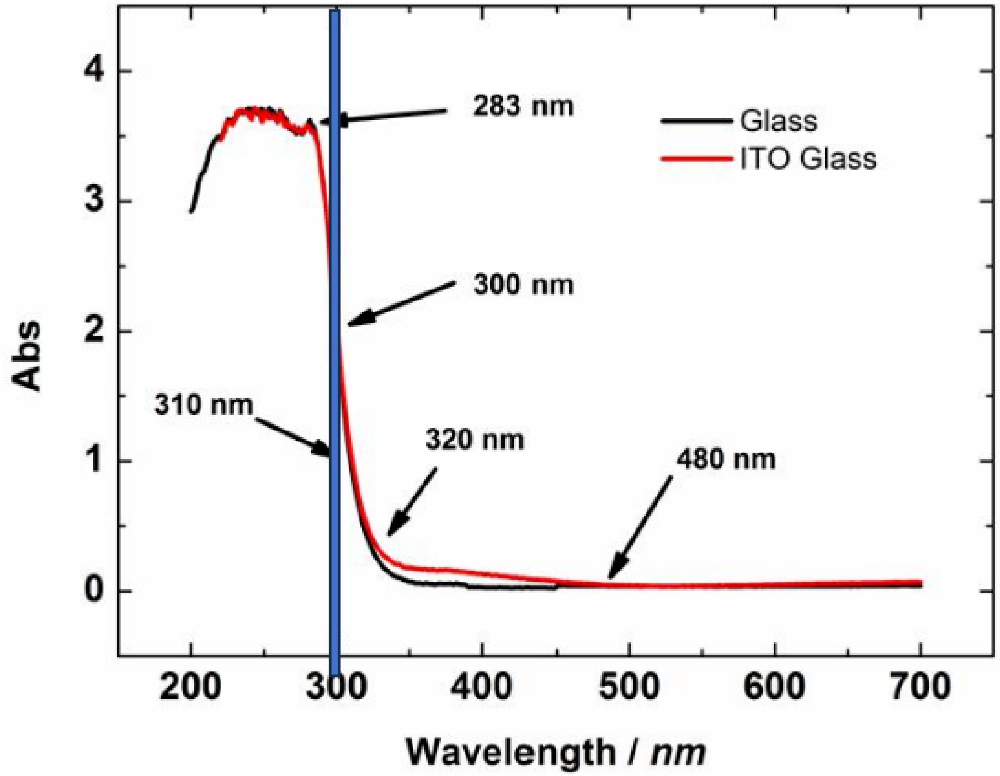


MEASURED !!!

Is indium-tin-oxide (ITO) compatible with SiPMs?

SiPM PDE from our current simulation





Absorption of glass and ITO glass.