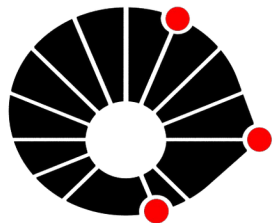


# VD PHOTON DETECTION SYSTEM

*ETTORE SEGRETO*

*University of Campinas - UNICAMP - Brazil*



**UNICAMP**



Conselho Nacional de Desenvolvimento  
Científico e Tecnológico

# PD VD Physics and Detector Requirements

- We are assuming for the PD VD the same physics and detector requirements as the ones for the HD
- There could be some differences, but should be minor ones

Label	Description	Specification (Goal)	Rationale	Validation
SP-FD-3	Light yield	> 20 PE/MeV (avg), > 0.5 PE/MeV (min)	Gives PDS energy resolution comparable to that of the TPC for 5-7 MeV SN $\nu$ s, and allows tagging of > 99% of nucleon decay backgrounds with light at all points in detector.	Supernova and nucleon decay events in the FD with full simulation and reconstruction.
SP-FD-4	Time resolution	< 1 $\mu$ s (< 100 ns)	Enables 1 mm position resolution for 10 MeV SNB candidate events for instantaneous rate < 1 m <sup>-3</sup> ms <sup>-1</sup> .	

# PD VD Baseline design: $4\pi$ configuration

- 320 X-ARAPUCA modules ( $60 \times 60 \text{ cm}^2$  - 160 SiPMs each) mounted on the cathode
- 288 X-ARAPUCA (2 x 4 rows) modules mounted on the membrane, close to the anode ( $\sim 60 \text{ cm}$  from the field cage). Assuming 70% transparency of the FC
- Assuming Xe doping
- According to simulations, ensures a good uniformity in the detection of light inside the active volume
- Solidly meets the requirements, improves the performance of the detector at low energies

# PD VD Back-up design: Membrane mounted

- 720 X-ARAPUCA (60x60 cm<sup>2</sup> - 160 SiPMs each) modules (20 rows) installed on the membrane (~60 cm from the FC) .  
Assuming 70% transparency of the FC
- Assuming Xe doping
- Ensures a good uniformity in the detection of light inside the active volume
- Less efficient than the 4 $\pi$ , but meets the minimal requirements.  
Should be able to do the same physics as the PD HD module
- The two solutions have comparable costs