ARAPUCA

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UNICAMP

Work principle

SIPM

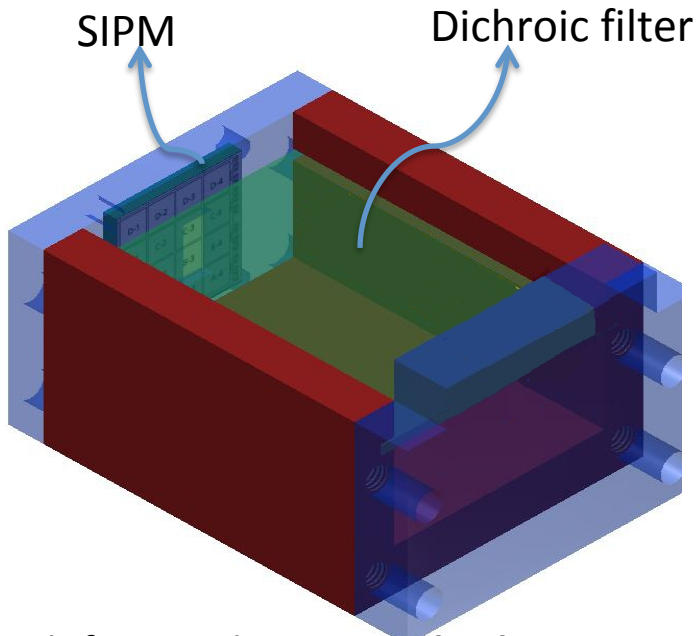**Dichroic filter**

The simplest geometry is a **box** with highly reflective internal surfaces with an open side.

The open side hosts the **dichroic filter** it has the property of being **highly transparent** for wavelengths **below a cutoff** and **highly reflective above it**.

The filter is deposited with **TWO SHIFTERS** – **one on each side**

The shifter on the **external side**, S1, converts LAr scintillation light to a wavelength L1, with **L1 < cutoff**

The shifter on the **internal side**, S2, converts S1 shifted photons to a wavelength L2, **with L2 > cutoff**
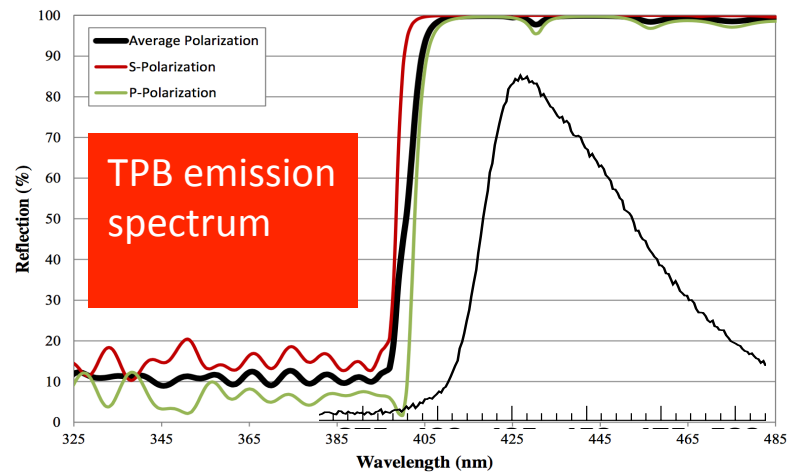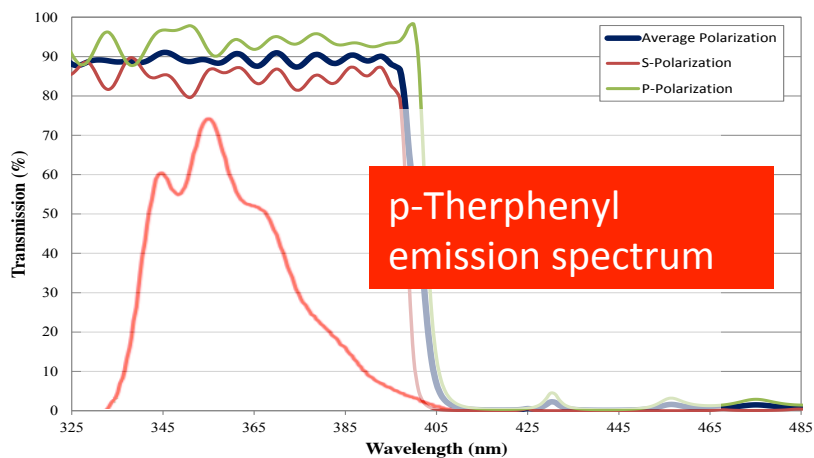
The internal surface of the ARAPUCA is observed by **one or more SiPM**

S_1, L_1 nm

Dichroic Filter

S_2, L_2 nm

SIPM

Filter is transparent

Filter is reflective

γ

$\lambda \approx 127$nm
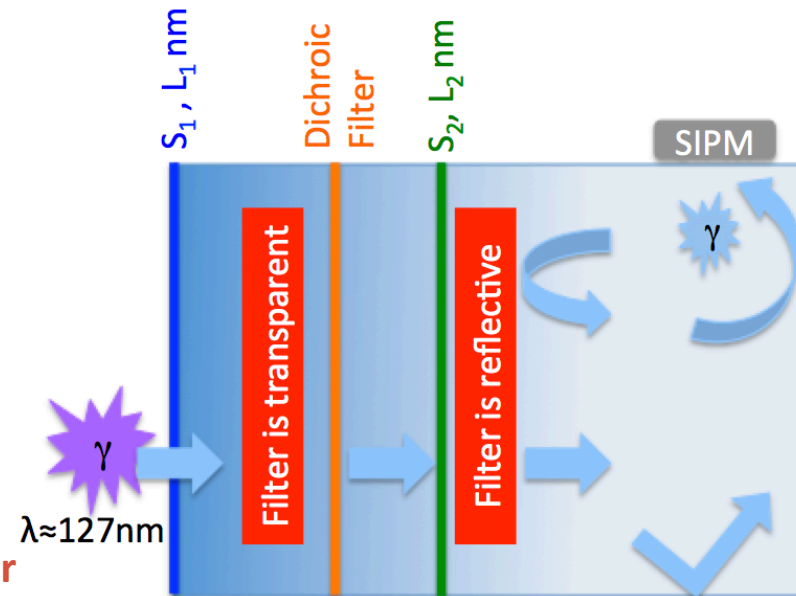
Dichroic Filter
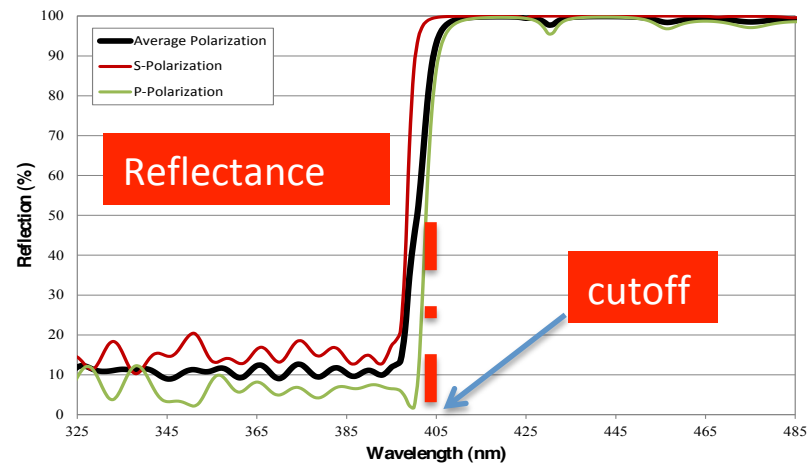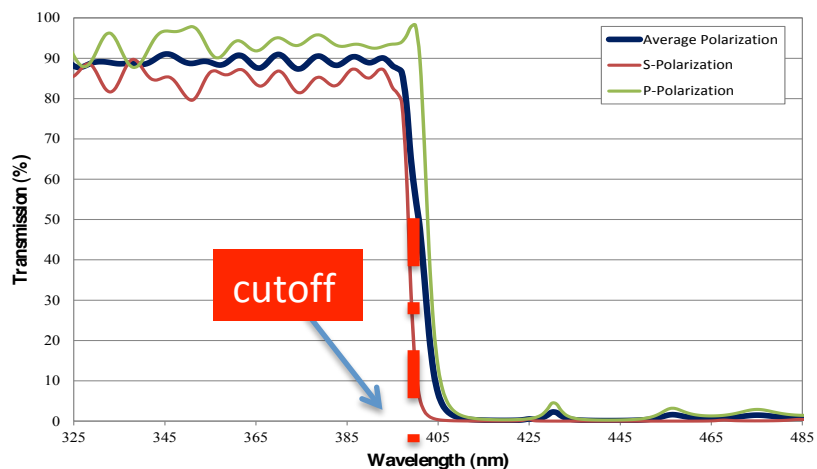

TPB and pTP emission spectrum

ARAPUCA

- Large area photon collector
- Modular and thin device easily adaptable to different mechanical constraints
- Can detect light on both sides
- Can be detect VUV or/and visible light
- Efficiency can be tuned by varying the photo cathode coverage. Currently at few percent level (3-4%) with a limited coverage with active SIPM
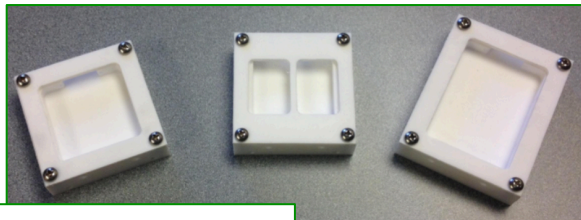- Other applications

Gain factor between 7 and 10

X-ARAPUCA window
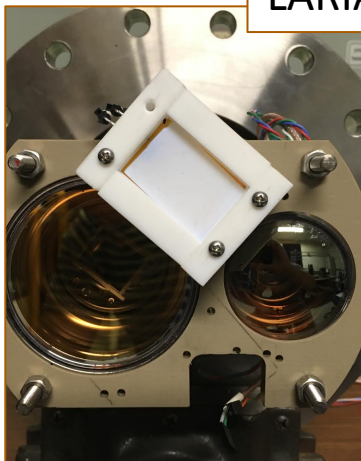
Equivalent SIPM active surface

SiPM active surface
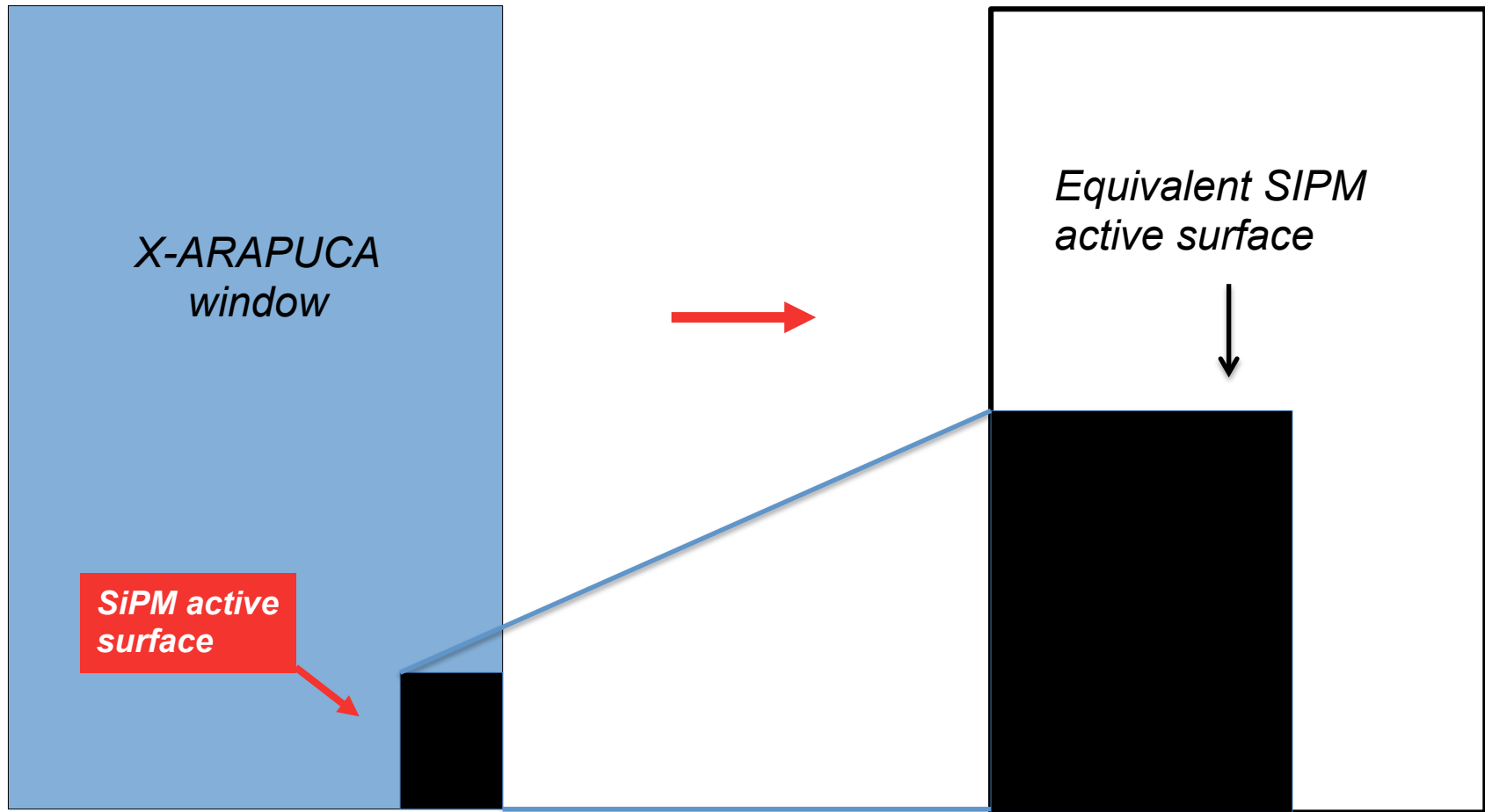
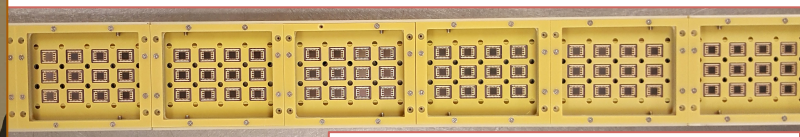In units of 8" PMT: 1 ***X-ARAPUCA bar*** is equivalent to ***2.5 8" PMTs*** ->***25 equivalent PMTs/APA***
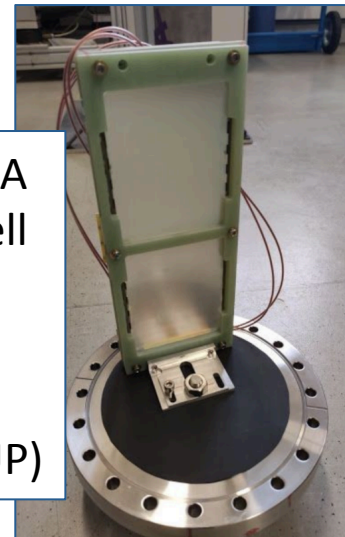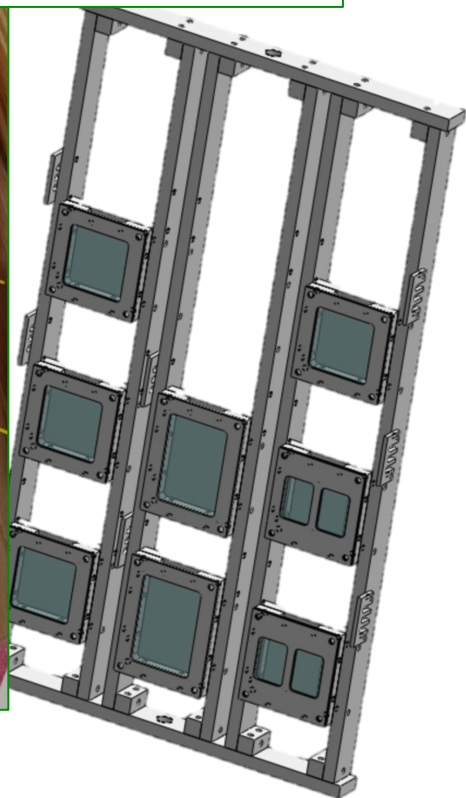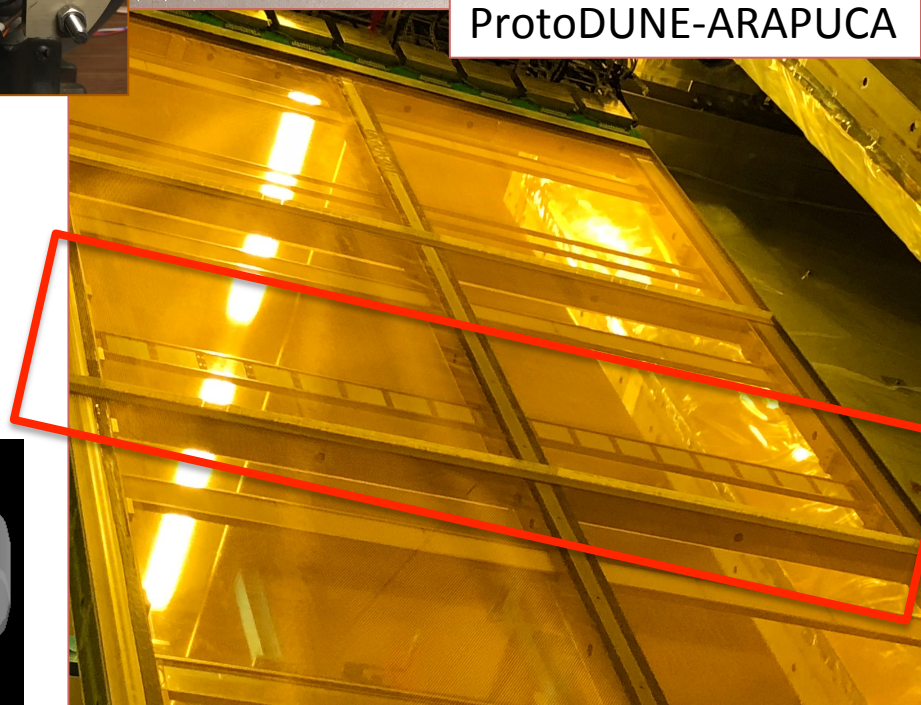
ARAPUCA
TallBo

ARAPUCA
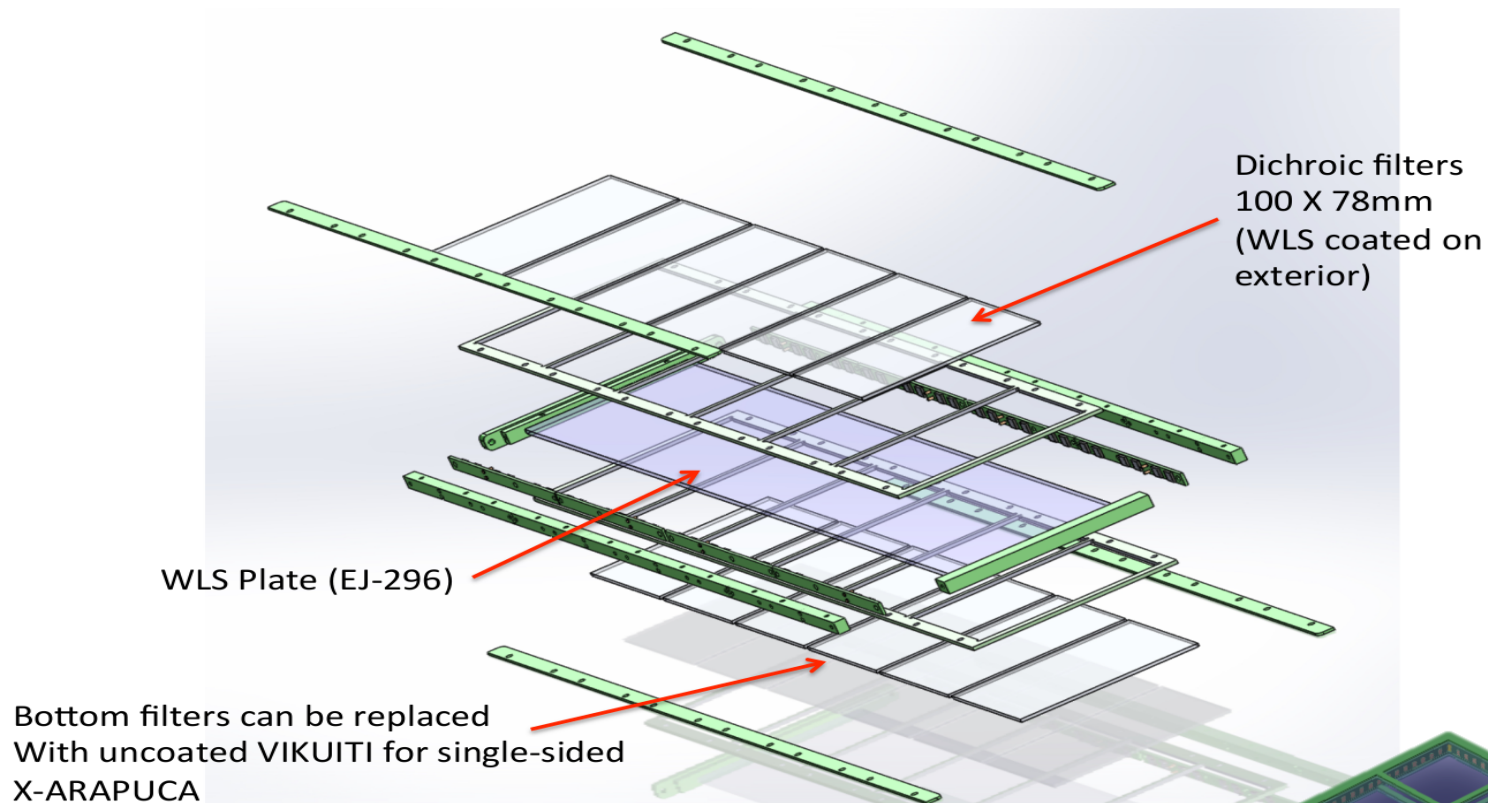LARIAT

X-ARAPUCA
Double−cell
SBND
(CERN
MILANO
TEST-SETUP)

ProtoDUNE-ARAPUCA

Simulation using different shape

F.Marinho & L.Paulucci

Dichroic filters
100 X 78mm
(WLS coated on
exterior)

WLS Plate (EJ-296)

Bottom filters can be replaced
With uncoated VIKUITI for single-sided
X-ARAPUCA
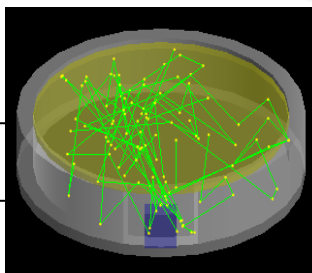
DUNE Double sided X-ARAPUCA

Vertical Drift proposal
ARAPUCA-AÇÚ