

PoWER

Polymer Wavelength shifter and Enhanced Reflection

E. Segreto on behalf of PoWER team

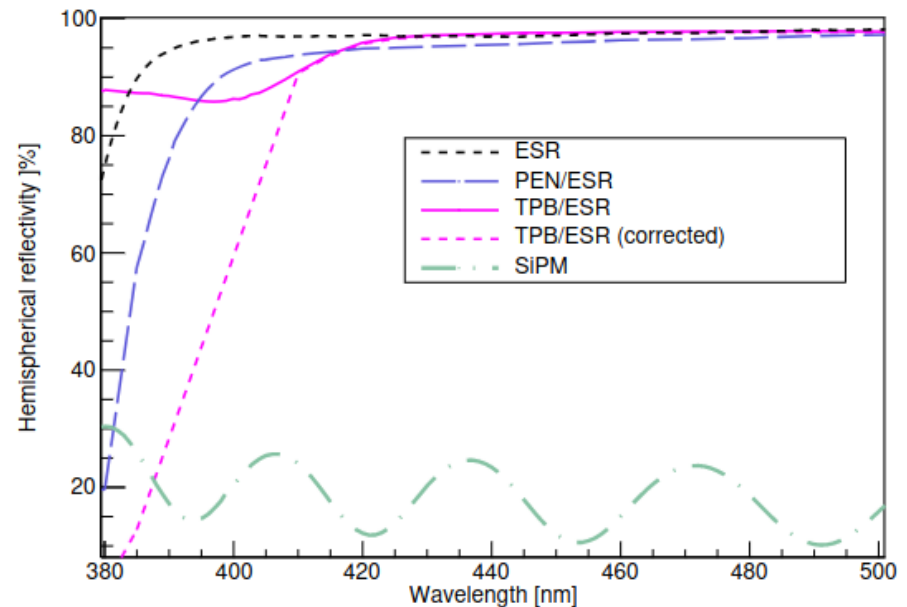
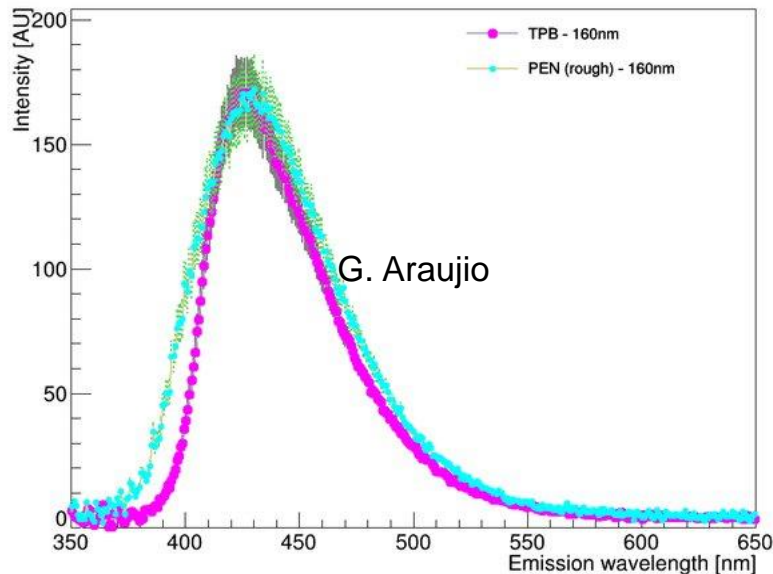


Recap: PoWER design

- **Full coverage of the field cage with polymeric wavelength shifting foils (PolyEthylene Naphthalate – PEN).**
- **Large arrays of SiPMs mounted on the membrane.** Combination of standard and VUV sensitive SiPM to use the LAr buffer between Field Cage and membrane **as an active veto;**
- **Large plastic panels lined up with ESR reflector** (reflectivity up to 98% in the visible) installed on the membrane, to enhance the detection probability of the shifted photons;
- **Cathode (partially) covered with PEN and reflector**

PolyEtyleneNaphthalate - PEN

- **PEN has good optical characteristics:**
 - Emission spectrum peaked **around 420 nm**. *Well matched with the sensitivity of standard SiPMs;*
 - **Good transparency to its own light**

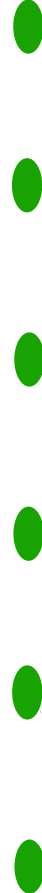


M. Kuźniak et al. Eur. Phys. J. C (2019) 79:291

Side view

- **Side view** of the space *between the field cage and the membrane*
- **Thin acrylic foils with PEN on it**, installed on the Field Cage
- **High transparency Field Cage**
- **LDU installed on panels coated with Enhanced Specular Reflector (3M VIKUITI)**
- Maximum possible coverage of the membrane

PEN and acrylic foils



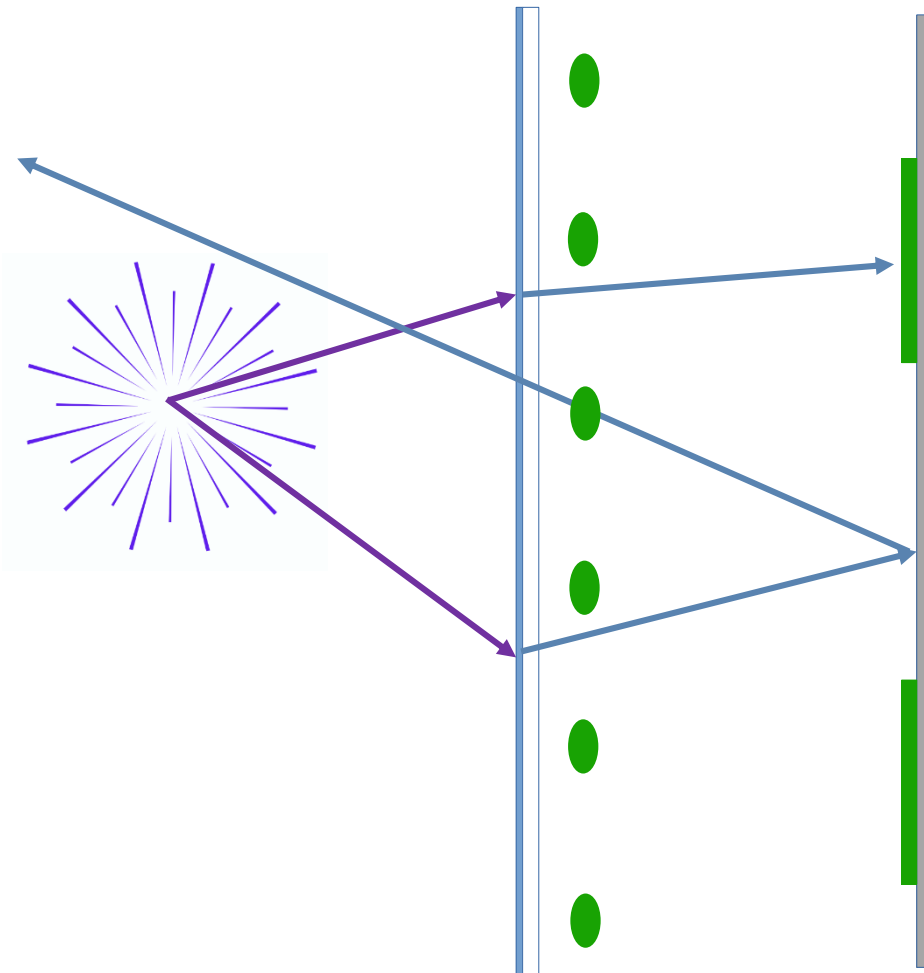
Reflector on panels



LDUs: light detection units

Field Cage

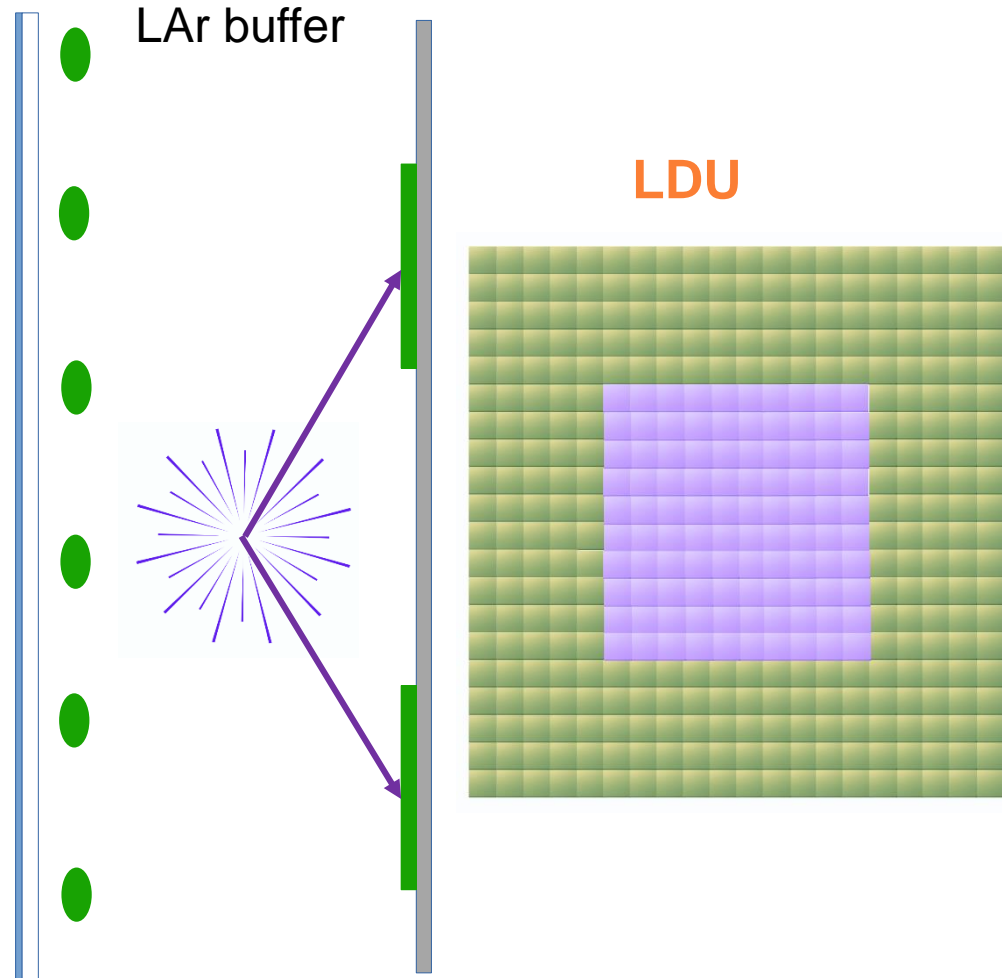
Side view



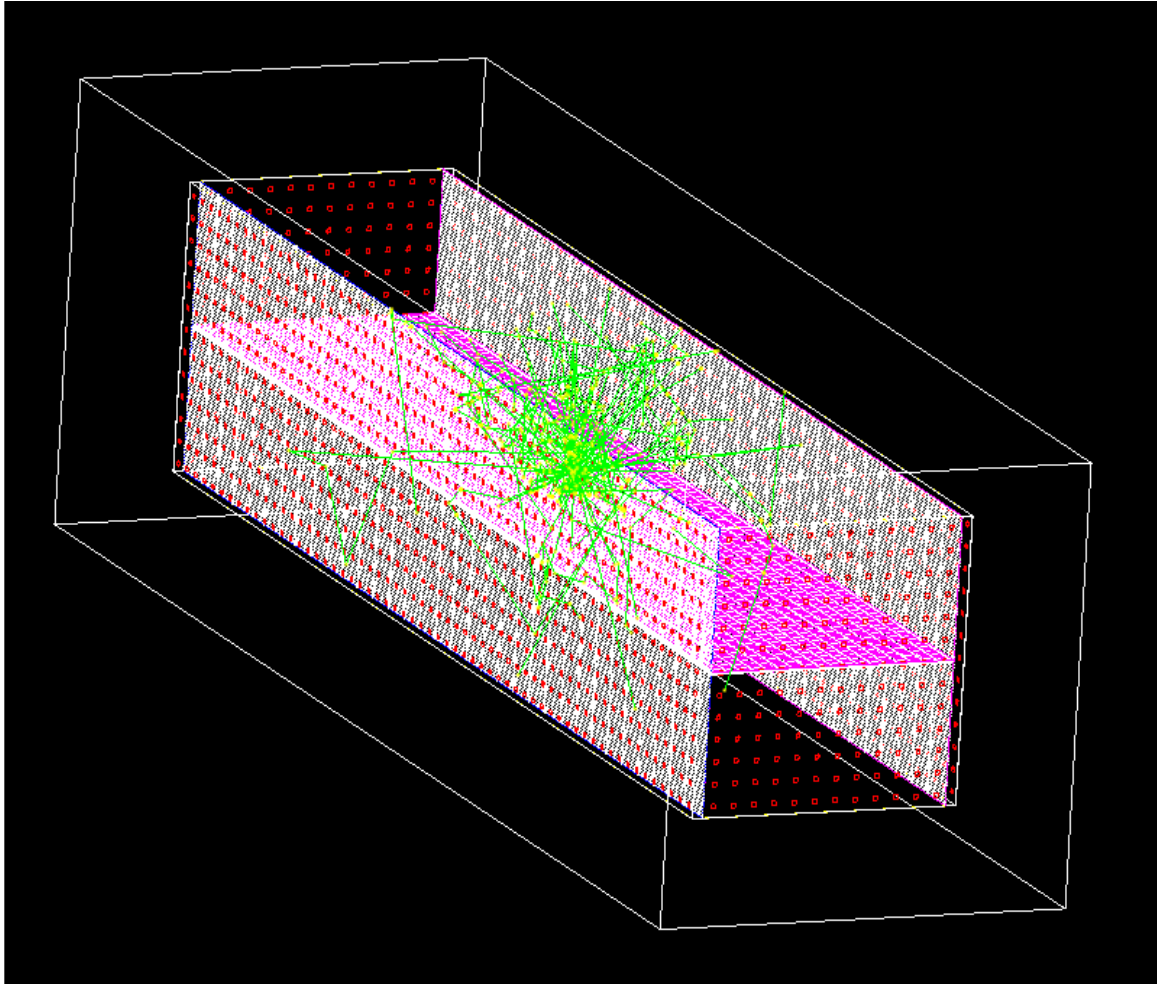
- **Scintillation VUV photons converted by PEN**
- Converted photons (420 nm) can be detected **directly on the LDU**
- Can hit the reflector and **bunched back in the active volume**
- Can be detected by an LDU **on the other side of TPC, or after several reflections**

Active veto

- LDU can be a **combination of standard and VUV sensitive SiPMs**, ganged into **two separate read-out channels**;
- *Photons produced in the LAr buffer are not shifted (acrylic foil). **VUV photons directly detected by the VUV active fraction of the LDU**;*
- *Events inside the active volume produce signals on both Standard and VUV sensitive SiPM*
- **Unbalance of the signals between the two channels** allows to **use the LAr buffer as an active veto**



MC simulation

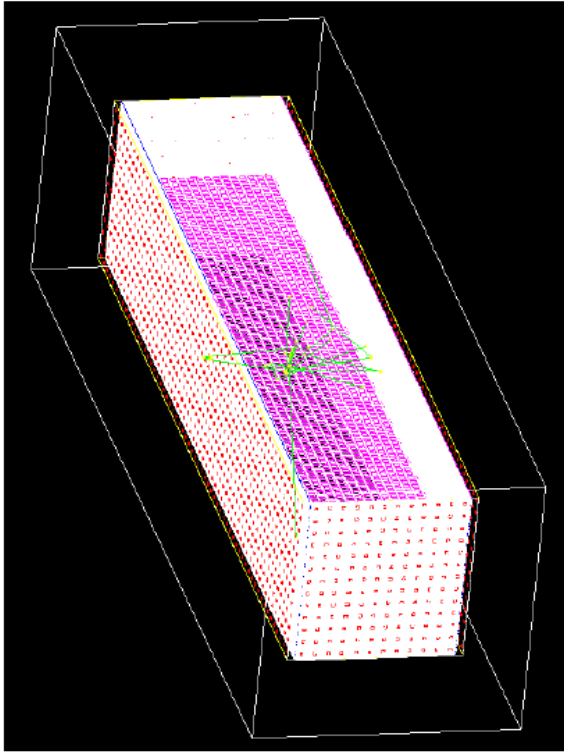


A. Steklain

We are developing a **complete Geant4 MC simulation** which includes:

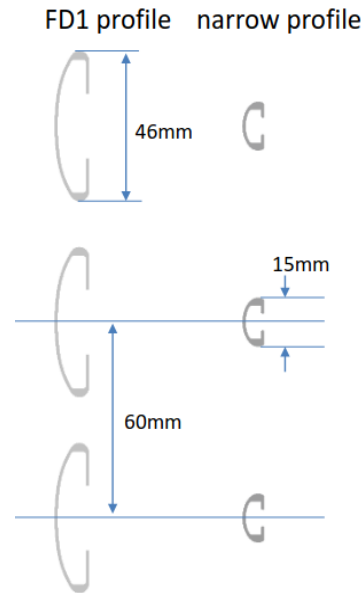
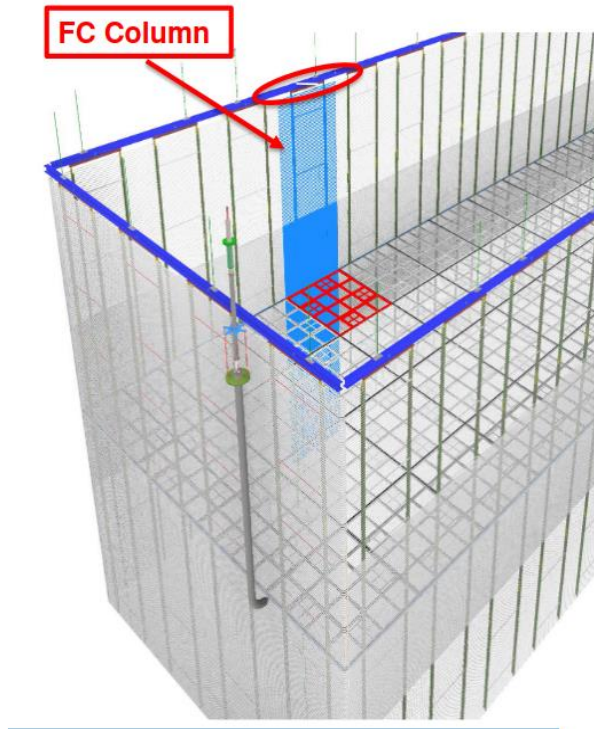
- *Single photon transport;*
- *Optical properties of **LAr doped with Xe;***
- *Optical properties of **the internal surfaces.***

General View

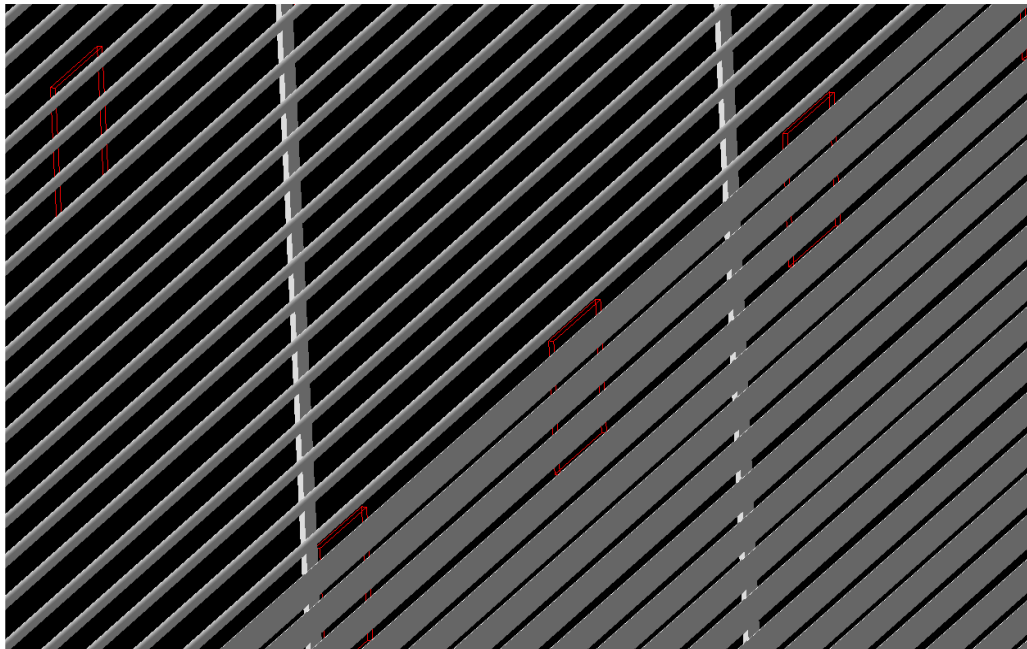
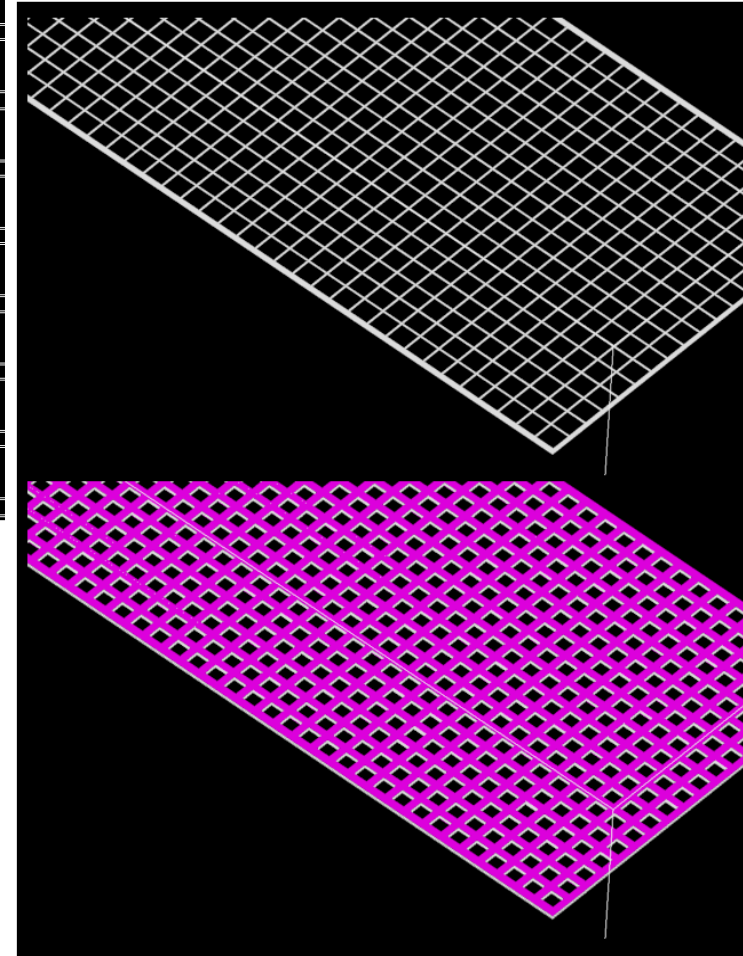
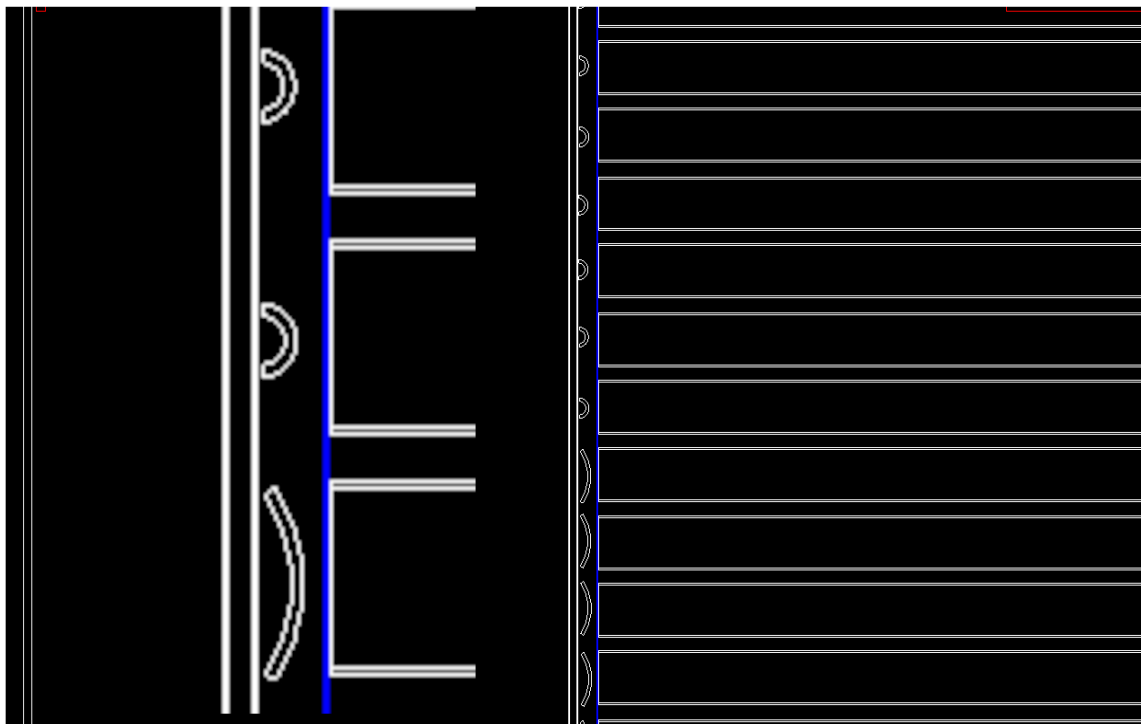


- Dimensions: 60m × 13m × 13m.
- Lateral membranes and field cage covered with enhanced reflectors (98%).
- Field cage covered with a wall made of acrylic and a layer of PEN (thickness 100 μm).
- Anodes covered by 30% reflectance material.
- Cathode in the middle covered by the enhanced reflector and PEN.
- 1872 LDUs on the membranes (75m²).

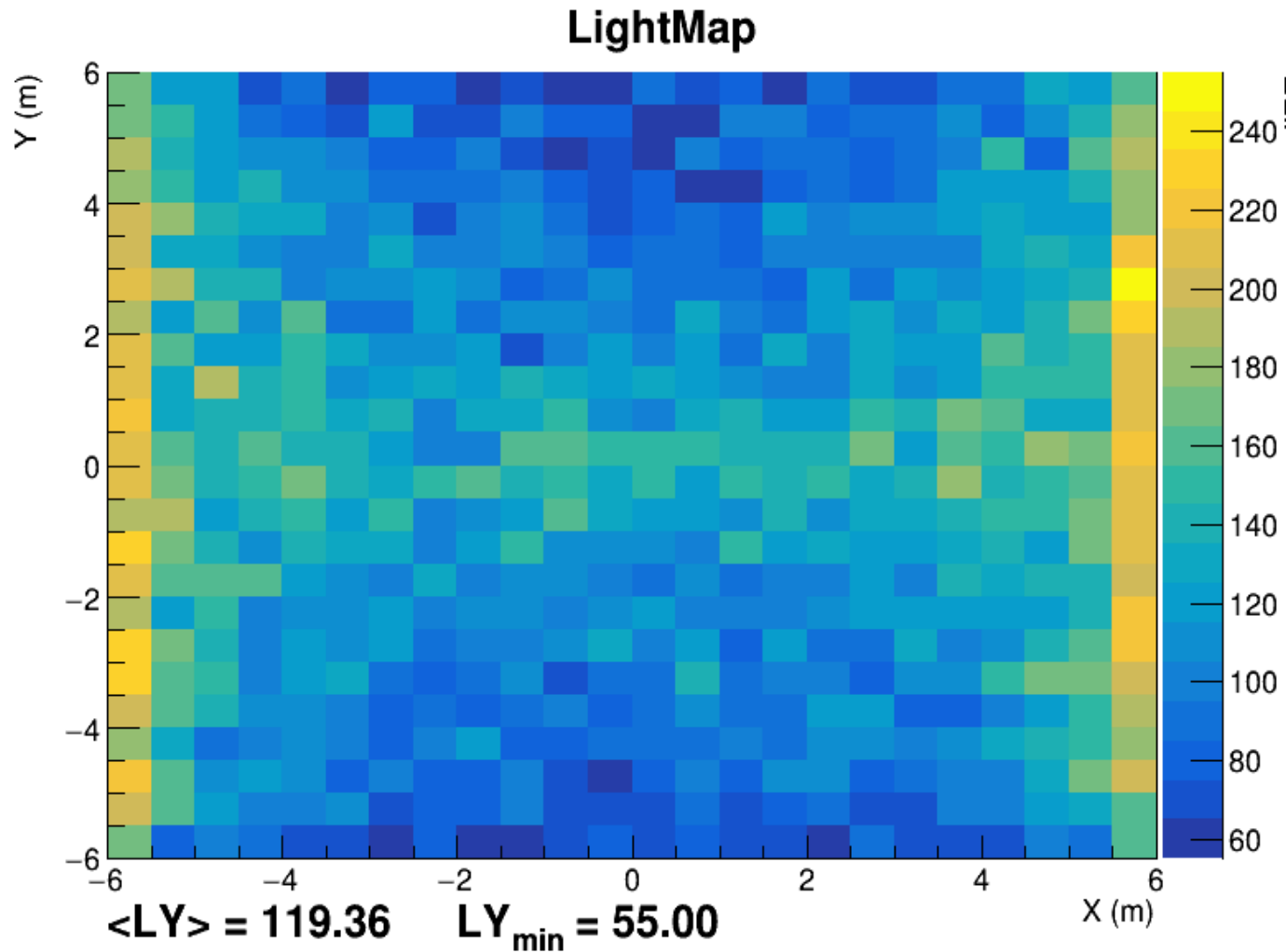
MC simulation



- FD 1 profile
Transparency: $\sim 23\%$.
- Narrow profile
Transparency: $\sim 75\%$.
- Narrow profiles cover the long walls 2.5m from the cathode.
- Vertical bars: $13\text{m} \times 45\text{mm} \times 8\text{mm}$;
- Distance between two vertical bars: 1.8m.



LY map – PEN eff. 50%





PoWER kick-off meeting






A blue banner for the PoWER kick-off meeting. On the left is the PoWER logo. To its right, the text "PoWER kick-off meeting" is displayed in white. Below the banner, the event dates "18 – 19 de nov. de 2024" and location "IFGW, Unicamp" are listed, along with the time zone "Fuso horário America/Sao_Paulo". A search bar on the right contains the placeholder text "Digite o seu termo de pesquisa" and a magnifying glass icon.

- Visão Geral
- Tabela de Horários
- Lista de Contribuição
- Minha Conferência
- Minhas contribuições
- Registro
- Lista de participantes

 **Começar (Iniciar)** 18 de nov. de 2024 09:00
Fim 19 de nov. de 2024 19:00
America/Sao_Paulo

 IFGW, Unicamp
Auditório do DRCC

 Ainda não há materiais 

 **Registro**
Você está registrado para este evento. [Ver detalhes >](#)

<https://indico.ggte.unicamp.br/event/9/>

Zoom: <https://fnal.zoom.us/j/2853196459?pwd=a1FieWhCRzhGcDA1Z3VtV2pkcHU5QT09>

PoWER kick-off meeting



18 de nov. de 2024 09:00 → 19 de nov. de 2024 19:00 America/Sao_Paulo

Auditório do DRCC (IFGW, Unicamp)

Registro

Você está registrado para este evento.

[Verifique os detalhes](#)

Participantes

A Ana Amelia Machado **A** ANA AMELIA MACHADO **A** Ana Paula Mendonça **A** André Fabiano Steklain Lisbõa
C Camila Pierobão **C** Carmen Palomares **D** David Warner **E** Ettore Segreto **F** Francesco Di Capua

SEGUNDA-FEIRA, 18 DE NOVEMBRO



10:00 → 10:15

Introduction

🕒 15m



Palestrante: Ettore Segreto (Universidade Estadual de Campinas)

10:15 → 11:00

Physics case and open questions ⓘ

🕒 45m



Palestrante: Michael Mooney (Colorado State University)

11:00 → 11:20

Mechanics

🕒 20m



Palestrante: David Warner (Colorado State University)

11:20 → 12:05

PEN status and perspectives

🕒 45m



Palestrantes: Marcin Kuźniak (Astrocent, Nicolaus Copernicus Astronomical Center of the Polish Academy of Sciences), Tina Pollmann (NIKHEF)

12:05 → 12:25

Coffee

🕒 20m



12:25 → 12:55

Simulation status

🕒 30m



Palestrantes: André Fabiano Steklain Lisbõa (Universidade Tecnológica Federal do Paraná), Marcio Adames (UTFPR)

12:55 → 13:25

SiPM

🕒 30m



Palestrantes: Prof. Ana Amelia Bergamini Machado (unicamp), Prof. Francesco Di Capua (UNINA - INFN Na)

TERÇA-FEIRA, 19 DE NOVEMBRO



10:30 → 10:50 **Test set-up at UNICAMP**

🕒 20m

Palestrantes: Prof. Ana Amelia Bergamini Machado (unicamp), Ettore Segreto (Universidade Estadual de Campinas)

10:50 → 11:20 **Test set-up @ CSU**

🕒 30m

Palestrantes: David Warner (Colorado State University), Michael Mooney (Colorado State University)

11:20 → 11:40 **Coffee**

🕒 20m

11:40 → 12:10 **Test set-up @ UNINA**

🕒 30m

Palestrante: Prof. Francesco Di Capua (UNINA - INFN Na)

12:10 → 12:40 **Test set-up @ Stanford**

🕒 30m

Palestrante: Yun-Tse Tsai (SLAC National Accelerator Laboratory)

Power tema

- PoWER team is growing.



UNICAMP



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FEDERICO II



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OF THE POLISH ACADEMY OF SCIENCES

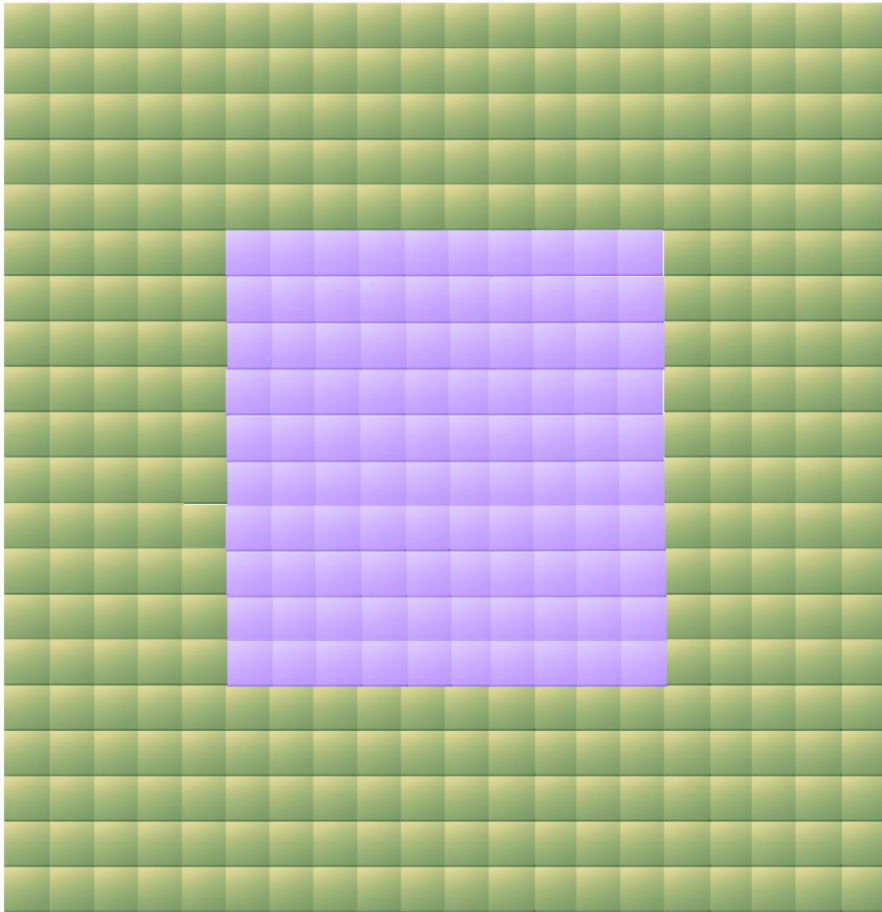
Nik|hef



COLORADO STATE
UNIVERSITY

Thank you

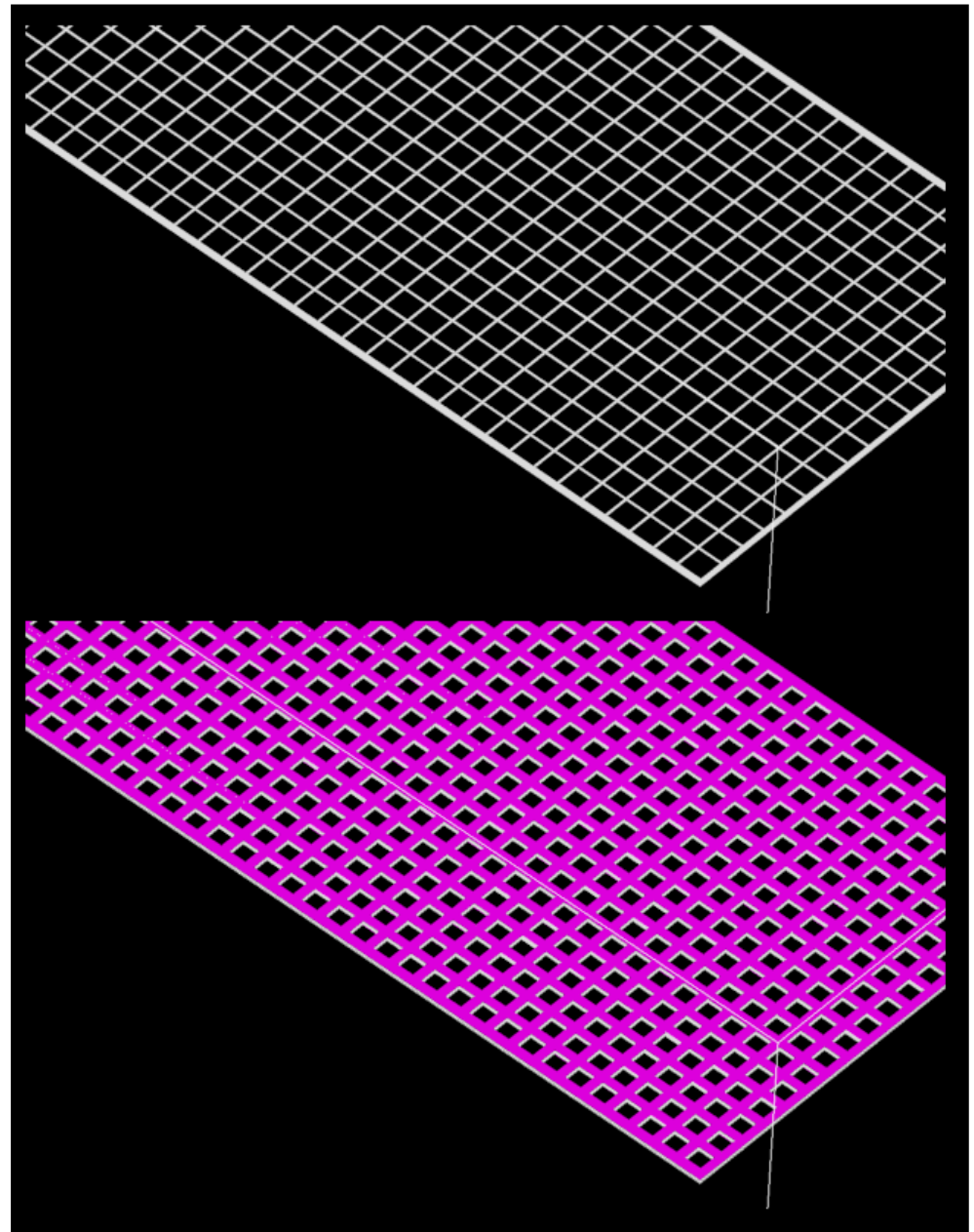
Light Detection Units - LDUs



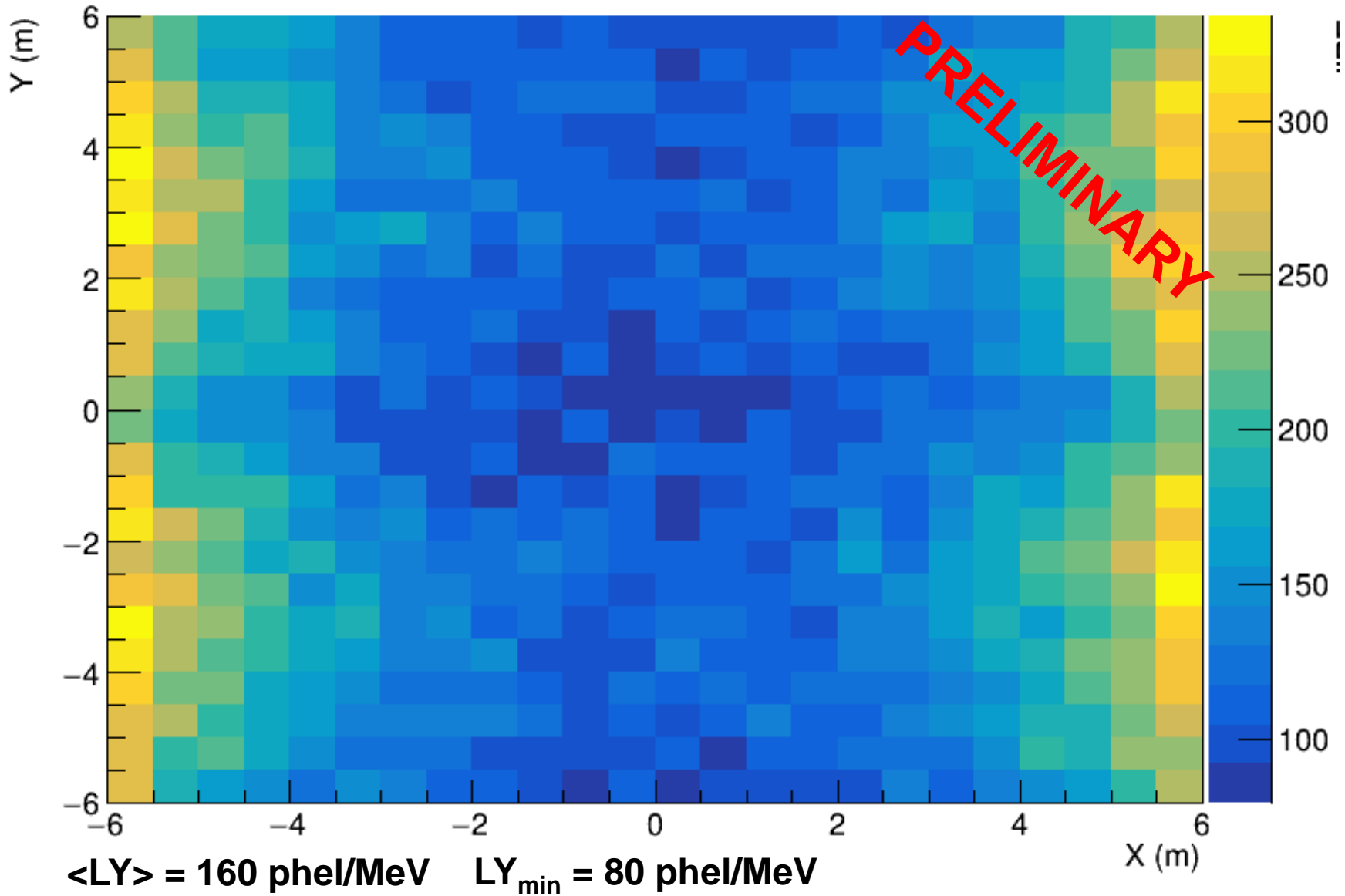
- Dimensions: **20cm × 20cm**;
- Efficiency: **50%**;
- **1872 detectors**, distributed as *780 on the lateral walls and 156 on the front/back walls*;
- **No LDUs on the cathode or anodes**;
- Total of **75 m² active area**.

Cathode

- Cathode is **50% perforated** to allow the circulation of LAr
- *Laminated with plastic reflector and PEN*



LightMap



LY map – PEN eff. 100%

