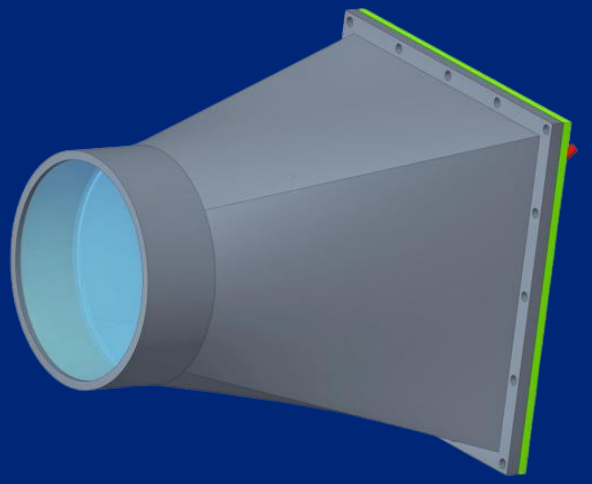
Università di Genova

INFN GENOVA
Istituto Nazionale di Fisica Nucleare
Sezione di Genova

DUNE
DEEP UNDERGROUND NEUTRINO EXPERIMENT

Technical information about lens-based cameras

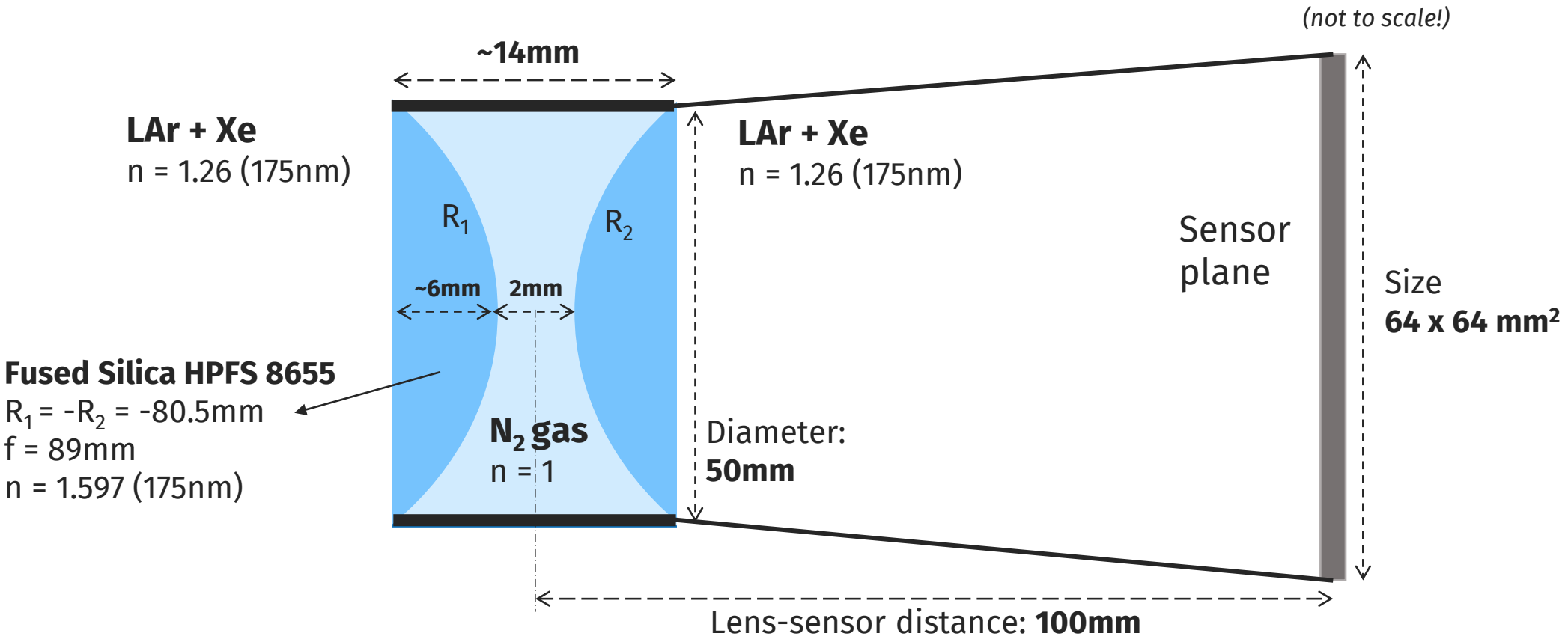


SAND-GRAIN Working Group meeting
07/04/2022

Matteo Vicenzi – INFN Genova

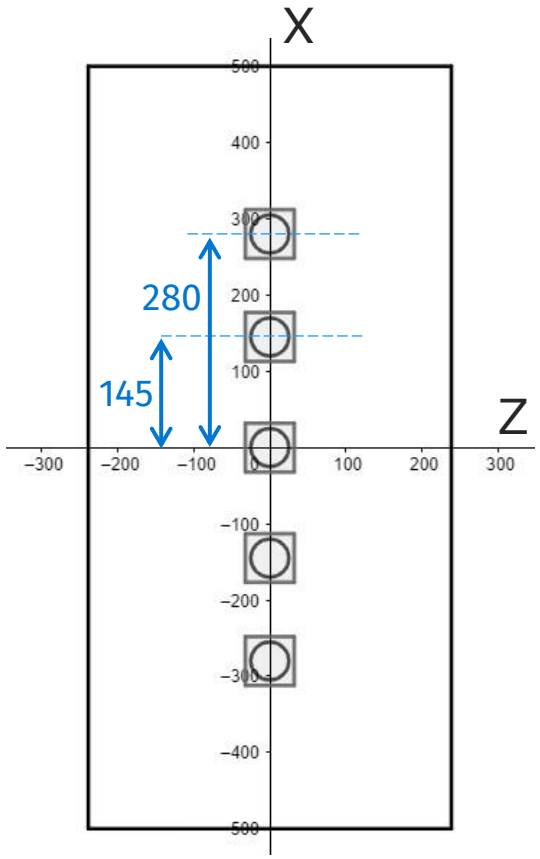
Lens camera

- **«Reference» design**: two plane-convex lenses with gas between them.
- Gas acts as a bi-concave focusing lens ($n_{gas} < n_{ext}$) .

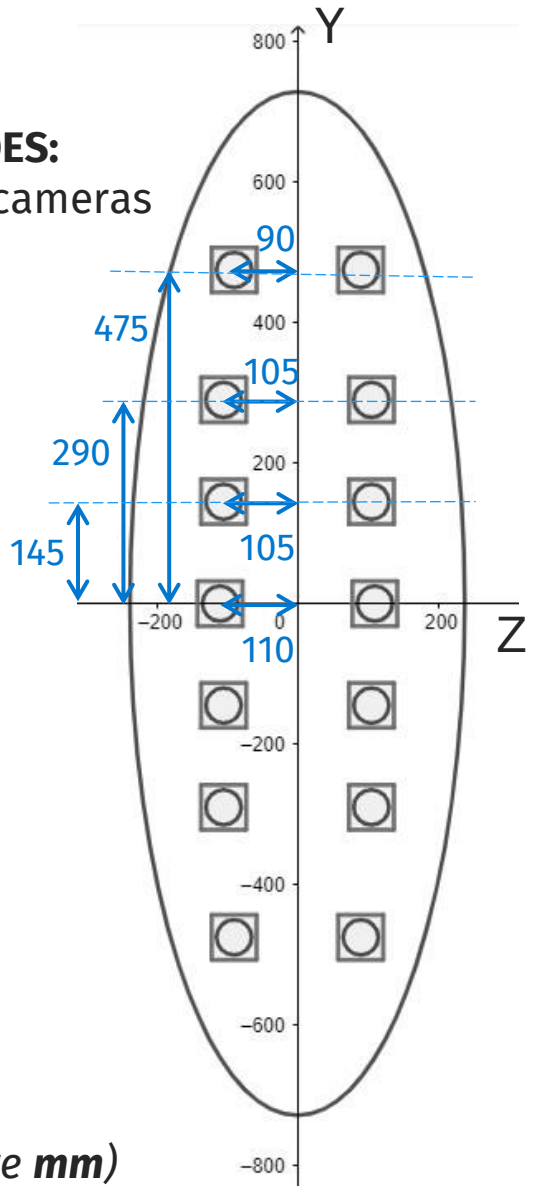


Geometry

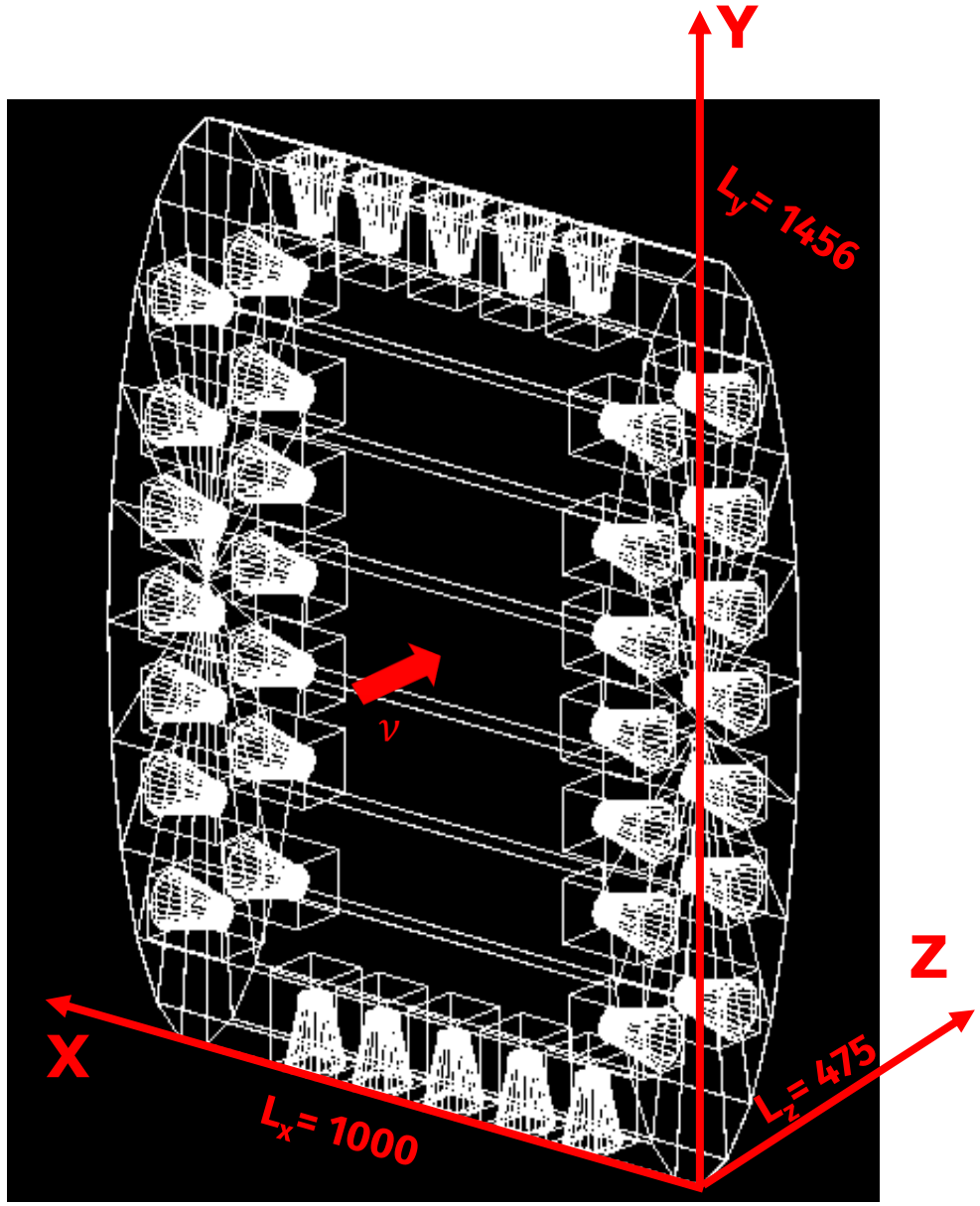
TOP/BOTTOM:
5 cameras



SIDES:
14 cameras



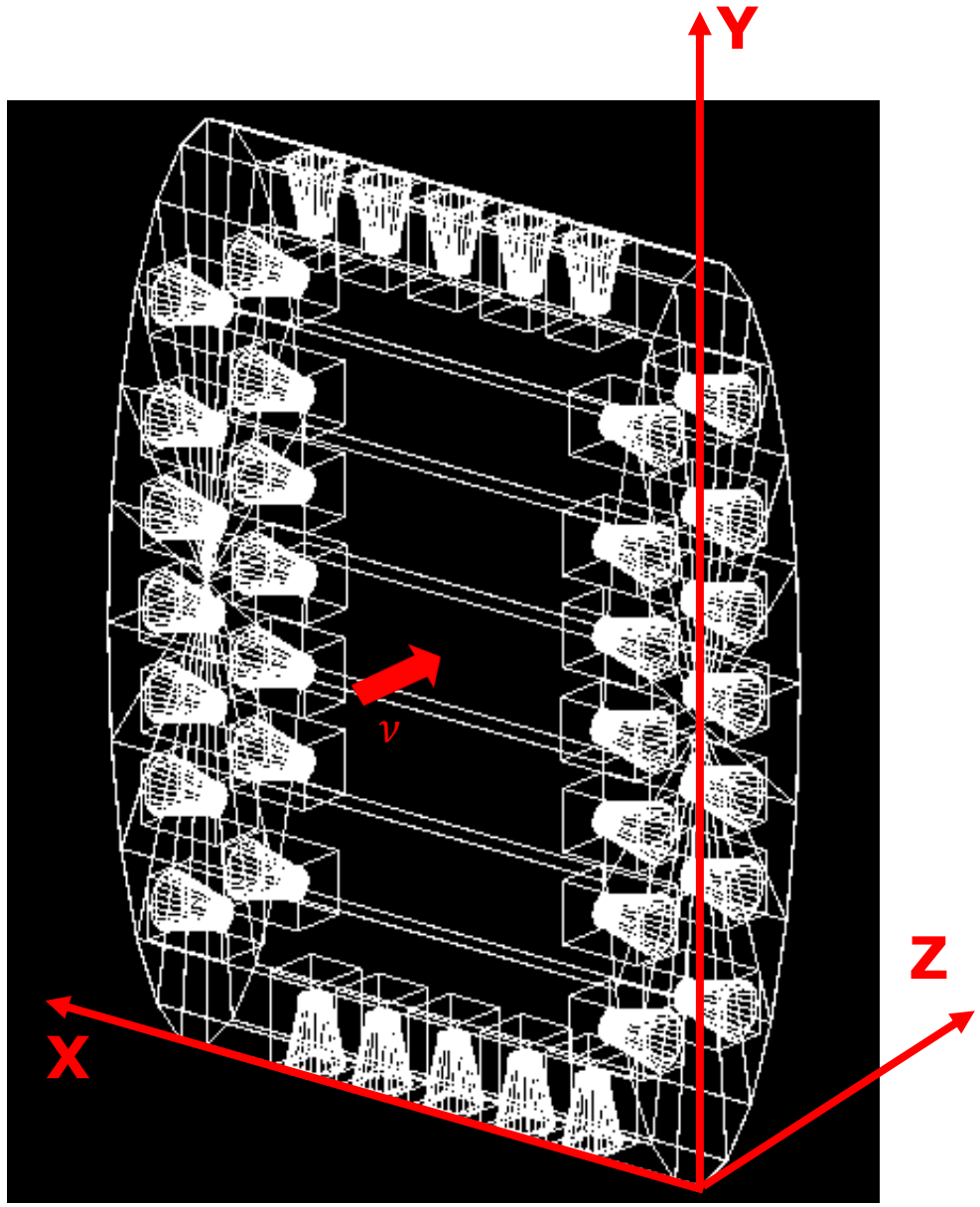
*(Units are **mm**)*



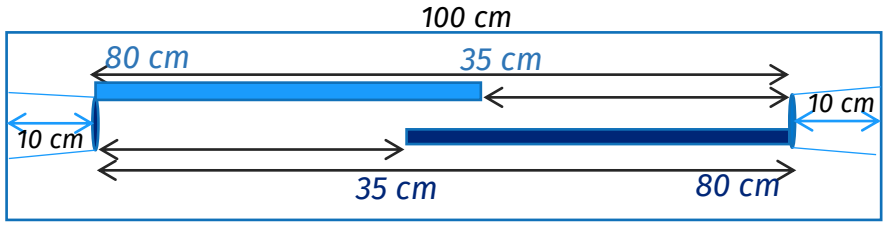
Channels

- Total cameras: **38**
- Sensor: **32x32 SiPMs, 2mm pitch** (1024 channels) → simulations with FastElectronics (for now): 20% PDE only
- Total channels: **38912**

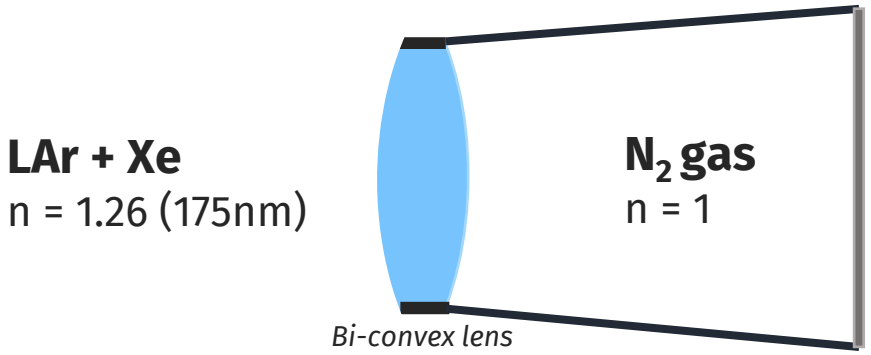
- **SIDE CAMERAS:** best performing, positioning could change a little but number is more or less fixed.
- **TOP/BOTTOM CAMERAS:** design not optimized for their distance, but still needed to constrain position along X.



Other options…



- Current reference design is optimized for two opposite cameras at a 1m distance → longer distances, get more light by increasing the diameter **up to 60mm**
  - Two **plane-convex** lenses with **gas:** $R_1 = -R_2 = -79mm$, $\phi = \mathbf{60mm}$, $\mathrm{f} \approx 84mm$ (thickness: 10mm)
- Another option is a design with gas between the lens and the SiPMs
  - **Bi-convex** lens, gas between lens and sensor: $R_1 = -R_2 = -55mm$, $\phi = 50mm$, $\mathrm{f} \approx 65mm$ (thickness: 18mm)

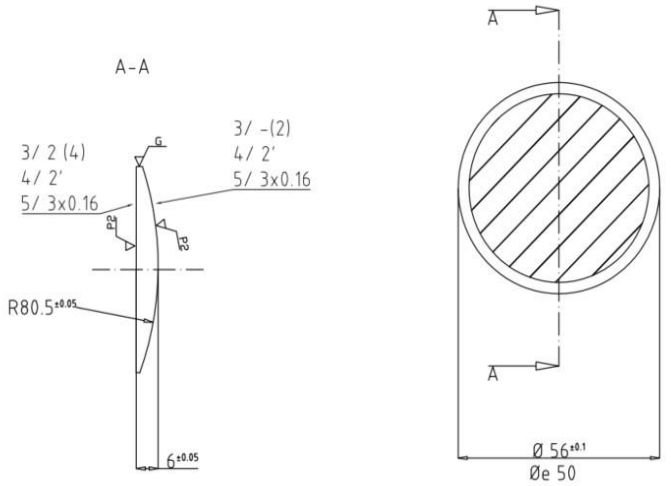


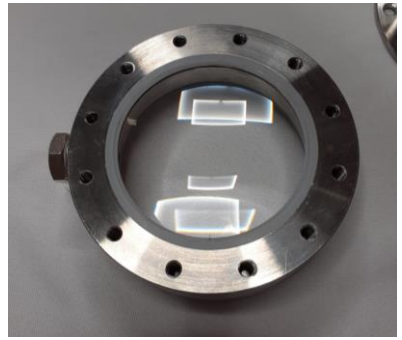
- → Possible **changes of a few-centimeters** in lens-sensor distance (**80mm – 120mm**)

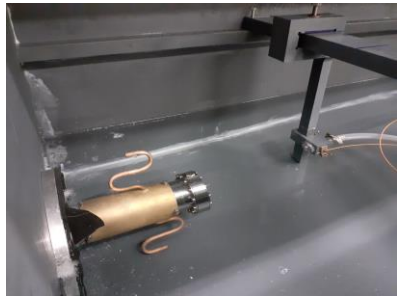
Prototyping

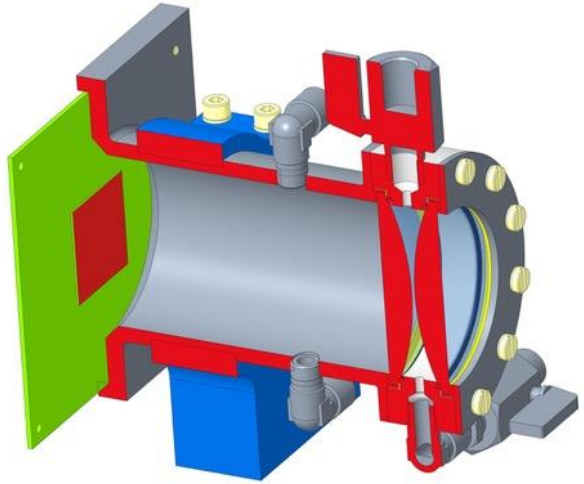
- Prototype for «reference design» ready.
  - **Fused Silica HPFS 8655**
  - [R = 80.5mm, ϕ = 50mm (eff.), f ≈ 90mm, thickness 6mm]
  - Same as simulated design.
- **Planned tests**:
  - In water with CCD Hamamatsu S7030-1008N, 650nm [✓]
  - In LAr (ARTIC), with external UV source [WIP…]
  - ….

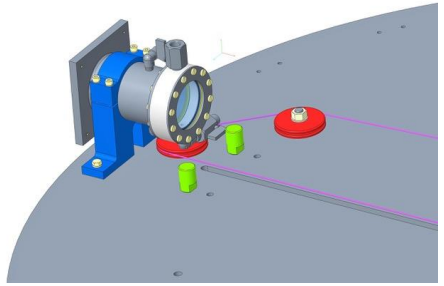
→ **Procurement of other prototypes** (bigger diameter + bi-convex lens) is under way…











CAD designs of the lens support for testing in LAr inside ARTIC

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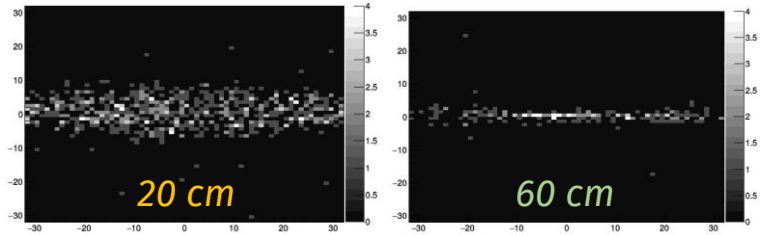
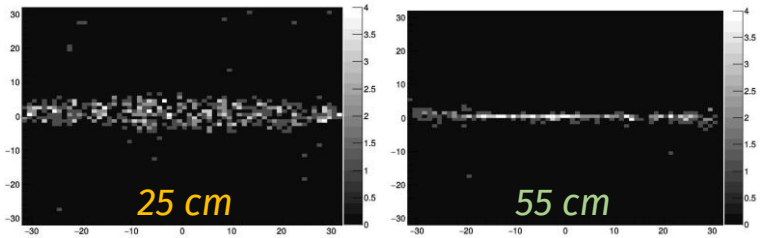
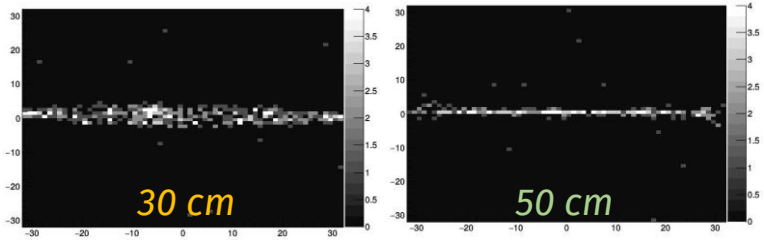
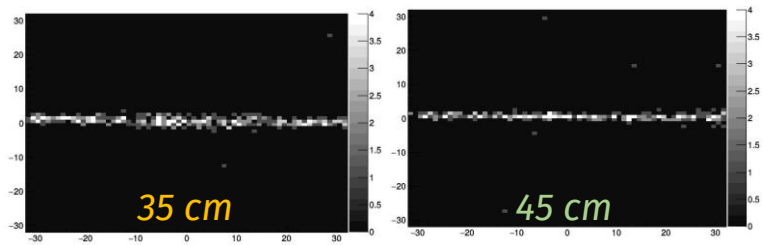
Backup

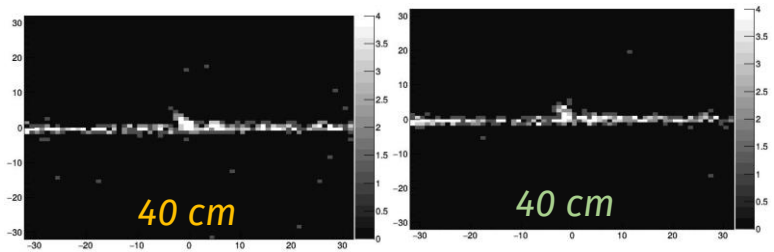
Matteo Vicenzi – INFN Genova

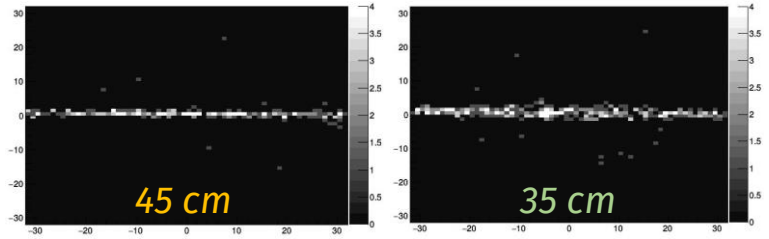


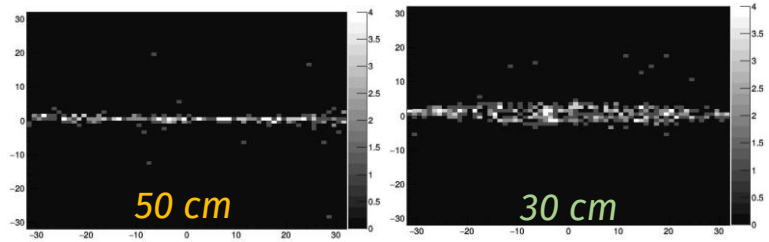


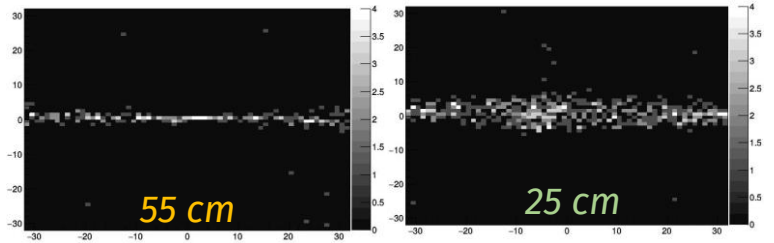


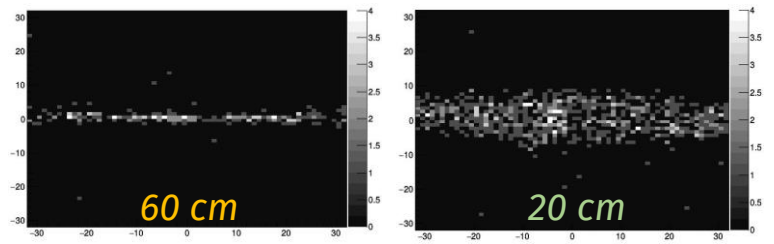


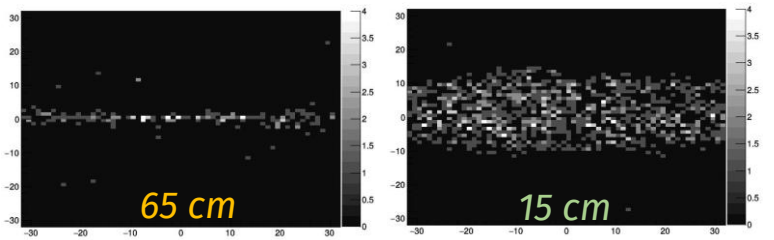


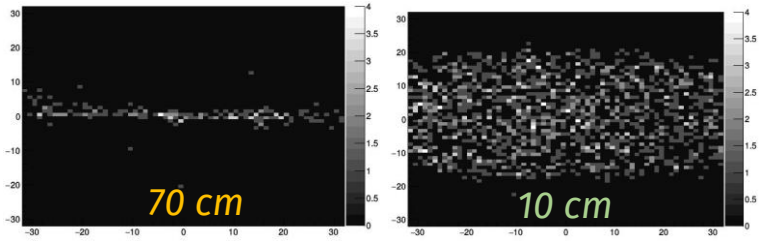


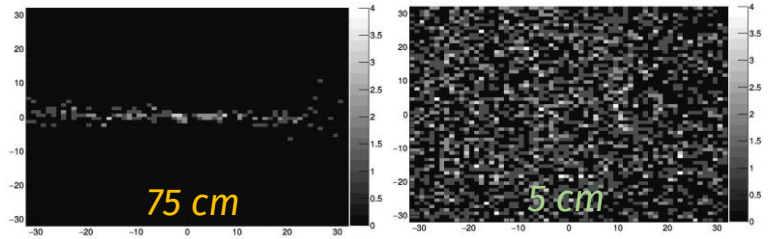


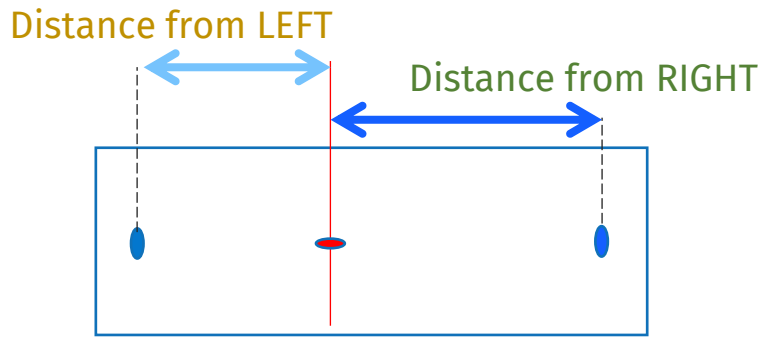








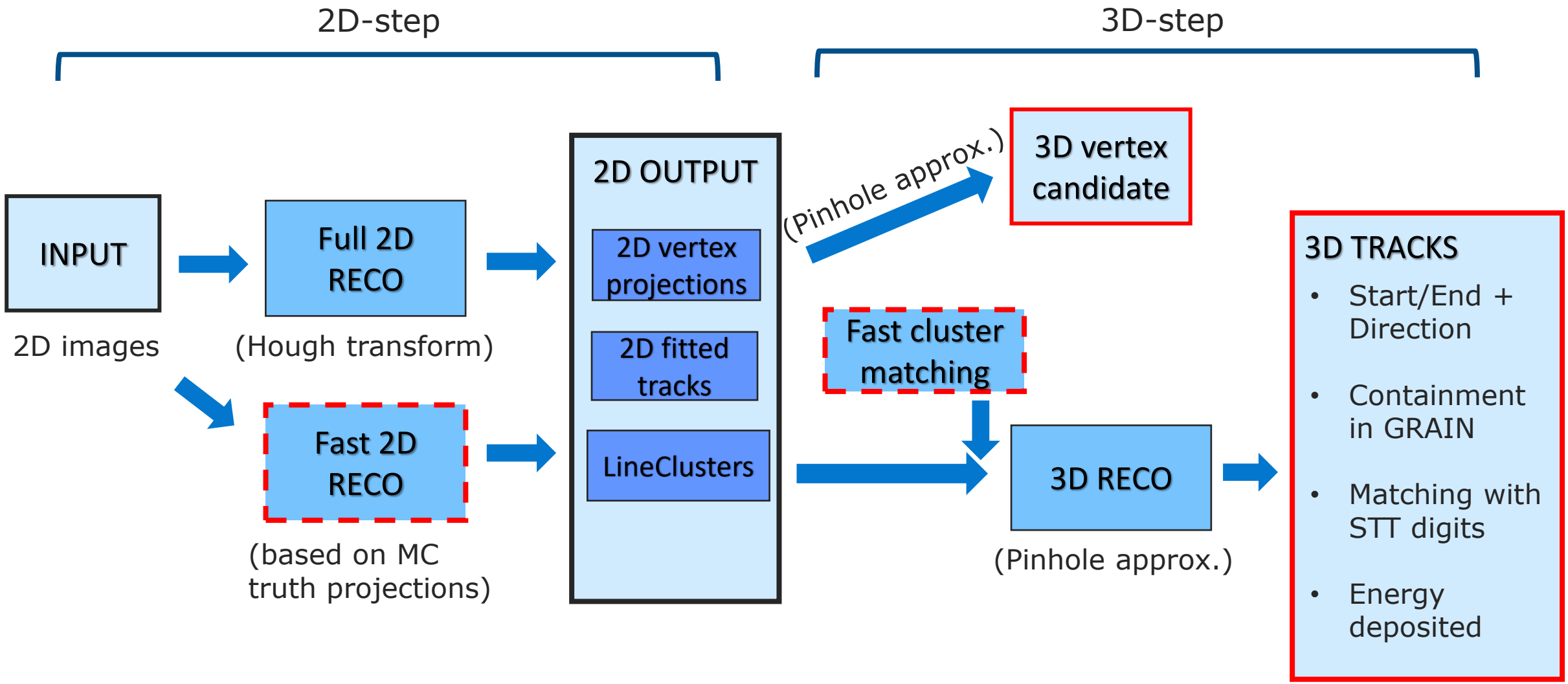




Sensor 64x64
SiPM 1mm²
SiPM QE: 20%

40cm track
175 nm
LY: 40000 ph/MeV

Current status of the reconstruction



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