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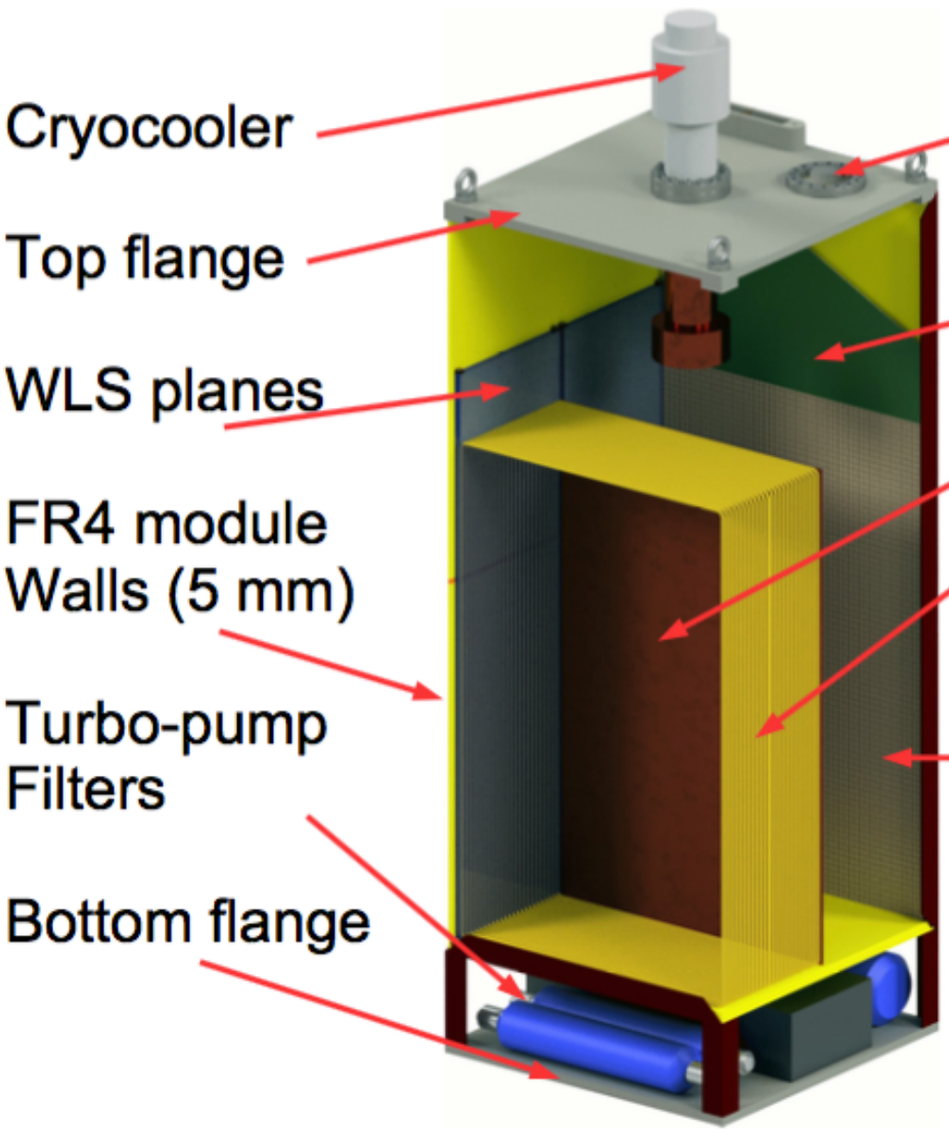
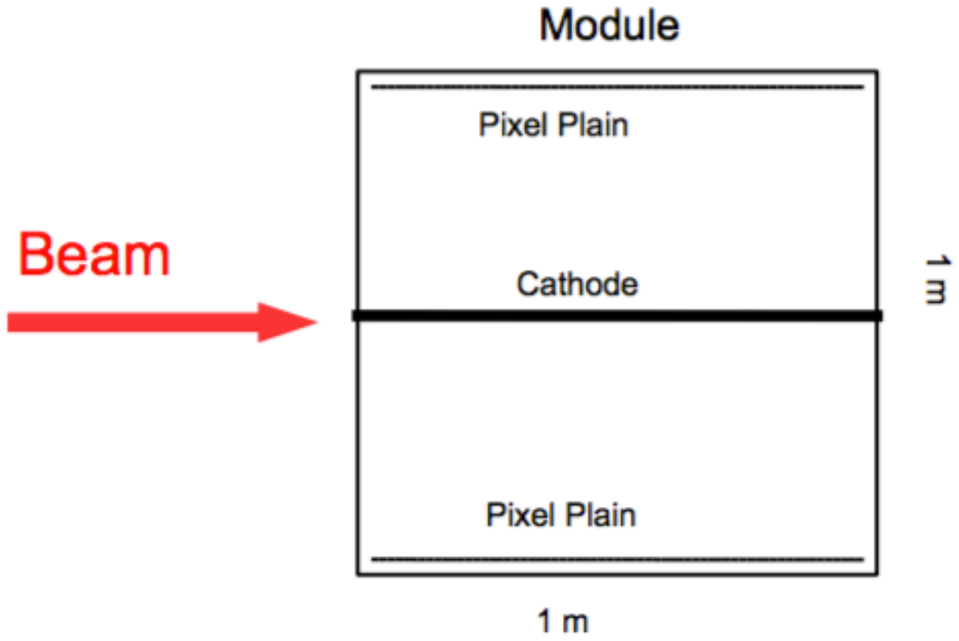
Light detection system of LAr TPC

The 6th conference of AYSS, Alushta, 2017

DUNE LAr TPC concept



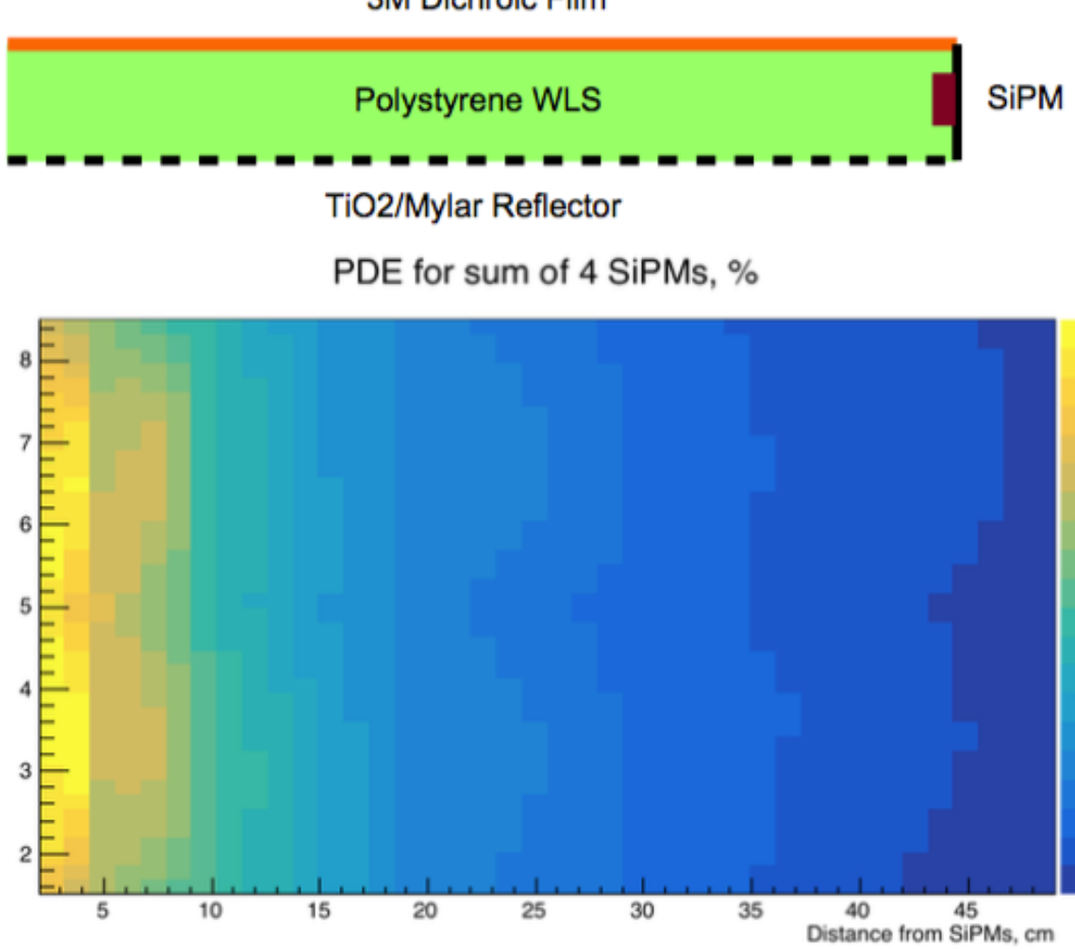


DUNE ND modules: 1.0 x 1.0 x 2.0 m^3.
0.5 m drift length

Prototype modules 0.67 x 0.67 x 1.8 m^3.
0.33 m drift

LAr Light Readout (Bern studies)

Inspired by ARAPUCA, JINR Dubna & Bern have proposed ArgonCube Light readout (ArCLight):



Bern proof principle studies show 0.8% photon detection efficiency at far field (50 cm).

JINR Dubna will continue development

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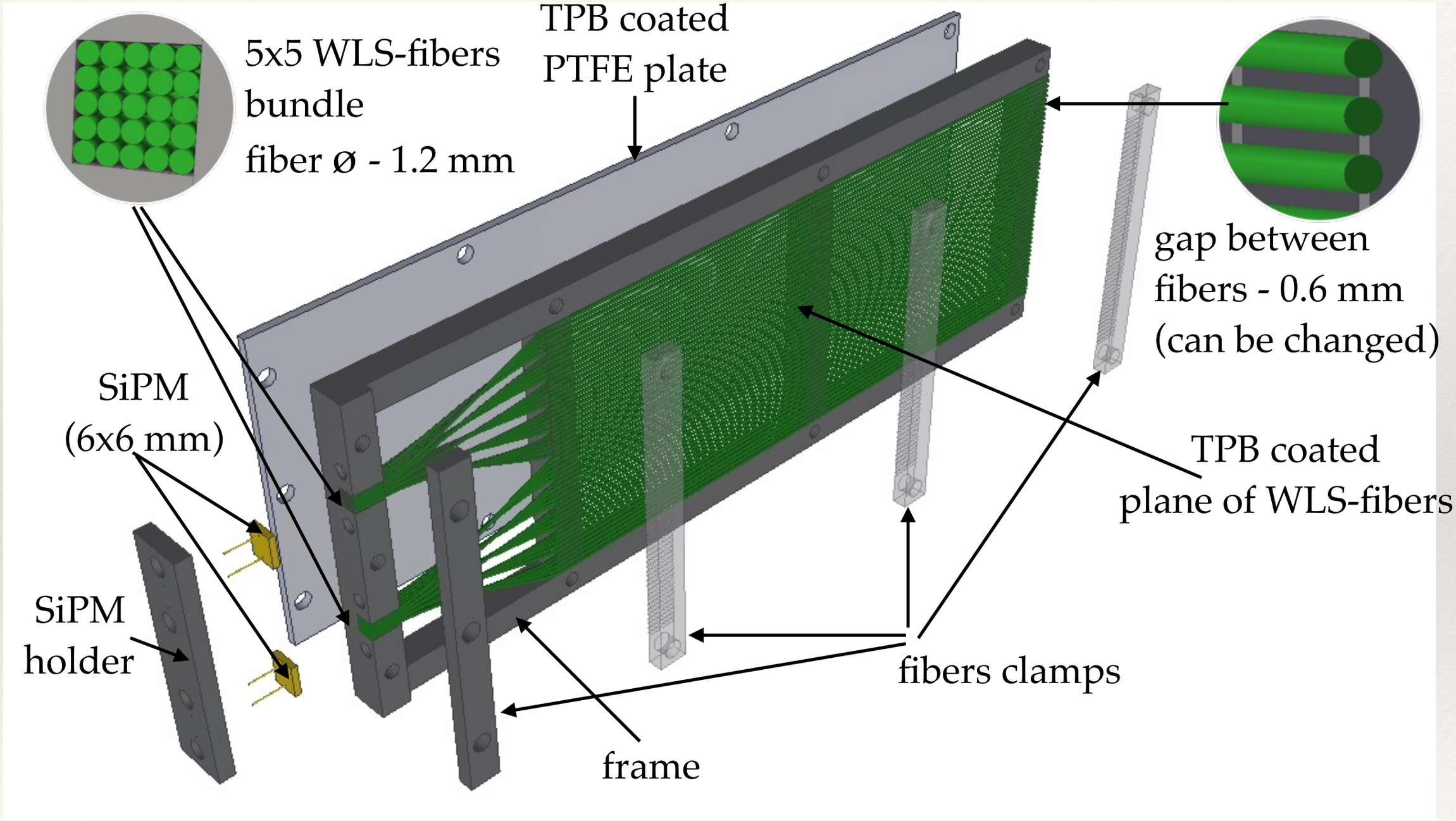
Light collection efficiency in such construction is about 1%

Simulation of ARAPUCA in Dubna

ARAPUCA size	SiPM size	Mirrors reflectivity, %	photons collected on SiPM, %
100x100x4 mm	4x4 mm	99.6	18.3
100x100x4 mm	4x4 mm	97	4.1
300x300x4 mm	4x4 mm	99.6	3
300x300x4 mm	4x4 mm	97	0.62

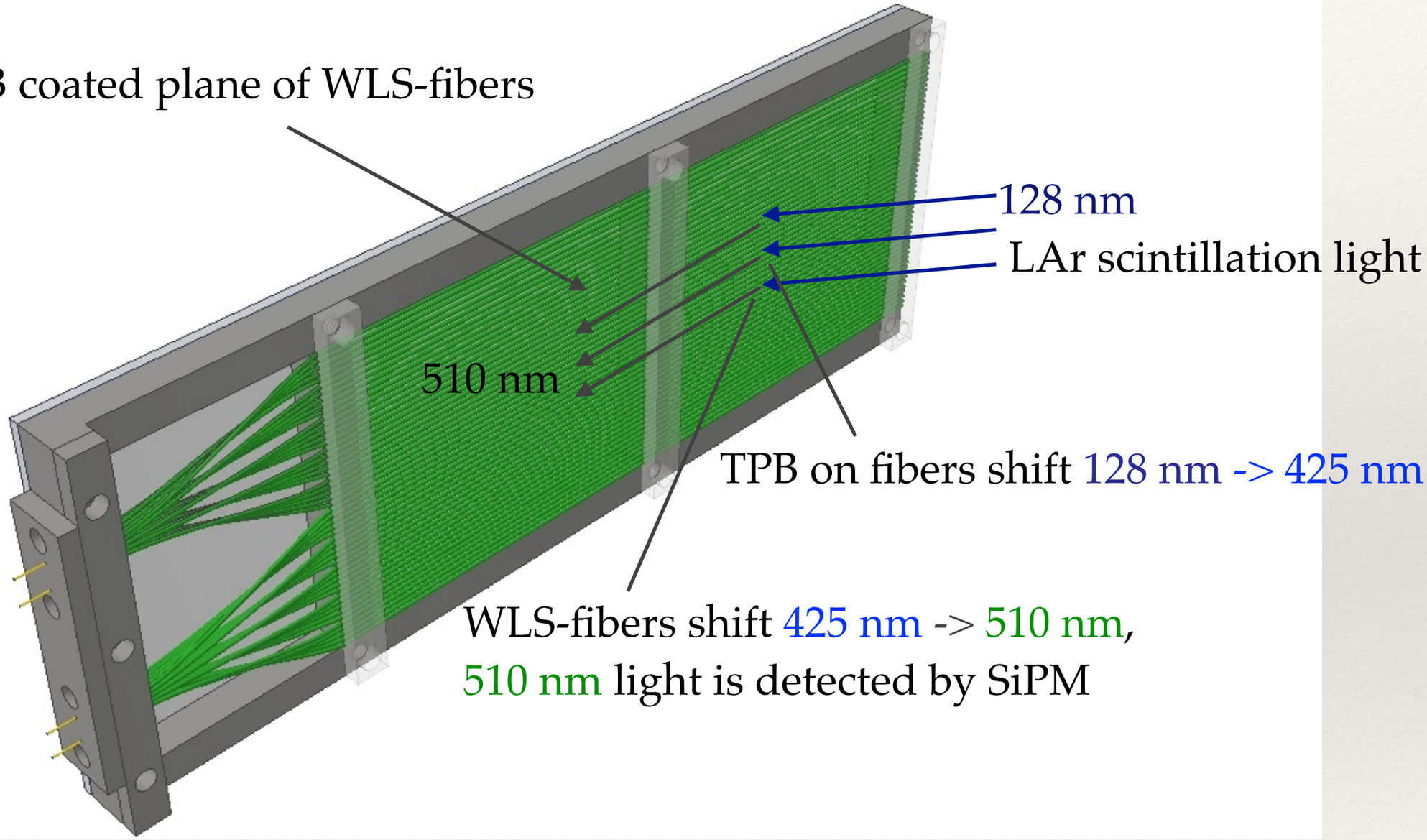
In all performed simulations we used 10 m absorption length and polished mirror as faces

Design of light readout module (Dubna)



module size can be changed optionally
(for the first tests it will have 30 cm length and 11 cm width)

Design of light readout module (Dubna)

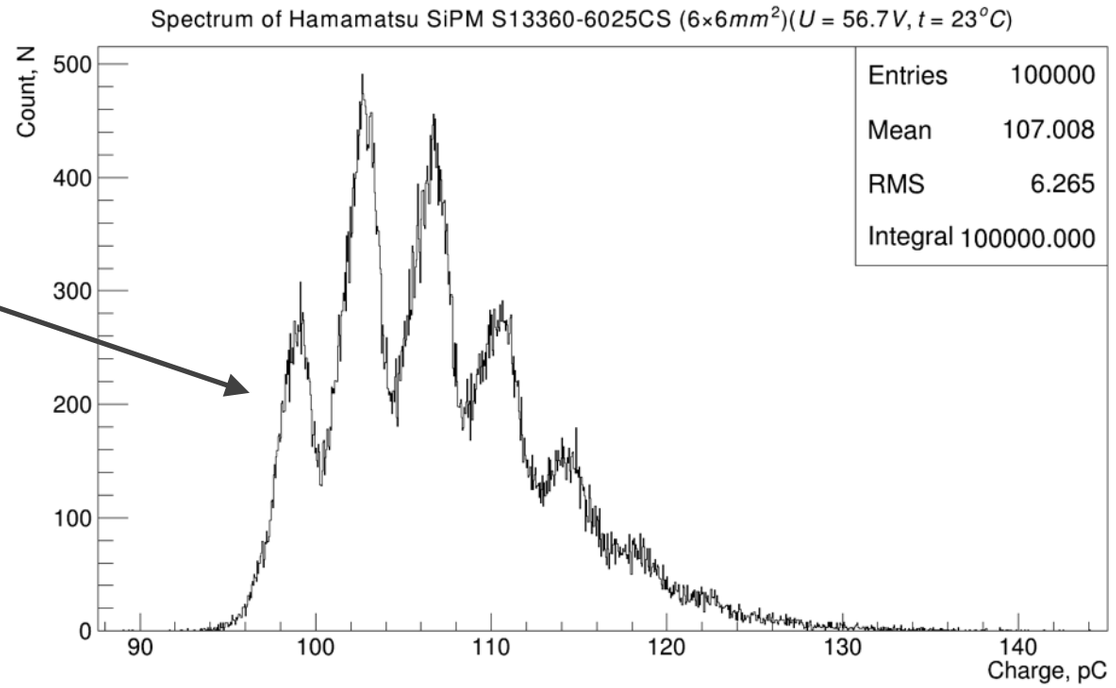


WLS-fiber trapping efficiency up to 5 %,
therefore, we estimate that light collection
efficiency will be about 1-2 % as well as for ARAPUCA design

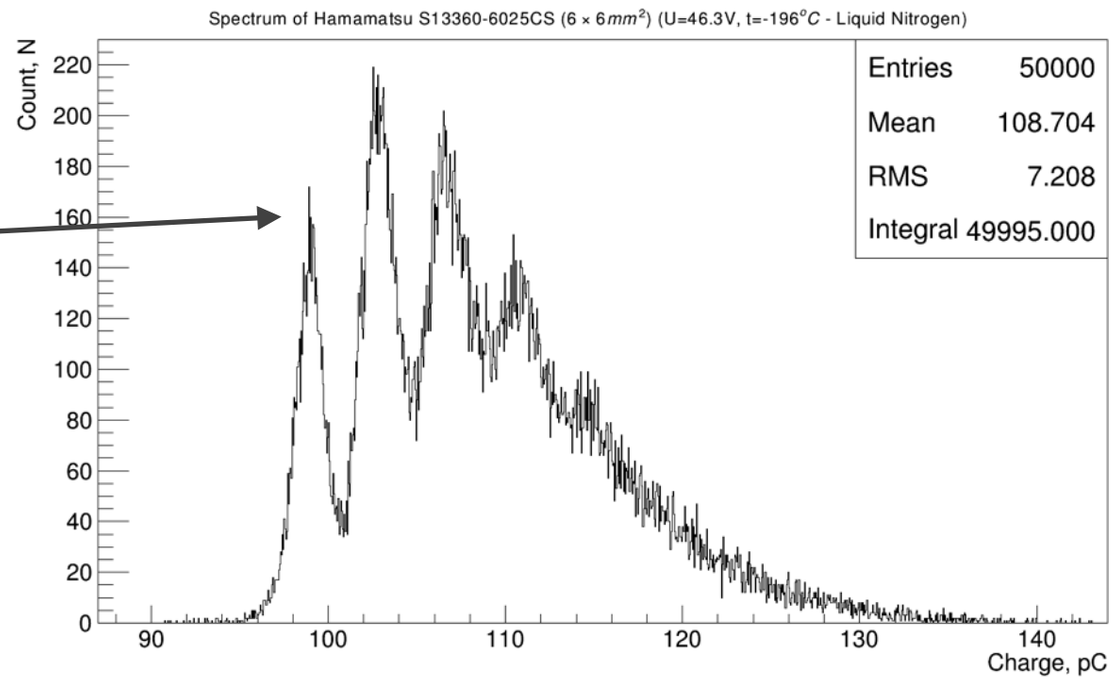
Performance of Hamamatsu SiPM S13360-6025CS in liquid nitrogen

SiPM size - 6x6 mm

Spectrum of SiPM at room temperature



Spectrum of SiPM at liquid nitrogen temperature (-196 deg. of C)



Status and plans

- Light readout module was designed

- First prototype will be ready this summer
(30 cm length, 11 cm width, 50 fibers)

- Operation tests of prototype in LN at Dubna this summer

- Performance test of prototype in LAr at Bern this fall (October)

Thank you for attention!

Questions?