

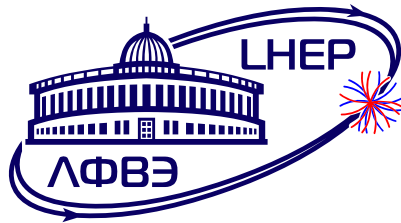
VIII SPD collaboration meeting

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# MEPhI

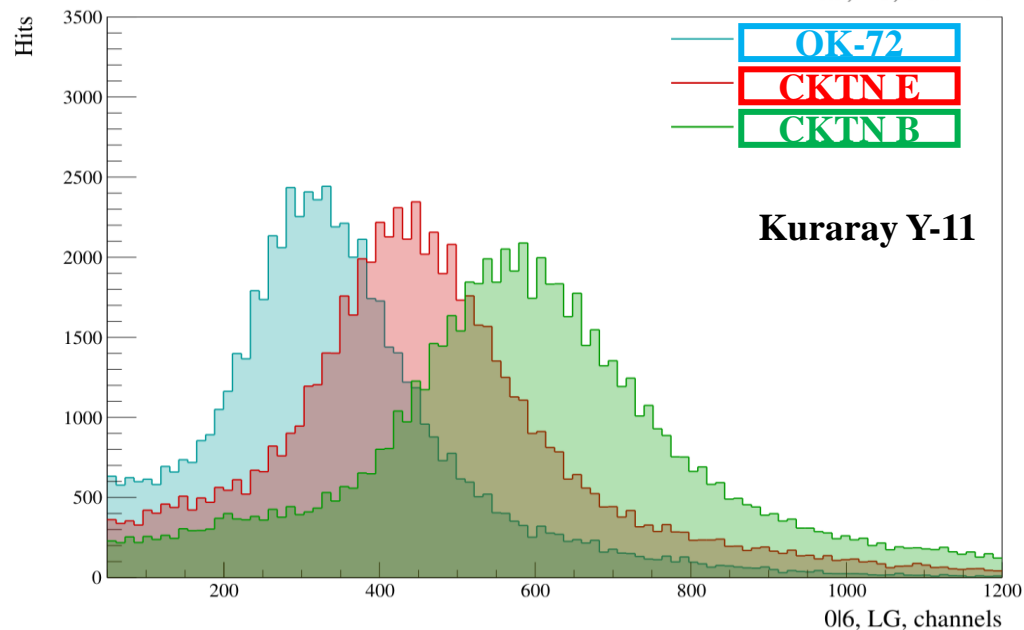
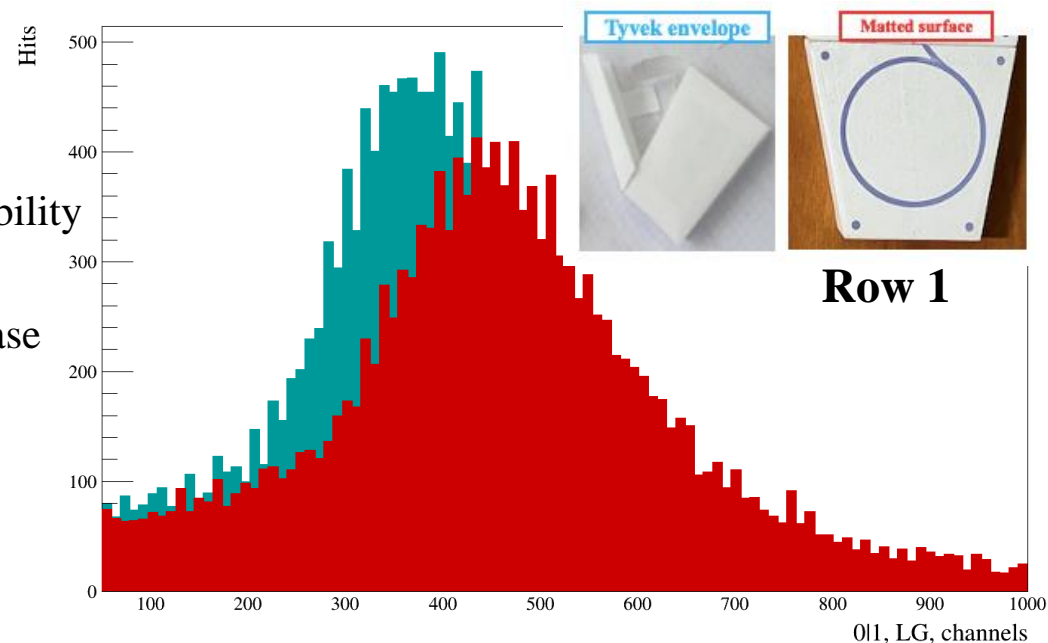
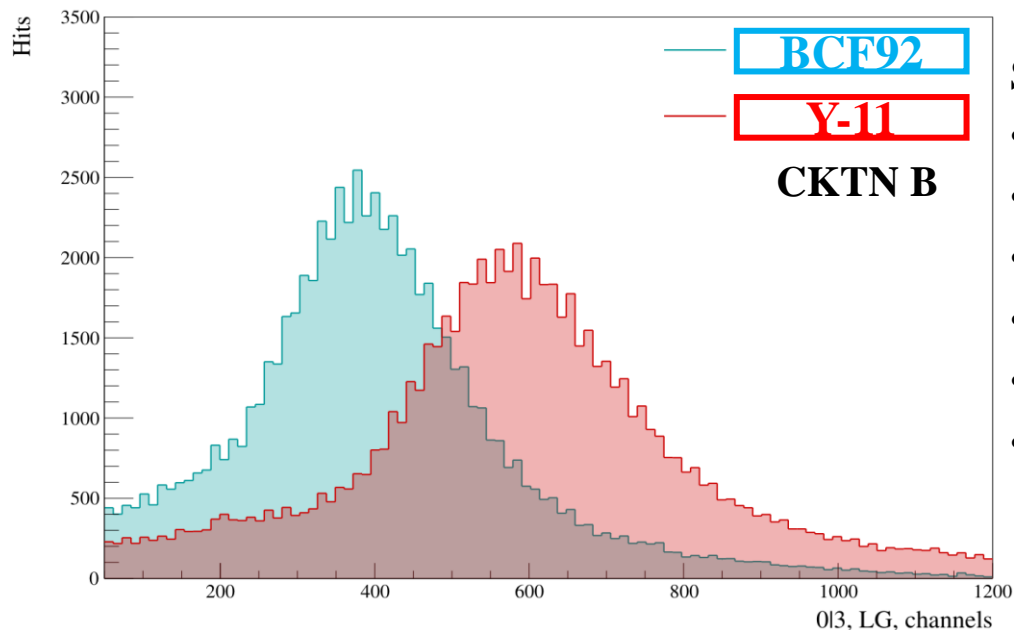
## Status of BBC development

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**Zakharov Arseny**  
on behalf of MEPhI group

Dubna, 5<sup>th</sup> November 2024

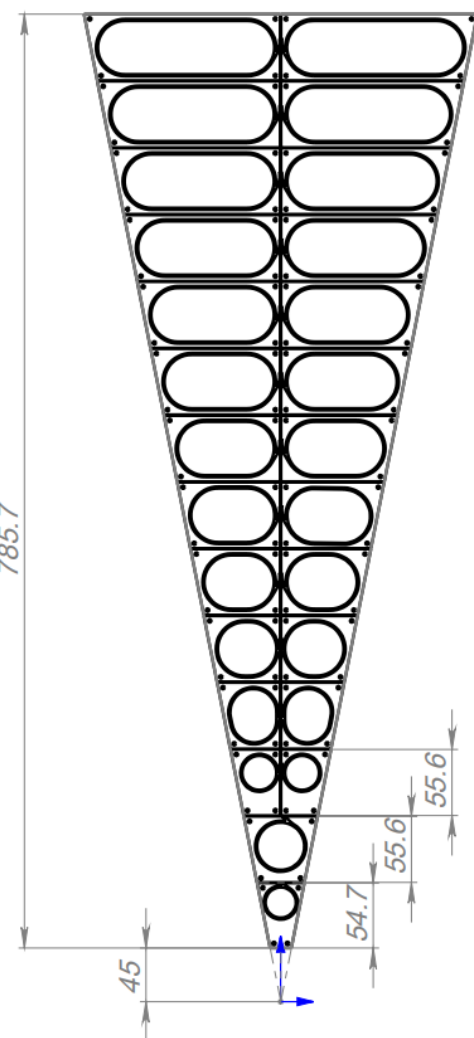


**Materials selection** and tests with different material combinations of tile prototype includes:

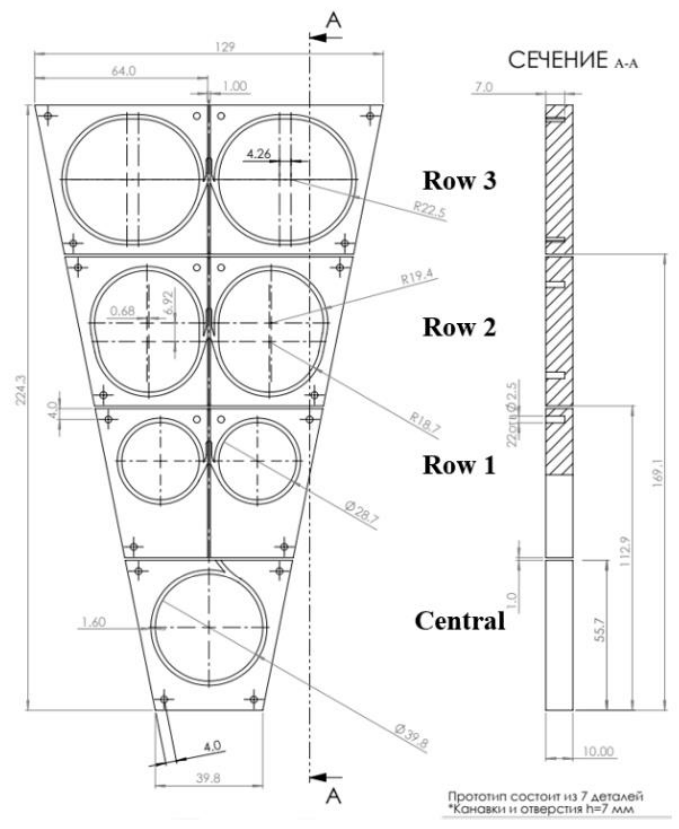
- Scintillator: **Matted** or Tyvek covered
- Optical cement: **CKTN MED** vs OK-72
- Fiber: Saint-Gobain Crystals vs **Kuraray**
- SiPMs: 3x3 vs 1x1 mm<sup>2</sup> (**currently: Hamamatsu**)

The material selection for BBC is completed

Final configuration: **matted** surface, **Y-11** fiber and **CKTN B** optical cement



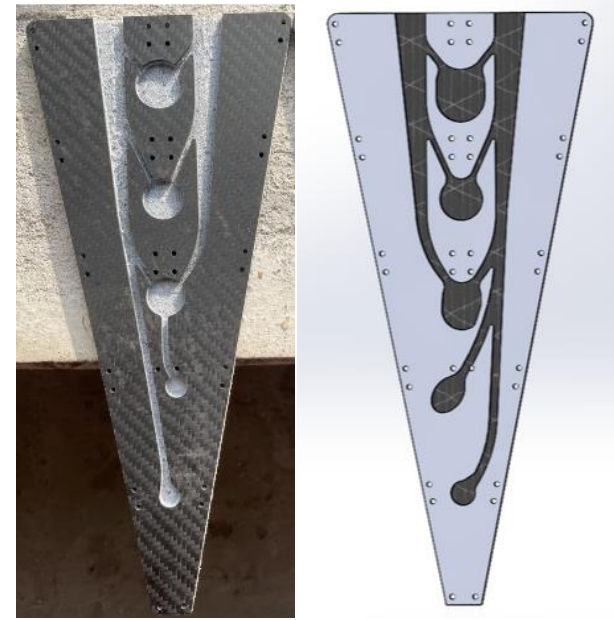
BBC Sector (Ring 1/16) design



Prototype w/o innermost tile



WLS-SiPM test connector couple

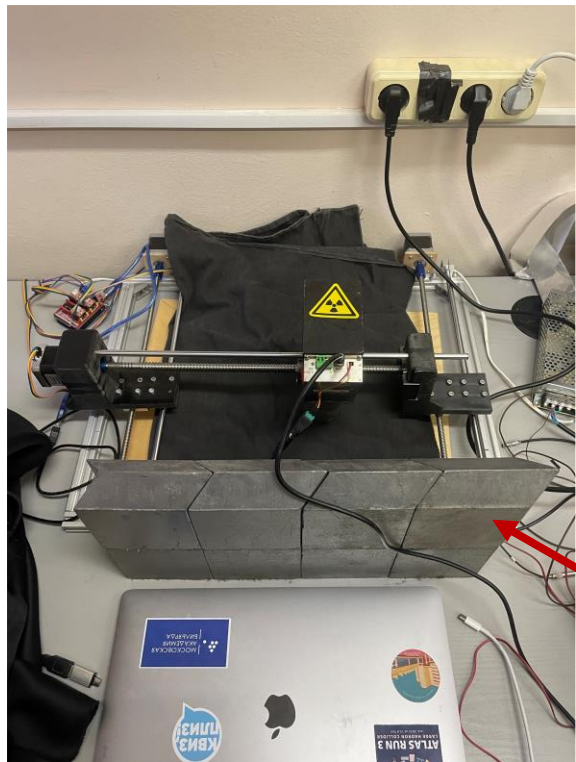


Grooved carbon fiber backplate v1 prototype and updated design

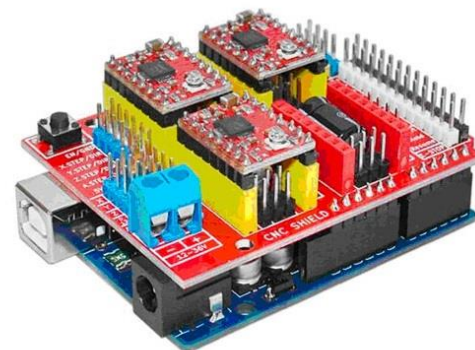


2x reduced sector prototype

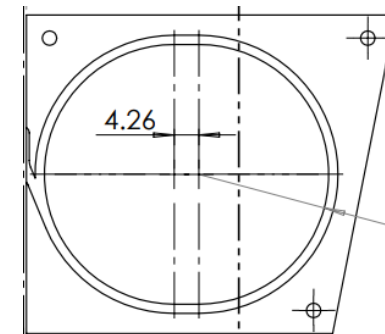
- Currently we have in hands 2 small sector prototypes of 8 tiles with CKTN B and SG BCF92 fiber assembled on carbon fiber backplate
- We plan to produce a full wheel with reduced sectors in mid 2025



Mini-X X-ray tube



Arduino with CNC shield and drivers



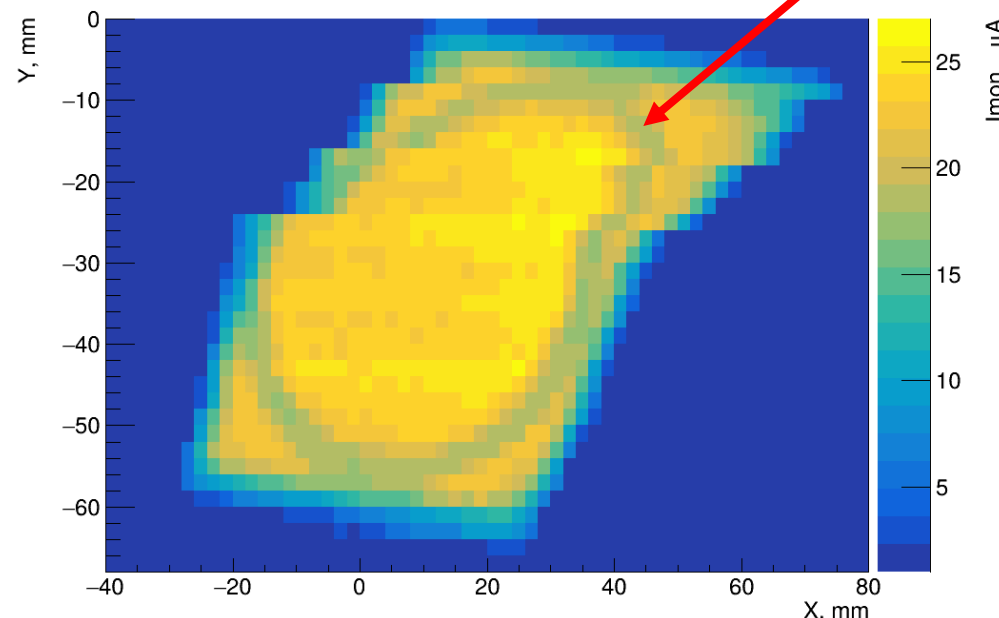
Row 3 tile with SG BCF92

WLS fiber

Pb bricks for radiation shielding

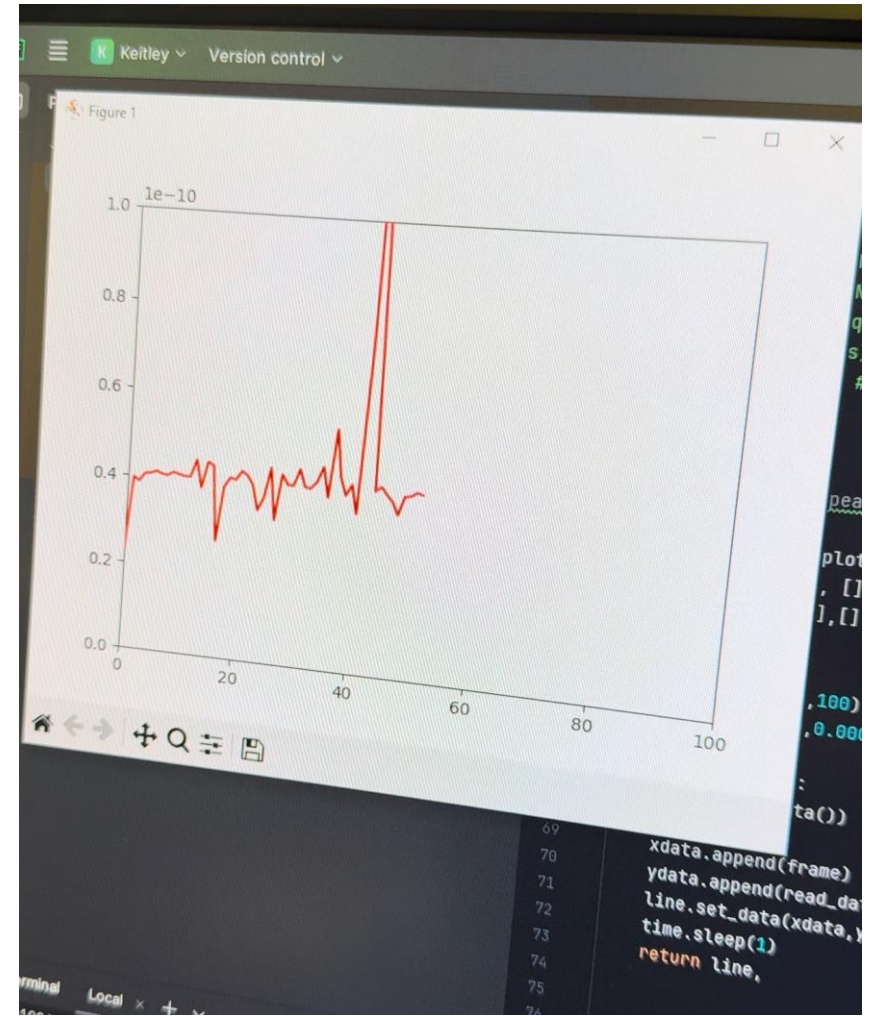
Coordinate table with X-ray tube:

- **AMPTEK Mini-X X-ray tube**  
Ag target, 50 kV / 80  $\mu$ A, 2 mm collimator ( $5^\circ$  X-ray cone) with  $\sim 2$  cm from tile
- **NEMA 17 stepping motors**  
Angular step  $1.8^\circ$ , 20 & 40  $\mu$ m resolution (X and Y axis correspondingly)
- **Arduino and CNC Shield**  
Microcontroller board, enables movement automatization
- **CAEN DT5202**  
A7585D power supply with 1  $\mu$ A resolution



Detector response VS. coordinate  
(preliminary)



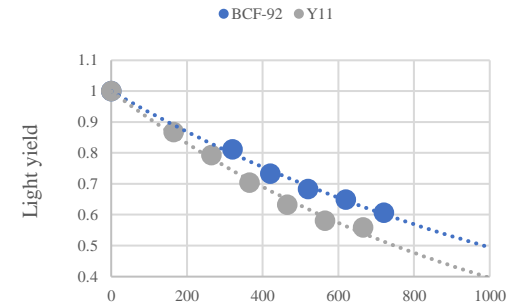
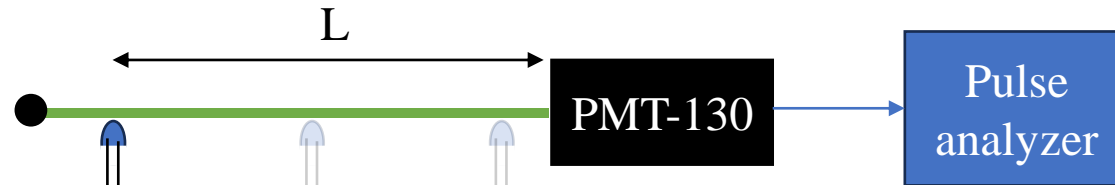
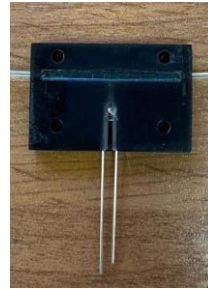


Keithley 2400

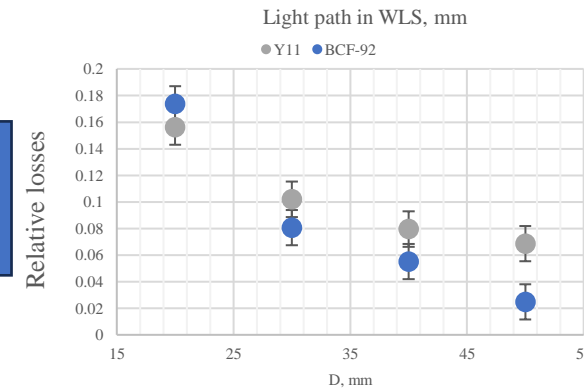
Real-time data reading

500 pA – 5 nA current resolution

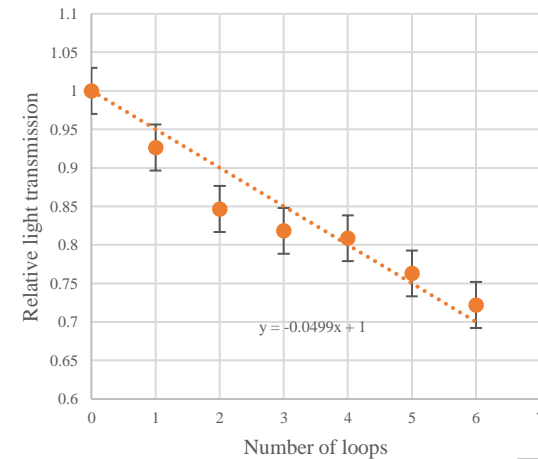
## Relative light absorption & Light collection efficiency



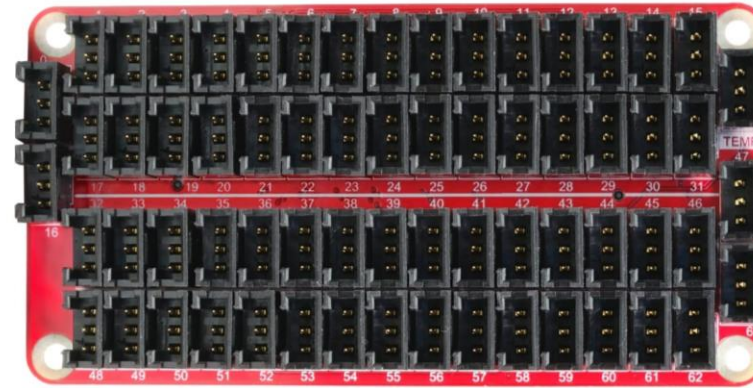
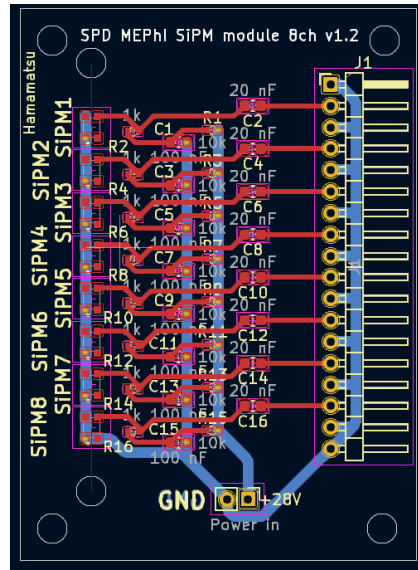
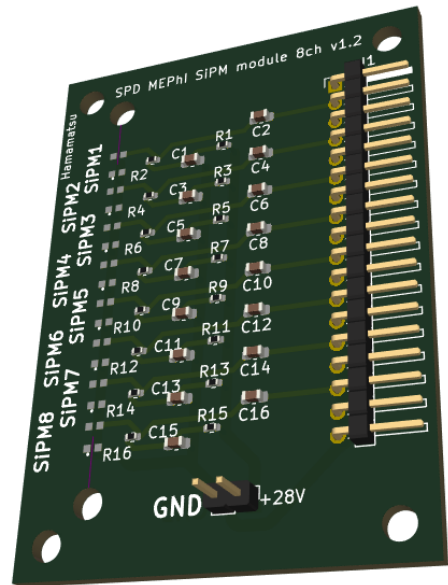
## Bending loss measurement



## Dependence on the number of loops



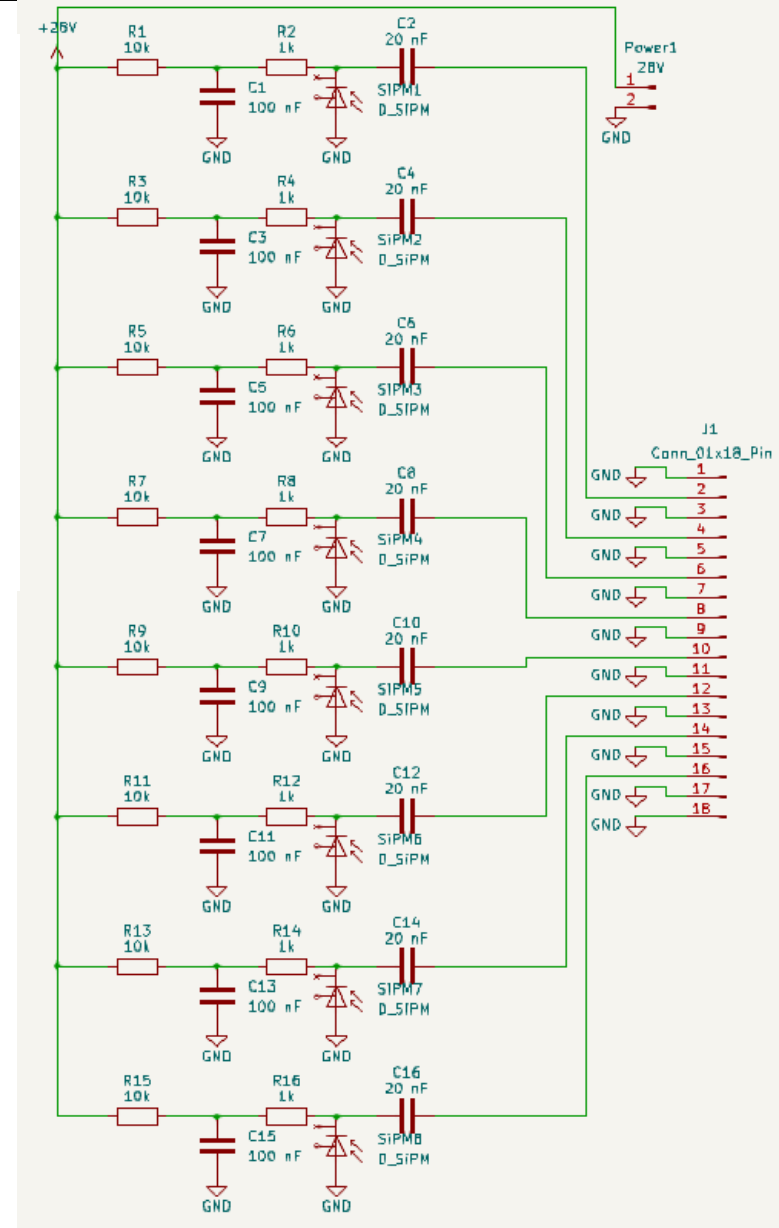
More details in following report "WLS studies" by Filipp Dubinin



A5253 - 3-pin header adapter for FERS-5200 (optional)

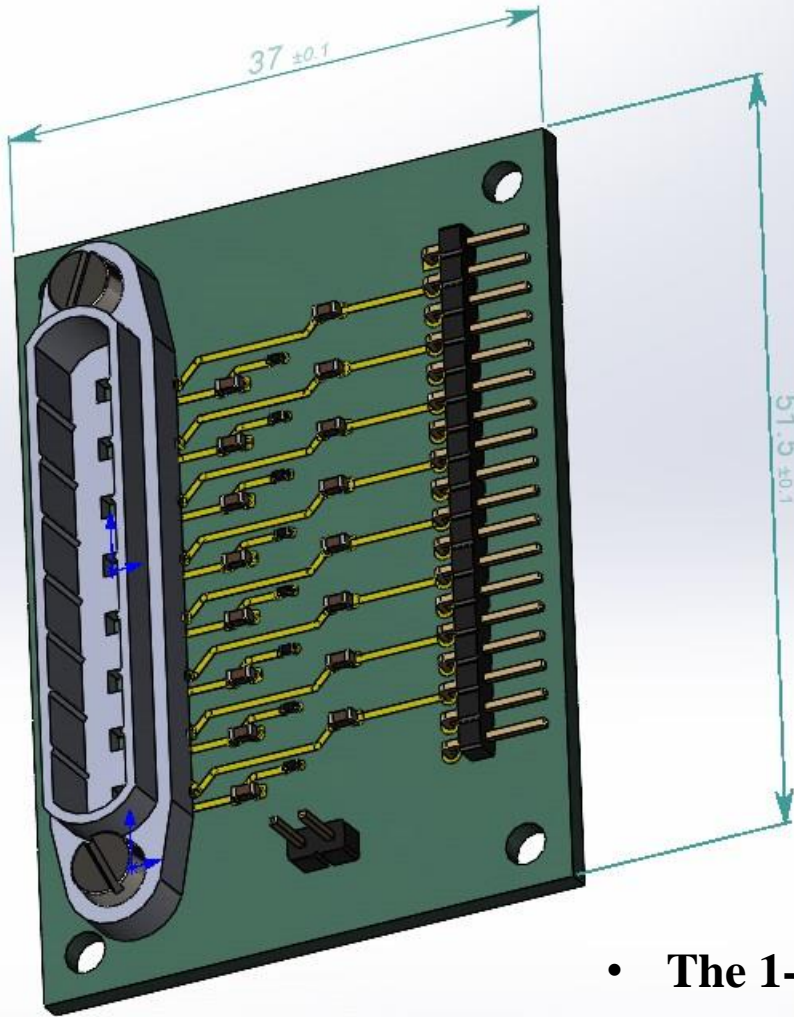
...to be connected to the CAEN 64-channel unit with multiwire pin-connector cable

- **The preliminary design of the interconnection test board for CAEN FERS 5200 is prepared**
  - 8x SiPM – 1x1 OnSemi (SENSL) and 1.3x1.3 Hamamatsu
- **8x SiPMs for 8-tile prototype testing**

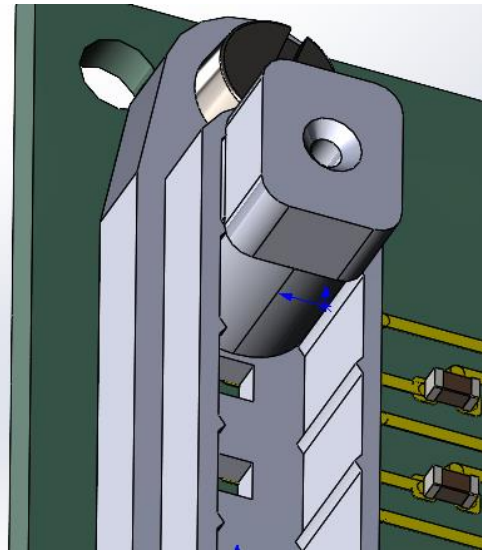


SiPM PCB schematics



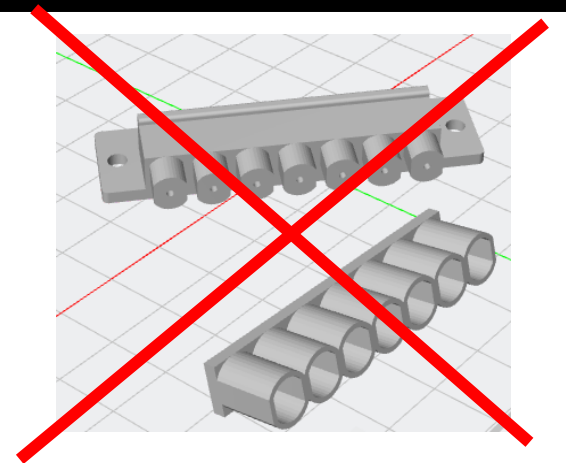


Assembly model  
with PCB

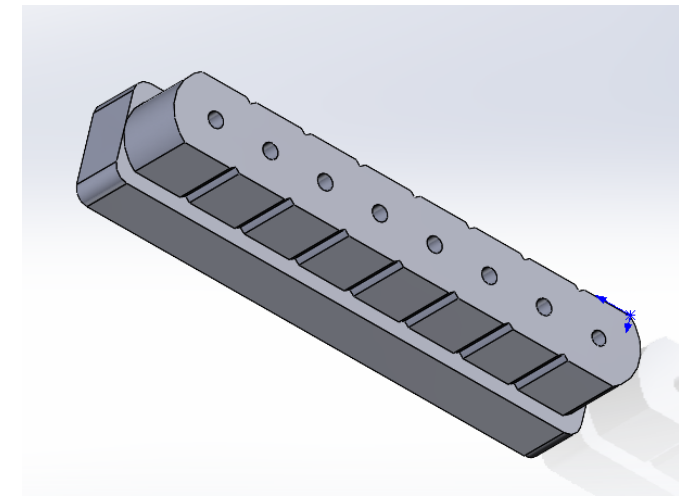


Single channel connection  
with test single-connector

- **The 1-row connector for 8 SiPMs is designed**
- **Current design allow to perform tests with existing single-WLS connectors**



Previous version of the  
connector (not working,  
too high friction)



Current version, not yet  
tested



By now we have:

- Material selection study, enough materials to perform several detector prototypes (reduced and full sector);
- Updated grooved carbon fiber backplate and two reduced sector prototypes with CKTN B and SG BCF92 fiber assembled on it;
- Coordinate table with X-ray tube, that allows us to perform tile homogeneity study, and, what is more, a preliminary result of the research;
- Automized data collection from Keithley 2400;
- Study of wavelength shifters, that we use for prototype and will use in experiment;
- The design of the PCB and connector model for CAEN FERS 5200 is prepared, it fits 8 SiPMs.

In future:

- The production of a full wheel prototype with reduced sectors by mid-2025;
- Further studies with tile homogeneity, detector response using Keithley 2400;
- CAEN FERS DT5202 calibration;

**THANK YOU FOR ATTENTION!**

