SPD ECAL Status Report

IX SPD collaboration meeting

Erevan, May 13 of 2025

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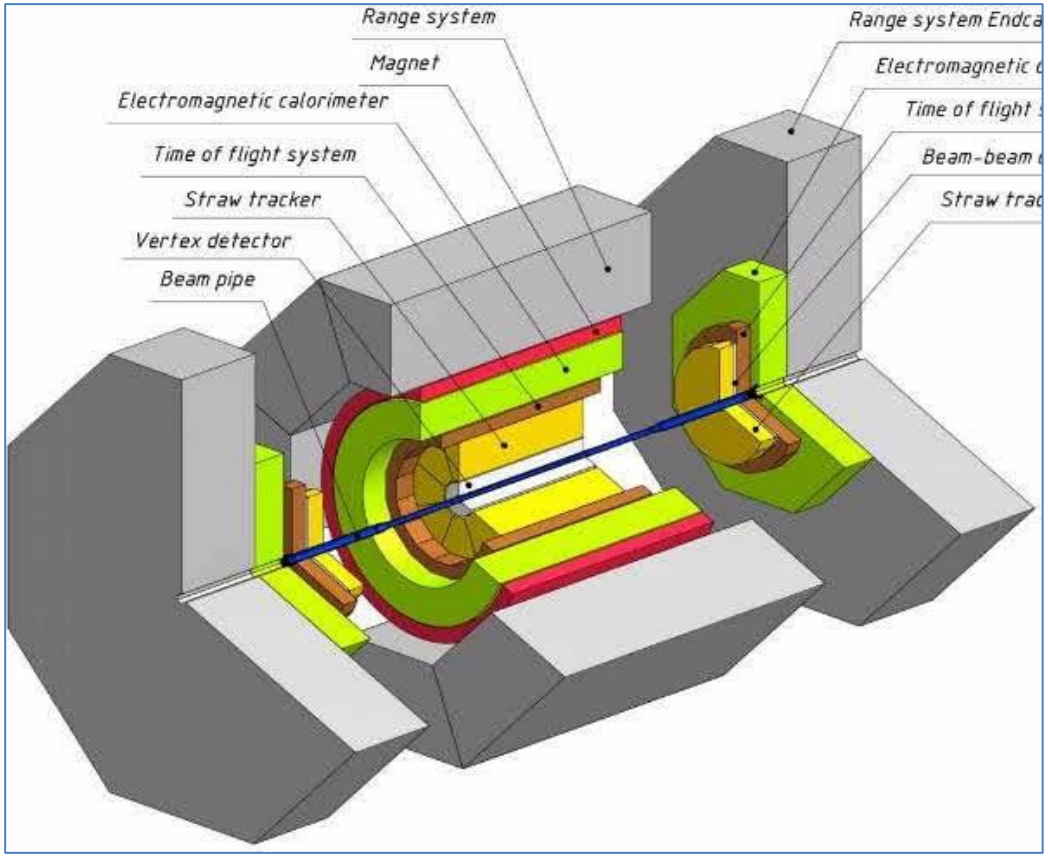
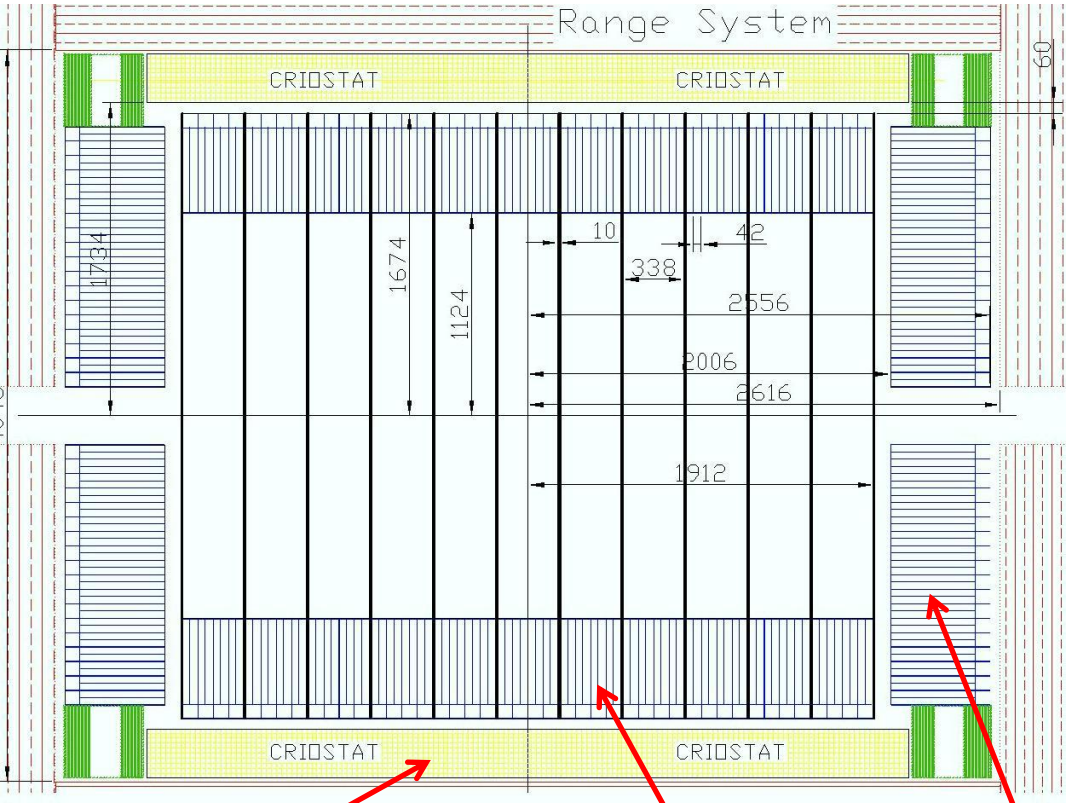
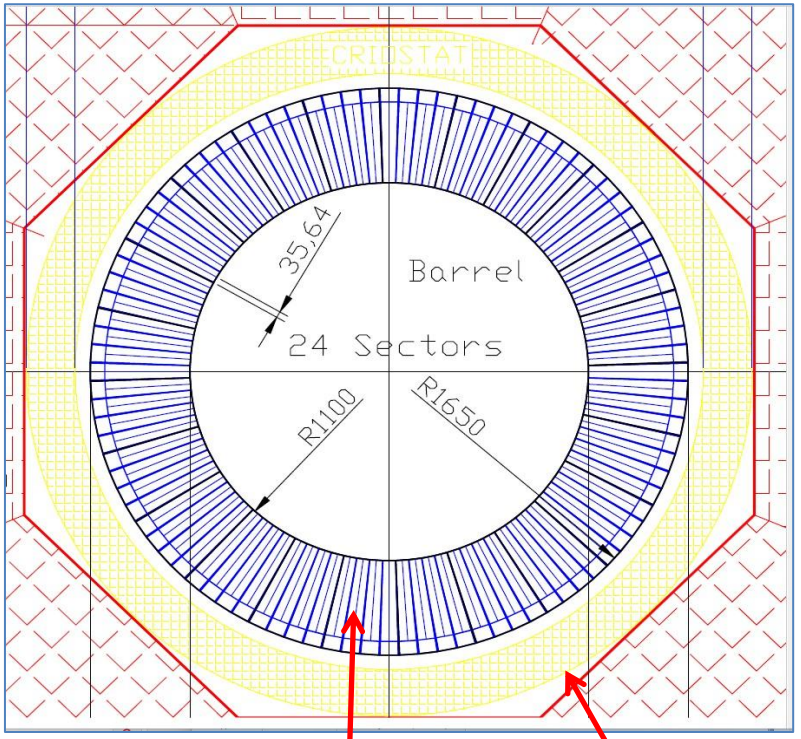
Overview of the SPD ECAL

1. **The calorimeter placed inside of Cryostat (Red) and shown in layout Green color.**
2. **The calorimeter is designed for efficient registration of electrons and gamma quanta in the energy range up to 10 GeV.**
3. **The transverse size of the calorimeter cell should be on the order of the effective Moliere radius of the calorimeter medium: ~58 mm.**
4. **The cells in the End-Cup part of the calorimeter have a rectangular shape 40x40 mm^2.**
5. **The cells in the barrel part of the calorimeter have a trapezoidal shape in the azimuthal direction with vertex angle of the trapezoid equals 1.87 and 40 mm in beam direction.**



Schematic view of a calorimeter placed inside of cryostat.





Criostat

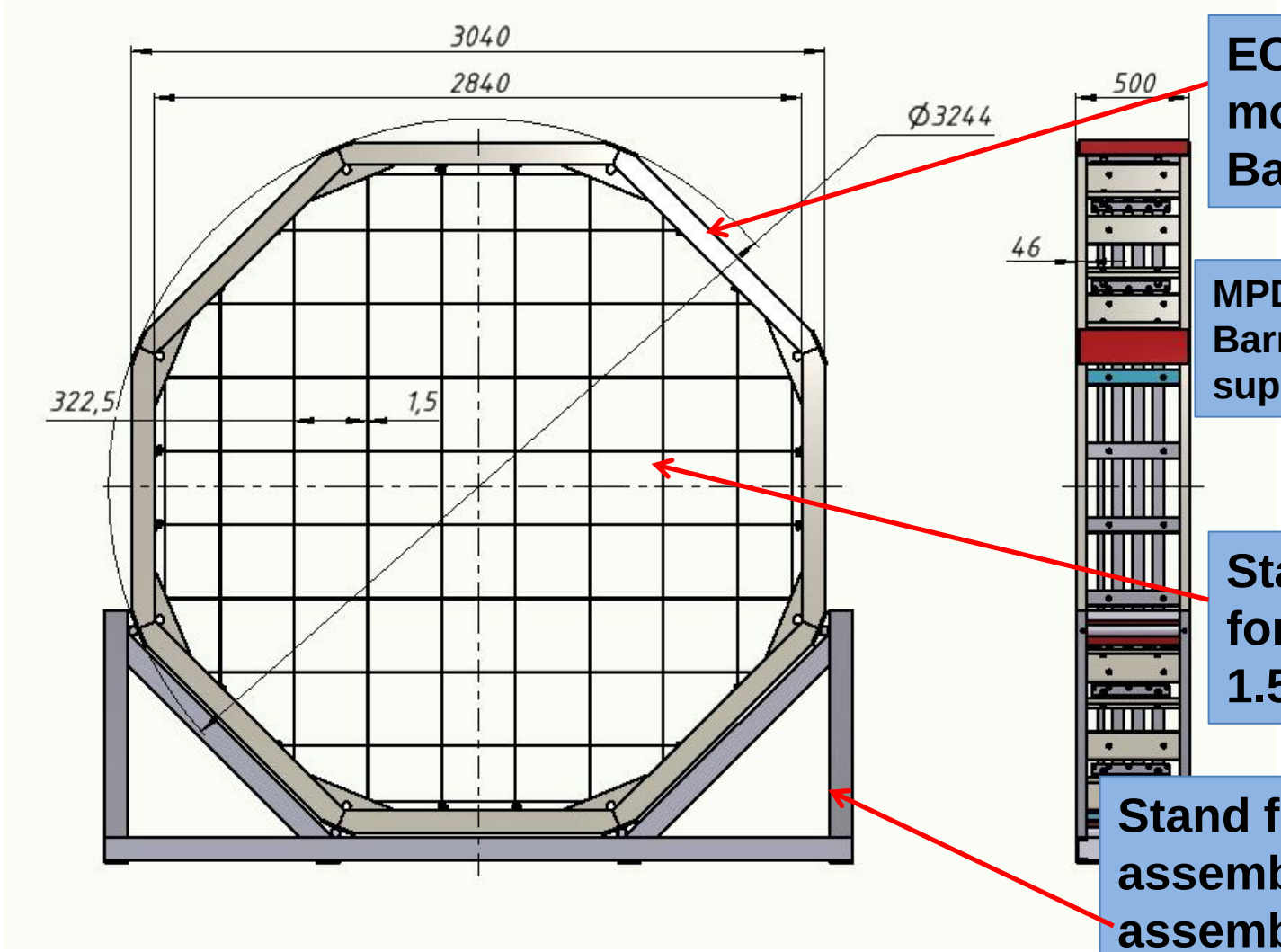
Barrel

End-Cup

Barrel

Criostat

End-Cup calorimeter support. Frame design – option One



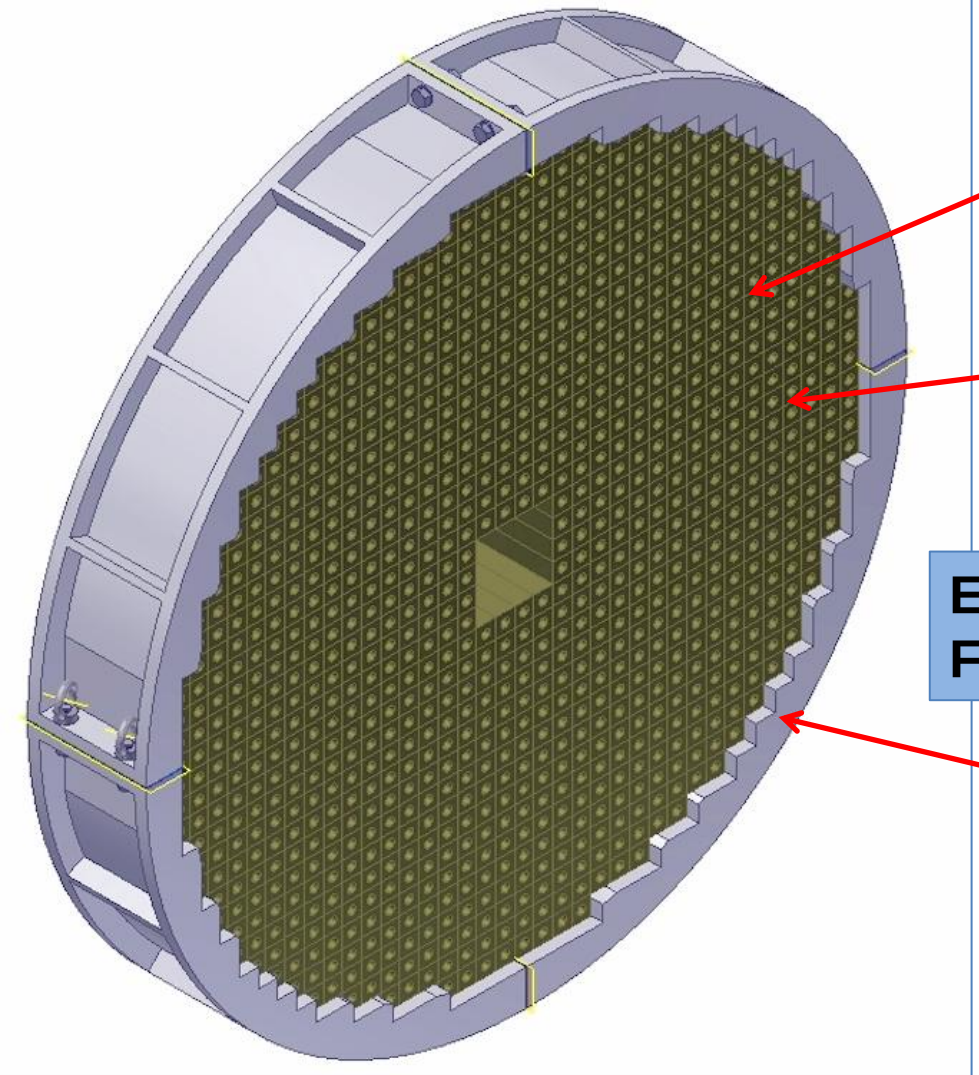
ECAL frame mounted inside of Barrel support

MPD Barrel support

Stainless strips for ECAL support 1.5 mm thick.

Stand for ECAL assembling in the assembly room

End-Cup calorimeter support. Frame design – option Two.



ECAL's modules placed inside of frame

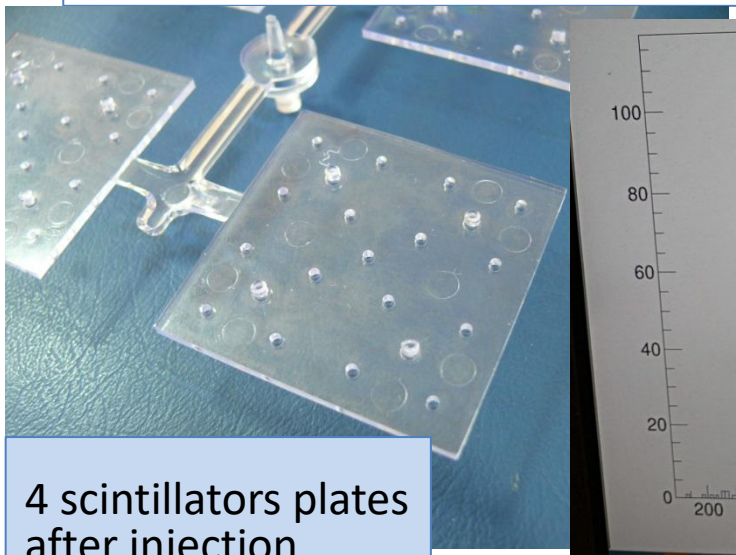
ECAL module 80x80 From 2x2 cells 40x40

Aluminum frame composed from 4 details made by casting into a mold

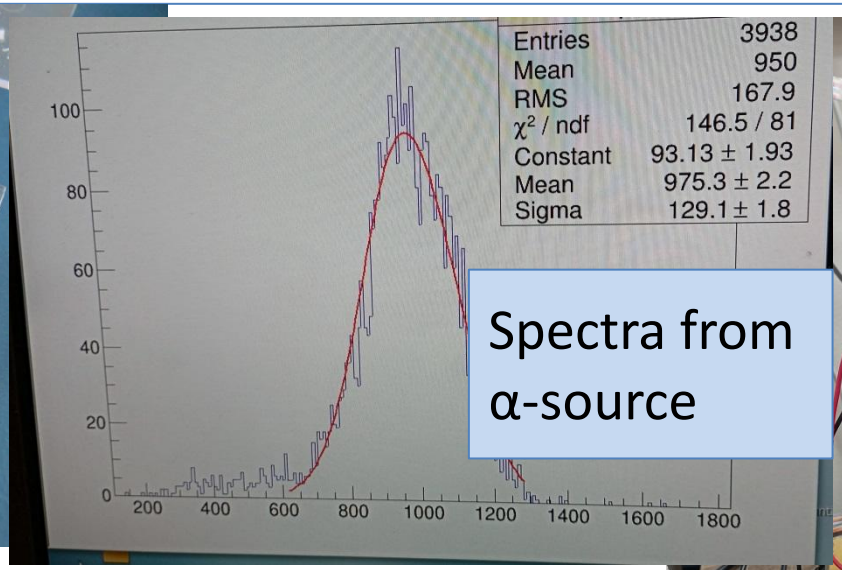
Calorimeters cell composition

1. **Shashlik type calorimeter has been selected with the sampling structure of 200 layers of 1.5-mm polystyrene scintillator and 0.5-mm lead, the length of the active part 400 mm, which corresponds to ~18X0.**
2. **The Cells in the End-Cup part of the calorimeter have a rectangular shape 40x40 mm^2.**
3. **4 calorimeter cells are assembled into a Module, where four 40x40 mm scintillators cells are joint by a common 80x80 mm lead plate.**
4. **200 Polystyrene scintillator plates with 1.5% P-terphenyl and 0.05% POPOP is used.**
5. **199 Lead plates 0.5 mm: alloy Cca with 0.5% antimony is used as an absorber.**
6. **16 WLS fibers (1 mm diam.) collect light onto the SiPm of 6x6 mm^2 with 15 micron pith size. Its corresponded to 160.000 pixels.**
7. **SiPm EQR15 11-6060D-S - it is a novel China design of NDL technology. NDL SiPM employs intrinsic epitaxial layer as the quenching resistors**

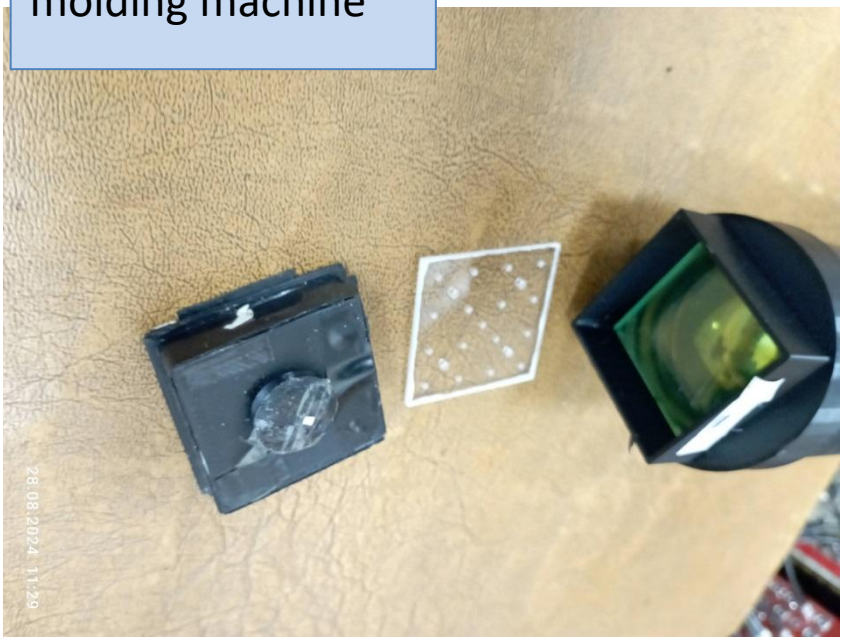
160000 scintillator Cells 40x40x1.5 mm^3 produced in Vladimir at February 2024



4 scintillators plates after injection molding machine



Spectra from α-source

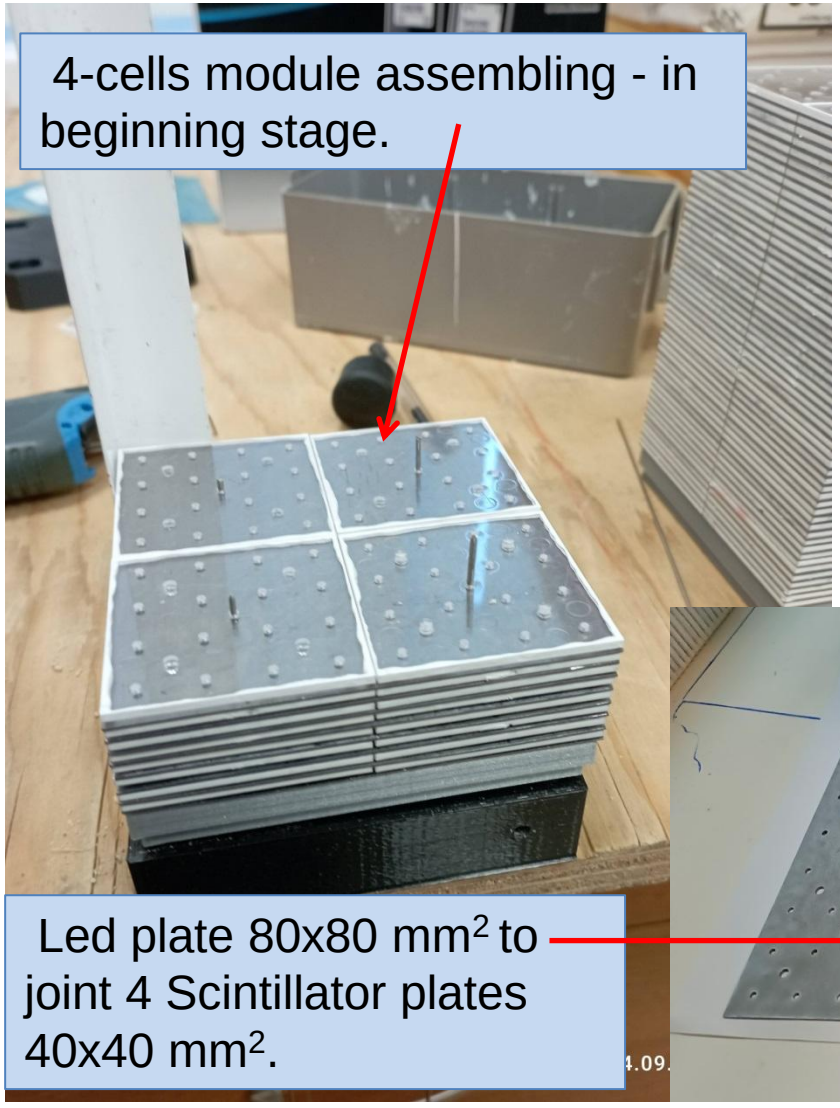


Scintillator plate:
40x40 mm^2 , t=1.5 mm
WLS and PM

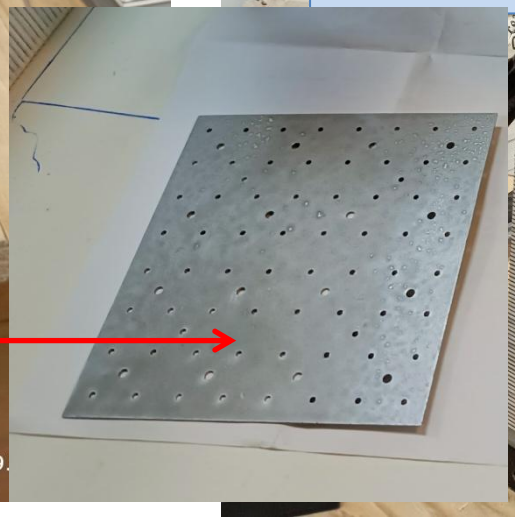
Setup for scintillators test

Module assembling – first setup

4-cells module assembling - in beginning stage.



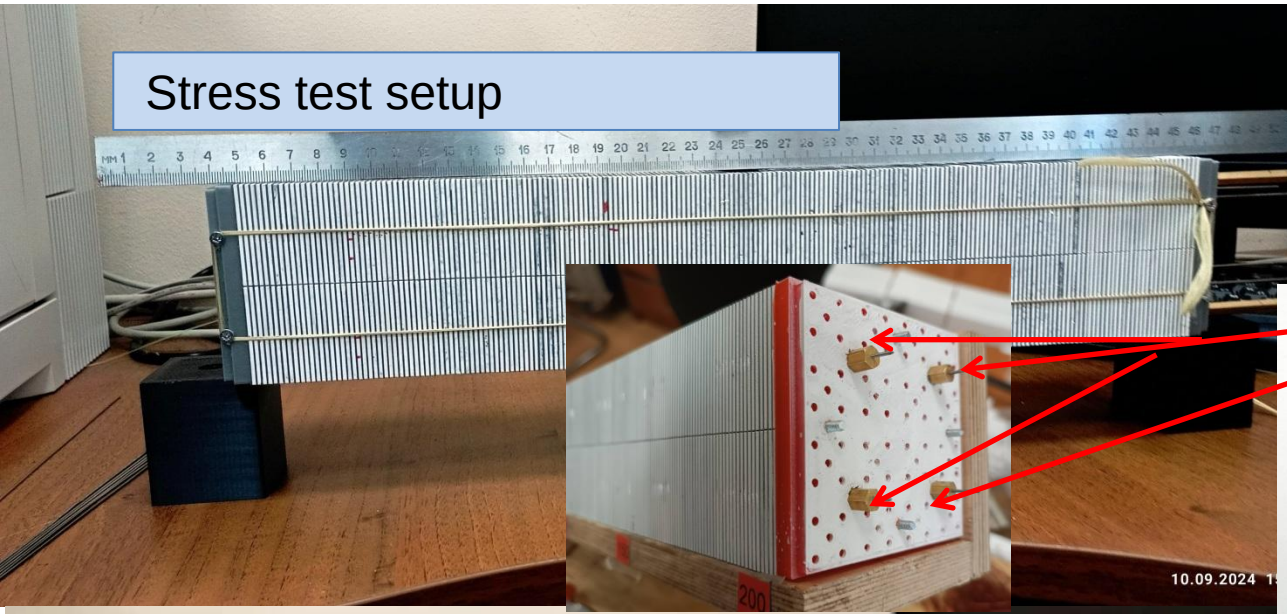
Led plate 80x80 mm^2 to joint 4 Scintillator plates 40x40 mm^2.



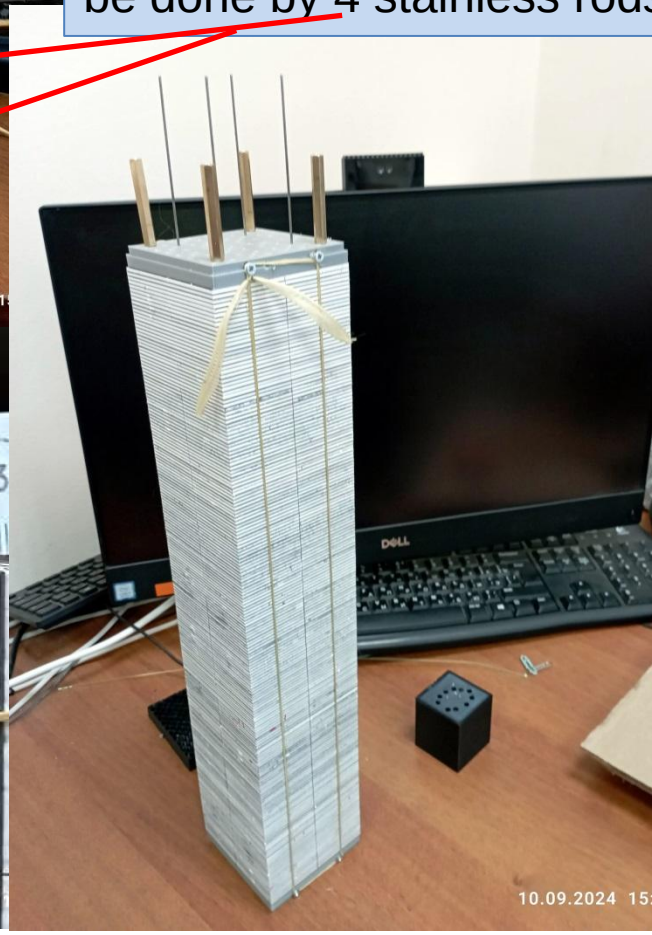
Final stage of module stacking with 200 layers of 1.5+0.5 mm scintillators And Led plates. The length of Active volume is equal 403 mm , that corresponded to the estimated period 2.02 mm

Module assembling and stress test setup

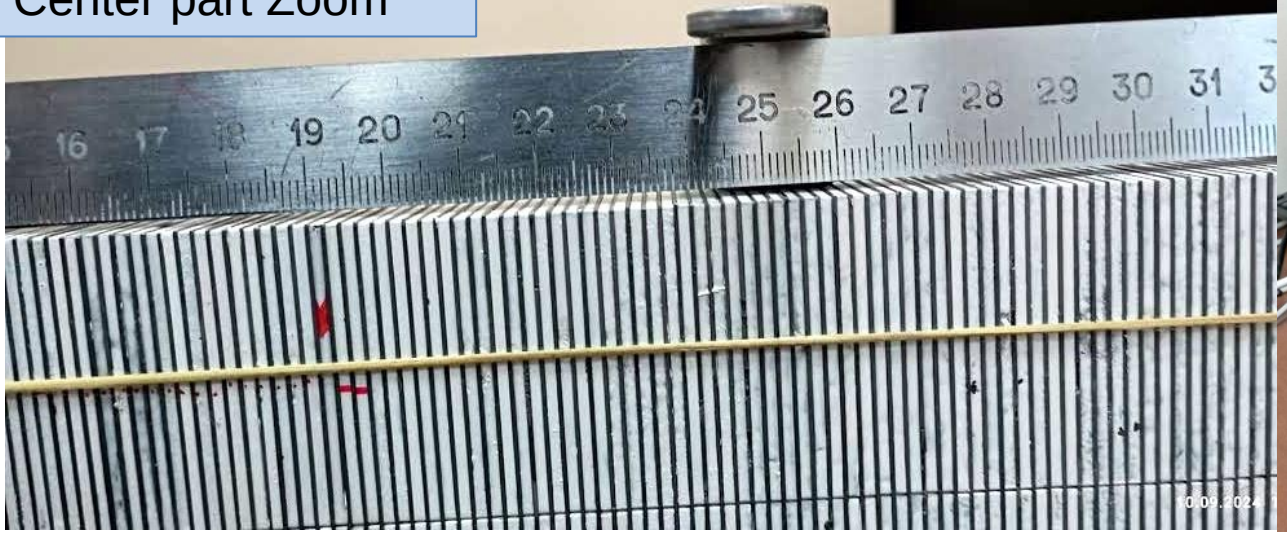
Stress test setup



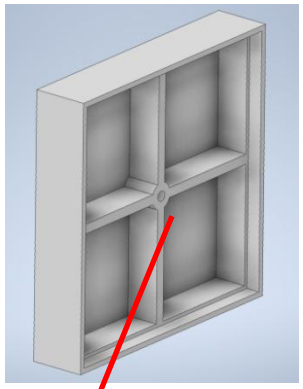
4-cells module assembled and tied with a Kevlar rope
It was first example to fix 200 layers stack .
The next stack fixation wil be done by 4 stainless rods

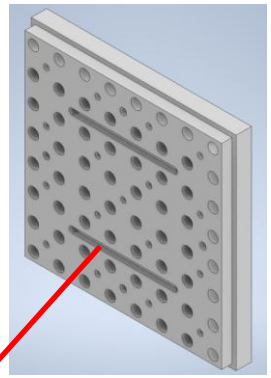


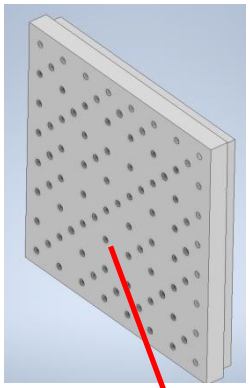
Center part Zoom

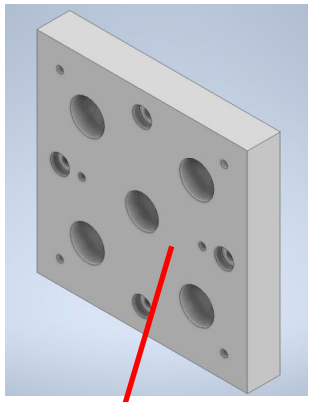


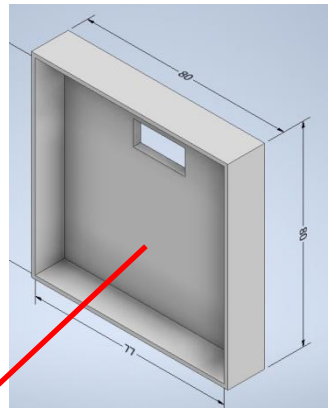
Assembling Details

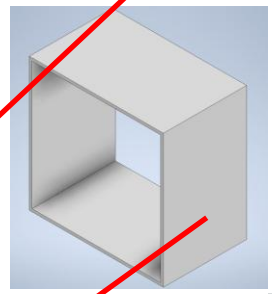


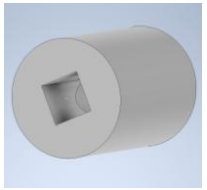




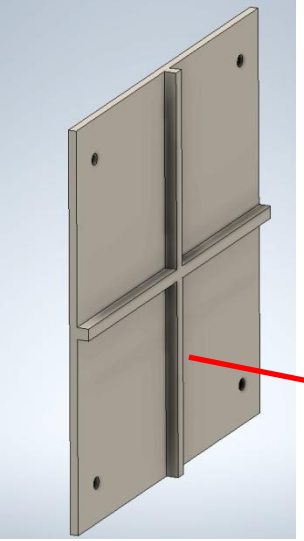






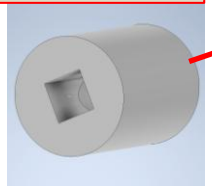


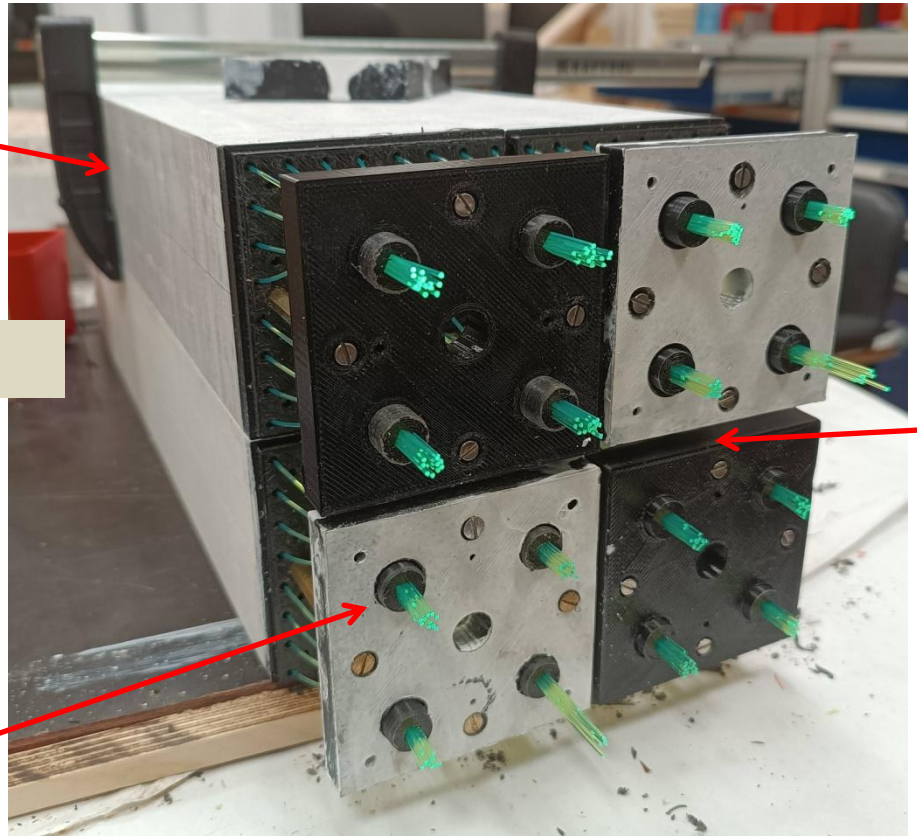
Cluster of 4 Modules (16 cells 40x40) design



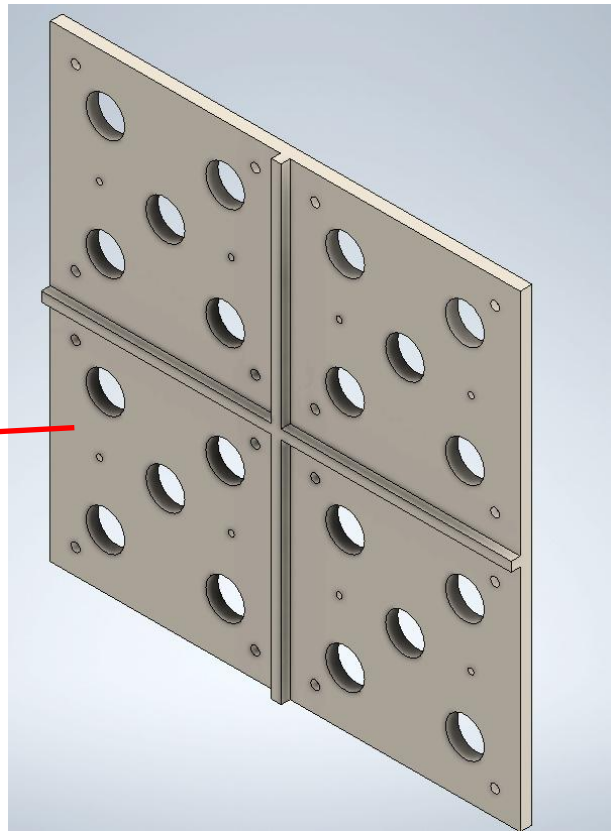
Joint Front Plate

Sleeve for
16 fibers



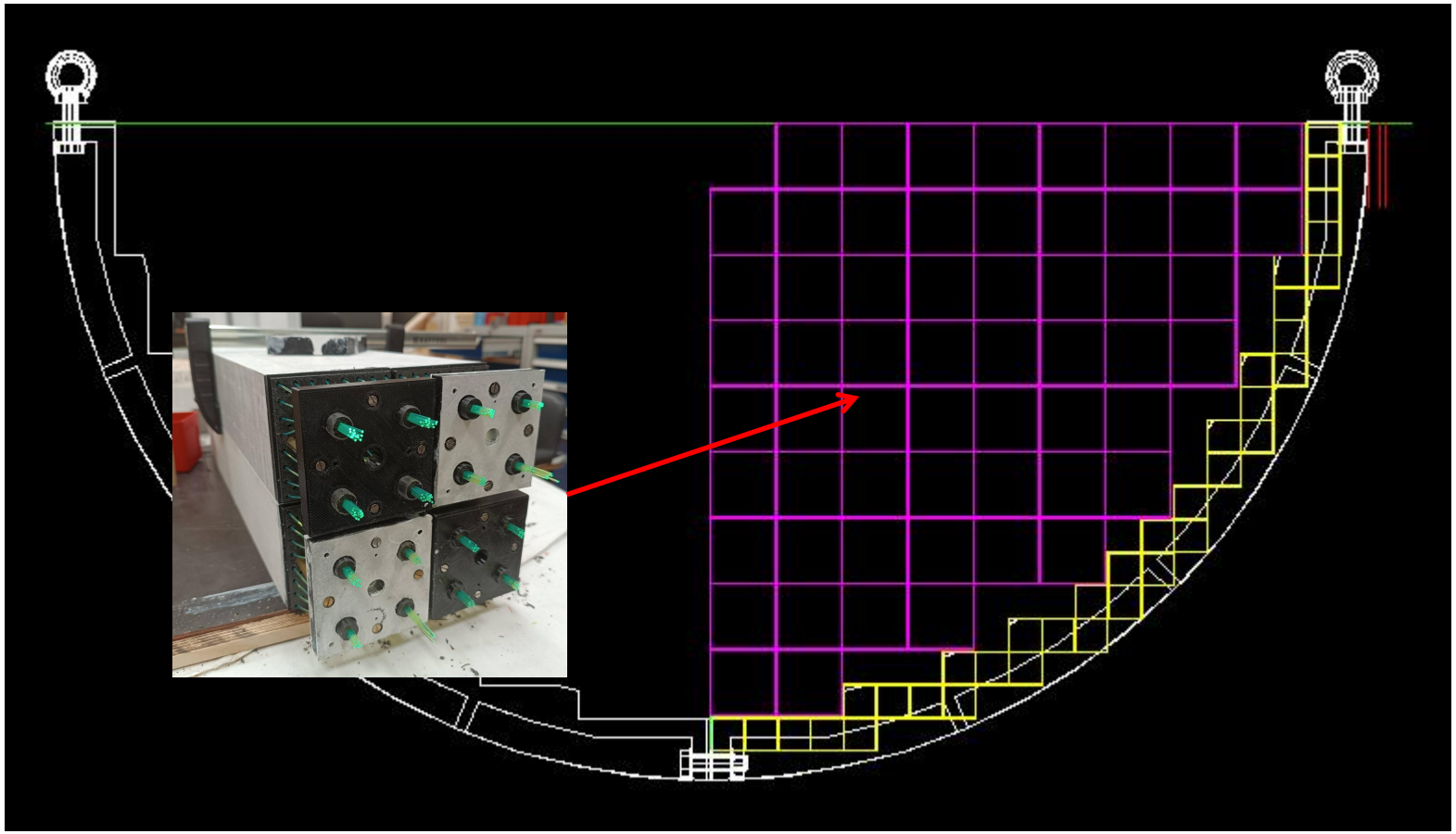


Cluster = 4 Modules Setup of 16-ch



Joint Back Plate

End Cup and 16-ch Clusters design:



End Cup Quarters consist from 58 Clusters composing from 232 Modules as 2x2 Cells.
Total End Cup consist from 928 Modules or 3712 cells of 40x40 mm2.
16 Ch cluster selected to have associate with Front End card and ADC board.

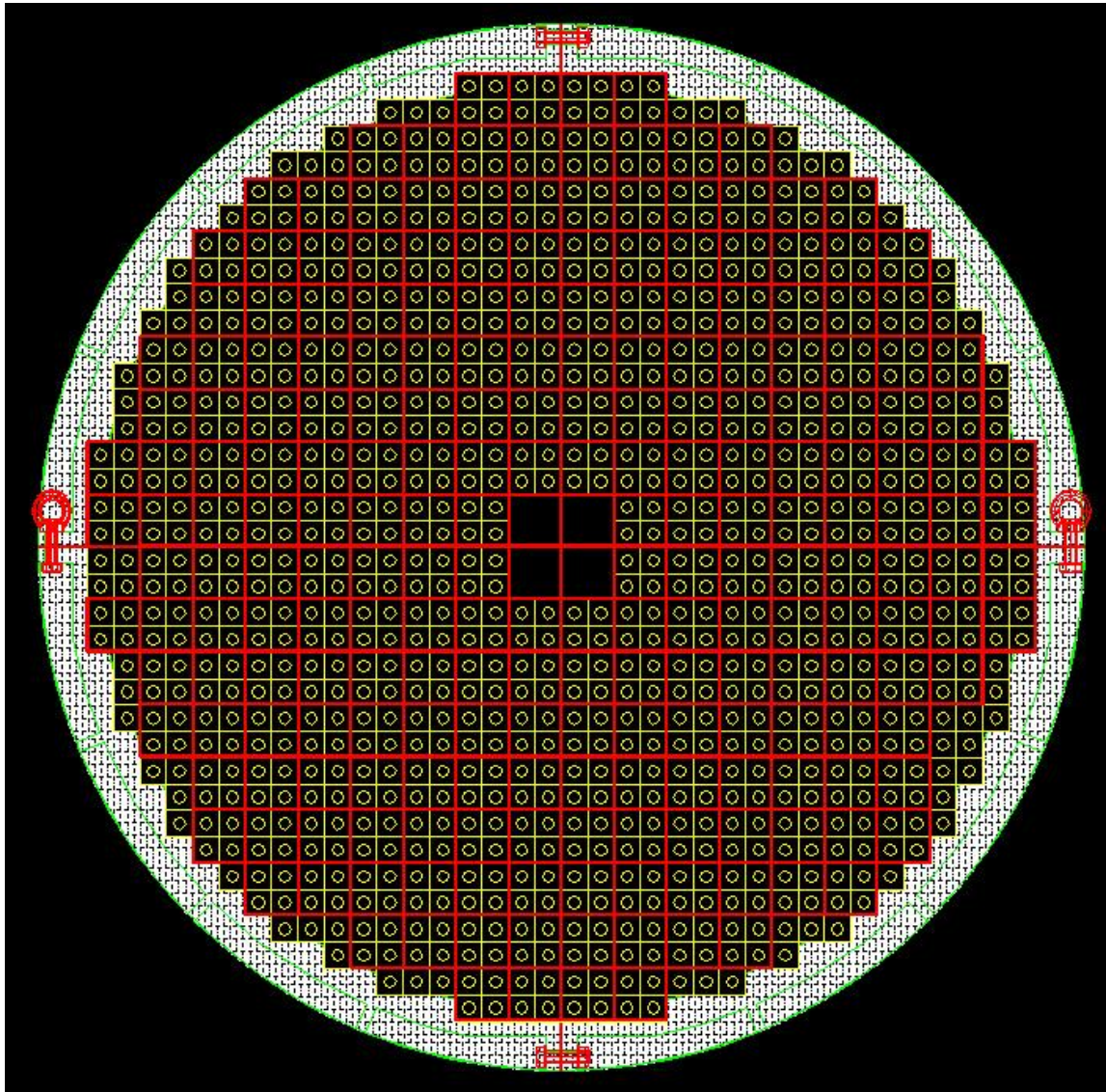
End-Cup calorimeter in support frame

This End-Cup support for 928 Modules (3712 cells 40x40 mm^2) – proposed by Valey Shvetcov.

Frame composed from 4 tiles – manufacturing from molded Aluminum.

The frame with ECAL modules should be inserted in Barrel support after their assembling.

Total End-Cup weight is equal ~10 tons.



Was done up to Now in 2025:

1. **Scintillator tiles production in Vladimir (Uniplast) started since 2024.**
2. **Plan: plates 40x40x0.5 mm^3 for one End-Cup , ~1000 modules, ~4000 cells:**
   1. **Ready for 200 Modules - 160.000 plates – in 2025**
   2. **In progress for 500 Modules - 400.000 plates – should be ready in 2026**
3. **Lead absorber plates 80x80x0.5 mm^3 :**
   1. **Ready for 200 Modules - 40.000 plates – 2 tons Lead in 2025**
   2. **In progress for 500 100.00 plates – 5 tons Lead – plan for 2025-2026**
   3. **Lead plate blanks (85x168 mm^2) are produced in JINR and their stamping is done in Vladimir to obtain size 80x80 mm^2 with 64 holes for WLS.**
4. **Modules assembling:**
   1. **200 – JINR VBLHE – 2025 – assembling procedure in progress.**
   2. **500 – Vladimir (Uniplast) – assembling will started in 2025 will ready in 2026.**
   3. **Modules assembling in Vladimir should be made complete with WLS .**
5. **WLS test was done in LNP – Results and report: Baranov V. - Kuraray-OSL8-BC**
   1. **MC – Zimin Iliya report – WLS att. length influence on E-resolution.**
6. **WLS Fiber preparation – Not solved – polishing – painted – Used Loop option.**
7. **ADC and Frontend – status approximately is defined – Anfimov N. , Kreslo I.**

End of Report

Thanks for attention to All