

# SPD ECAL status 2020

1. В 2019 году изловлен прототип калориметра в виде 9 модулей размером  $11 \times 11 \text{ см}^2$
2. Модуль состоит из 4-х ячеек  $55 \times 55 \text{ мм}^2$
3. Сэмплинг: 1.5 мм сцинт. + 0.3 мм свинца
4. 220 слоев –  $12 X_0$  - длина 440 мм – актив. часть
5. В 2020 году изготавливается прототип в виде 16 модулей размером  $11 \times 11 \text{ см}^2$  (4 -  $55 \times 55 \text{ мм}^2$ )
6. Сэмплинг: 1.5 мм сцинт. + 0.5 мм свинца
7. 180 слоев –  $16 X_0$  - длина 360 мм – актив. часть

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- Закуплены фотодиоды 6x6 mm<sup>2</sup>:
  1. S131-6025 – 25 mk – pixel size
  2. S141-6050 – 50 mk – pixel size
  3. FC-60035 – 35 mk – pixel size

# SPD ECAL status 2020

| Type      | PDE,% | F/fac/% | N-Eff   | U Break | T mv/°C | dU, V |
|-----------|-------|---------|---------|---------|---------|-------|
| S131-6025 | 40    | 47      | 27.000  | 54      | 54      | 2.5   |
| S141-6050 | 50    | 74      | 11.000  | 25      | 34      | 3.0   |
| FC-60035  | 30    | 64      | 19.000  | 37      | 25      | 2.7   |
| S141-6015 | 50 ?  | 74 ?    | 110.000 |         |         |       |

S141-6015 – New series – to be developed in 2020-2021

# SPD ECAL status June 2020

1. WLS fibers ordered in 2018-2020
  1. Y11(200) 1 mm diameter – Multy cladding
  2. Y11(200) 1 mm diameter – Single cladding
2. WLS (1) installed in Prototype 2019 and tested
3. WLS (2) – will be tested in 2020

# SPD ECAL modules – 4 cells 55x55



Произведено в ИФВЭ:

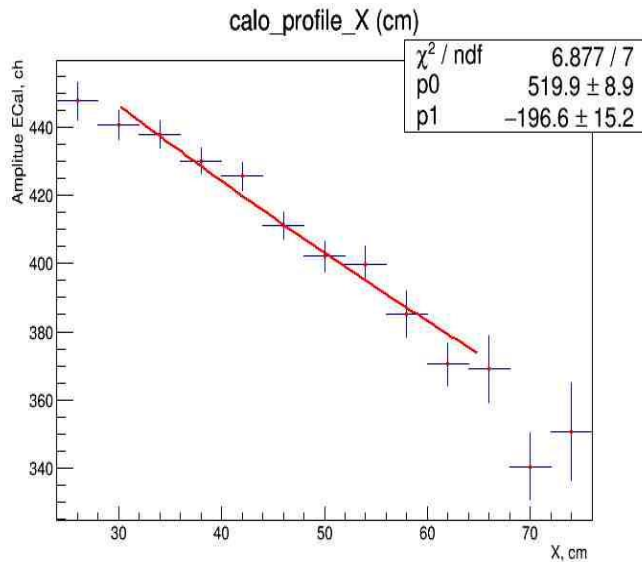
1. Изготовление пластика и свинца
2. Набор слоев, стяжка – фиксация башни
3. Свето изоляция

Взят модуль КОПИО, укорочен и без ФЭУ.

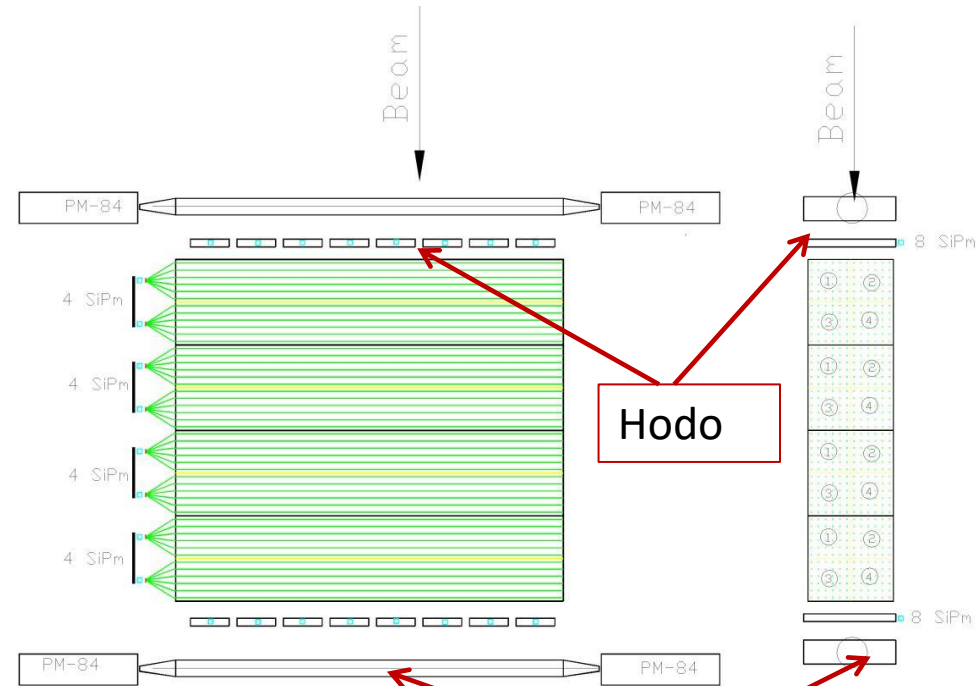
Нами Доработано:

1. Установка волокон
2. Светодиод
3. Система светосбора
4. Крепление SiPM
5. H/V модуль
6. Фрезеровка трапеции

# Horizontal test – attenuation length



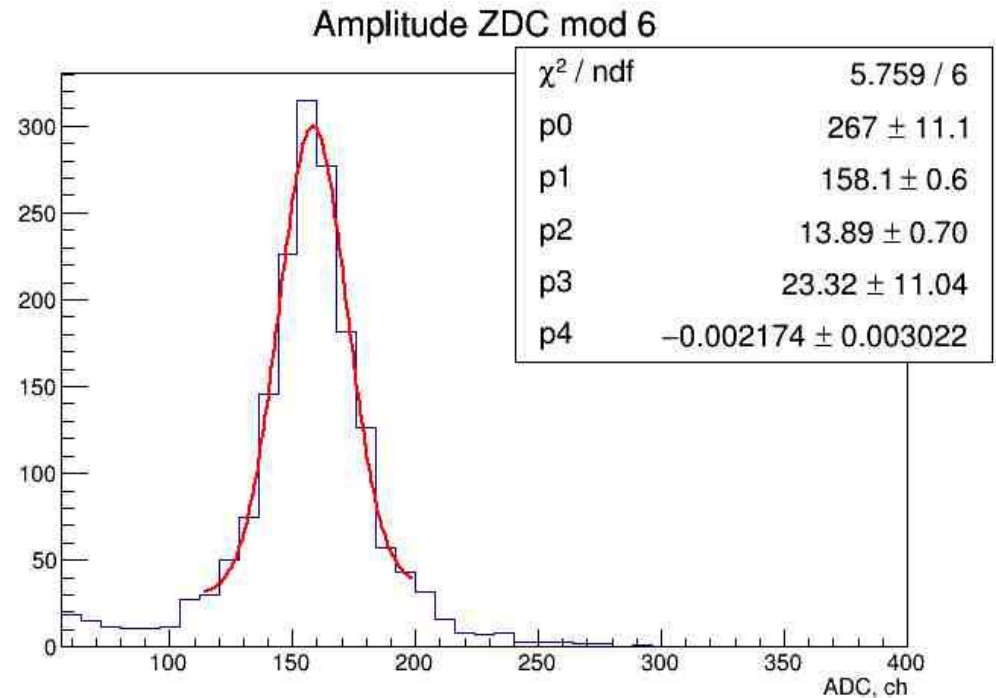
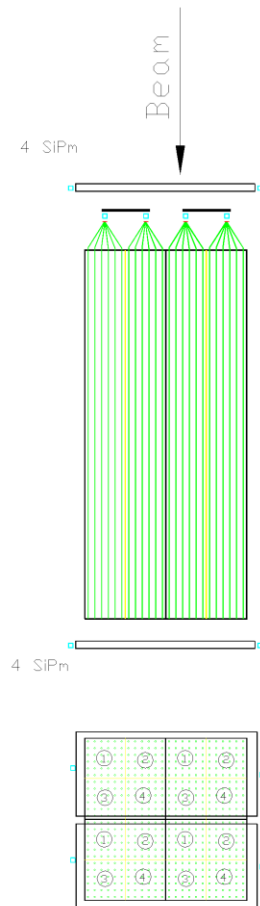
Attenuation length: p1=196 cm



Layout test setup

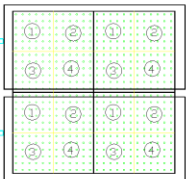
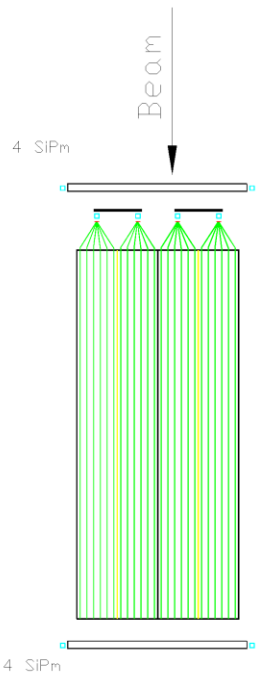
Double side  
2-Trigger counters

# Energy resolution for single cell

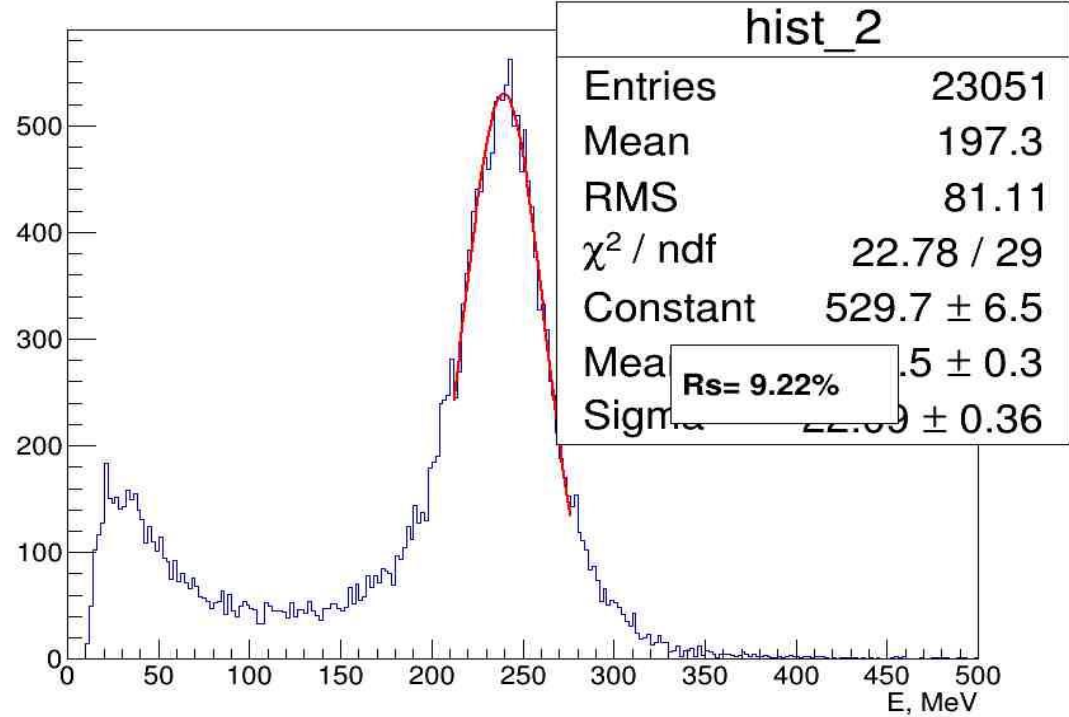


$dE/E=7\%$  for cell 6

# Sum\_16 mip Energy resolution



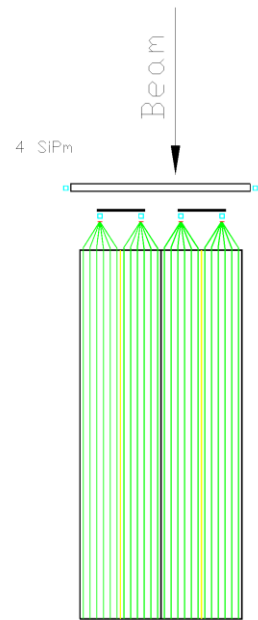
Sum ECAL Energy



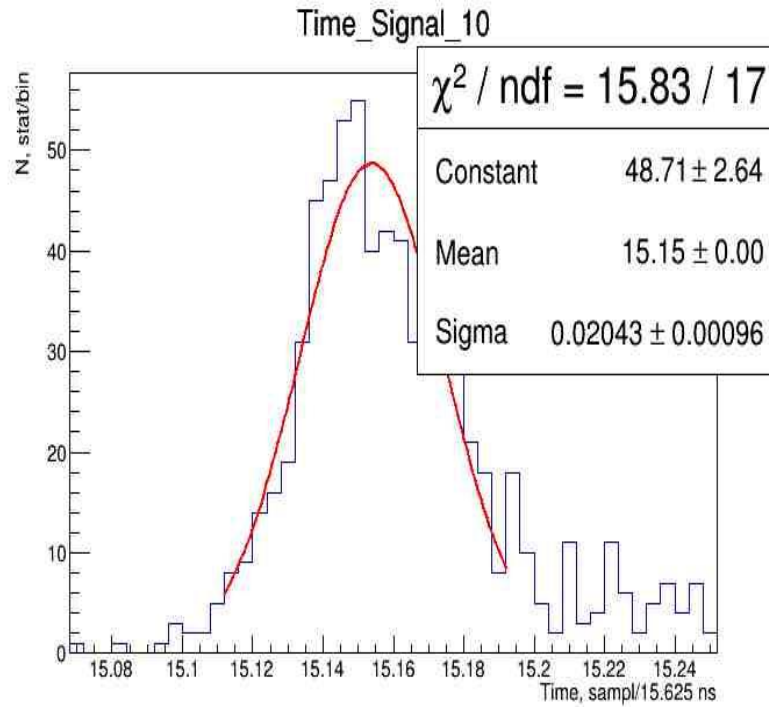
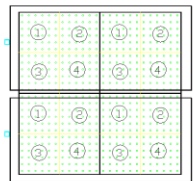
$dE/E=9\%$  for 16 cells,  
calibrated on Mip



# Vertical cosmic test

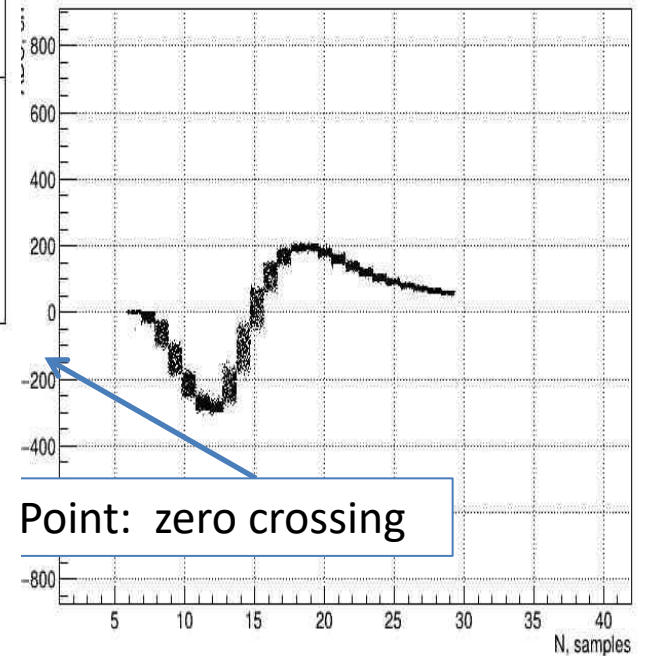


4 SiPM



Time resolution for cell 10  
 $dT/T = 312 \text{ ps}$

cfd\_Samples\_hist\_led6

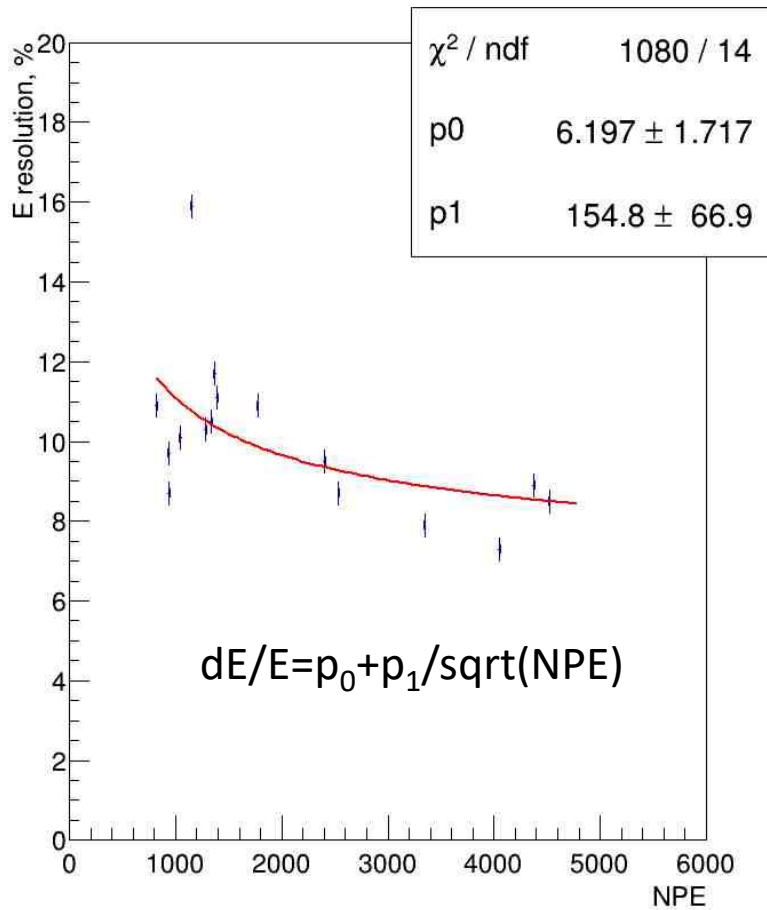


Point: zero crossing

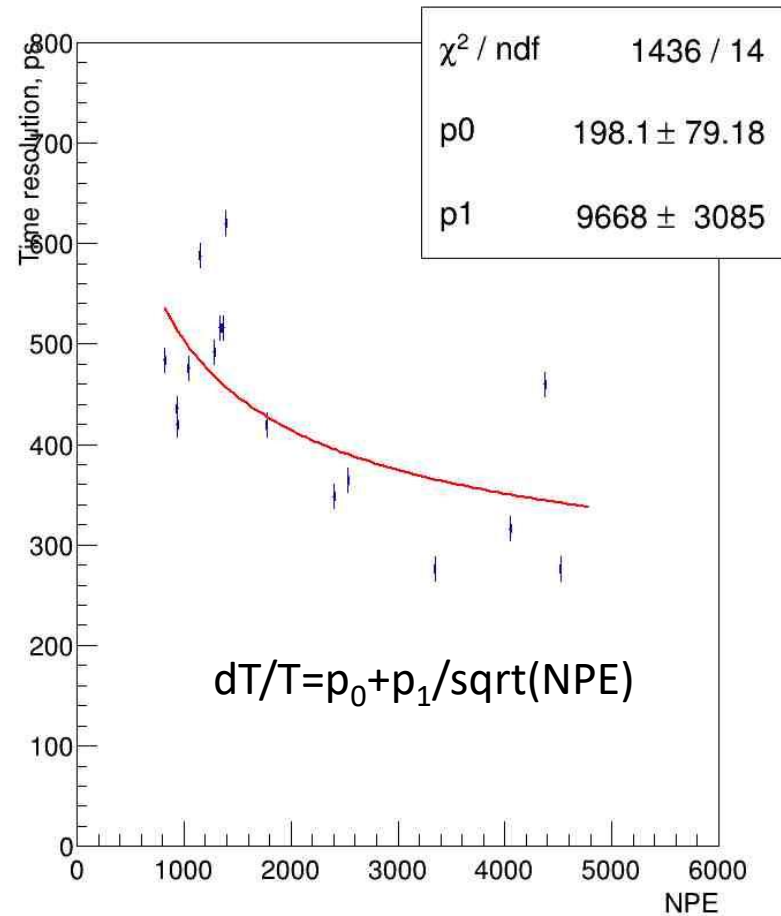
Wave form for cell 6, used for CFD method to estimate the time resolution

# Energy & Time resolution vs NPE

E-resolution vs Npe

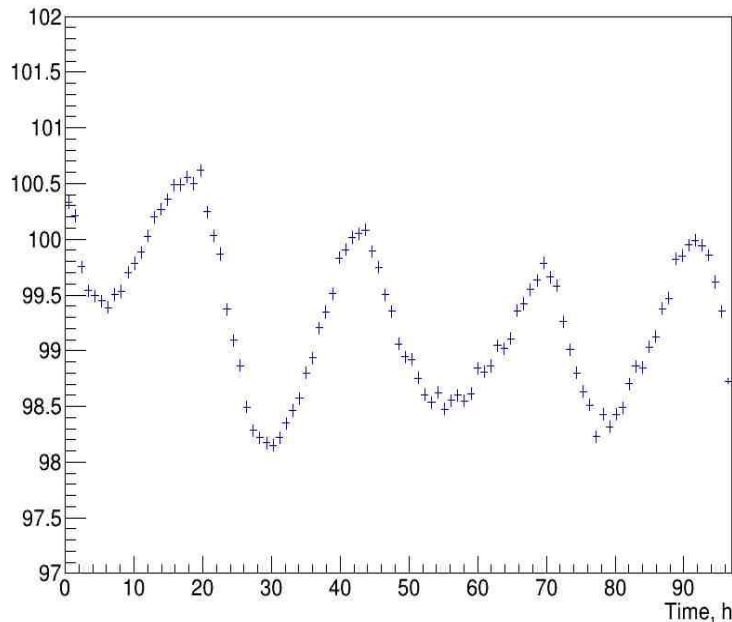


Time-resolution vs Npe



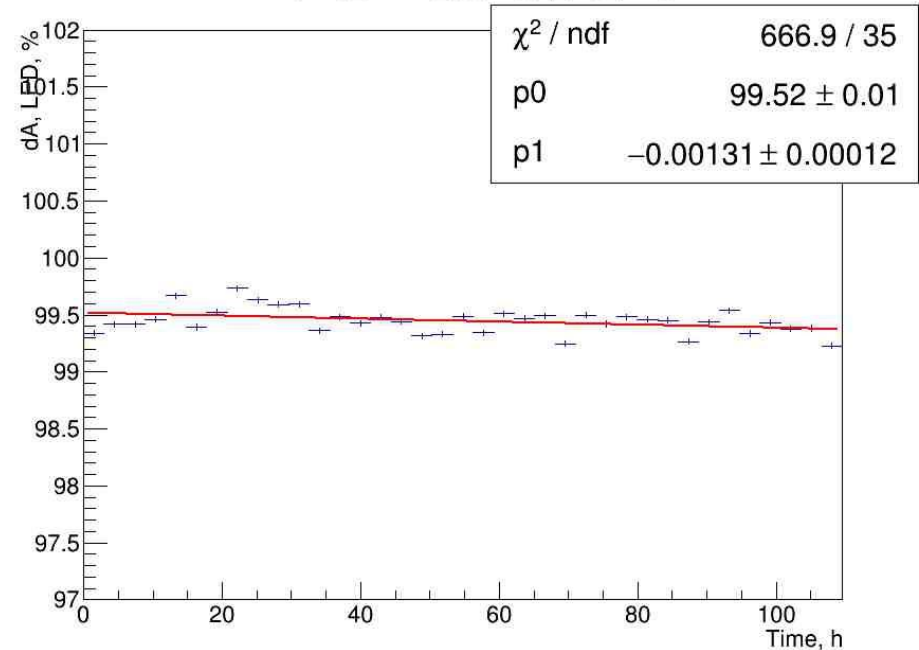
# LED amplitude vs long time exposition

Profile\_LED\_Sumtot\_vs\_Evt



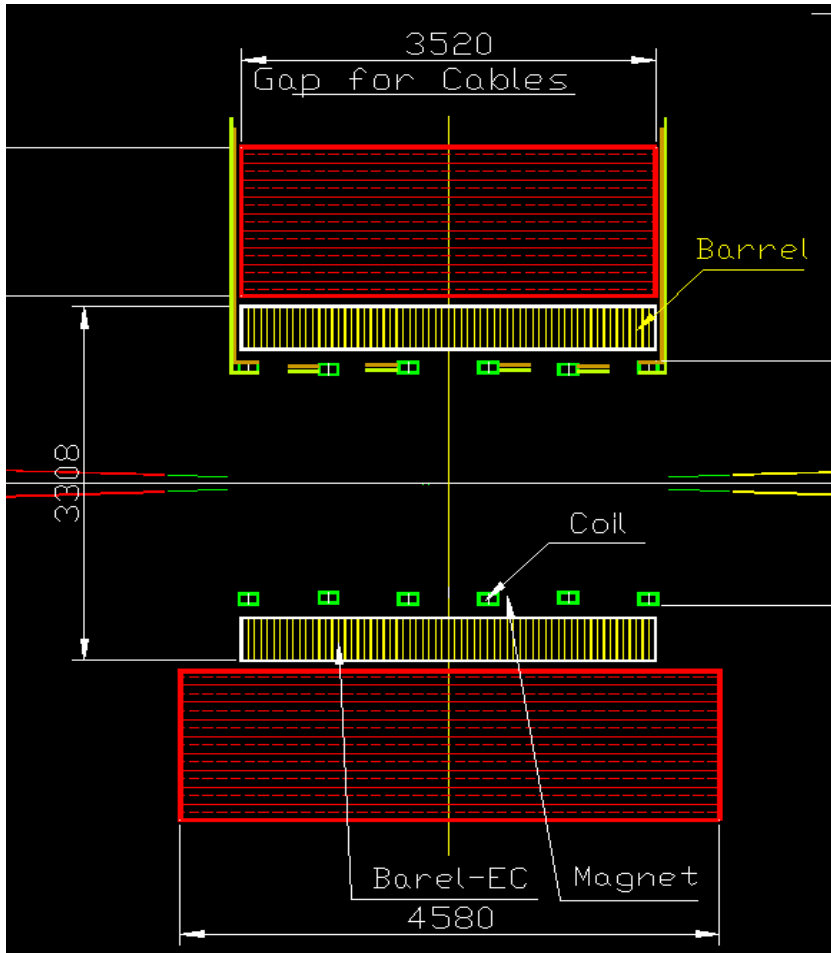
Without T-correction.  
Daily temperature  
variation is visible clearly

Profile\_LED\_Sumtot\_vs\_Evt



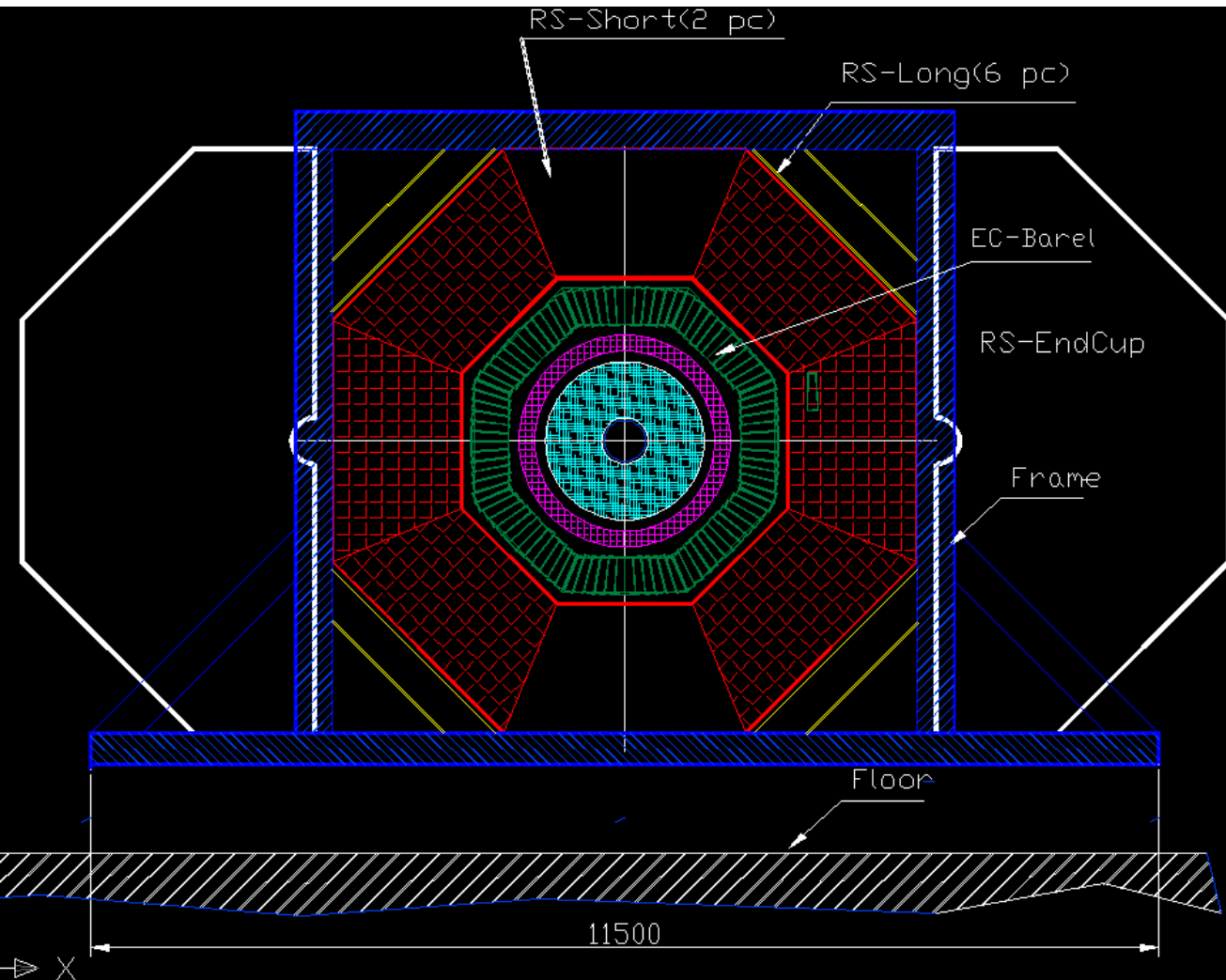
With Break-point T-correction:  
 $k=0.034 \text{ mv}/^\circ\text{C}$  :  
The A variation  $\sim 0.2\% / 100 \text{ h}$

# SPD ECAL – Barrel part



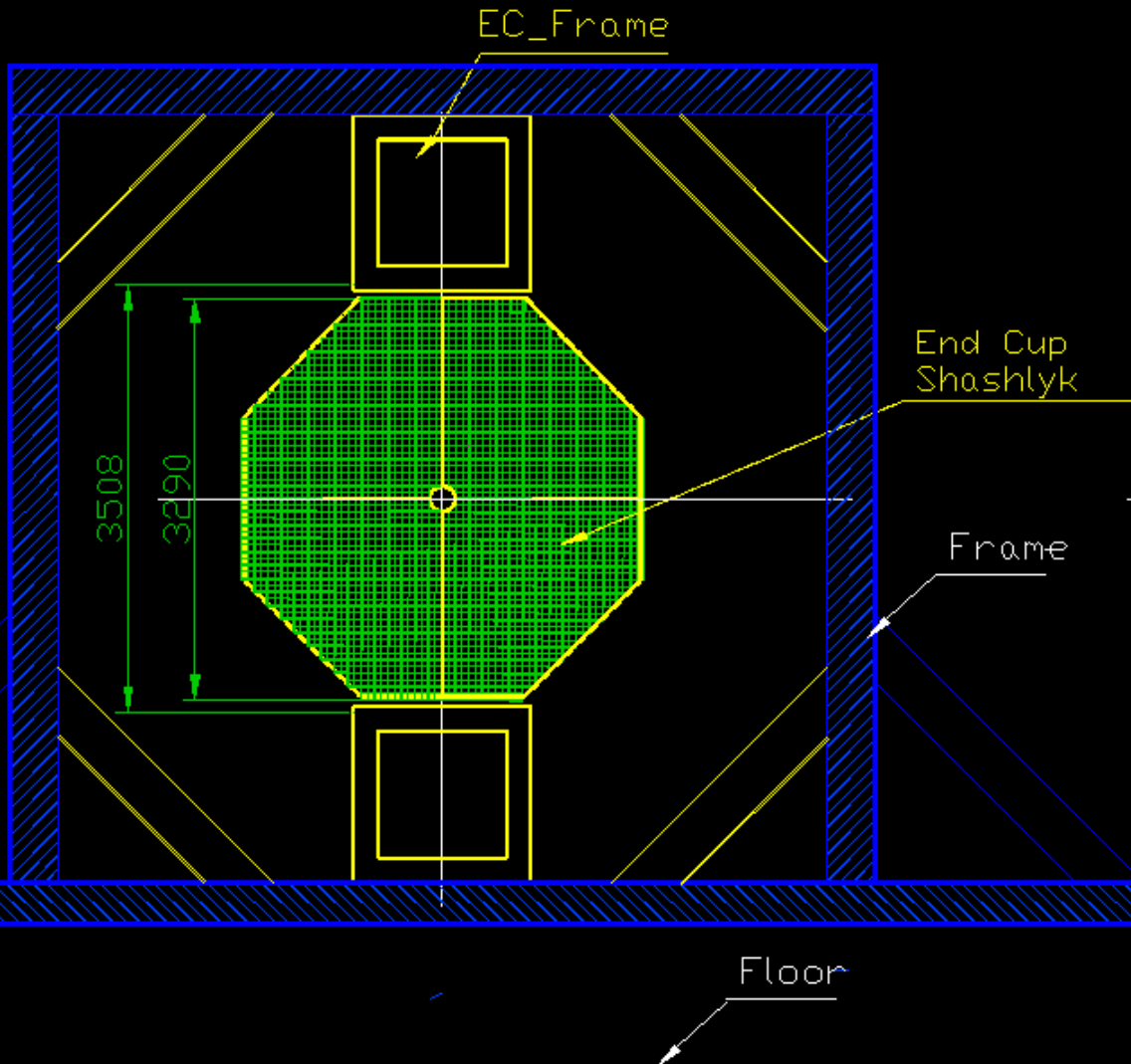
1. Barrel consist from 96 modules in pfi
2. Module size  $110 \times 110 \text{ mm}^2$
3. 1 module = 4 cells  $55 \times 55 \text{ mm}^2$
4. 32 modules– in Z direction
5. 96 modules in pfi
6. 3072 – totally modules  $110 \times 110 \text{ mm}^2$
7. 12288 – cells  $55 \times 55 \text{ mm}^2$
8. Weight = 40 tons
9. Sampling -  $1.5 \text{ Sc} + 0.3 \text{ Pb} - 12 X_0$
10. 420 mm module active part
11. 80 mm reserved for WLS bundles & HV
12. 500 mm – total module height
13. Price – 9.000.000 USD

# SPD ECAL – Barrel part



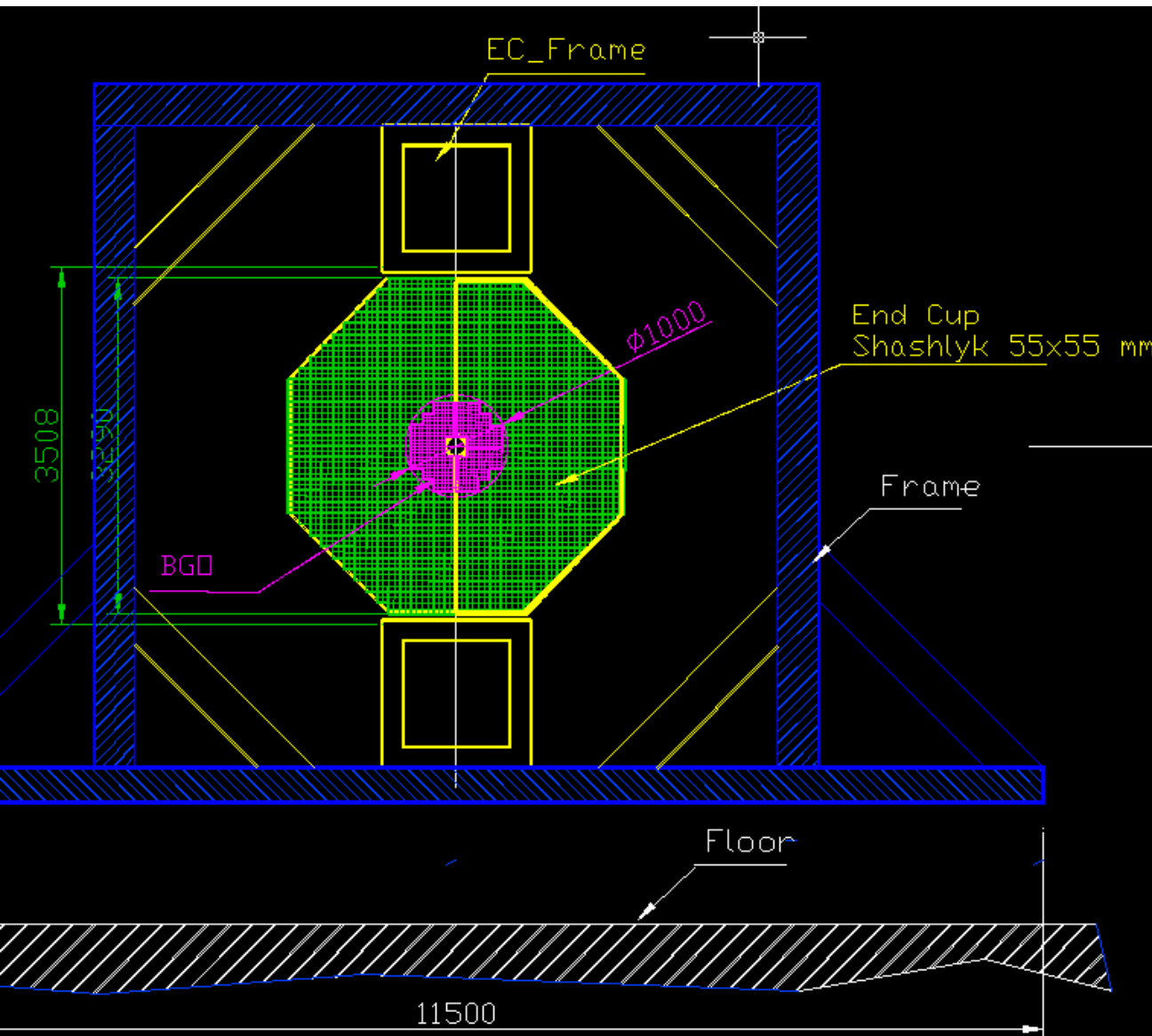
1. Barrel consist from 8 gaskets of  $12 \times 32 = 384$  modules  $110 \times 110 \text{ mm}^2$
2. Gasket weight = 5 tons
3. Total barrel weight is equal to 40 tons

# SPD ECAL End Cup\_1



1. End Cup\_1 :
  - 720 modules  $110 \times 110 \text{ mm}^2$
  - 2880 cells of  $55 \times 55 \text{ mm}^2$
  - Weight - 9.360 kg
  - Price= 2.160.000 USD
1. Sampling -  $1.5 \text{ Sc} + 0.3 \text{ Pb} - 12 X_0$
2. 420 mm module active part
3. 80 mm reserved for WLS bundles & HV
4. 500 mm – total module height

# SPD ECAL End Cup\_2\_3



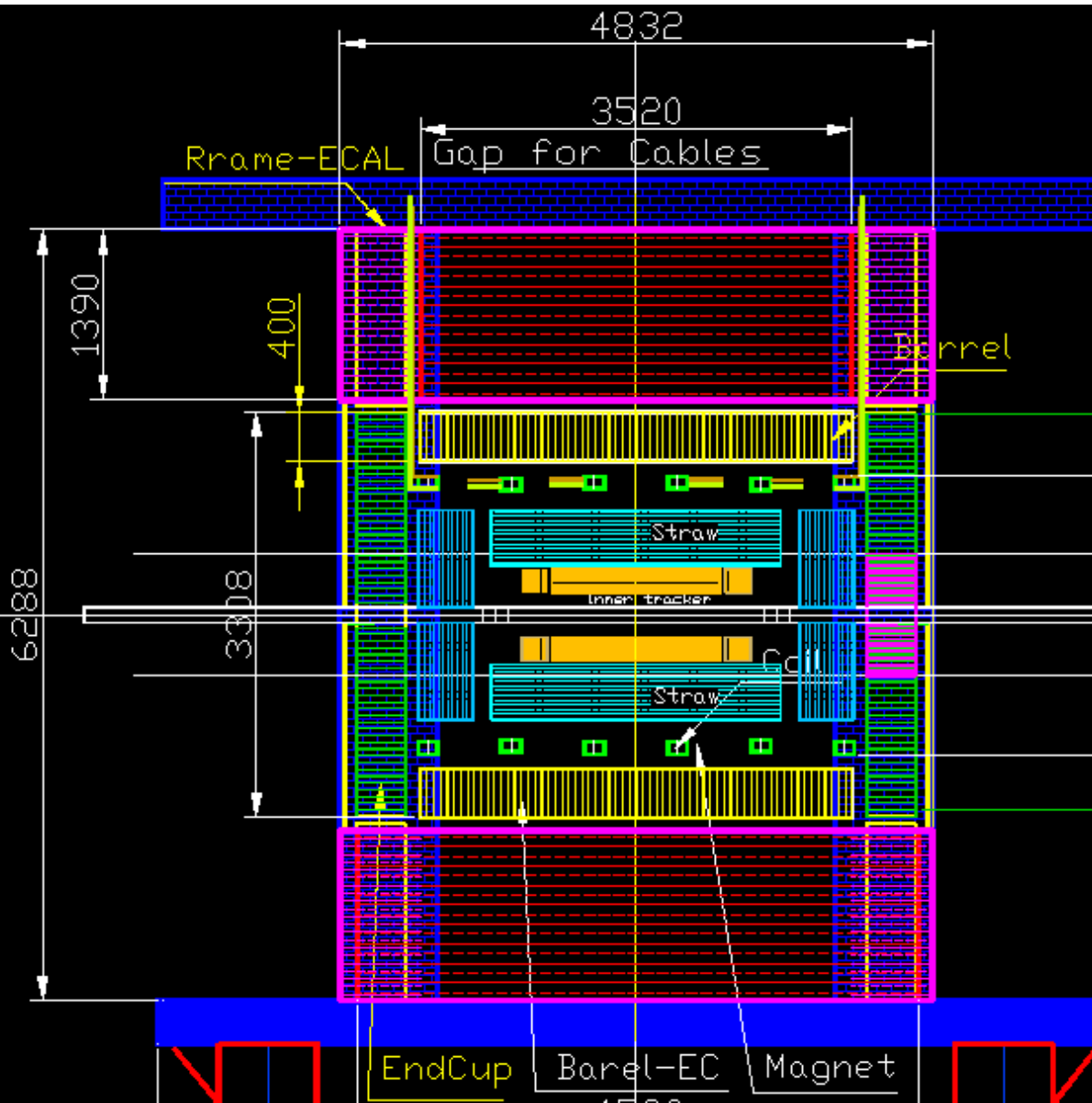
End Cup\_2 - shashlik :

- 672 modules 110x110 mm<sup>2</sup>
- 2880 cells of 55x55 mm<sup>2</sup>
- Weight = 8736 kg
- Price= 2.016.000 USD
- Sampling - 1.5 Sc+ 0.3 Pb - 12 X<sub>0</sub>

BGO crystal 36.6x36.6 mm<sup>2</sup>

- L=20 cm, 17.8 X<sub>0</sub>
- R<sub>M</sub>= 26.3 mm
- 432 cells
- Weight = 800 kg
- Price/unit = 7 USD/cm<sup>3</sup>
- Price = 800.000 USD

# SPD ECAL End Cup\_1\_2\_3



ECAL consist from:

1. Barrel
2. End Cup\_1 – shashlyk
3. End Cup\_2 – shashlyk
4. End Cup\_3 – BGO



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- End of report
- Thanks all for attention