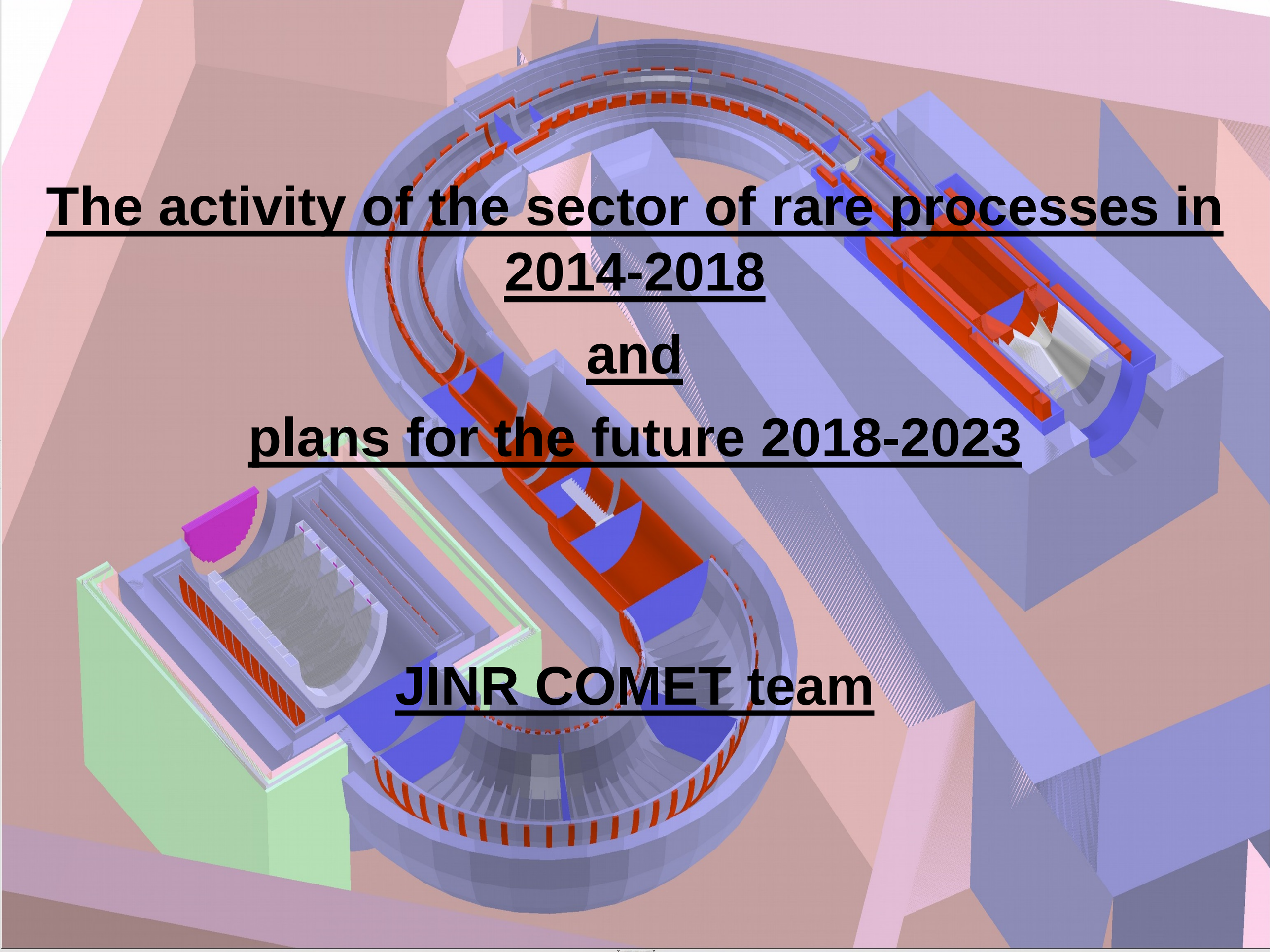
The activity of the sector of rare processes in 2014-2018

and

plans for the future 2018-2023



JINR COMET team

Straw tracker

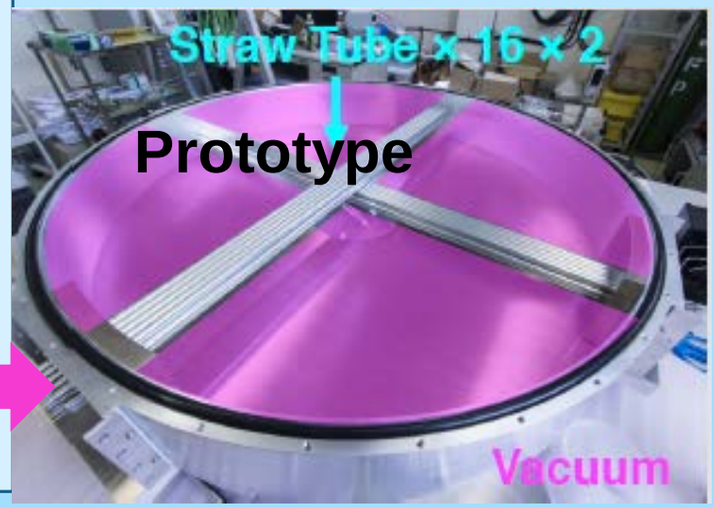
In 2014-2016 the R&D for Phase-I have been done.

- **Simulations: efficiency, resolution etc.**
- **R&D on straw tube modifications (full responsibility)**
- **All the methods of quality control for NA62 36 μm tubes was adapted for COMET- 20 μm (aluminized Mylar)**
- **All devices were re-calibrated: welding machine, breaking force machine, gas leaking test machine**
- **Production of straw tubes, quality checks in accordance to the COMET requirements (full responsibility)**
- **Participated in assembling, calibration and beam testing of the prototype**

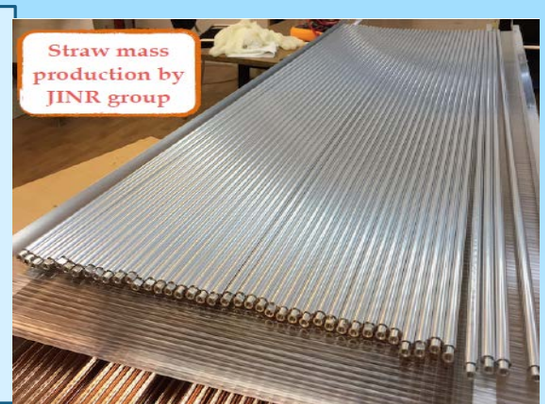
Straw tube thickness and diameter:
COMET Phase-I - 20μm, 9.8mm

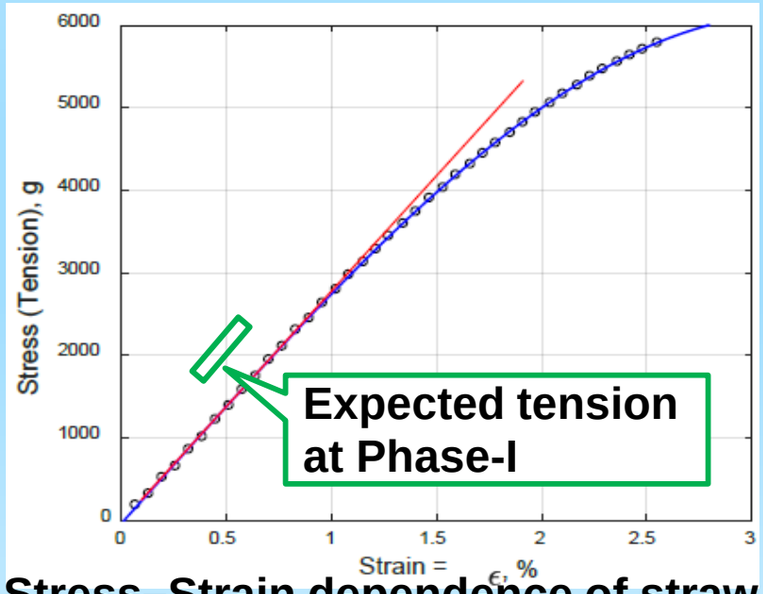
The complete set tubes for Phase-I has been produced and tested in 2015:

- **2700 tubes of 20 μm wall thickness, Ø 9.8 mm 120 and 160 cm length have been produced**
- **These tubes passed all the tests and have been sent to Japan**



For Phase-II we need even thinner and less diameter tubes:
5 mm diameter and 12 μm wall thickness.
For this purpose the R&D works are planning in our laboratory.

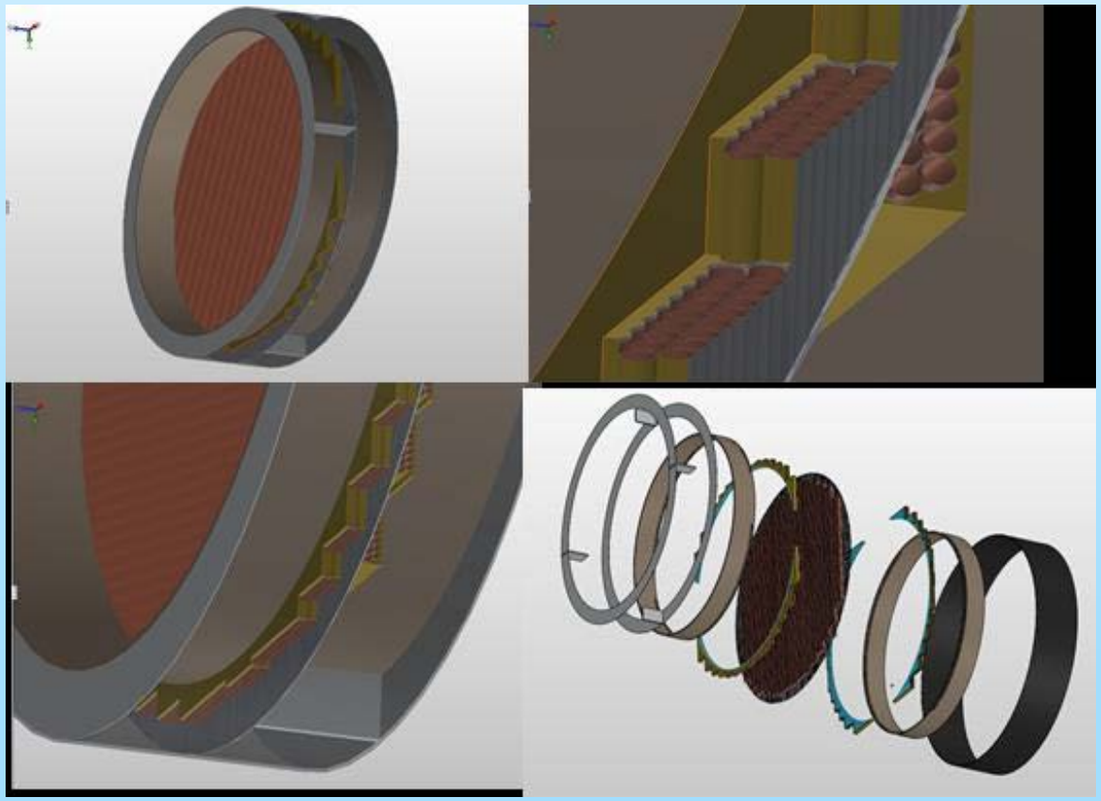


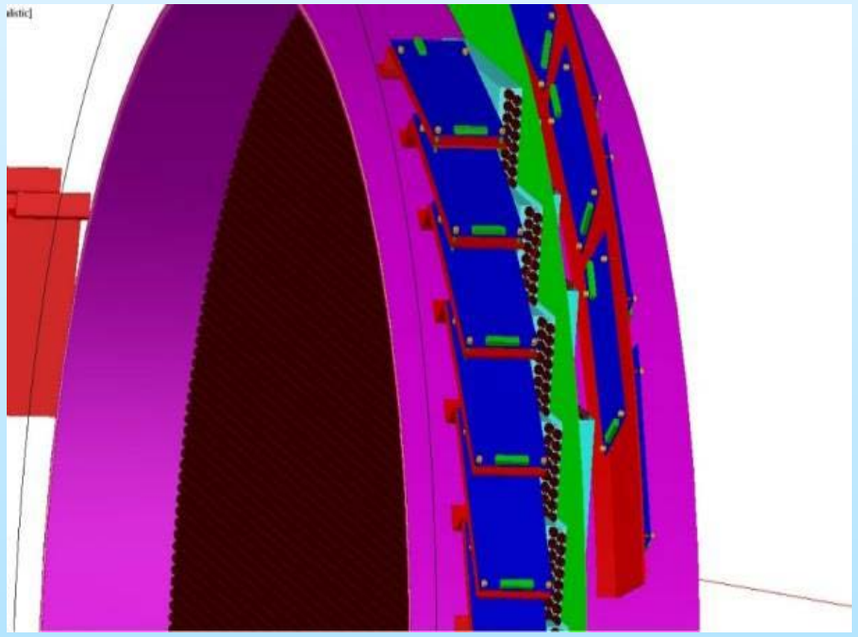


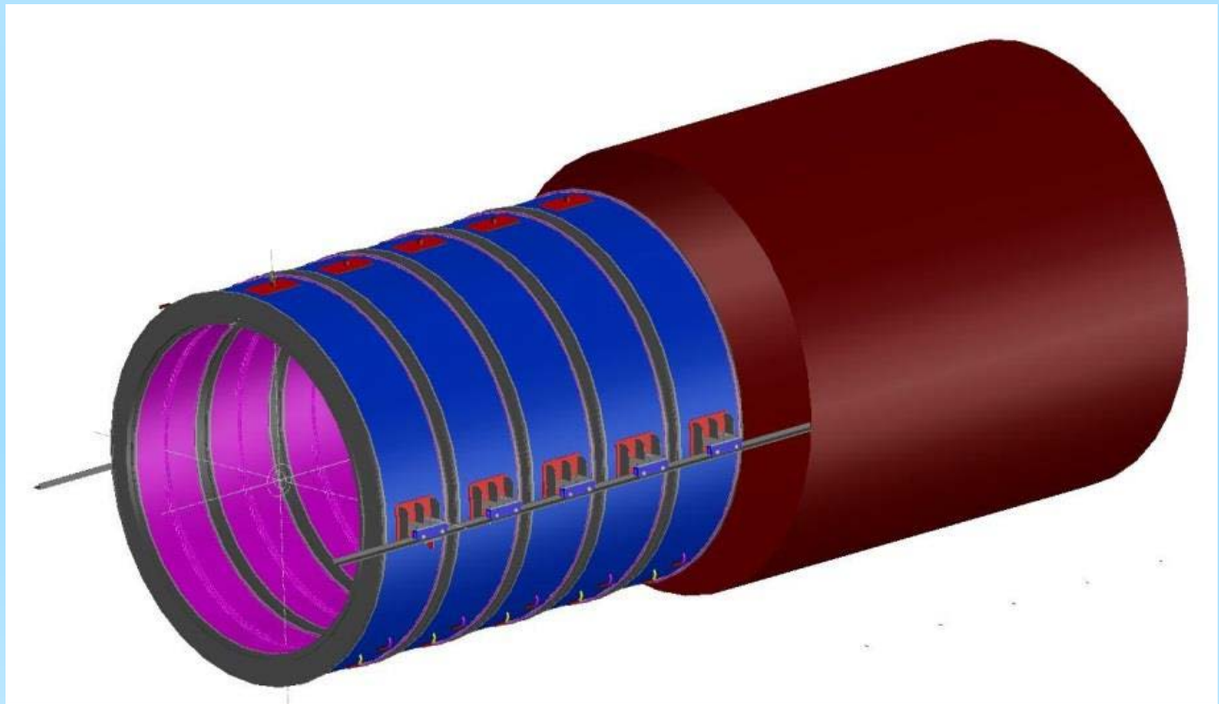
Stress–Strain dependence of straw

Straw design and development

Development of versions of mechanical structure of the straw-detector, location of electronics and assembly of the detector in the solenoid

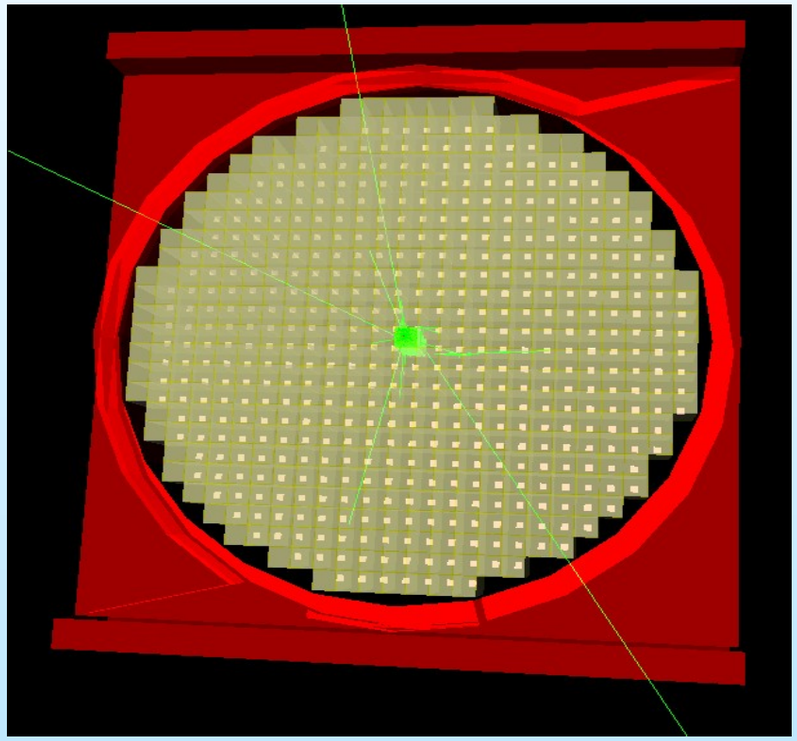






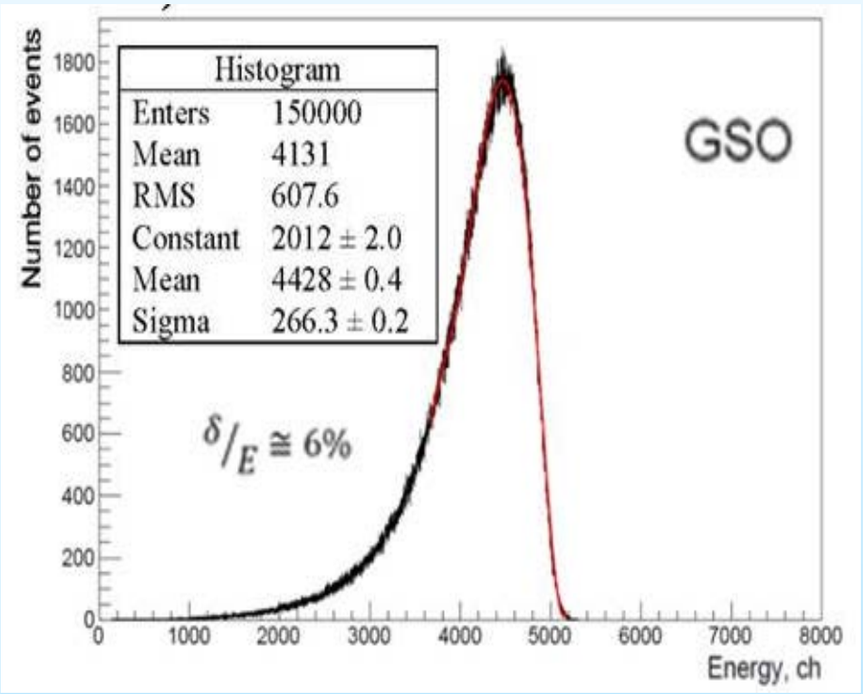
Calorimeter

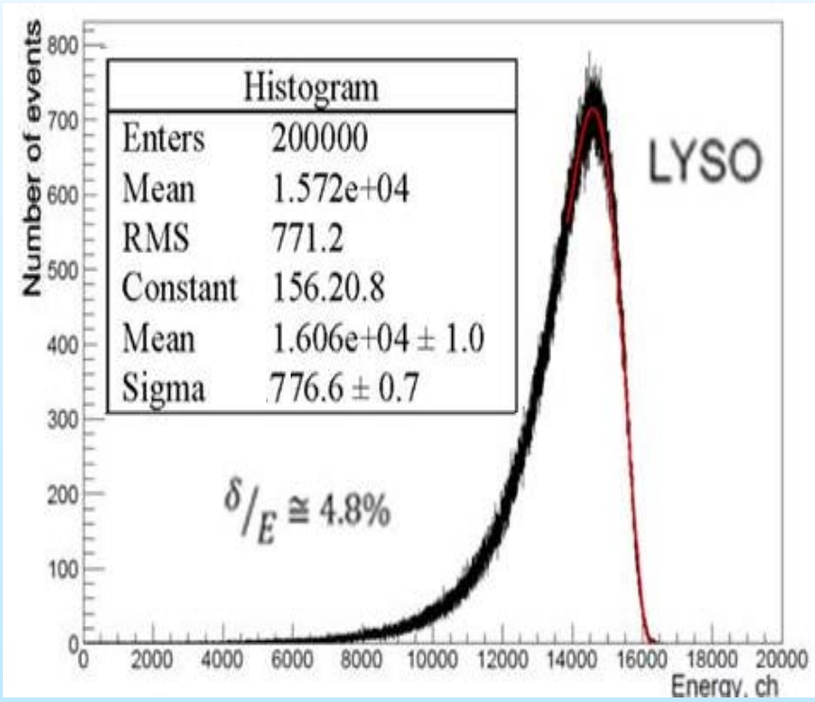
- Simulation of processes in crystals
- Comparison of the crystal types
- Simulation of optimal structure of the calorimeter
- Simulation of the calorimeter geometry in framework ICEDUST
- Experimental study of the main parameters (uniformity, light output) LYSO crystals on a precision JINR stand
- Calibration of 64 crystals of LYSO at the JINR stand for Beam Test (Tohoku, March, 2014)
- Participation in a calorimeter design
- Quality control of all crystals will be tested in JINR (full responsibility)
- Calorimeter assembling, testing, calibration and installation at setup. (In the future)



The test bench has been prepared in DLNP

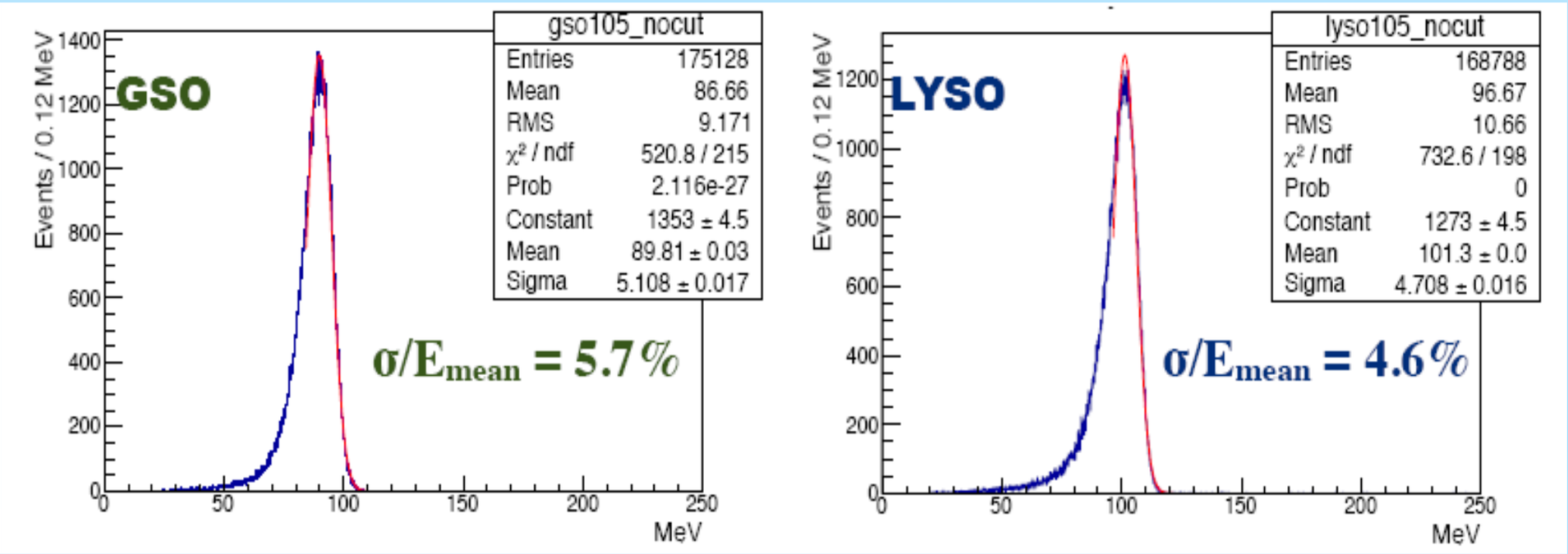
Studies of the crystal properties, light collection, wrapping materials etc. have been done both by simulations and experimentally





GEANT4 + LITRANI

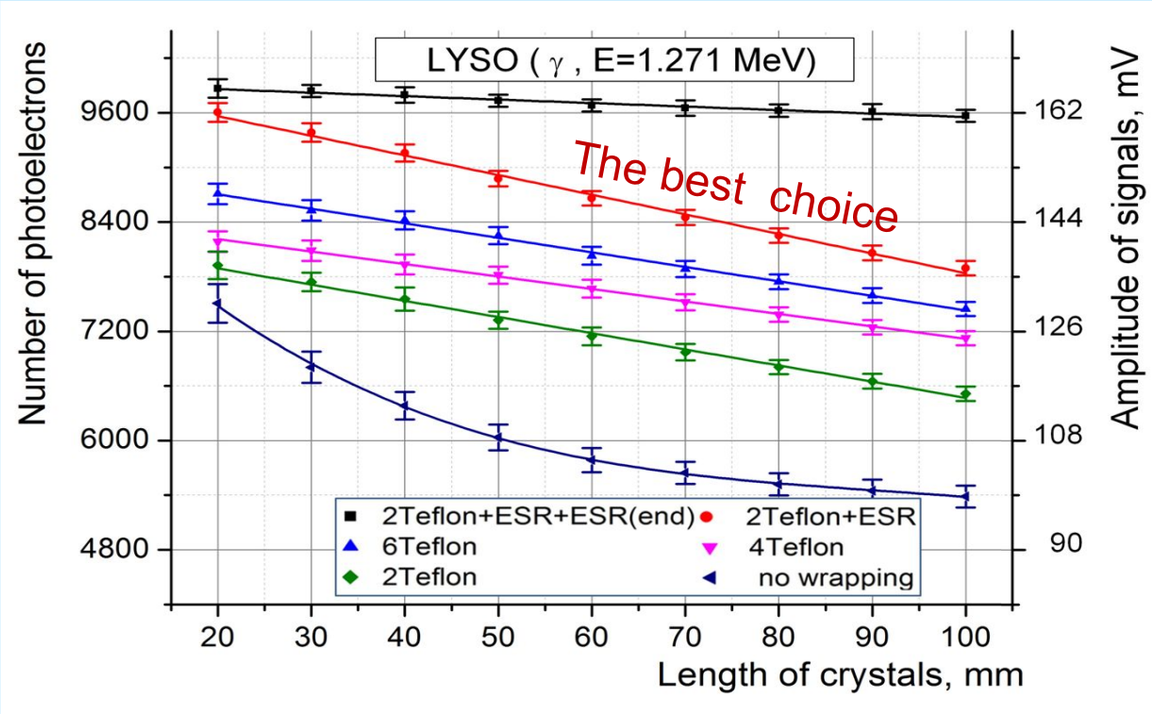
Energy resolution of the calorimeter on GSO and LYSO crystals at the 105–MeV electron beam (simulation)



Energy resolution of the calorimeter prototypes at the 105- MeV electron beam (measurement)

A detailed experimental study of LYSO crystals, at JINR using radiation sources

Light yield non-uniformity along the crystal length with various types of wrapping materials



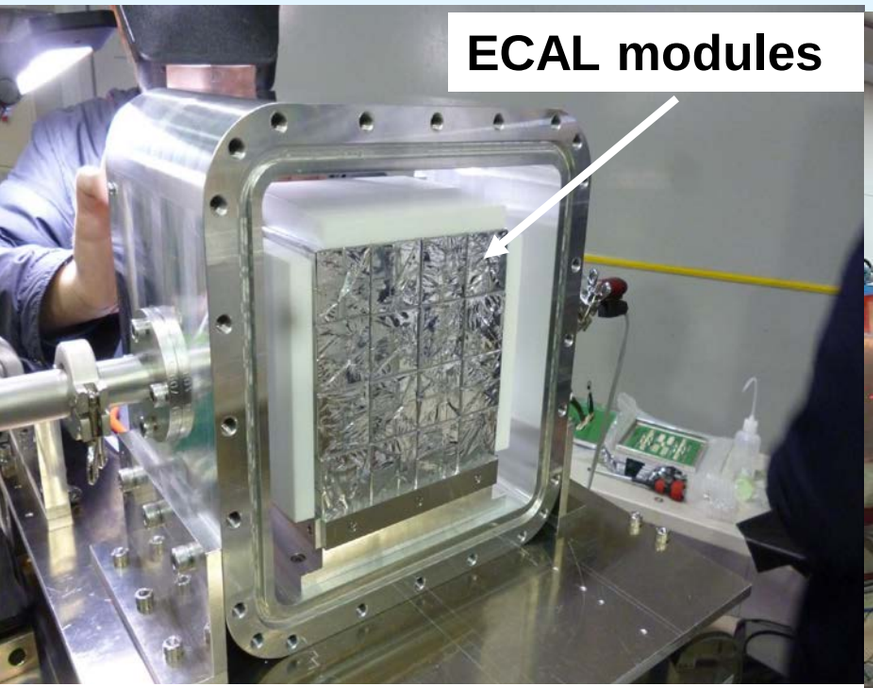
Light yield (LY) non-uniformity, relative yield and energy resolution for various methods of crystal wrapping

Wrapping	LY non-uniformity, % cm^{-1}	Relative LY (L=60nm), %	Energy resolution, (L=60 nm),%
Without wrapping	0.78 ± 0.01	60	11.4
2Teflon	0.4 ± 0.06	74	11.4
4Teflon	0.36 ± 0.05	79	10.6
6Teflon	0.27 ± 0.004	83	9.5
2Teflon+ESR	0.23 ± 0.004	90	8.6
2Teflon+ESR +ESR(end)	0.064 ± 0.003	100	8.6

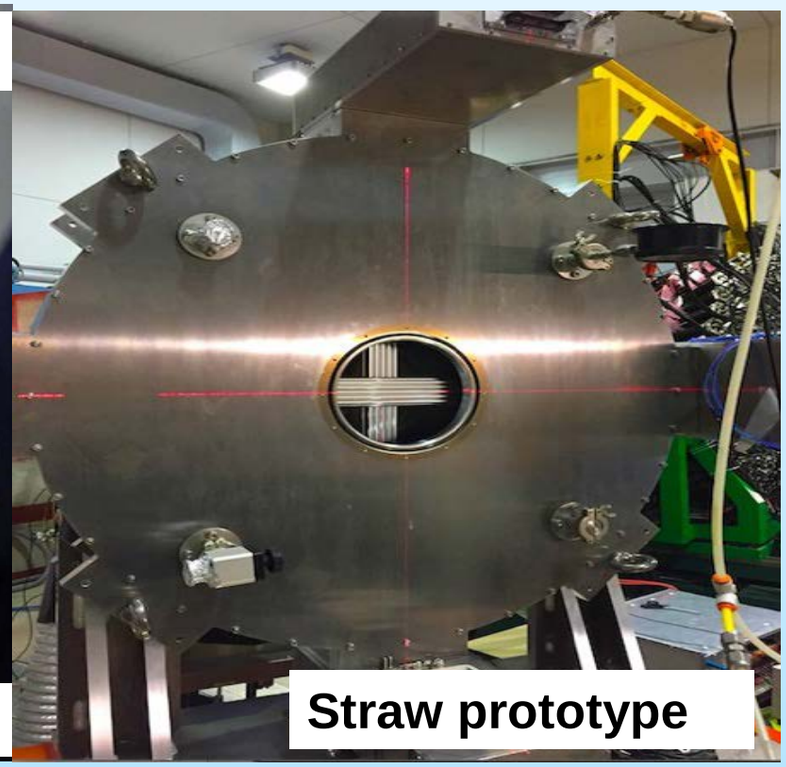
Materials:

- Teflon (AF1601, 60 μm)
- ESR film (VM2000, 69 μm)

Straw-Ecal prototypes combine beam test (2014, 2015, 2016, 2017) at Tohoku University, Japan (1.3 GeV electron cyclotron)



ECAL prototype 64 (8x8) JINR crystals



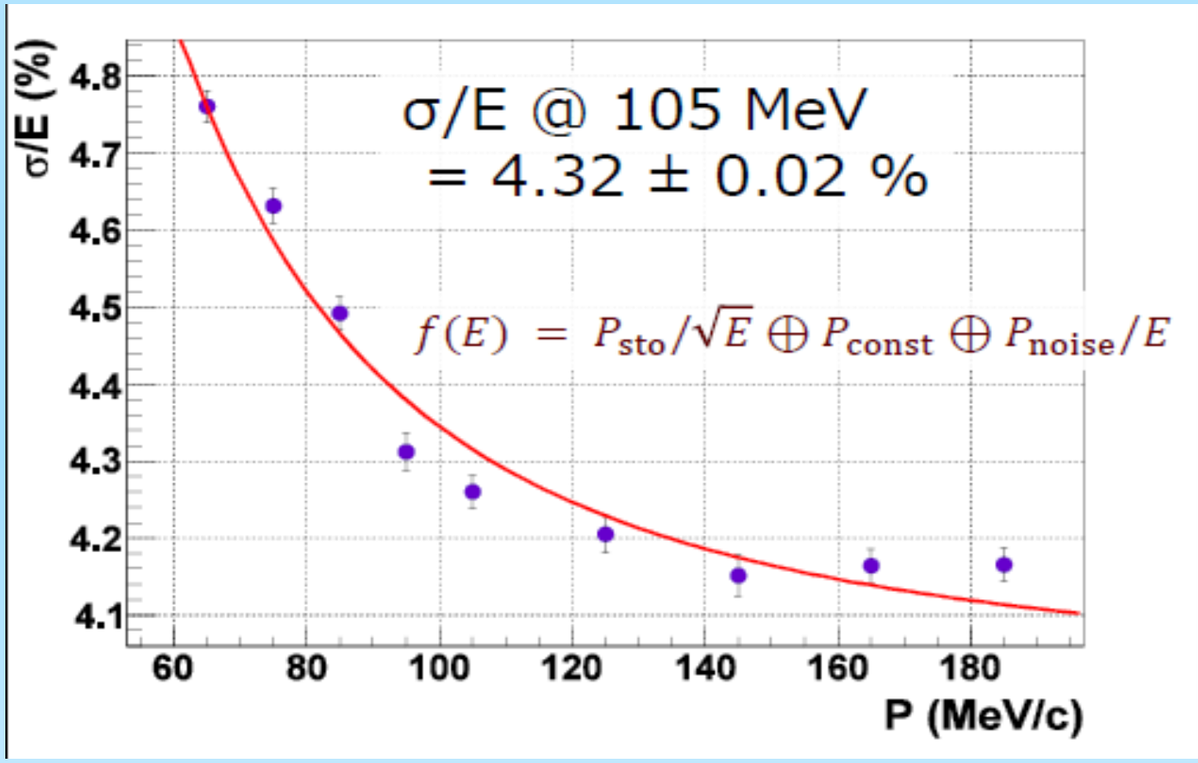
Straw prototype

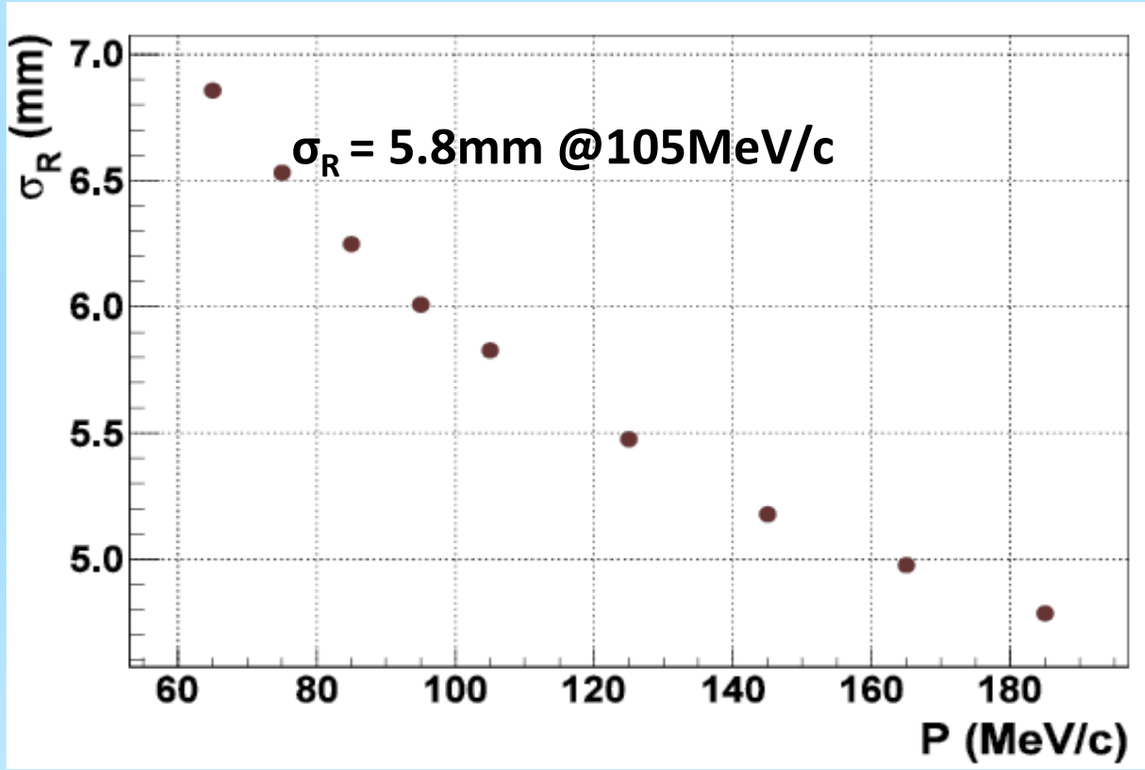
Many tests carried out using full-scale prototype

- Establish the construction procedure
- Evaluate out-gas rate of straw tubes
- No, leak, no significant out-gas
- **Operation in vacuum performed in success**

The results of straw efficiency and spatial resolution

- **ε > 96%**
- **σ =143μm**





План работ 2018-2023

- Сборка строу-детекторов для Фазы-I 2018-2019
- R&D программа по производству строу трубок с толщиной стенок 12 мкм и диаметром 5мм для Фазы II 2018-2020
- Производства трубок и сборка детектора для фазы II 2020-2023
- Разработка конструкции калориметра 2018-2020
- Тестирование в ОИЯИ кристаллов для калориметра 2017-2021
- Сборка калориметра, тестирование и инсталляция для фазы I 2019-2020
- Сборка калориметра, тестирование и инсталляция для для фазы II 2020-2022
- Тестовые измерения на пучке компонент детектора 2017-2021
- Сборке, наладке и тестировании всего детектора 2018-2022
- Технический и физические сеансы фазы I,II 2019-2023
- Набор статистики и обработка данных фазы I,II 2021-2023

Thank you for attention!