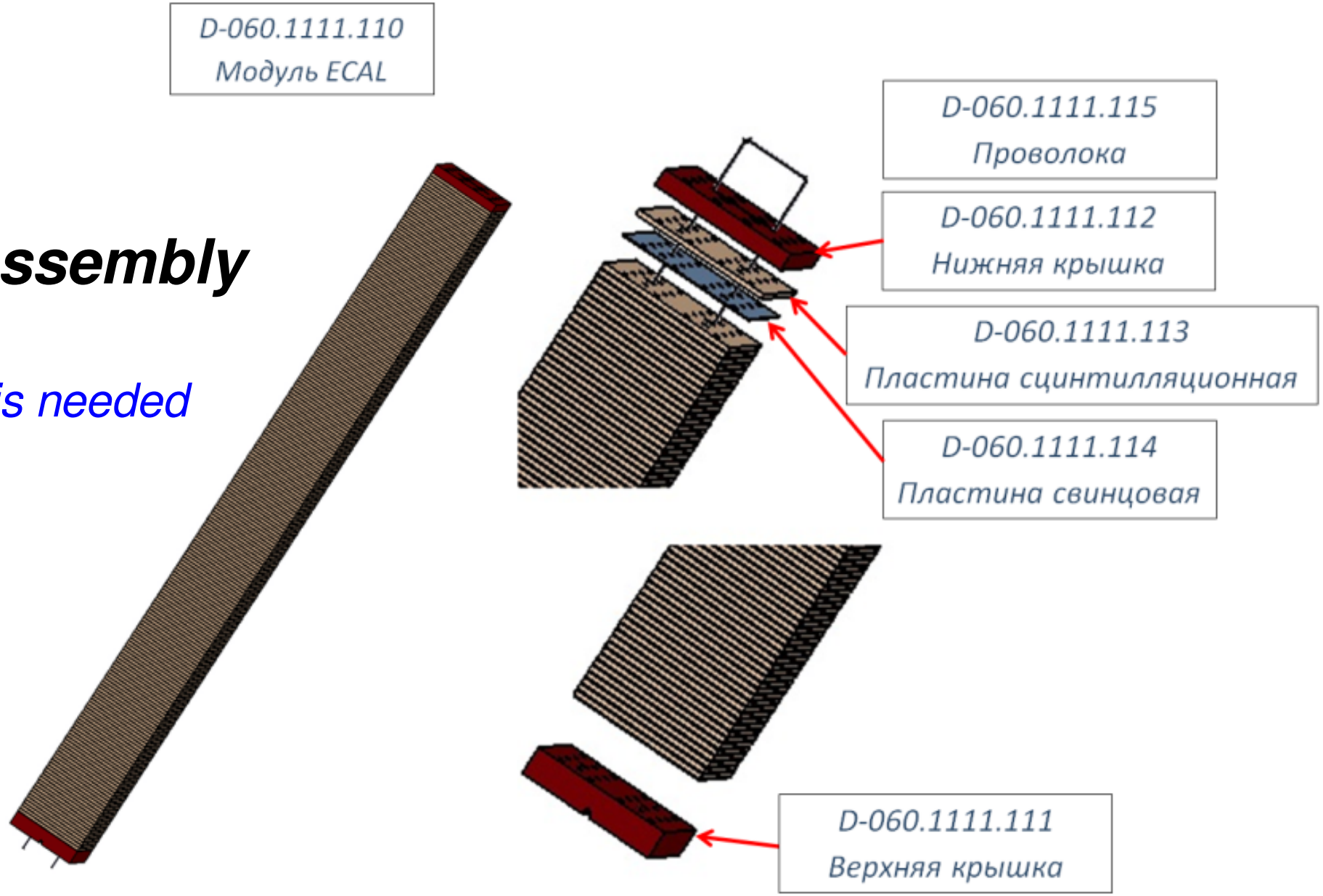
# Update on ECAL Construction

***Andrei Semenov and MPD ECAL Group***

*Dubna, January 23, 2019*

# ECAL Tower Assembly

*About 43k towers is needed*

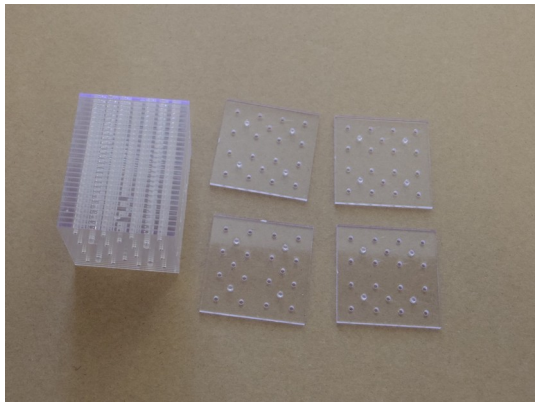


# Components

- **Scintillator plates, 40x40x1.5 mm³**

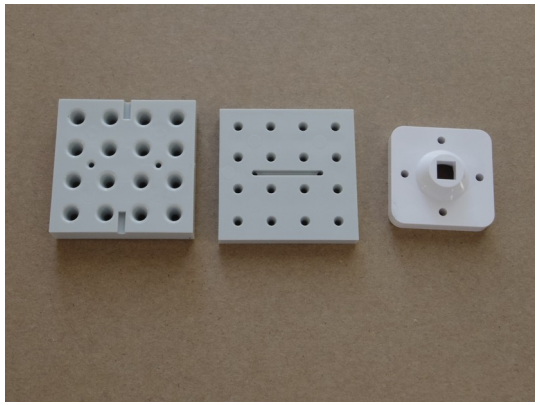
  *Polypac company (Dubna) and Uniplast company (Vladimir)*

  ***(Total amount ≈ 10 ⁷ plates; at the moment, more than 50% of plates are produced)***



- **Pressure plates and fiber bonding plate**

  *Polypac (Dubna) – half of the full set is produced*



- **Lead plates, 40x40x0.3 mm³**

  *IHEP(Protvino) + ARMUL company (Mytishchi, Mockow region)*

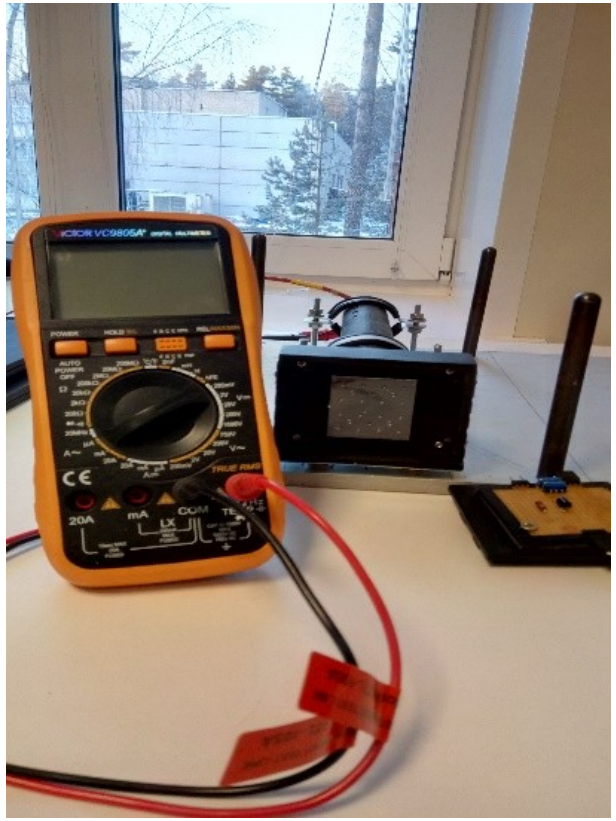
  ***(Total amount ≈ 10 ⁷ plates)***

- **Lead painting, layer thickness of 50μm**

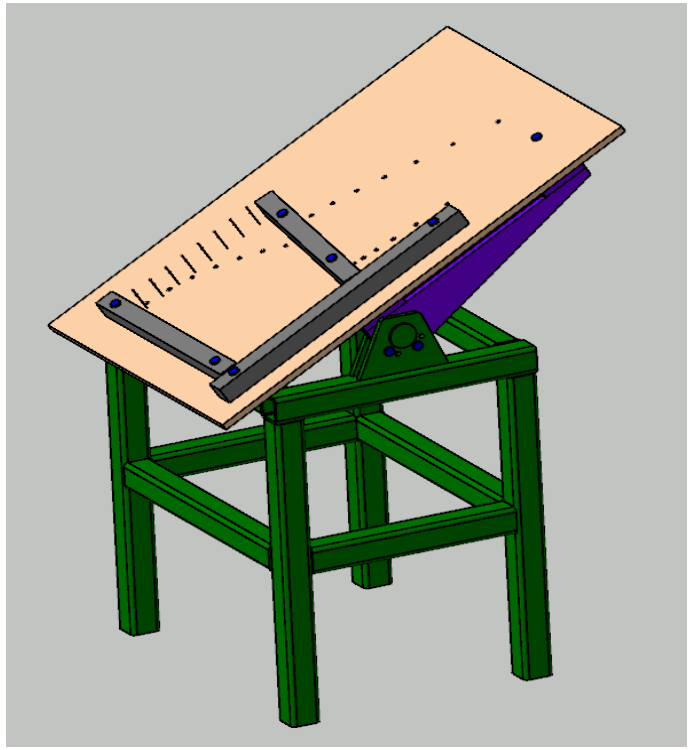
  *Helios company (Dubna)*

  ***(Pilot batches)***

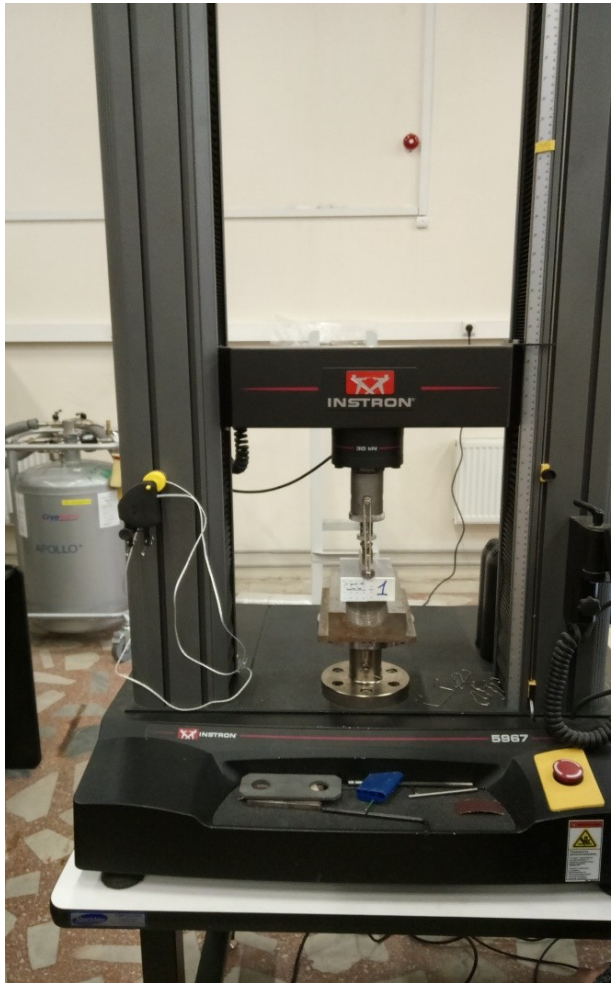
# *Modules Gluing and Tests*



Tests of scintillator light output and painted lead reflectivity

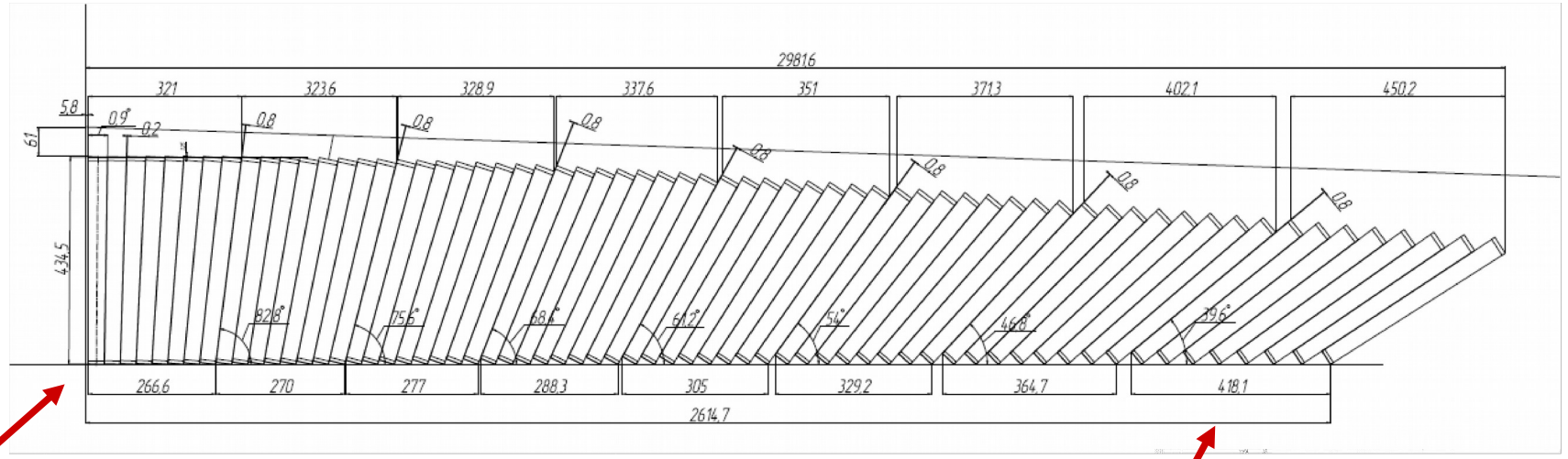


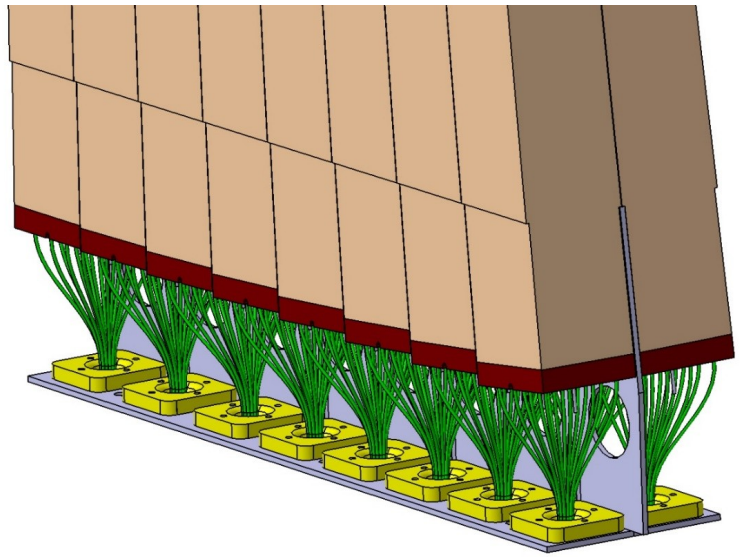
Universal tool for towers gluing



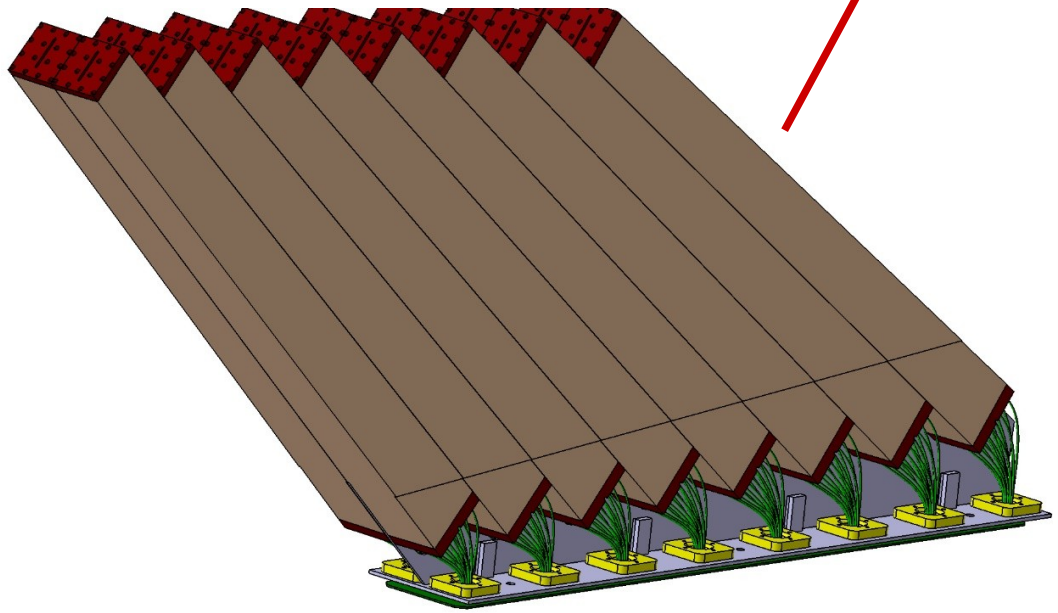

Tests on the bonding strength of the $TiO_2$-based paint-glue

# *Eight Module Types for Projective Geometry of ECAL*



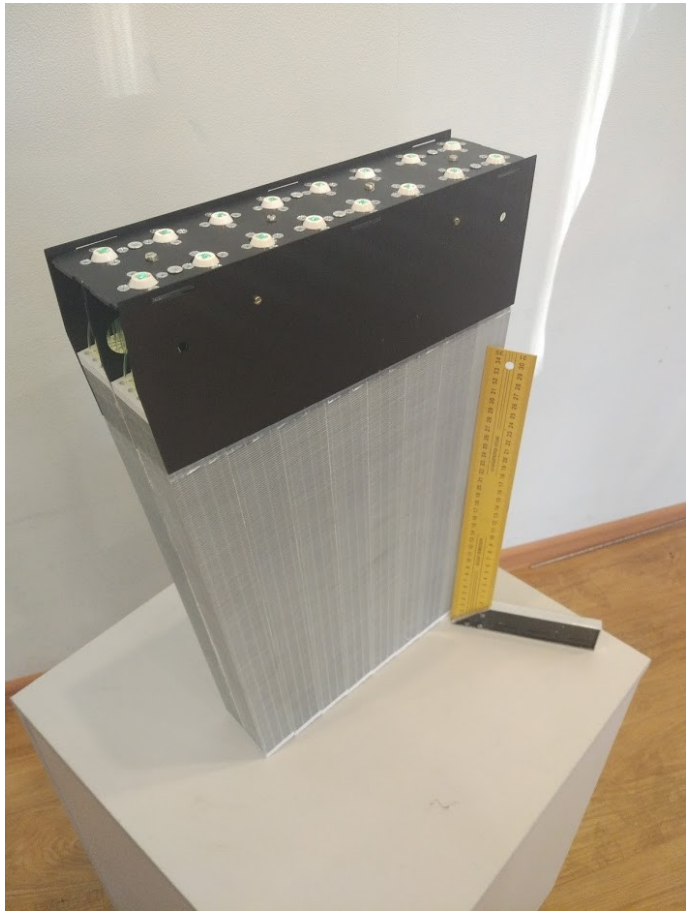



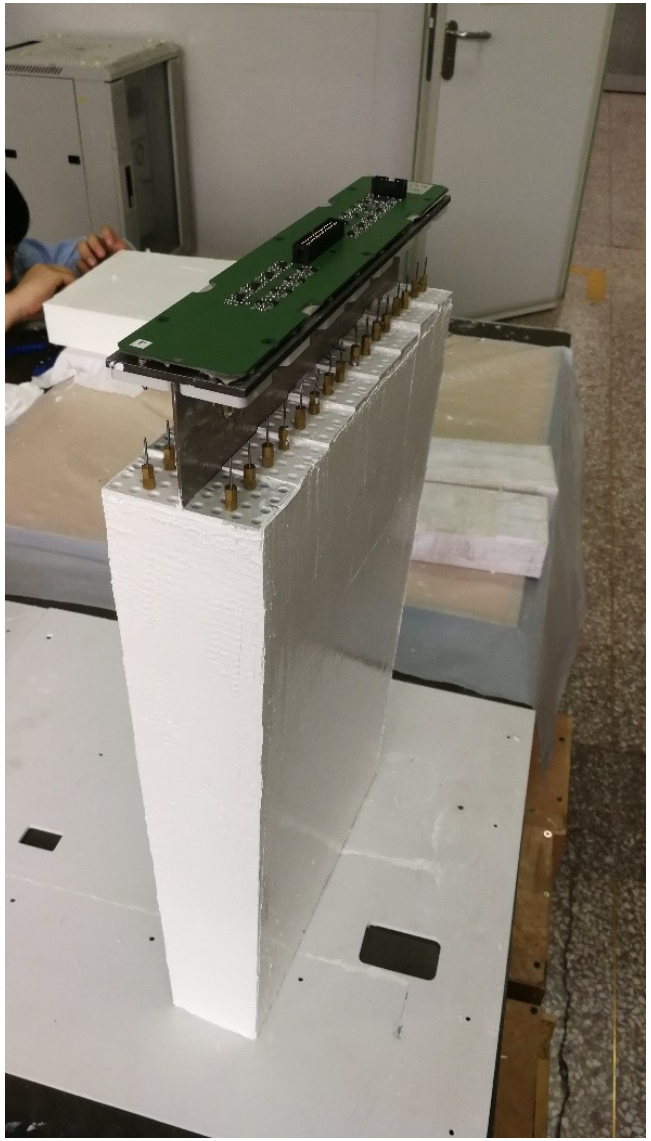
1st Module Type



8th Module Type

# *Prototype Modules Made in Protvino and China*





**The same production technology is used at all construction sites**

# *Timelines for ECAL Modules Production*

## Russia Contribution (25%):

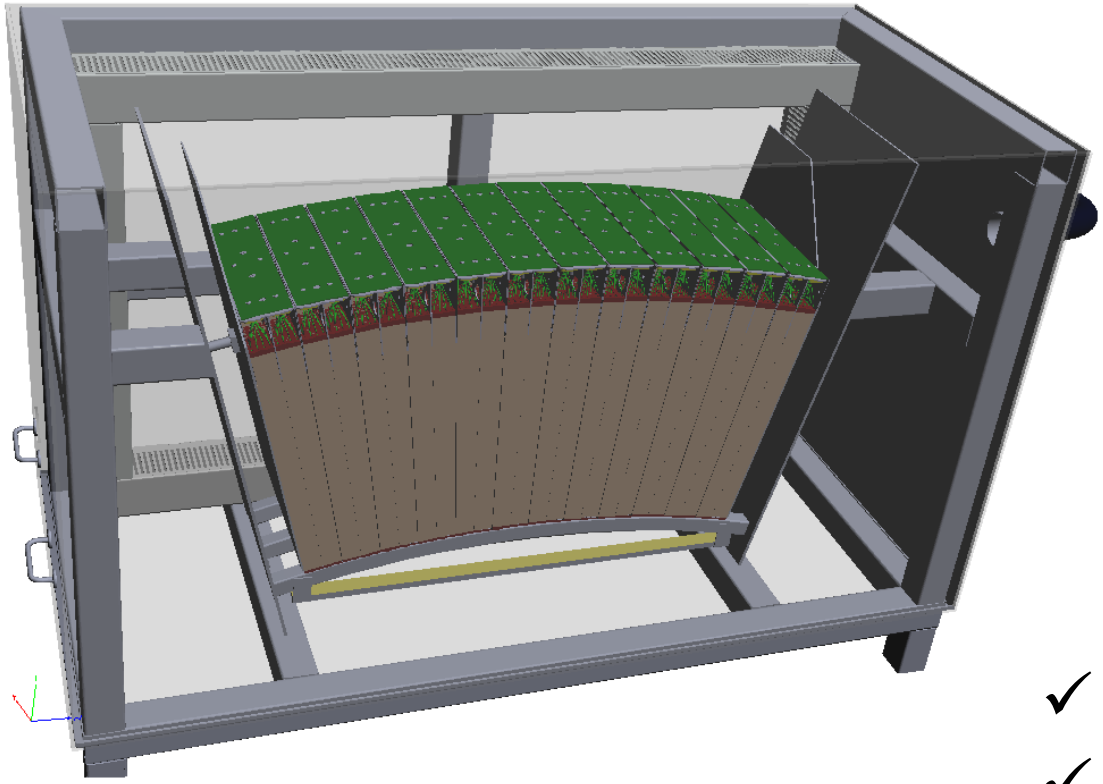
- **IHEP (Protvino)**: 2 sectors in 10 months from now
  +2 sectors by the end of Summer 2020

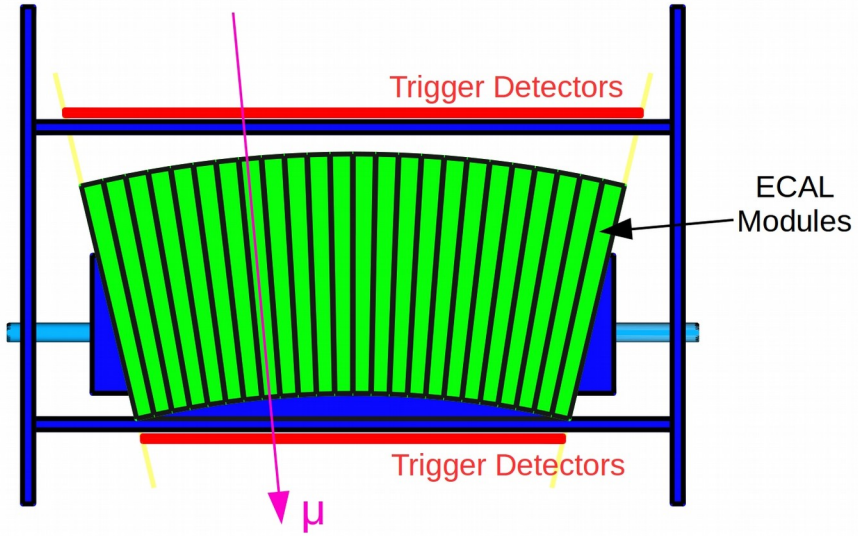
- **Tenzor (Dubna)**: 1 sector in 6 months from now
  +2 sectors by the end of Summer 2020


## China Contribution (75%):

- Tsinghua University (Beijing, China) + 3 other universities:
  we hope that financing will be started in 2019

# Stand for ECAL Modules Calibration

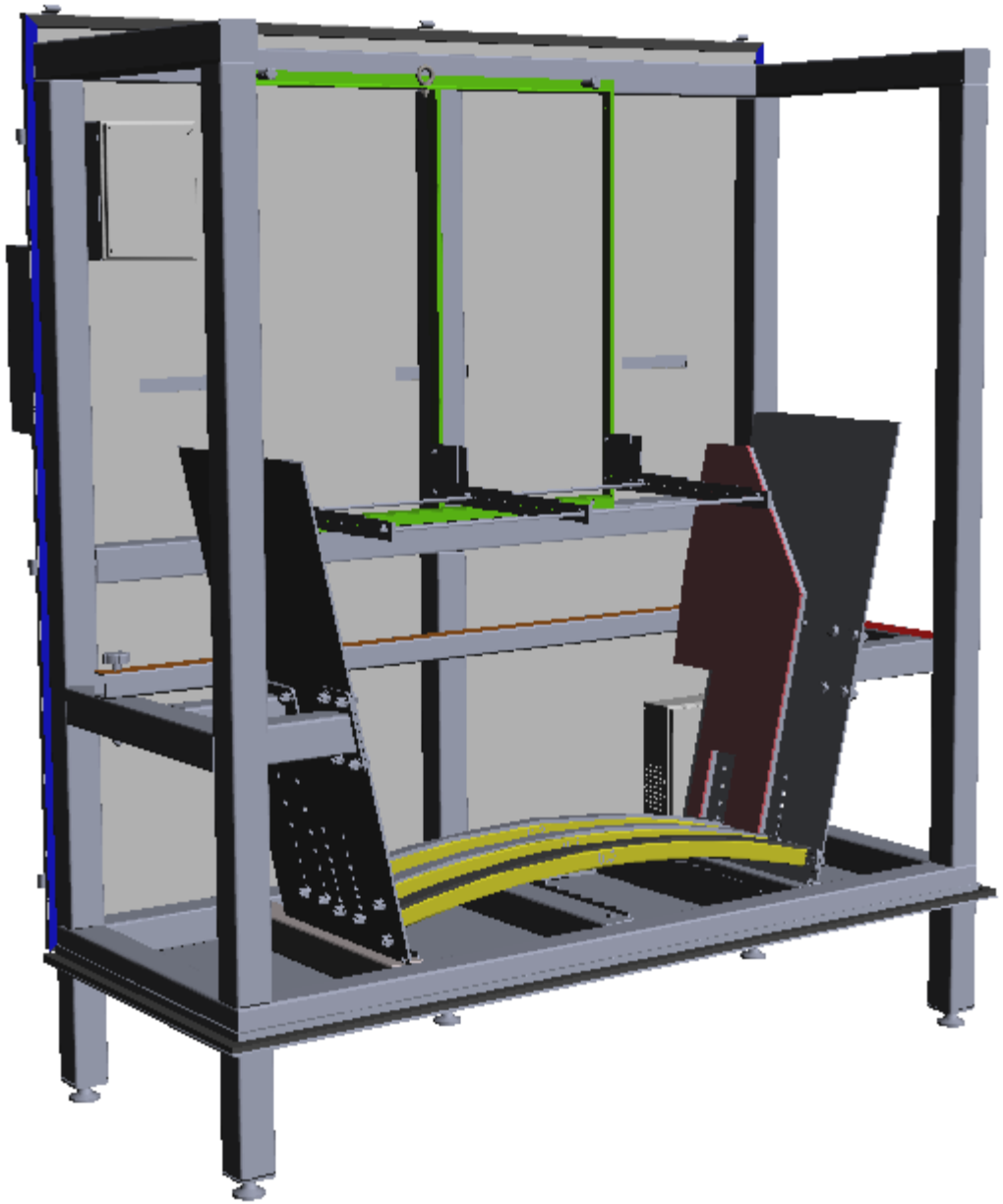




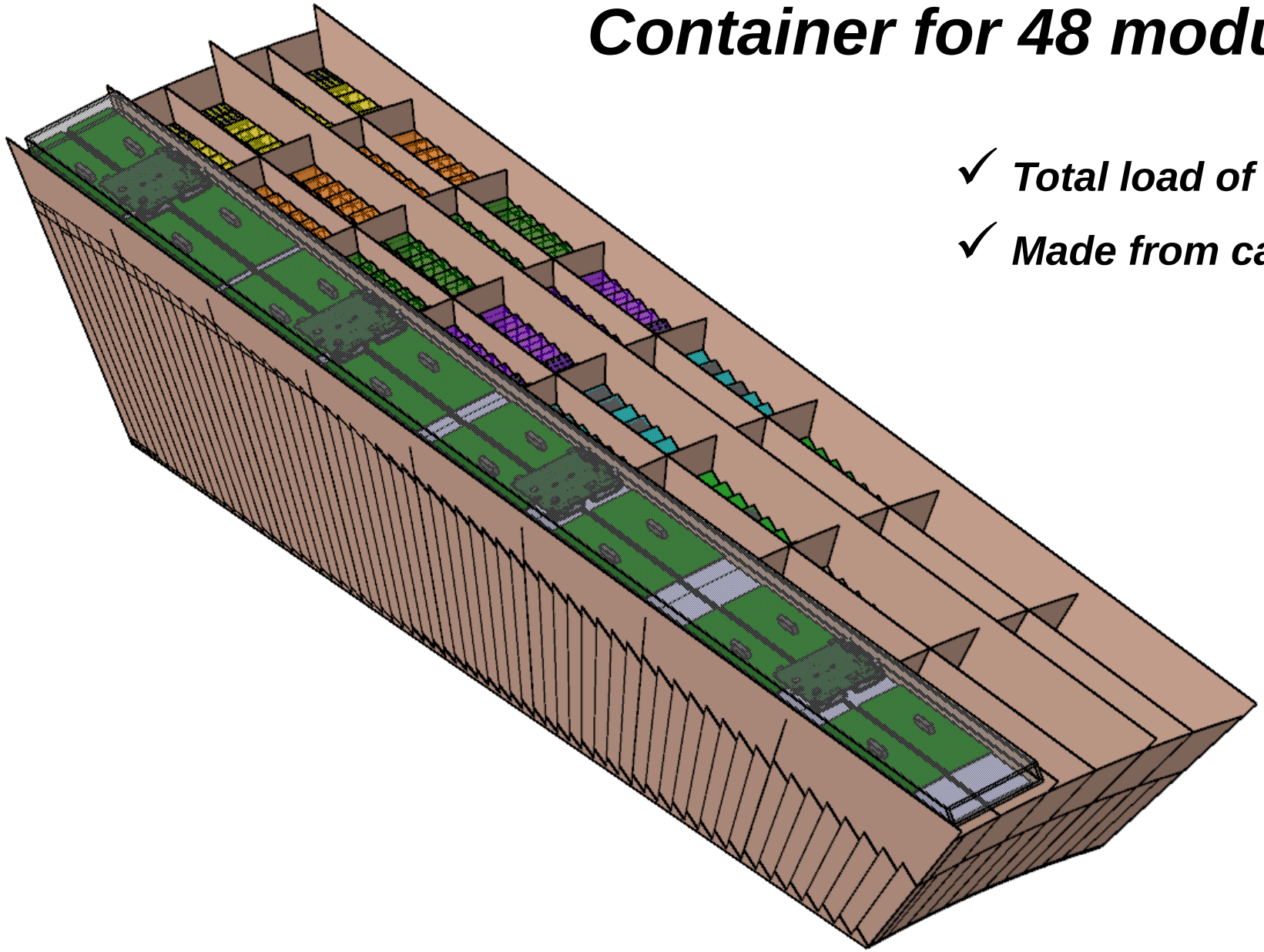

- ✓ *Cosmic rays*
- ✓ *Test one load (12 modules) in 10-14 days*
- ✓ *8 stands for 8 types of modules (with possibility of stend reconfiguration if needed)*
- ✓ *All modules test and calibration in about 1 year*

# *Production of Calibration Stands*


- ✓ *Contract with Tenzor Company*
- ✓ *Engineering documentation is ready*
- ✓ *Sample stand is under production*
- ✓ *After the test of the sample stand, a tender for all stands production will be conducted*

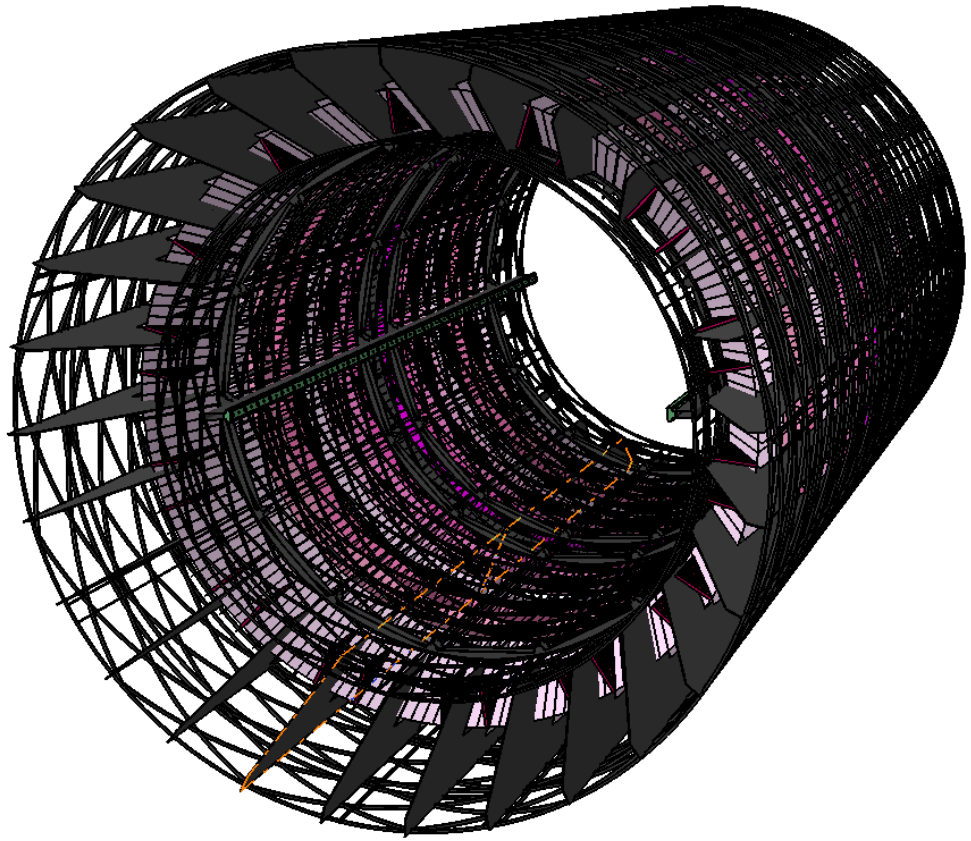


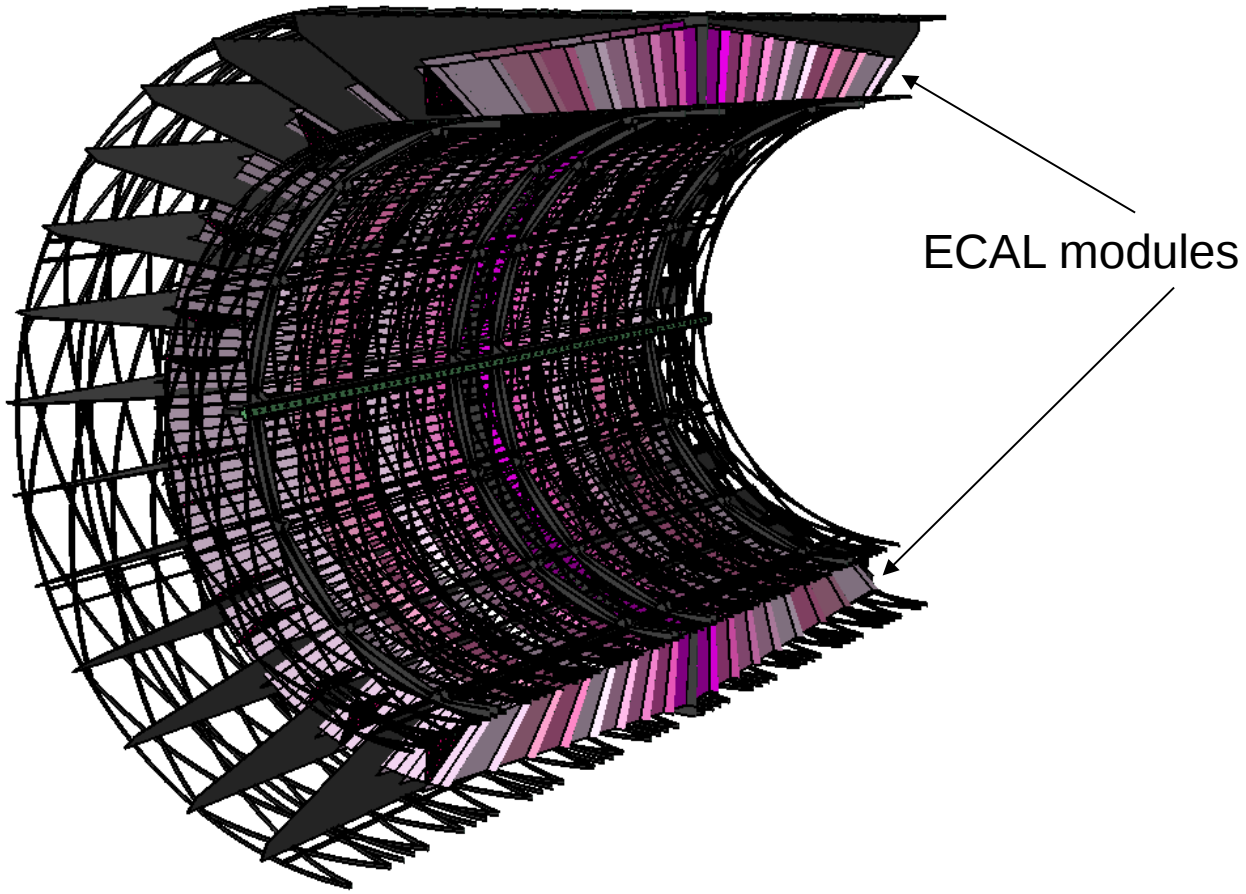
# *Container for 48 modules (half-sector)*



- ✓ *Total load of about 1.2 tons*
- ✓ *Made from carbon composite*

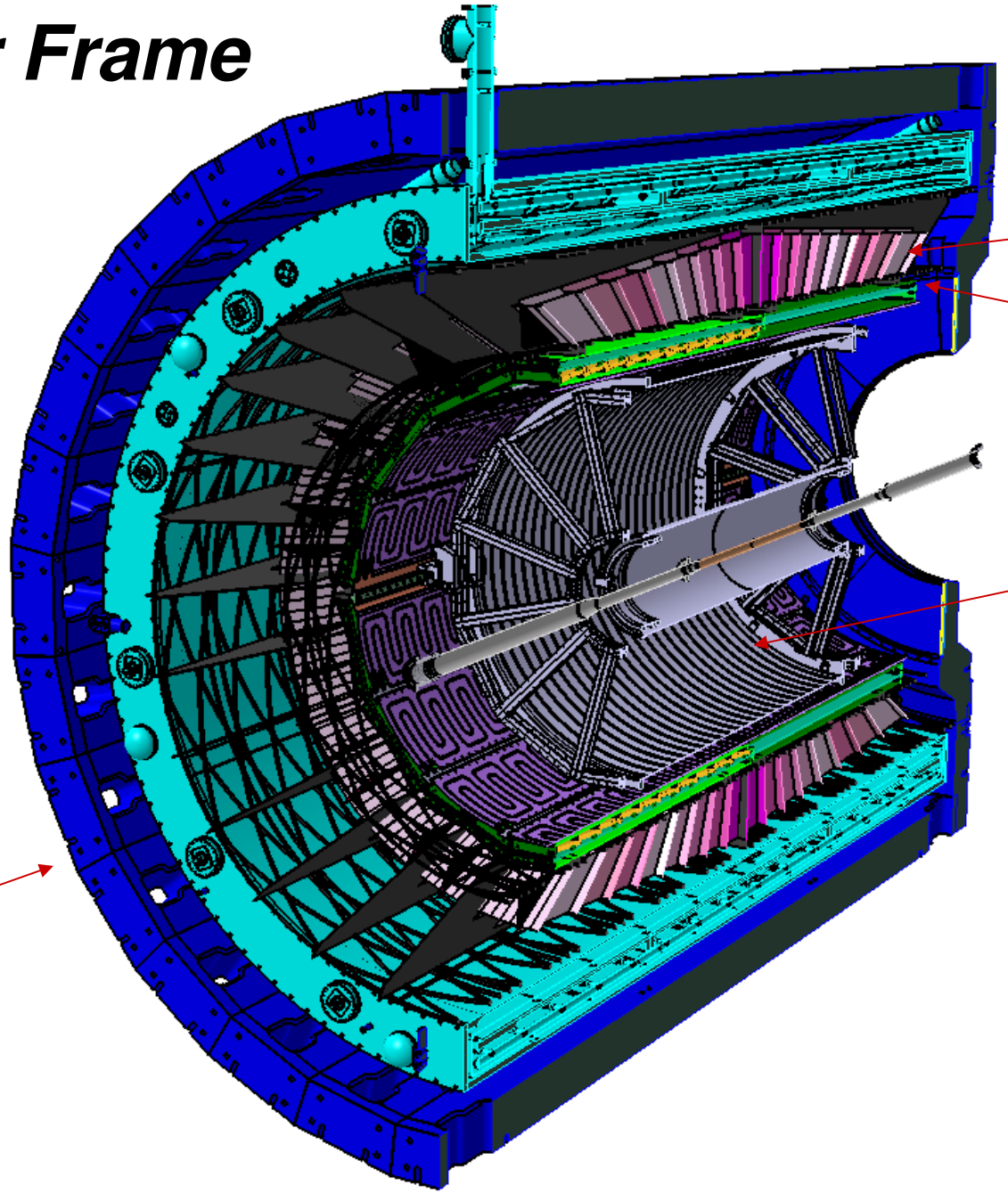
# *MPD Power Frame*

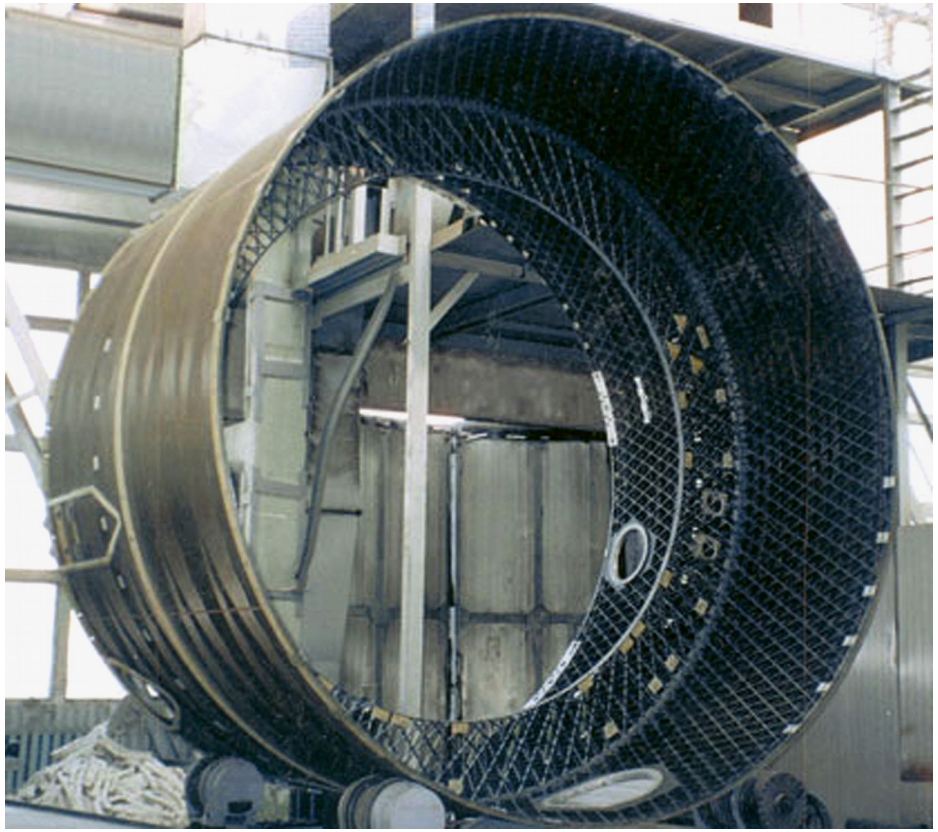





- ✓ ***More than 6-m long and about 4.5 m in diameter***
- ✓ ***Inner and outer mesh cylinders (carbon composite)***
- ✓ ***27 compartments for 54 half-sectors***
- ✓ ***Total load of about 100 tons***
- ✓ ***Maximal frame sagging should be less than 0.5 mm***

# *MPD Power Frame*





## CENTRAL RESEARCH INSTITUTE FOR SPECIAL MACHINERY

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### About the Institute

The Central Research Institute for Special Machinery, Joint Stock Company (CRISM JSC) founded in 1963 in Khotkovo and reorganized into a joint stock company in 1993 is a leading Russian enterprise in design and production of structures on the basis of advanced polymer composite materials for rocket & space engineering, transport, power, petrochemical machinery and other industries.

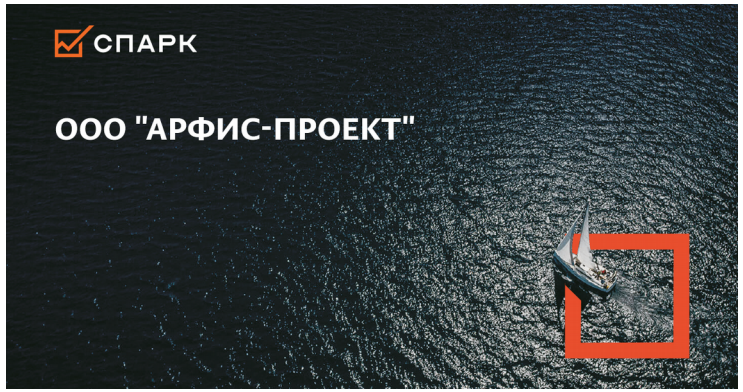
- ✓ ***Extensive experience in design and production of big power frames***
- ✓ ***Unique technologies***
- ✓ ***Good history of collaboration with JINR (production of TPC cylinders for MPD)***

# *Timelines for Containers and Frame*

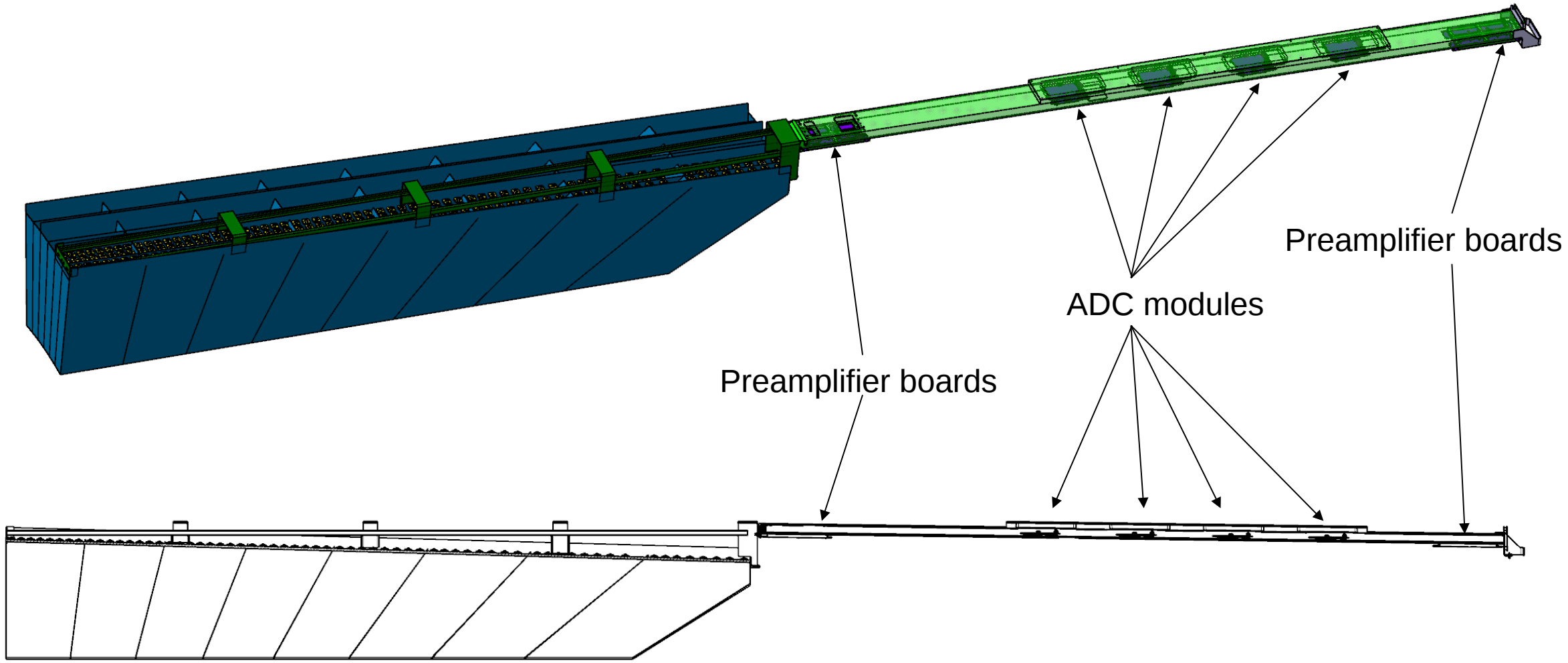
- ✓ ***Contracts with CRISM JSC to perform frame and container durability calculations and make 3D models are under negotiations***
- ✓ ***Plan to have the engineering documentation by the end of the Summer 2019***
- ✓ ***After that, the tender for production of the frame and the total amount of 54 containers will be conducted (hope to have the contract with CRISM JSC)***
- ✓ ***Hope to have the frame and containers ready by the end of the Summer 2020***

# *Installation of ECAL Electronics*

***Preliminary Concept from Arfis-Project Company***

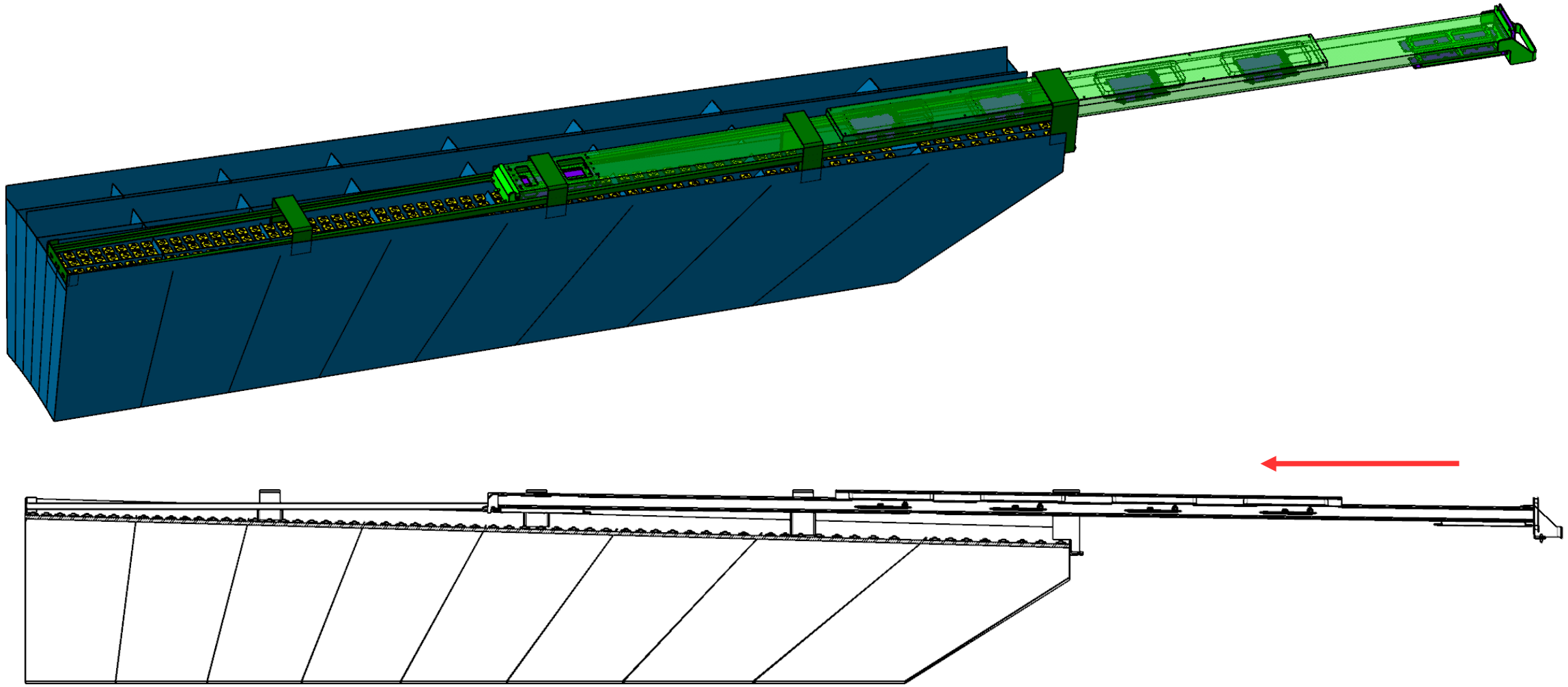



- ✓ ***One unit (box) carries 4 ADC boards (inside the box) and 16 preamplifier boards (below the box)***
- ✓ ***The unit contains signal, power and cooling lines***
- ✓ ***One installation unit for every 16 modules (viz., 3 unique boxes for every half-sector)***
- ✓ ***Exact positioning of the preamplifier boards before the half-sector installation***
- ✓ ***SiPMs positioning accuracy of about 0.2 mm***
- ✓ ***Ability to extract and re-install electronics without dismounting the calorimeter***

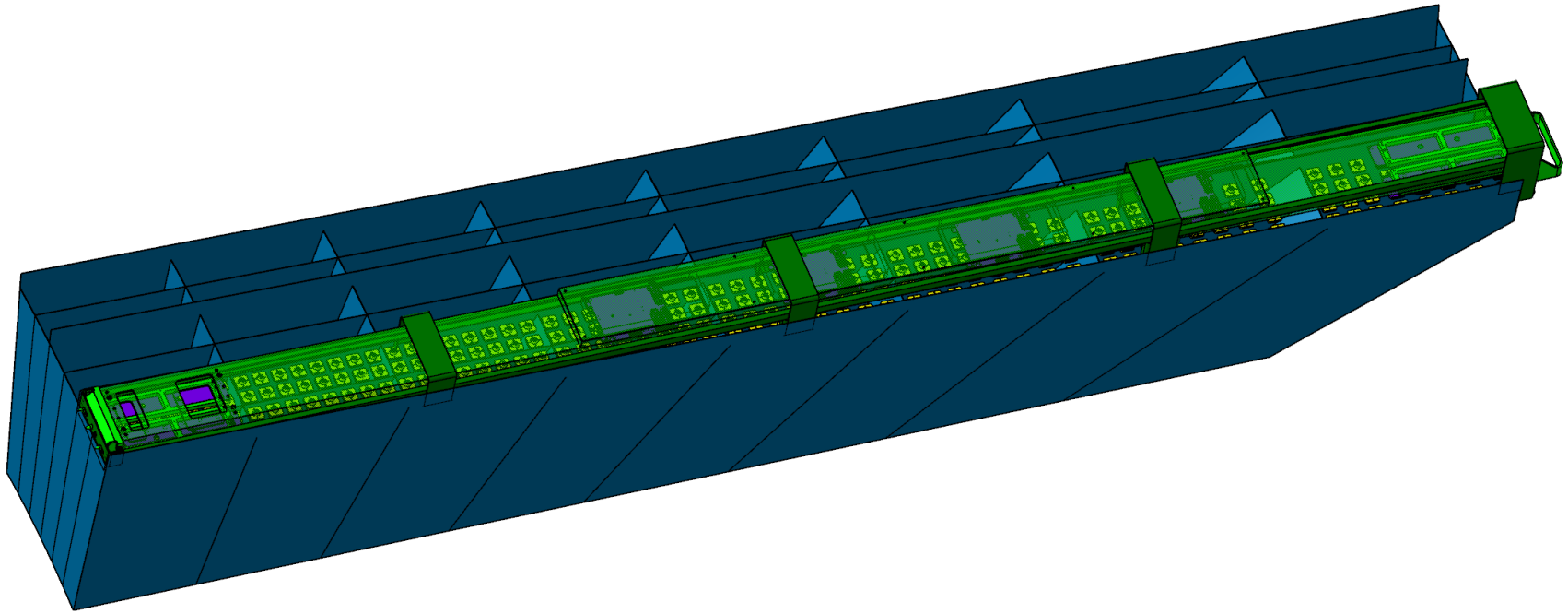


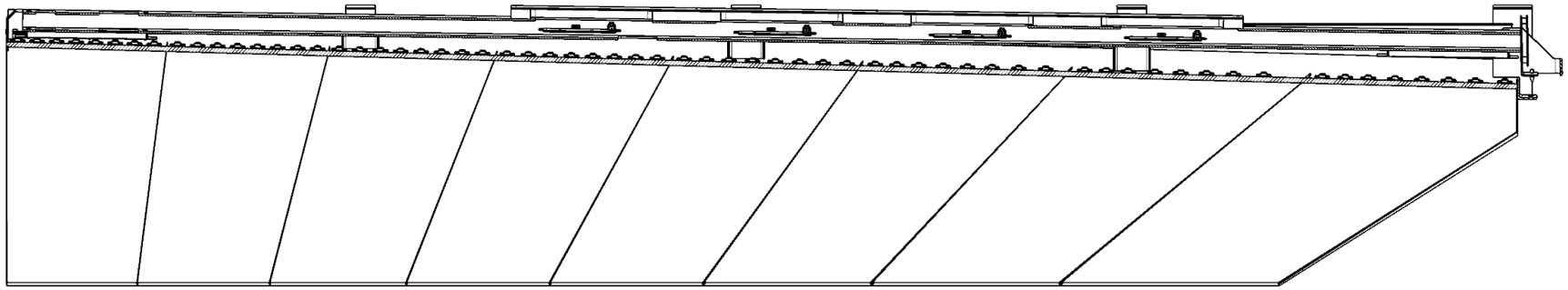

**Installation step #1**: ***The box with electronics (shown in green) is outside the half-sector.***

All four ADC modules inside the box as well as 4 preamplifier boards (out of 16) below the box are shown.

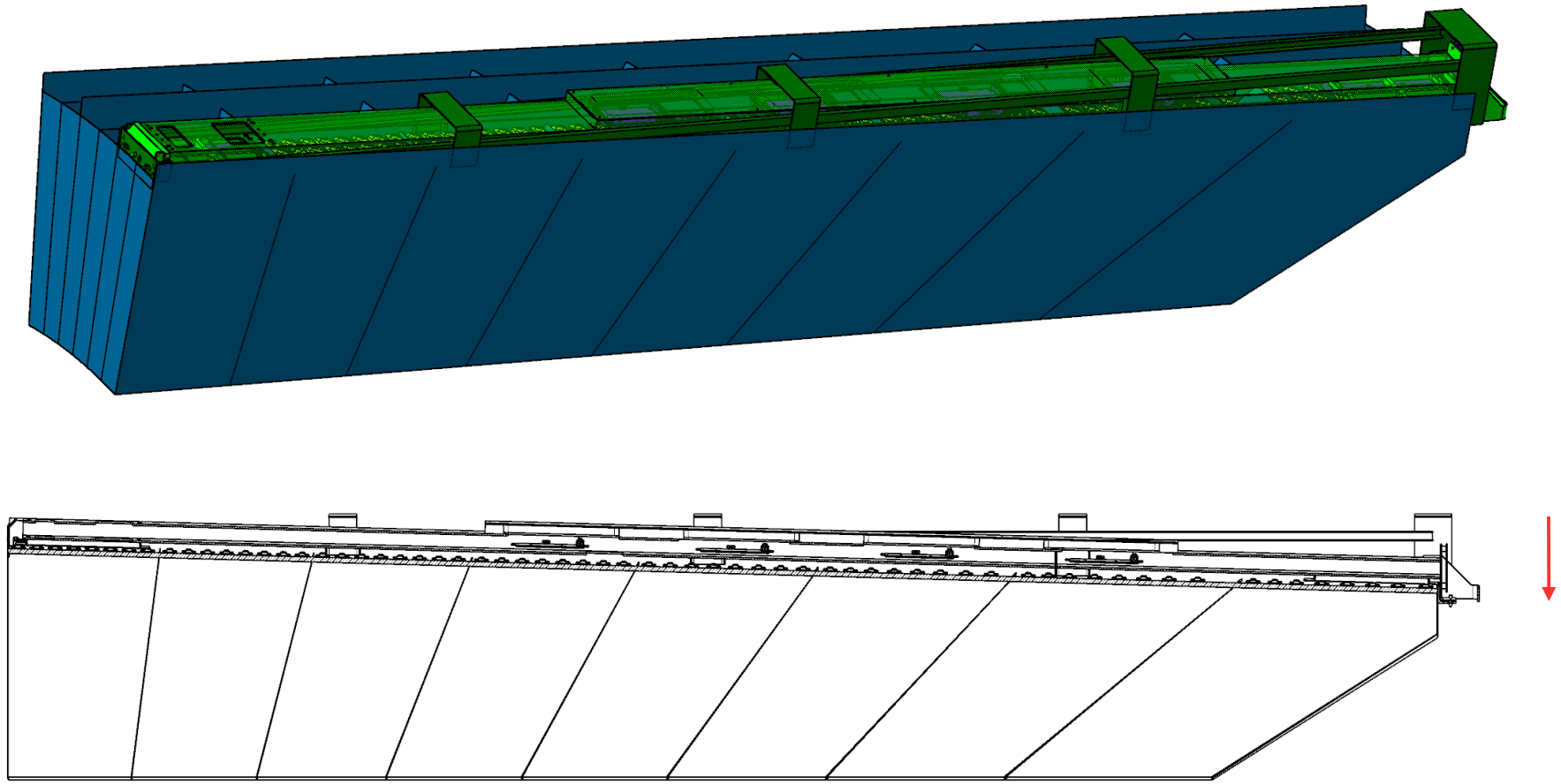


**Installation step #2**: ***The box with electronics moves parallel to the beam direction, and it's half-way inside the half-sector.***





**Installation step #3**: ***The box with electronics is completely inside the half-sector. SiPMs are still located far away the fiber's output windows.***



**Installation step #4**: ***The box with electronics is lowered to the operation position. SiPMs have fixed gaps with the fiber's output windows.***

# *Timelines for Electronics Installation System*

- ✓ ***Contract with Arfis-Project to produce engineering documentation is under negotiations***
- ✓ ***Plan to have the documentation by the end of April 2019***
- ✓ ***After that, the tender for production of the sample unit and the total amount of 162 units will be conducted***

# *Conclusions*

- ✓ **We expect the MPD frame to be ready by the Fall 2020**
- ✓ **We plan to have 7 sectors (25%) of ECAL by the end of 2020**
- ✓ **We expect that the financing of China contribution (20 sectors or 75% of ECAL sectors) will be started in 2019**