

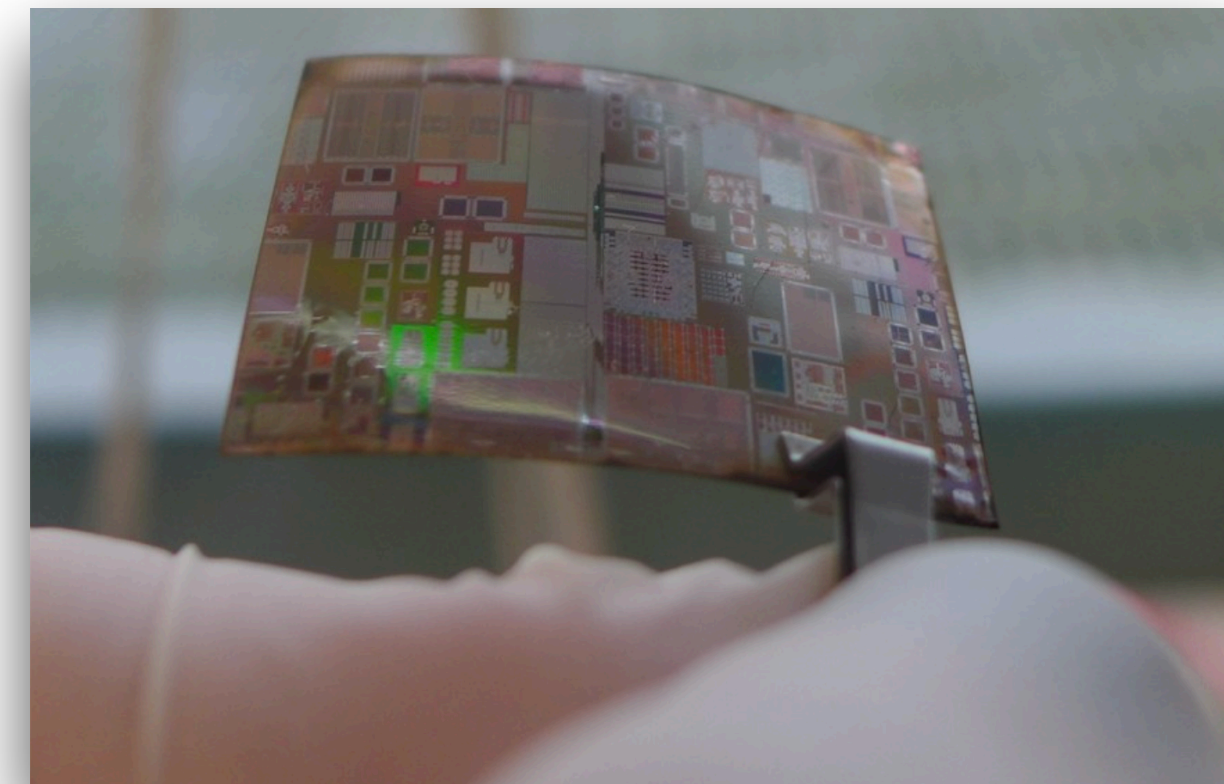
MPD - ITS



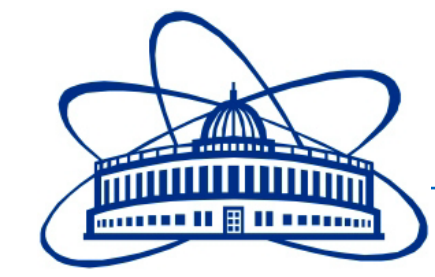
MPD-ITS on CREMLIN+ WP7.

MAPS sensors beyond the state of art.

César Ceballos Sánchez - JINR

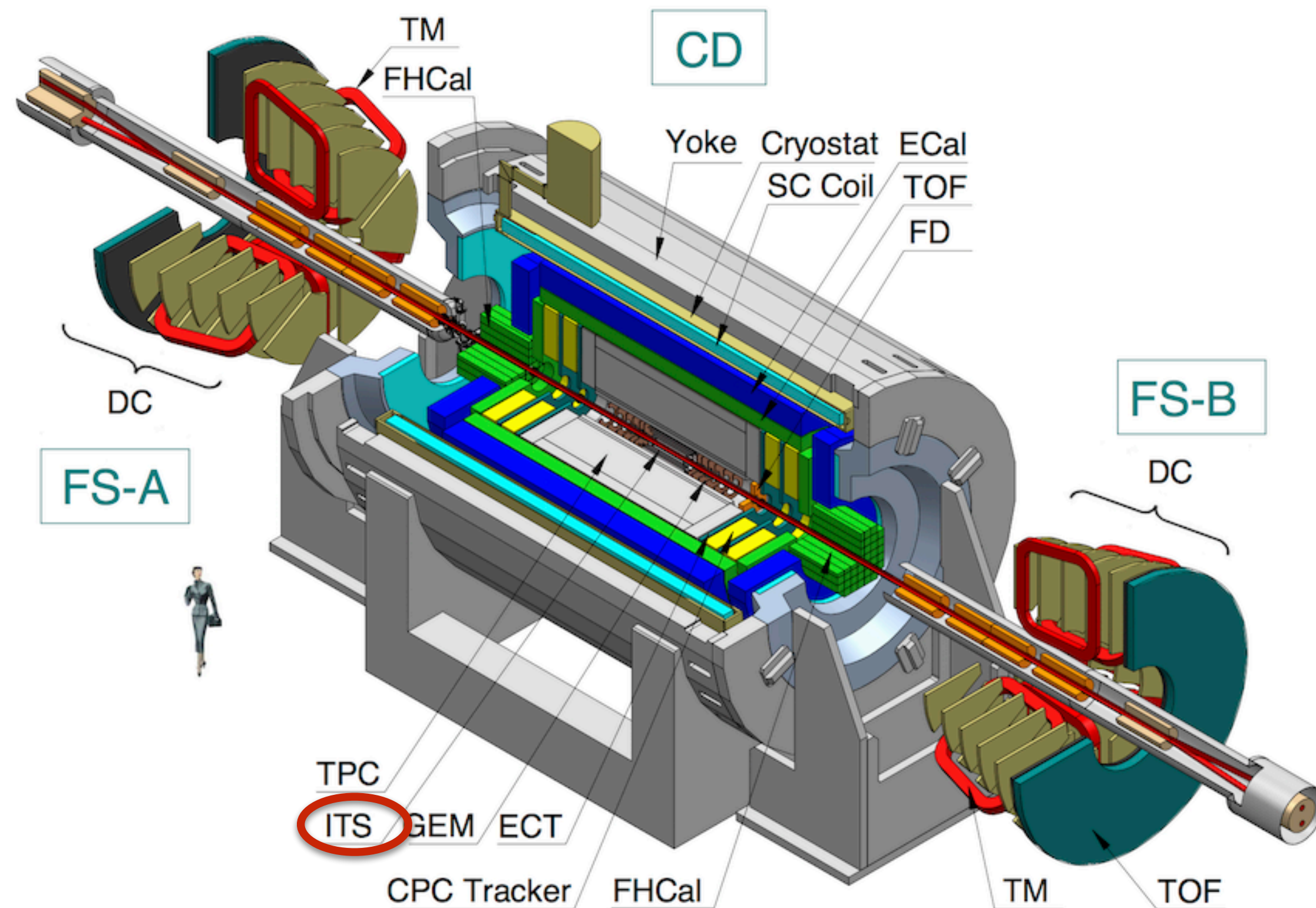


CREMLIN+ WP7 Coordination Meeting, 04.09.2020.



MPD-ITS structure: 3-layers Inner Barrel + 2-layers Outer Barrel.

It will supplement the TPC for the precise tracking, momentum determination and vertex reconstruction for hyperons (Λ , Ξ , Ω) and **D-mesons**.



Some of the MPD-ITS requirements:

- Fast, high granularity CMOS pixel sensors with low noise level.
- Spatial resolution of track coordinate registration at the level of $\sim 5-10 \mu\text{m}$.
- Material budget as low as possible.



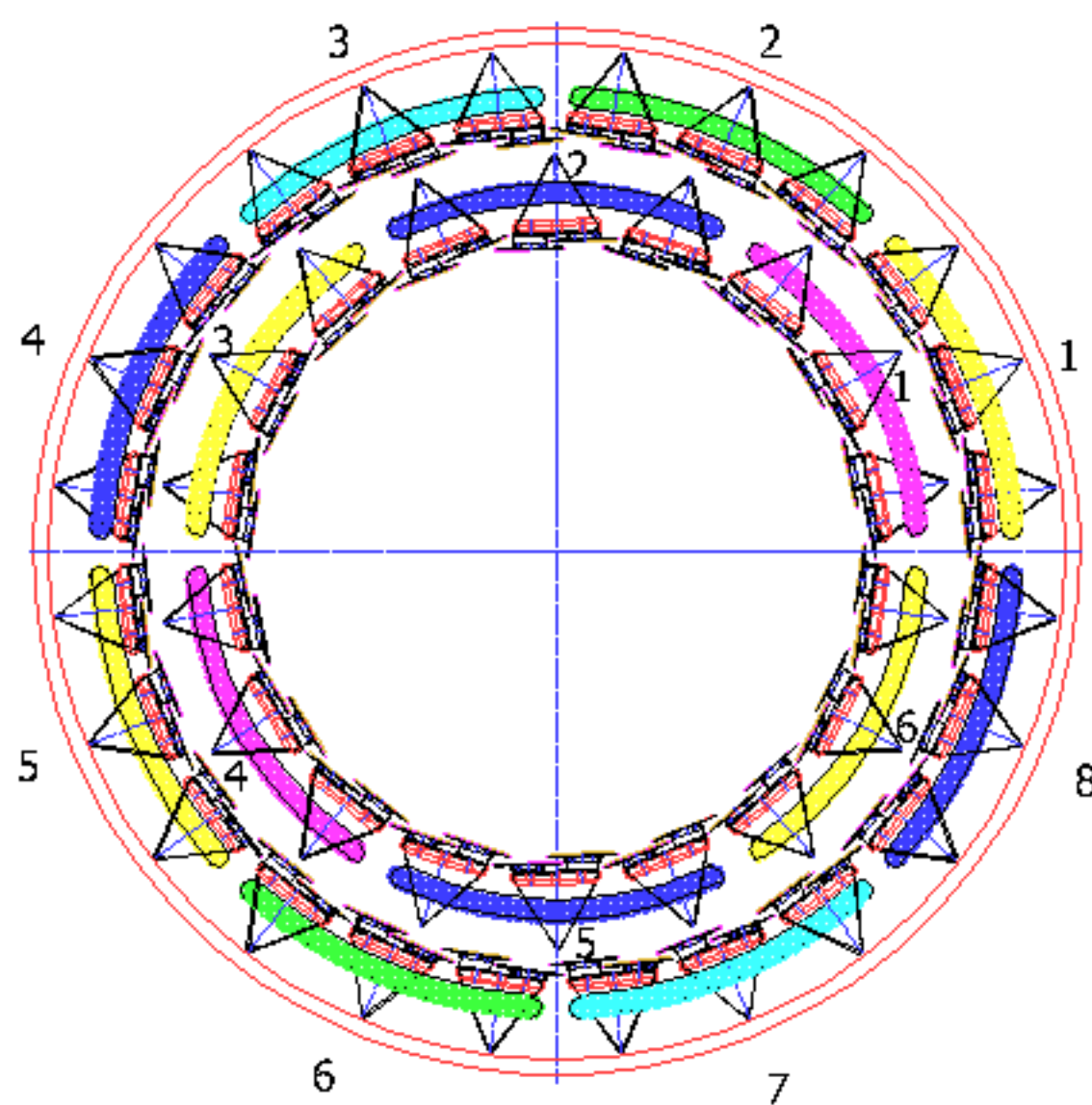
The Two Stages Construction Scenario.

MPD - ITS



Stage 1: The Outer Barrel (by 2022/2023).

Copy&Paste ALICE-ITS2 technology



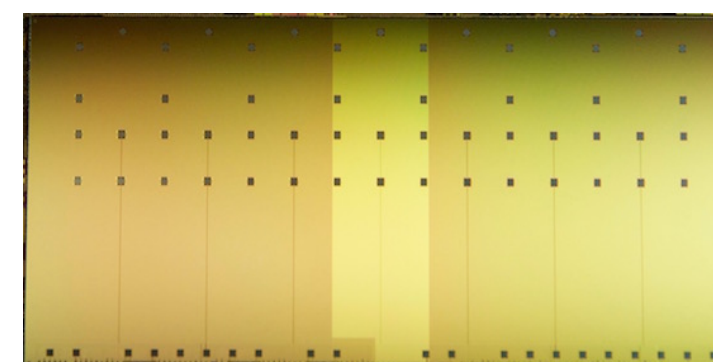
Layer 4 Staves (36 panels) :

- 6 Feed lines
- 6 Return lines

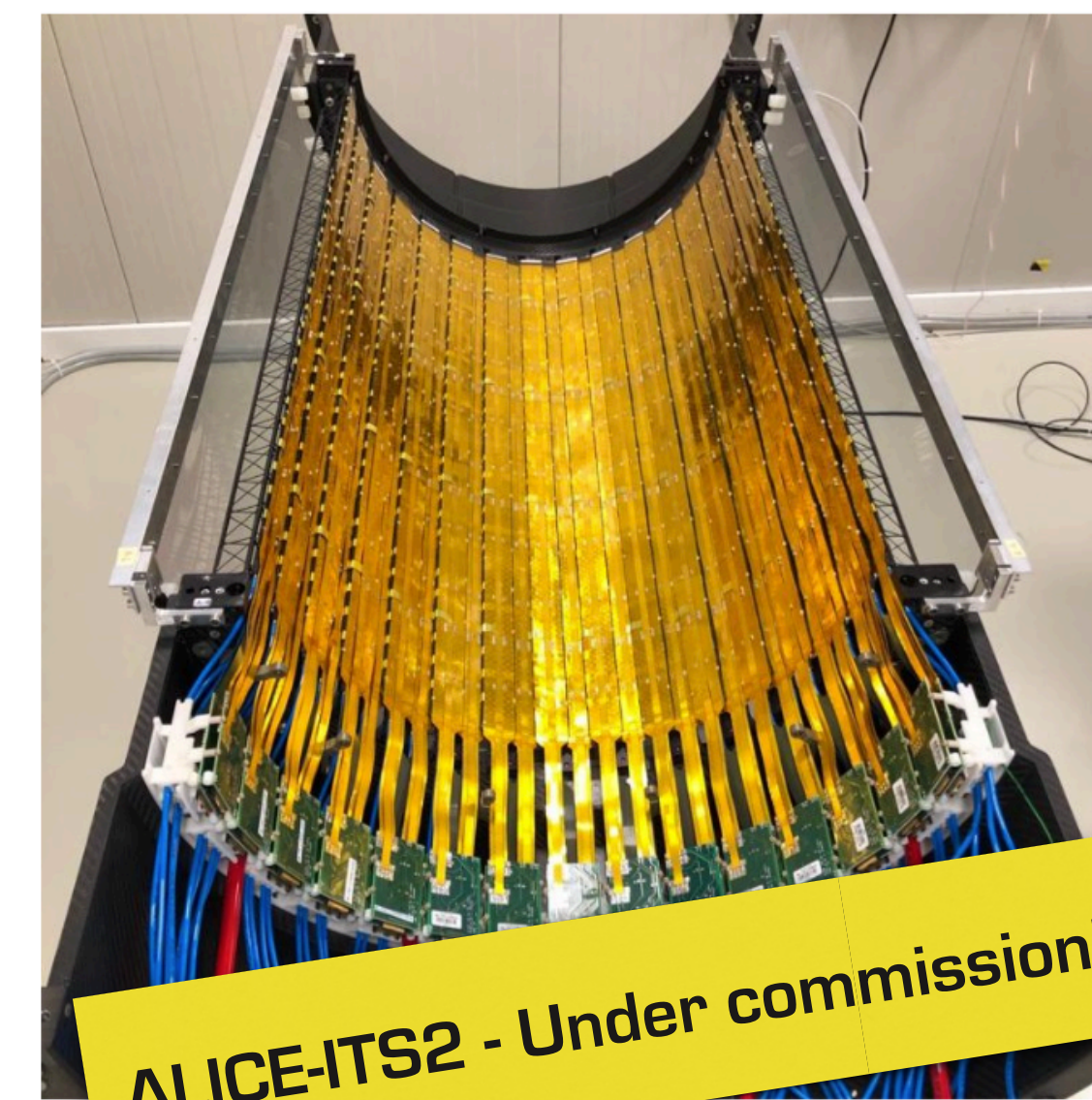
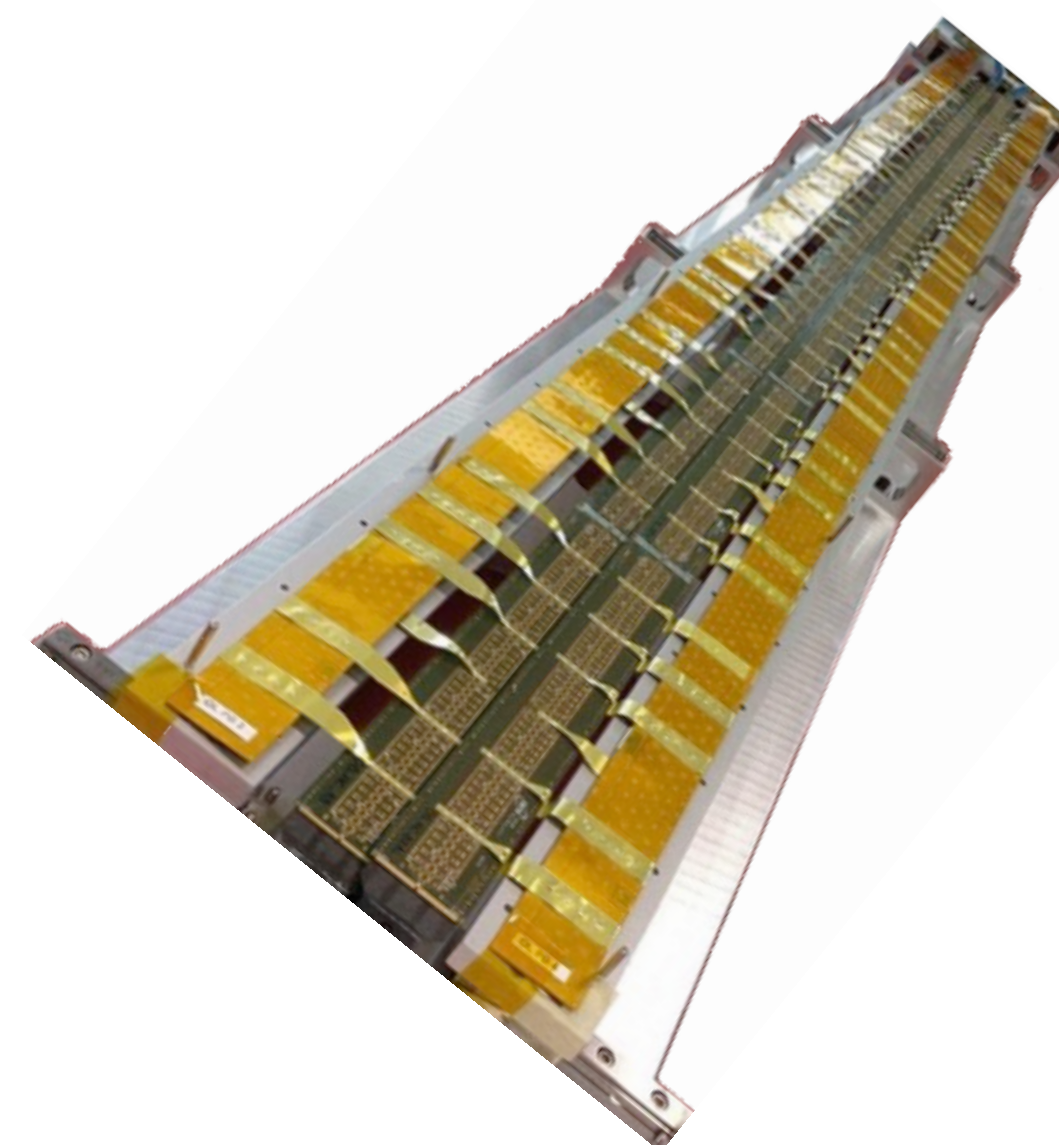
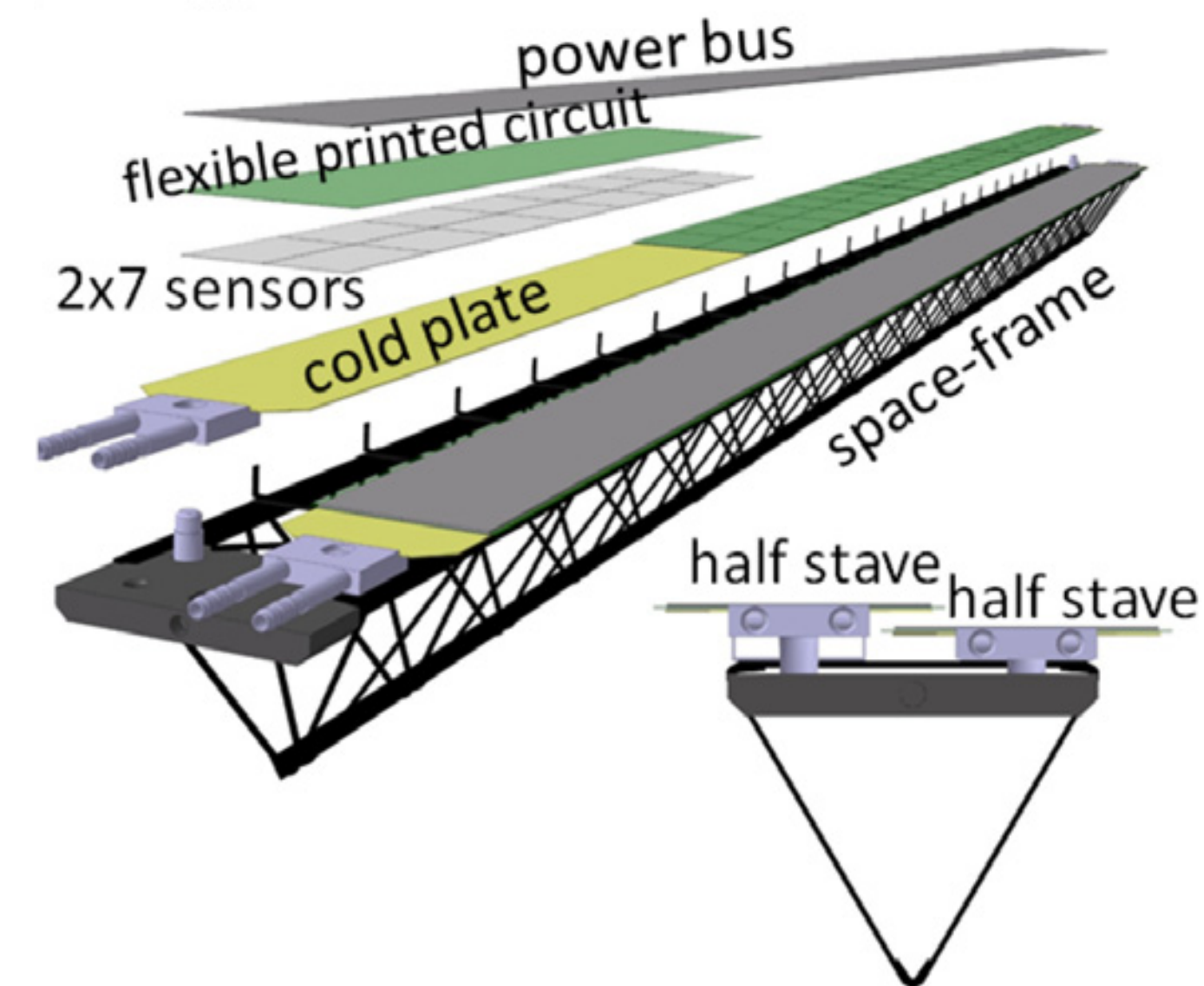
Layer 5 24 Staves (48 panels) :

- 8 Feed lines
- 8 Return lines

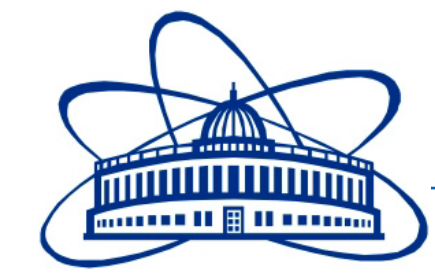
Sensor



100 um-thick MAPS



ALICE-ITS2 - Under commissioning



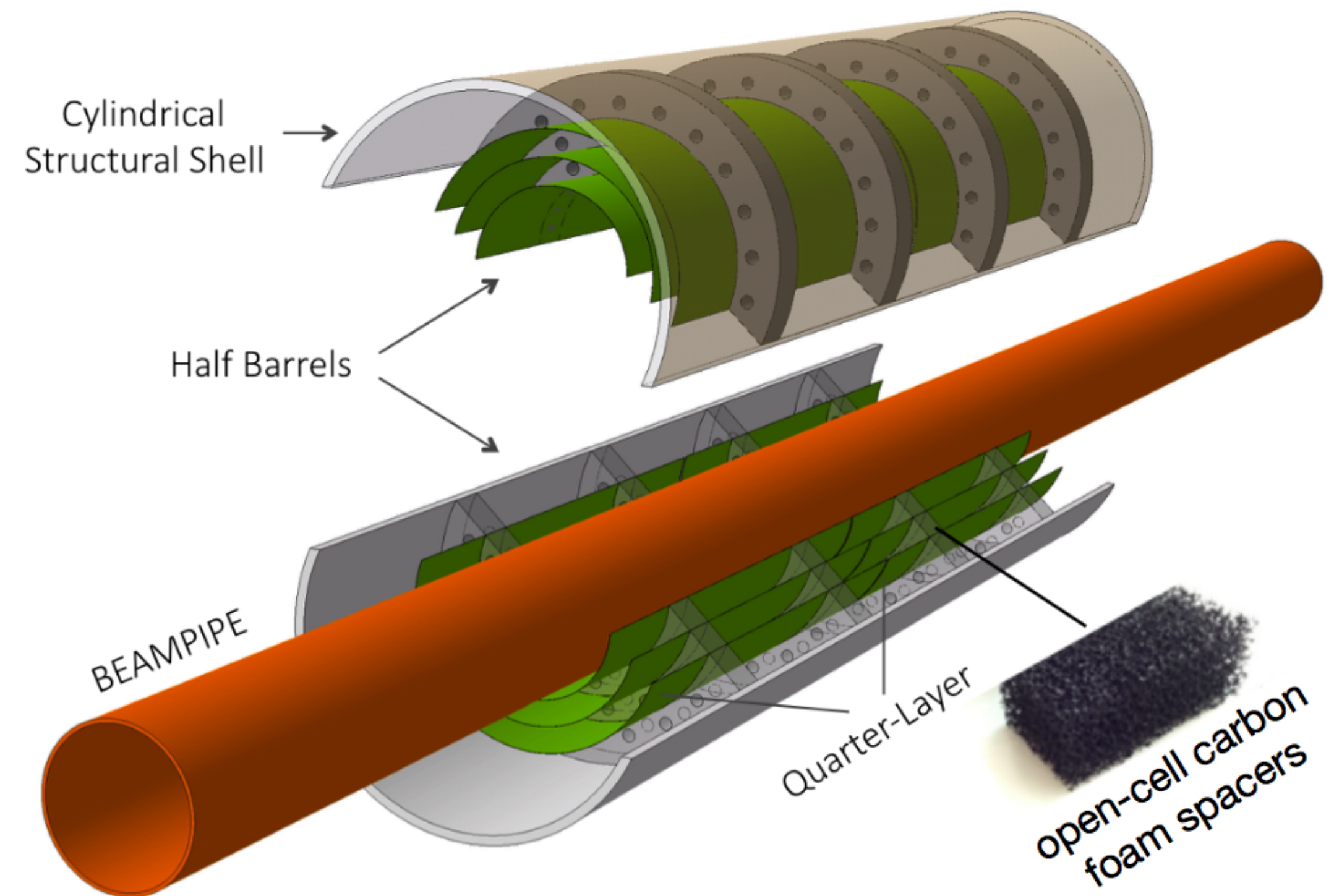
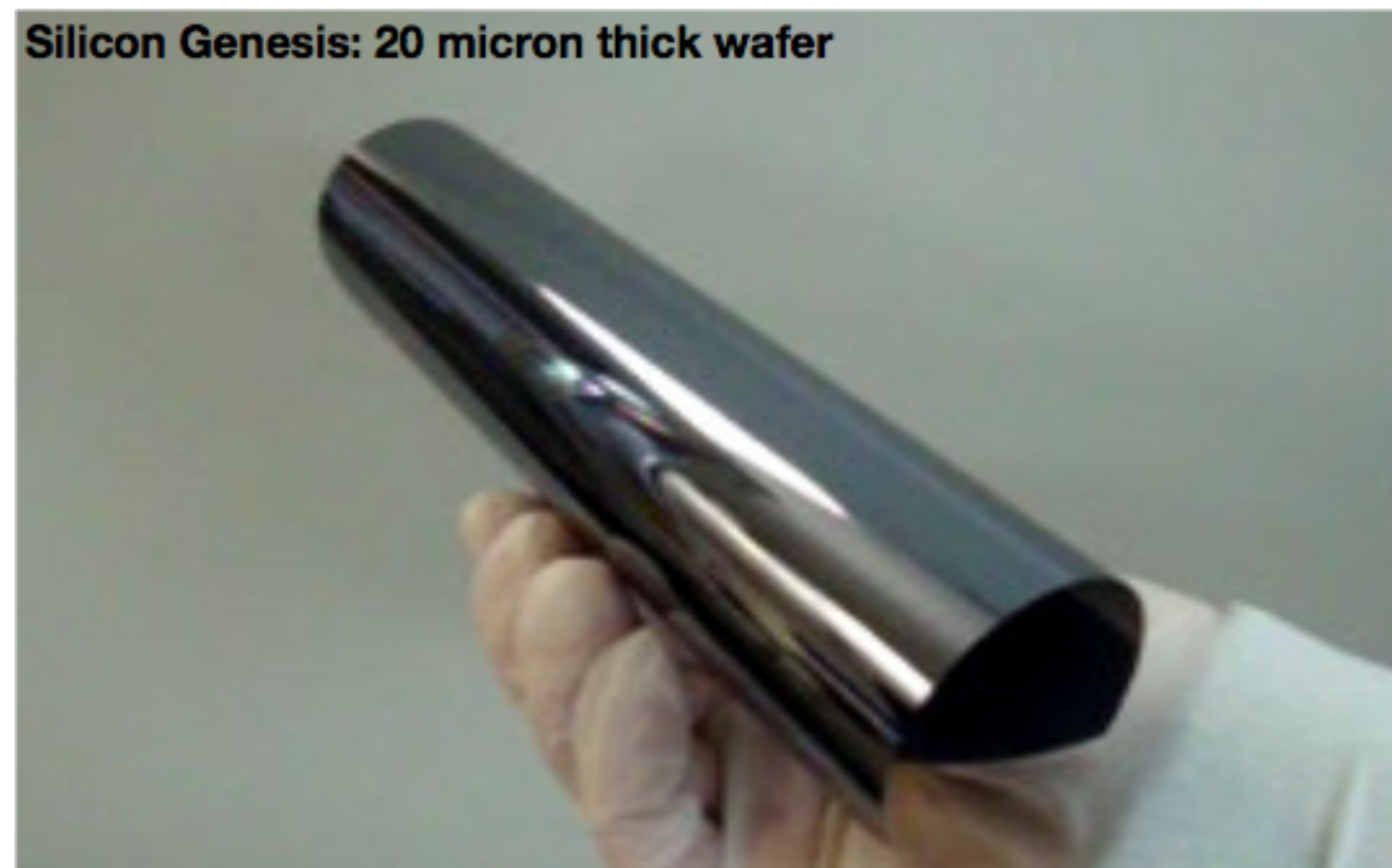
Stage 2: The Inner Barrel (by 2025/2026).

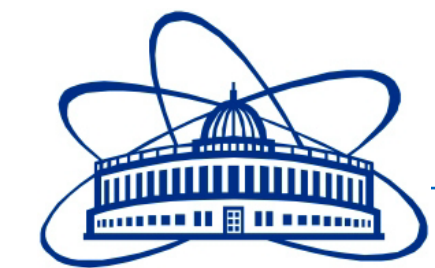
(To the infinity and beyond...)

With support from CREMLIN+

Goal: Use double-size ALICE-ITS3-like sensors on a beam pipe of 40 mm in diameter

ALICE-ITS3 (Under R&D): 20 um-thick (!!!) by 280 mm-long bent MAPS

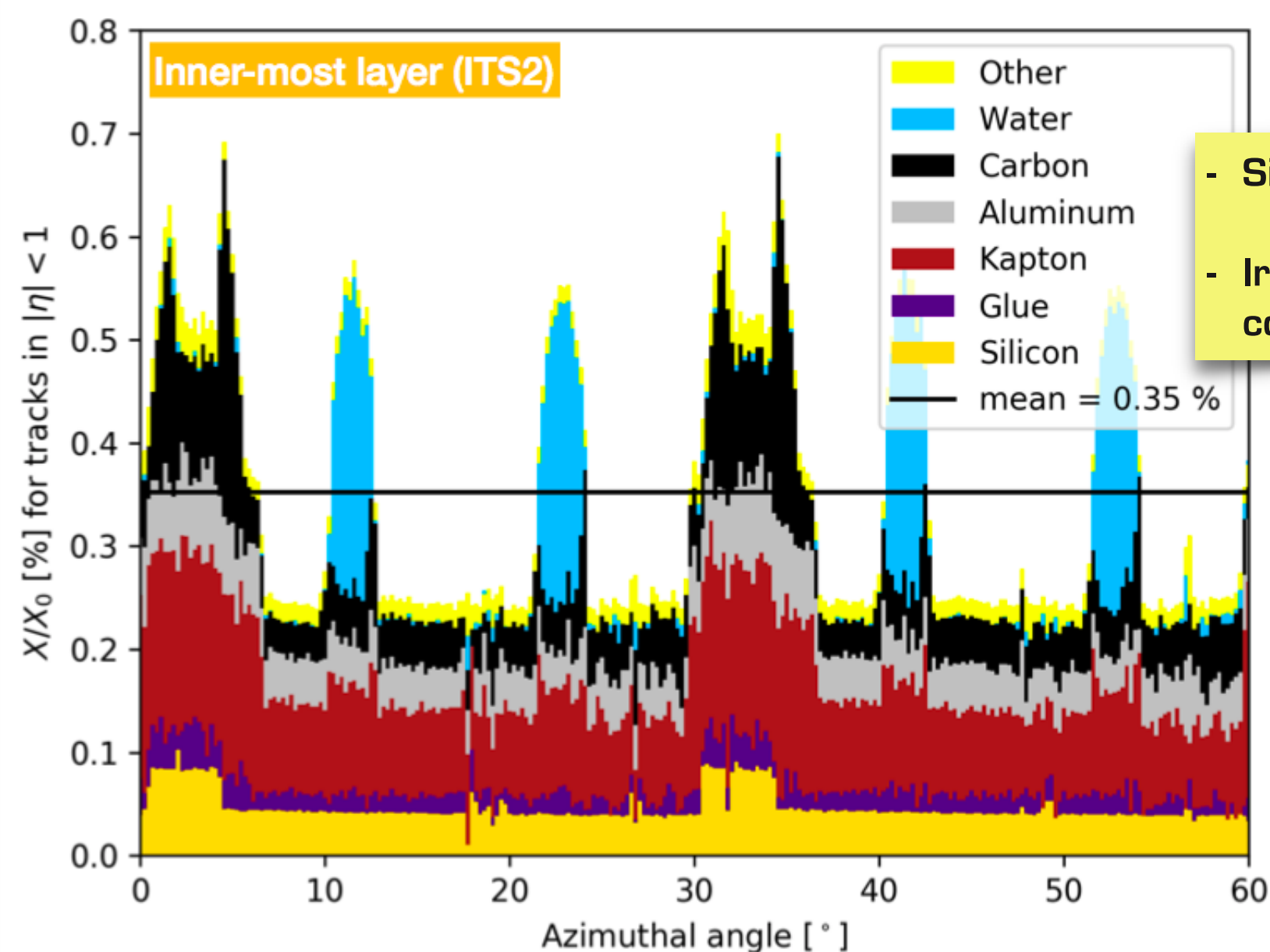




Stage 2: The Inner Barrel (by 2025/2026).

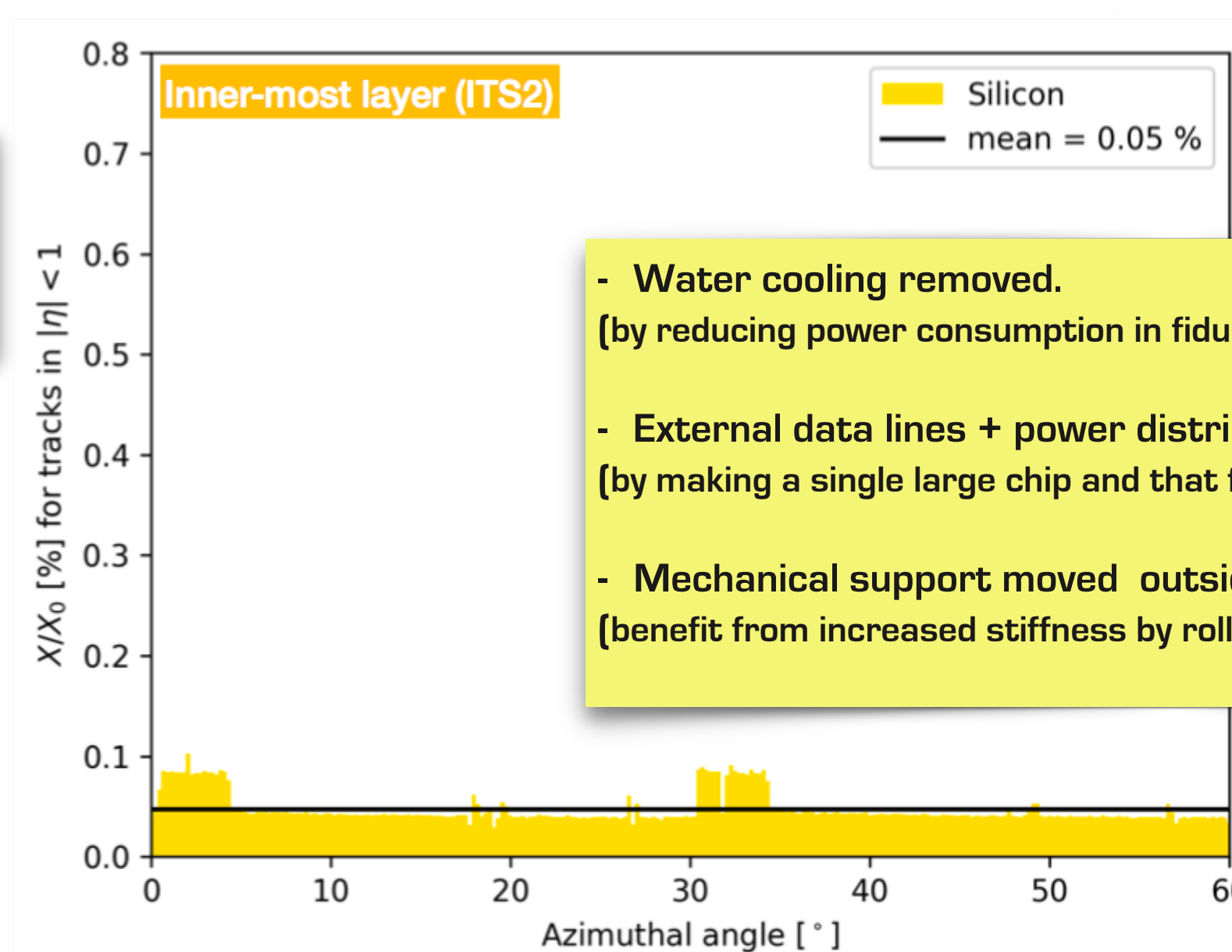
Material Budget (*)

IB ITS2



- Si only 1/7th of total material.
- Irregularities due to overlaps + support/cooling.

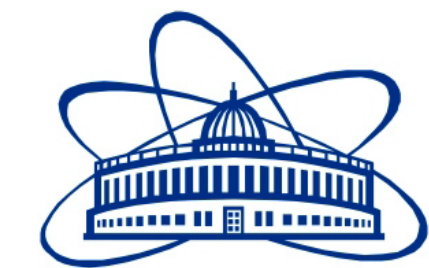
IB ITS2 “translated” into ITS3



- Water cooling removed.
(by reducing power consumption in fiducial volume to <20 mW/cm²)
- External data lines + power distribution removed.
(by making a single large chip and that for distribution)
- Mechanical support moved outside acceptance.
(benefit from increased stiffness by rolling Si wafers)

- ✓ Reduction of material budget (0.35% → 0.05% per layer) and equalisation of its inhomogeneities.
- ✓ Increase of tracking precision and efficiency at low transverse momenta.

(*) Data from M.Mager, “Proposal for an ITS upgrade in LS3”, LHCC 10.09.2019 .



Last April there was the first coordination with the ALICE-ITS project (led by Vito Mazari), for identifying the basis of the collaboration of the MPD-ITS project with the ALICE-ITS3 project.

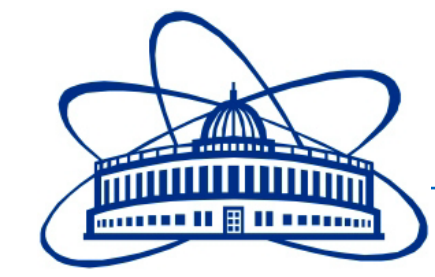
It was proposed:

- The participation of JINR in cooperation with SPbU for the design of support and cooling mechanics for the ALICE-ITS3 project.
- The participation of MPD-ITS members supported by JINR on the physics simulations of the ALICE-ITS3.

- JINR would support through the **CREMLIN+ grant** the hiring of a postdoc (through CERN) to be working on the ALICE-ITS3 project that would also contribute to the development of the **new chips** that may fulfill the MPD-ITS need of producing IB layers **twice longer** than those currently under development for ALICE-ITS3

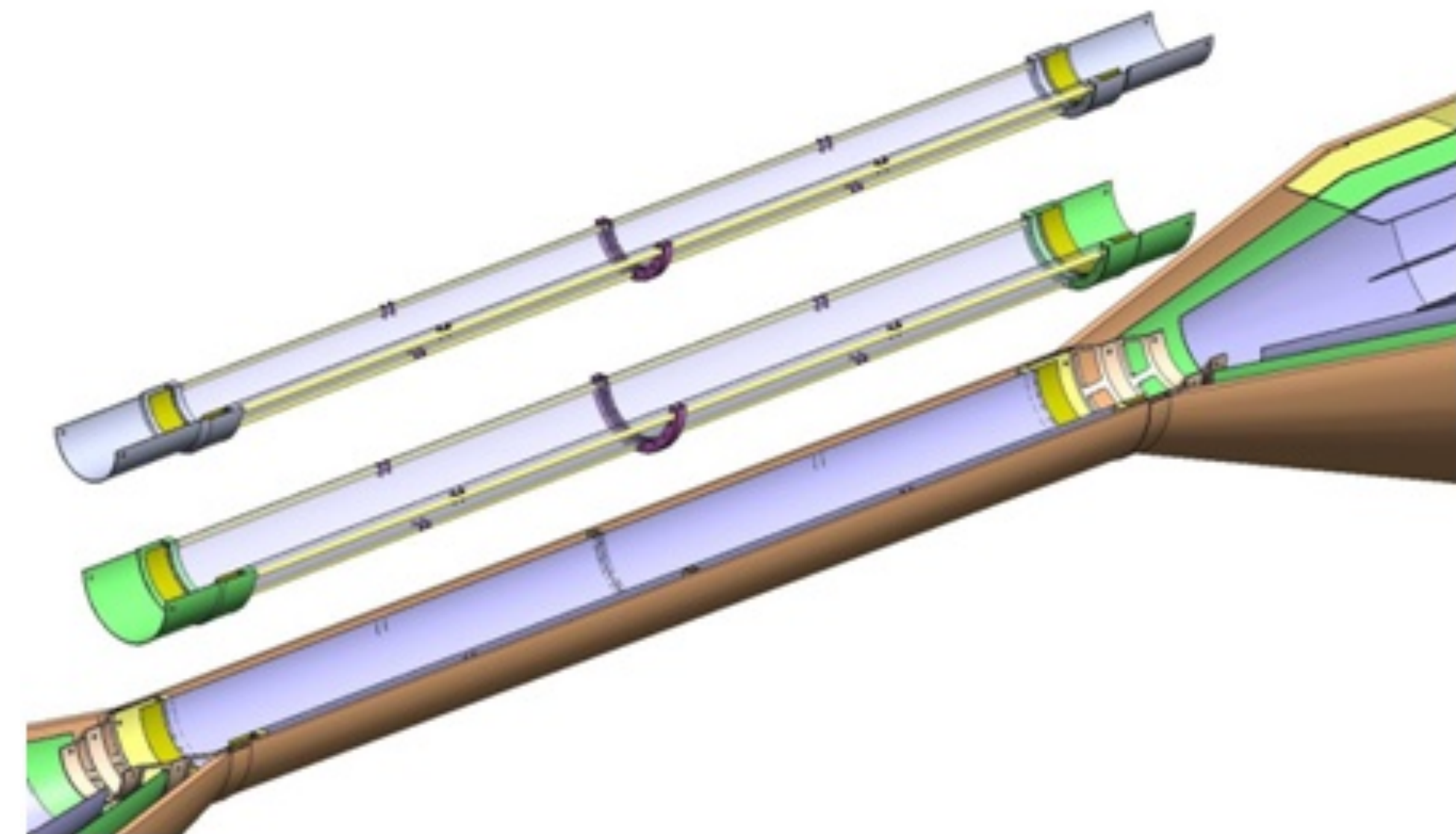
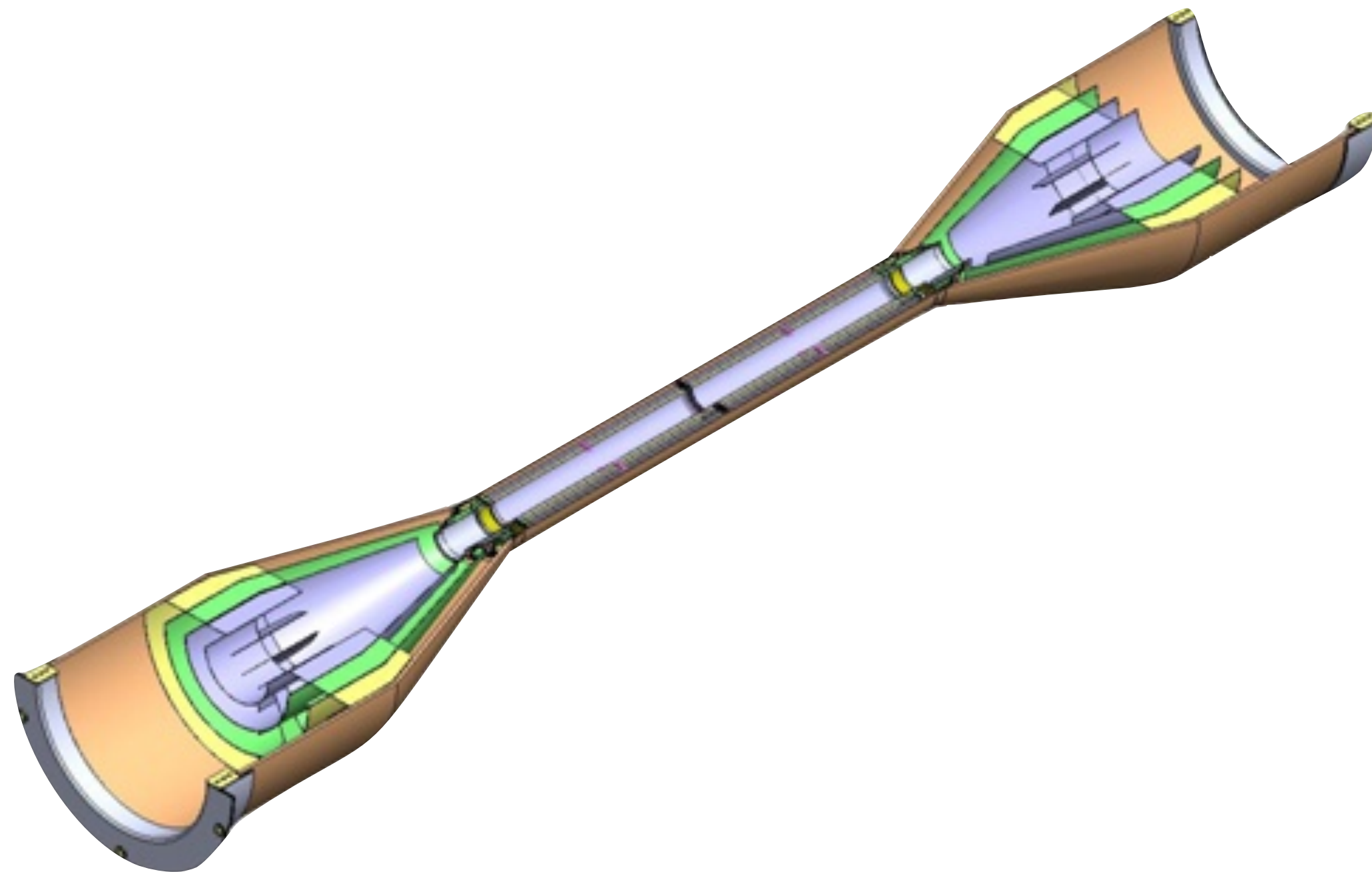
In return, JINR's MPD-ITS project would:

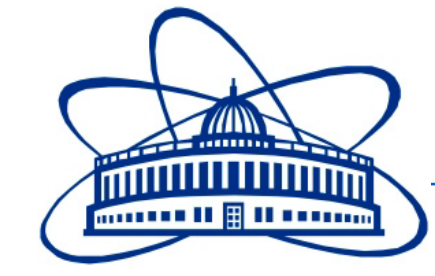
- benefit from the development of “double-size” ITS3-like chips to be used for the MPD-ITS IB;
- get full access to the mechanics and cooling design of the ALICE-ITS3 to be used for the development of the MPD-ITS IB;
- participate on the physics simulations of the ALICE-ITS3 project, including the adaptation of the ALCIE-ITS codes for particle reconstruction to the context of the MPD tracking system.



Our first goal:

To produce a mockup of the the first layer of the MPD-ITS Inner Barrel based on a “double-sized” version of the novel (yet-to-be) ALICE-ITS3-like bent MAPS.





Thank you.

Acknowledgement:

To the ALICE-ITS collaboration for most of the pictures used in this presentation.