

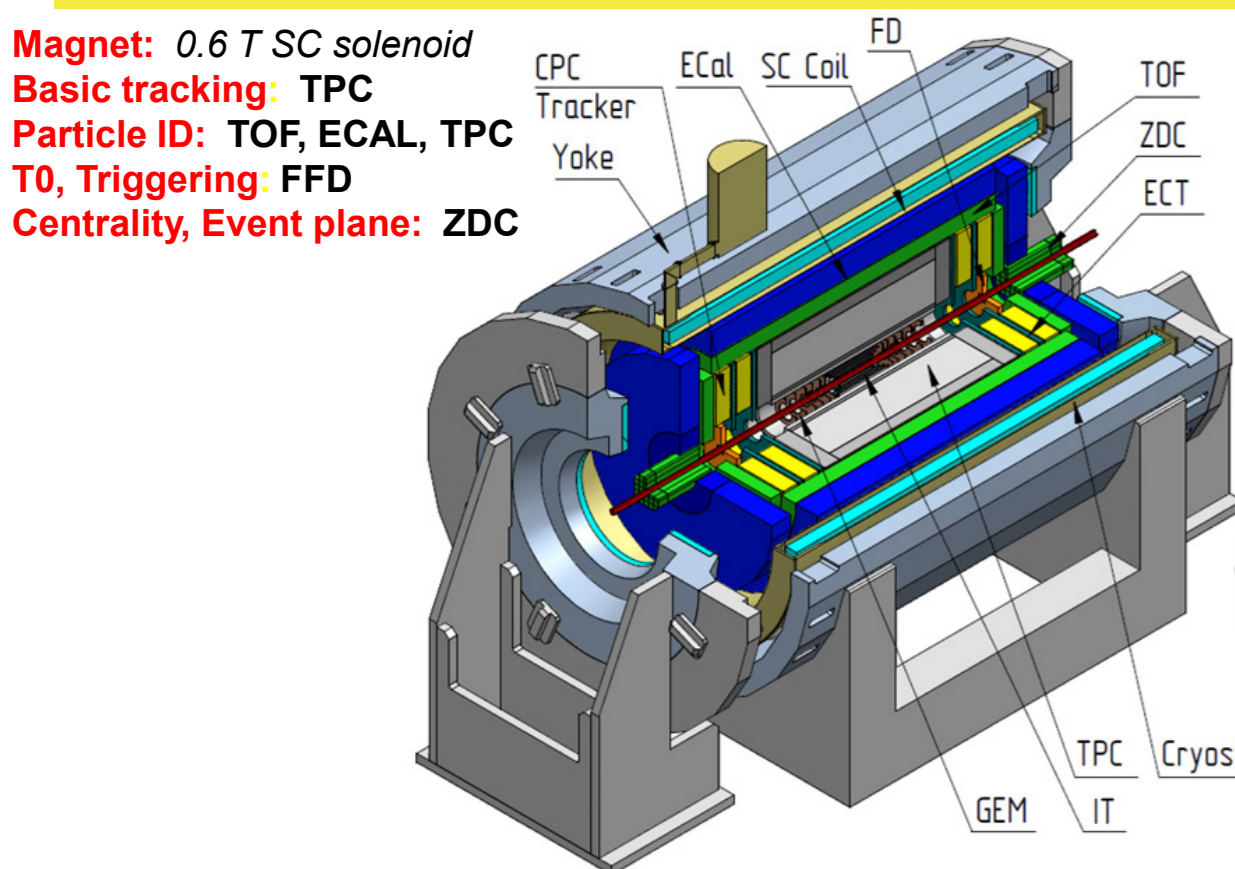
TPC assembly tolling and procedure

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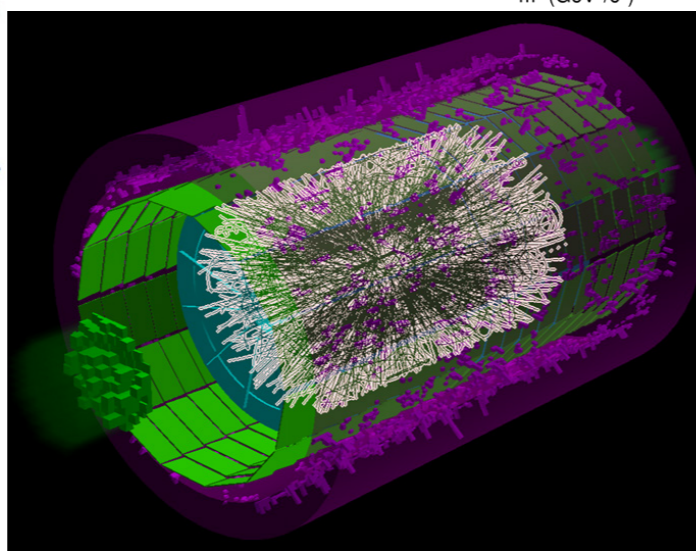
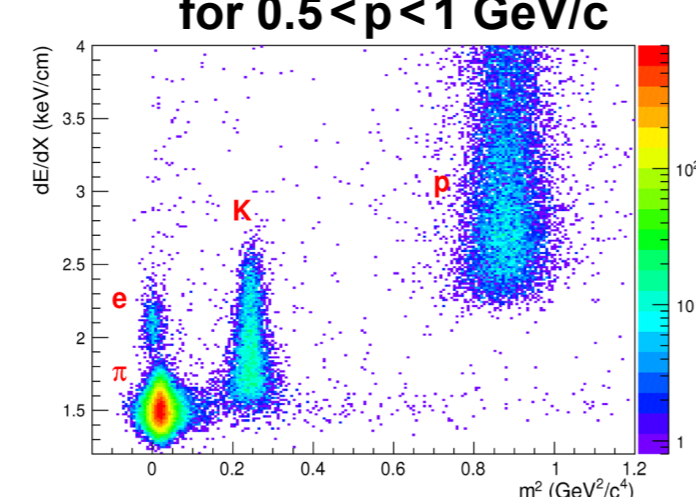
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The Time-Projection Chamber (TPC) is the main detector for tracking and charged particles identification in the Multi-Purpose Detector (MPD) at the NICA collider experiments.

Central barrel of Multi-Purpose Detector (MPD)



PID: TOF, TPC, ECAL for $0.5 < p < 1$ GeV/c

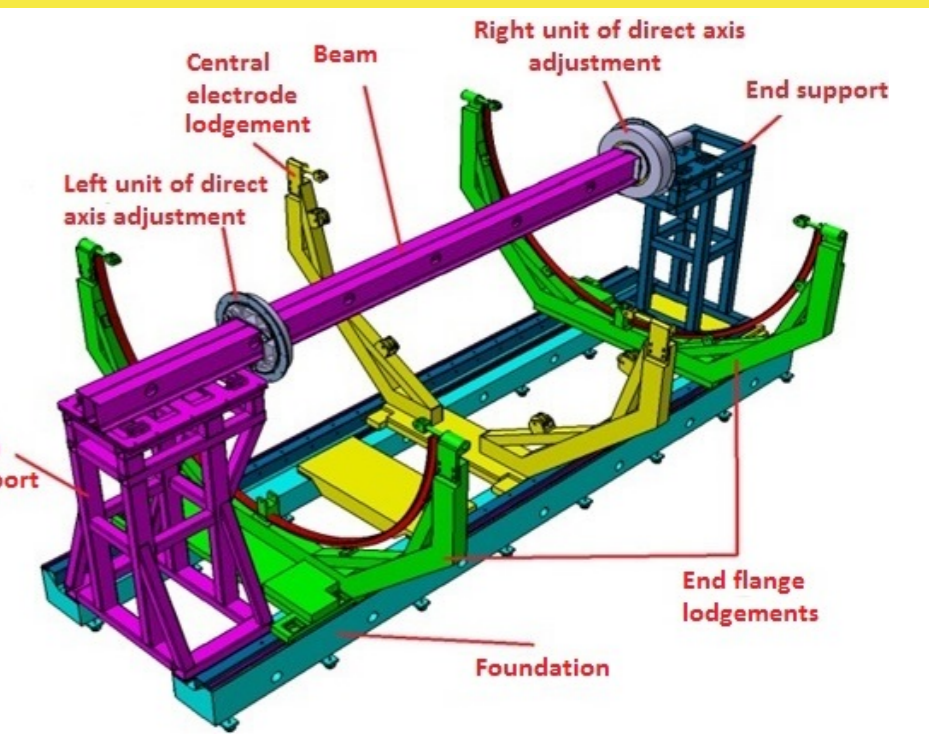


Example of the event in MPD

TPC basic parameters

Item	Dimension
Length of the TPC	340 cm (without FEE)
Outer radius of vessel	140 cm
Inner radius of vessel	27 cm
Outer radius of drift volume	133 cm
Outer radius of drift volume	34 cm
Length of the drift volume	163 cm (of each half)
Cathode	Membrane at the center of the TPC
Electric field strength	~140 V/cm (for Ar/CH ₄)
Magnetic field strength	0.5 Tesla (max.)
Drift gas	90% Ar + 10% CH ₄ (P10) at Atmospheric pres. + 2 mbar
Gas amplification factor	~ 10 ⁴
Drift velocity	5.45 cm/μs for P10 gas mixture
Max. electron drift time	~ 30 μs
Temperature stability	< 0.5 °C
Readout chambers	24 (12 per end plate) sectors
Segmentation in φ	30°
Multiplicity (max.)	~ 1000 (central collision)
Pad size	5x12 mm ² and 5x18 mm ²
Number of pads	95232
Pad row numbers	53
Maximum rate	~ 7 kHz (Lum. 10 ²⁷)
Electronics shaping time	~180 ns (FWHM)
Signal to noise ratio	30:1
dE/dx	better than 8 %
Δp/p	≤ 3% in 0.1 < p < 1 GeV/c

TPC assembling tolling



Schematic view of the arrangement for TPC assembly



Made in Briansk (Russia)
Delivery to JINR in May 2017

Tooling for TPC assembling
in to clean room

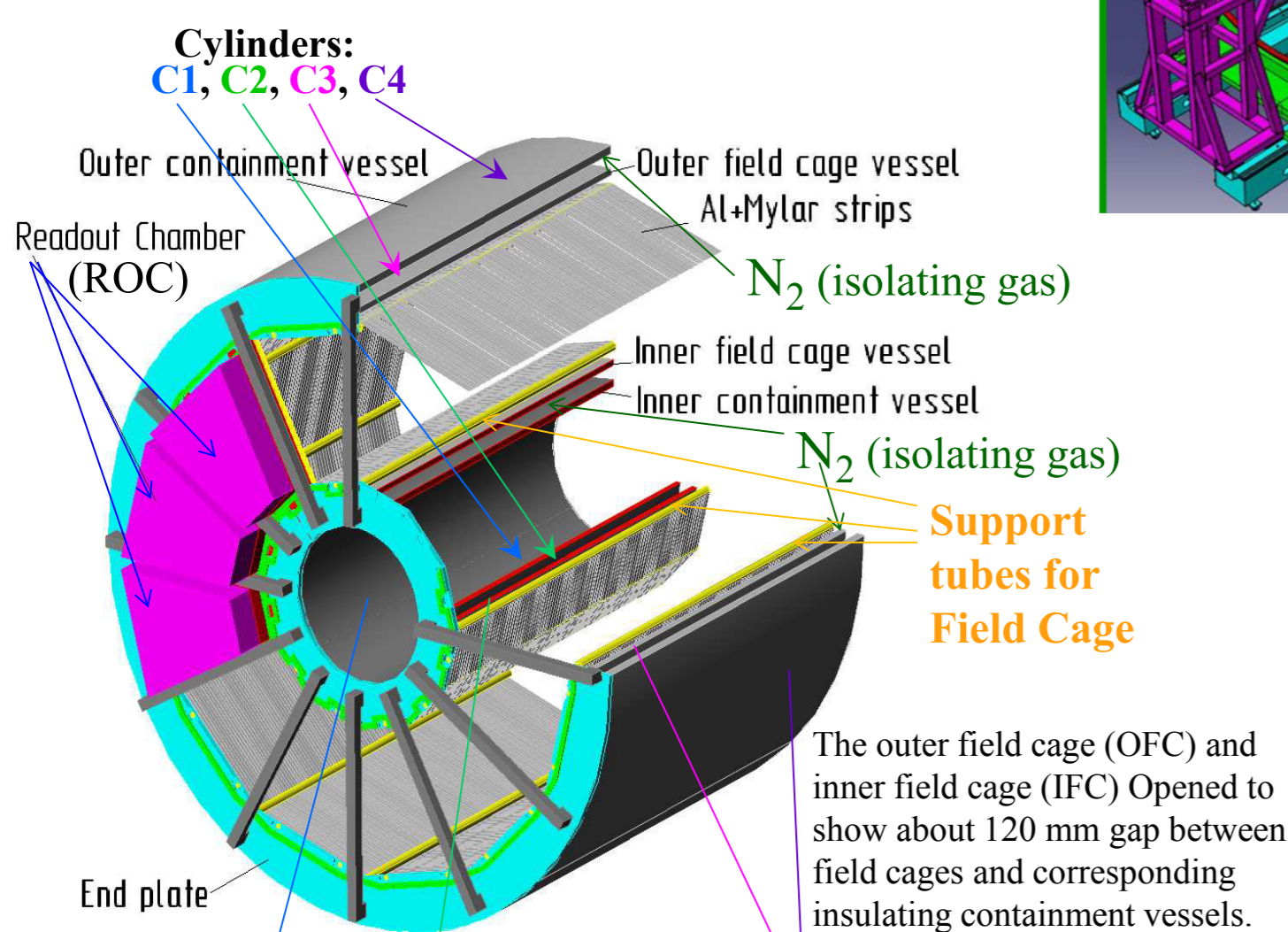
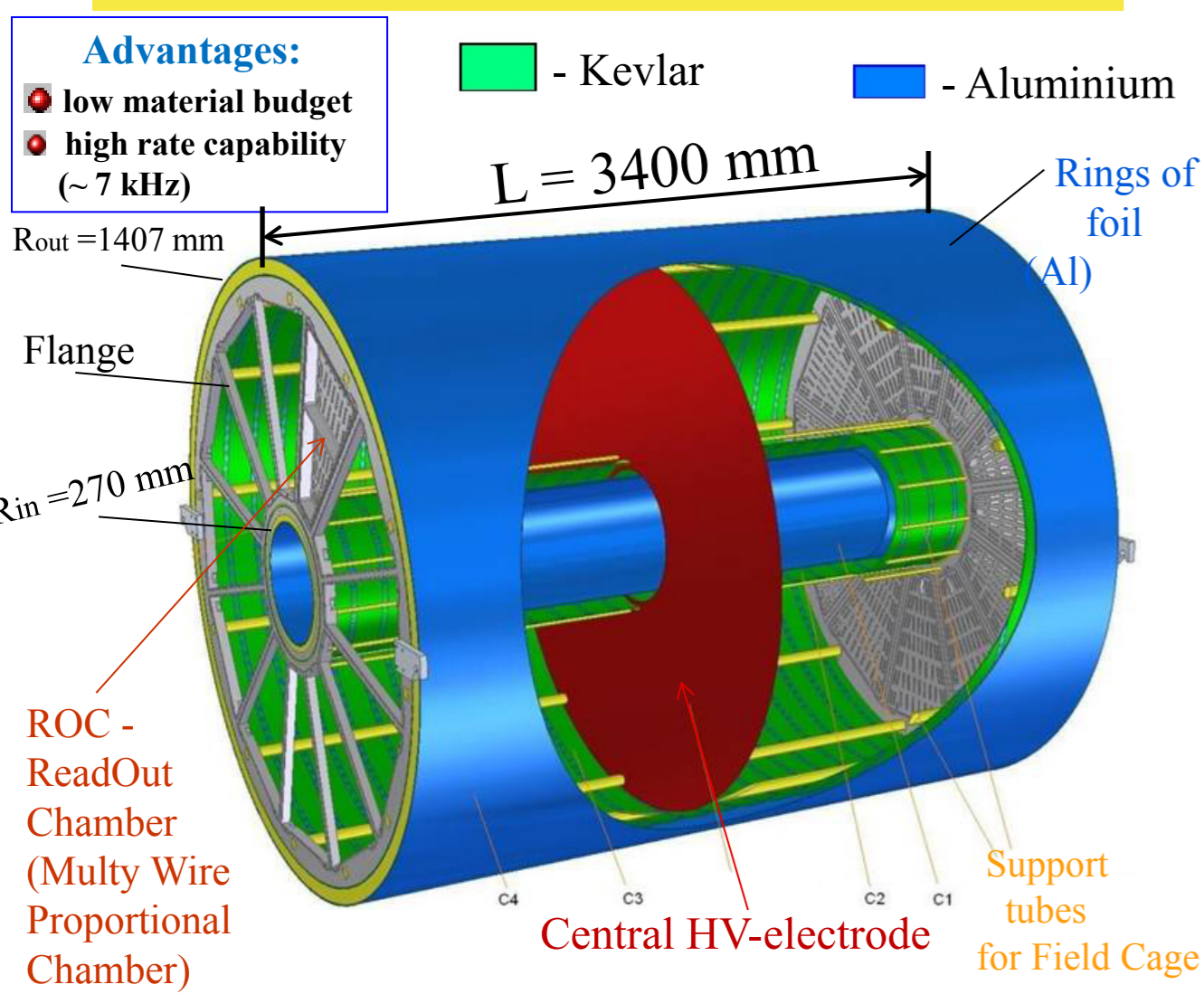
Requirements to the apparatus:

- Hermeticity, homogenous acceptance: 2π in azimuthal angle
- High efficient 3-D track reconstruction ($|\eta| < 2$), high resolution vertexing
- powerful PID: π/K up to 1.5 GeV/c, K/p up to 3 GeV/c, ECAL for γ , e
- careful event characterization: impact parameter & event plane reconstruction
- Minimal dead time, event rate capability about ~ 6 kHz

TPC requirements

- Spatial resolution: $\sigma(x,y) \sim 0.6$ mm, $\sigma(z) \sim 1.2$ mm;
- Two track resolution: about 10 mm;
- Momentum resolution: $\Delta p/p \leq 3\%$ ($0.1 < p_t < 1$ GeV/c);
- dE/dx resolution: better than 8%;
- Overall acceptance of $|\eta| \leq 1.2$;
- Max. multiplicity: ~ 1000 (central collision Au+Au at $\sqrt{s_{NN}} = 11$ GeV and the event rate about ~ 6 kHz).

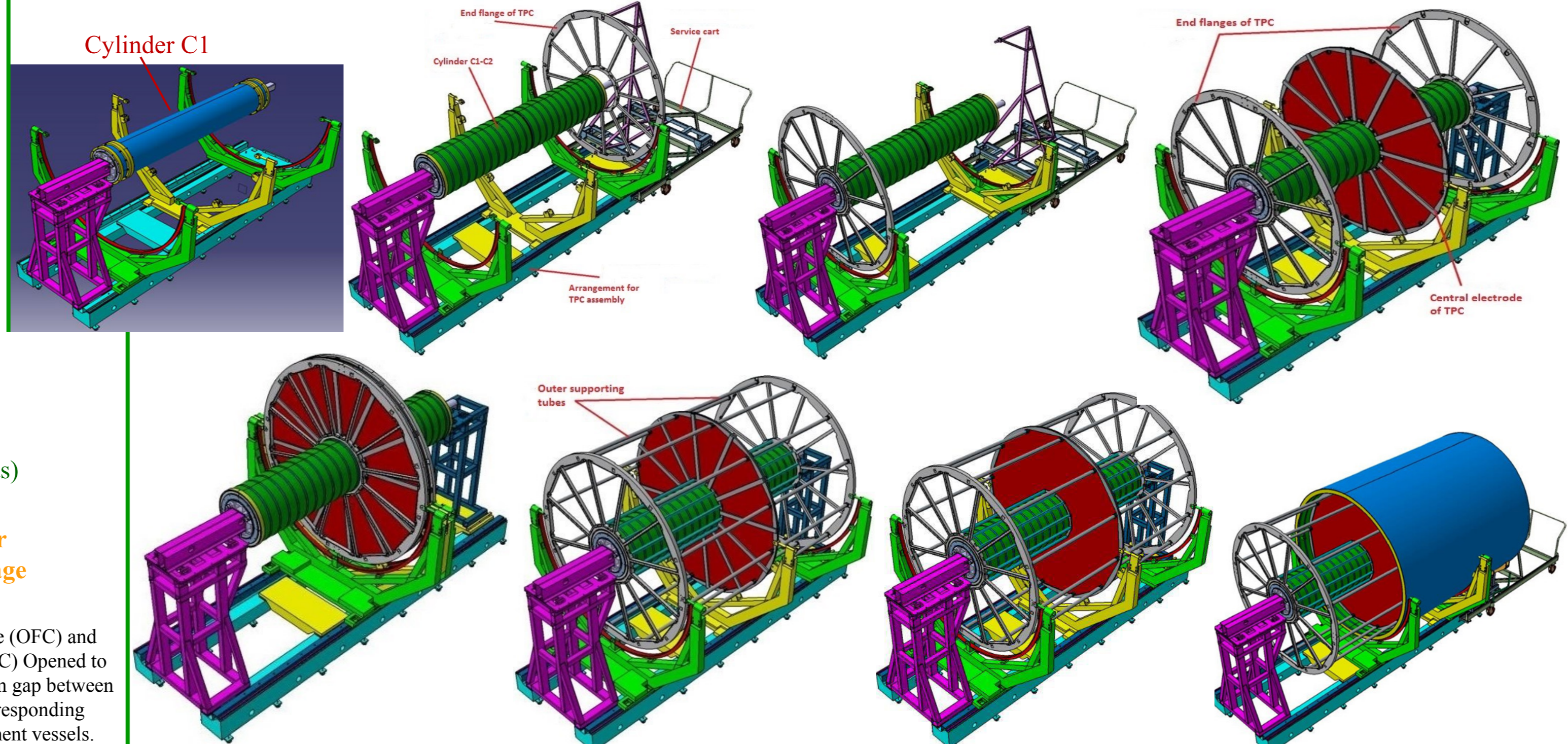
TPC structure



Procedure of TPC assembly



The consecutive steps of C3-C4 cylinders assembling procedure



C1-C2 cylinders, HV electrode and TPC end cap flange assembling procedure

TPC cylinders

A technology elaborated how to produce hermetic large diameter Kevlar vessels inner tube

- Material: Kevlar
- Thickness: (4-6) mm



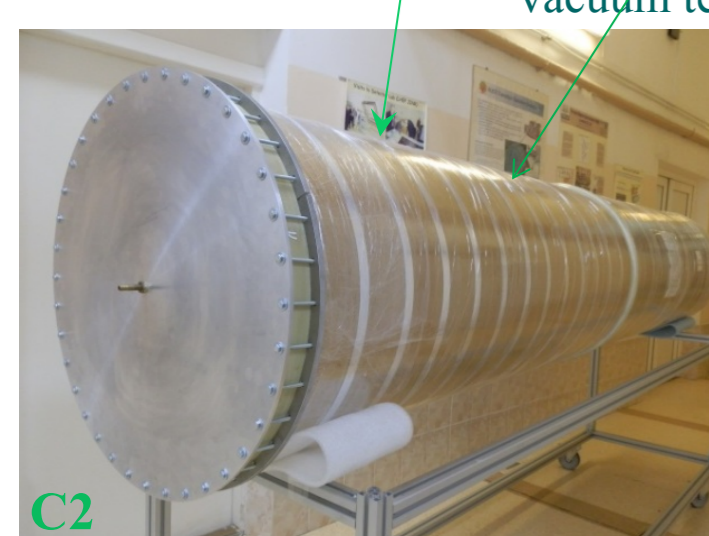
Outer tube



- Length: 3.4 m
- Diameter: 0.54 m

- Length: 3.4 m
- Diameter: 2.66 m

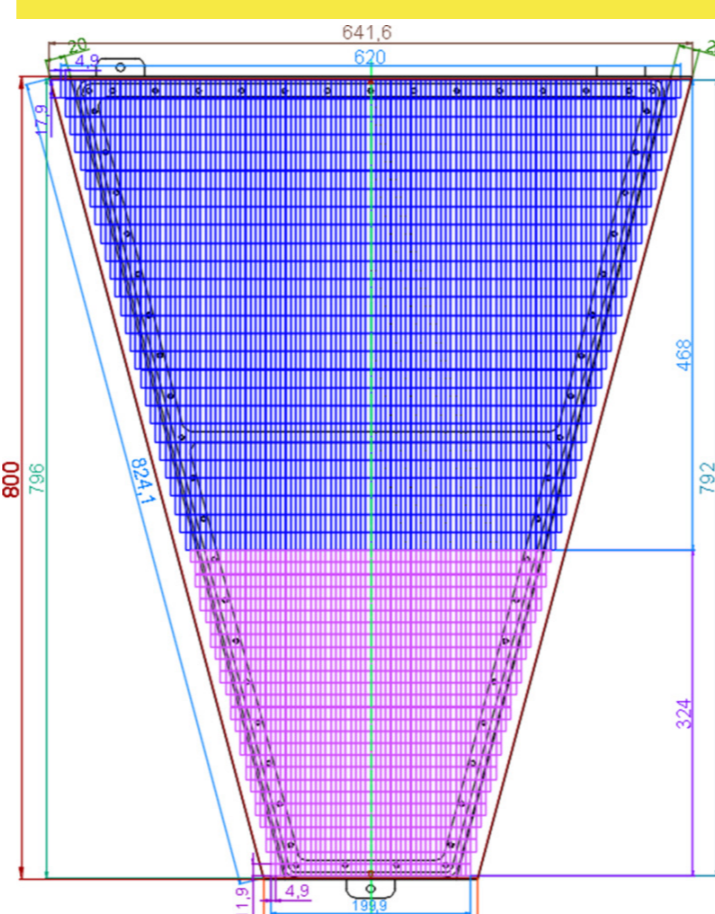
Cylinder C2, preparation for vacuum tests



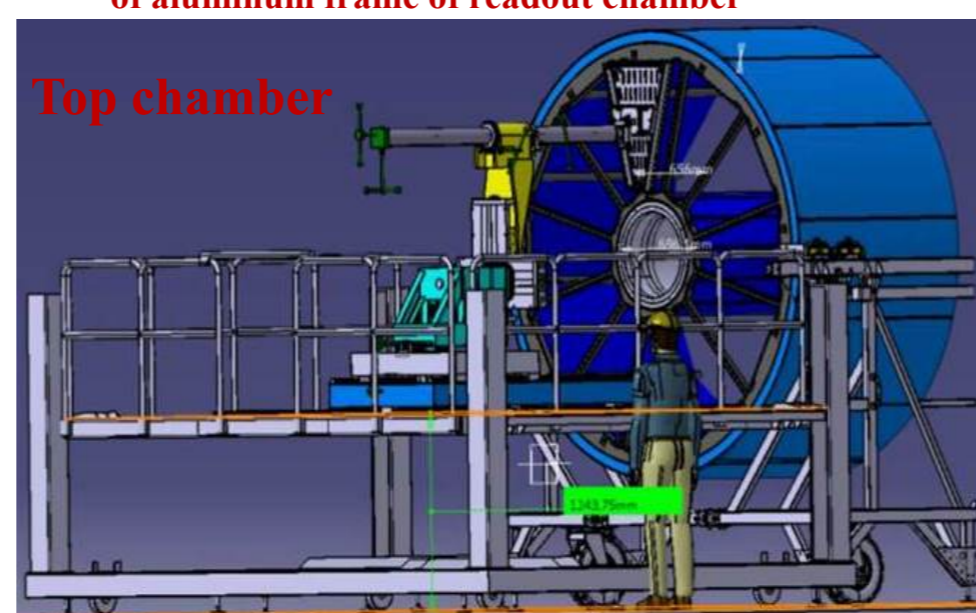
- Length: 3.4 m
- Diameter: 0.676 m

- Length: 3.4 m
- Diameter: 2.814 m

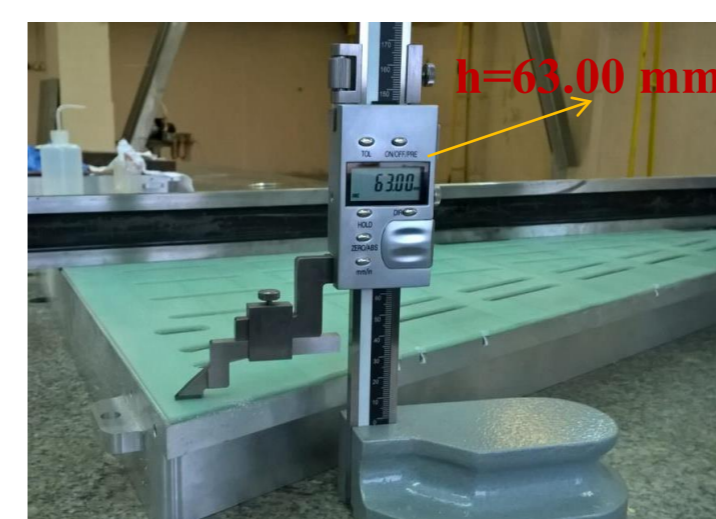
ROC chamber and Manipulator for its installation



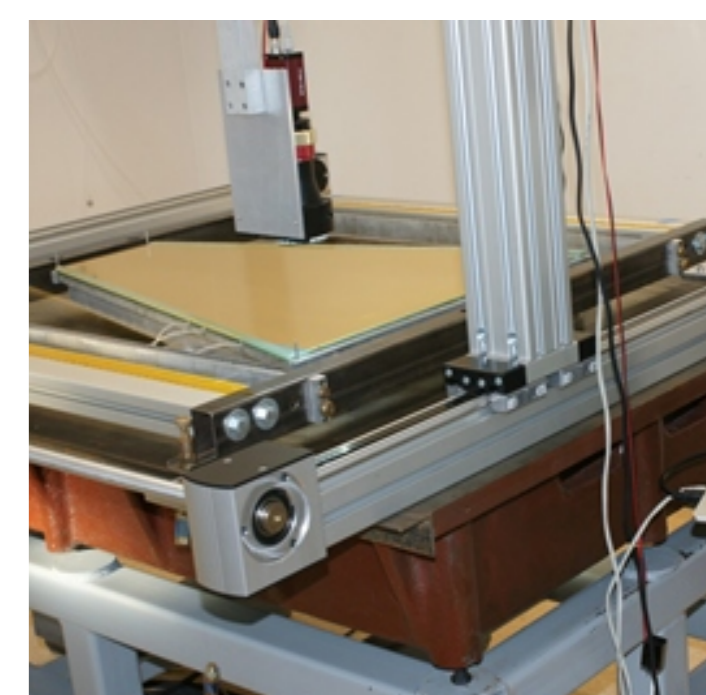
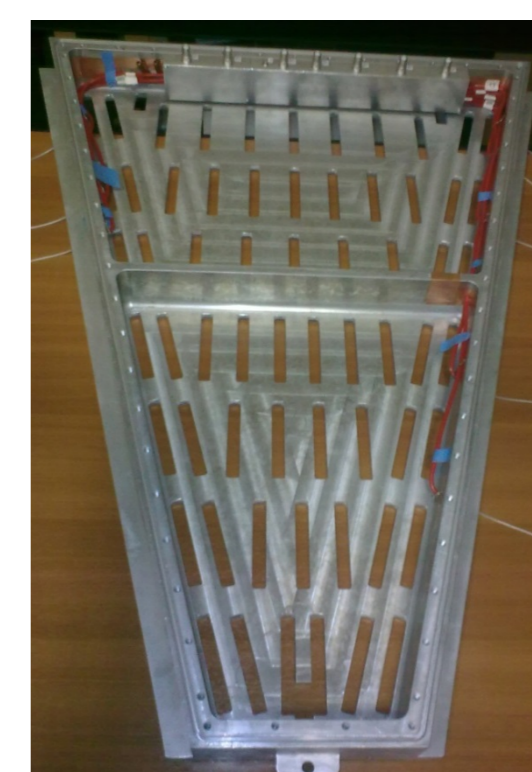
TPC readout pad plane and front view of aluminum frame of readout chamber



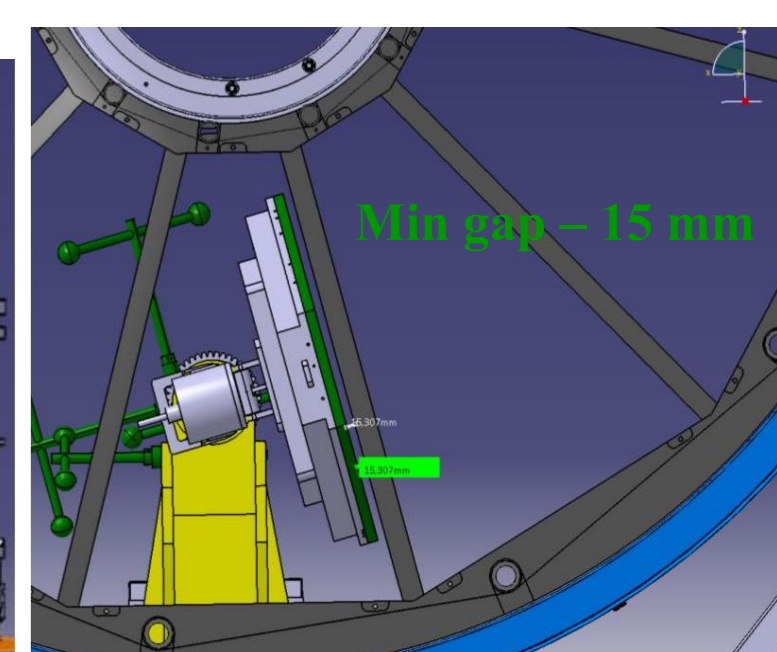
Top chamber



ROC frame and ROC chamber



Manipulator for ROC chamber installation



Min gap - 15 mm