

TPC status of MPD/NICA

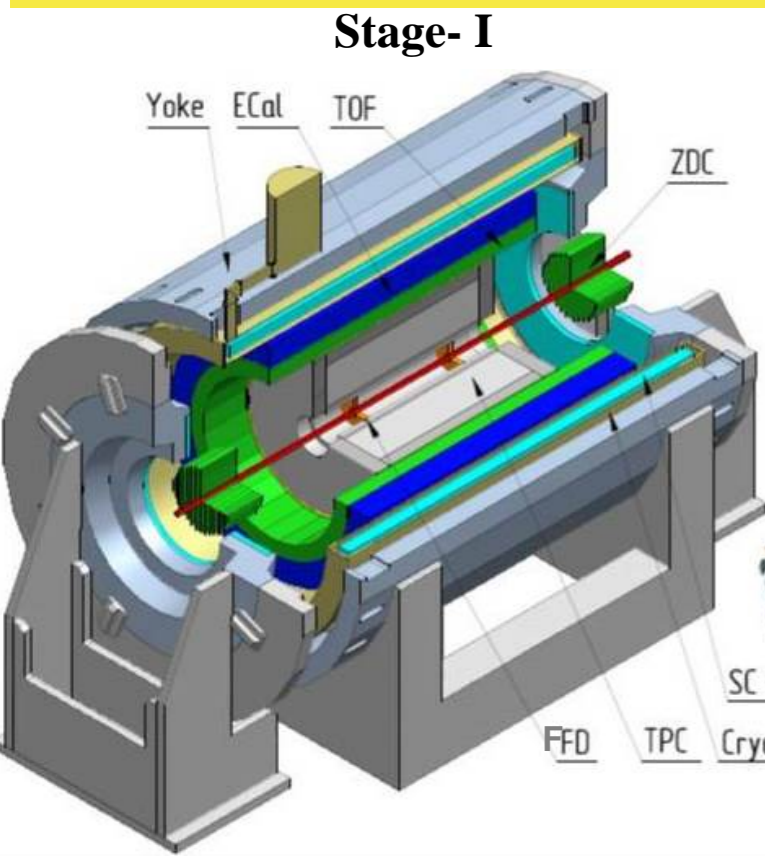
S. Movchan, A. Bazhzhin, J. Lukstins, S. Razin, V. Samsonov, S. Zaporozhets, A. Pilyar, S. Vereschagin, O. Fateev, V. Zruev, A. Ribakov, V.F. Chepurnov, V.V. Chepurnov, G. Cheremukhina, I. Balashov, A. Makarov, et. al. (on behalf of the TPC/MPD group)

Veksler and Baldin Laboratory of High Energy Physics (VBLHEP), Joint Institute for Nuclear Research (JINR)

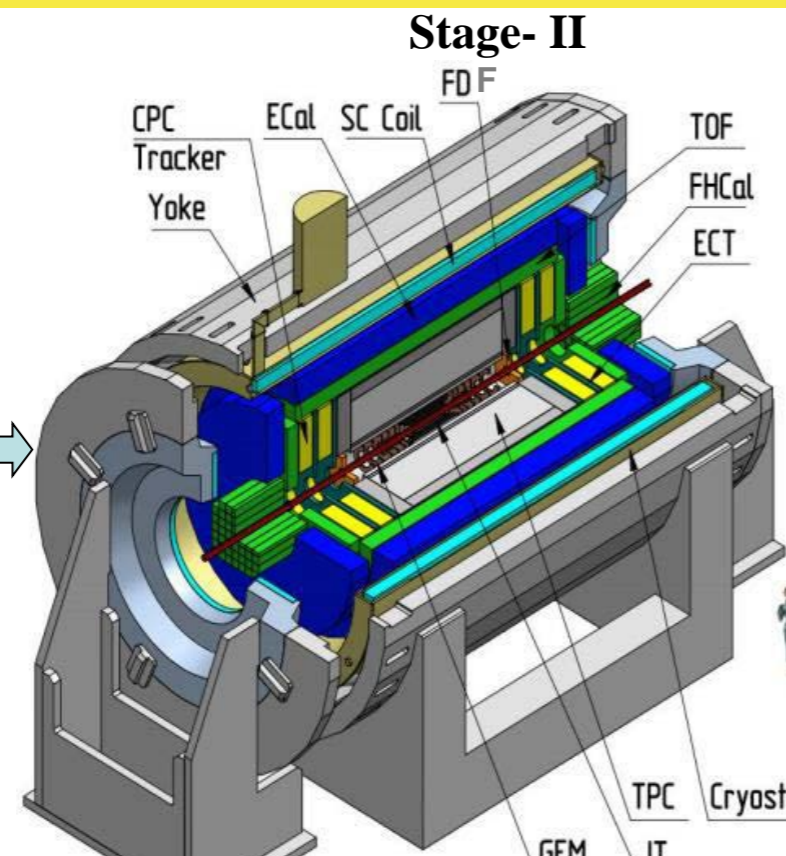
The Time-Projection Chamber (TPC) is the main tracking device in the MPD central barrel for 3-dimensional tracking charge particles and particle identification.

Central barrel of Multi Purpose Detector (MPD)

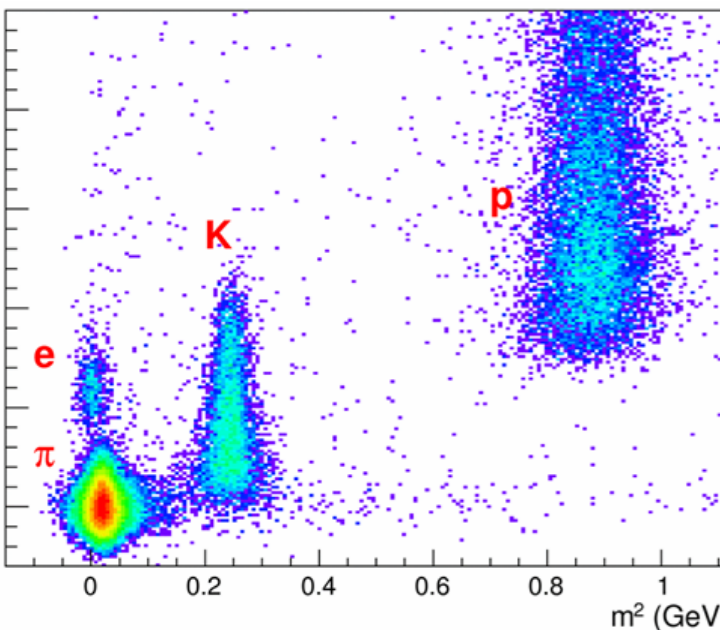
Stage-I



Stage-II

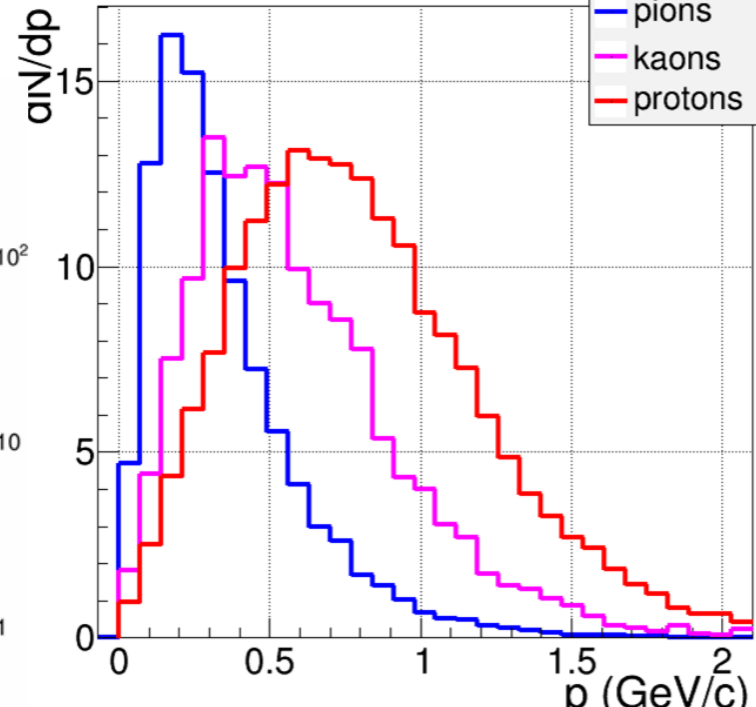


TPC: $|\Delta\phi| < 2\pi$, $|\eta| \leq 1.9$
 TOF, ECal: $|\Delta\phi| < 2\pi$, $|\eta| \leq 1.4$
 FFD: $|\Delta\phi| < 2\pi$, $2.9 < |\eta| < 3.3$
 FHCat: $|\Delta\phi| < 2\pi$, $2 < |\eta| < 5$



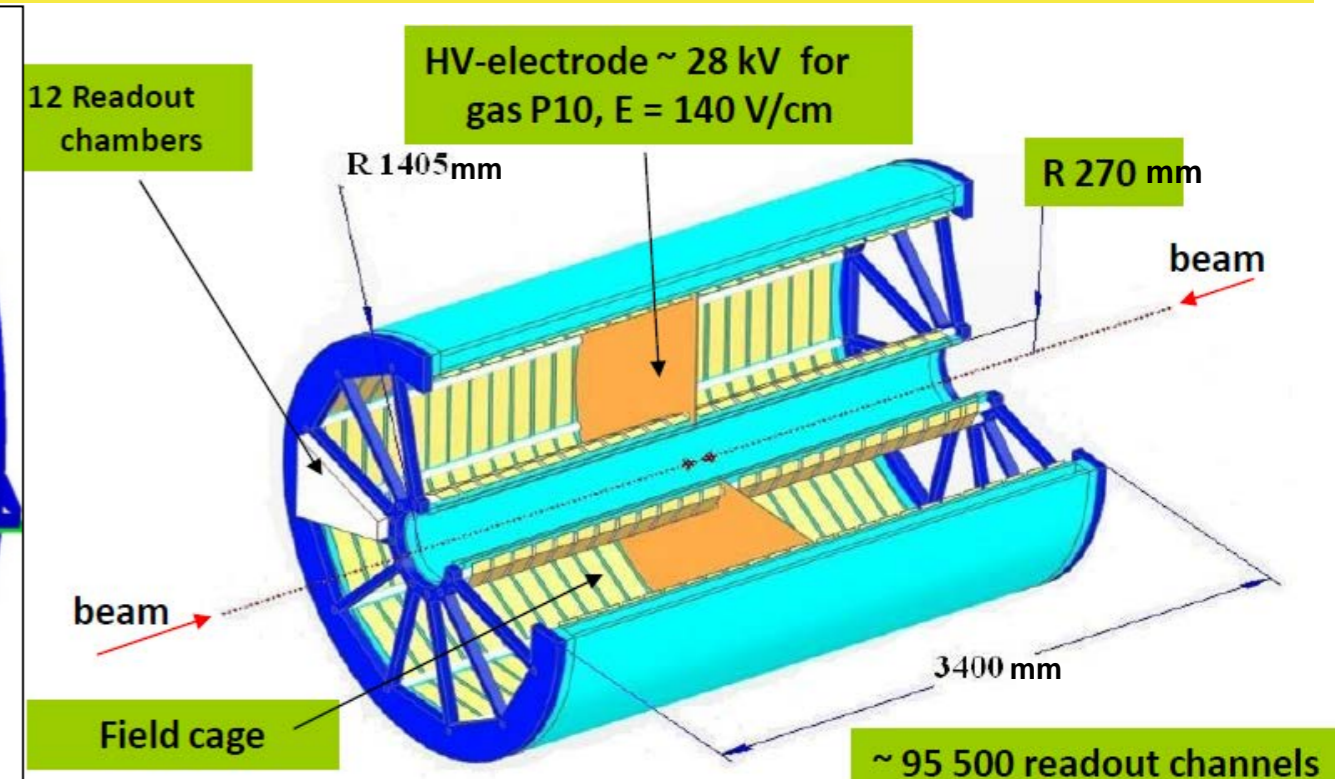
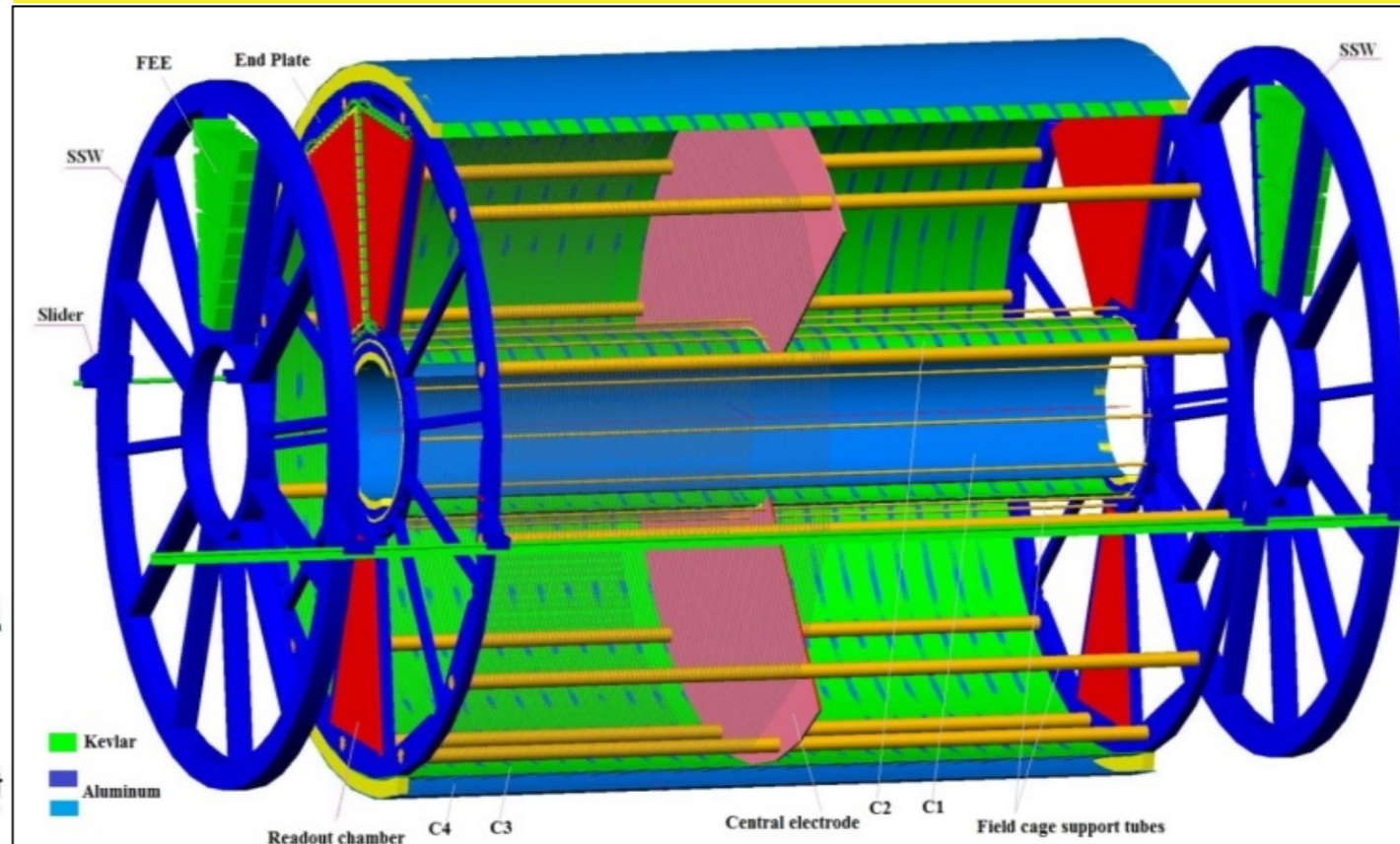
Particle identification in MPD

+ ITS (heavy-flavor measurements)
 + forward spectrometer

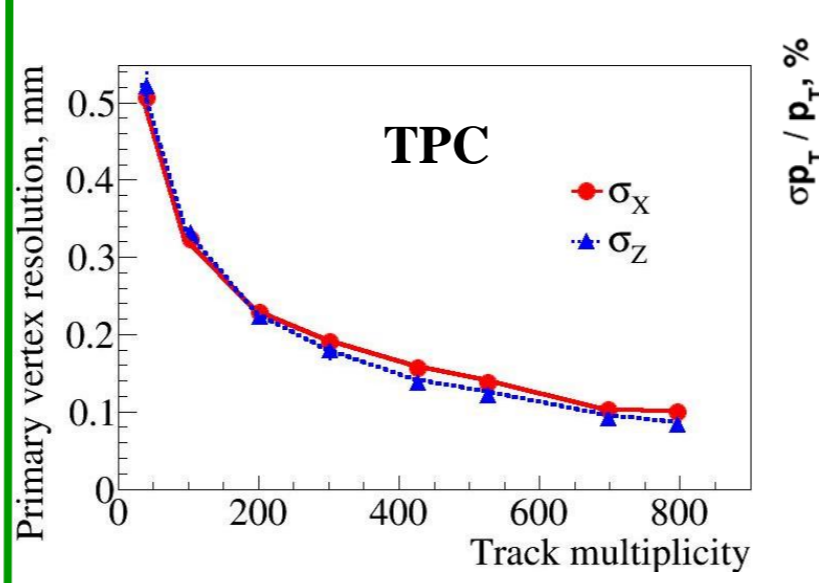


Momentum distr. of secondary particles in MPD

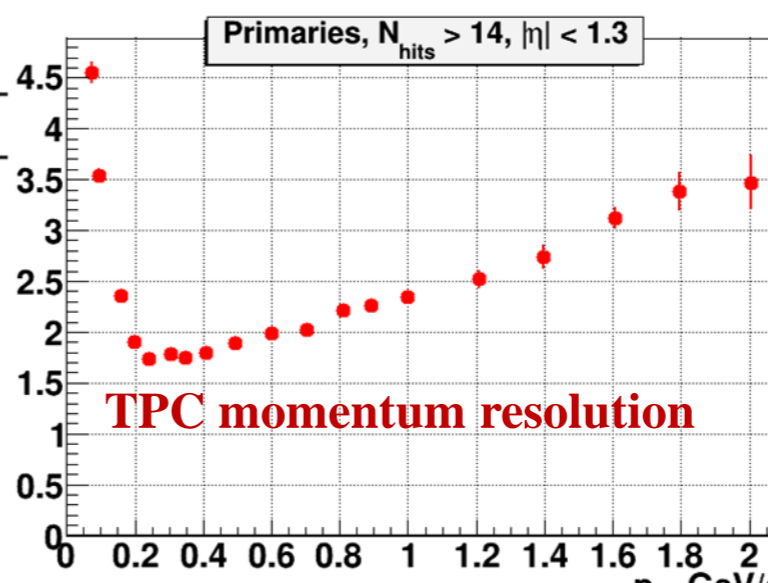
TPC structure



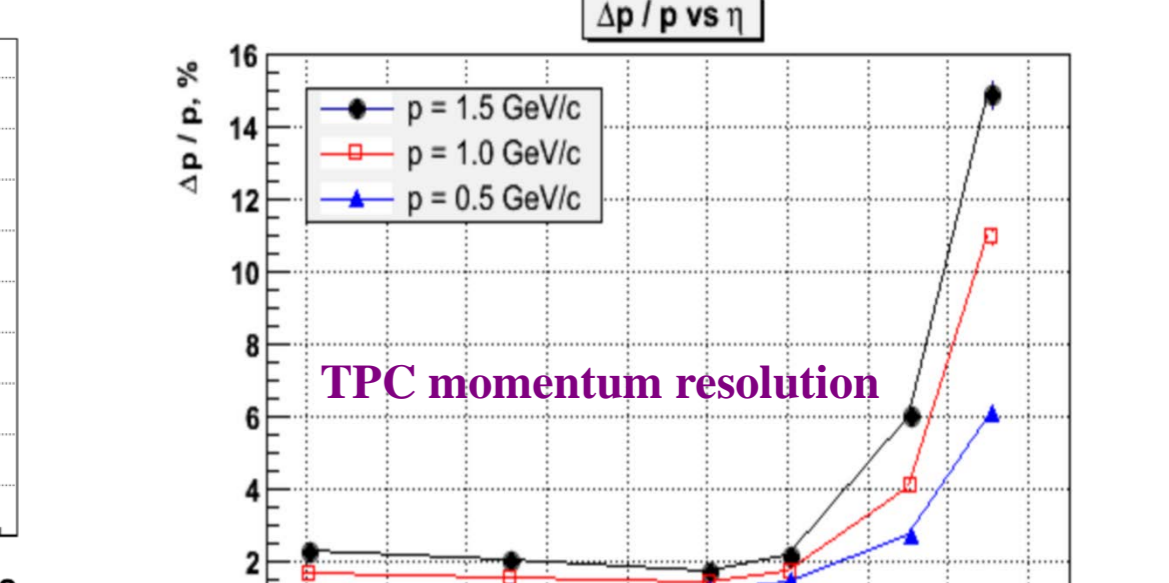
Au+Au @ 11 GeV (UrQMD + full chain reconstruction) [A. Zinchenko et al.]



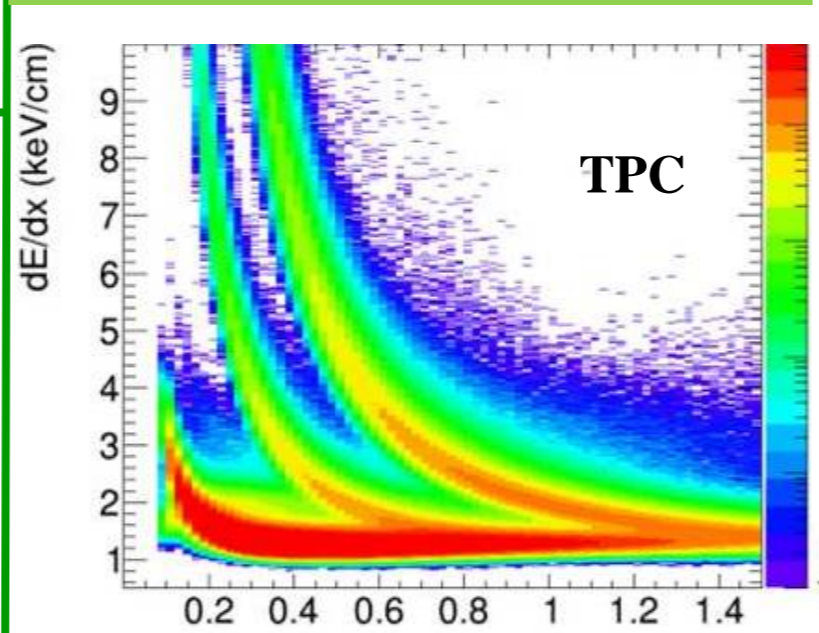
The primary vertex position resolution along transverse and longitudinal directions as a function of primary track multiplicity



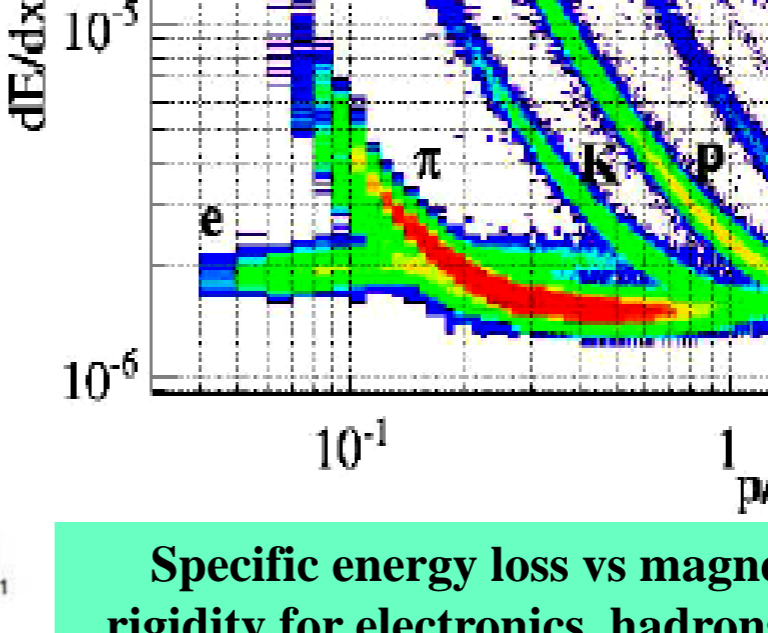
TPC momentum resolution



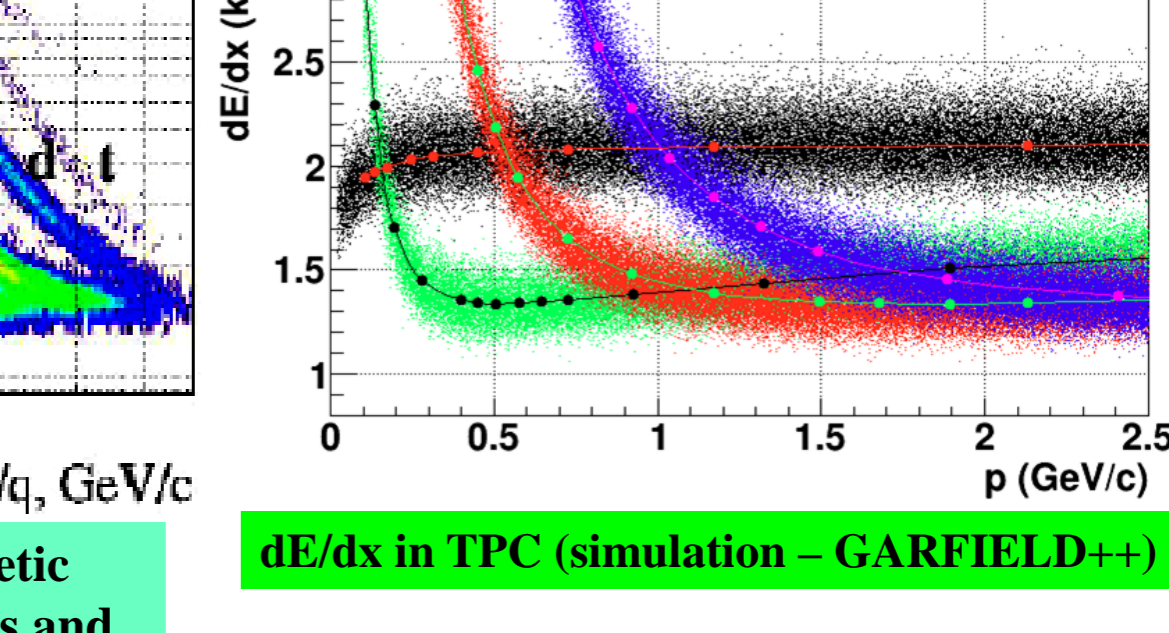
TPC momentum resolution



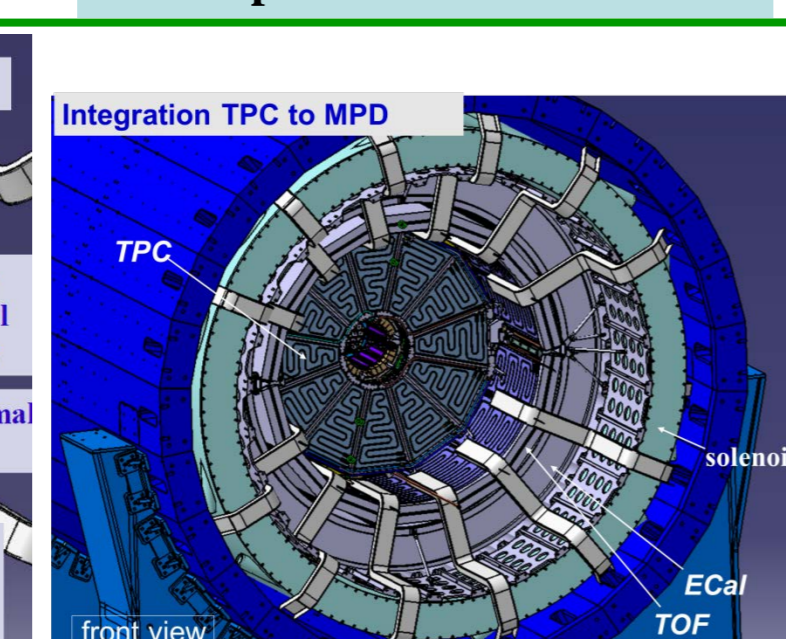
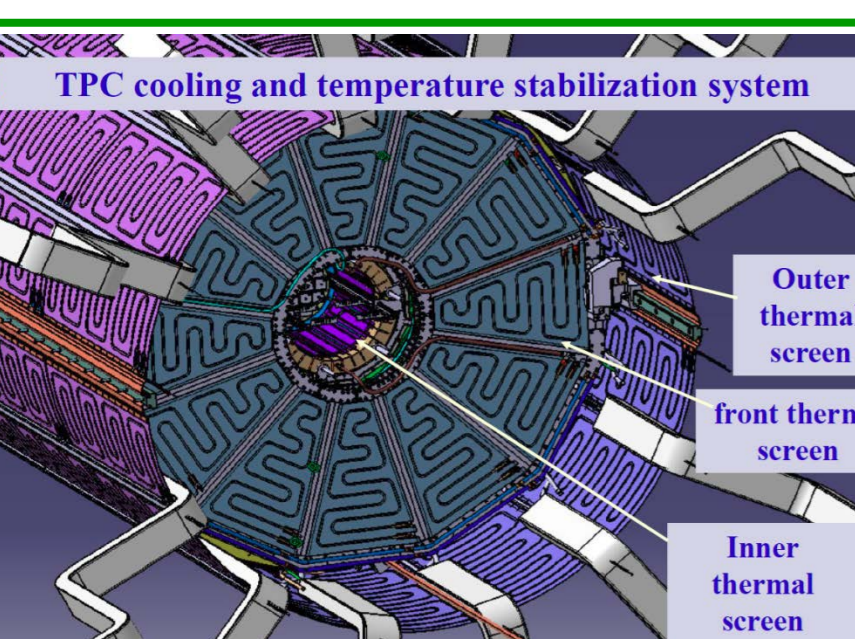
Particle identification



Specific energy loss vs magnetic rigidity for electronics, hadrons and light nuclei in TPC



dE/dx in TPC (simulation - GARFIELD++)

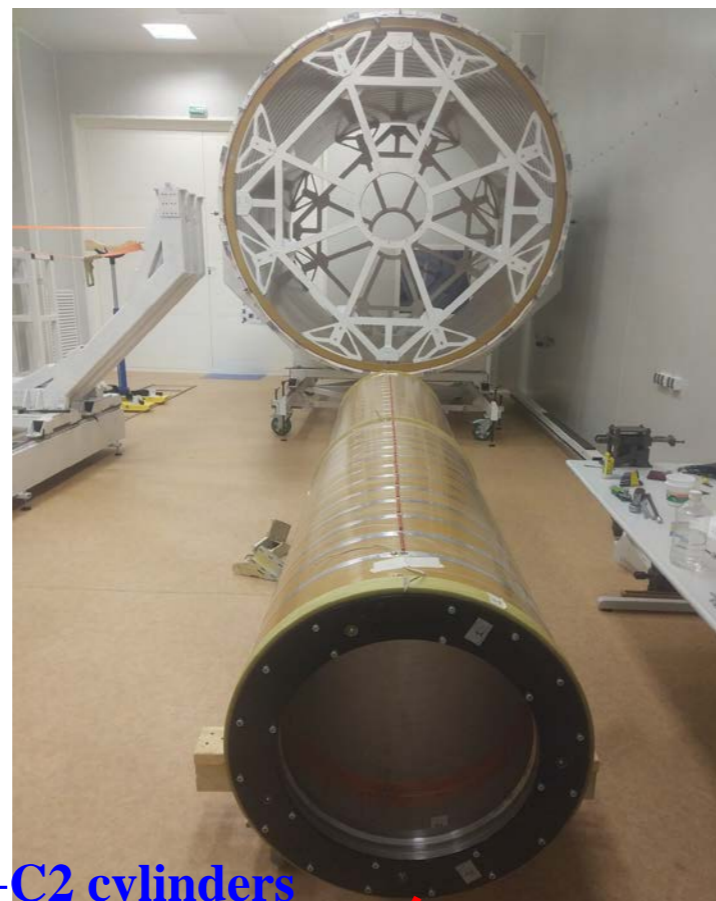


TPC cylinders and HV electrode (membrane) assembly

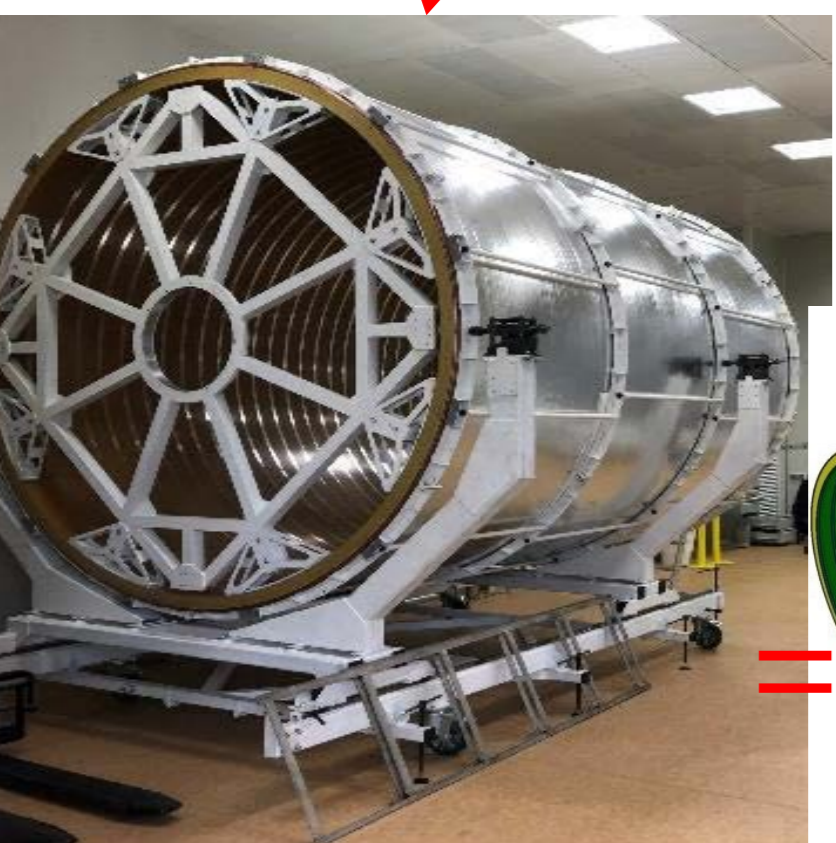
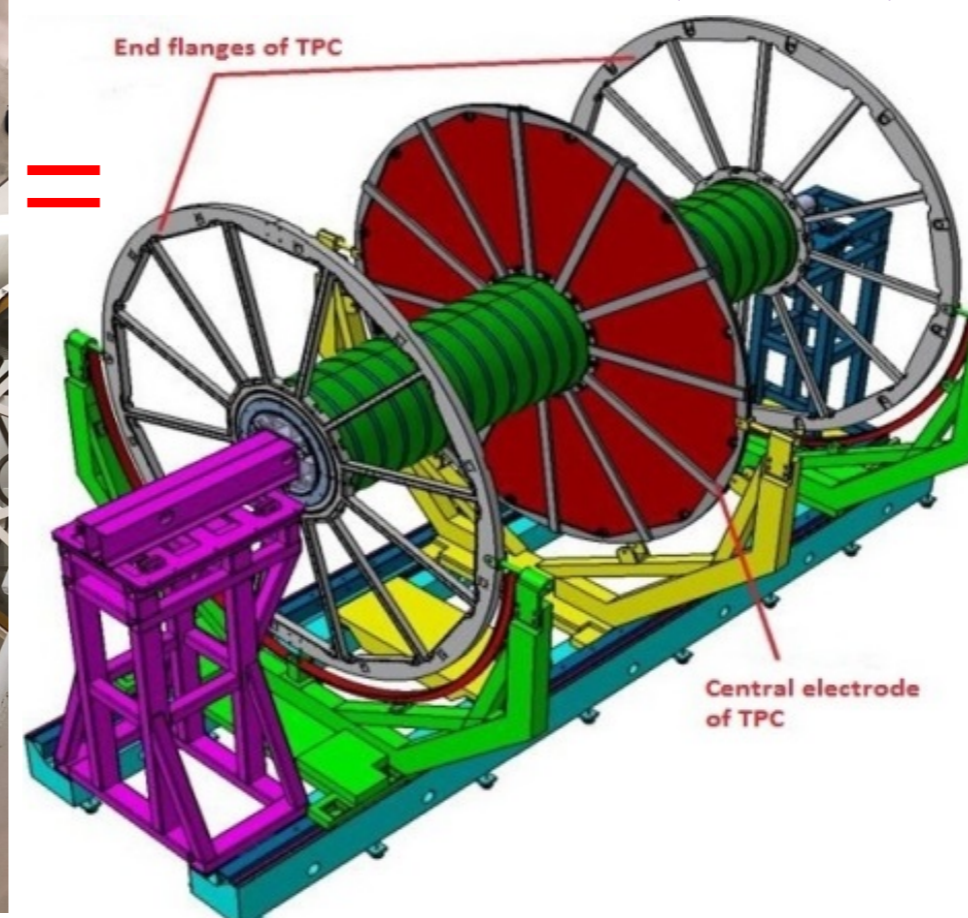
C3+C4 cylinders



C1+C2 cylinders



HV membrane (electrode)



C3+C4 glued

C3-C4 assembled; C1-C2 assembled; HV membrane - tested; (C1-C2) + flanges + HV membrane - assembly in progress

TPC basic parameters

Item	Dimension
Length of the TPC	400 cm (with FEE)
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)
HV electrode (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)
Max rate	7 kGz (L=10 ²⁷ cm ⁻² s ⁻¹)
Pad size	5x12 mm ² and 5x18 mm ²
Number of pads	95232
Pad row numbers	53
Zero suppression	up to 90%
Electronics shaping time	180-190 ns (FWHM)
Signal to noise ratio	30:1
Signal-to-noise ratio	10 bit
Sampling rate	10 MHz
Sampling depth	310 time buckets
Track point resolution in X-Y (R-φ) plane	~ 600 μm
Track point resolution in Z plane	~ 1 mm
Resolution of two tracks	1 cm
Momentum resolution (Δp/p) for charge particle	≤ 3% in 0.1 < p < 1 GeV/c
Hadron and lepton identification by dE/dx measurements	better than 8 %



Set up for FE cards tests

TPC sub-systems status: DAQ, LV+HV, GATE

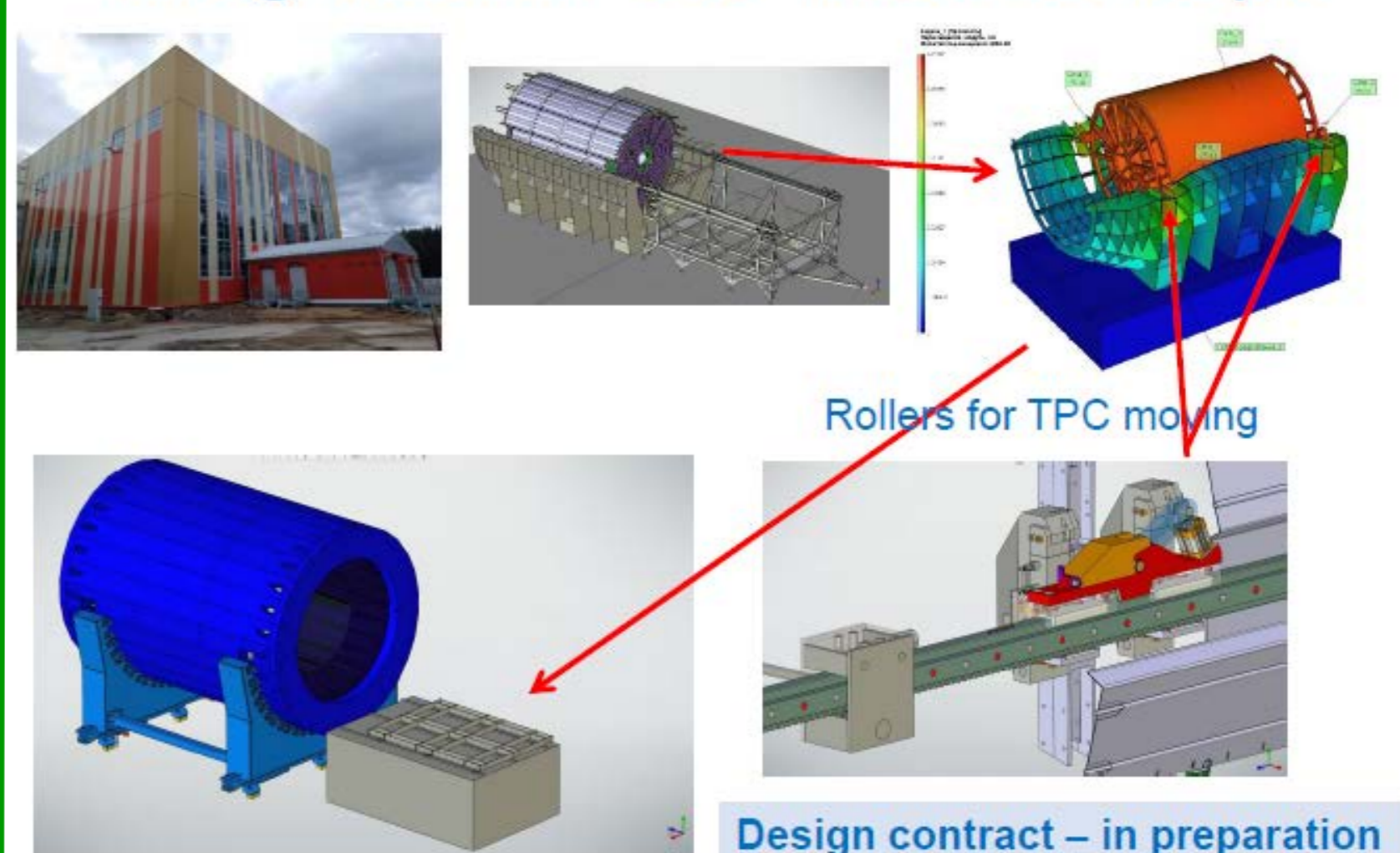


Gate prototype: tests with ROC



Pulse: shift = -40V, ampl = +-200V
 T=30 mksec, rise time - 700 nsec

Integration TPC to MPD: concept



Readout chambers (ROC) :
 2 produced + 24 tested

Design contract - in preparation