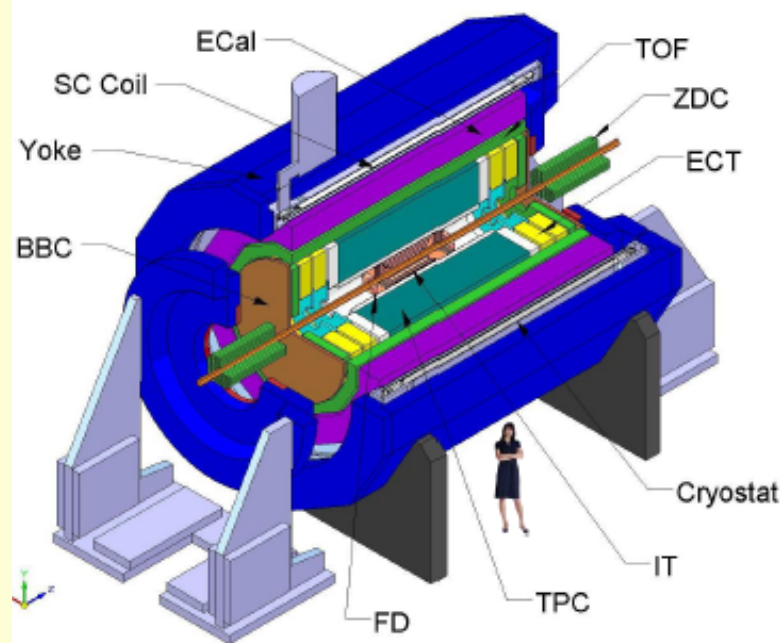


TPC status (28.02.2017)

- TPC for MPD
- tooling for TPC assembly (Progresstech-Dubna)
- ROC chambers
- front end electronics: FEC-64S and FEC32S
- gas, cooling and laser systems
- integration TPC to MPD
- time schedule

Presented by Sergey Movchan
on behalf of the MPD collaboration

Tracking: up to $|\eta| < 1.8$ (TPC)
PID: hadrons, e, γ (TOF, TPC, ECAL)
Event characterization:
centrality & event plane (ZDC)

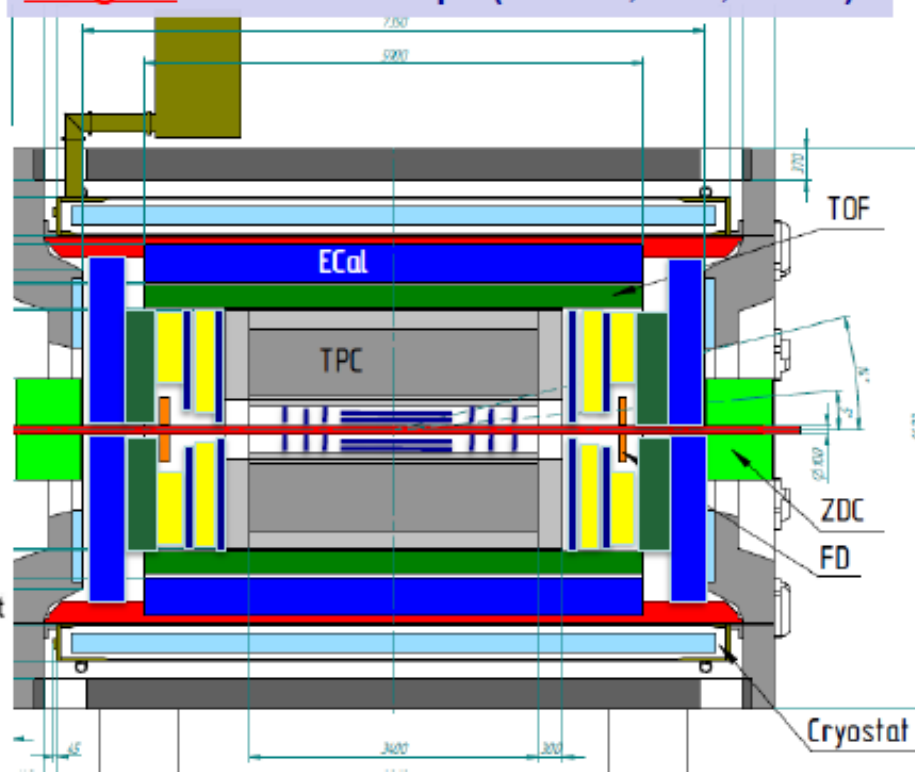


The detectors of MPD will provide
hermetic & homogenous acceptance (2p in azimuth), low material budget,
good tracking performance and powerful particle identification (nuclei, hadrons, e, γ),
high event rate capability and reliable event separation.

13 октября, 2016

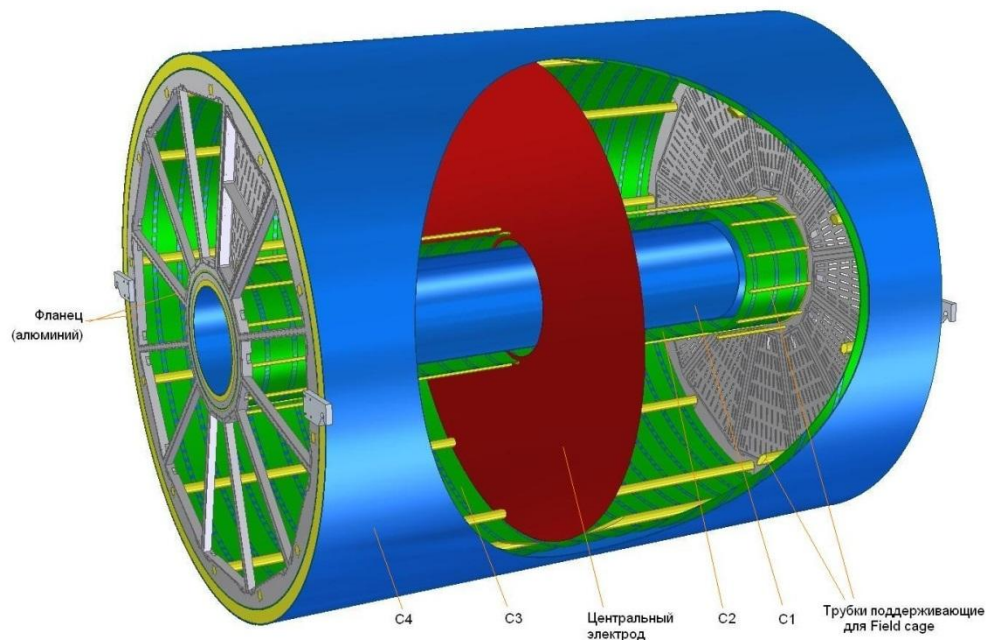
В. Кекелидзе, ОИЯИ - Баку

Stage 2: IT + Endcaps (tracker, TOF, ECAL)



MPD TPC conception

Корпус TPC/ MPD



Item	Dimension
Length of the TPC	340cm
Outer radius of vessel	140cm
Inner radius of vessel	27 cm
Outer radius of the drift volume	133cm
Inner radius of the drift volume	34cm
Length of the drift volume	170cm (of each half)
HV electrode	Membrane at the center of the TPC
Electric field strength	~140V/cm;
Magnetic field strength	0.5 Tesla
Drift gas	90% Ar+10% Methane, Atmospheric pres. + 2 mbar
Gas amplification factor	$\sim 10^4$
Drift velocity	5.45 cm/ μ s;
Drift time	< 30 μ s;
Temperature stability	< 0.5°C
Number of readout chambers	24 (12 per each end-plate)
Segmentation in ϕ	30°
Pad size	5x12mm ² and 5x18mm ²
Number of pads	95232
Pad raw numbers	53
Pad numbers after zero suppression	< 10%
Maximal event rate	< 7 kHz (Lum. 10 ²⁷)
Electronics shaping time	~180 ns (FWHM)
Signal-to-noise ratio	30:1
Signal dynamical range	10 bits
Sampling rate	10 MHz
Sampling depth	310 time buckets

28-Feb-17

S.Movchan MPD/NICA TPC status
INSTR-2017, Novosibirsk, Russia

TPC cylinders: C1-C4

- Length: 3.4 m
- Diameter: 0.540 m



- Length: 3.4 m Diameter: 2.660 m



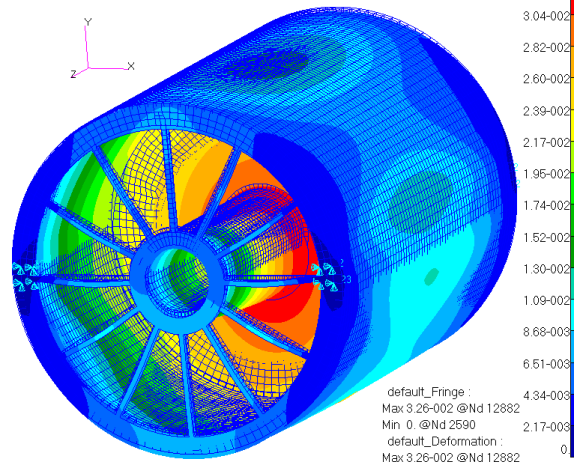
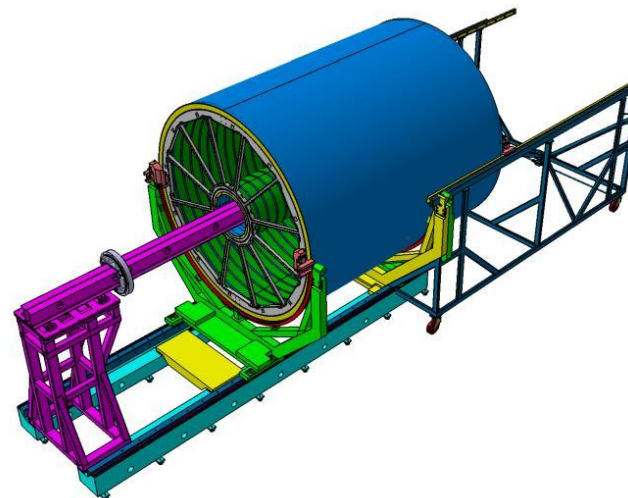
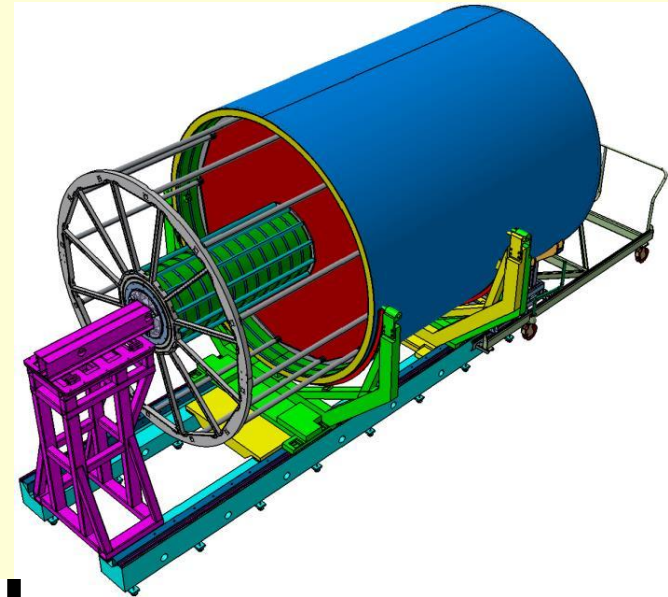
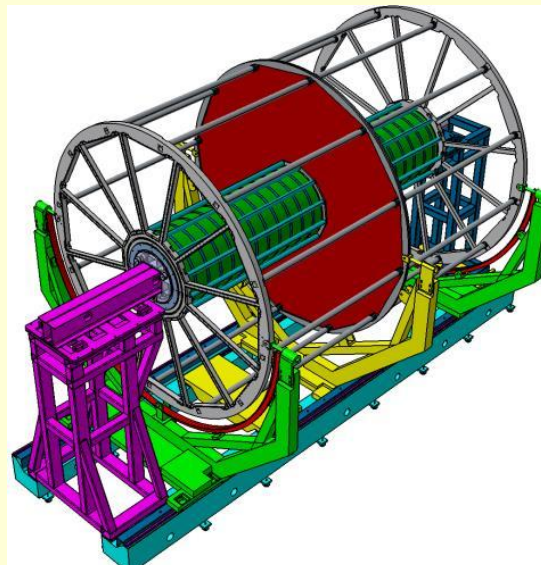
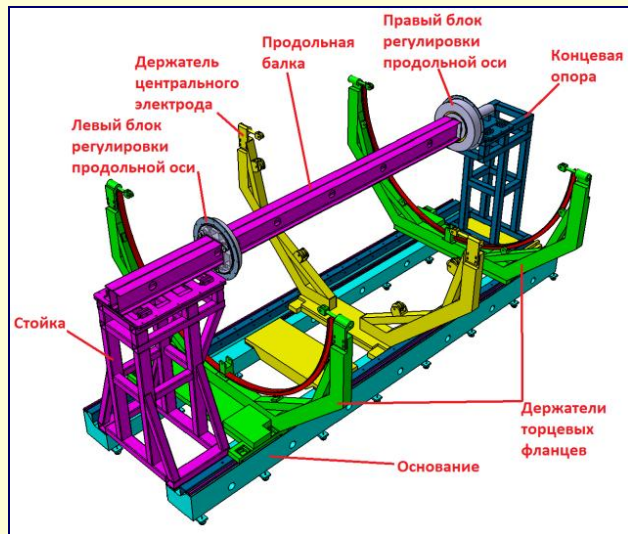
- Length: 3.4 m
- Diameter: 0.676 m



- Length: 3.4 m
- Diameter: 2.814 m



Tooling for TPC assembly

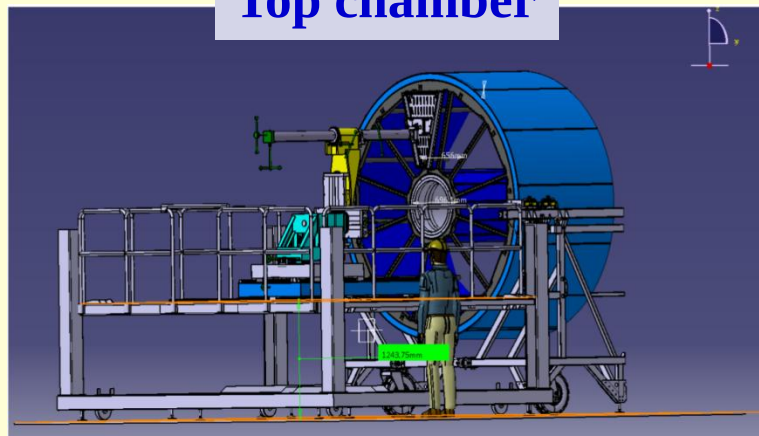


Manufacture - started

**Delivery to JINR –
May 2017**

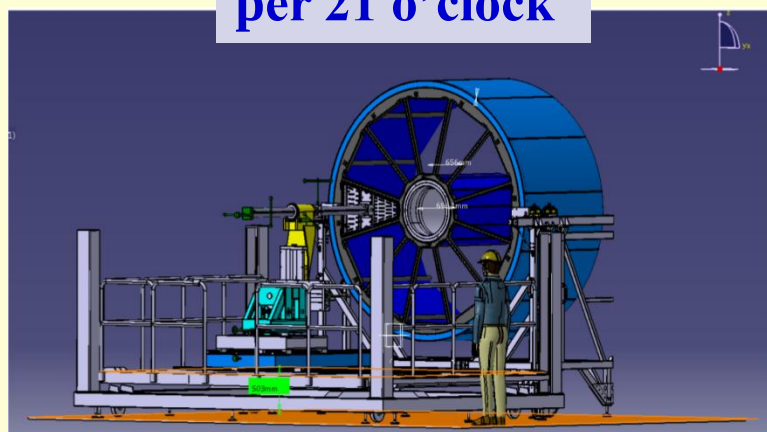
Manipulator for ROC chamber installation

Top chamber



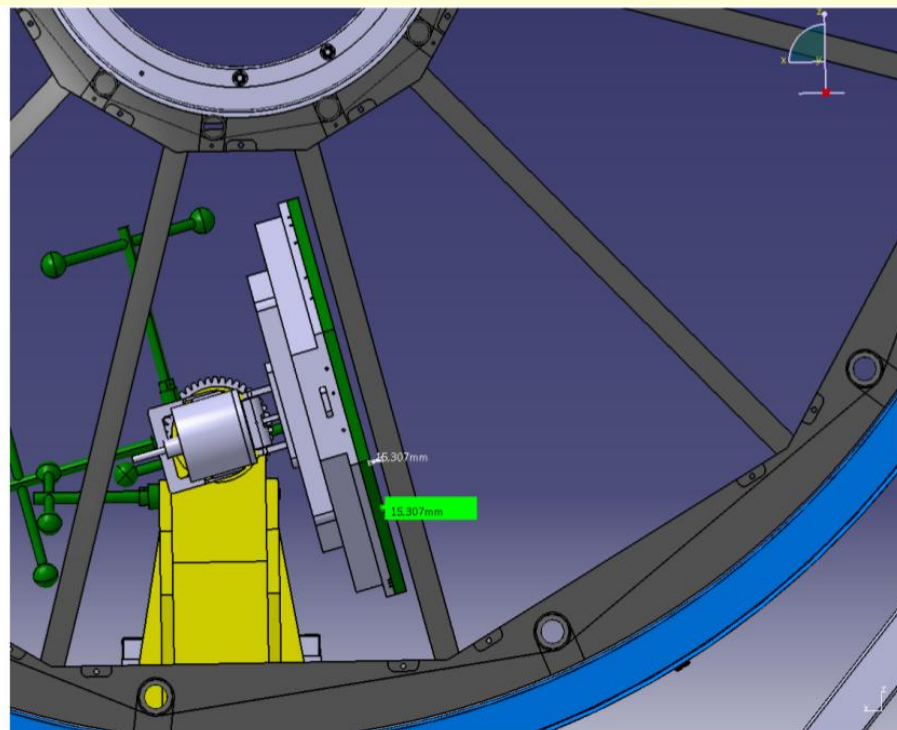
Высота о 43 mm.

per 21 o'clock



Высота от пола до подъемника составила примерно 503mm.

Min gap – 15 mm



Set of drawings – in progress

TPC assembly hall (Bld.217) – common view

Clean room - **ready**



S=84 m2

ISO-6

ROC chambers

ROC chamber assembly hall (Bld.40)

Gluing



Wiring



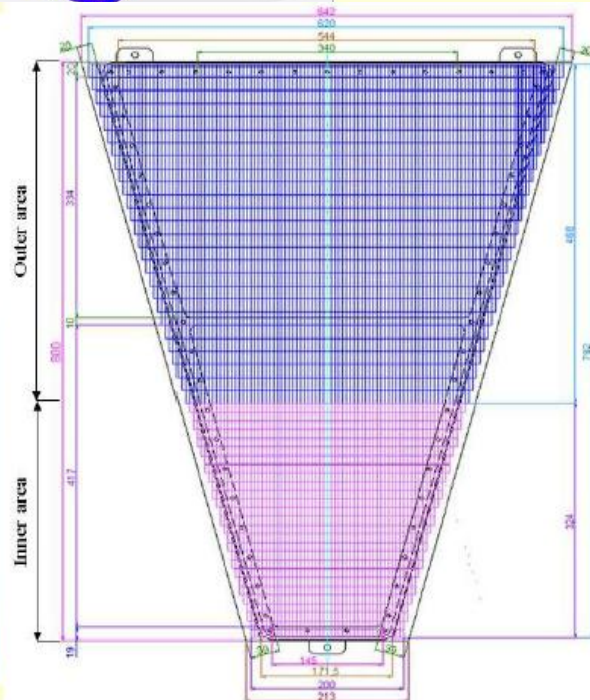
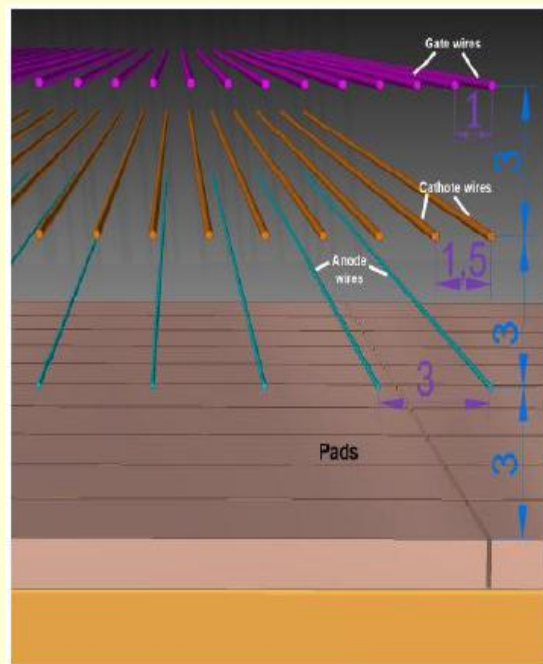
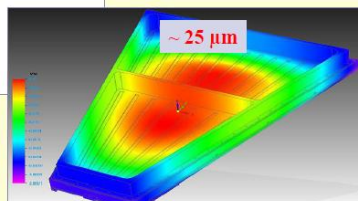
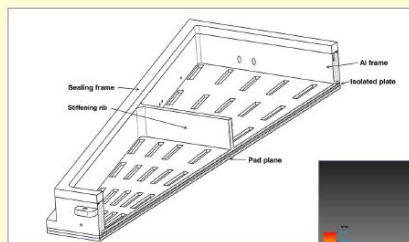
Test set up



Soldering



Read out chamber (ROC): MWPC (base line option)



Design of Read-Out Chamber (ROC) is defined

Structure of Readout Chamber:

- three wire planes
- pad plane
- insulation plate
- trapezoidal aluminum frame

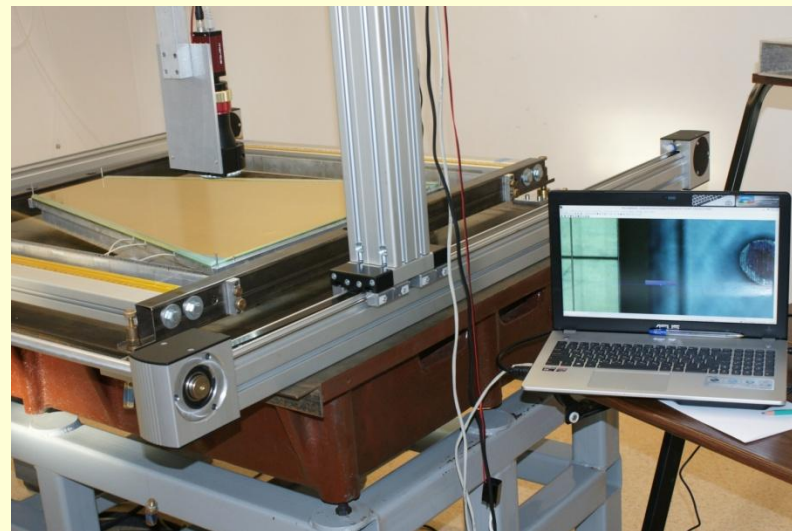
Wire structure:

- anode wire ($\varnothing=25\ \mu\text{m}$) pitch - 3 mm
- cathode wire ($\varnothing=75\ \mu\text{m}$) pitch - 1.5 mm
- gate wire ($\varnothing=75\ \mu\text{m}$) pitch - 1 mm
- wires gap - 3 mm

Pads:

- rectangular shape
- 27 rows of pad with size $5 \times 12\ \text{mm}^2$ at inner area
- 26 rows of pad with size $5 \times 18\ \text{mm}^2$ at outer area

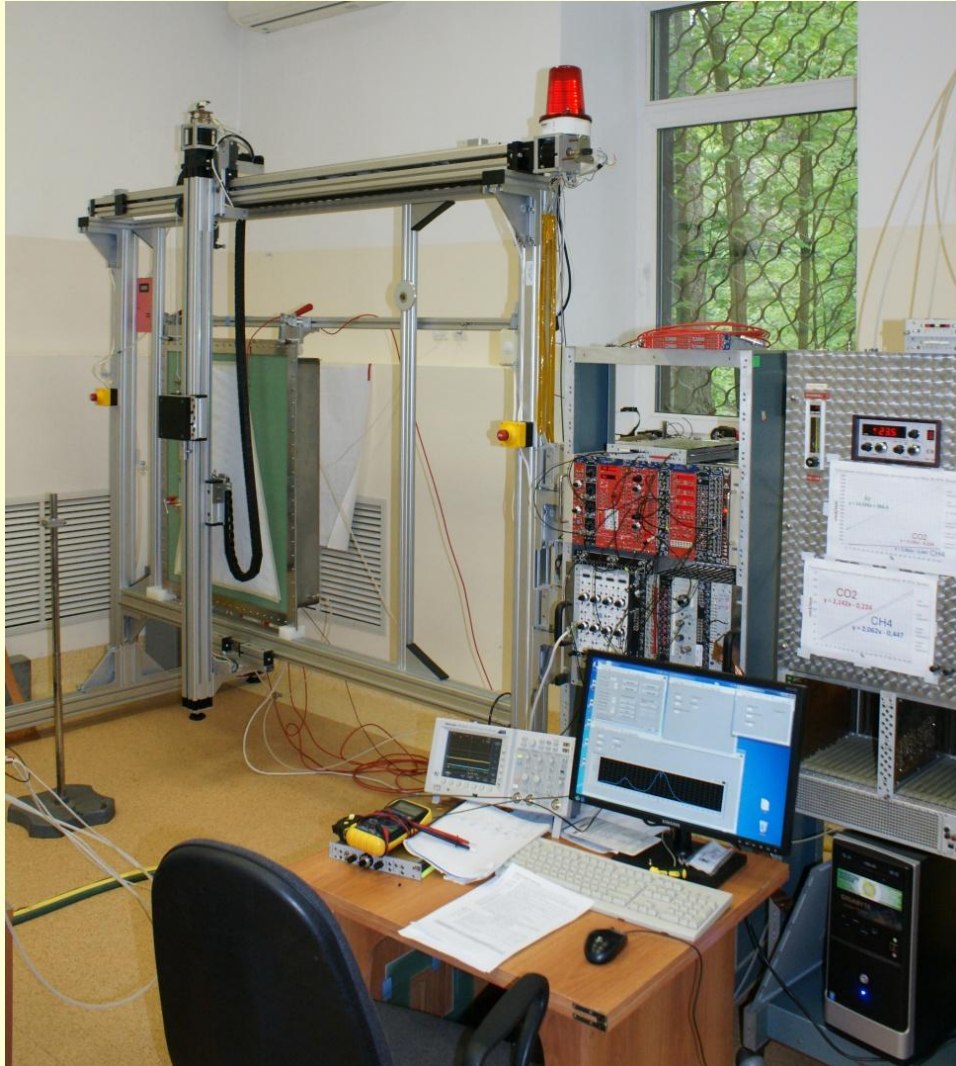
ROC chamber: mass-production



wiring

pad plane connectivity test

ROC chambers: test set up



Test procedure:

- counting plateau
- dark current
- energy resolution (Fe-55)
- uniformity of gas gain
 - ✓ linear scan
 - ✓ area scan



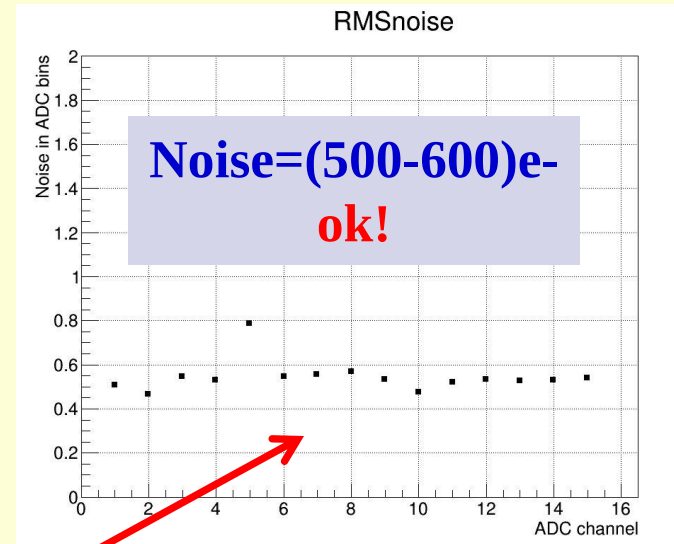
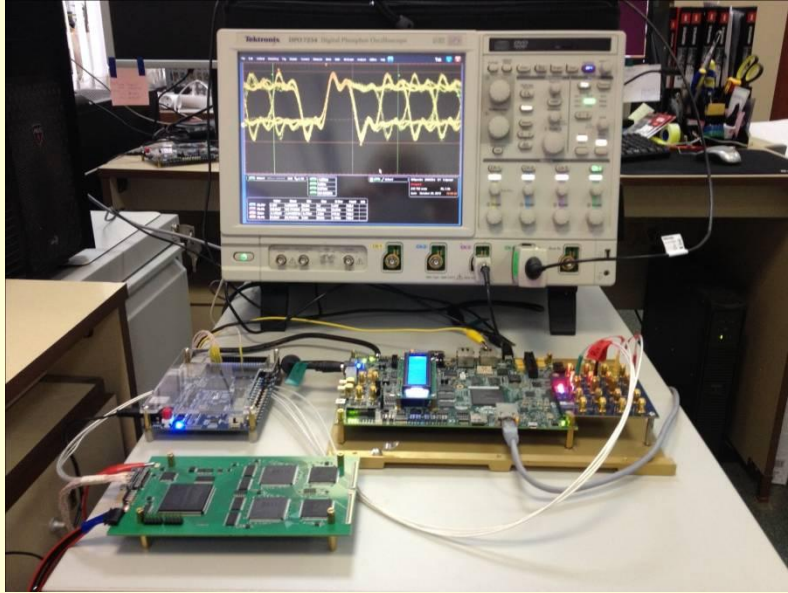
Read out electronics

Base line option – FEC-64S

SAMPA options - NCCA, FEC32S

for more info – see **Stepan Vereschagin talk (Friday, 10:00)**

Base line option: **FEC-64S** status



Plans:

- pedestals readout
- readout up to 8 boards
- test electronics with pad plane
- test electronics with ROC chamber

OK!
in progress
OK!
in progress

Test set up

Back view



Serial ROC
chamber

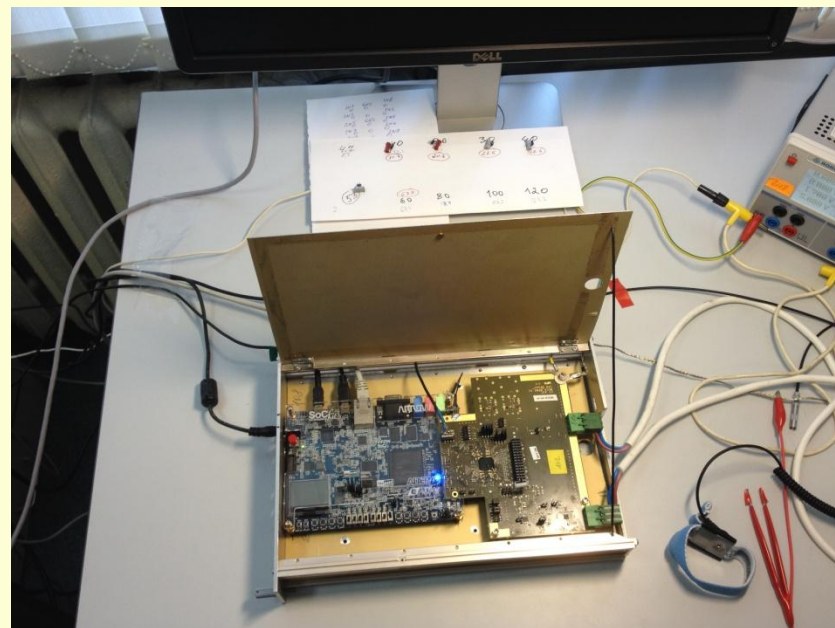
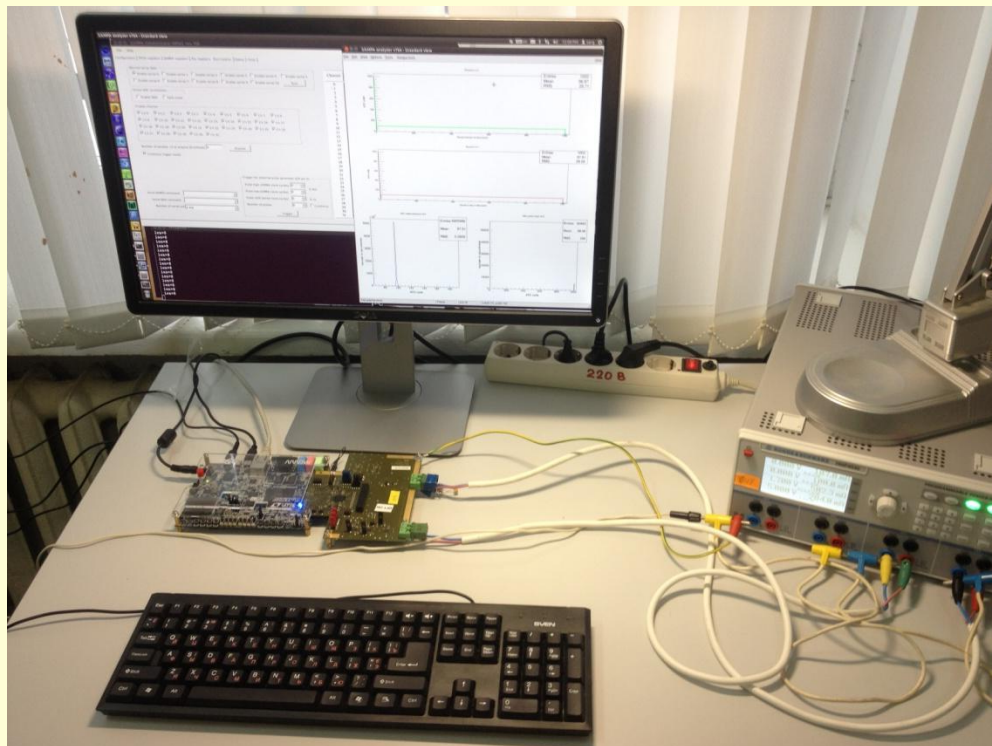
FE
cards

LV power
supplies

Front view



Test of NCCA board with SAMPA chip – in progress



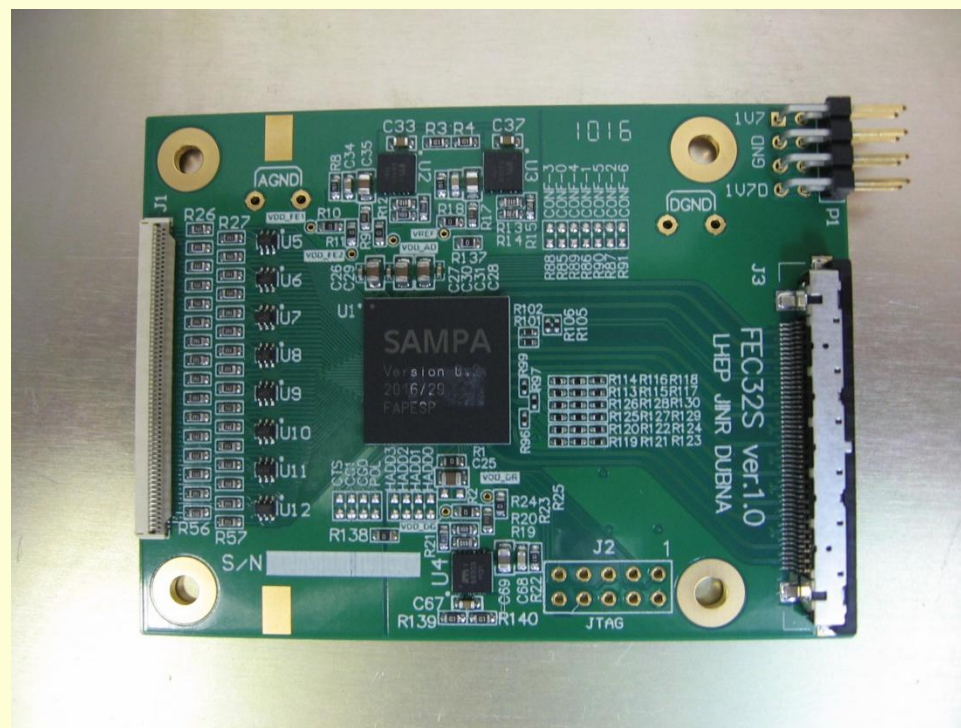
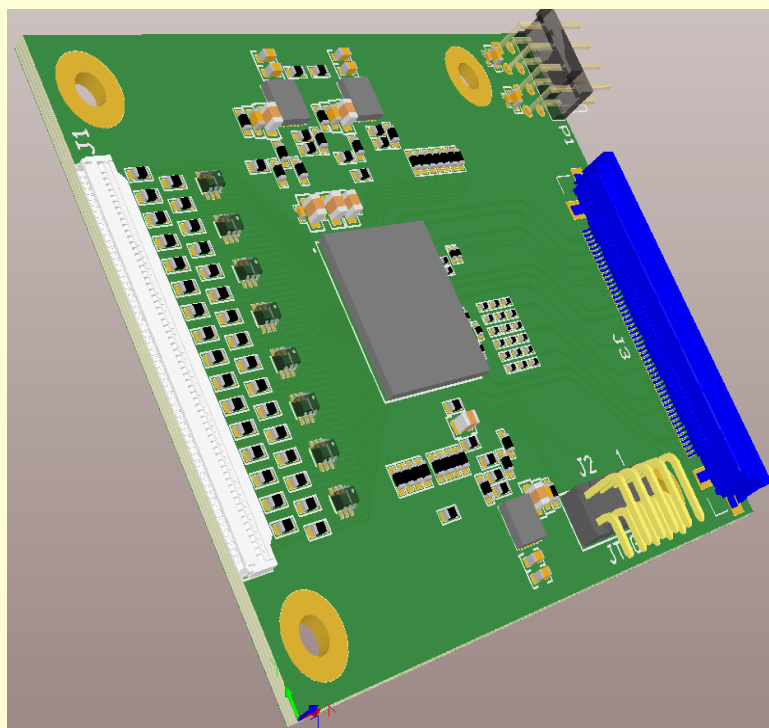
Parameters:

- Cross-talks < **0.5%**
- Noise < **500e⁻** (for Cdet=(10÷20) pF и G = **20mV/fC**)
- ADC ENOB = **9 bit**
- e-links (**350 MHz each**)

MPD TPC **FEC32S** board rev.01 based on **SAMPA** chip

6 layers

Size: 75 x 56 mm



Design - **done**
Components soldering – **done**
FEC32S - ready for tests



Gas, cooling and laser calibration systems

TPC gas system

Rack 2



Rack 1

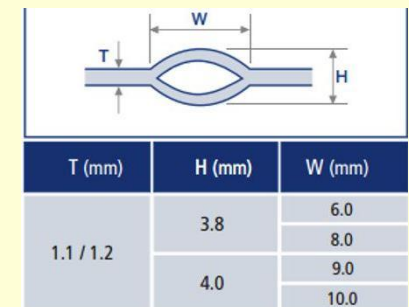
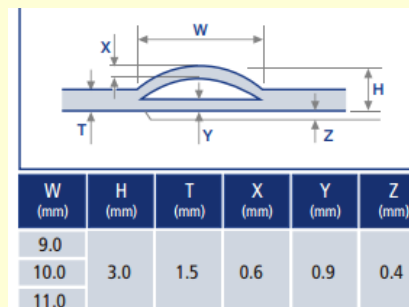
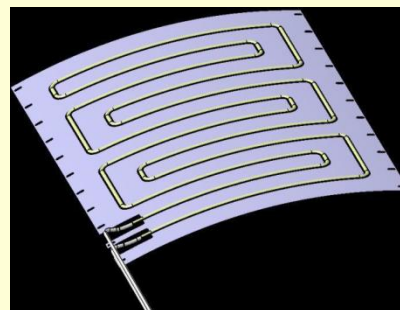
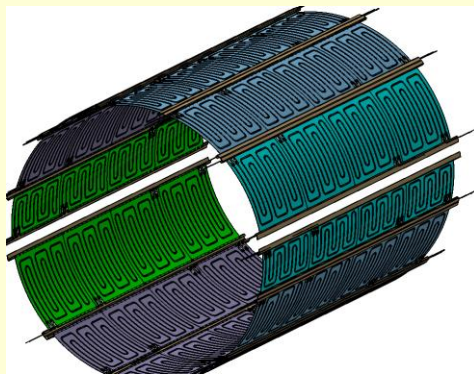
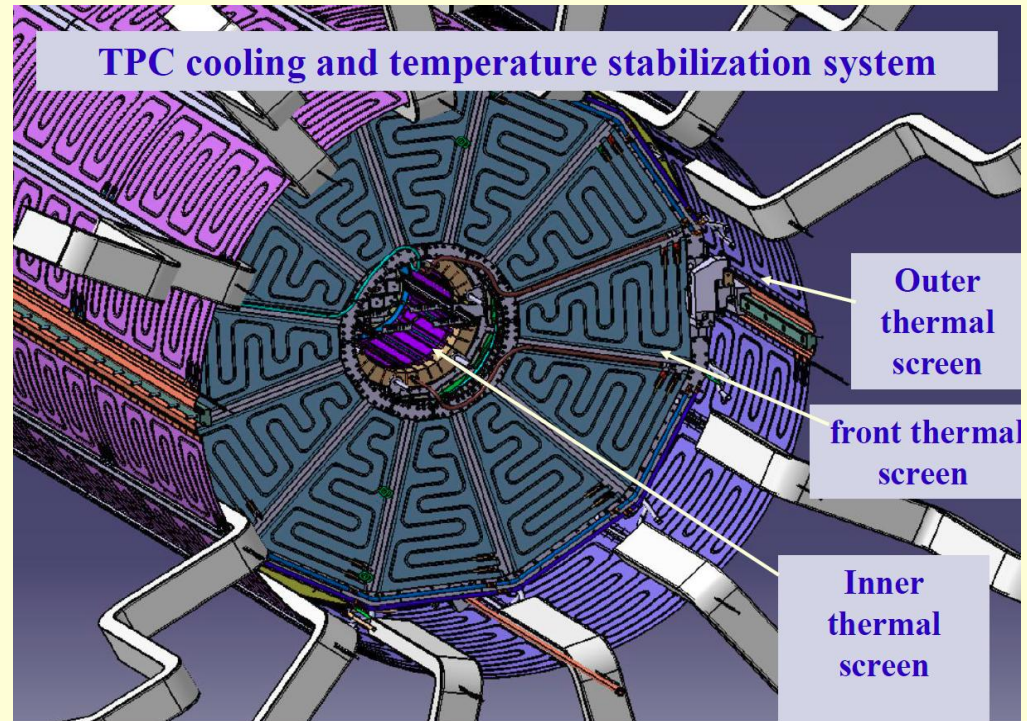
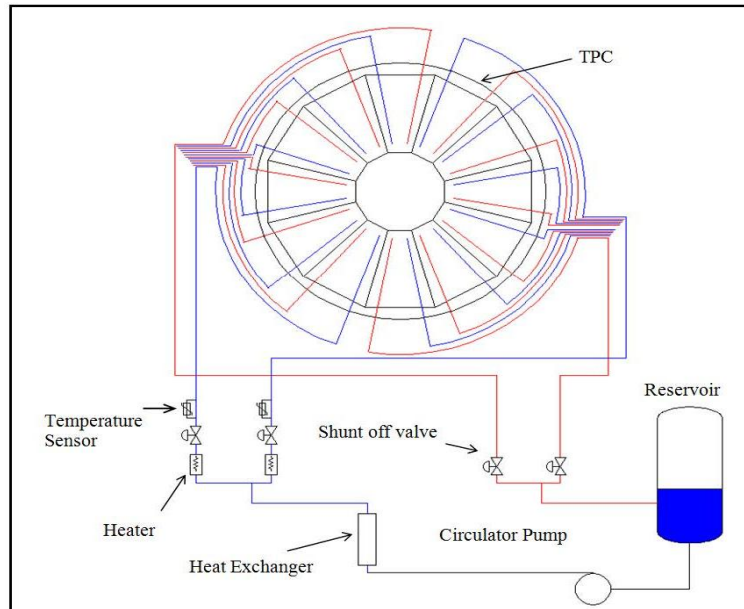


Gas mixture	Ar + 10%CH ₄
TPC gas flow, nominal	200 l/min
TPC overpressure	(2.0 ± 0.1)mBar
O ₂ admixture	20 ppm
H ₂ O admixture	10 ppm
External loop, refresh gas rate	30 l/min
Fresh part of gas mixture add to external loop, range	(0-50) l/min
TPC isolating gas	N ₂
N ₂ gas flow	(5-20) l/min

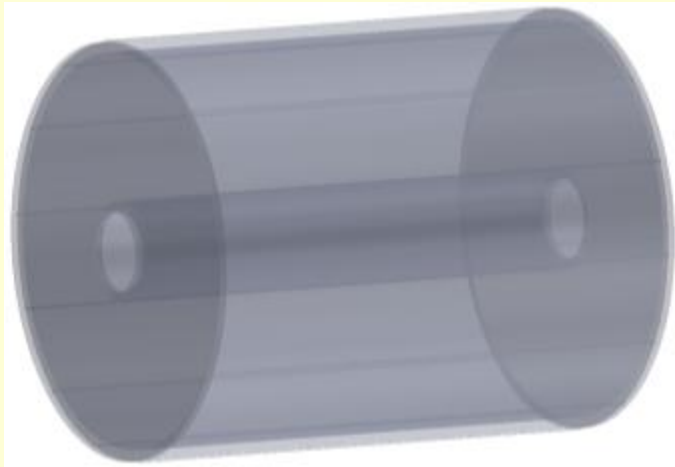
Purification system tested with TPC volume imitator at PNPI – November 2016

TPC gas system delivery to JINR – 2017

TPC cooling system



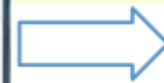
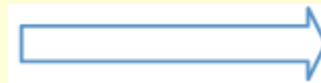
TPC **cooling** system: status



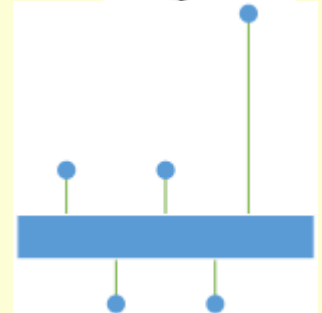
Sensors

Crate

TANGO server



NET



Prototyping and software – in progress

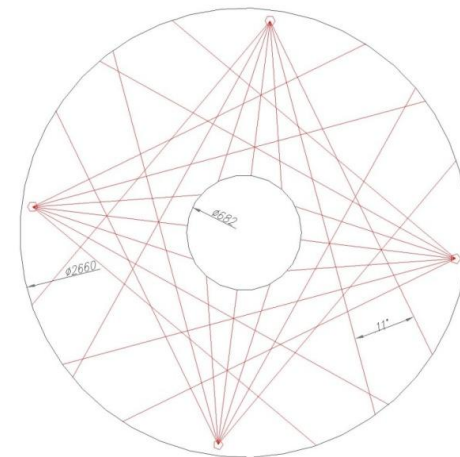
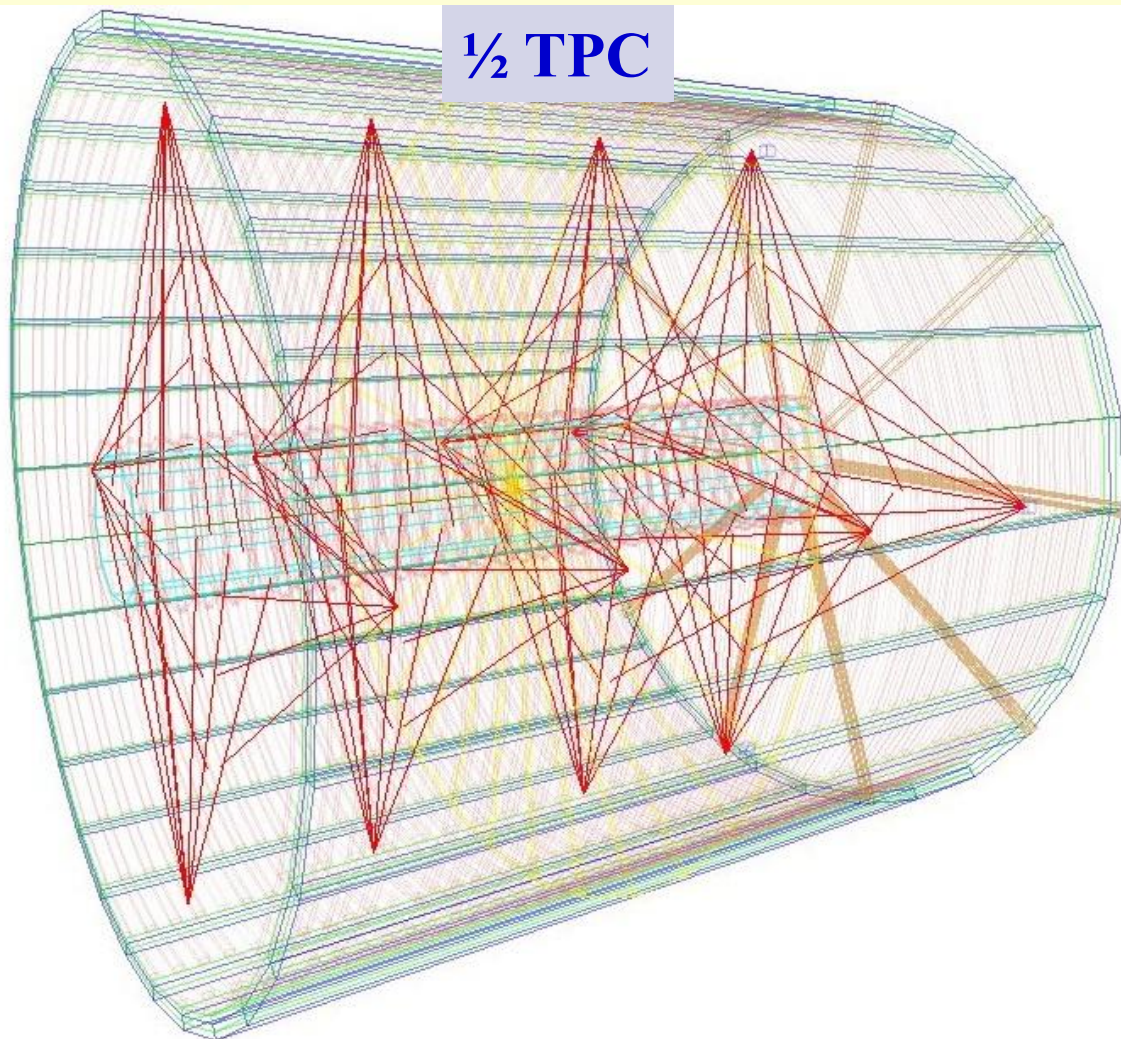
Necessary to purchase: water tank, pumps, pipes, heat exchanger, control cabinet

Cooling equipments and components **purchased** :

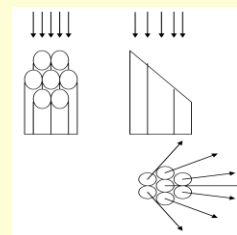
- | | |
|----------------------------|----------|
| - crate NI PXIe-1075 | – 1 pc |
| - module NI TB 4357 (20ch) | – 10 pc |
| - module NI TB 4300 (8ch) | – 1 pc |
| - temp. sensor | – 200 pc |
| - pressure sensor | – 4 pc |

TPC laser calibration system

$\frac{1}{2}$ TPC

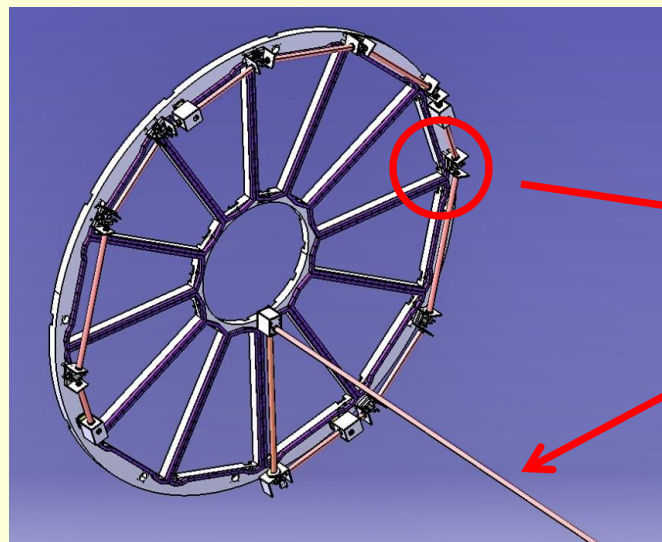


micro-mirror
bundles

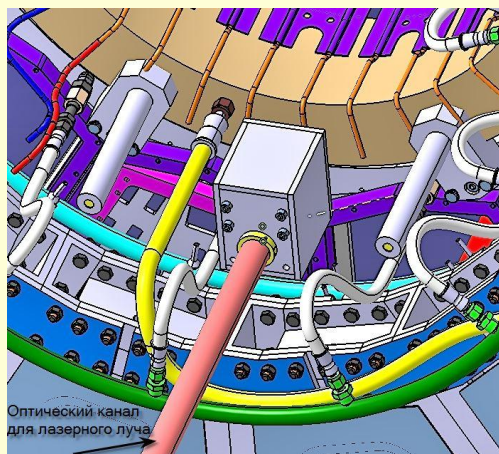
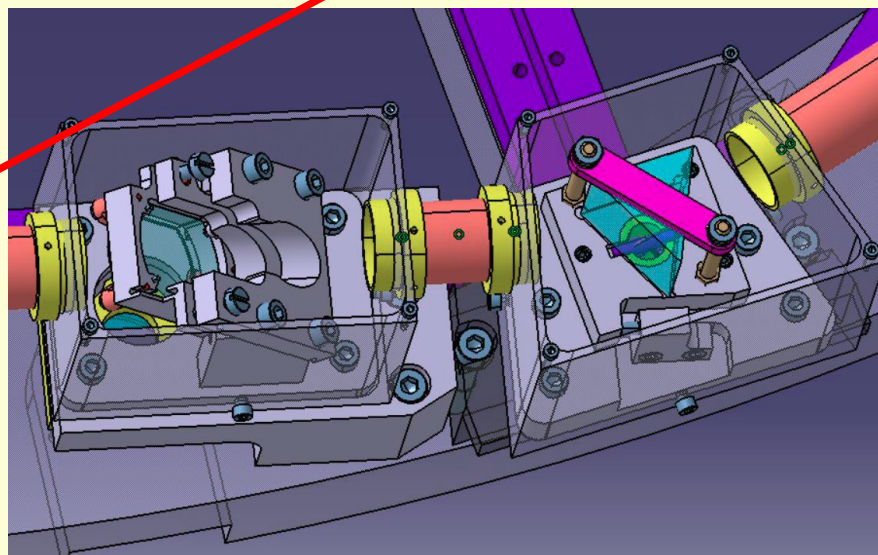


Laser “planes” – 4+4
 Points per plane – 4
 Beams per point – 7
 Laser “tracks”, **N** – 224

New position of channel for laser beam: **proposal**



Semi transparency mirror & prism

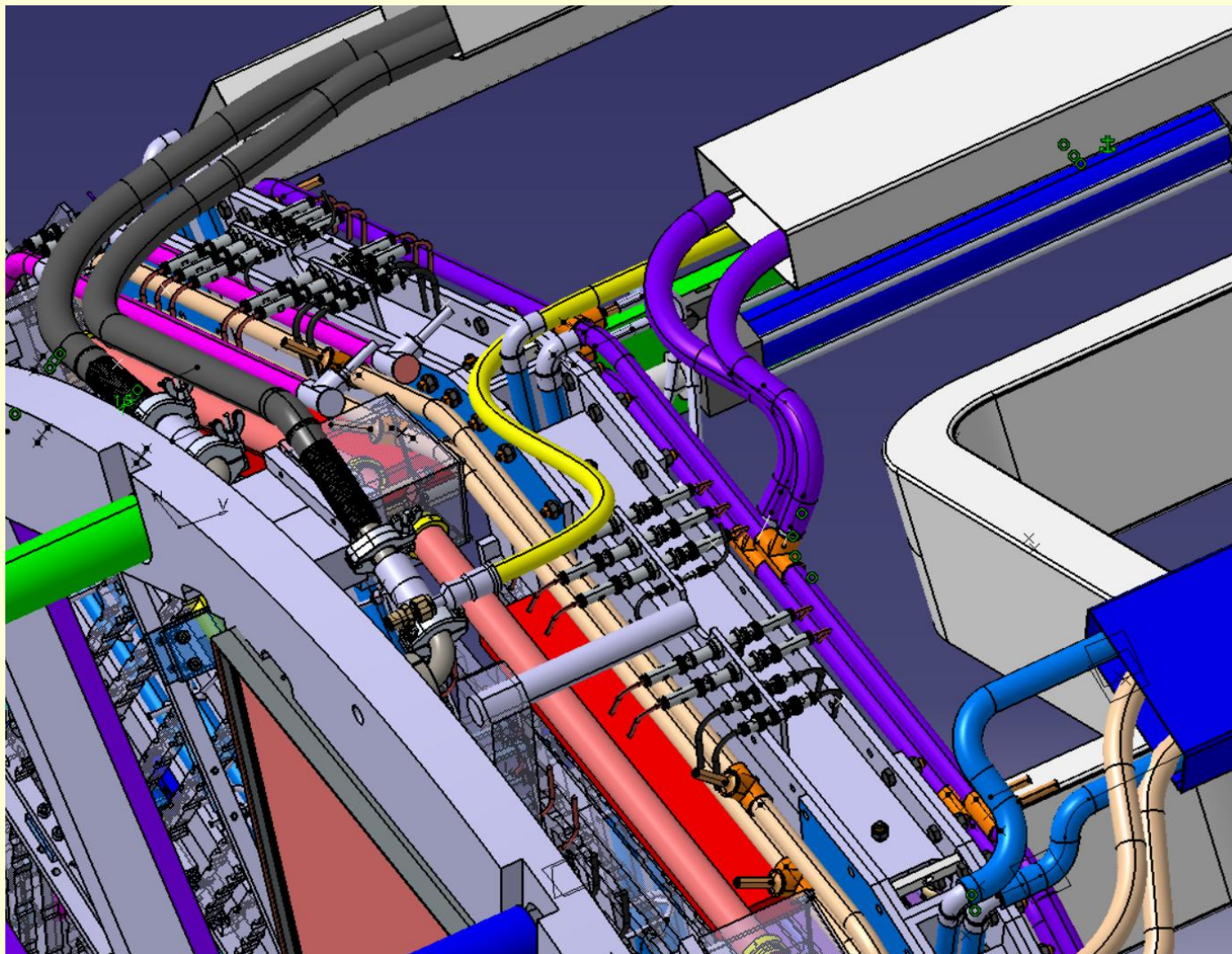


- full set of micro-mirror bundles - **assembled**
- 2 lasers (special option) - **ordering in progress**



TPC integration

TPC services: example



List of TPC cables and services: **tray 1** (example)

Cable and services per tray_20_06_2016 - Microsoft Excel

Главная Вставка Разметка страницы Формулы Данные Рецензирование Вид

Обычный Разметка страницы Представления Во весь экран Режимы просмотра книги

Линейка Сетка Панель сообщений Показывать или скрыть

Строка формул Заголовки

Масштаб 100% Масштабировать выделенный фрагмент Масштаб

Новое окно Разделить Упорядочить все Закрепить области

Скрыть Отобразить

Сохранить рабочую область Перейти в другое окно

Макросы

Окно

F5 $=3,14*(C5/2)^2*(D5)$

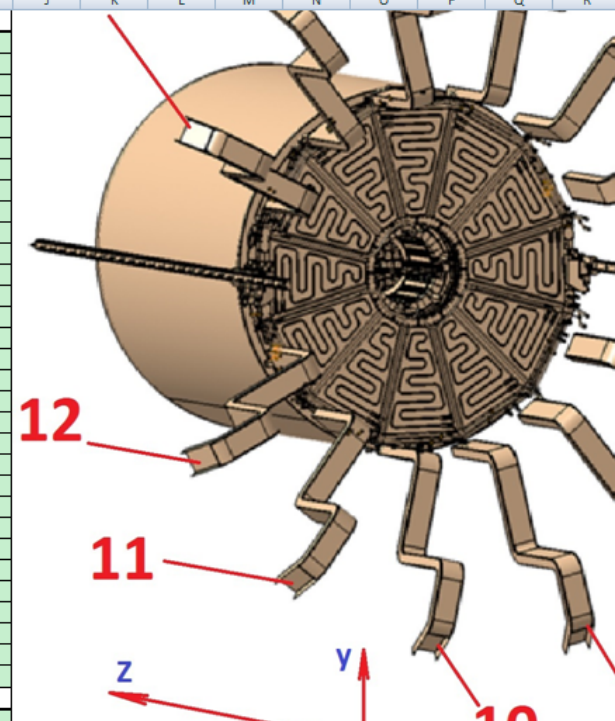
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
			D(mm)	количество (шт.)	сечение 1 шт.													
3																		
4		from ROC																
5		HV питание для 4 секций анода	4,1	4	13,19585	52,7834												
6		запирающая сетка	5	2	19,625	39,25												
7		верхний электрод камеры катод	4,1	1	13,19585	13,19585												
8		кабель сигнальный	2,6	1	5,3066	5,3066												
9		cooling ROC_enter-exit	24	2	452,16	904,32												
10					0	0												
11		from LVDB			0	0												
12		LV кабели питания	20	2	314	628												
13					0	0												
14					0	0												
15		from FEC			0	0												
16					0	0												
17		DAQ Ethernet cable	7	2	38,465	76,93												
18		DAQ optical cable	4	2	12,56	25,12												
19	1				0	0												
20					0	0												
21		Temperature Monitoring System.	5	15	19,625	294,375												
22		enter gas to TPC	13,5	1	143,06625	143,06625												
23		exit gas from TPC	13,5	1	143,06625	143,06625												
24		enter gas HV Divider	13,5	1	143,06625	143,06625												
25		шланги гидроцилиндра	14	2	153,86	307,72												
26		провода датчика перемещения	5	2	19,625	39,25												
27		мониторинг деформ. корпуса TPC ?			0	0												
28					0	0												
29					0	0												
30					0	0												
31					0	0												
32					0	0												
33					0	0												
34					0	0												
35		Суммарная площадь				2815,4496												
36																		

Лист1

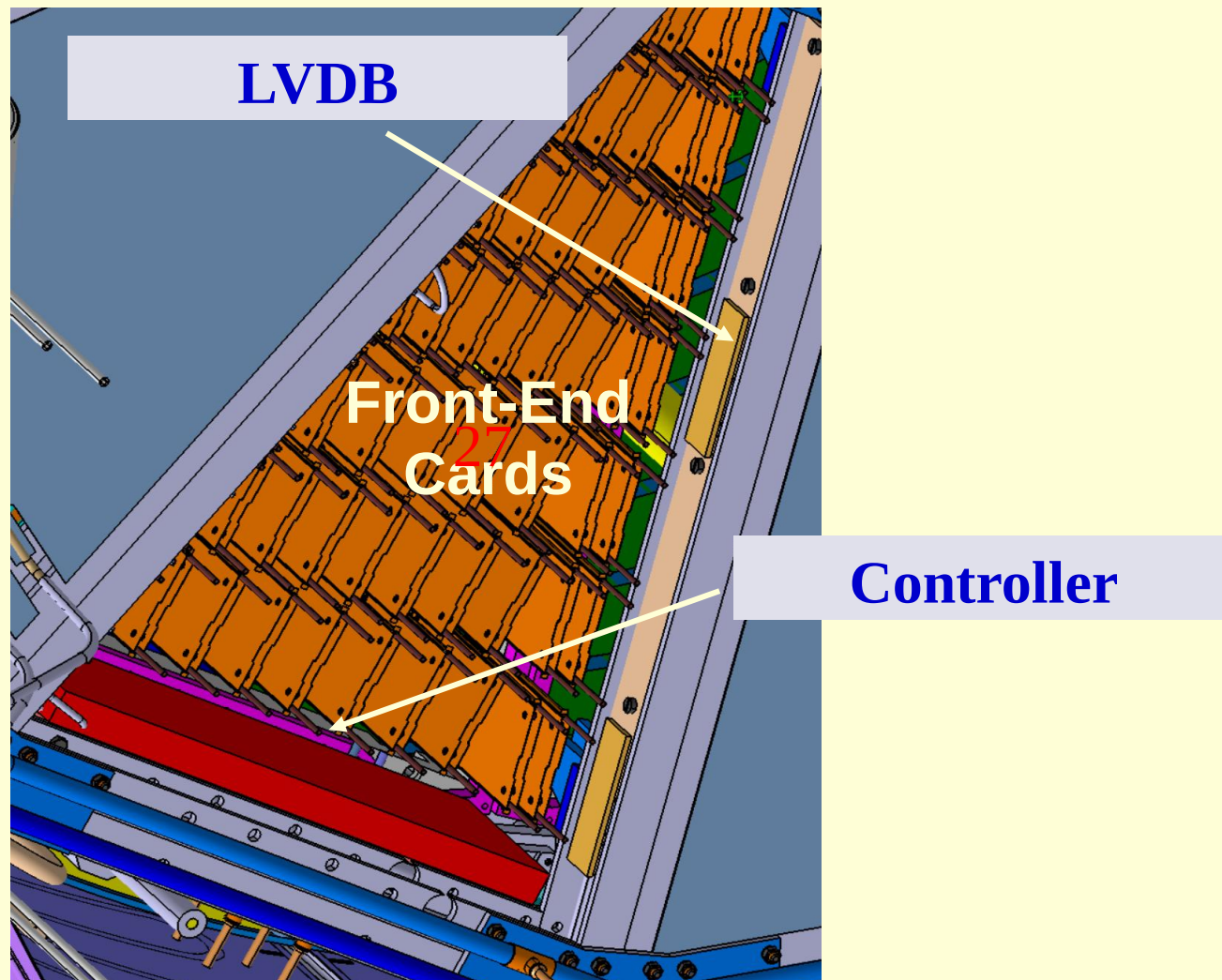
Готово

75%

19:22 20.06.2016



ROC chamber + electronics integration



Mock up



Tasks:

- check tooling for flat cables connection to FE cards
- FE card + cooling screen installation
- replace bad FE card
- chamber and FE grounding
- LVDB distribution board installation and LV cables connection to FE cards
- LVDB replace
- tubing
- services
- ...

Time schedule

	Item	Date
1	Assembly TPC cylinders C1+C2	Sept 2017
2	TPC assembly hall ready	Sept 2016
3	TPC assembly (C1-C4 + HV electrode + field cage + 2 flanges)	December 2017
4	ROC chamber manufacture (26 pc)	2017-2018
5	Installation ROC chambers (24pc) to TPC	December 2018
6	TPC electronics manufacture (FEC64S and RCU)	May 2018-2019
7	Assembly FEC64S cards to ROC chambers	Sept– Dec 2018
8	TPC test with cosmic and laser calibration system, Bld.217	January-July 2019
9	TPC transportation from Bld.217 to the MPD hall	August 2019
10	TPC installation to MPD	Sept 2019
11	TPC gas and cooling systems assembly in the MPD hall	Jan – Sept 2019
12	TPC commissioning	2020

Conclusion

- TPC assembly:
 - C1-C4 cylinders – **manufactured**
 - assembly hall – **ready**
 - tooling for TPC assembly – **May 2017**
 - 2 flanges manufacture – **May-June 2017**
 - HV electrode manufacture - **May-June 2017**
- ROC chambers: **1 pc - tested, 4 pc – ready for assembly**
 - ROC chamber serial frames (26 pc) – **ready**
 - pad planes – **quality is not so good ... new 2 samples will be ordered**
- front end electronics:
 - test of base line option FEC64S – **in progress**
 - test of SAMPA chip (second iteration) – **in progress**
 - MPD TPC **FEC32S** board rev.01 – **ready for tests**
- gas, cooling and laser systems – **in progress**
- integration TPC to MPD – **in well shape**

TPC commissioning - 2020



Thanks !

