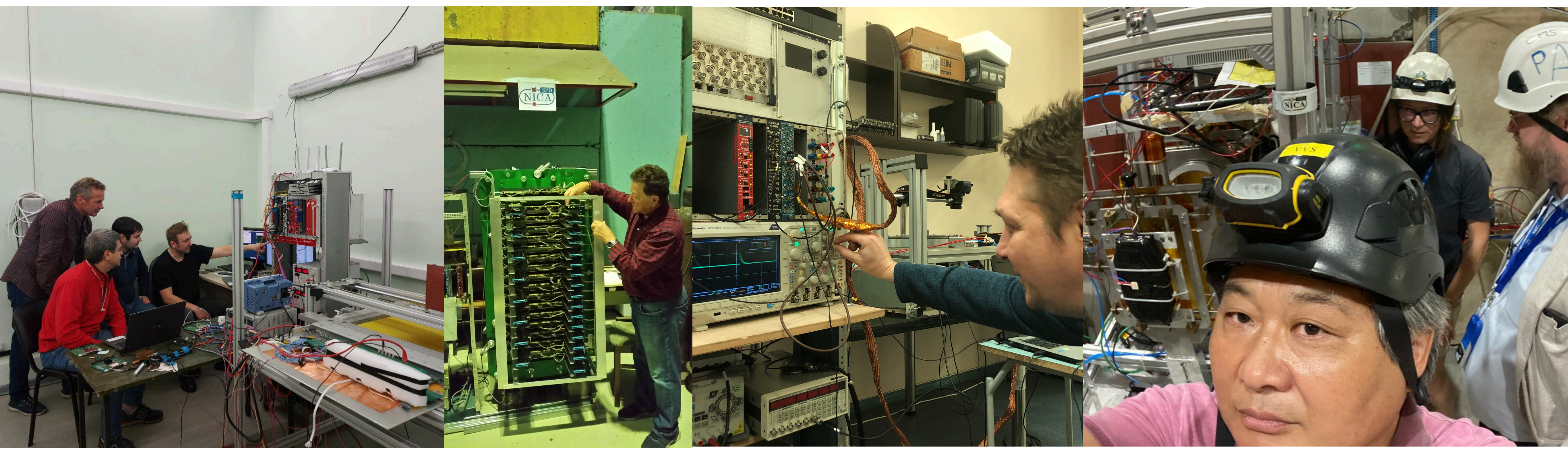
SPD TDR update: status

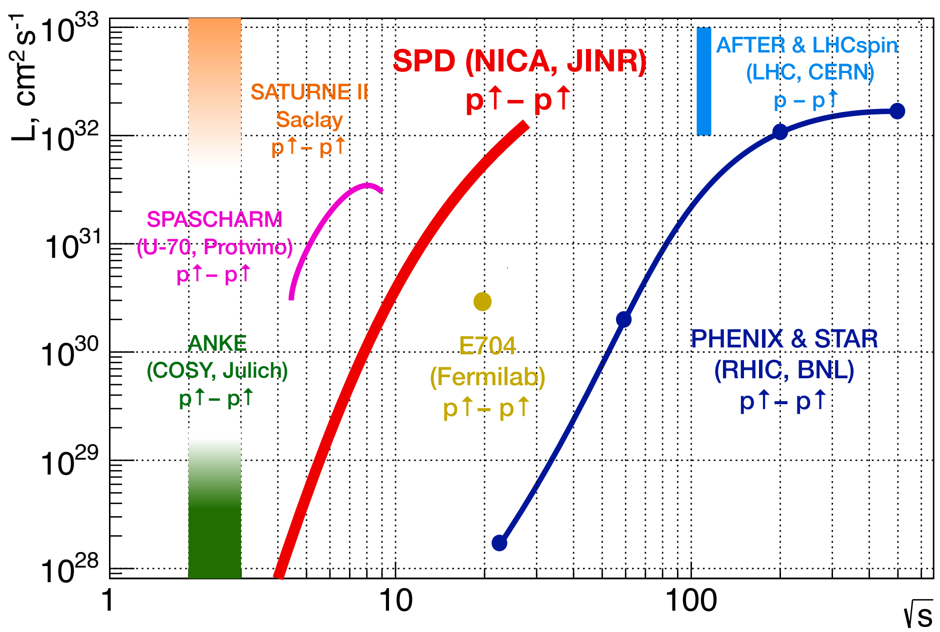


A. Guskov, avg@jinr.int

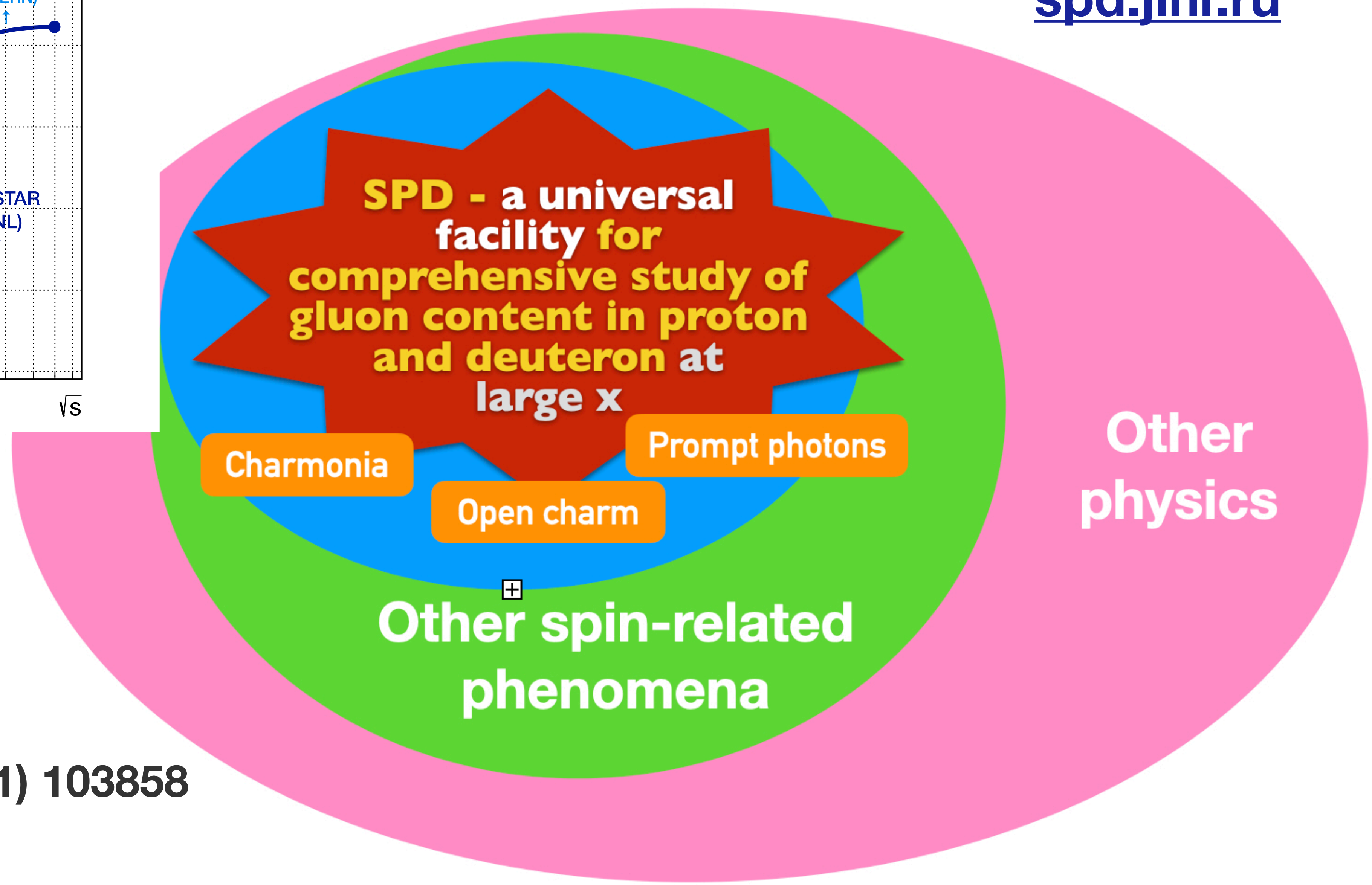
21.6.2023

SPD international collaboration

32 institutes from 14 countries, ~300 members



spd.jinr.ru



Prog.Part.Nucl.Phys. 119 (2021) 103858

arXiv:2011.15005

Phys.Part.Nucl. 52 (2021) 6, 1044-1119

arXiv:2102.08477

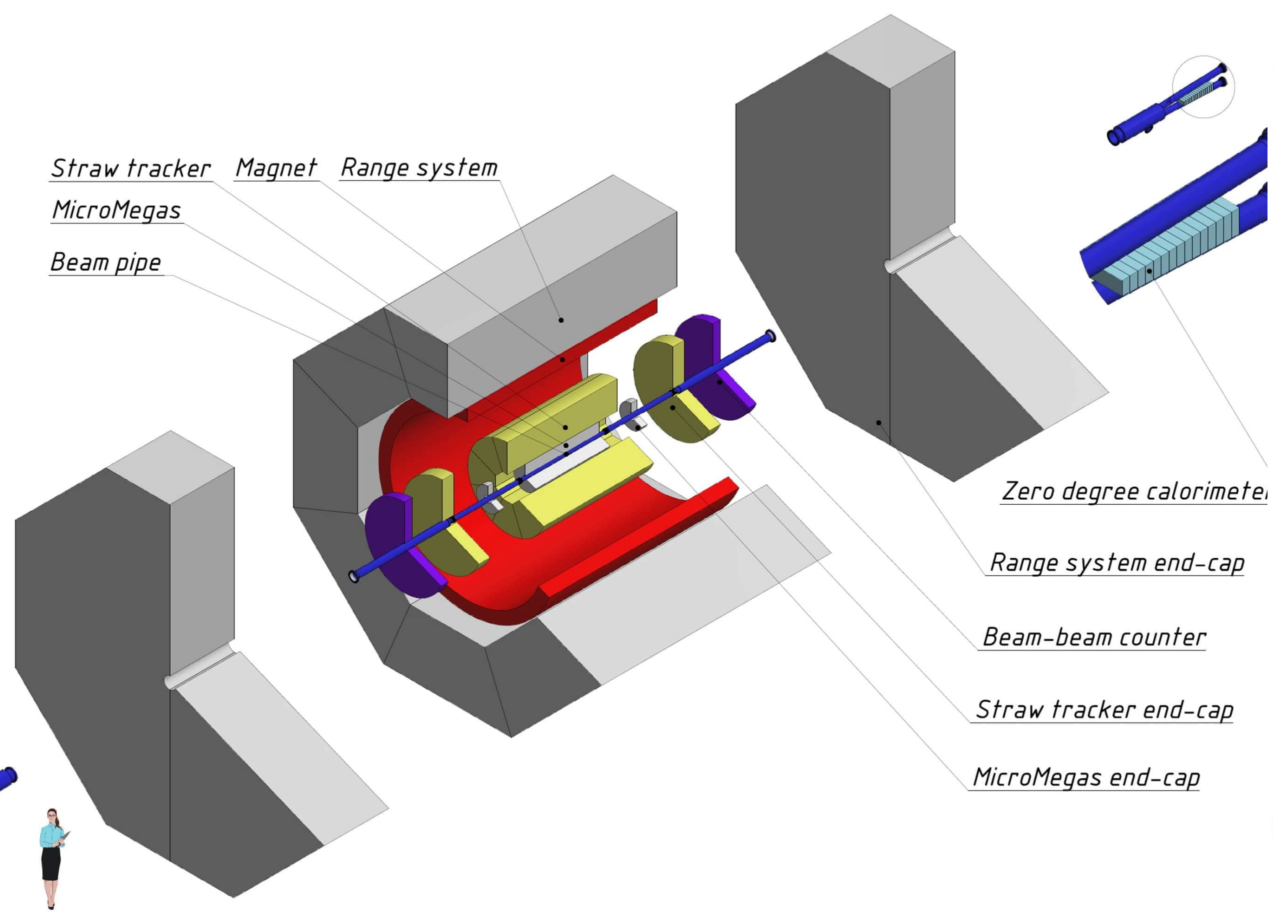
— SPD CDR was presented at PAC in Jan 2021 and approved by PAC in Jan, 2022

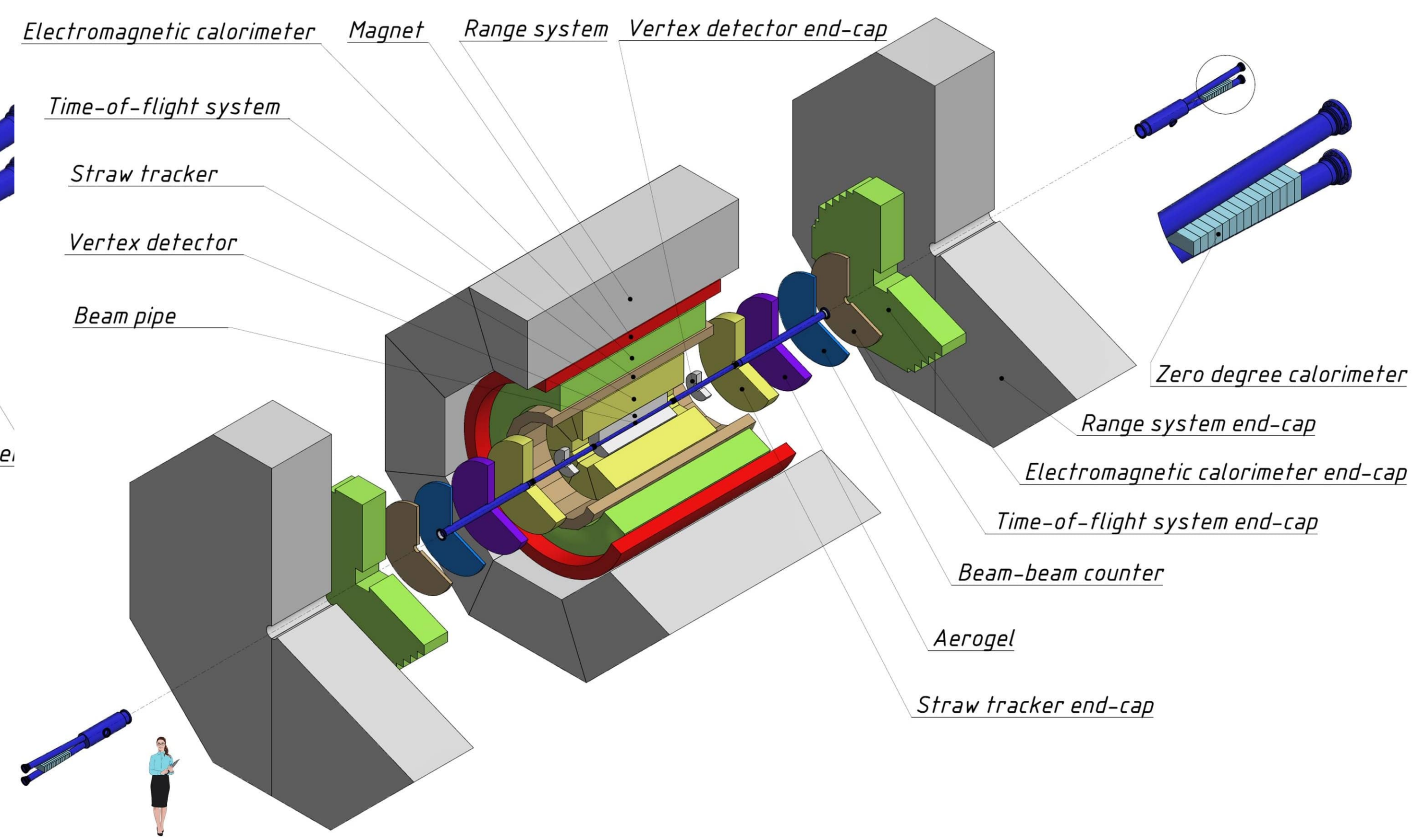
— the first version of SPD TDR was presented at PAC in Jan 2023

Creating of polarized infrastructure | **Upgrade of polarized infrastructure**

2023 — 2026 — 2028 — 2030 — 2032

SPD construction | **1st stage of operation** | **SPD upgrade** | **2nd stage of operation**





SPD Collaboration meeting

Dubna, 24-27 April

About 120 participants in person (50 external)
+ 40 remote participants

Two round tables:

The need and possibilities to develop and build silicon detectors for particle physics in Russia and, in particular. for SPD

Computing for NICA

Next meeting in Samara Univ. in October

New groups (from Jan, 2023)

Institute of Nuclear Physics (INP RK), Almaty

Tomsk State University (TSU), Tomsk

Budker Institute of Nuclear Physics, Novosibirsk - under discussion

New MoU signed

Institute of Nuclear Physics (INP RK), Almaty

Tomsk State University (TSU), Tomsk

National Research Nuclear University MEPhI (MEPhI), Moscow

Saint Petersburg Polytechnic University (SPbPU), St. Petersburg

Saint Petersburg State University (SPbSU), St. Petersburg

ITEP - in progress

Change of geometrical size

КОМПЛЕКСНЫЕ МЕДИЦИНСКИЕ ТЕХНОЛОГИИ И АППАРАТЫ
ЗАО КометА

General Conclusion Based On The Results Of All Calculations Performed (report received on Jan 25,2023. page 96)

Based on the calculations performed, it can be concluded that with a given *detector weight of 1200 tons* and the weight of a platform with electrical equipment of 100 tons, the reinforcement of the foundation plate is sufficient, the *deformations of the plate and the pile field do not exceed critical values*. The bearing capacity of the plate and the pile field is provided. In this case, the weight of the detector is distributed on 8 support points when parked and on 6 support points when moving, the weight of the detector is distributed evenly on the supports.

It is allowed to increase the weight of the detector to 1500 tons with the platform of a platform with electrical equipment of 100 tons, provided that the weight of the detector is distributed by 8 support points when parked and by 6 support points when moving, the weight of the detector is distributed evenly on the supports.

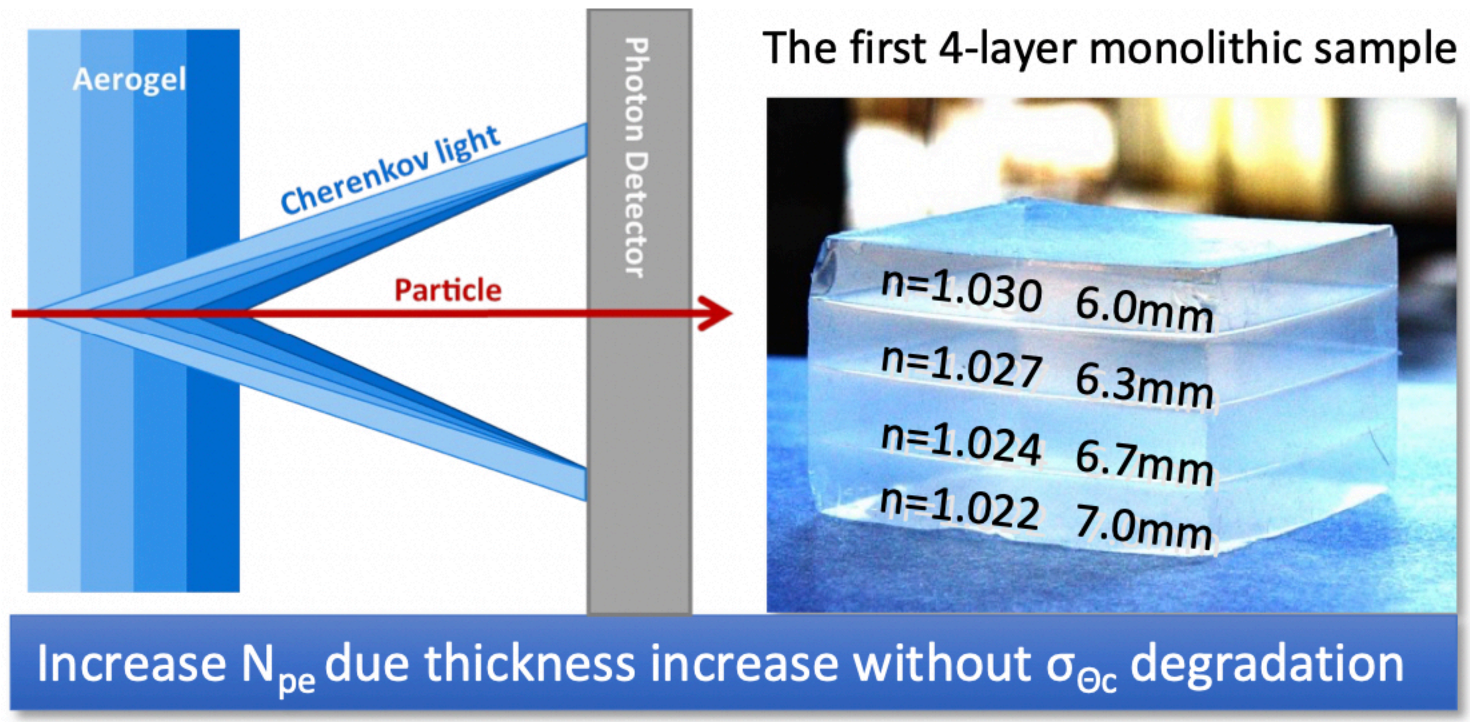
+10 cm in radius
+30 cm along beam

Update of the SPD composition

Subsystem	Stage	Major updates
MM-based Central Tracker	**1**	no major changes
SI Vertex Detector	**2**	no major changes
Straw Tracker	**1,2**	no major changes
ToF	**1*,2**	no major changes
Aerogel	**2**	Threshold counter -> FARICH
ECAL	**1*,2**	no major changes
Muon (Range) System	**1,2**	Increase in size
BBC	**1,2**	Higher granularity for reaction plane determination
ZDC	**1,2**	no major changes
Superconducting Magnet	**1,2**	Increase in size
DAQ	**1,2**	no major changes
Computing	**1,2**	no major changes
DCS	**1,2**	no major changes
Support & moving system	**1,2**	updated

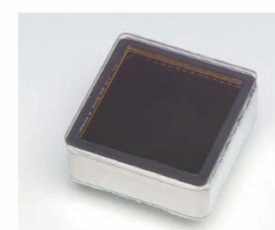
From threshold aerogel detector to FARICH - Focusing Aerogel RICH

MCP-PMT as a position-sensitive detectors



T.Iijima et al., NIM A548 (2005) 383
A.Yu.Barnyakov et al., NIM A553 (2005) 70

Hamamatsu MCP PMT
R10754-07-M16



matrix 4x4 anodes
anode size 5.28x5.28 mm
PMT size 27.6x27.6 mm
QE = 23% at λ=380 nm
gain 10^6
~60% active area
thickness 17 mm

We are in contact with Novosibirsk group (BINP)

FARICH: more FEE channels than for Threshold detector. But less volume of aerogel.

Critical components

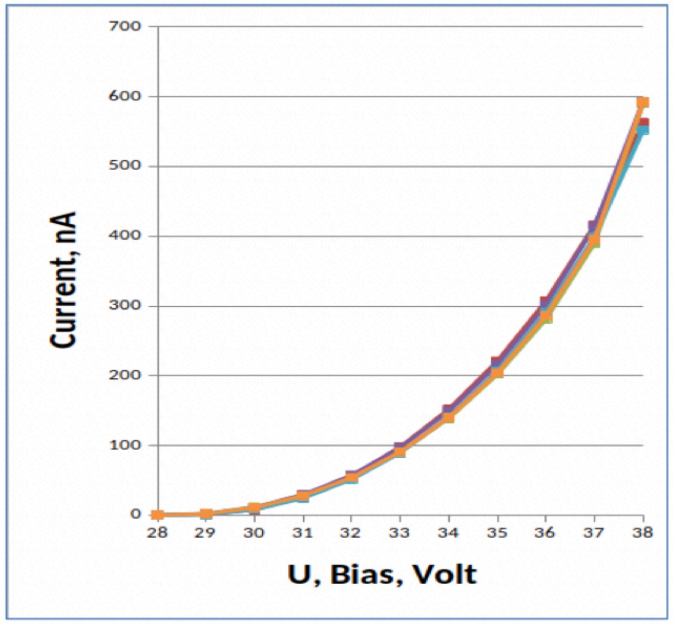
Subsystem	Stage	Technology	Materials & components	Electronics
MM-based Central Tracker	1			
SI Vertex Detector				
DSSD option	2			
MAPS option	2			
Straw Tracker	1,2			
ToF	1*,2			
Aerogel	2	New group		
ECAL	1*,2			
Muon (Range) System	1,2			
BBC	1,2			
ZDC	1,2			
Superconducting Magnet	1,2			
DAQ	1,2			
Computing	1,2			
DCS	1,2			
Support & moving system	1,2			

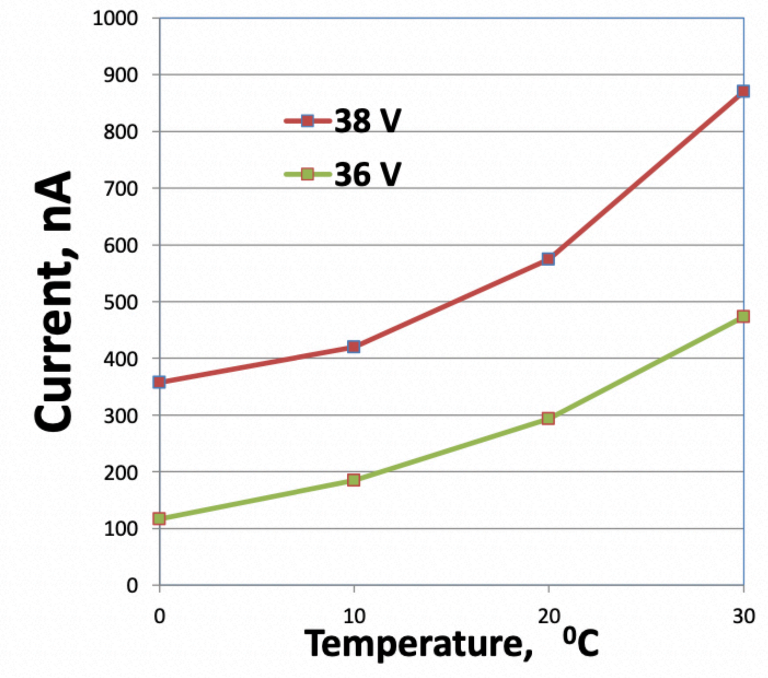
Main directions of our activity

- Searching for alternative suppliers and testing of their products (MPPC for ECAL, FE-electronics, scintillators, etc.)
- Initiation of developments in Russia (power supplies for muon system and DAQ, FEE for TOF & ECAL, etc.)
- Analysis of the feasibility of alternatives (skip amplitude measurement in Straw FEE at maximal luminosity, etc.)
- Rethinking priorities for subsystems

	Russian components	Foreign FFE	Other foreign components
Current cost / cost at Feb. 2022	>1	3	2

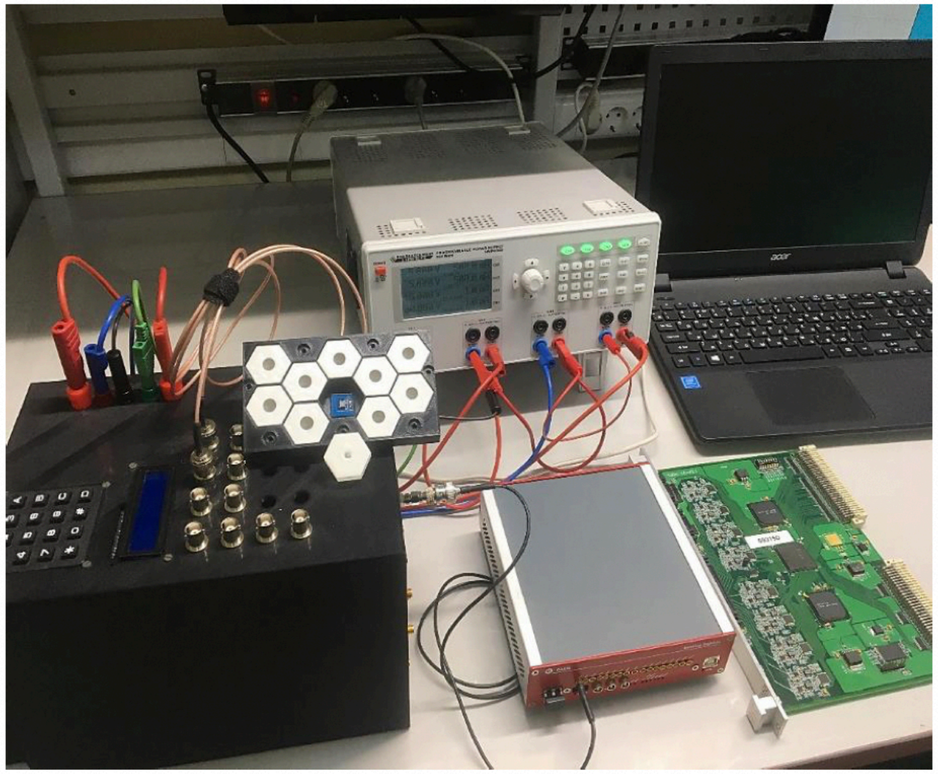
SiPmEQR15-60 (China) tests for ECAL





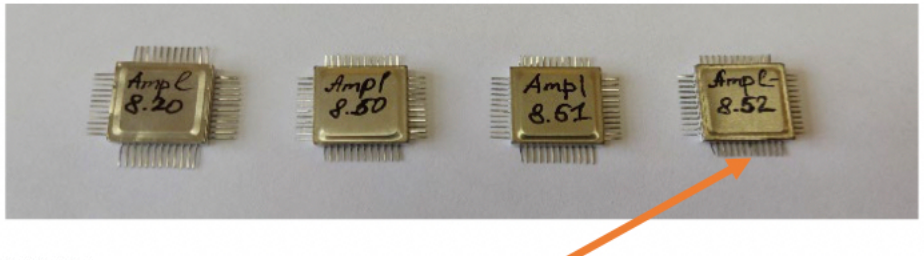
Tests of VMM3, VMM3a and TIGER readouts for Straw

BBC



Together with Chilie group

10 honey-comb scintillat and SiPMs,
FEE boards,
micro PC control.



Development and tests of low-impedance amplifier for RS

Summary

- SPD Collaboration continues to work on TDR update.
- Main directions are:
  - searching for alternative suppliers
  - initiation of developments in Russia
  - analysis of the feasibility of alternatives and optimization of solutions
- We do not see any show-stopper for the first phase of the SPD detector from point of available technologies and components
- We hope to have the next public version of the SPD TDR with updated solutions and cost estimation by the end of the year