

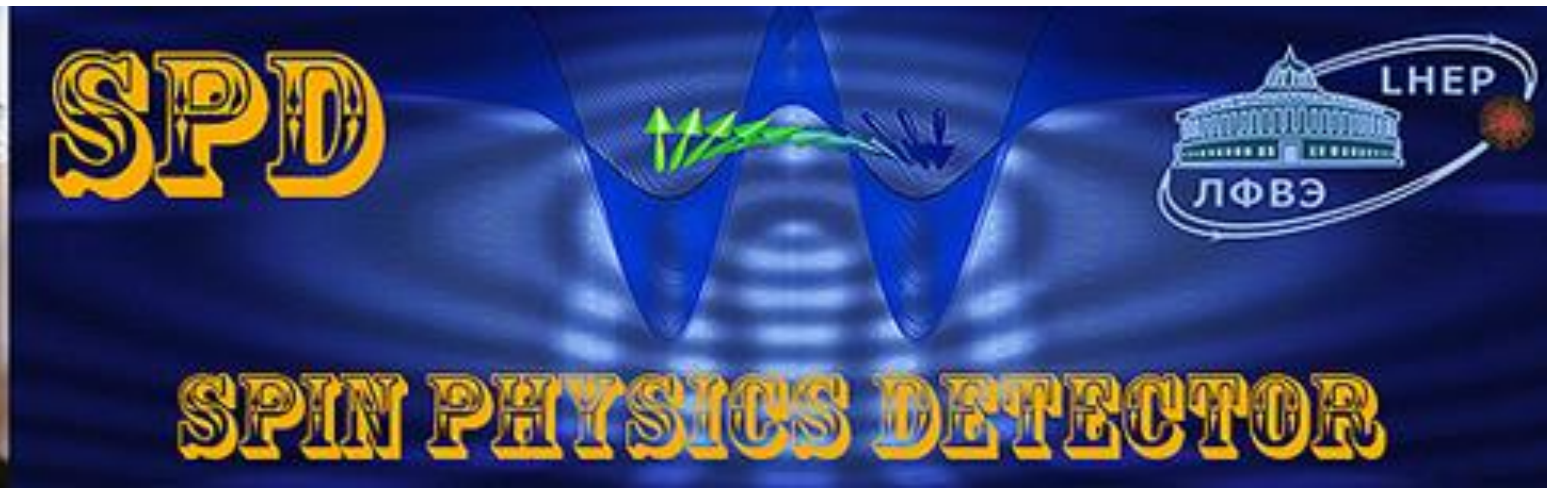
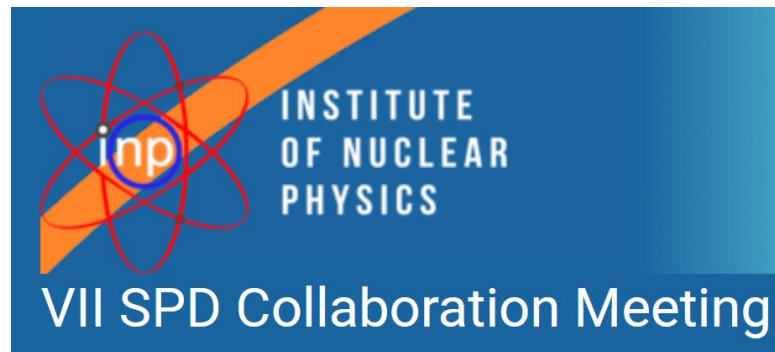
Zero Degree Calorimeter (ZDC) for SPD



Progress report

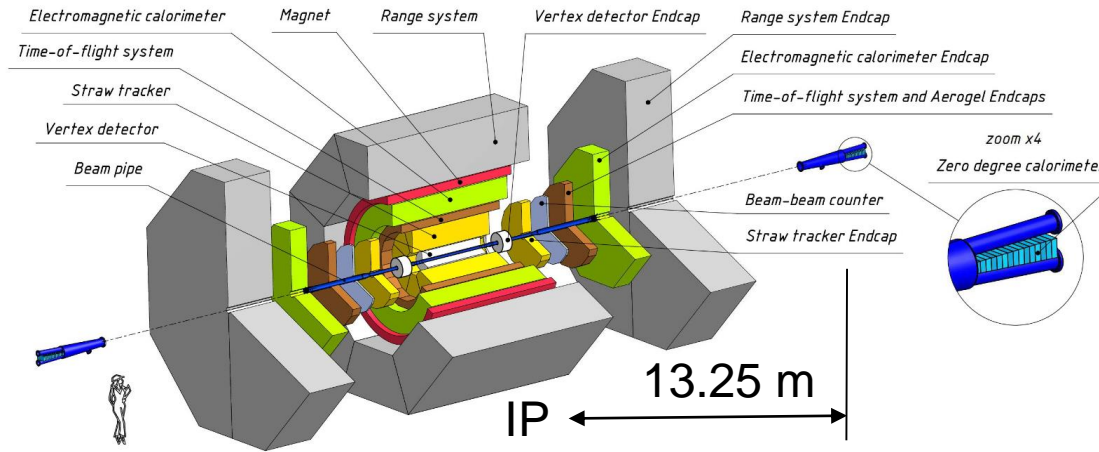
I. Alekseev

(KCTEP NRC KI, Moscow)





Zero degree calorimeter



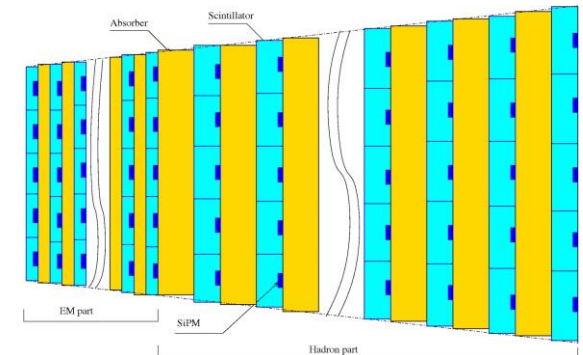
-> Detect neutrons and gammas. All charged particles swept by strong magnetic field.

-> Tasks:

- > beam alignment and luminosity measurement;
- > diffraction physics – trigger on the rapidity gap;
- > spectator neutron tagging

-> Concept:

- -> Sampling calorimeter with fine segmentation, 7x5 matrix.
- -> SiPM 3x3 mm² direct readout
- -> About 1000 channels
- -> Optimization based on MC and measurements with prototype is required



Design for the first year of NICA operation



Aims

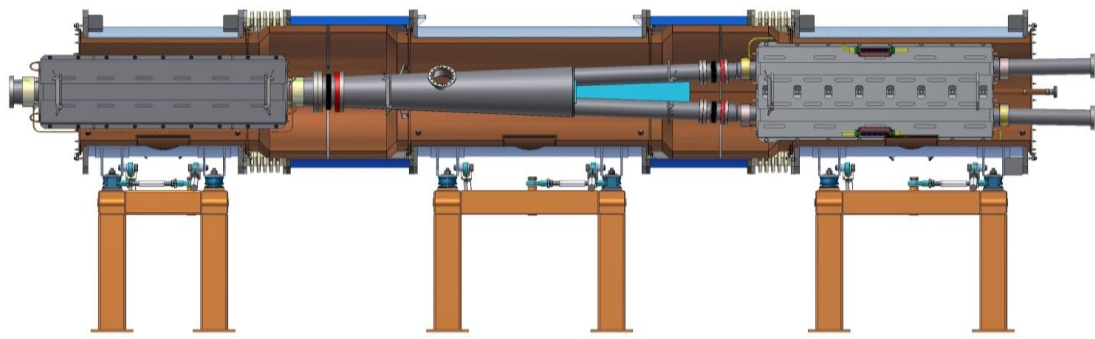
- ❑ Test the device concept technology in the real position:
 - Radiation
 - Cryogenic temperature
 - Signal pass out of vacuum
- ❑ Simple beam measurements:
 - Beam luminosity
 - Neutron to gamma discrimination
- ❑ Check MC simulations:
 - Compare the model results with real data
 - Check if it will be possible several configurations

The first year of running AuAu ($\sqrt{s} = 6 \text{ GeV}$, $L = 10^{25} \text{ cm}^{-2}\text{s}^{-1}$):
From STAR run in August 2020:
coincidence rate $\sim 0.3 \text{ Hz} \Rightarrow$
2% measurement in $\sim 2 \text{ hours}$.

Hardware

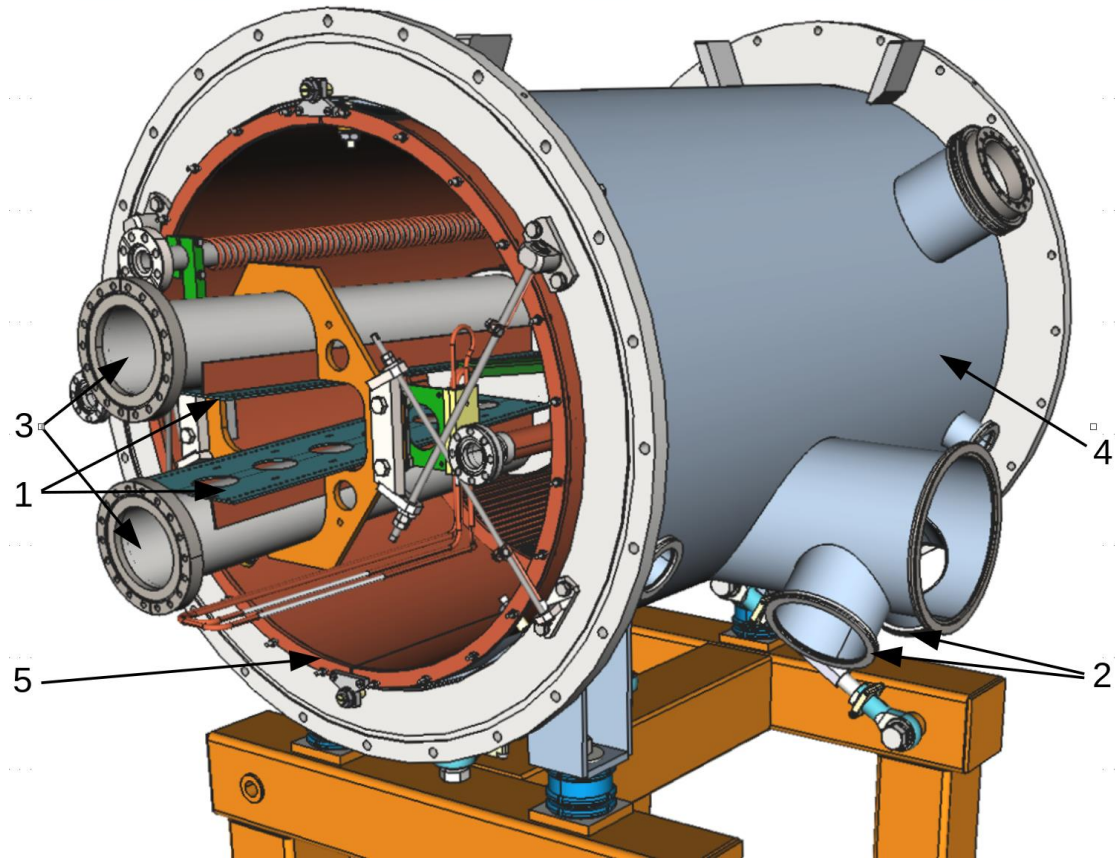
- 2 ZDCs installed around one IP
- 7x5 matrix
- 6 sensitive layers (210 SiPM channels) and VETO layer without segmentation
- 5-10 mm thick copper or stainless steel absorber plates – much cheaper than tungsten
- 10% of the total price

Position settled



Challenges

- Isolation vacuum
- LqN₂ temperature
- Tight space
- Access during long shutdowns only
- No electronics inside the cryostat

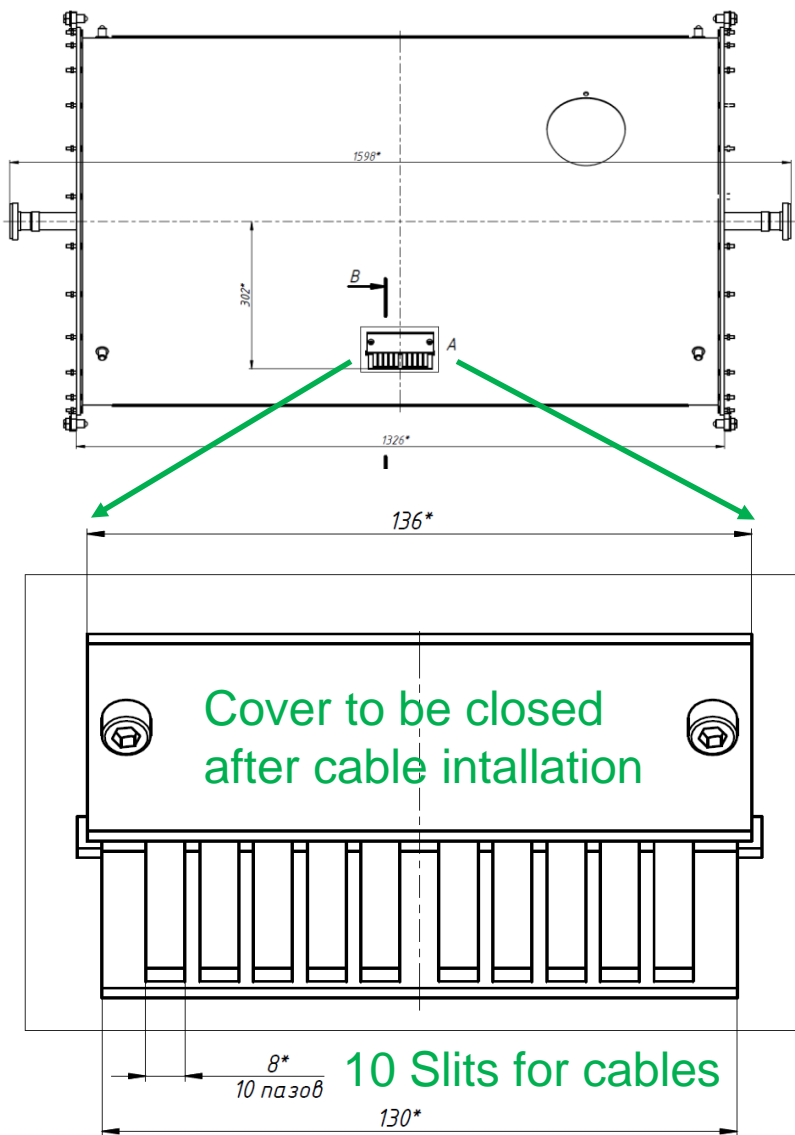


- 1 – rails
- 2 - flanges
- 3 – beam pipes
- 4 – outer shell
- 5 – LqN₂ screen



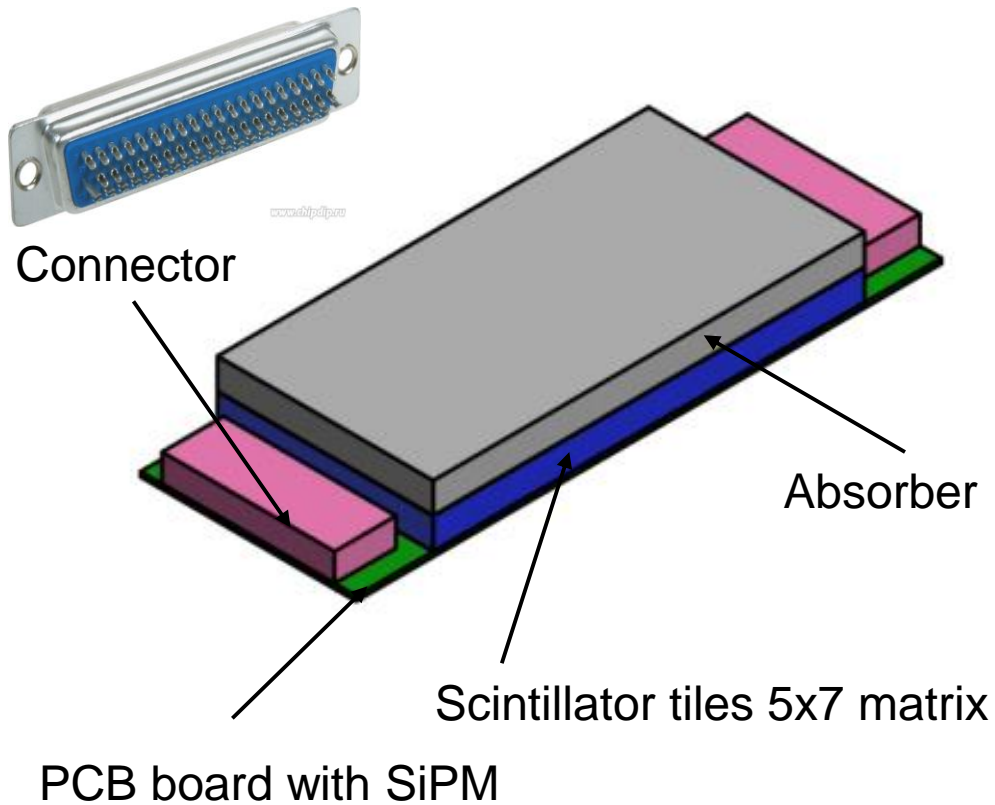
Igor Alekseev (KCTEP NRC KI)

Passing signals through LqN₂ screen



- Beam pipe sections for the ZDC (Y-sections) are received in JINR early October 2023. Tested by vacuum group, but still not inserted into cryostat. As it looks now the place for ZDC is fine and well accessible for installation.
- Modification of the liquid nitrogen screen so it would be possible to install signal cables later has been designed. The full design assumes 30 cables of 32 twisted pairs each for each calorimeter. All cables should go to one side of the cryostat. The designed solution includes 10 slits for the cables and a cover to be placed after.
- The feedthrough from the vacuum will be made by printed circuit boards glued with epoxy into special cylindrical extension of the flange.

ZDC module



- We are going to start with two planes with tile thicknesses 3 and 5 mm – test the light yield and collection uniformity. Tiles are already manufactured.
- No readout from the corners to make number of channels per plane less than 32 and leave the space for screws



Thank you for your attention