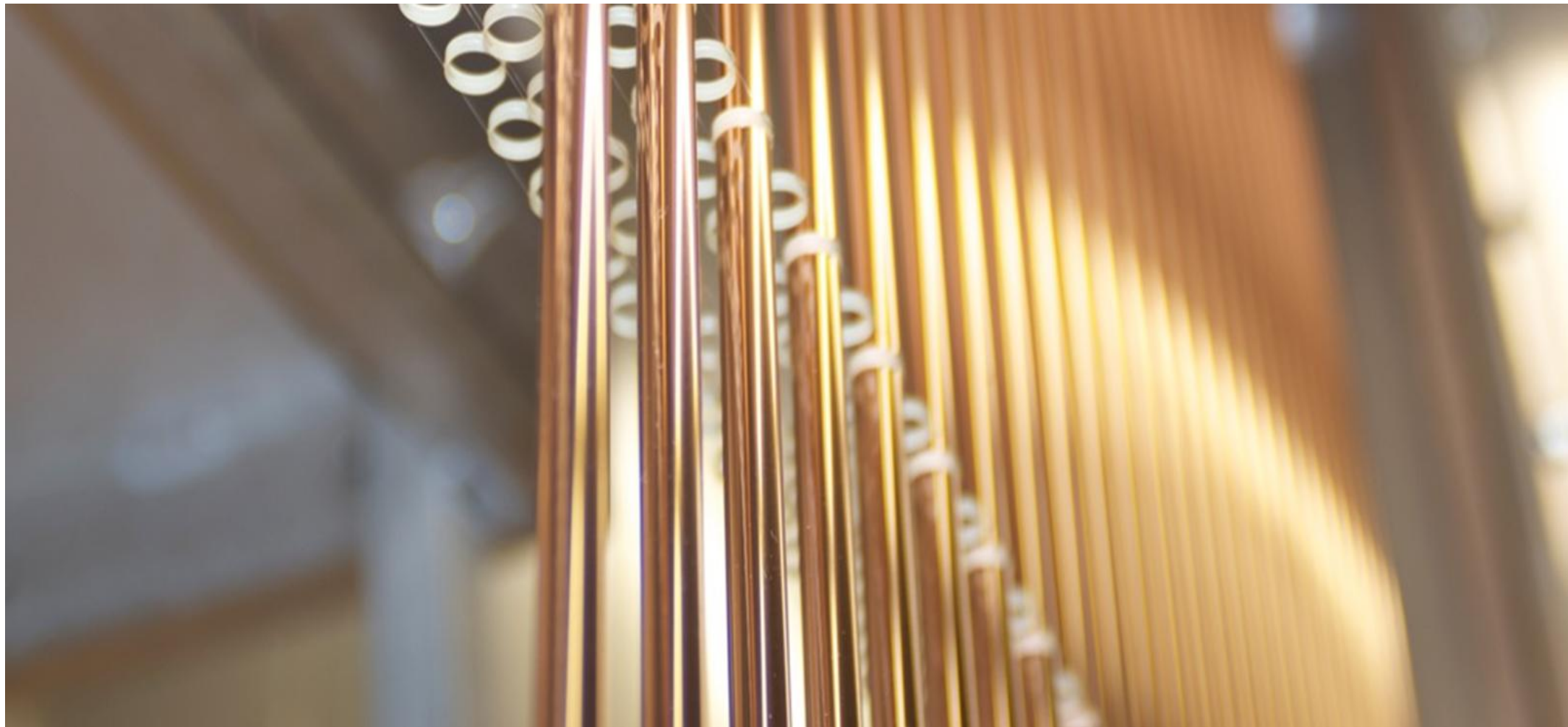


Straw технологии как центр притяжения научно-исследовательской активности



Production

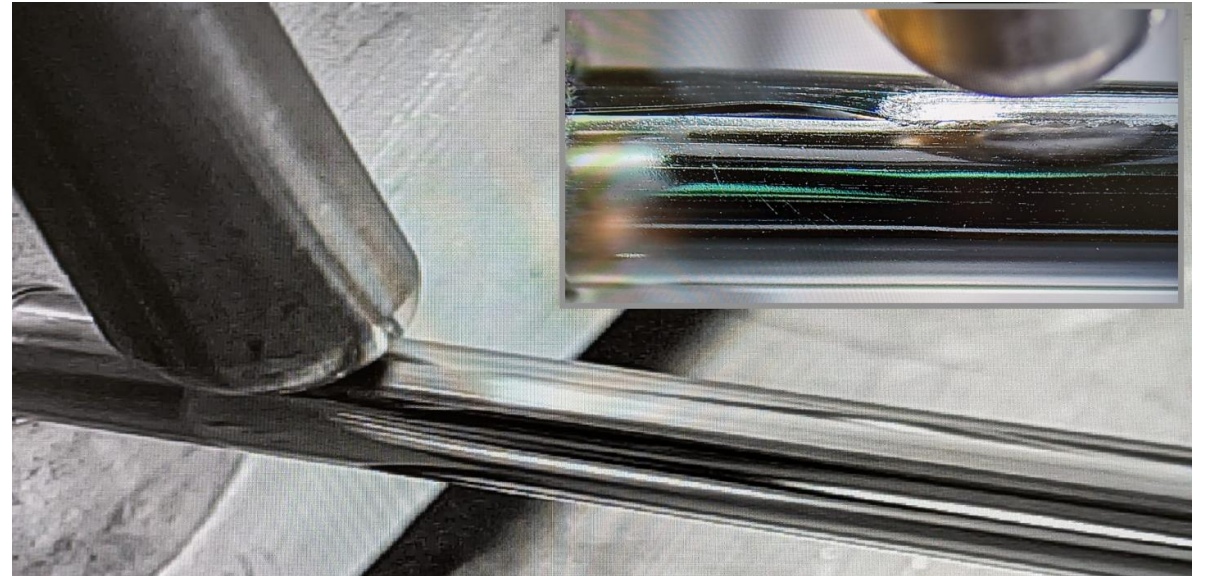
STRAW winding

- Production- 1 m/min
- Lenth up to 5.5 m
- Diameter-2, 4, 6, 10, 20 mm
- Wall thickness-15+ μm



STRAW welding

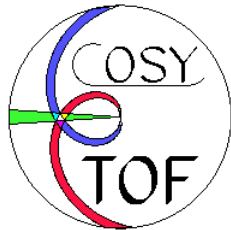
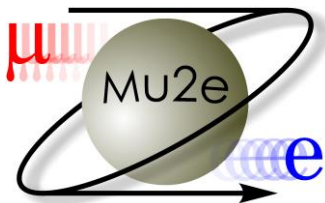
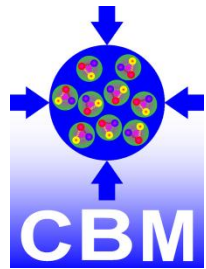
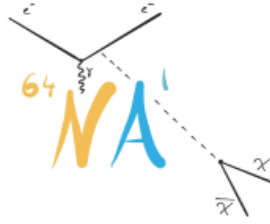
- Production- 1m/min
- Lenth- up to 5.5 m
- Diameter- 5, 10, 20 mm
- Wall thickness-12+ μm



The straw trackers in the different experiments

Straw winding

- ATLAS
- LHCb
- COMPASS
- COZY-TOF
- NA64
- Mu2e
- PANDA
- CBM
- SVD-2
- Glue-X
- Muon g-2
- ...



Straw welding

- NA62
- SPD
- KEDR
- COMET
- SHiP
- DUNE
- OKA
- VES
- SPASCHARM
- HIPTAN
- ...



Straw winding-ATLAS, COMPASS

Пешехонов В.Д

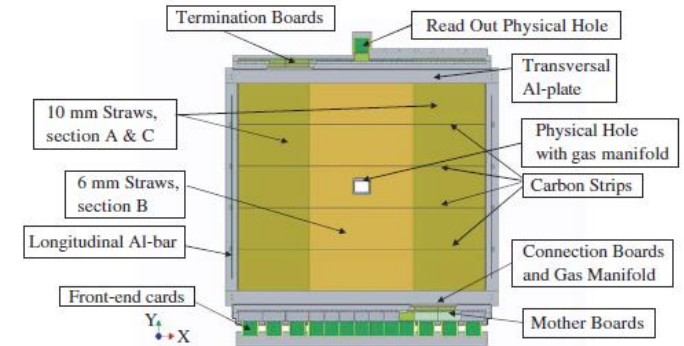
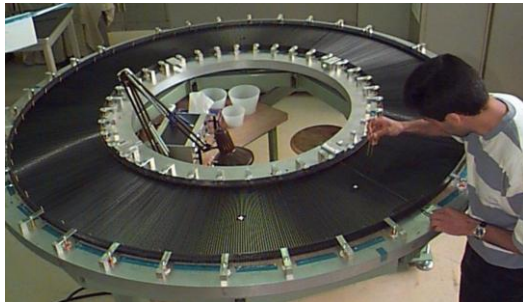
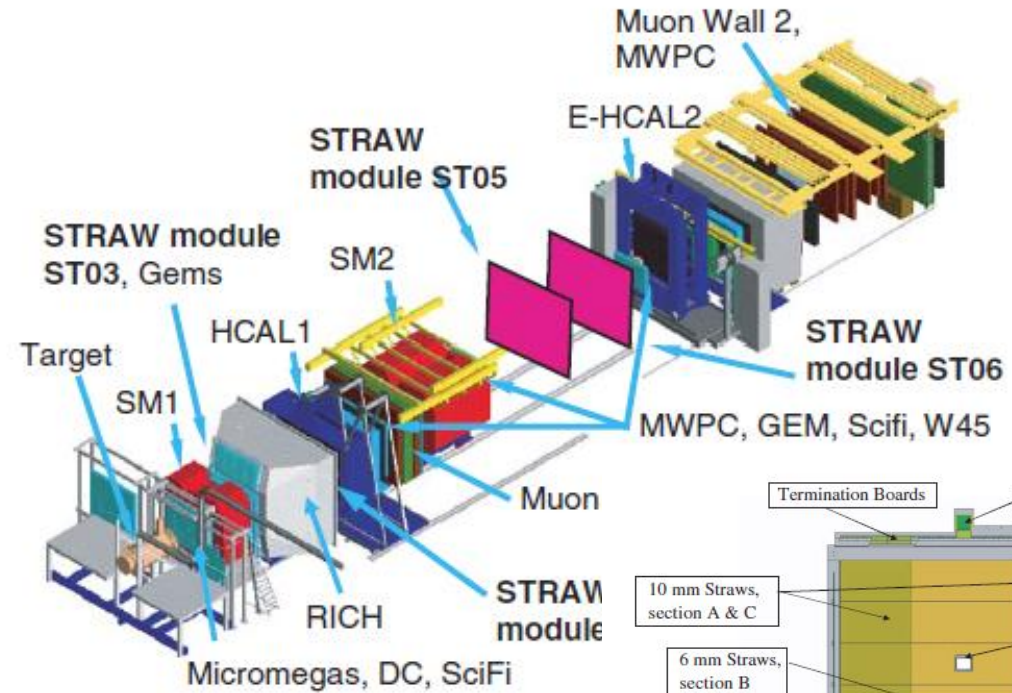
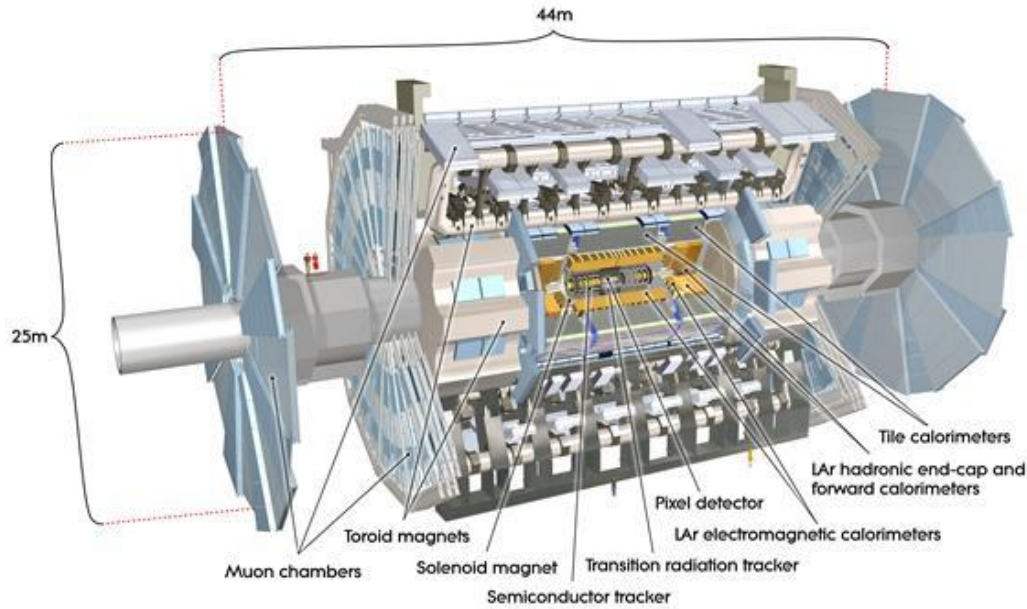


Fig. 2. Schematic view of a chamber (type X).

Endcap modules: **248760 straw**
 Module of type A (PNPI) **147456 straw**
 Module of type B (LHEP) **98304 straw**

12440 straws
2802x3232(mm²) for X
3254x2427(mm²) for Y

Straw welding-NA62



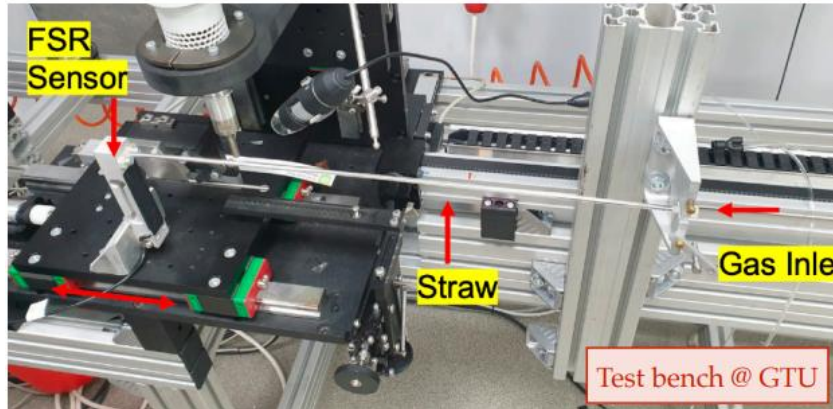
Кекелидзе В.Д
Потребеников Ю.К

Current NA62 straw spectrometer:

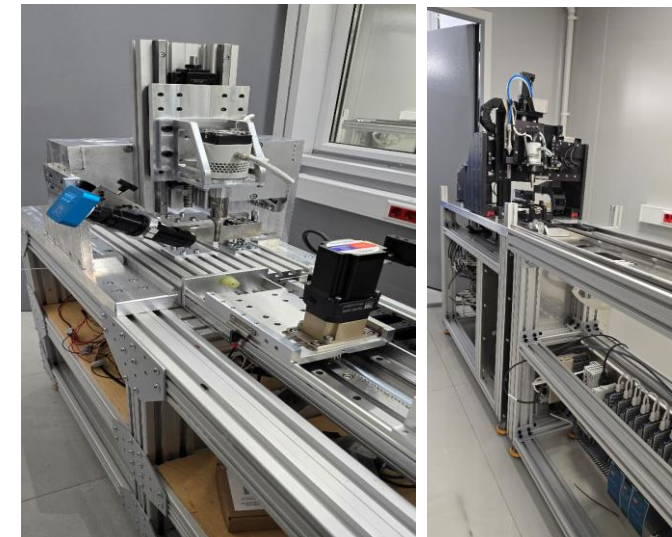
- **Straw diameter: 9.8 mm**
 - Material: 36 μm thick PET
 - Plating: 50 nm copper + 20 nm gold
 - Wire: 30 μm tungsten wire
- **Gas: Ar+CO₂ (70:30)**
- **4 chambers, 7168 straws in vacuum**
 - ~30 straw hits per track
- **Total material budget: 1.7% X₀**
 - Dominated by the PET (70%)
- **Single straw timing performance:**
 - Maximum drift time: ~150 ns
 - Leading time resolution: 3-4 ns
 - Trailing time resolution: ~30 ns



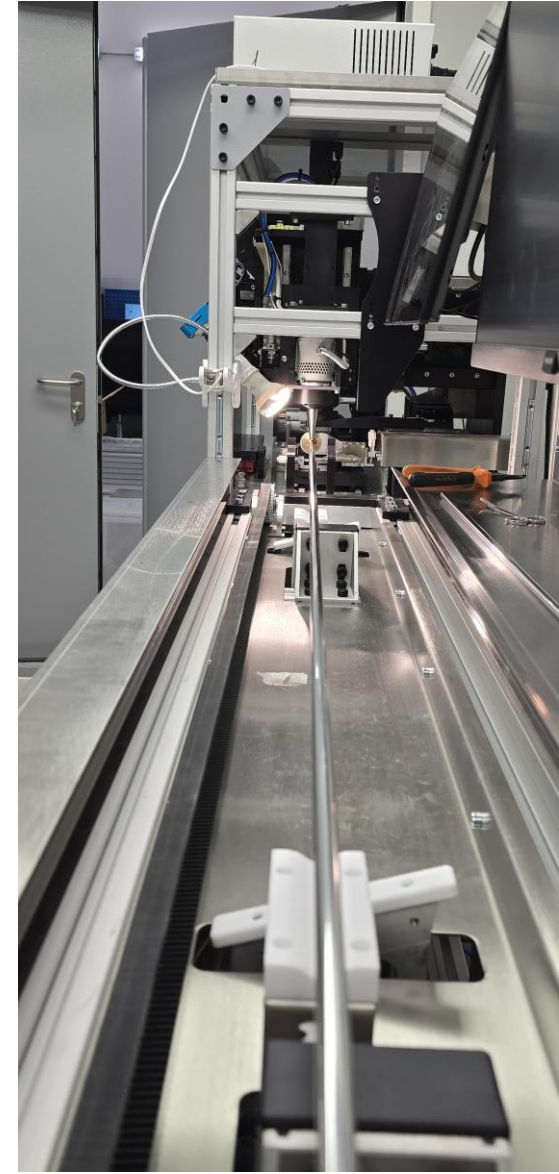
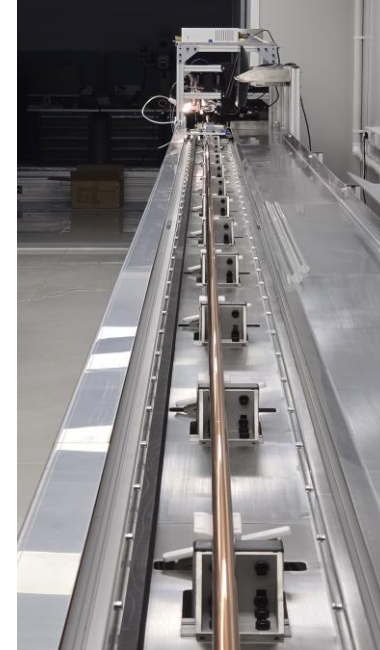
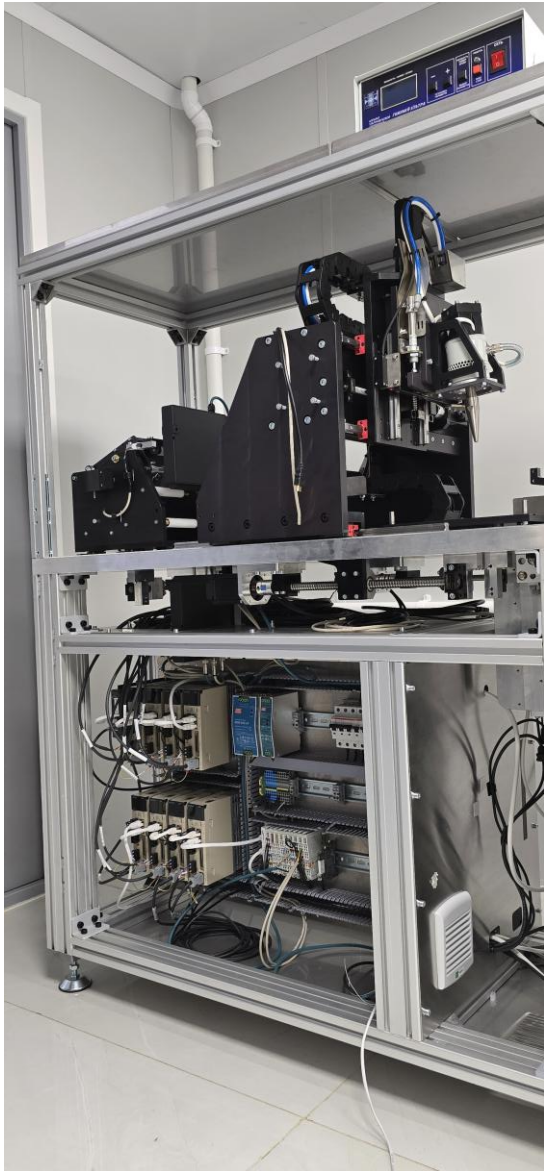
Straw welding-production lines



- JINR (Dubna) – operational for mass production
- INP (Almaty) - developing mass production lines
- GTU (Tbilisi) - operational
- SEFAR (Swiss industrial company) - operational
- PNPI (Gatchina) - developing
- IHEP (Protvino) - operational for mass production
- PTI (Houston industrial company)-operational
- BINP (Novosibirsk)-on hold



New Straw production line and assembling place JINR

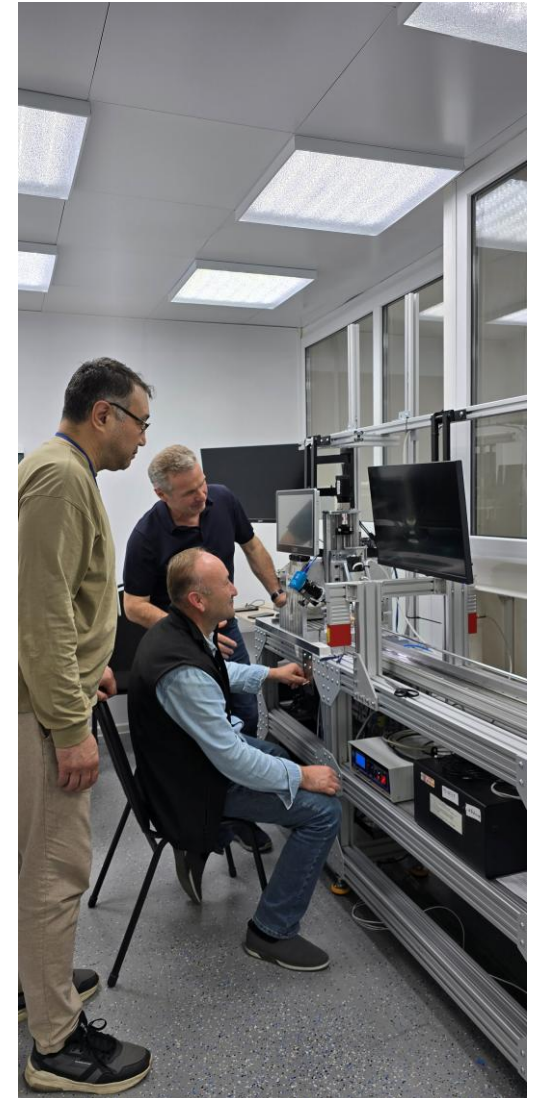
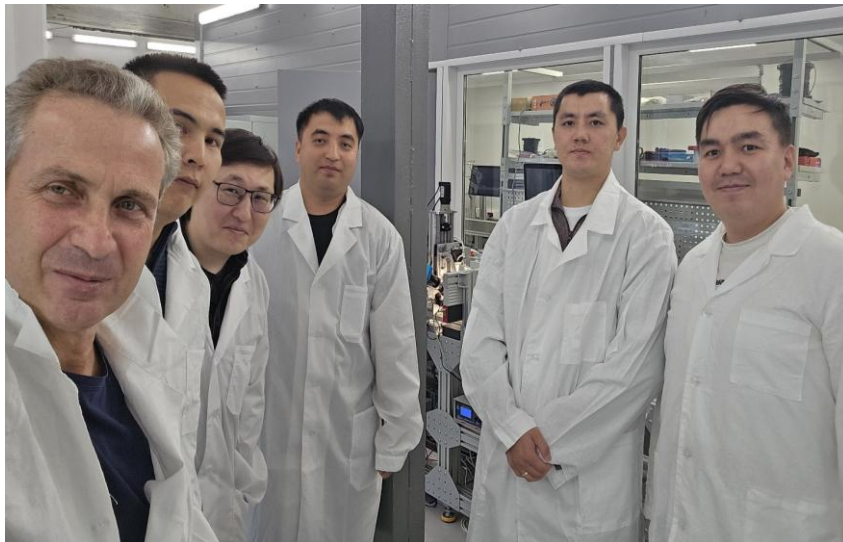


- Area ~200 sq.m., clean room~100 sq.m, machine shop and assembling hall~50 sq.m and 8,5 m high
- Production line length~12m
- Fine-tuning work began successfully and the first 12 meter straw was welded
- The possibility of integrating AI into the production and quality control process is provided

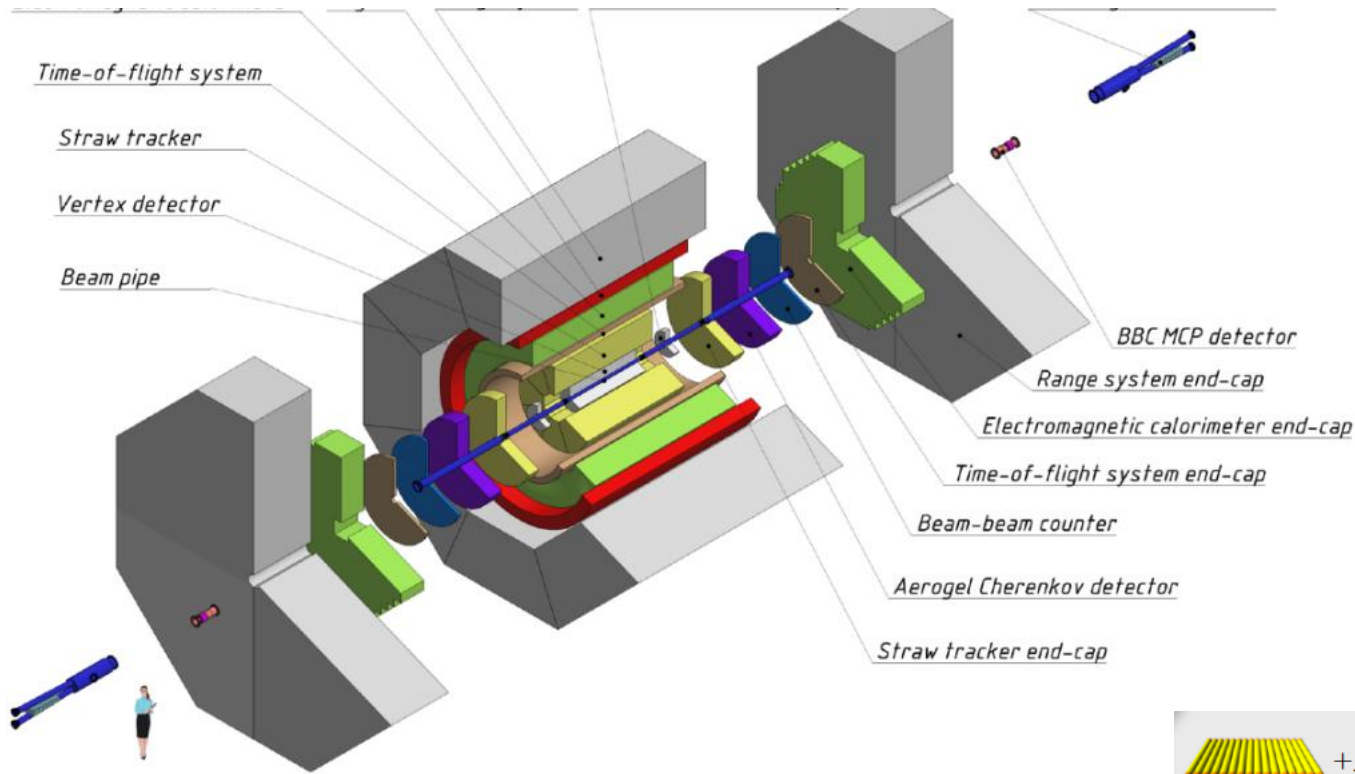
Straw production line and assembling place at INP(Almaty)



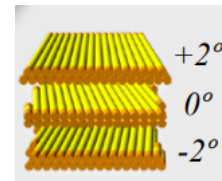
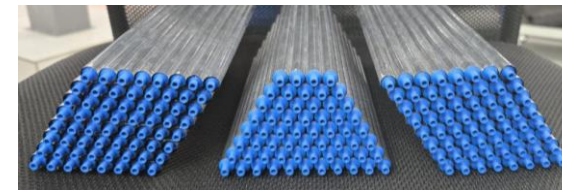
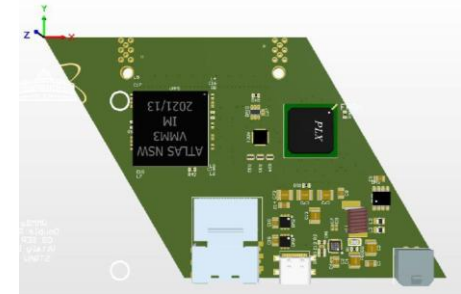
- The line was manufactured and successfully tested at JINR
- INP(Almaty) engineers and physicists took an active part in the developpt and testing
- Commissioning work is planned to be carried out in May
- Production is scheduled to start at the end of June



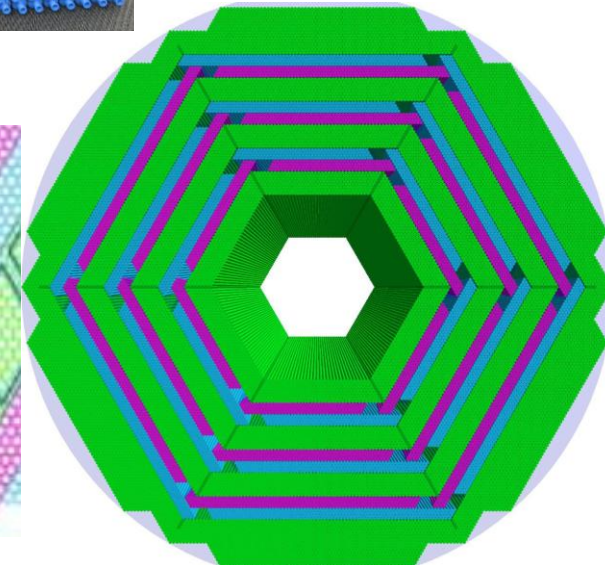
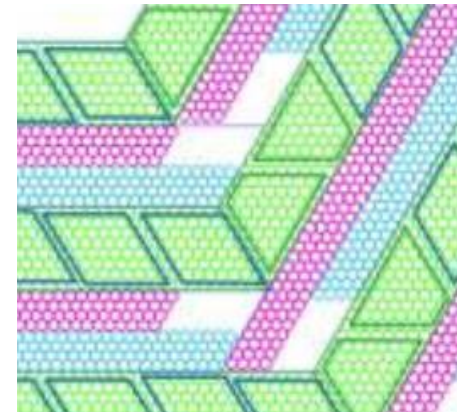
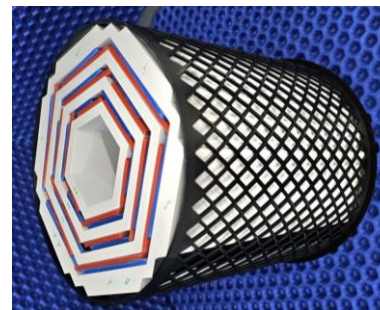
SPD Straw Tracker



- Main tracker system of SPD $\sim 2\text{m}$ long, $D \sim 1.6\text{ m}$
- Straw diameter 10 mm, thickness 36 μm PET
- Spatial resolution of 150 μm
- Barrel is made of 6 modules with up to 30 double-layers, with the ZUV orientation ($0, \pm 2^\circ$)
- Endcaps are made of 12 double-layers with the XYUV orientation
- Rate $O(100\text{ kHz})$
- ~ 20000 straws

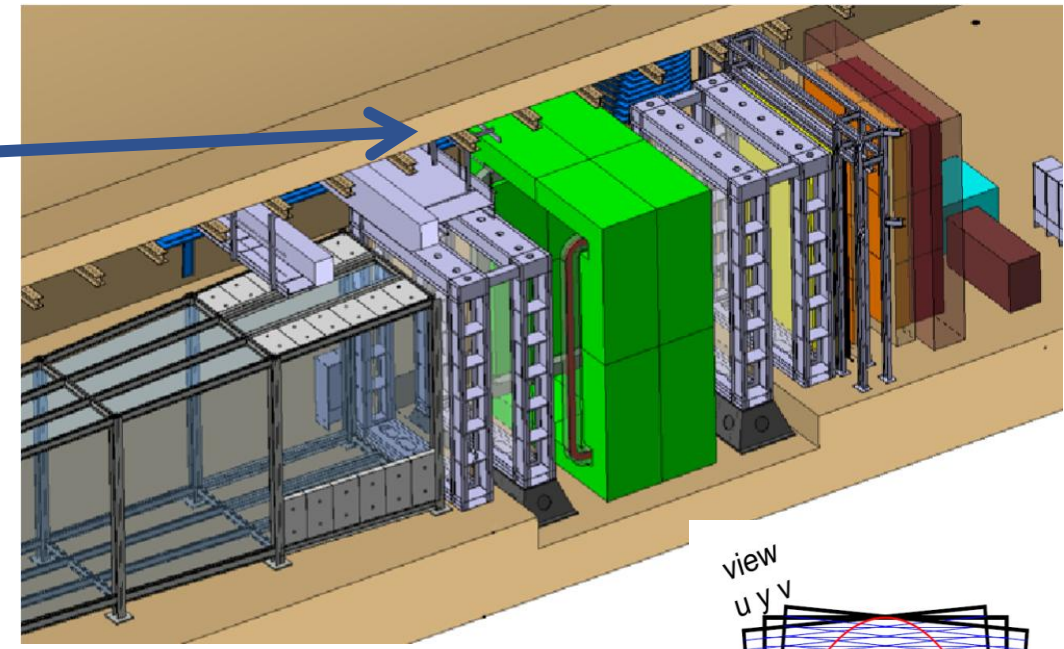
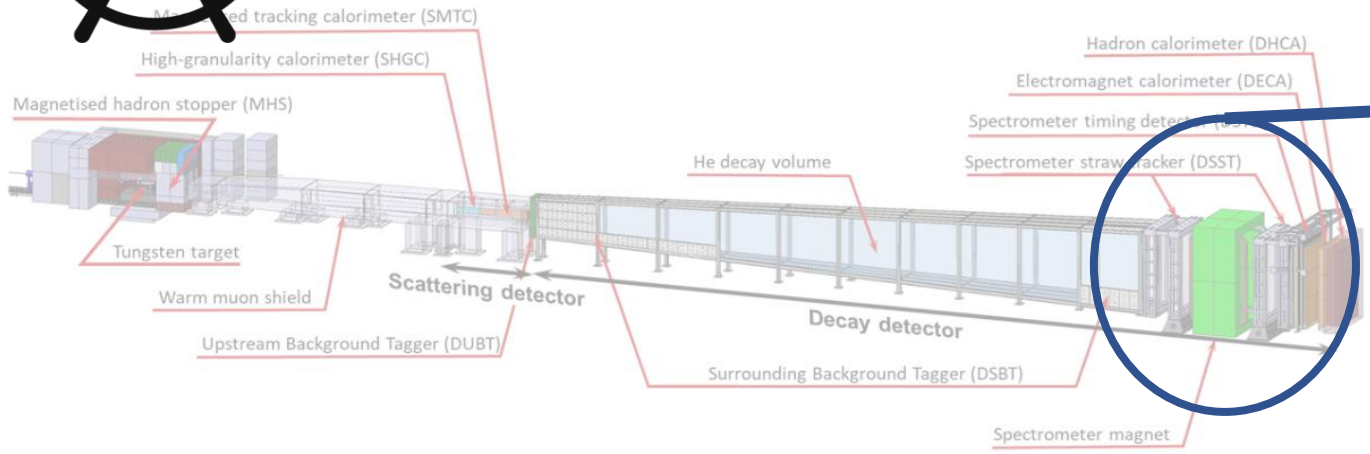


The main idea is to divide the entire detector into modules of 64 channels (rhomb and trapezoid), which allows replacing blocks of 64 channels if needed. Then all the modules are assembled into a closed cylindrical volume and, under overpressure, are tightly fixed in place.

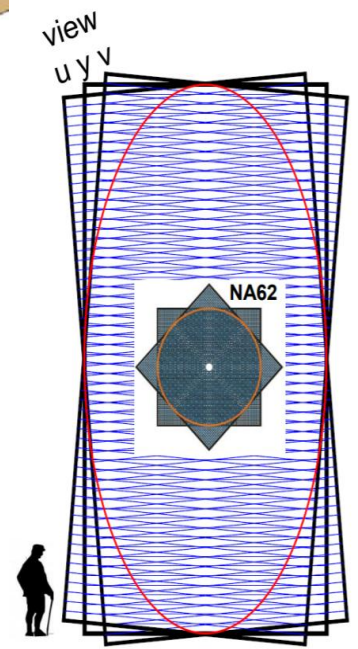




SHiP-Search for Hidden Particles at the High-Intensity ECN3 Facility

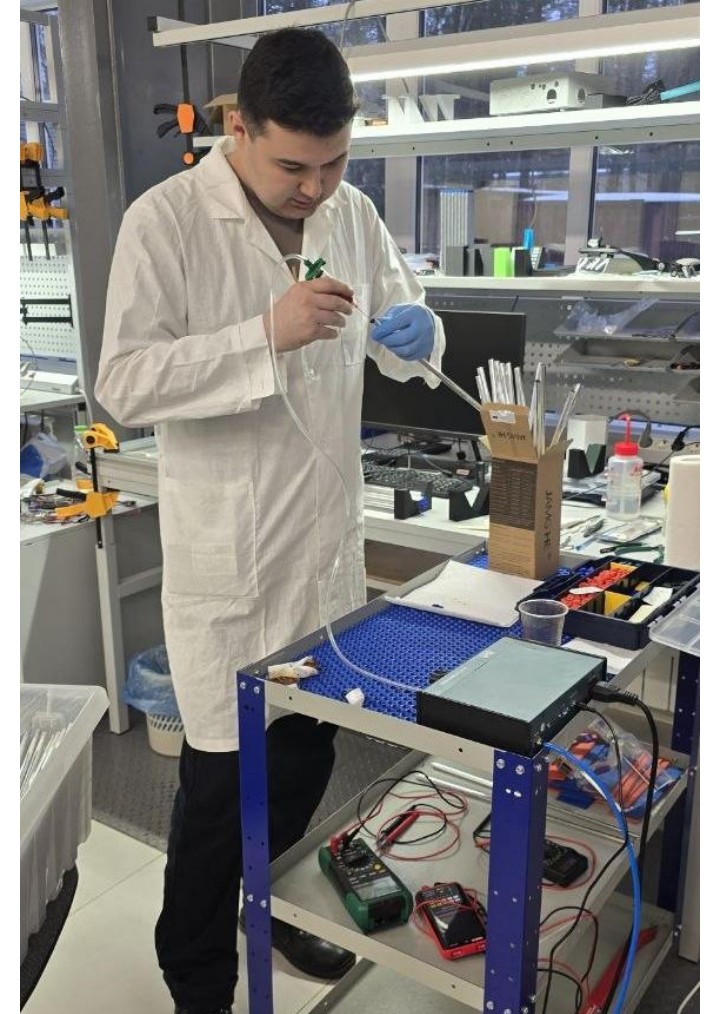
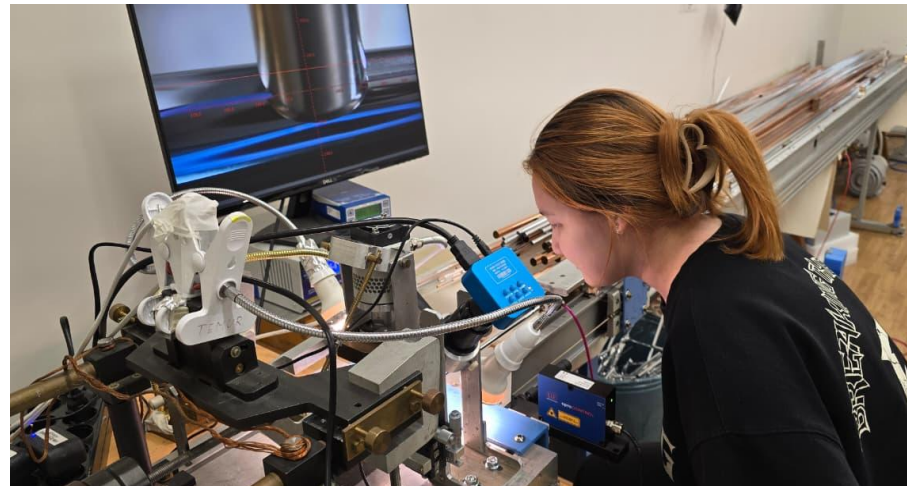
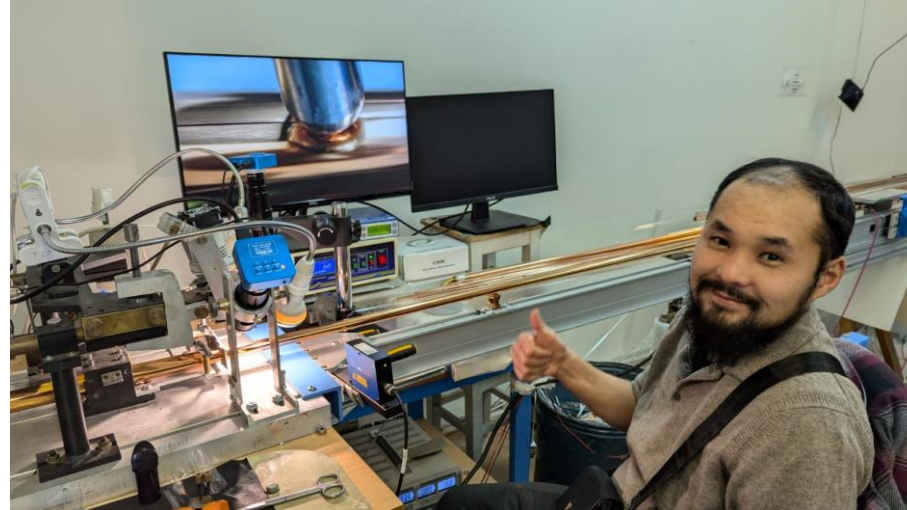
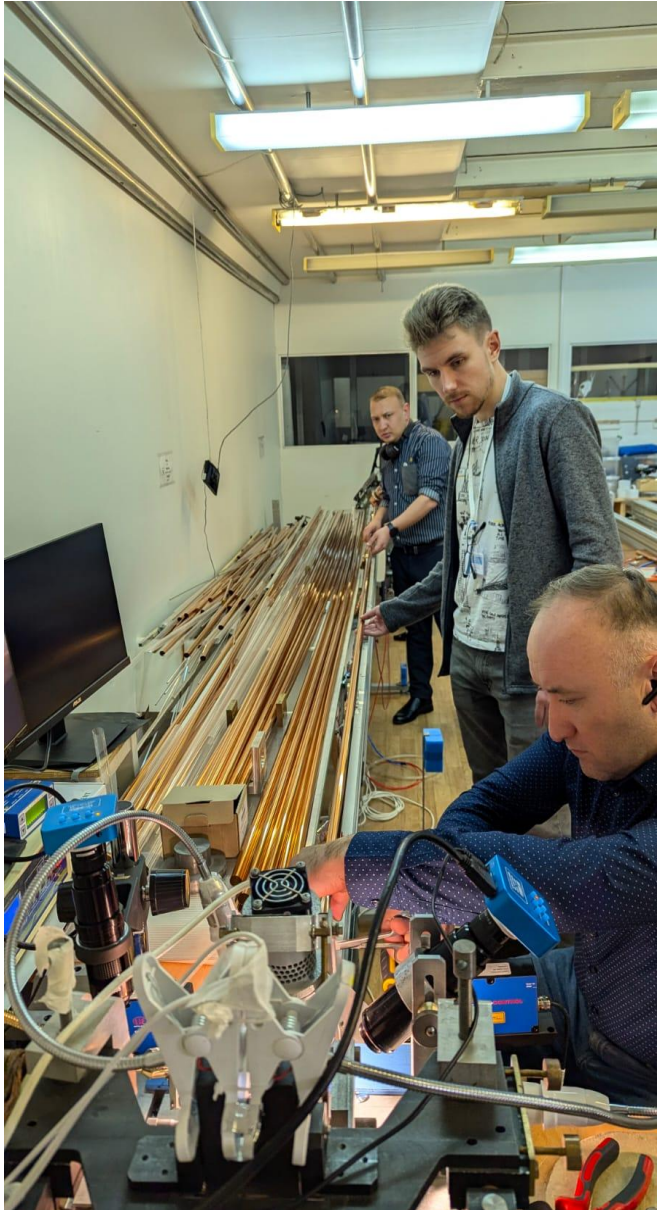


- Sensitive Area 4x6 m²
- Wall thickness- 36 μm
- Ultra light straw detectors ~ 20000 straws 4 XYUV station
- Straw tube with 20 mm diameter, anode 30 μm diameter
- Length straw 4m
- Spatial resolution 160 μm



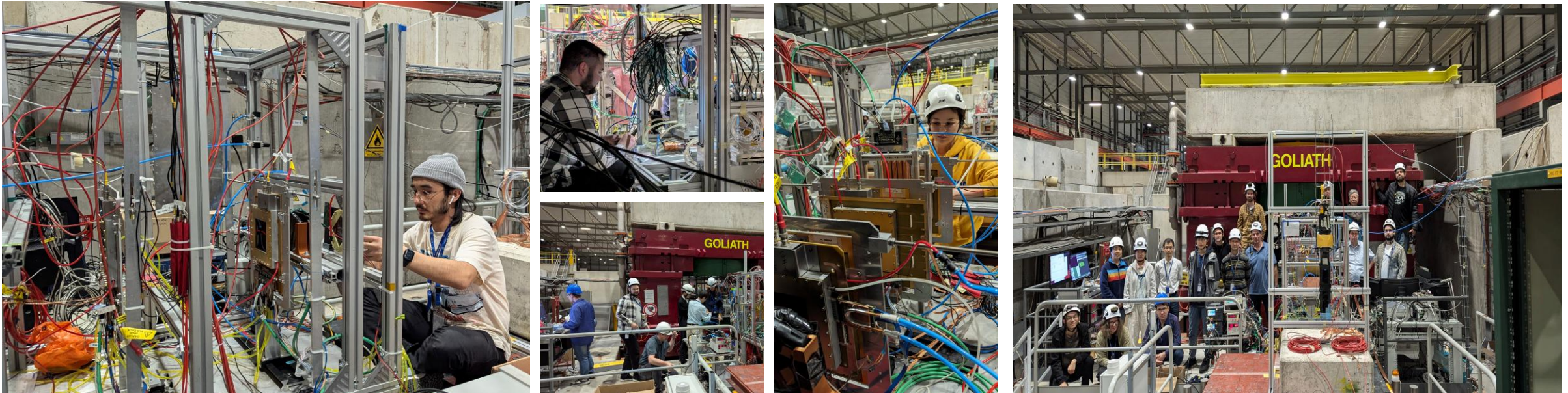
INP Personnel training at JINR Straw Production Site

Active work is underway in the field of R&D with colleagues from the INP



Joint Test Beam activity in CERN

- Since 2022, our team has been actively conducting beam tests at the H8 and T9 beam line at CERN(**Straw Tracker R&D**).
- These efforts focus on the development and optimization of our straw tracker technologies, leveraging the capabilities of both experimental setups to validate performance under real beam conditions.
- The work in these areas is critical for advancing our understanding and ensuring the reliability of detectors in future high-energy physics experiments.



Thank you for your attention

