The target station, mechanics of the beam diagnostics tools, X-ray tests of the carbon beam pipe

LLC “Vacuum systems and technologies”
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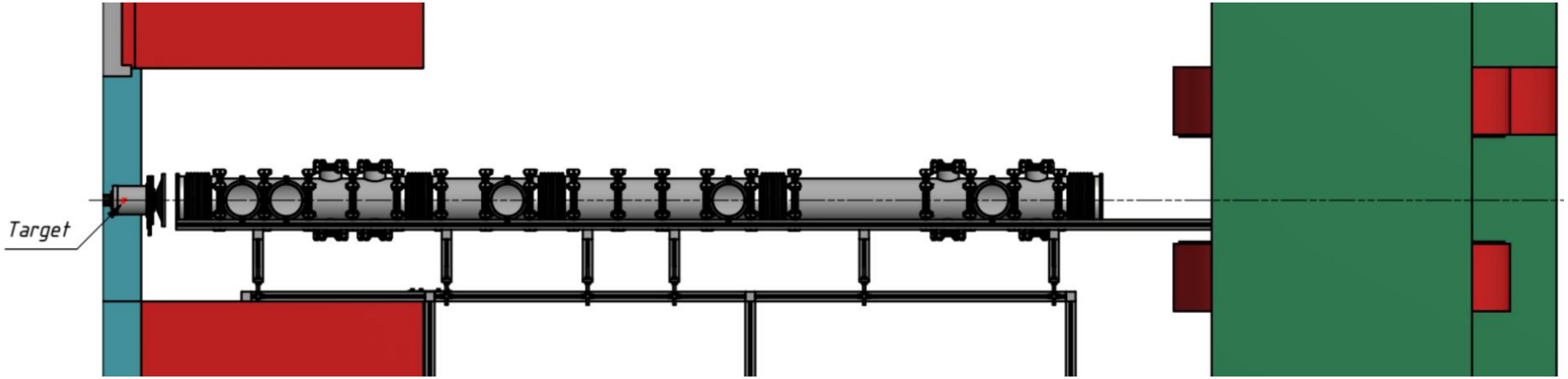
Radiation Physics Laboratory of Belgorod State University
LLC "Vacuum systems and technologies"
LLC "R@D Vacuum"

Manufactured beam pipe before the target



Content

1. The target station
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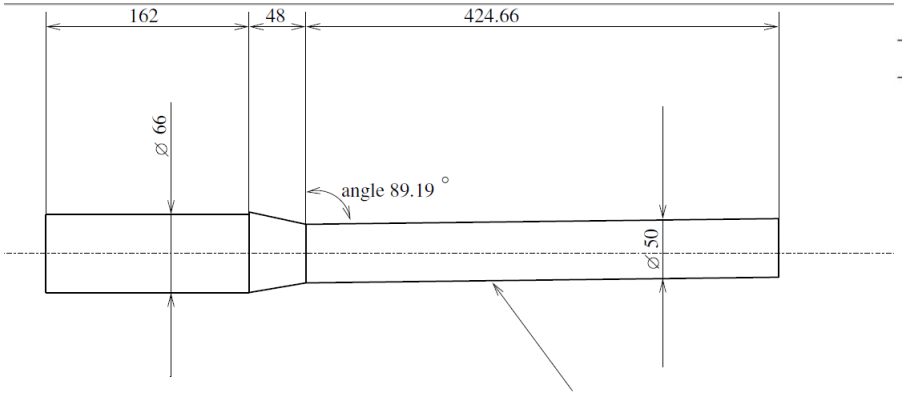
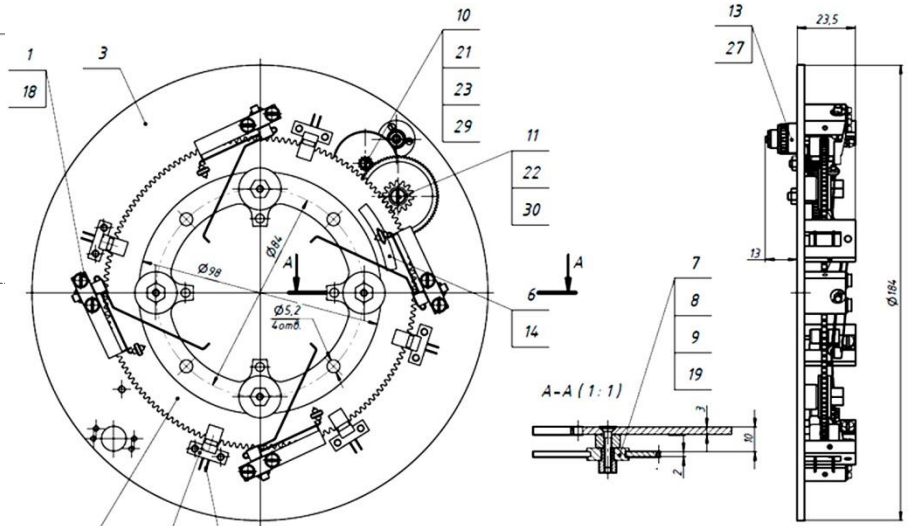
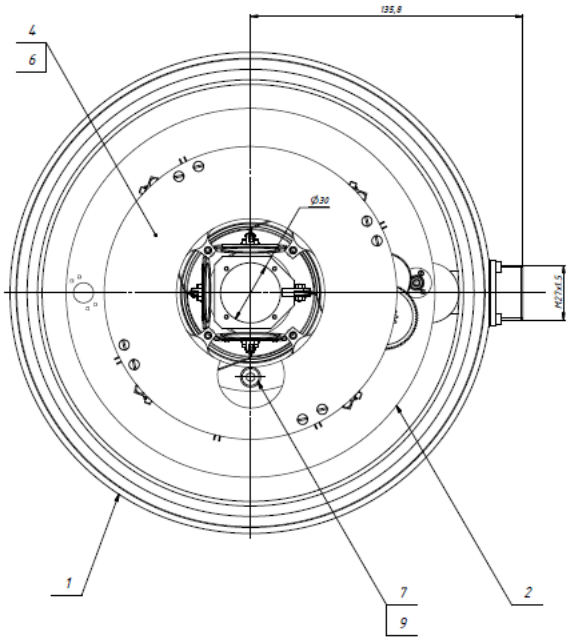
The target station with piezoelectric actuator

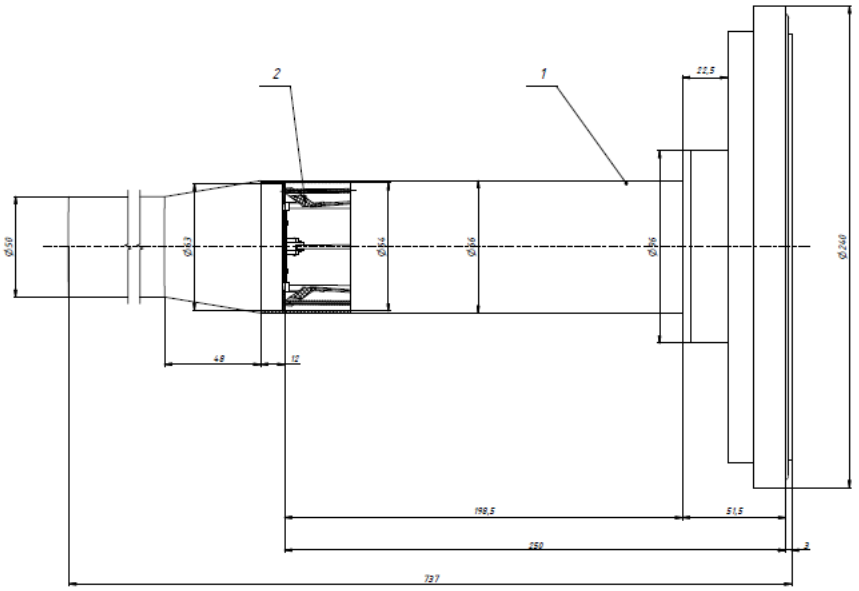


material carbon with wall thickness 1.0 mm

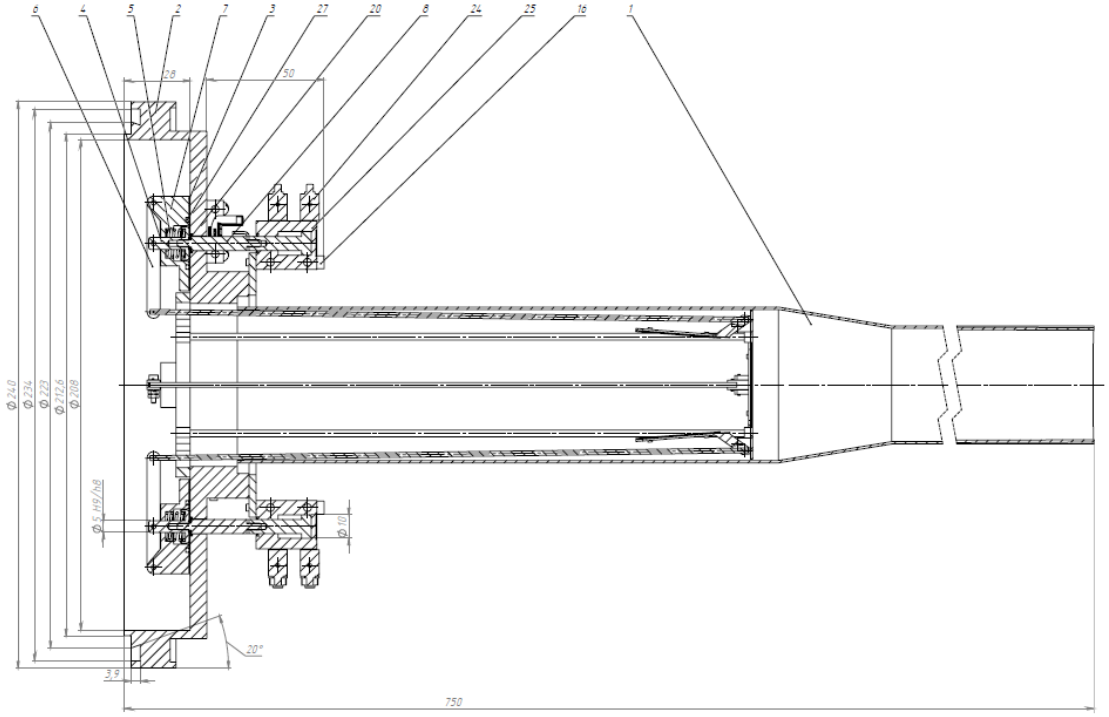
pipe rotation relative to Z axis 0.81 degrees

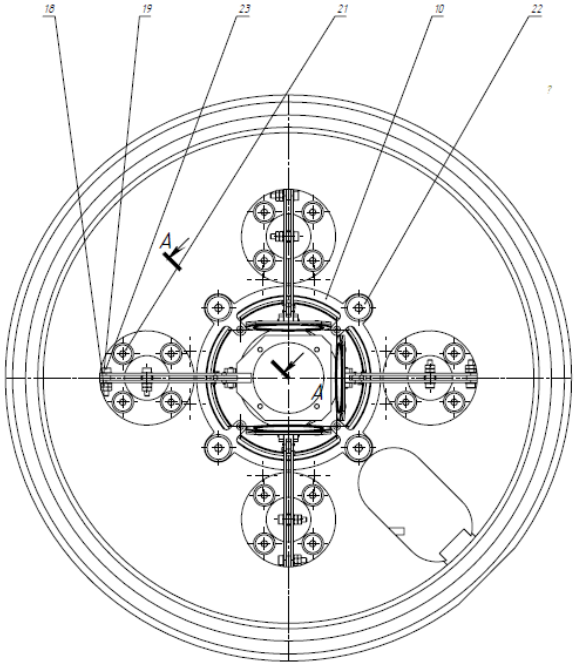




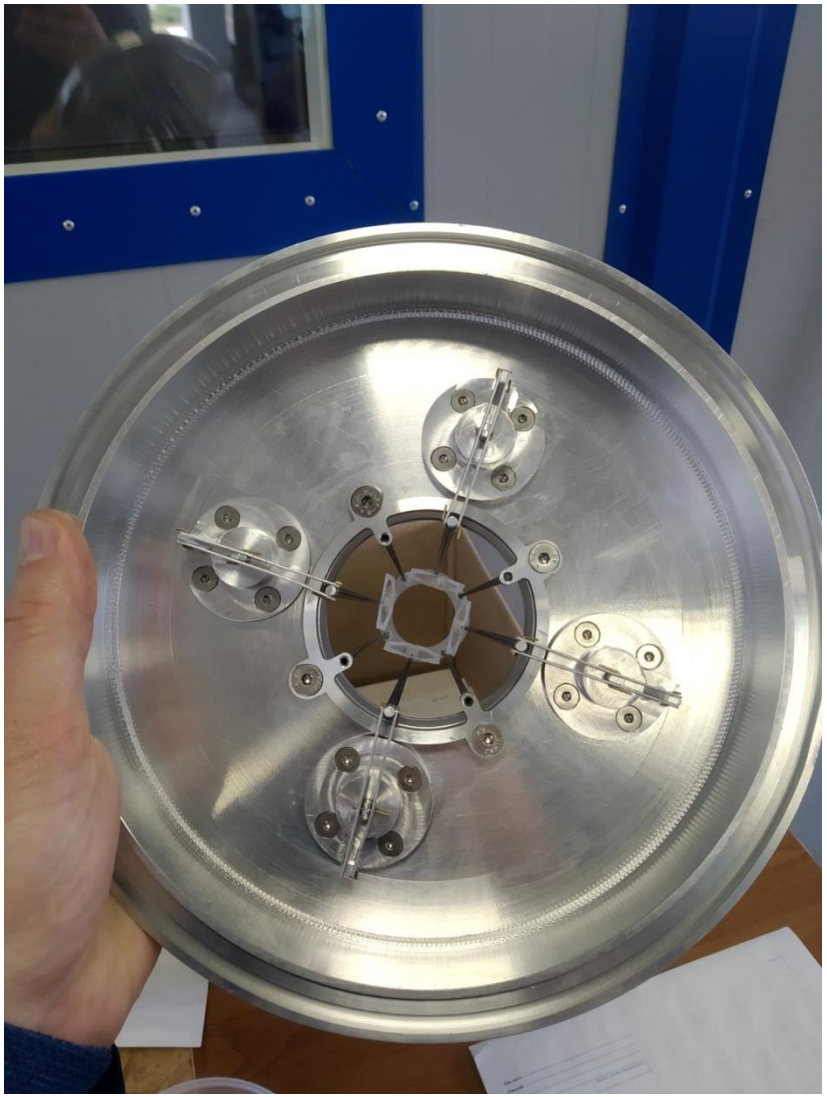


The target station with pneumatic actuator

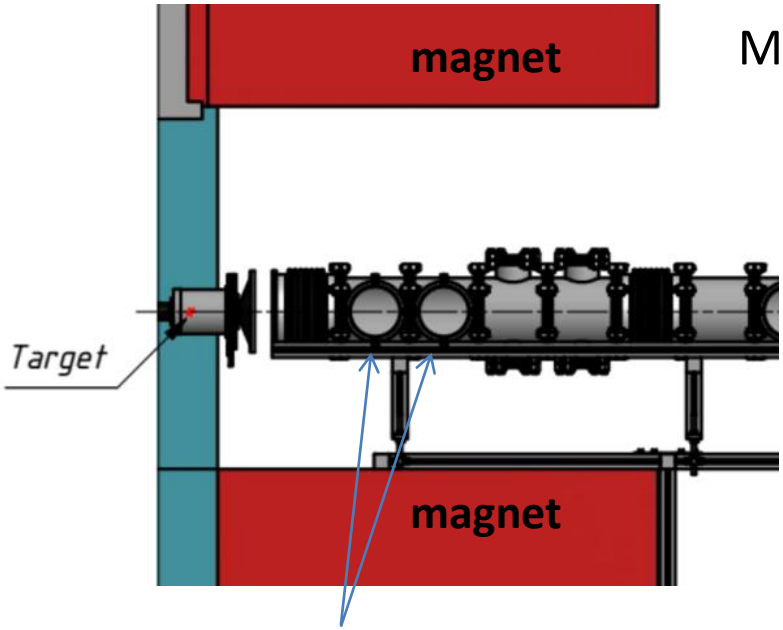




The target station with pneumatic actuator



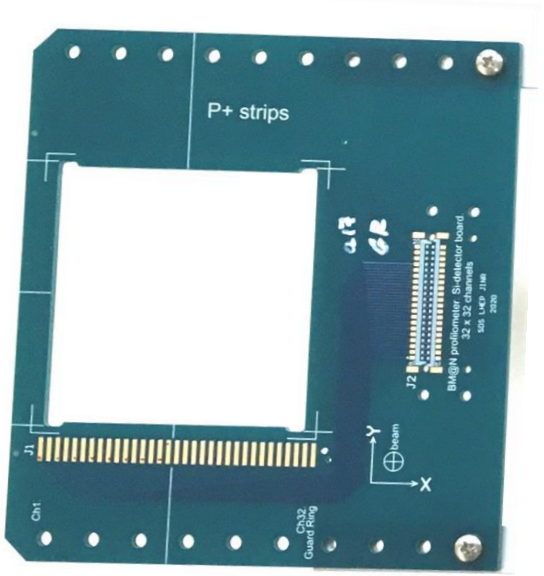
The mechanics of beam diagnostics tools



Two flanges for mounting of beam diagnostics tools

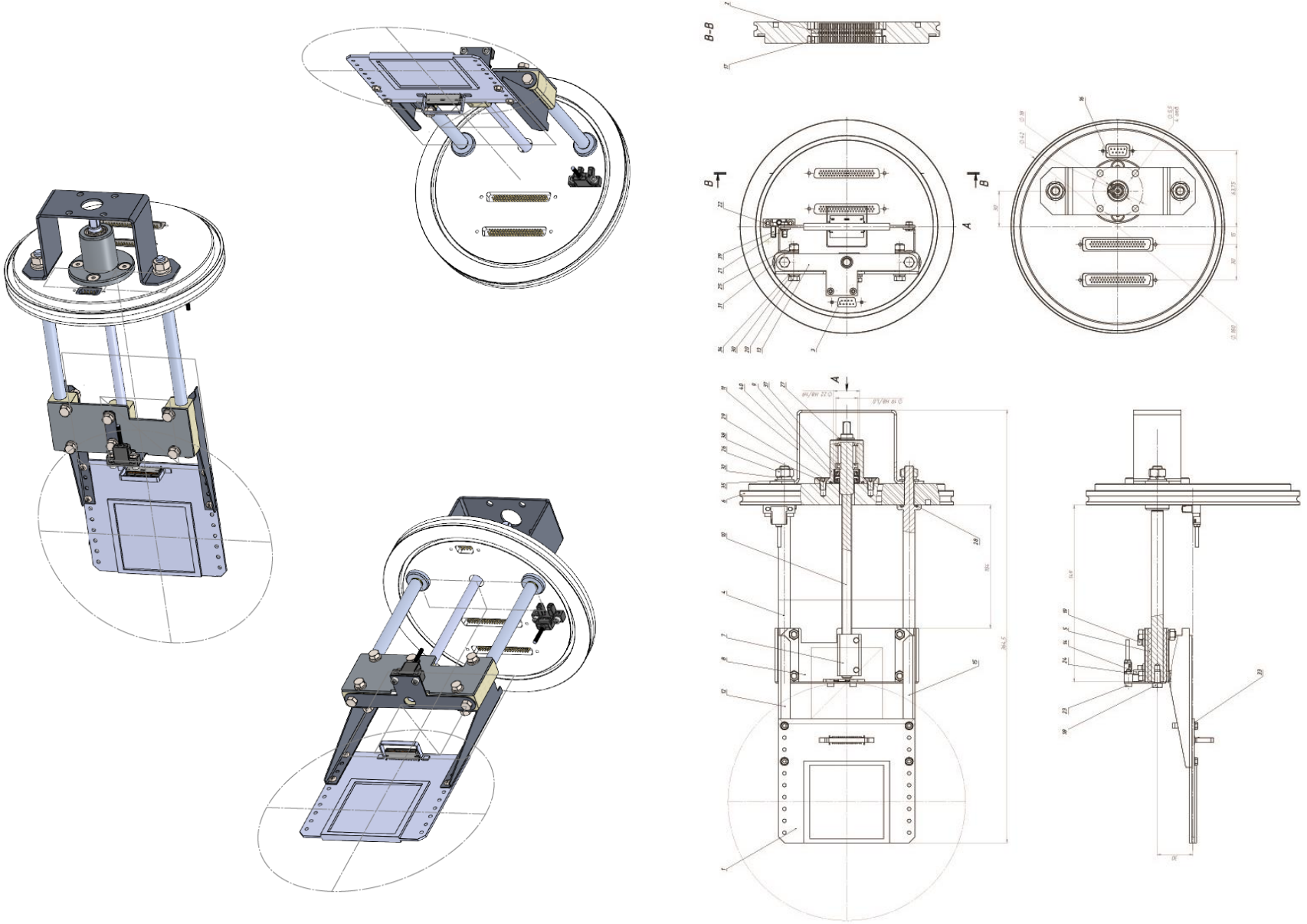
Main requirements for the mechanics:

- vacuum compatibility;
- no magnetic materials.

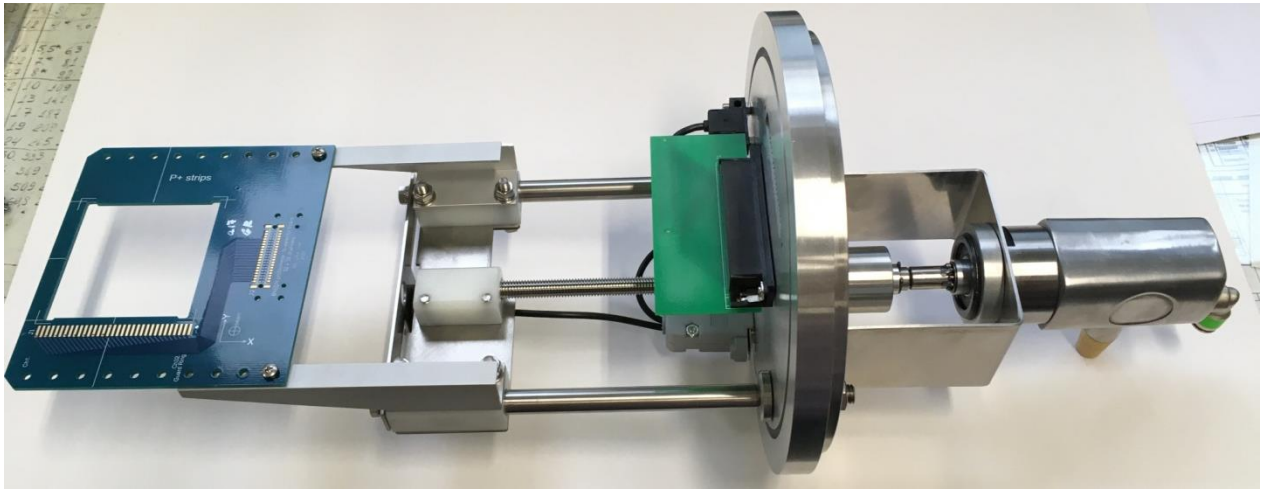


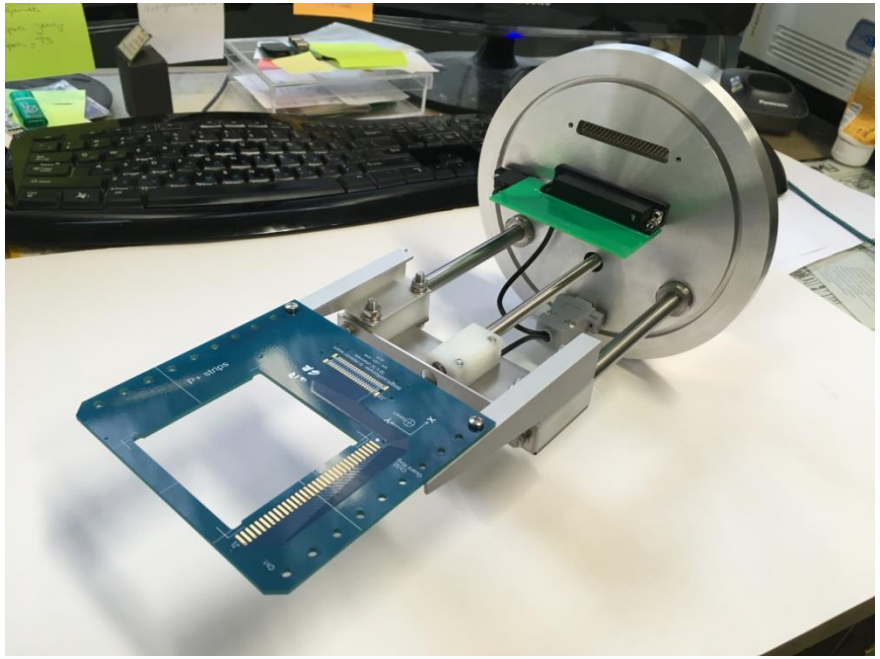
X-Y Si-profilemeter

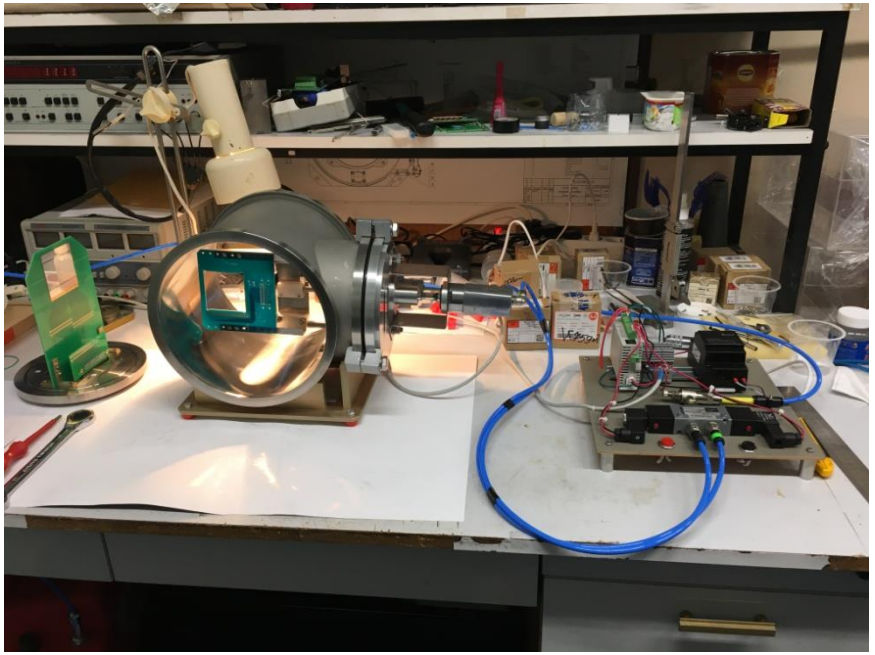
The mechanics of beam diagnostics tools



The mechanics of beam diagnostics tools







X-ray tests of the carbon beam pipe

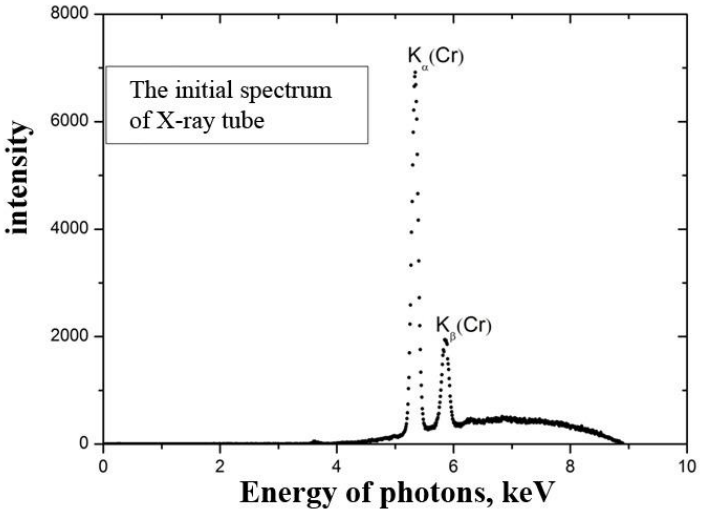
One of important tasks of BM@N setup development is quality control of the carbon beam pipe.

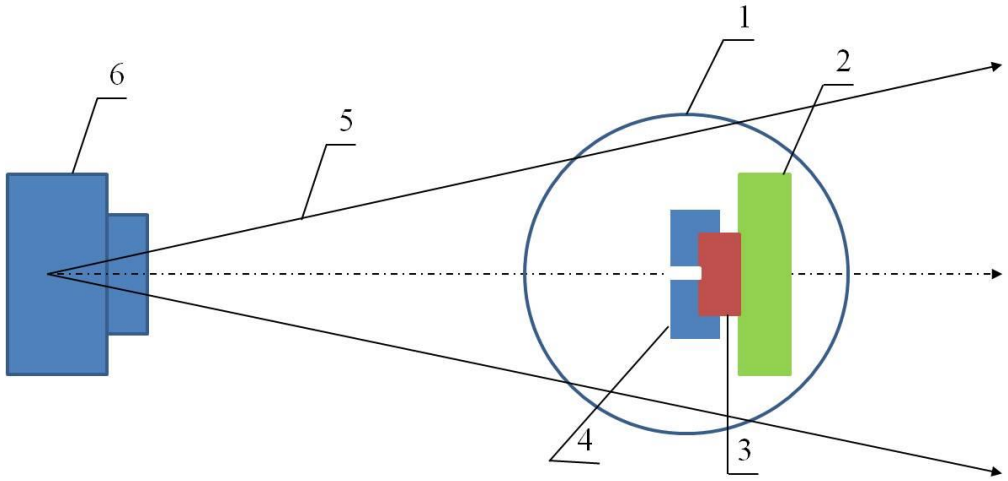
The task: development of the experimental setup for measurement of thickness of carbon tubes (beam pipe) wall.

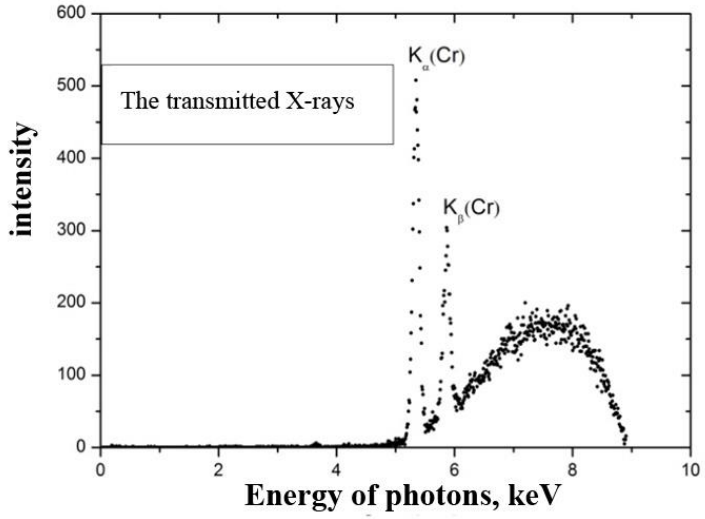
Main characteristics:

- accuracy of thickness measurement must be better than 100 um for thicknesses of 0.5...5 mm;
- possibility to perform the measure in scanning mode including edges of the tube (scanning must be without any «black» areas of the tube surface);
- tube diameter 50…100 mm;
- minimal area of the tube surface element smaller than 1 mm^2.

X-ray tests of the carbon beam pipe

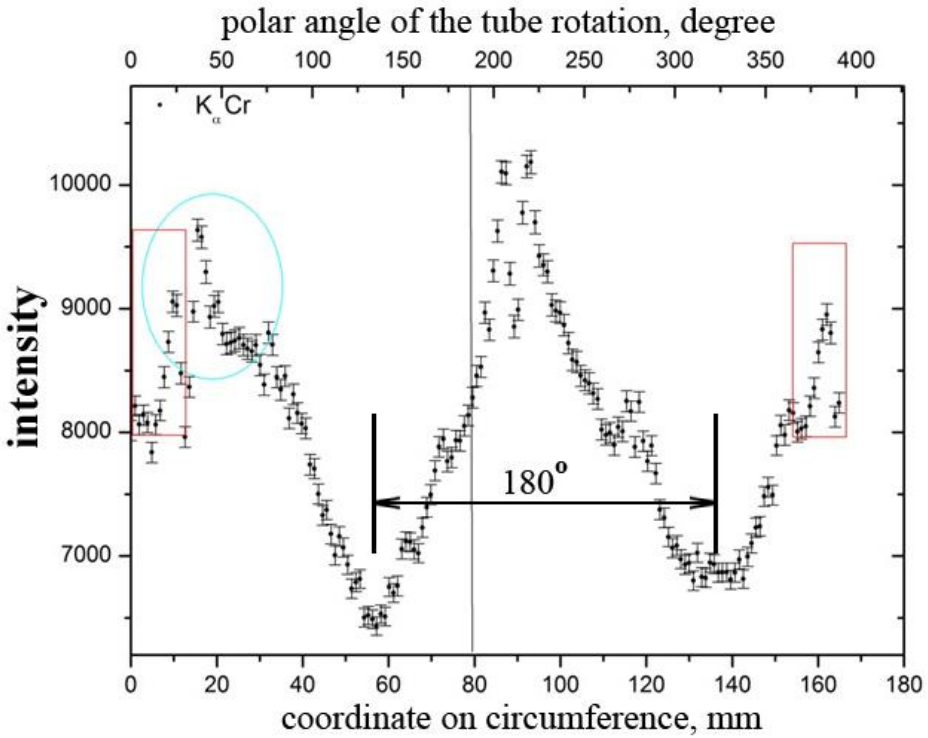


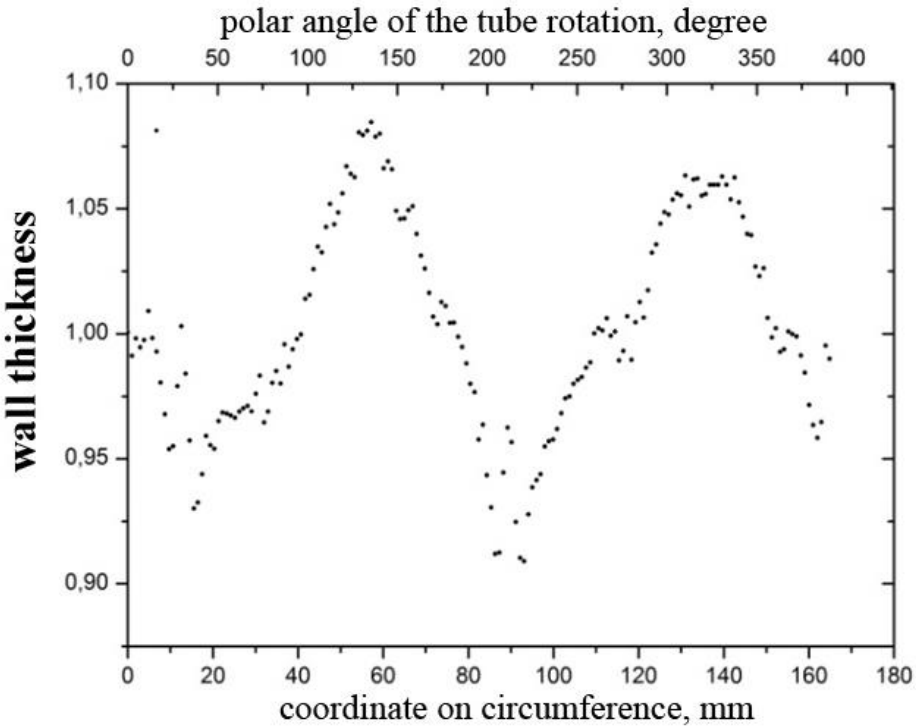




The experimental setup. 1 – the tube; 2 – X-ray spectrometer mount plate;
3 – X-ray spectrometer; 4 – lead collimator; 5 – area of X-ray flux; 6 – X-ray tube.

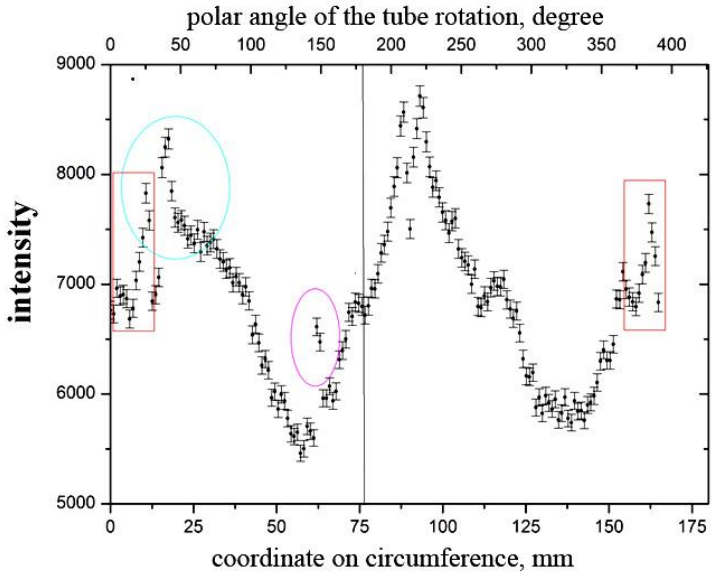
X-ray tests of the carbon beam pipe





The results of the wall thickness measurements for a fixed coordinate along axis of the tube.

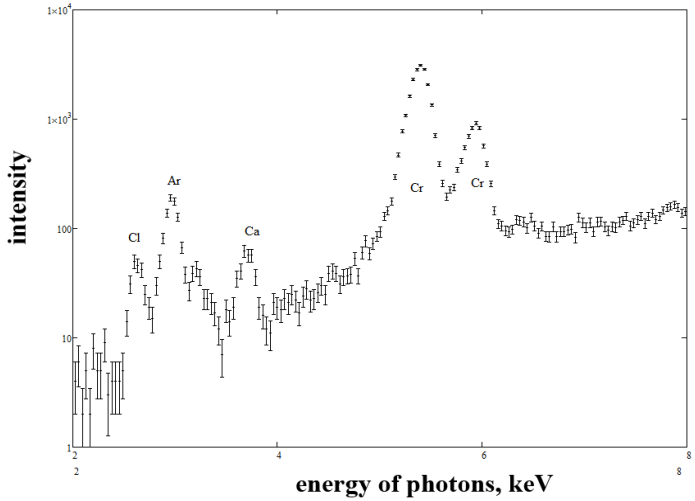
X-ray tests of the carbon beam pipe



Measurement of transmitted X-ray intensity

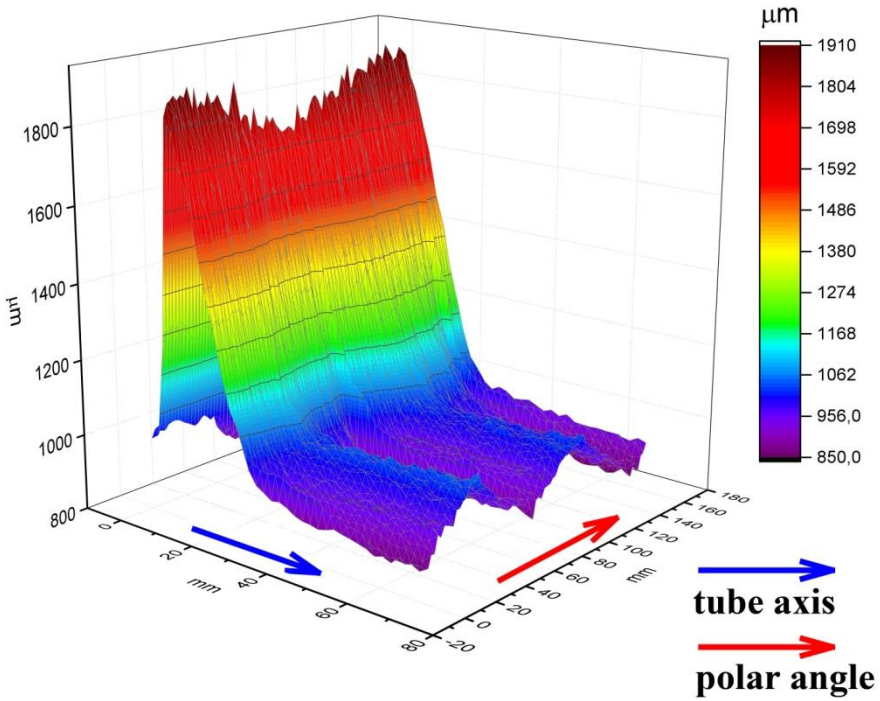
The achieved accuracy of the wall thickness measurement: better than 10 um for the time of measurement 10 seconds (one point).

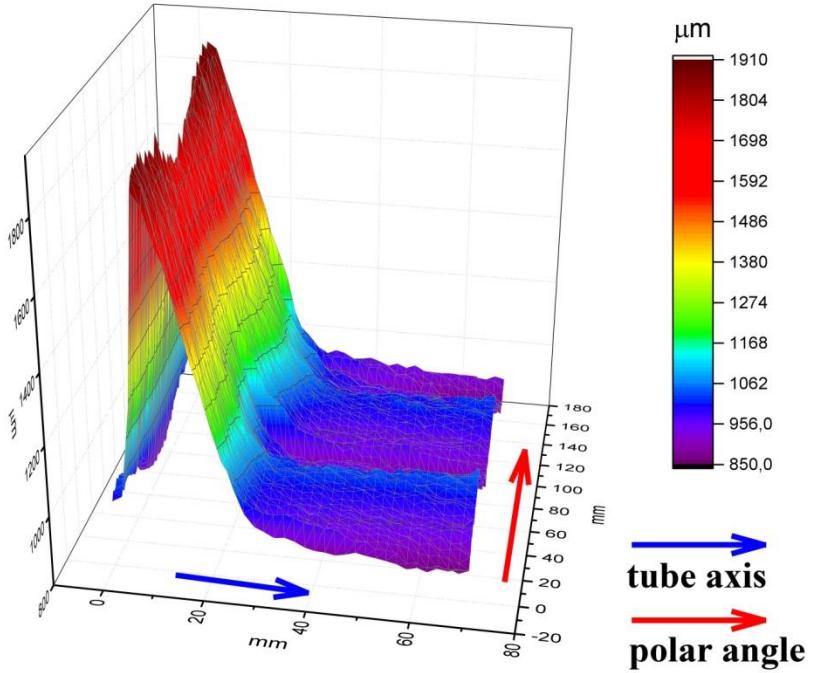
The additional result: possibility to control local elemental composition of the tube material on the base of measurement of X-ray fluorescence spectra.



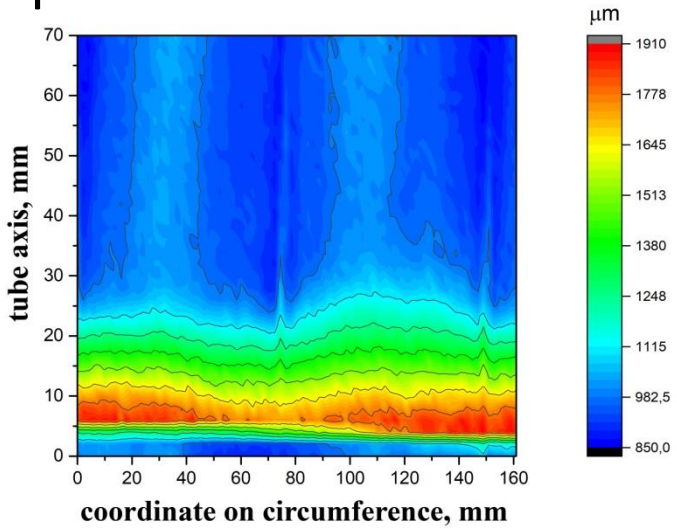
Measurement of X-ray fluorescence spectrum

X-ray tests of the carbon beam pipe

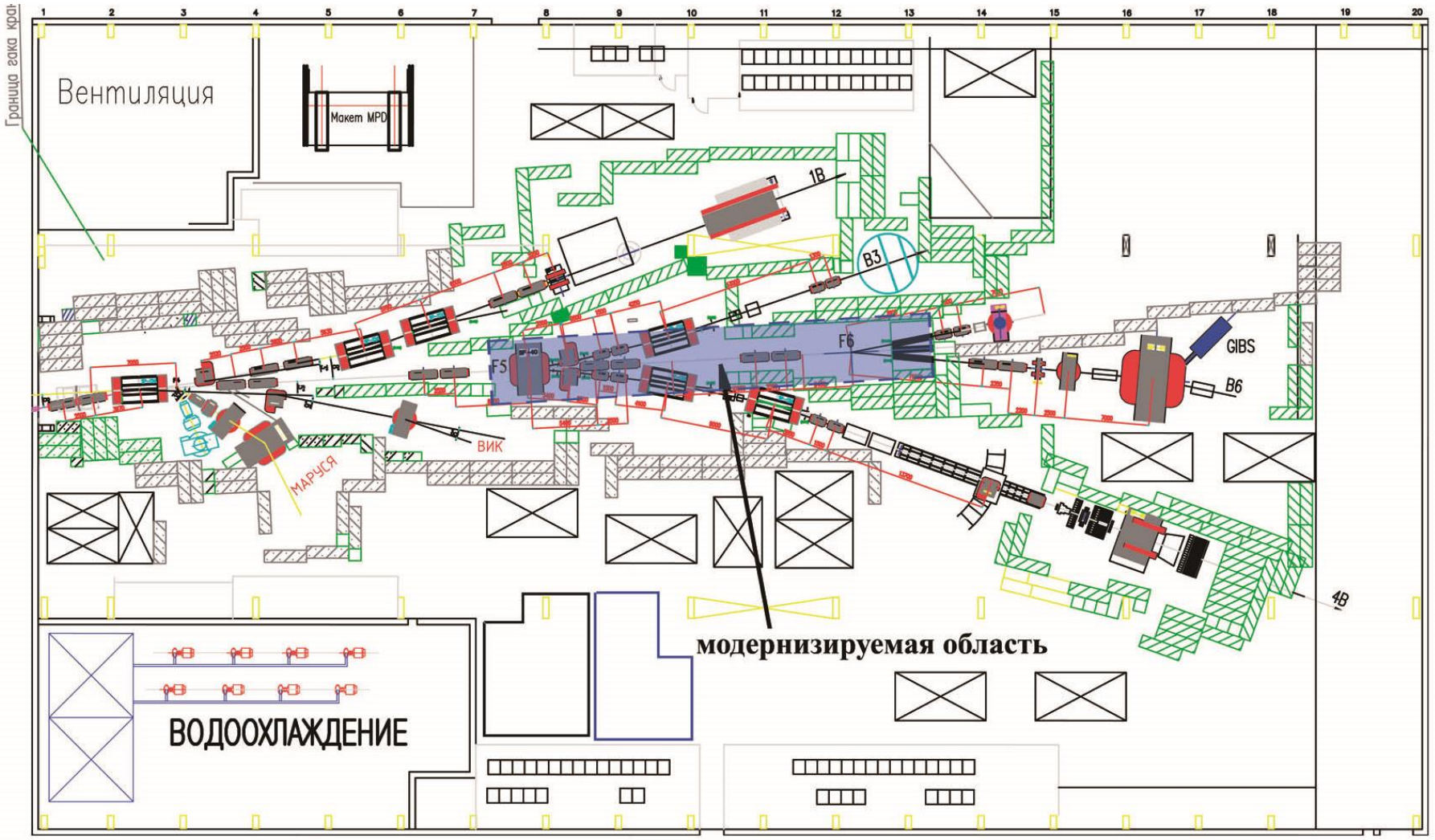




X-ray 3D map of the wall thickness distribution



The vacuum beam pipe



The modernized area of the beam pipe

The main results

- The following parts of BM@N experimental setup have been developed and produced: mechanics of the beam diagnostics tools and target station. The both devices do not have magnetic materials and can be used in conditions of strong magnetic field.
- The experimental setup for measurement of wall thickness of carbon beam pipe is developed and tested.
- The production of the vacuum ion beam pipe will start soon.

Thank you so much for the attention!