



Status of the IBR-2 modernisation and its spectrometer complex development

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Preparation for the IBR-2 physical start-up in 2010

Fully completed phases (on September 24, 2010):

- Reactor cooling circuits filled with liquid sodium
- Spent fuel assemblies transported into additional storage facility
- Executive mechanisms and control rods mounted at the reactor
- Automated system for technological parameters control installed
- New operator console mounted in the main control room
- Automated safety and control system assembled at the reactor
- Spontaneous source (Cf 252) loaded into the reactor

The IBR-2M' automated safety and control system (ASCS-12R)

- all equipment delivered to JINR by manufacturer



ASCS-12R' system boxes assembled in the main control room.



Testing of automated safety and control system



ASCS-12R' elements:

Operator terminal in the reserve control room



Control stands of the executive bodies in the reactor hall



All equipment of the automated system for technological parameters control (ASTPC) installed at its working places



Servers of ASTPC at the main control room



Renovated working place of reactor control engineer at the operator console



New reactor exterior and the first line of additional protection system around the reactor





Remaining tasks to be completed for the reactor physical start-up (key points marked in red)

Task	Date of completion
Performance of tests and adjustment of ASCS-12R' electronic equipment, of the control panel at the main control room as well as electronic equipment at the reserve control room.	September 30, 2010
Full-scale complex tests of new technological, electronic and electrical equipment.*	October 29, 2010

* This stage of the plan has a crucial importance for timely physical start-up of the reactor as during of its fulfillment some additional time might be required for correction of detected equipment' malfunctions.



Remaining tasks to be completed for the reactor physical start-up (key points marked in red)

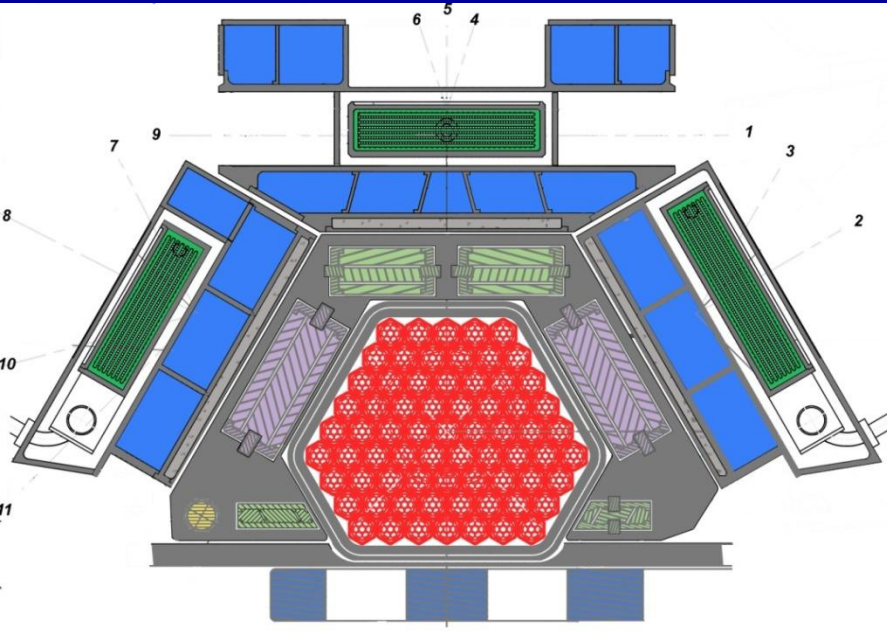
Task	Date of completion
Preparation of organizational and technical documentation	before the reactor commissioning
Commissioning of the modernized IBR-2 reactor:*	
• reactor systems review	November 01 10, 2010
• nuclear safety review	November 11 19, 2010
Beginning of the reactor physical start-up	November 24 31, 2010

* The beginning of the commissioning depends on the results of complex tests of the equipment necessary for the physical start-up of the reactor as well as fulfillment of nuclear and radiation safety requirements.

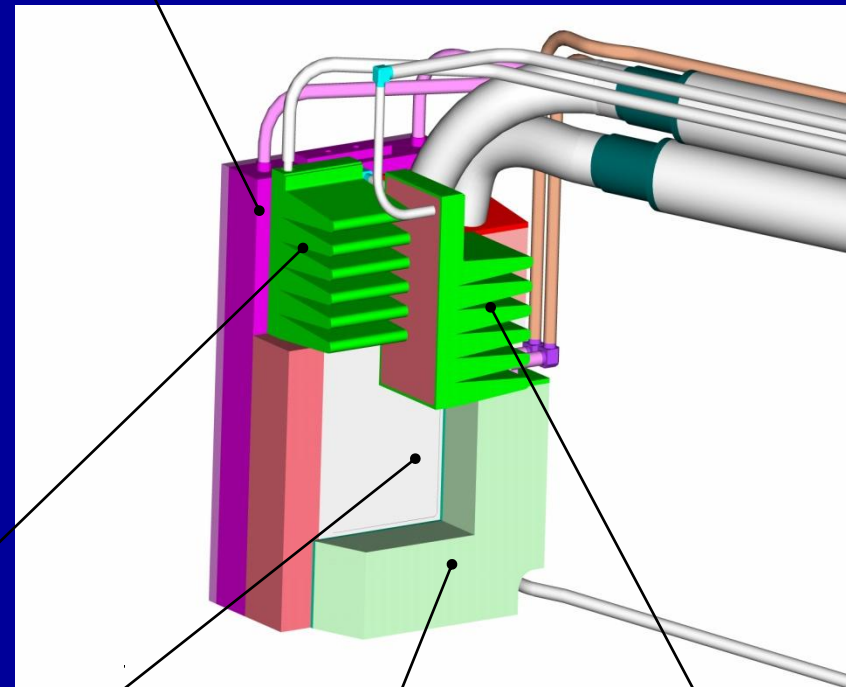


Cryogenic moderator and Spectrometers at the IBR-2 Reactor

Moderator complex for beams # 7,8,10,11



Water pre-moderator



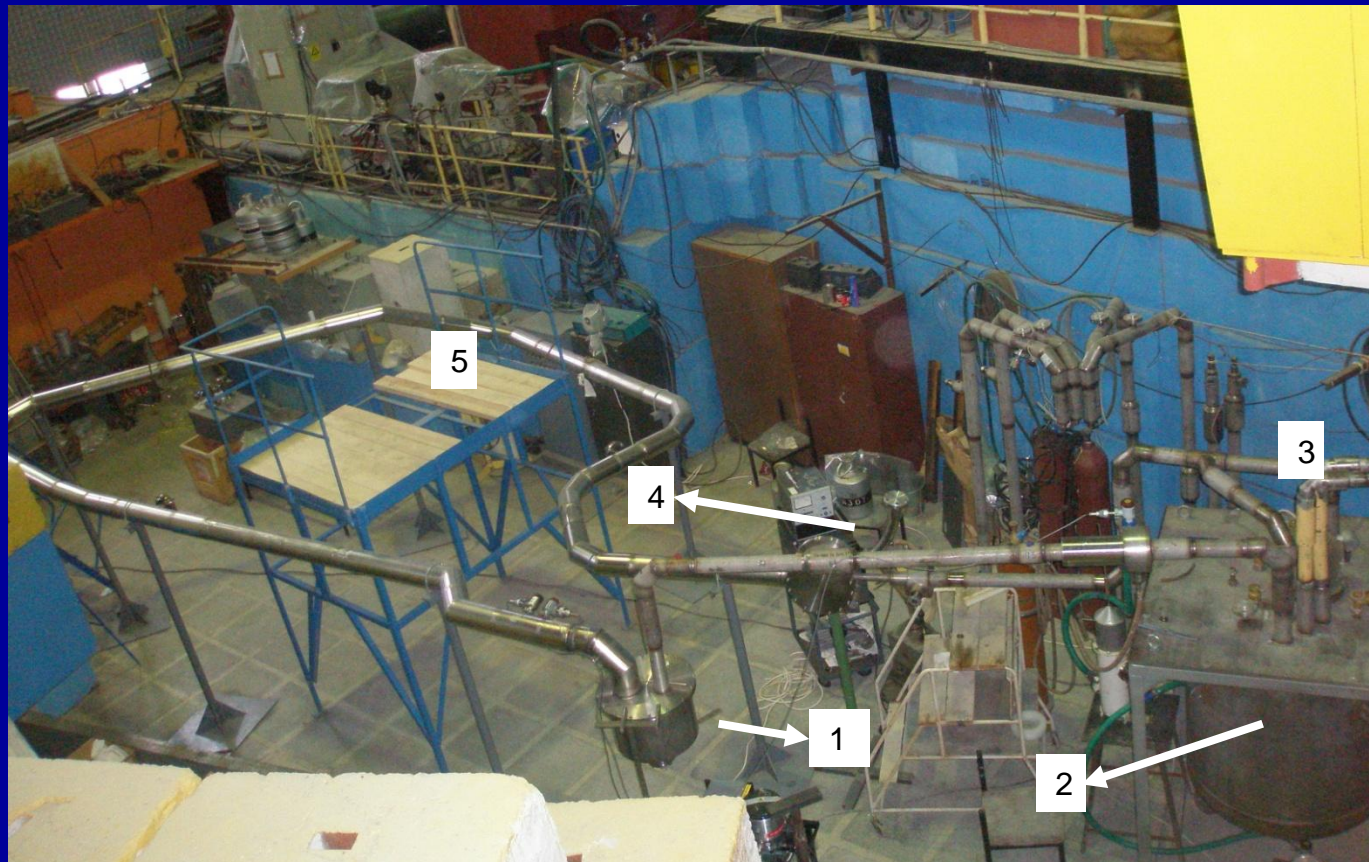
Grooved water moderator for beams 7

Front plate of cold moderator for beams 7, 8 and 10

Flat water moderator

Grooved water moderator for beams 11

Full scale model of cold moderator at the IBR-2 experimental hall



1 – chamber of cold moderator with vacuum shielding, 2 – heat exchanger with helium blower, 3 - cryogenic pipes from/to the helium cooler, 4 – place for charging device of mesithylene beads, 5 –transport pipes (~ 15 m)



Main goals to be achieved with the full scale model

To check the process of charging mesithylene beads into a moderator chamber :

- whether beads can come without jamming and keep its integrity,
- what is an optimal feeding rate of beads,
- what is a reproducibility of beads shape inside the moderator chamber.

To find out parameters of transporting gas (flow rate, temperature)

To estimate heat loads onto every part of the cooling loop (to have a sufficient information for calculation of real temperature of mesithylene during normal operation at the reactor) .

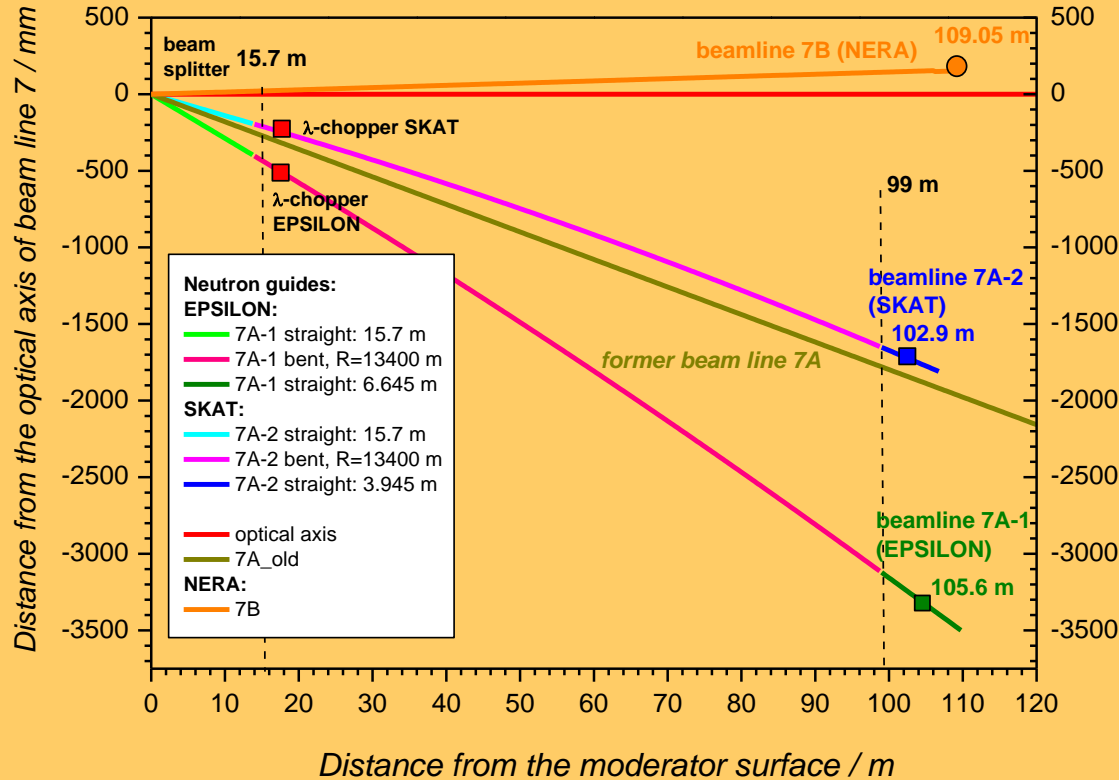
To check all technological systems (helium blower, charging device, pellets counters, software etc.



Current status

1. Experimental stand has been developed, and mounted at the IBR-2 experimental hall
2. The control system has been developed and tested on the stand.
3. The temperature of 50K has been achieved in the chamber
4. First experiments showed that mesitylene beads can be delivered by helium flow from charging device to the chamber. But some malfunctions of the charging device were observed.
5. Additional improvement of the system is now in progress.

General layout of the planned neutron guides at beamline 7A (EPSILON / SKAT)



Dubna, 19.01.10

Bent neutron guides:

- enhancement of the neutron flux at sample position,
- expansion of the accessible wavelength range up to 14 Å,
- improvement of peak-background ratio.

$m=1$, Divergence: $\Delta\alpha = 0.008$ rad. (0.45°), $\Delta\beta = 0.016$ rad. (0.9°)

Current state of beamline 7, IBR-2M

Reconstruction of the concrete pillar
for transmitting the neutron guides
of the beam lines 7A-1
(EPSILON-MDS) and 7A-2 (SKAT)



Head part - neutron guide splitter for

- strain diffractometer EPSILON-MDS (7A-1),
- texture diffractometer SKAT (7A-2),
- inelastic instrument NERA (7B).



Background- and λ -chopper system

Background chopper and λ -chopper



AC drives



22 kW for the background chopper

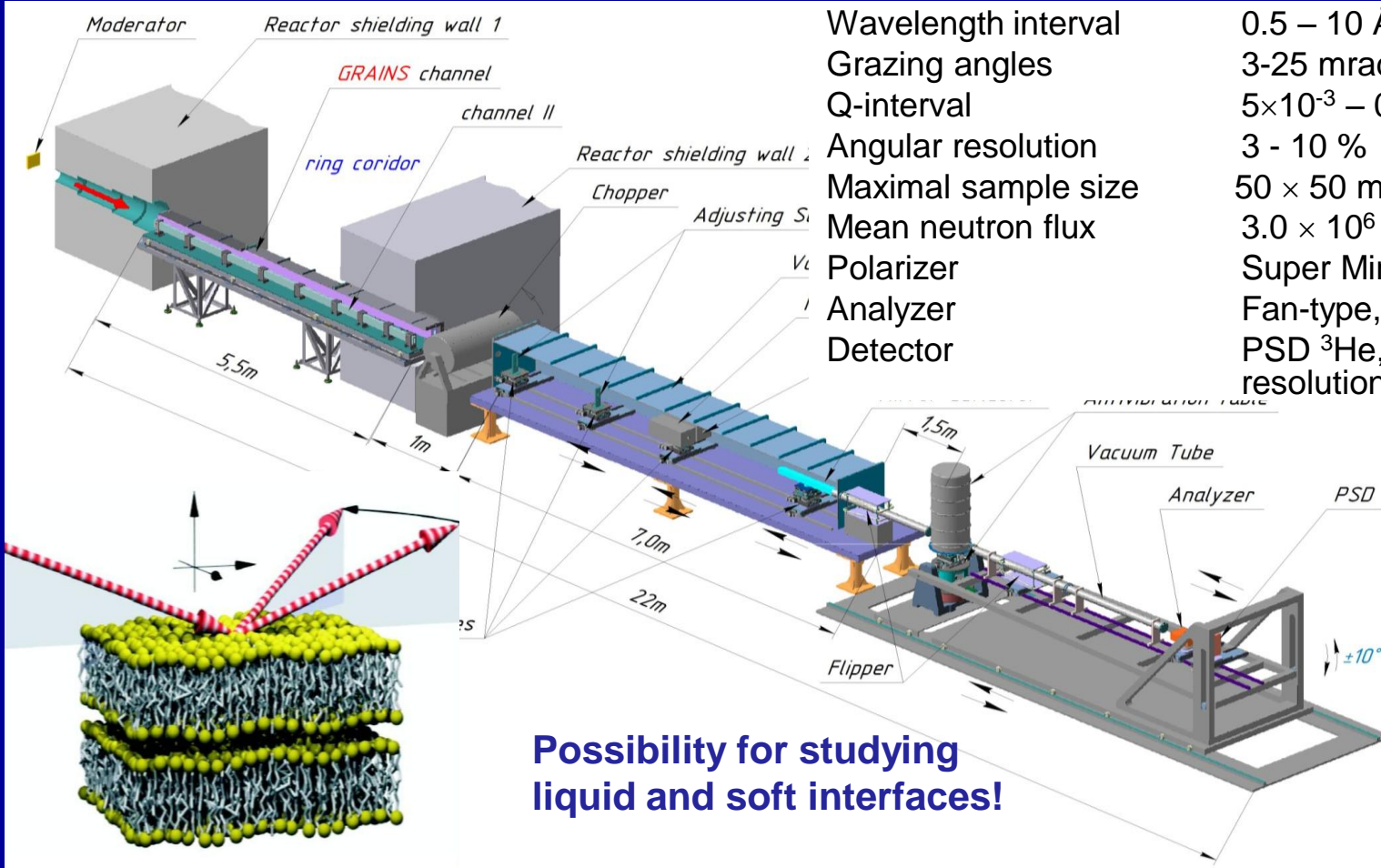
2.2 kW for the λ -choppers



Plans for 2011

1. Assembling and adjustment of the bent neutron guide
2. Assembling and adjustment of the end part
3. Installation of the background chopper (beamline 7)
4. Installation of two λ -choppers (beamline 7A-1 and 7A-2)
5. Installation of the vacuum system
6. Sample environments
7. DAQ

**Multifunctional neutron reflectometer
with horizontal sample plane at the IBR-2M GRAINS (GRAZing Incidence Neutron Scattering)
2007-2011
Cooperation BMBF – HAS – FLNP JINR**



- Wavelength interval 0.5 – 10 Å
- Grazing angles 3-25 mrad
- Q-interval $5 \times 10^{-3} - 0.6 \text{ \AA}^{-1}$
- Angular resolution 3 - 10 %
- Maximal sample size $50 \times 50 \text{ mm}^2$
- Mean neutron flux $3.0 \times 10^6 \text{ cm}^{-2} \text{ c}^{-1}$
- Polarizer Super Mirror (m=2)
- Analyzer Fan-type, Super Mirror (m=2)
- Detector PSD ^3He , $20 \times 20 \text{ cm}^2$, resolution $2 \times 2 \text{ mm}^2$

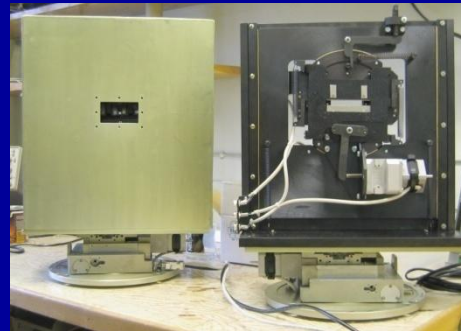
**Possibility for studying
liquid and soft interfaces!**

**Head part
(ATOM-PNPI RAS-JINR)**

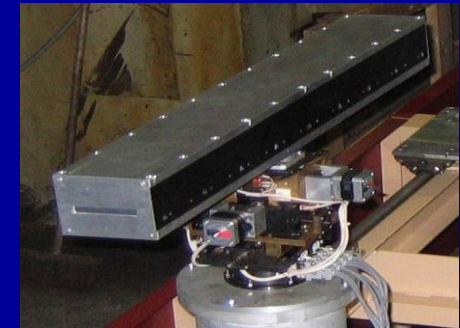


GRAINS: Current state

**Elements of beam-forming system
(PNPI RAS)**

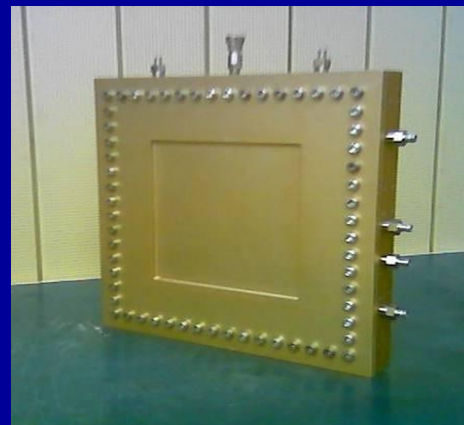


Collimating slits

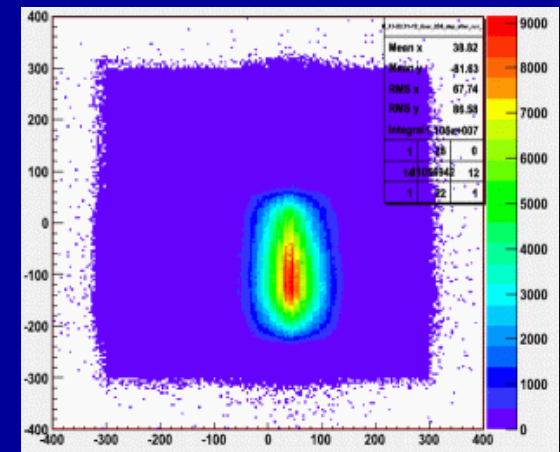


Deflector and Polarizer

**2D Position Sensitive Detector
(SC FLNP JINR)**

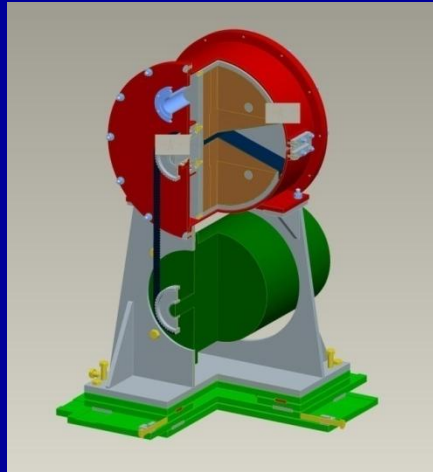


Gas chamber



Test image at IR-8

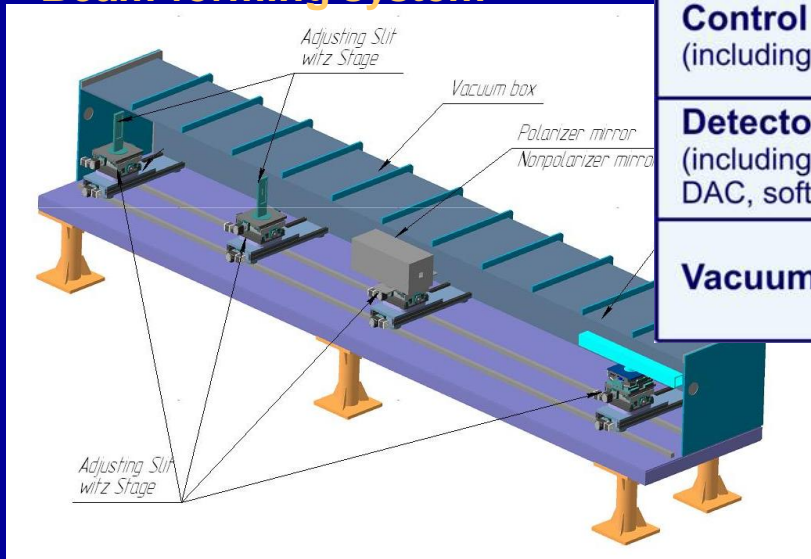
Background chopper



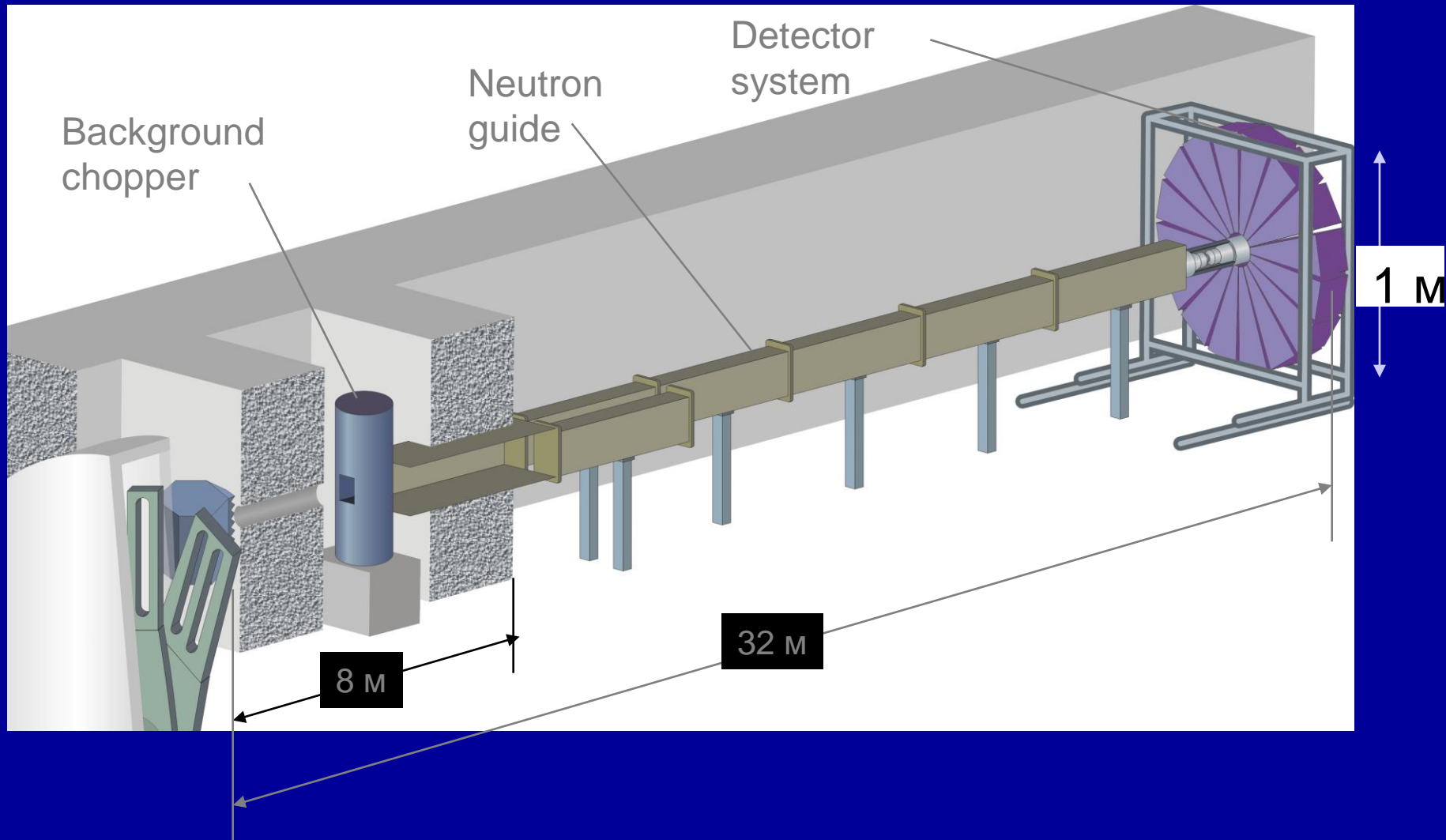
GRAINS: Plans

	2007	2008	2009	2010	2011
Head part	█				
Beam-forming system (including polarizing units)	█				█
Background chopper			█	█	
Sample holder				█	█
Control system (including software)				█	█
Detector system (including PSD, monitors, DAC, software)	█				█
Vacuum system			█	█	

Beam-forming system



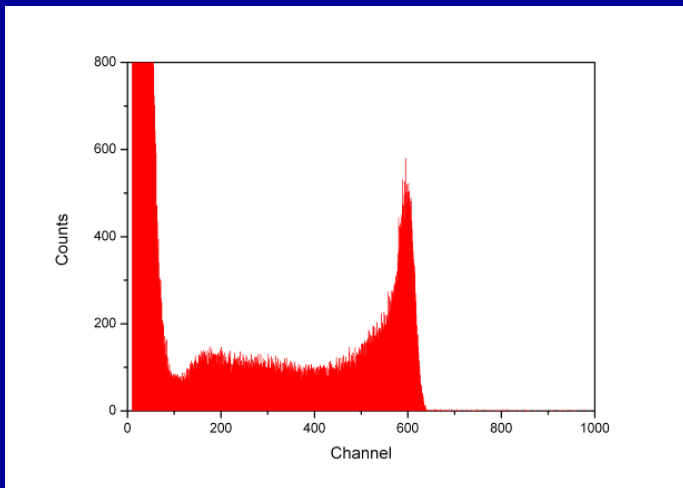
New high Intensity diffractometer DN-6 for studies of materials under extreme conditions (high external pressure up to 50 GPa, temperature down to 10 K)



- Leading part of the neutron guide (vacuum casing and mirrors) – completed, installed at 6b channel of IBR-2;
- Tail part of the neutron guide - vacuum casing completed, fabrication of mirrors in progress;
- Background chopper – completed, installed at 6b channel of IBR-2;
- Detector system – design completed, model element tested;
- Mechanical units – design in progress

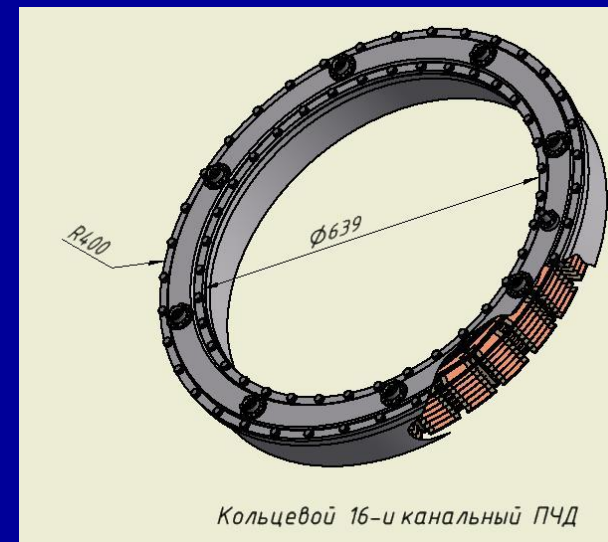


Leading part of the neutron guide



Amplitude spectrum

In order to estimate influence of border effects and to measure parameters of the detector signals a test module have been created. Module imitates a section of the 32-sections detector. It is segmented into 6 independent elements. Signals are received from each element separately.



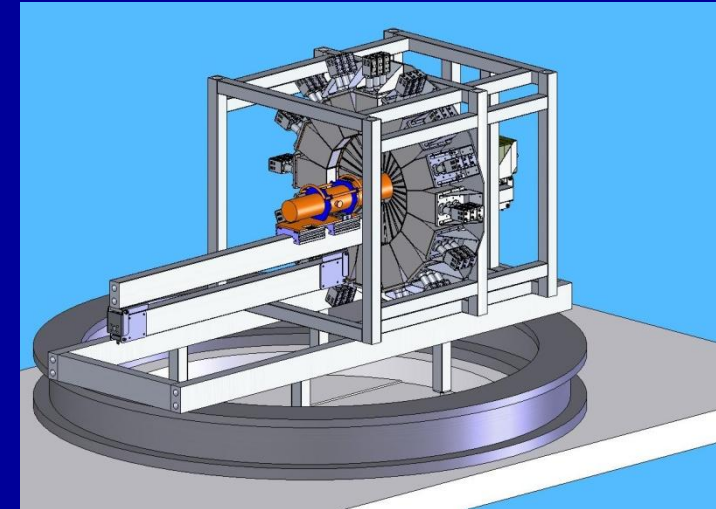
Design of ^3He gas detector system



Sapphire anvil high pressure cell for DN-6

DN-6: planned activities for 2011

- Tail part of neutron guide - fabrication of the mirrors, installation at 6b channel of IBR-2;
- Mechanical units - fabrication, installation at 6b channel of IBR-2;
- Detector system – fabrication, tests, installation at 6b channel of IBR-2



Design of the mechanical units of the diffractometer DN-6

Financing:

2010: 350 kUSD (FLNP JINR, theme -1069)

2011: 450 kUSD planned within the 7-years plan of JINR development



Thanks for your attention!