Inelastic Neutron Scattering facilities at IBR-2 reactor

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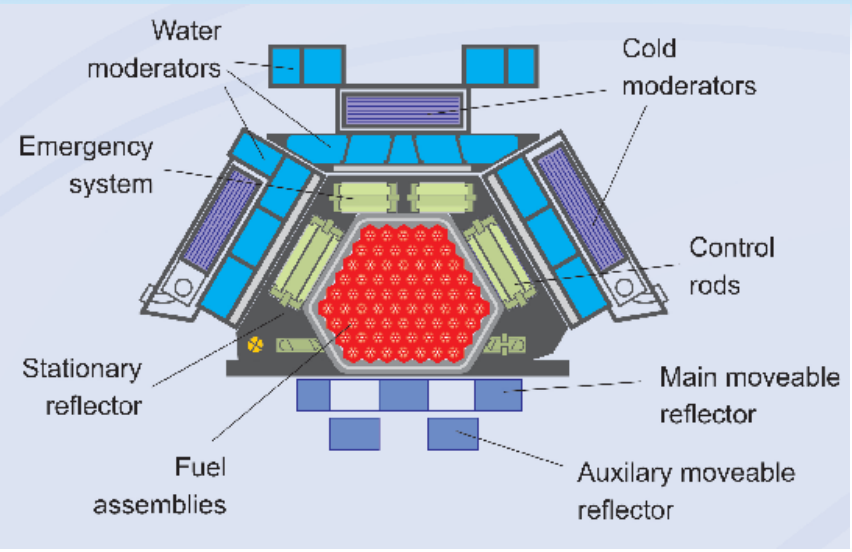
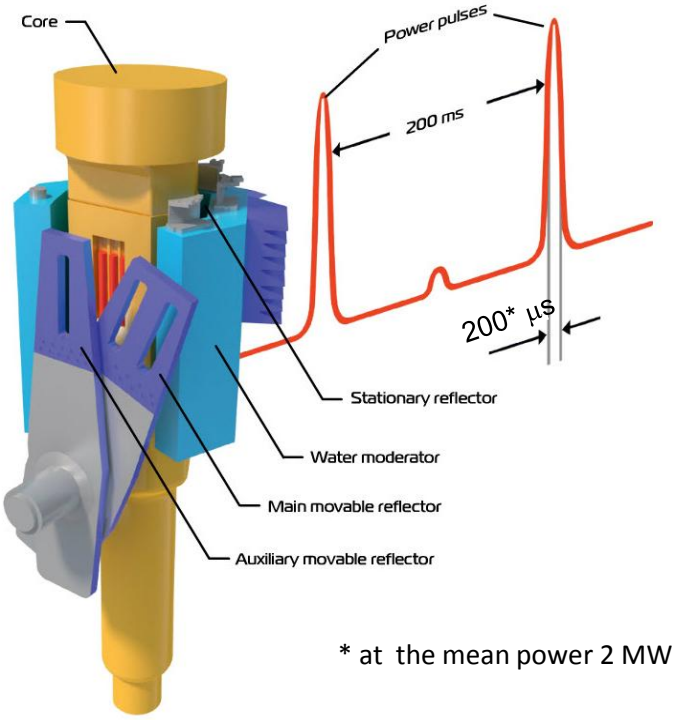
Spektrina 2016
Gatchina, 23-24.06.2016

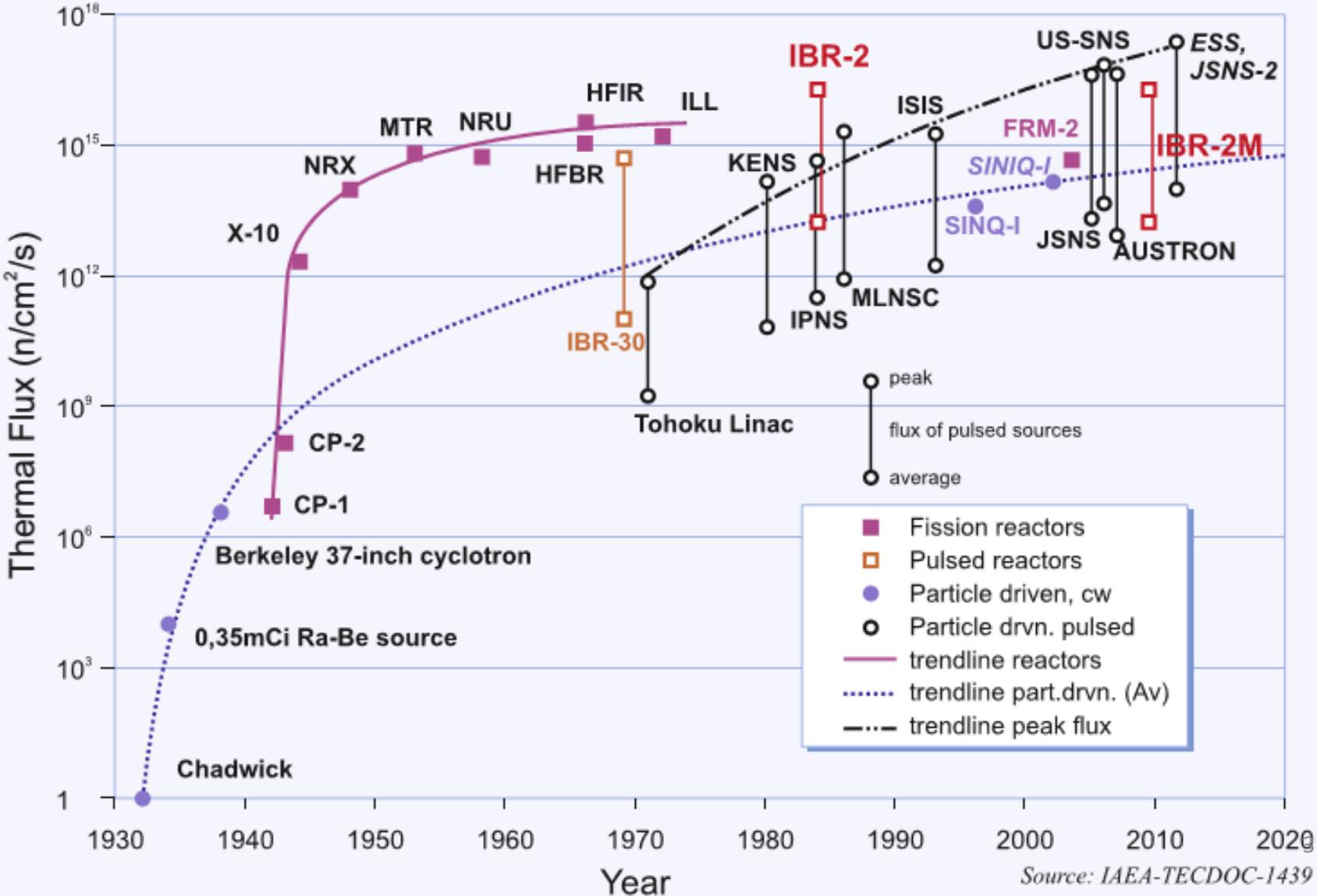




* at the mean power 2 MW

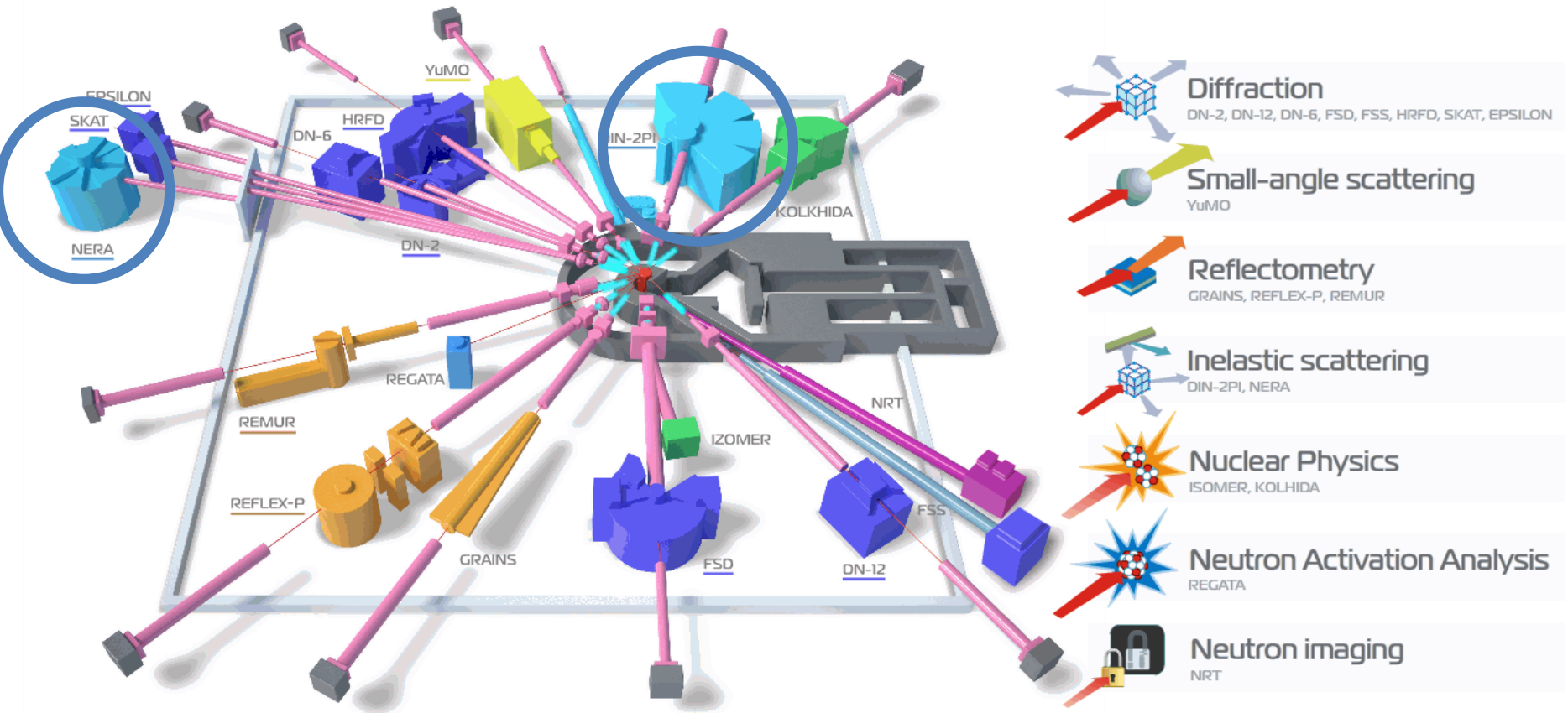
Mean power	2 MW
Fuel	PuO_2
Repetition rate	5 Hz
Puls width for fast neutrons at mean power 2 MW	200 μs
Number of satelites at 5 HZ	1
Thermal neutron flux (from the surface of moderator)	
Time-avrage	~ 10^{13} n/cm^2·s
Burst maximm	~ 10^{16} n/cm^2·s

World neutron sources



Source: IAEA-TECDOC-1439

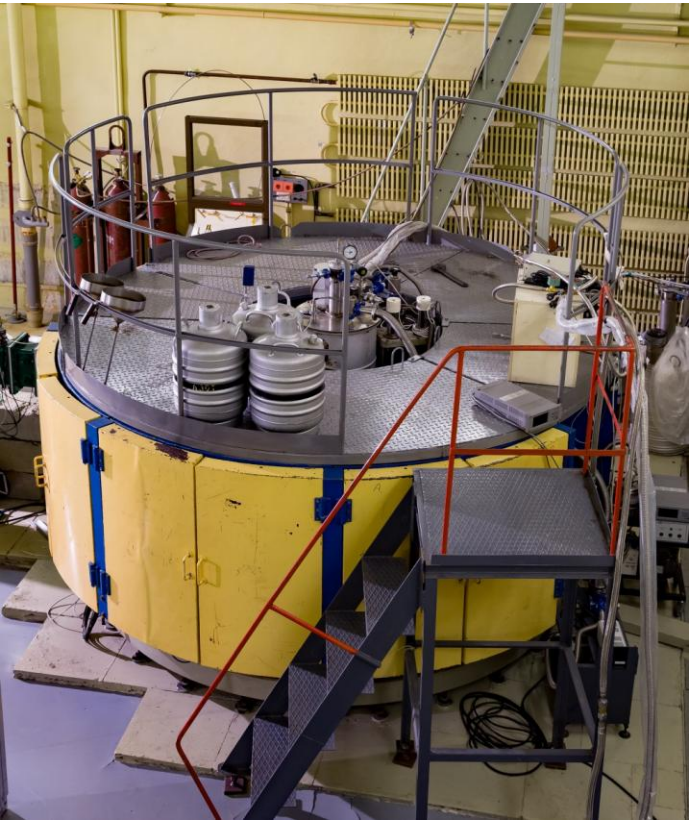
Experimental facilities



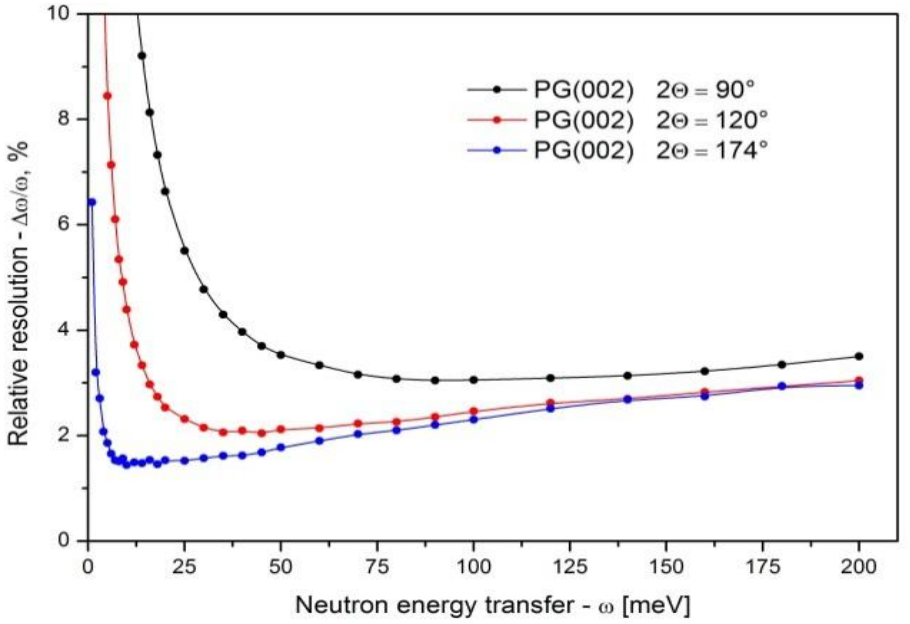
- **NERA (Inverted Geometry TOF Spectrometer)** - study of the molecular dynamics and structural parameters of molecular crystals
- **DIN-2PI (TOF Spectrometer of Direct Geometry)** – study of the lattice and atomic dynamics of liquids and amorphous materials

Inverted geometry time-of-flight spectrometer NERA

(**HE**упругого **PA**ссеяния)



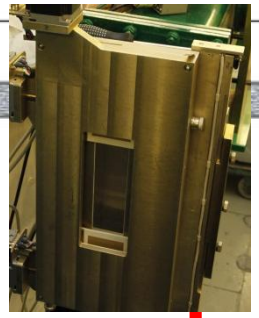
Neutron guide	Mirror, vacuum
Guide aperture	50×160 mm^2
Wavelength range	0.8-7.0 Å
Scattering angles range	10^o-170^o
Energy transfer range (INS)	1-130 meV
solid angle for INS	~ 0.2 sr

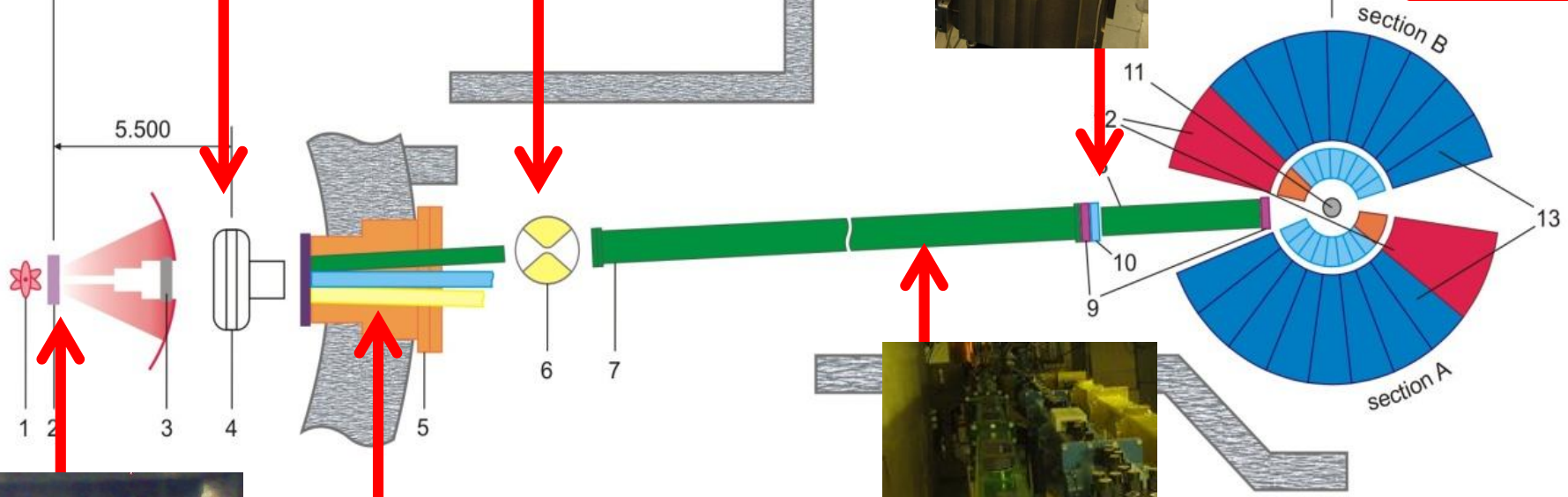


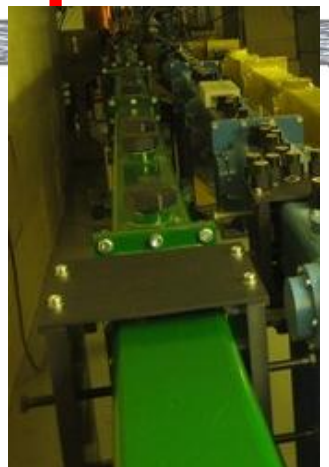
Average neutron flux
- at splitter 5.8 x 10^7 n/cm^{2}s
- at sample position 3,5*10^6 n/cm^{2}s

Resolution - Inelastic scattering	see Fig
Resolution - Neutron diffraction	D d/d=0.4% for l>1Å

Modernization 2006-2011



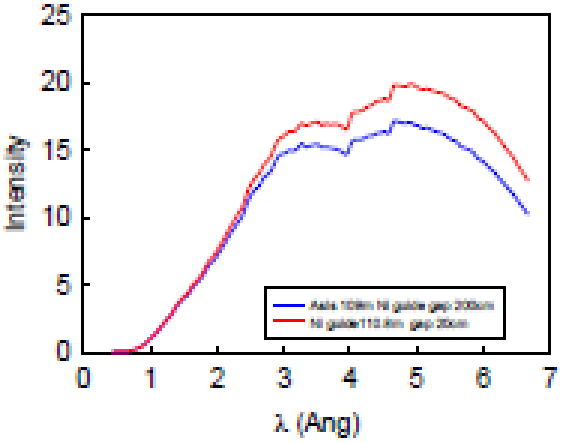


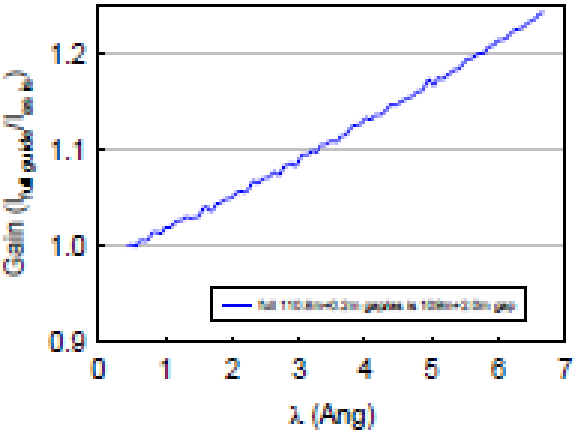


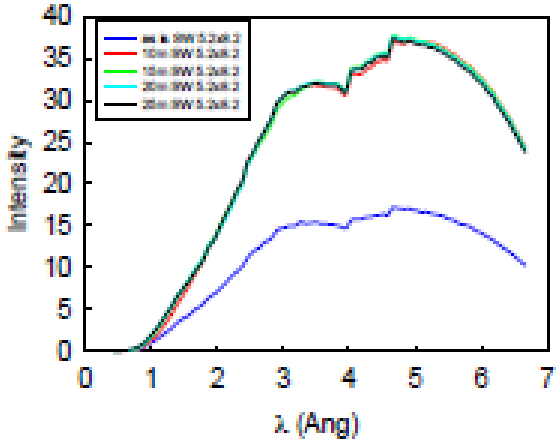
The modernization plan

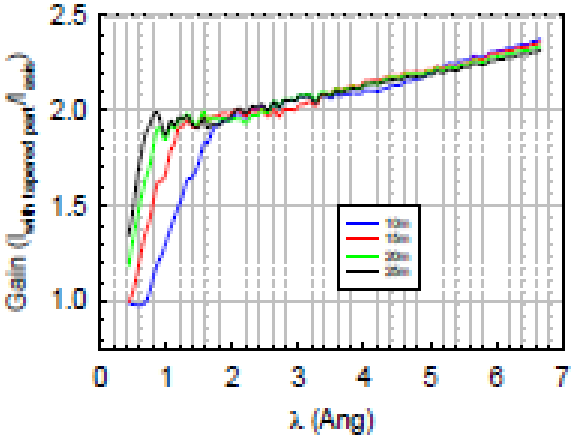
To install rectangular focusing super concentrator (m =?) to the sample position.
This would reduce the cross section of the incident beam and increase the density of the neutron flux at the sample position ..

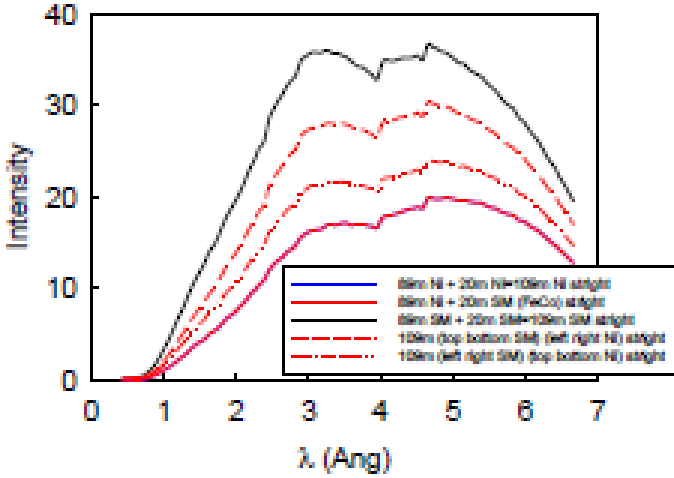
To increase the solid angle of the spectrometer - increase the area of the detectors 4-5 times.

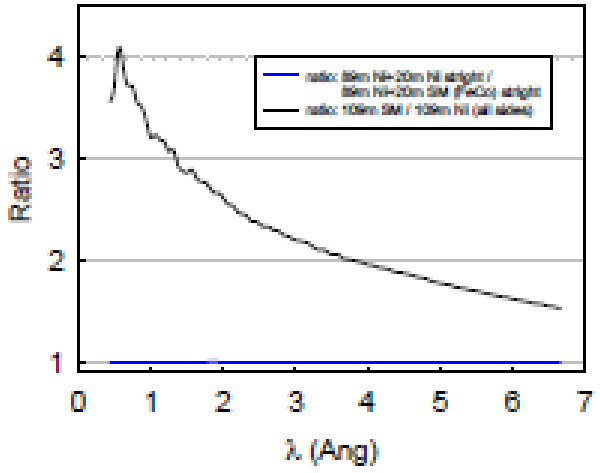

Intensity
λ (Ang)

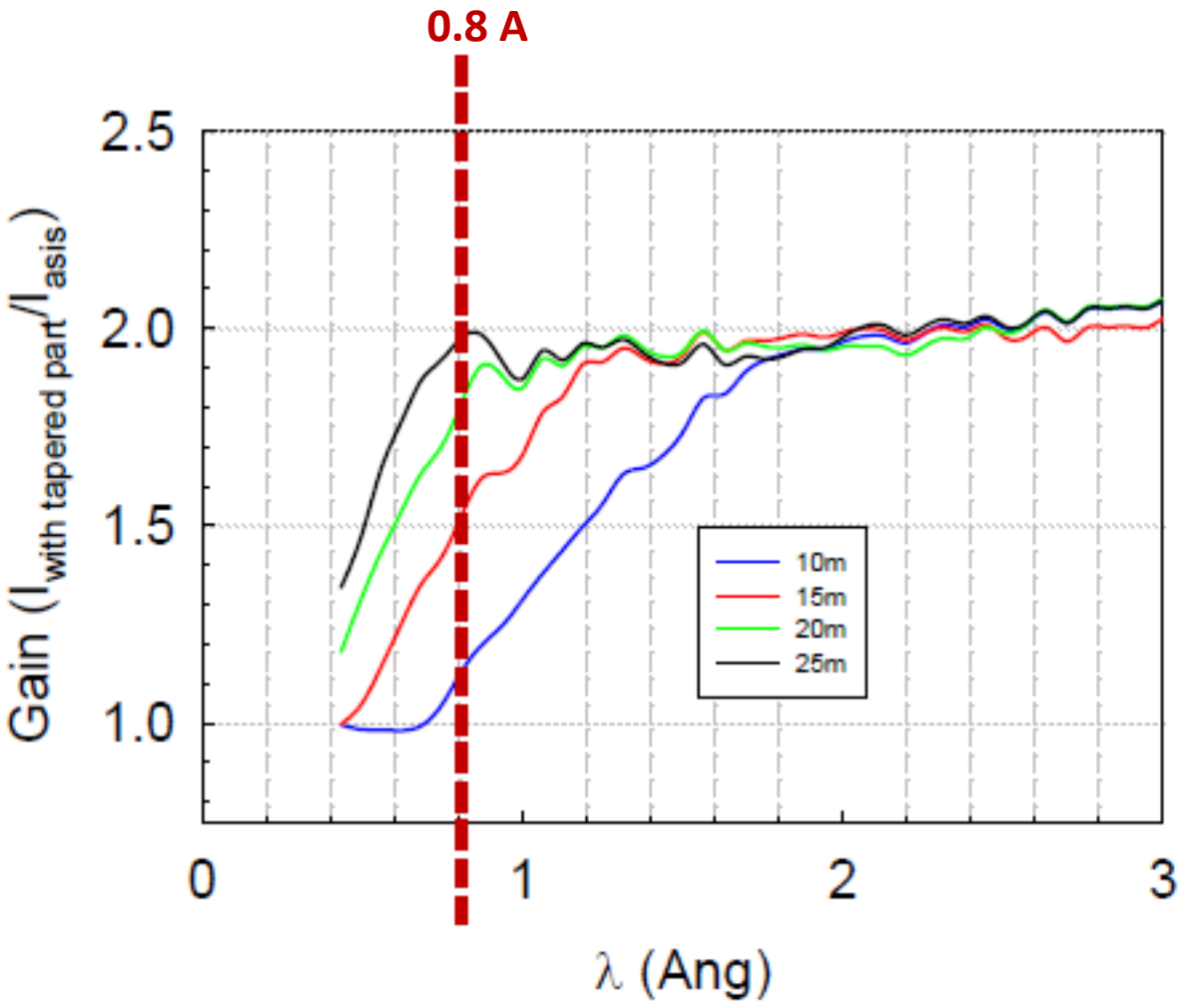

Gain
λ (Ang)


Intensity
λ (Ang)


Gain
λ (Ang)


Intensity
λ (Ang)


Ratio
λ (Ang)


0.8 A
2.5
2.0
1.5
1.0
Gain (I with tapered part/I asis)
0
1
2
3
λ (Ang)
10m
15m
20m
25m

The modernization plan

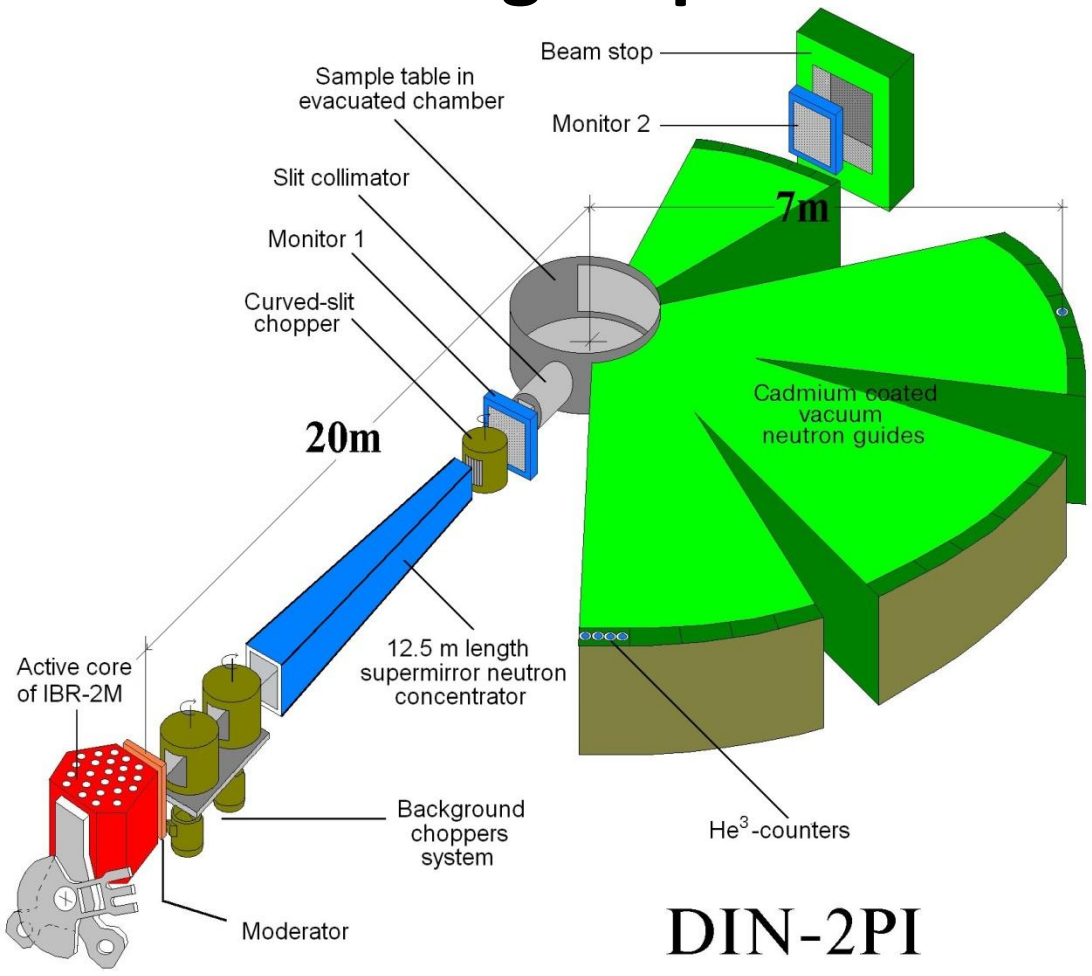
To install rectangular focusing super concentrator (m =?) to the sample position.
This would reduce the cross section of the incident beam and increase the density of the neutron flux at the sample position ..

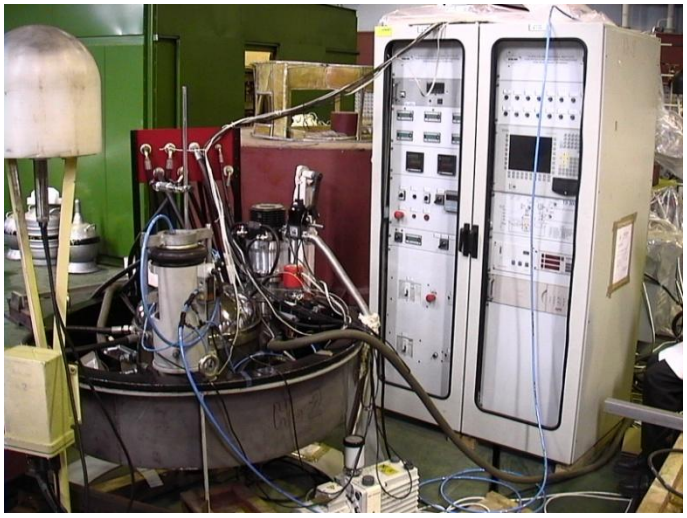
2017

To increase the solid angle of the spectrometer - increase the area of the detectors 4-5 times.

After 2018

Time-of-flight spectrometer of direct geometry

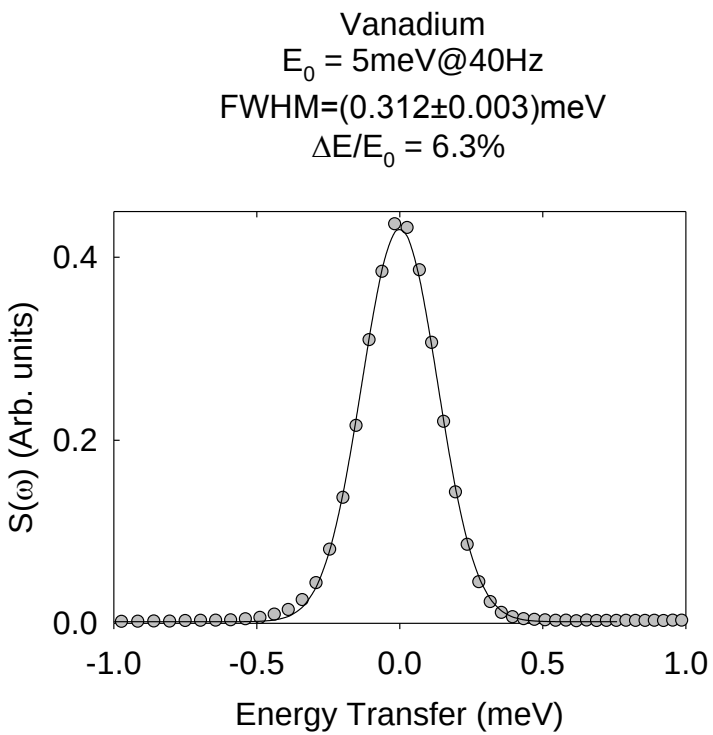


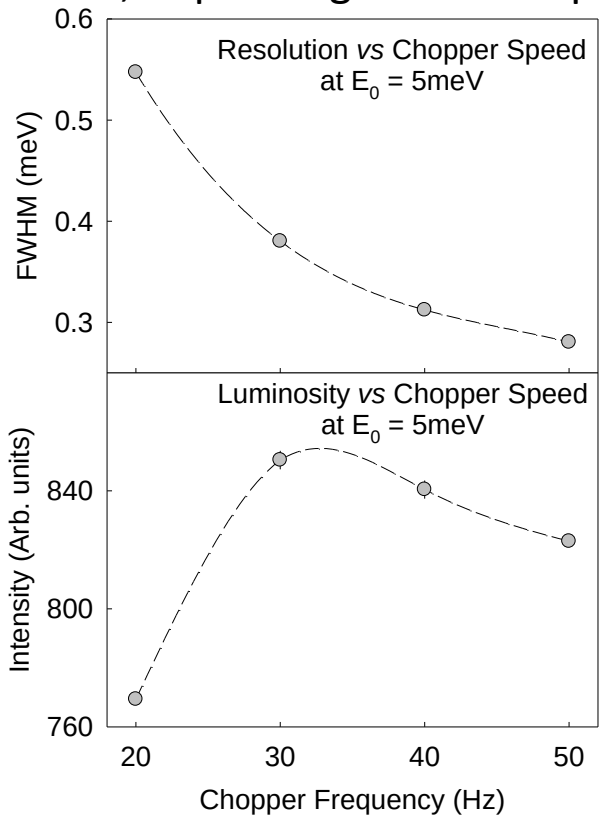


И.В. Калинин, В.М. Морозов, А.Г. Новиков, А.В. Пучков, В.В. Савостин, В.В. Сударев, А.П. Булкин, С.И. Калинин, В.М. Пусенков, В.А. Ульянов **"Характеристики спектрометра ДИН-2ПИ с нейтронным концентратором"** *Журнал технической физики, 2014, том 84, вып. 2*

Scattering angles	5° – 135°
Dimensions of the beam on the sample, mm^2	160 × 120
Neutron flux at the sample for E_0 = 10 meV, n/cm^{2}s	$1.5 \cdot 10^3$
The range of primary energies (meV)	1 – 30
The energy resolution $\Delta E_0/E_0$, %	4 – 10

An example of the behavior of the resolution function, depending on the frequency of rotation of the chopper





Traditional directions of experimental work carried out and developed on the spectrometer was:

1. Study of liquid metals (Na, Ga, Pb, K, Li) and liquid-metal systems with impurities (melts K-O, Pb-K, Na-Pb, Li-H).
2. Studies of water ionic and hydrophobic solutions, including aqueous dispersions of carbon particles (fullerenes, schungite, soot).
3. Studies of quantum liquids in "bulk" state, and in confined geometry and films ^{4}He of atomic thickness.
4. Studies of multicomponent crystalline and amorphous systems, including solid solutions, metallic oxides and hydrides, superionic conductors and triple impurity systems.
5. Studies of reactor materials in a wide temperature range to improve security level of Nuclear Power Setups.

DIN-2Pi:

To 2015 - Lab of Neutron Scattering for Condensed matter study (IPPE, Obninsk)

From 2016 – FLNP JINR, Dubna

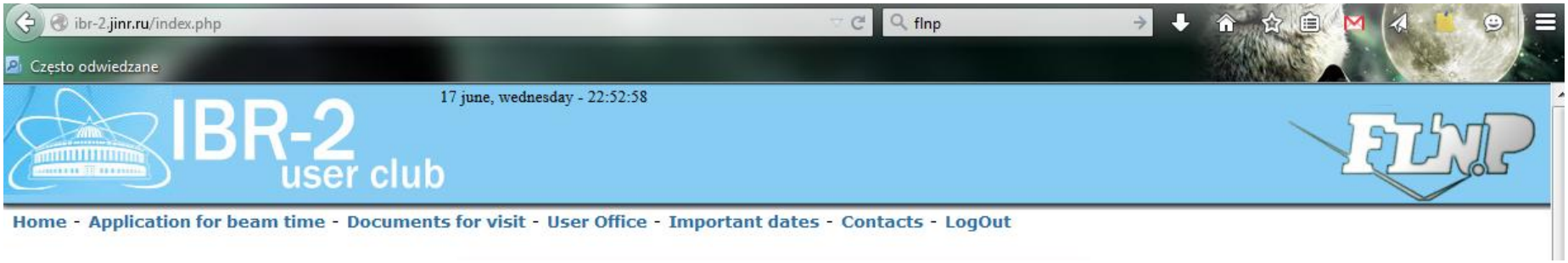
NERA Group:

1. P. Bilski,
2. D.Chudoba,
3. K. Druzbicki,
4. E. Goremychkin – **spectrometer responsible**,
5. A. Filarowski,
6. J. Krawczyk,
7. J. Waliszewski,
8. V. Suhanov - Lead Engineer,
9. K. Luczynska (PhD Student),
10. T. Nagorna (PhD Student),

DIN-2Pi Group:

1. V.A.Morozov - Engineer,
2. E. Goremychkin – **spectrometer responsible**,
3. **Free position ☺**

ibr-2.jinr.ru



2016

NERA: 15 proposals – only slightly oversubscribed (by 7 days)

DIN-2PI: 6 proposals – undersubscribed!!!

Period for proposal submission	**September 1 - October 15**	March 1 - April 15

THANK YOU
FOR YOUR ATTENTION!