

MARIA reactor for medicine, nuclear and material research

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National Centre for Nuclear Research, Poland

Sydney, 5.12.2017

Presentation plan

1. MARIA reactor overview
2. „Horizontal” science
3. „Vertical” science
4. Scientific cooperation and future plans







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FOR BIOMEDICAL RESEARCH



MARIA reactor

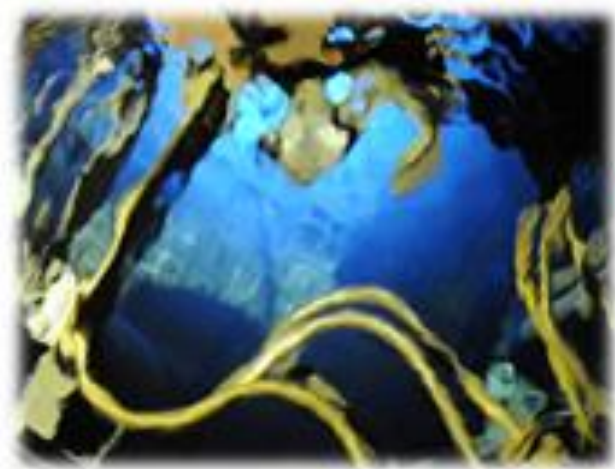


MTR



Thermal neutrons: $4 \times 10^{14} \text{ cm}^{-2} \text{ s}^{-1}$
 Fast neutrons: $3 \times 10^{13} \text{ cm}^{-2} \text{ s}^{-1}$
 14MeV neutrons: $5 \times 10^9 \text{ cm}^{-2} \text{ s}^{-1}$
 Radioisotopes: 600TBq/y
 Mo-99: 6000TBq/y

14MeV source since 2014
 NTD facility 6" Si crystal ingots
 electrical system modern, 2015
 cooling system modernization 2014
 operation expected until at least 2045
 since 1974 MARIA is operating only 28 years
 conversion from 36% to 20% enrichment in 2014



- Focus on international collaboration
- Investment in modernisation
- Investment in new projects
- Investment in young staff



NEUTRONY+H2

Relicensed in 2015 until 2025 (expected to 2035)

Field of scientific interest

Medical:
BNCT,
radioisotope

Nuclear:
fuel,
materials,
shieldings

Dosimetry:
n-g radiation
high dose,
active

Physics:
radiography,
neutrons

Starting programs 2019-2021:

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Cerad (cyclotron) + Mo „Świerk”



Material research



Maintenance



Administration

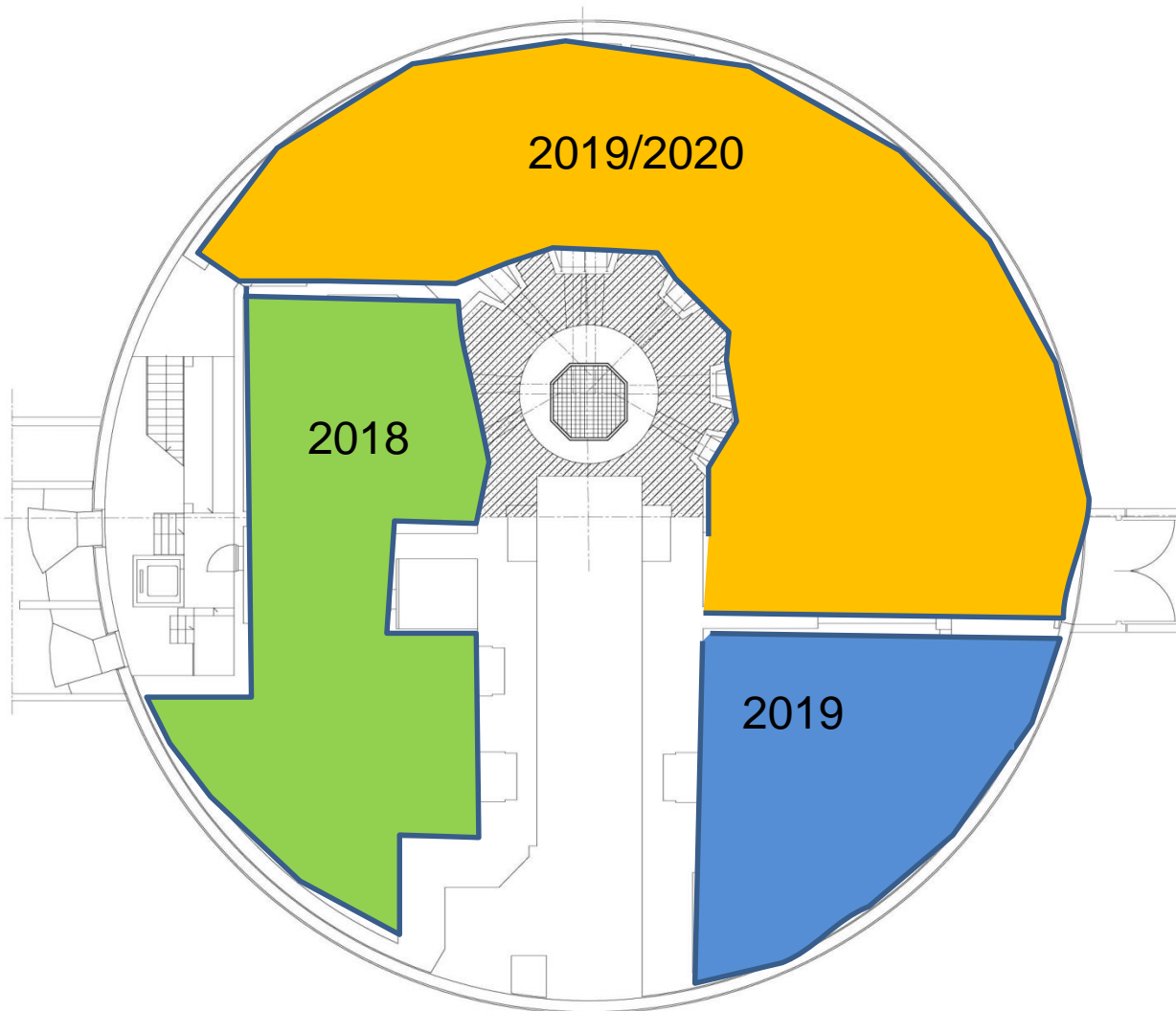
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Experimental halls

physical

radiobiology

material



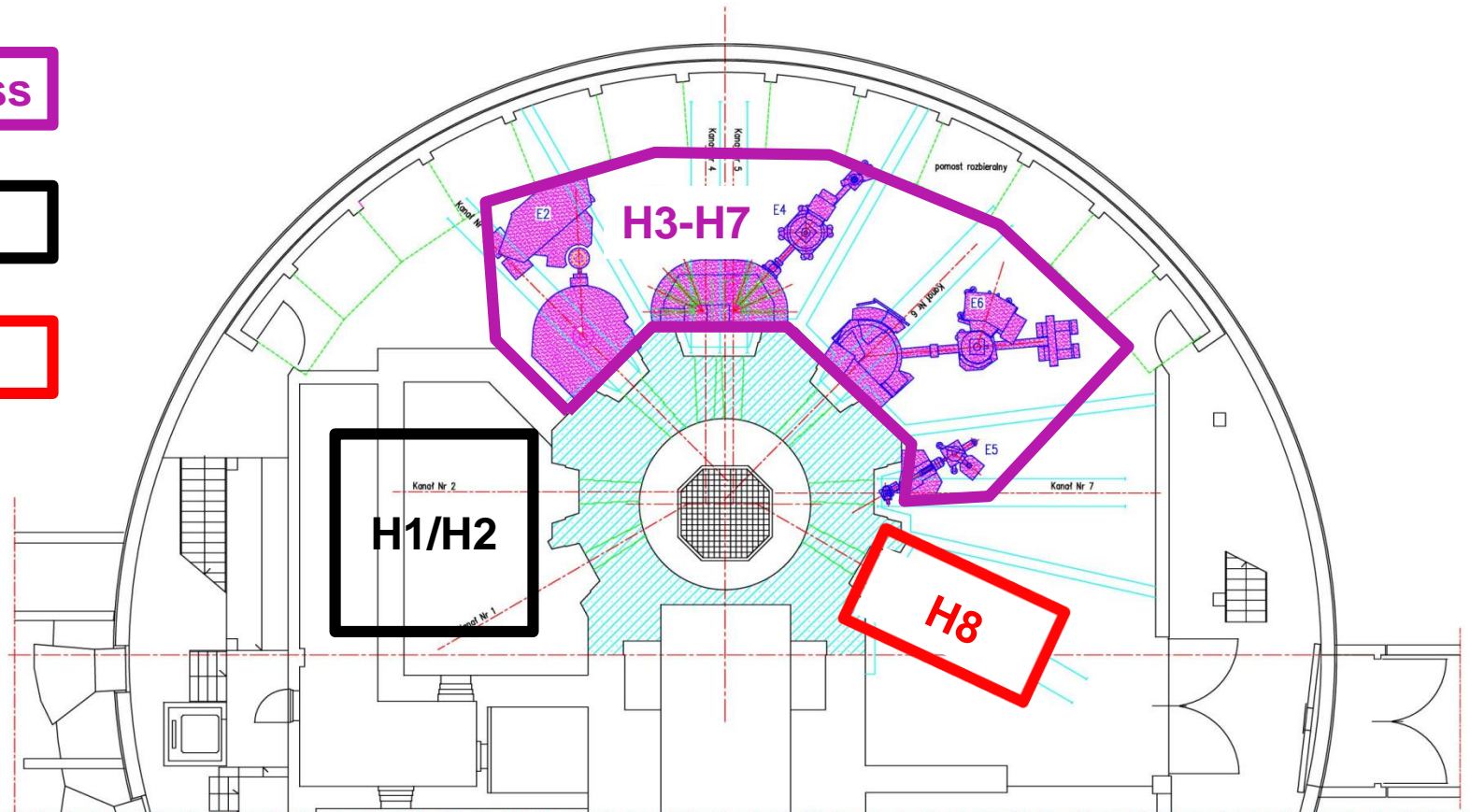
R2B Hala fizyczna poz. -1,7m
Skala 1:50

Horizontal channel facilities

In progress

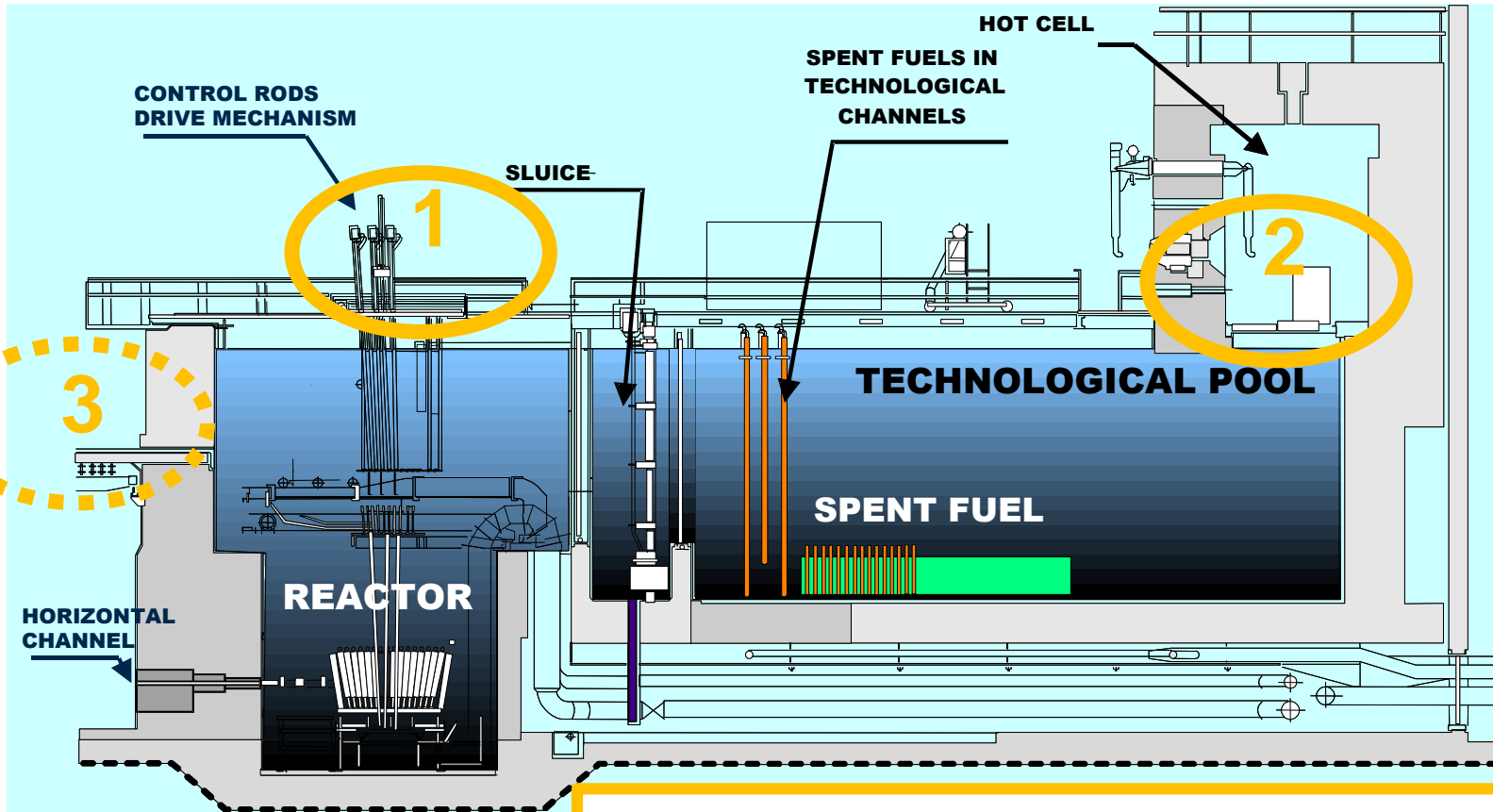
Starting

Existing



R2B Hala fizyczna poz. -1,7m
Skala 1:50
Propozycja ustawienia E2,E4,E5,E6

In-core experiments



1,2 – existing: rabbit, hotcell

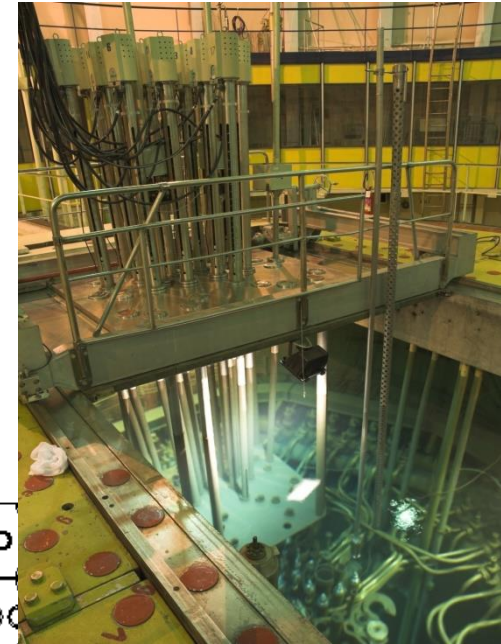
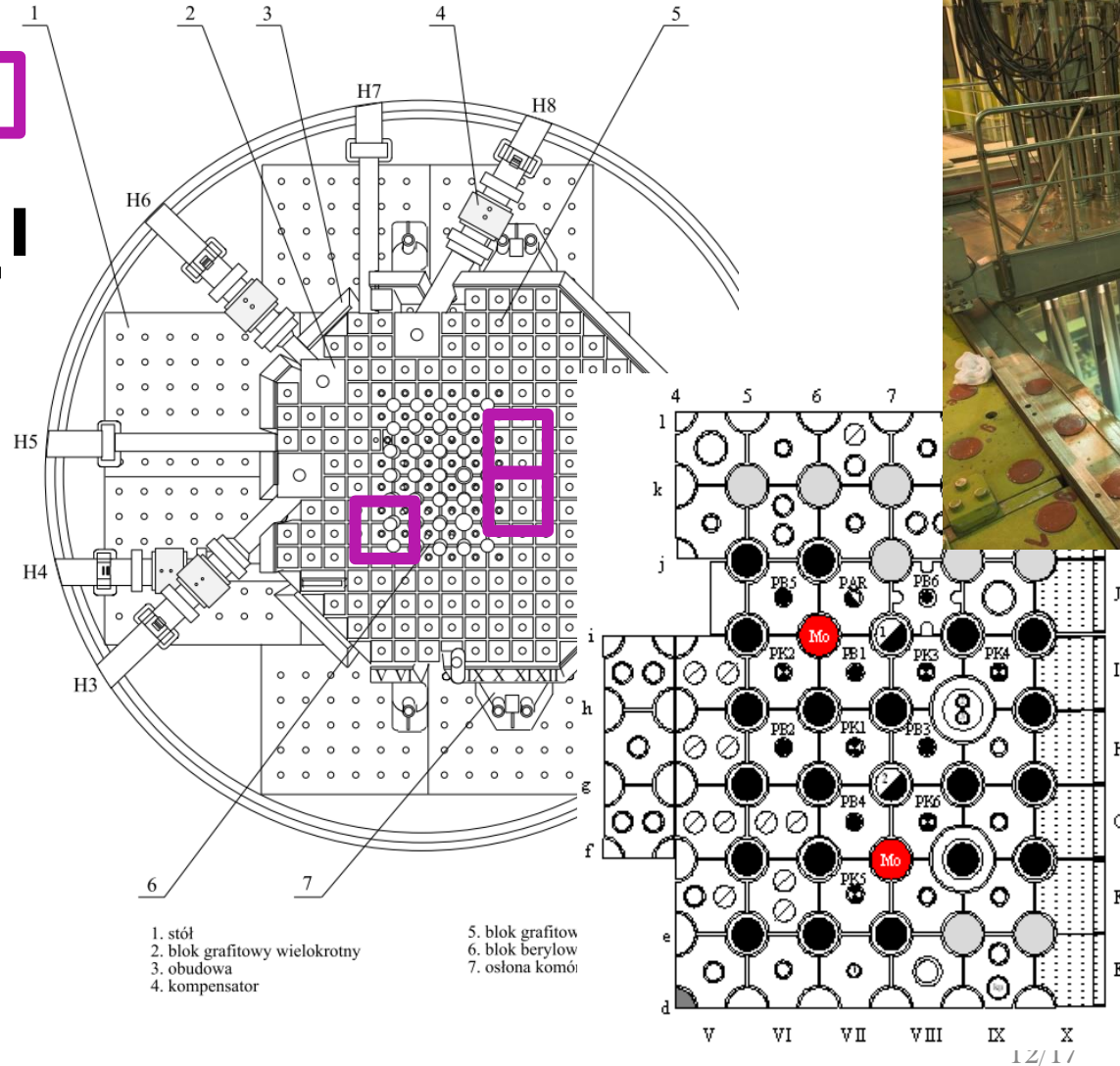
3 – projected: hT-loops, biol, Si, high A

In-core experiments

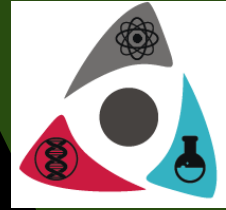
Large samples

Rabit system

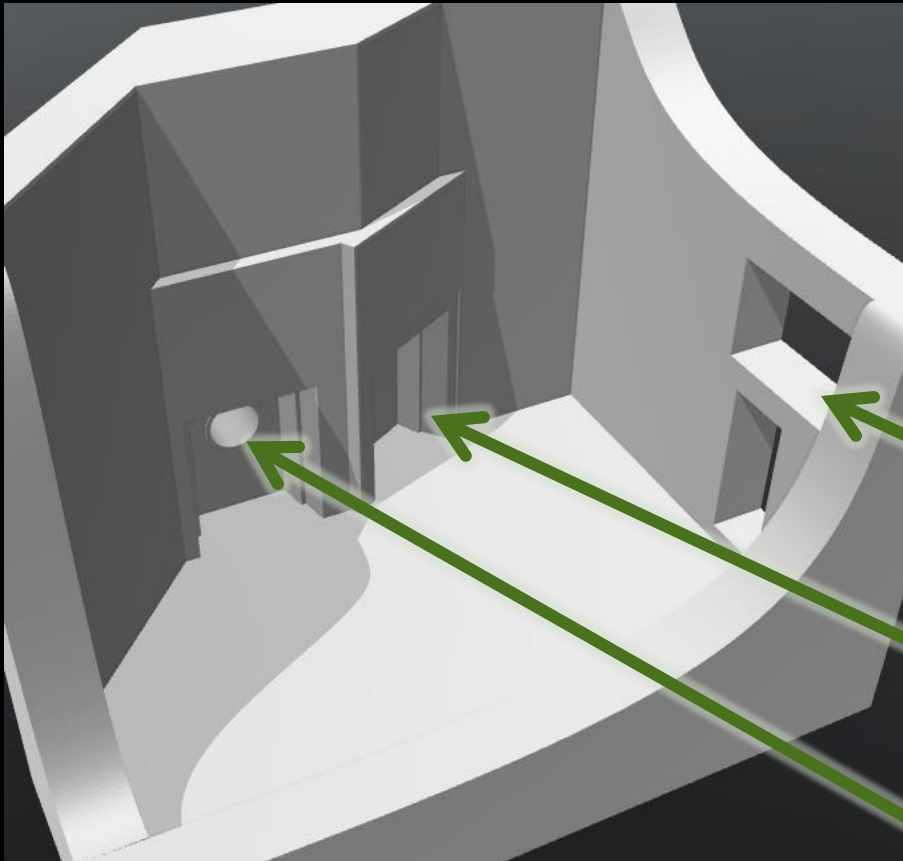
Mo, Ho, Y...



Radiobiological laboratory



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Transportage passage

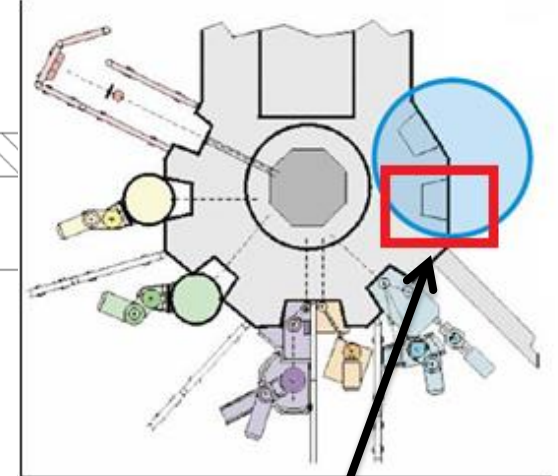
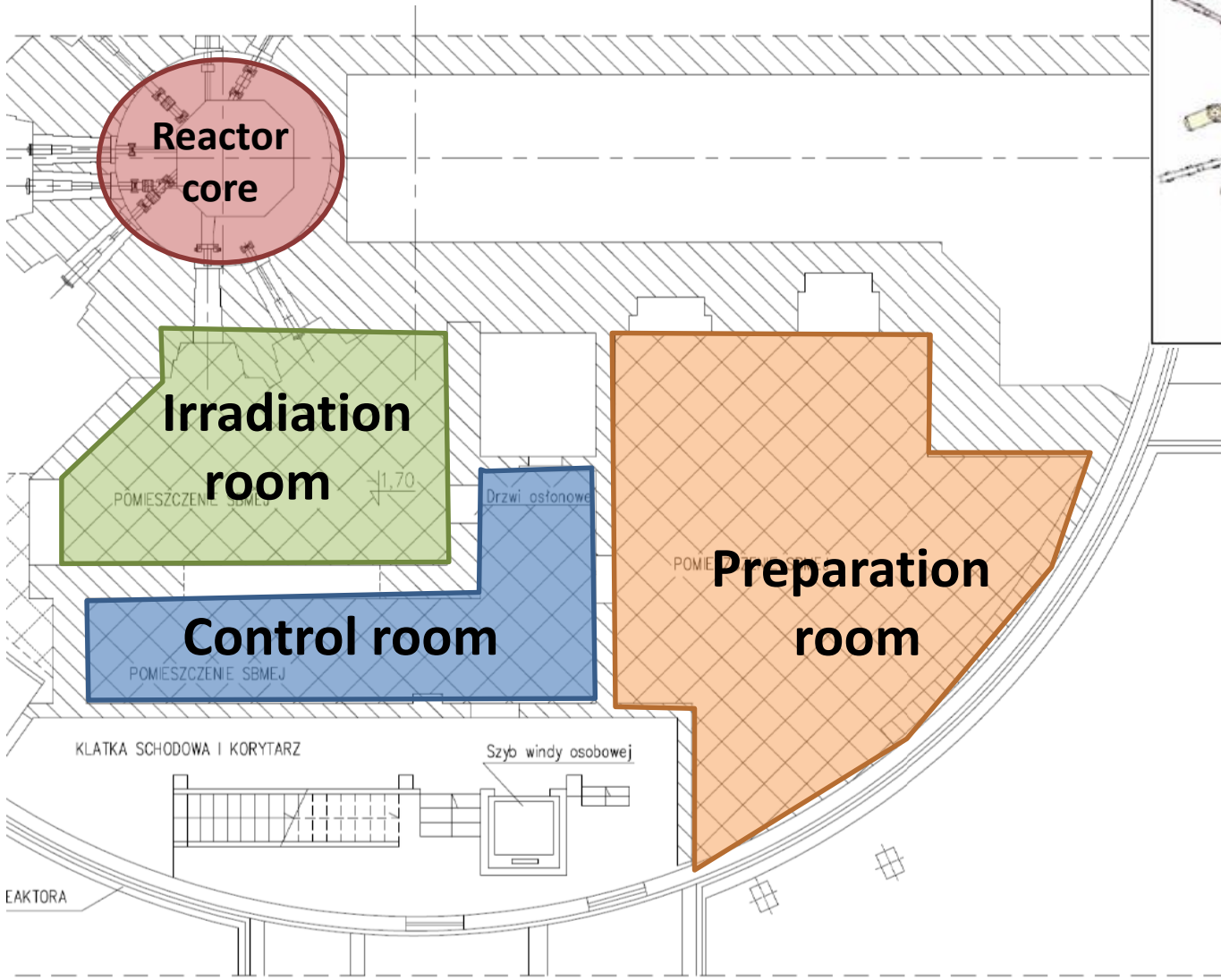
H1 channel – radiobiological samples

H2 channel - neutron beam

Expected date of finalize: May 2019

H2 channel facility

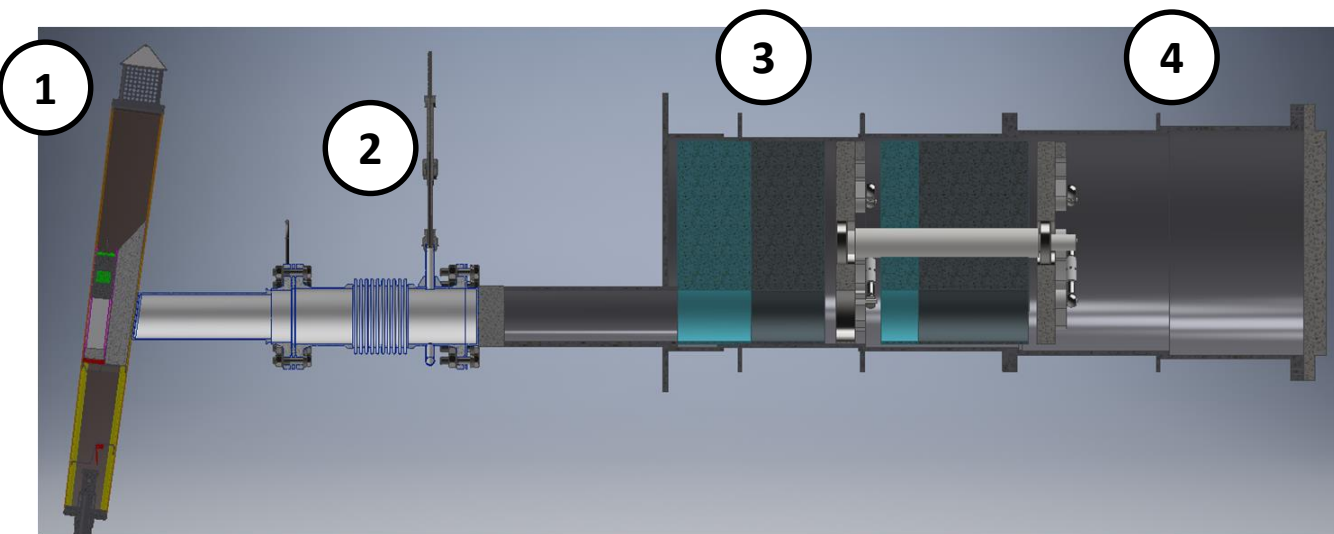
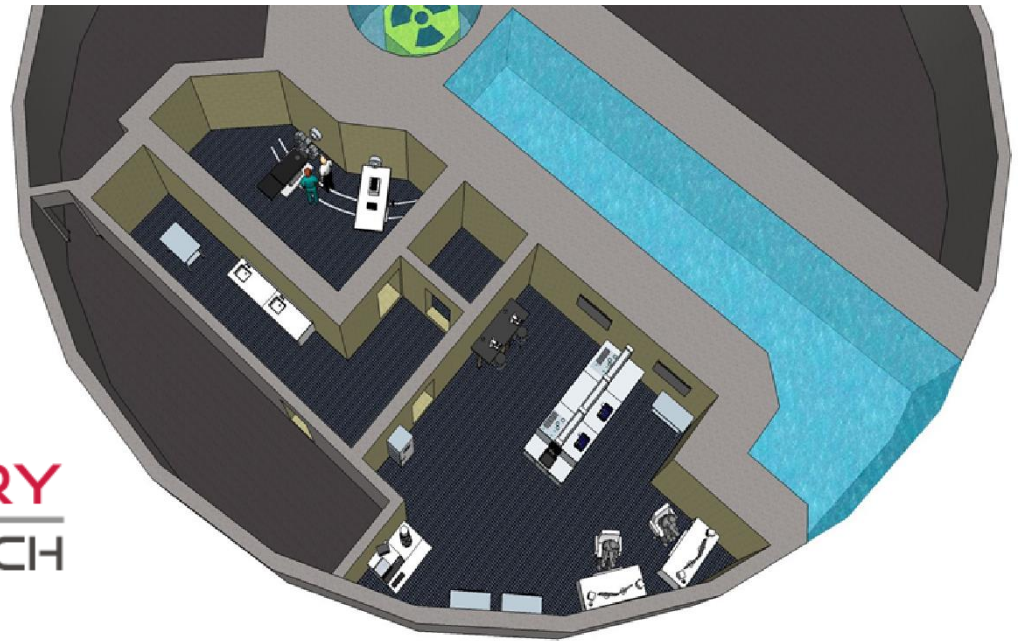
NEUTRONY•H2



Location of the H2 channel



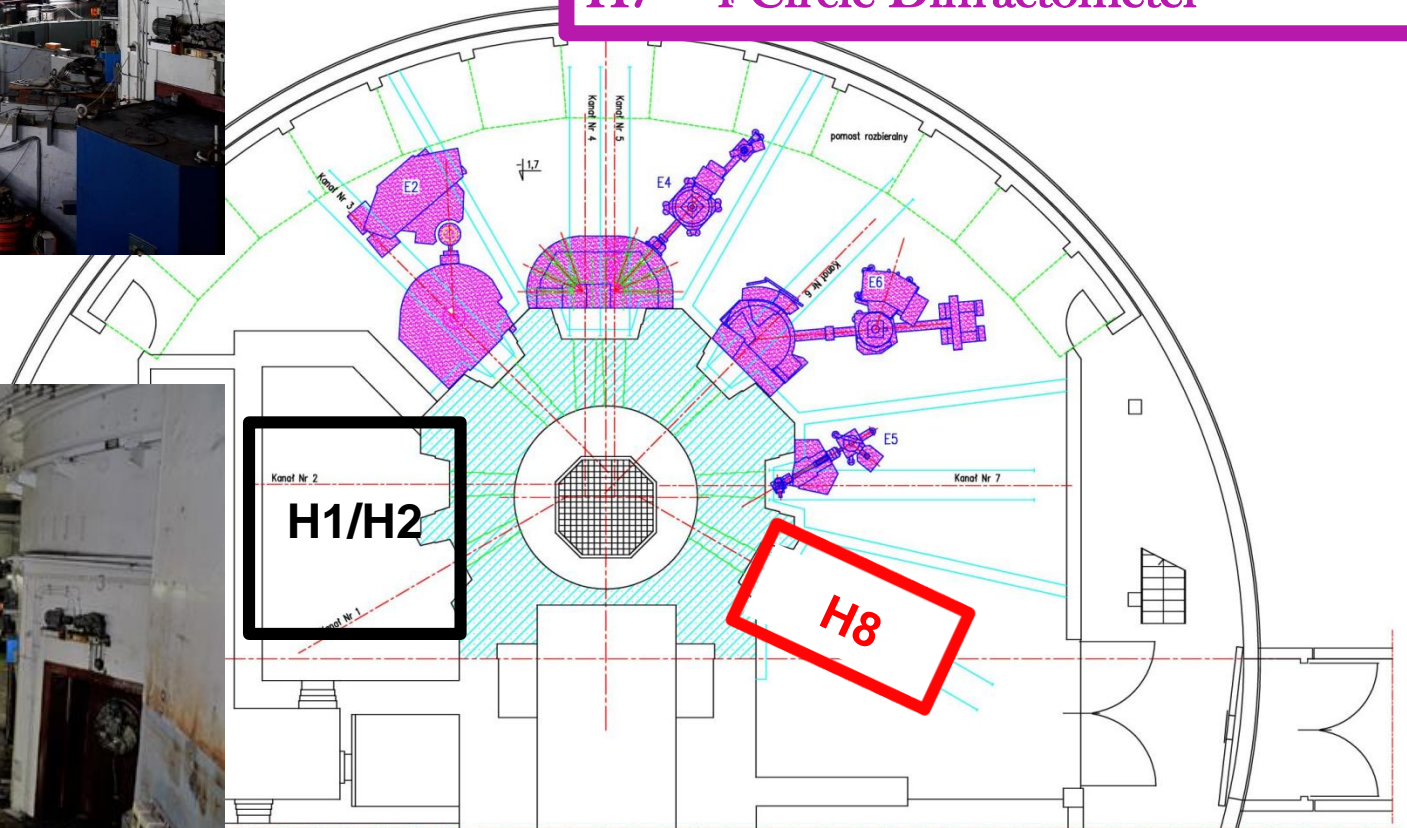
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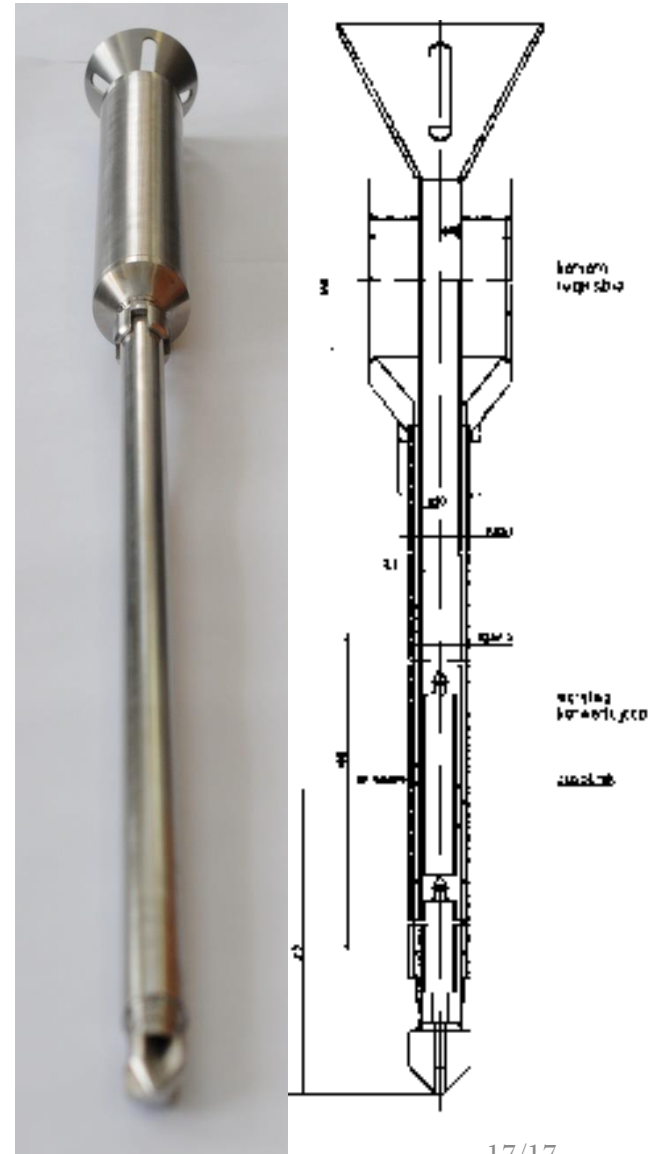
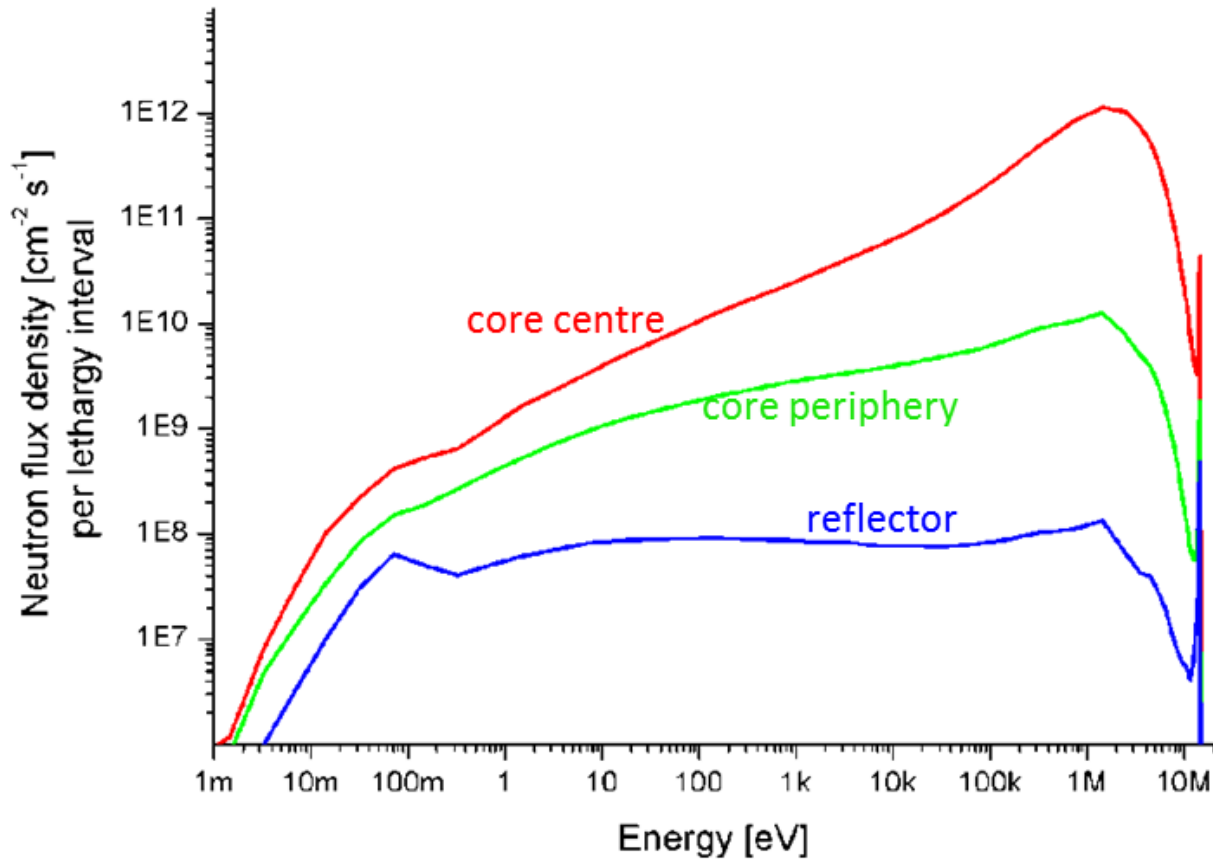
1. Converter
2. Intermediate channel
3. Discs
4. Shutter

HZB instruments

- H3 - Flat-Cone Diffractometer
- H4/5 - 2-Axis-Diffractometer
- H6 - Focusing Powder Diffractometer
- H7 - 4-Circle Diffractometer

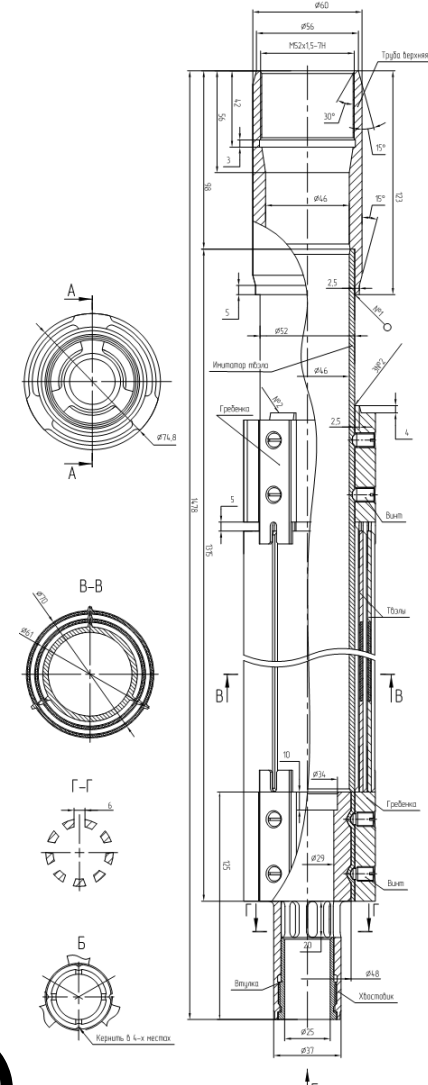


14 MeV converter



Material modification

MR-2 experimental elements



Experiments inside fuel element
(TVEL production in June 2017)

International scientific cooperation

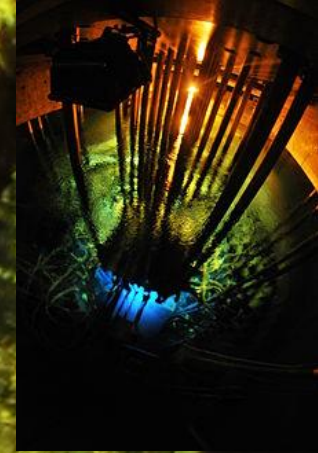


筑波大学
University of Tsukuba



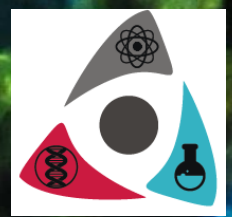
Medical/radiobiology **Neobor**
Radioisotope POLATOM/NWMI
Material LBM/Culham

PhD programmes
Students practise
(m.gryzinski@ncbj.gov.pl)



Thank you for your attention !

m.gryzinski@ncbj.gov.pl



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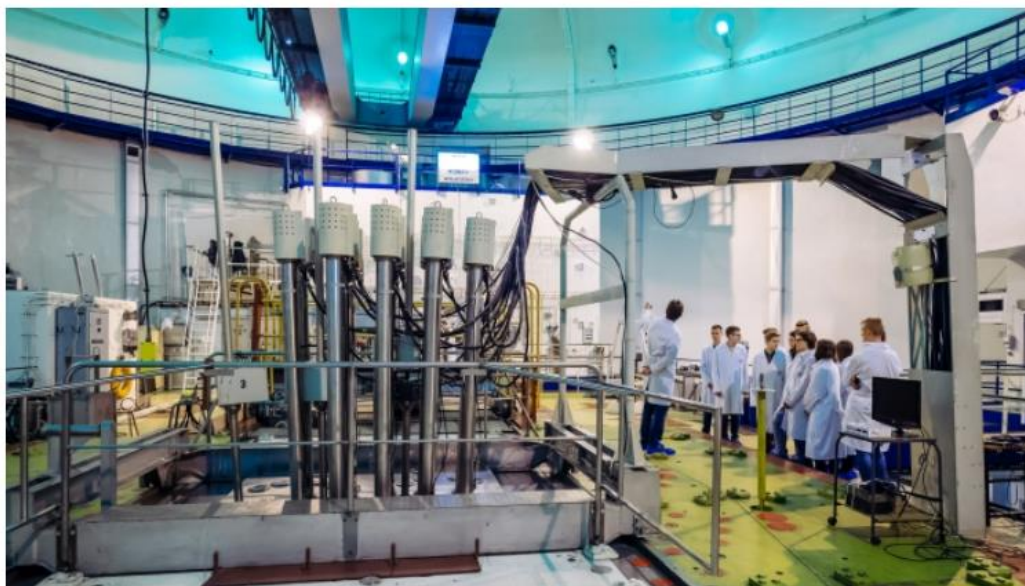
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IAEA Mission Sees Improved Safety at Polish Research Reactor, Says Work Remains

2017/65

Warsaw Poland

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4
2017



Related Resources

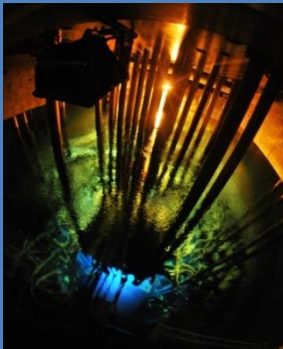
- [Integrated Safety Assessment of Research Reactors \(INSARR\)](#)

Local students visit the MARIA research reactor in Świerk-Otwock, Poland. (Photo: NCBJ)

Welcome to Poland, Warsaw...



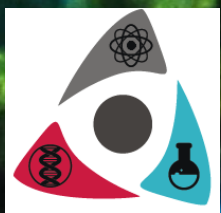
MARIA reactor for medicine, nuclear and material research



Welcome to Świerk, MARIA reactor...

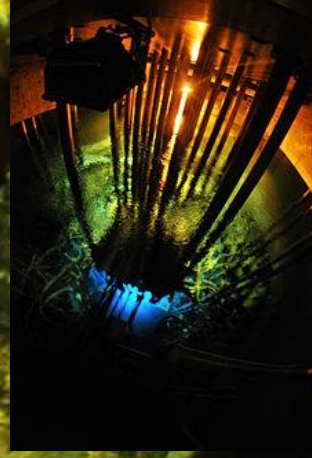
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FOR BIOMEDICAL RESEARCH

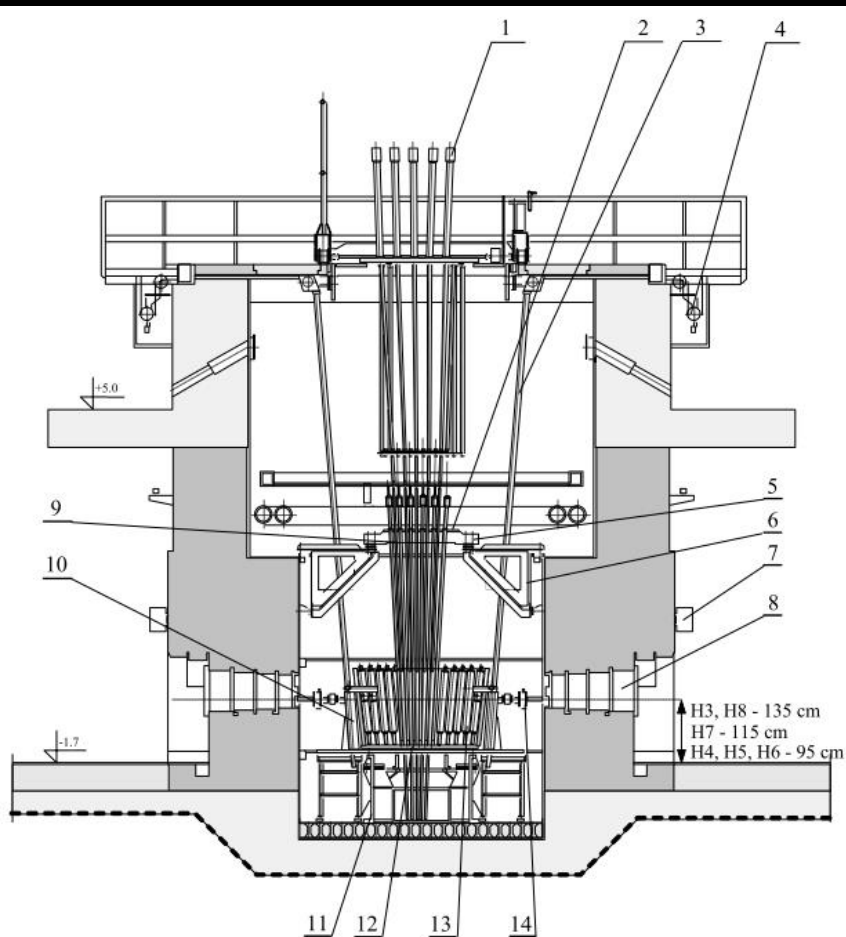




Radiobiological and medical laboratory

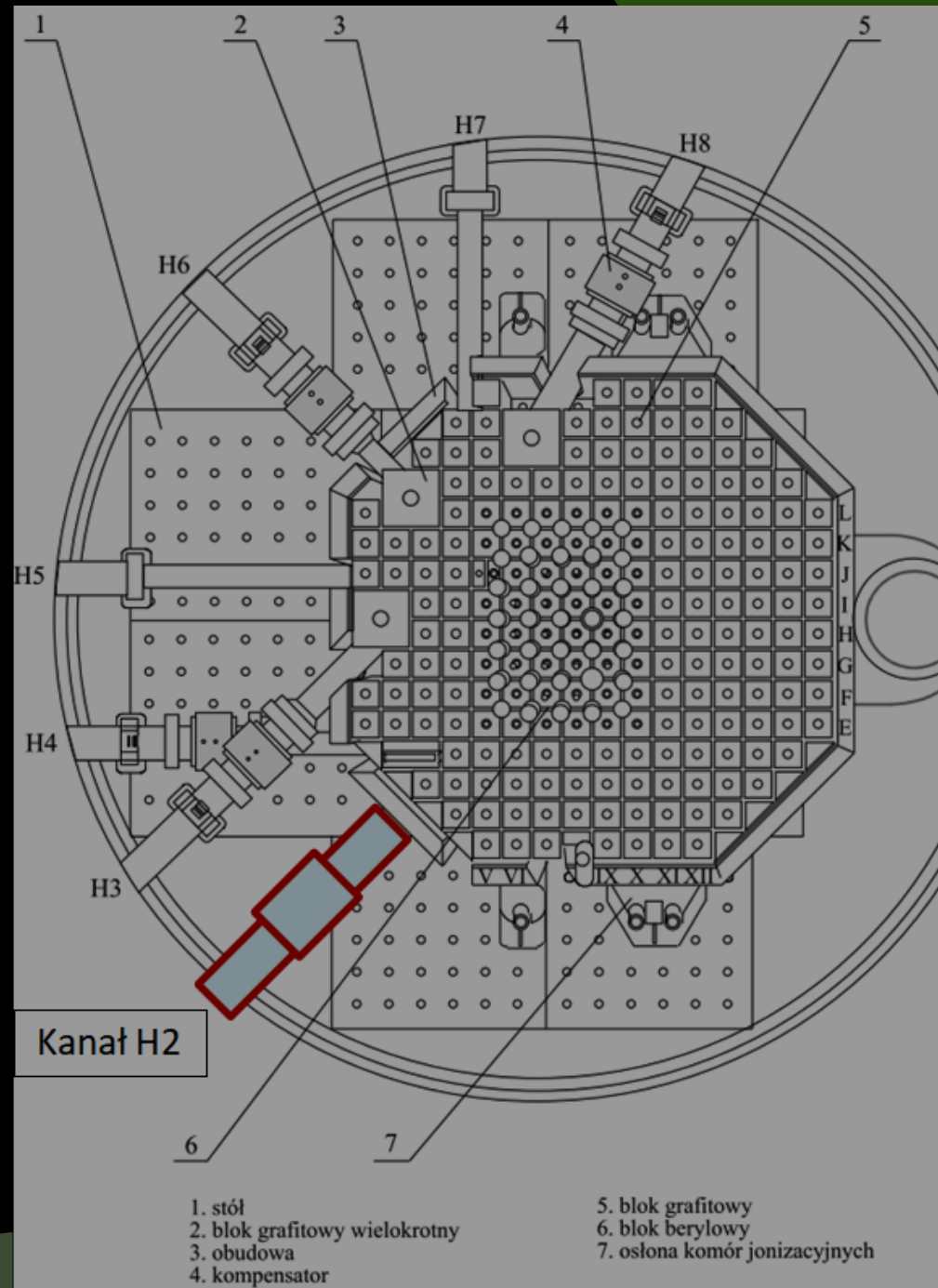


MARIA reactor



1. napęd pręta regulacyjnego
2. płyta montażowa
3. kanał komory jonizacyjnej
4. napęd komory jonizacyjnej
5. konstrukcja wsporcza płyty
6. wspornik płyty
7. napęd zasuwy kanału poziomego

8. zasuwa kanału poziomego
9. kanał paliwowy
10. osłona komór jonizacyjnych
11. podstawa kosza
12. obudowa reflektora
13. bloki reflektora
14. kompensator kanału poziomego

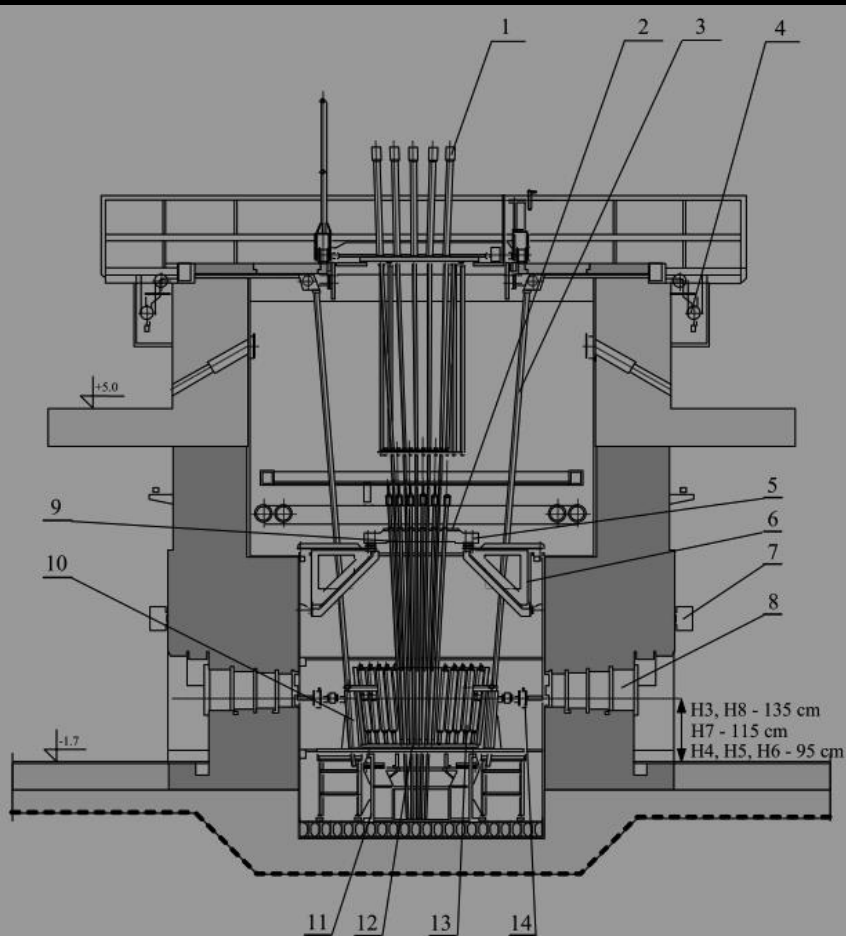


Kanał H2

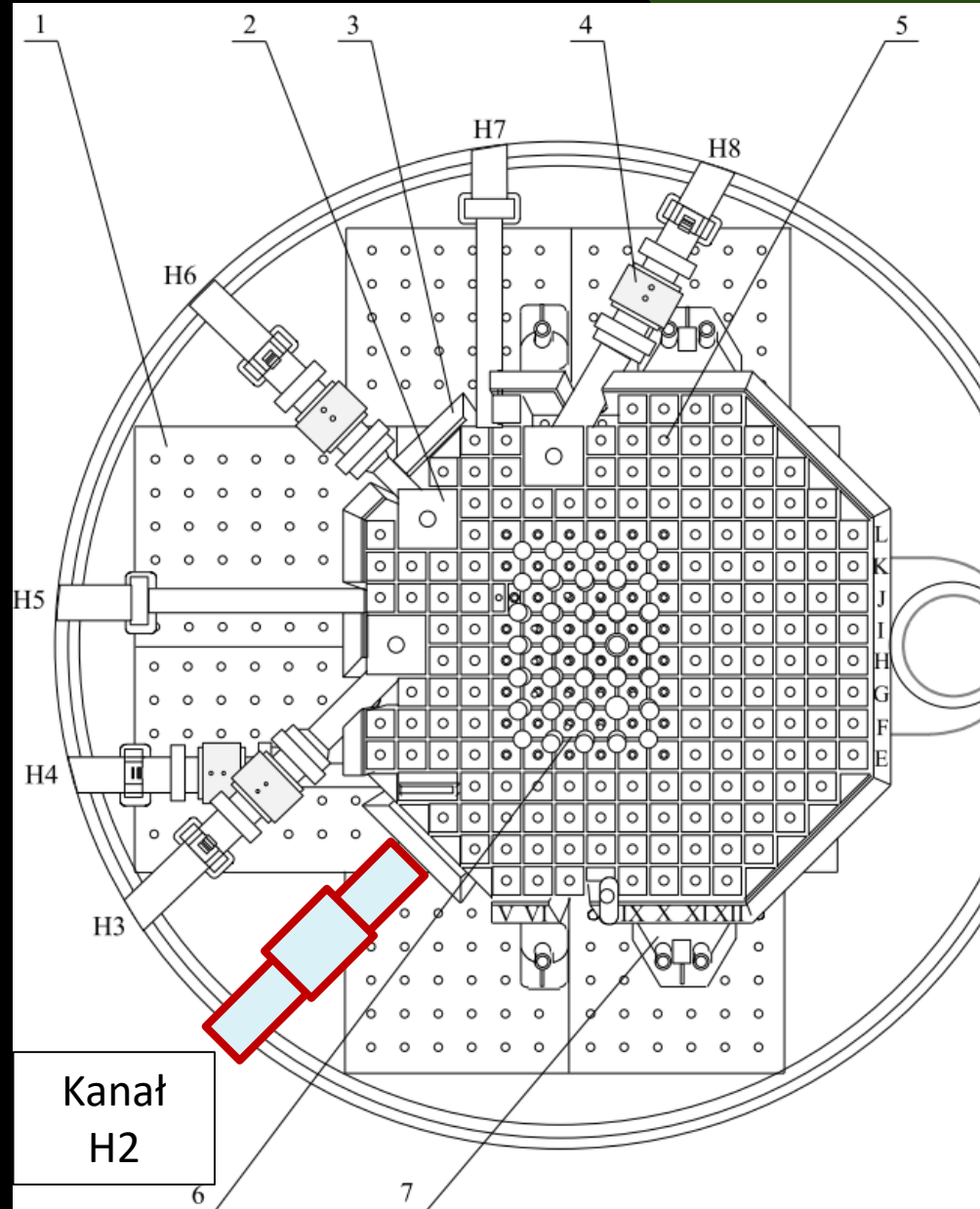
1. stół
2. blok grafitowy wielokrotny
3. obudowa
4. kompensator

5. blok grafitowy
6. blok berylowy
7. osłona komór jonizacyjnych

MARIA reactor



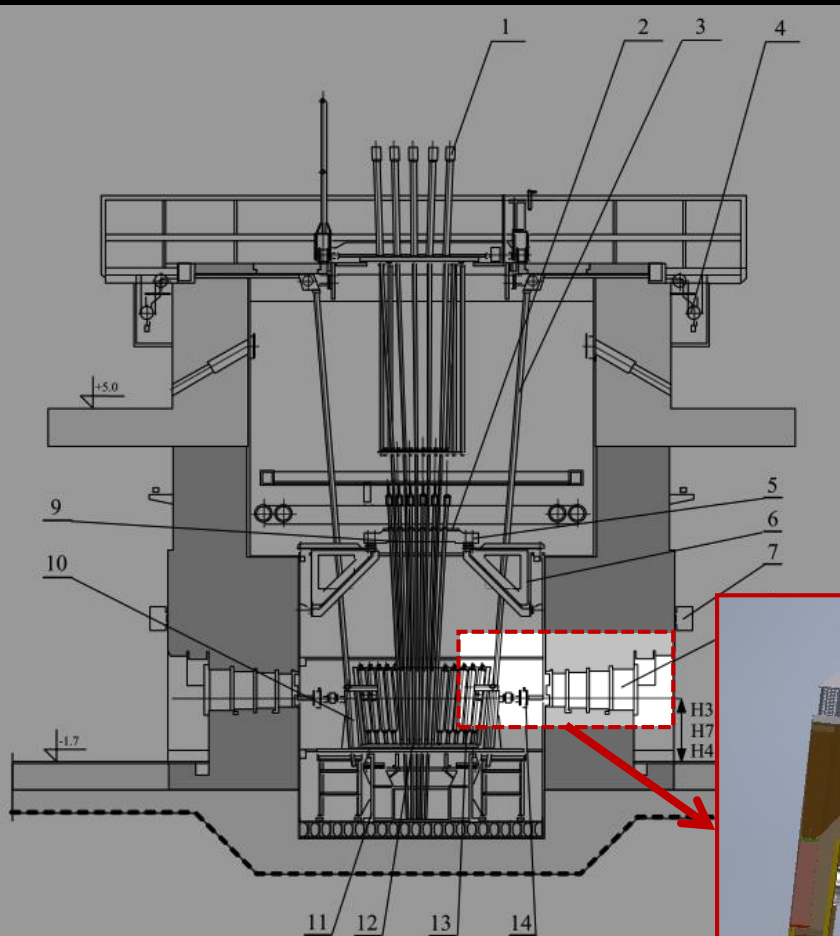
- | | |
|----------------------------------|----------------------------------|
| 1. napęd pręta regulacyjnego | 8. zasuwa kanału poziomego |
| 2. płyta montażowa | 9. kanał paliwowy |
| 3. kanał komory jonizacyjnej | 10. osłona komór jonizacyjnych |
| 4. napęd komory jonizacyjnej | 11. podstawa kosza |
| 5. konstrukcja wsporcza płyty | 12. obudowa reflektora |
| 6. wspornik płyty | 13. bloki reflektora |
| 7. napęd zasuwy kanału poziomego | 14. kompensator kanału poziomego |



Kanał
H2

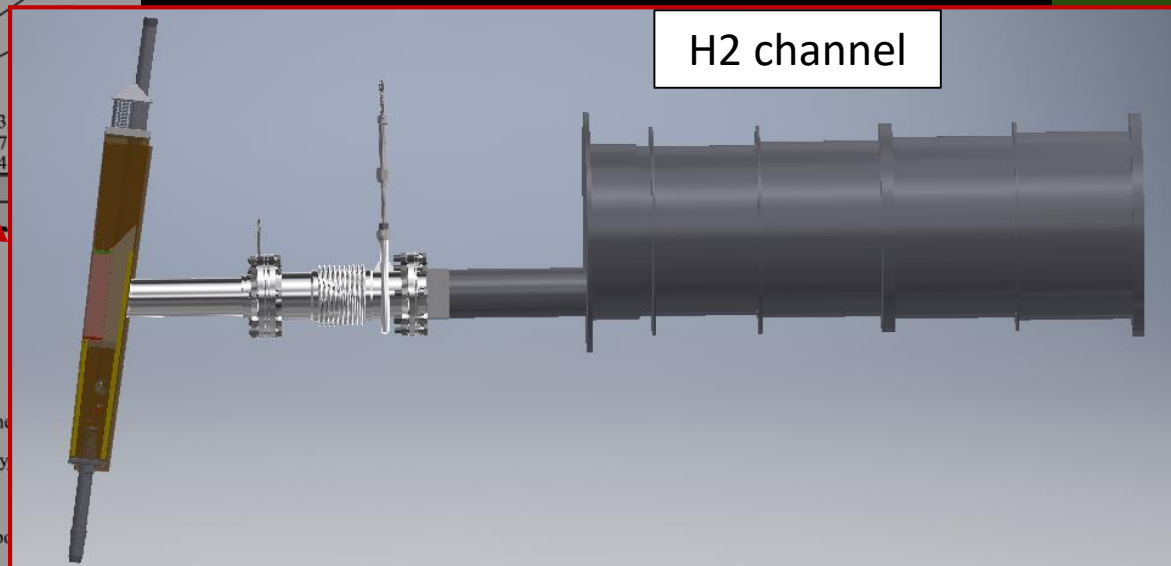
- | | |
|-------------------------------|-------------------------------|
| 1. stół | 5. blok grafitowy |
| 2. blok grafitowy wielokrotny | 6. blok berylowy |
| 3. obudowa | 7. osłona komór jonizacyjnych |
| 4. kompensator | |

MARIA reactor



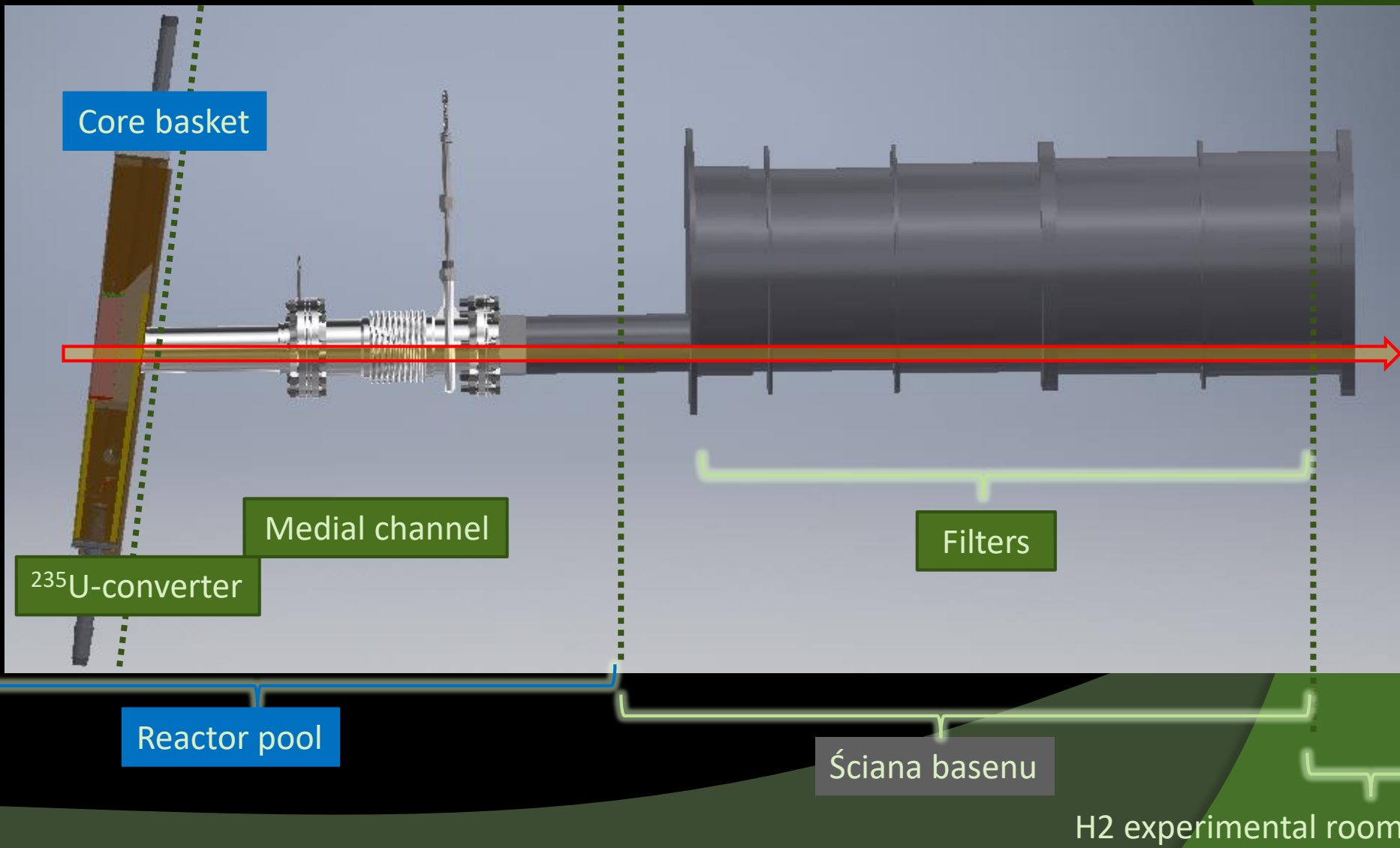
- 1. napęd pręta regulacyjnego
- 2. płyta montażowa
- 3. kanał komory jonizacyjnej
- 4. napęd komory jonizacyjnej
- 5. konstrukcja wsporcza płyty
- 6. wspornik płyty
- 7. napęd zasuwki kanału poziomego

- 8. zasuwka kanału poziomego
- 9. kanał paliwowy
- 10. osłona komór jonizacyjnej
- 11. podstawa kosza
- 12. obudowa reflektora
- 13. bloki reflektora
- 14. kompensator kanału po

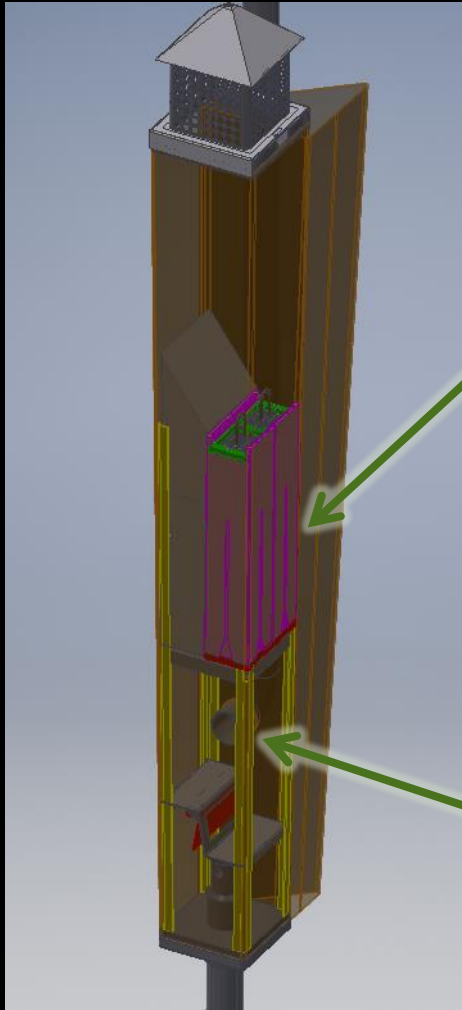
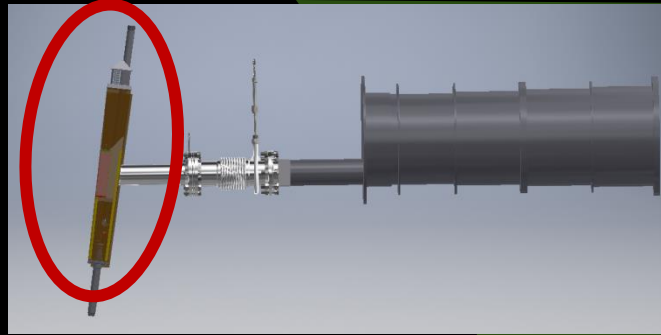


H2 channel

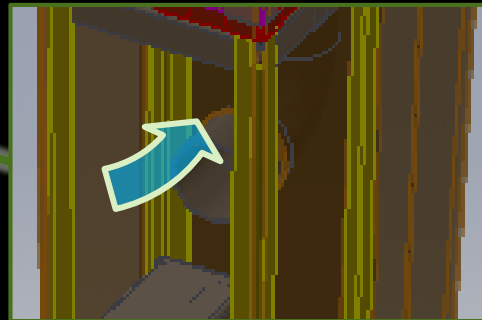
„Neutron production” for medical and radiobiological research



^{235}U converter

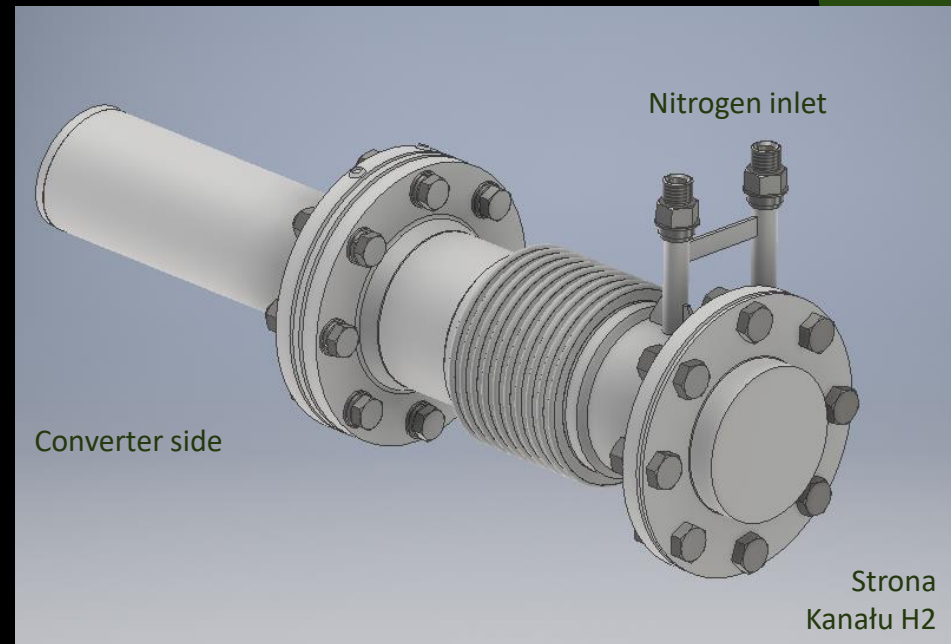
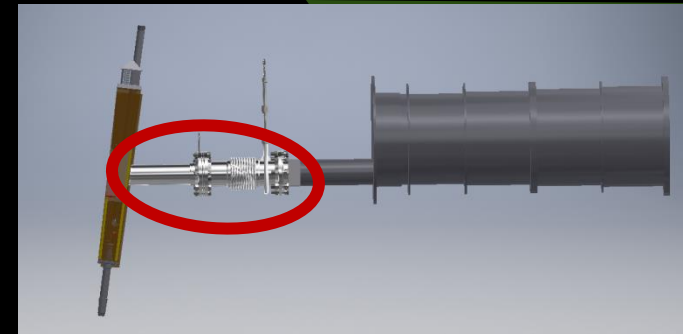


- ⊙ The source of neutrons – 24 U plates
- ⊙ When expedited to the technological pool it is possible to shuffle and rotate
- ⊙ And to check for leakage
- ⊙ Authonomic cooling system



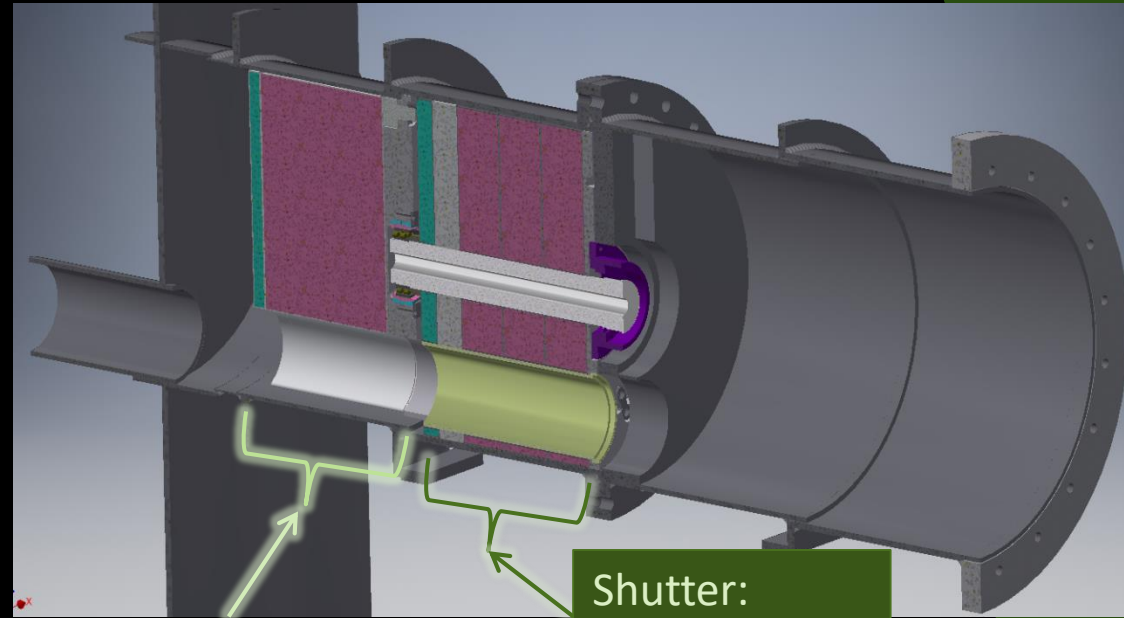
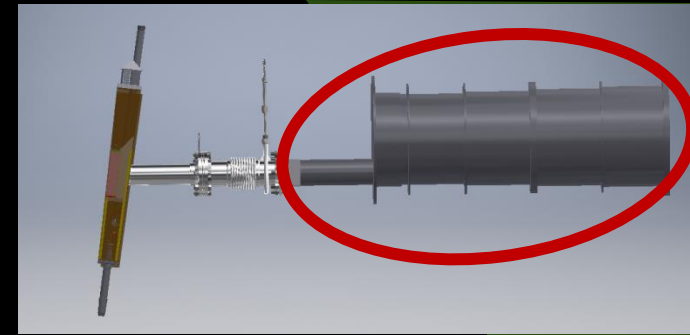
Medial channel

- ⦿ Positioned between the basket core and concrete shielding
- ⦿ 1m long, 25cm of diameter
- ⦿ Nitrogen exchange water inside
- ⦿ Filling/removing time ~90sec



Zamknięty kanał pośredni – pierwsza bariera dla neutronów

Filters and shutters



Filters:

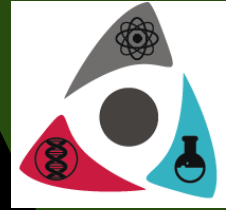
- 2 cm B_4C
- 25 cm Pb

Shutter:

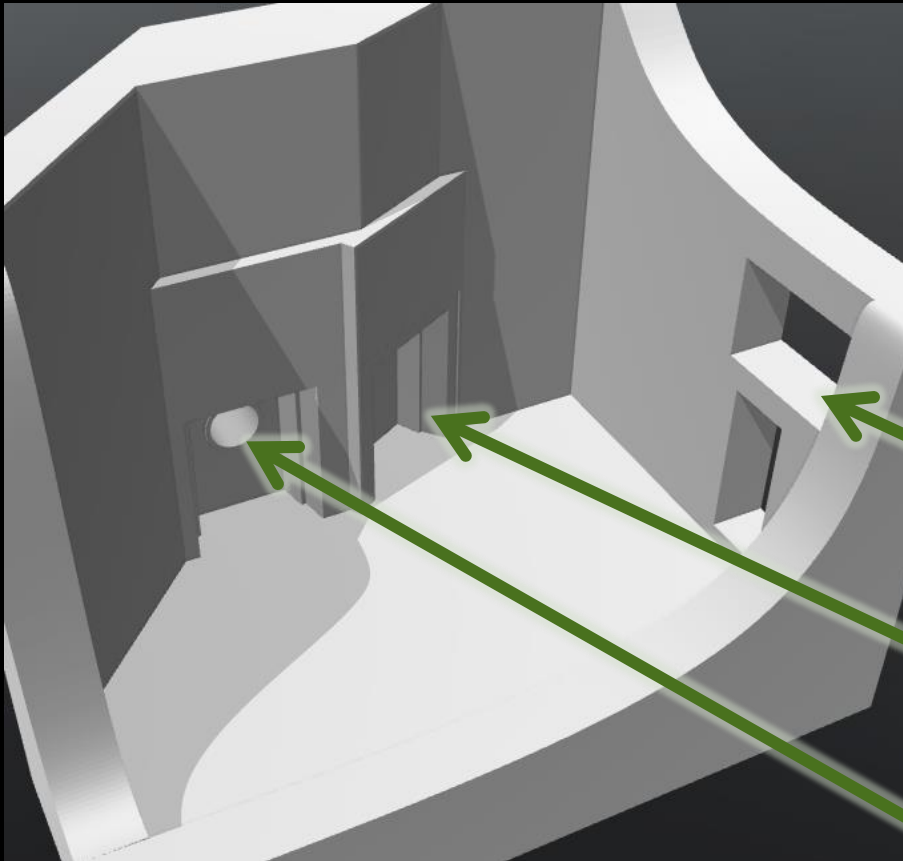
- 5 cm PP
- 3 cm B_4C
- 26 cm Pb

Pumpung the water out of the medial channel and turning shuttera = opening the beam for H2 experiments

Radiobiological laboratory



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Transportage passage

H1 channel – radiobiological samples

H2 channel - neutron beam

Expected date of finalization: May 2019

H1/H2 - experimental rooms

