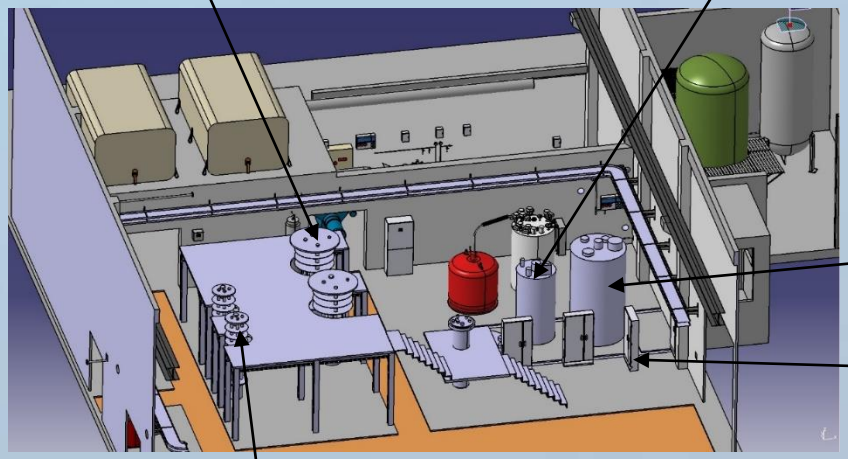
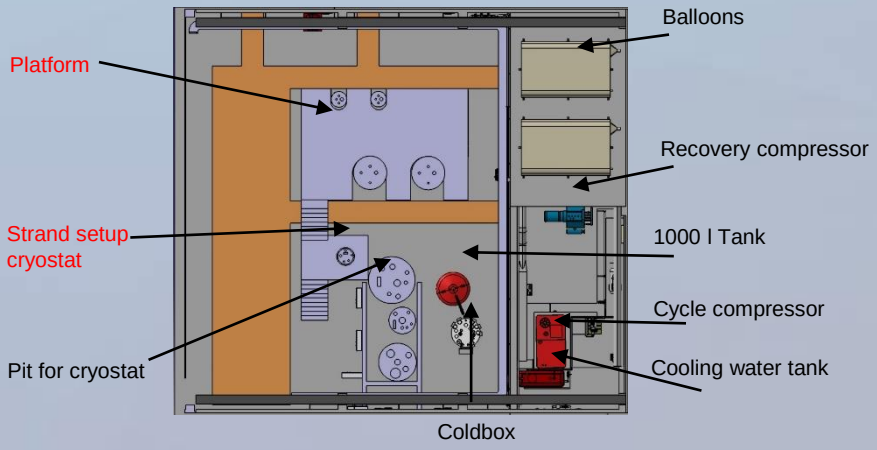
Activities Relevant to FuSuMaTech

Dariusz Bocian

- CONSORTIUM **IMBUK** - Cryogenic Materials and Scientific Devices Engineering (2018)
  - DAI – Division of Scientific Equipment and Infrastructure Construction at Institute of Nuclear Physics PAN, Cracow, PL
  - ACMiN - Academic Centre for Materials and Nanotechnology at AGH University of Science and Technology, Cracow, PL
  - LENT – Laboratory of Extremely Low Temperature at Cracow University of Technology, Cracow, PL



NEW Research Infrastructure



Cryogenic Infrastructure

Facts and Numbers

Turbine helium liquefier system:

- Able to liquefy up to 35l/h with LN_2 precooling
- Able to liquefy helium without LN_2 precooling (with reduced performance).
- Able to operate with helium contaminated by atmospheric air up to 1%.
- 1000 dm^3 storage Dewar

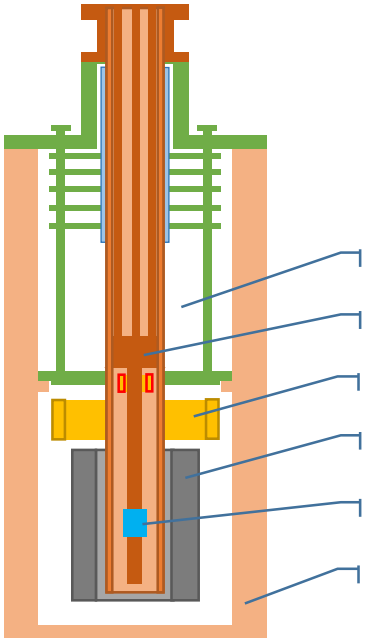
Recovery system:

- Two 15 m^3 and one 80 m^3 helium balloons,
- 70 m^3/h recovery compressor,
- 3 helium high pressure storage groups, containing 108 bottles of 90l volume each operating at 200 bar

Superconductors characterization setup (2022)

Objective: measurements of Ic(B,T)

- Nb3Sn
  - 9-15 T, 0-2000 A
  - 1.9 K,
  - 4.22 K and 4.3 K
- NbTi
  - 6-11 T
  - 0-1000 A
  - 1.9 K and 4.22 K
- MgB_2
  - 0-4 T
  - 0-1000 A
  - 4.3 K
- ReBCO
  - 0-12 T
  - 0-1500 A
  - 4.3 K ans 77 K



Specyfication:

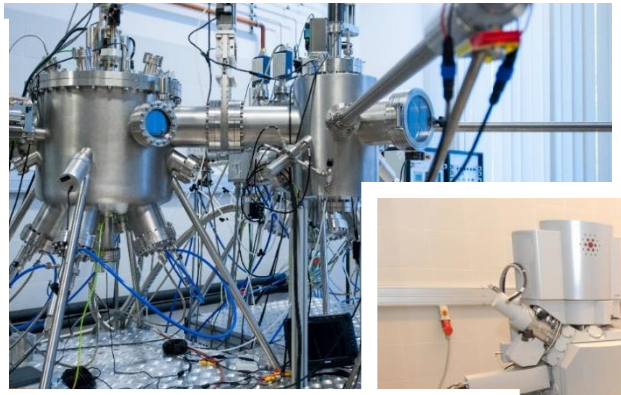
- Magnet 16 T at 4.3 K, 70 mm bore with dedicated power supply and quench protection
- 90 mm wide VTI operating at 1.9 K, 4.22 K, 4.3 K, 77 K
- Magnet cryostat operating at 4.3 K
- 1.5-2 kA low voltage power supply
- 11 designed inserts
  - 5 Nb3Sn – for continuous tests in series
  - 2 MgB_2 – for continuous test
  - 4 HTS – for continuous tests of 2 types
  - 2 NbTi – for continuous tests

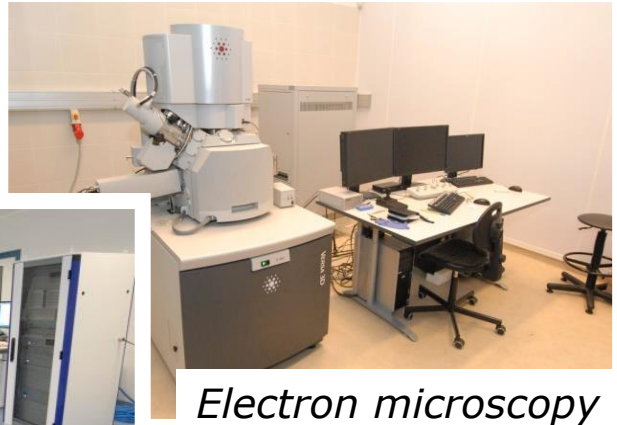
ACMiN AGH

Mechanical properties

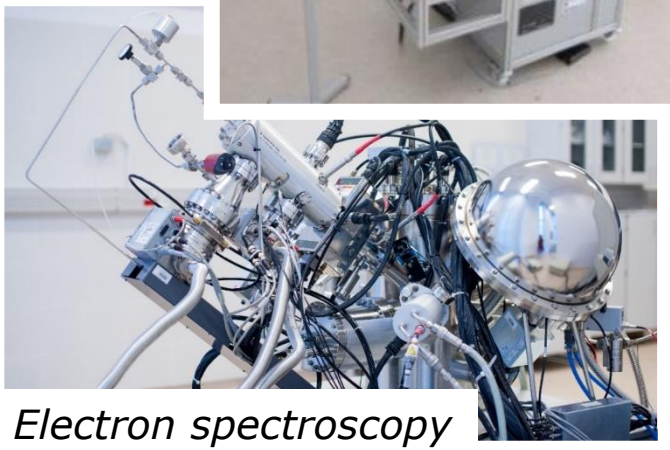
Deposition of thin films and nanocomposites

Synthesis of alloys and composites





Electron microscopy



Electron spectroscopy

Nanolitography clean-room

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Oxford Instruments Triton®

^{3}He/^{4}He dilution fridge

T = 0.01 – 30 K

B < 14 Tesla

- electronic transport
- magnetoresistance
- heat capacity

Lakeshore 7407

VSM magnetometer

T = 80 – 1300 K

B < 1.7 Tesla

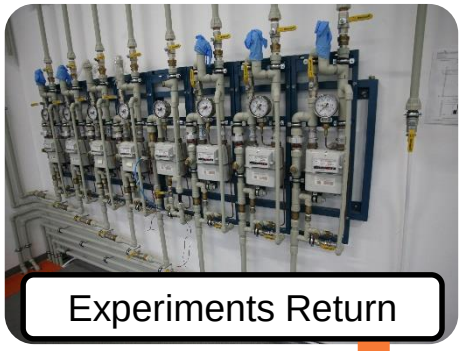
- DC susceptibility
- magnetization
- magnetoresistance

CONCLUSIONS

- Polish Road Map for Research Infrastructures
  - Centre of Engineering of Cryogenic Materials and Research Equipment (2020)
    - *consortium IMBUK (IFJ PAN, AGH, CUT)*
    - *consolidation of a unique distributed infrastructure of this kind in PL*
    - *conductor testing and material studies*
- Research Infrastructure development at IFJ PAN
  - New experimental hall
  - 16T test stand for strand characterization
  - Helium liquifier and helium storage and recovery system

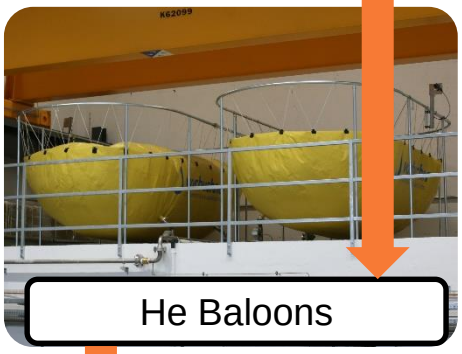
Cryogenic Infrastructure

In Pictures

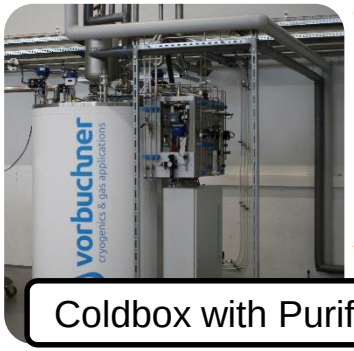

Experiments Return

Cycle Compressor


Oil Remover System


He Baloons

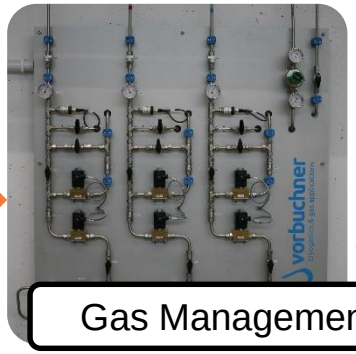

Impure He Storage



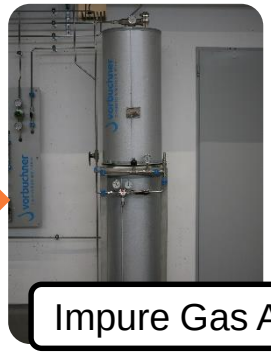
Coldbox with Purifier


Lhe Dewar

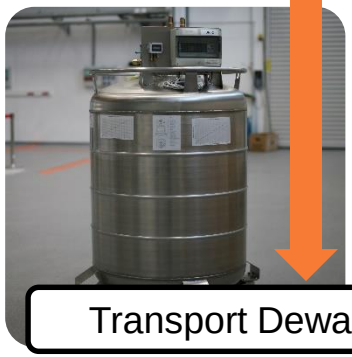

Recovery Compressor



Gas Management



Impure Gas Adsorber


Transport Dewar

IFJ PAN Magnet teststand – Possible Design

Actual IFJ PAN testing hall dimensions:

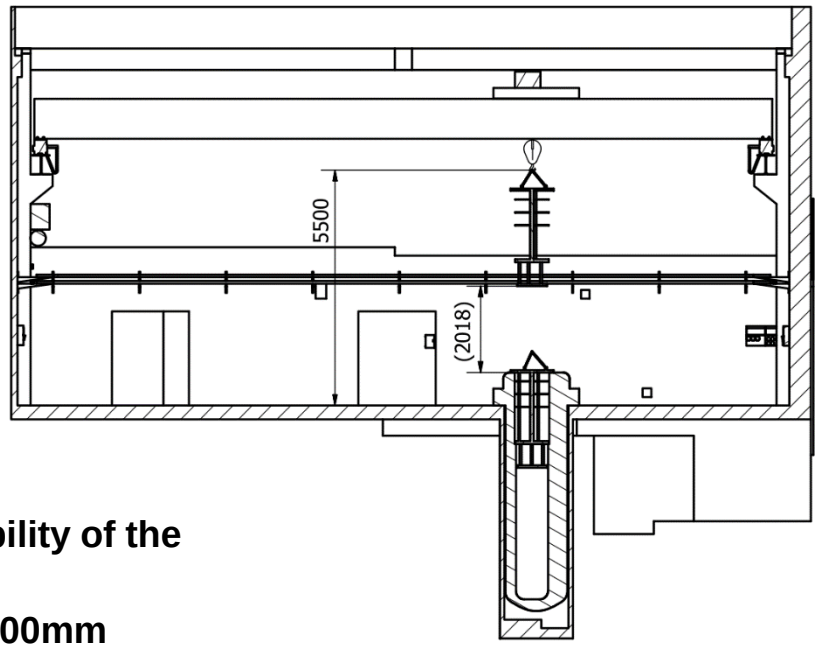
- From ground level to crane hook: 5500mm,
- Depth of a hole: 5000mm,
- Diameter of a hole: 1500mm.

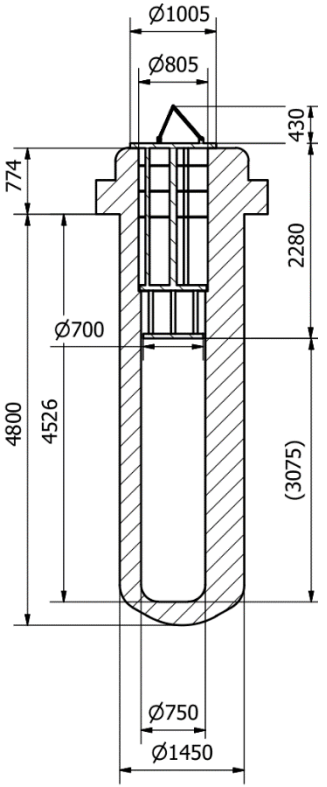
In this configuration, two types of magnets can be tested:

- diameter: **max 680mm, length: 2000mm** (larger diameter, magnet below a heat exchanger)
- diameter: **max 550mm, length: 2500mm** (smaller diameter, magnet next to a heat exchanger)

With some modifications max capability of the cryostat can be extened to:

- diameter: **max 900mm, length: 2700mm**





Wymiary w mm