The Heavy Ion Laboratory of the University of Warsaw – complex of particle accelerators used for radioisotope production

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Heavy Ion Laboratory, University of Warsaw

3rd Workshop on Research & Innovation in Poland
"Research Programme for a Linear Accelerator,"
Institute of Nuclear Physics, Polish Academy of Sciences, Kraków, October 22-23, 2026

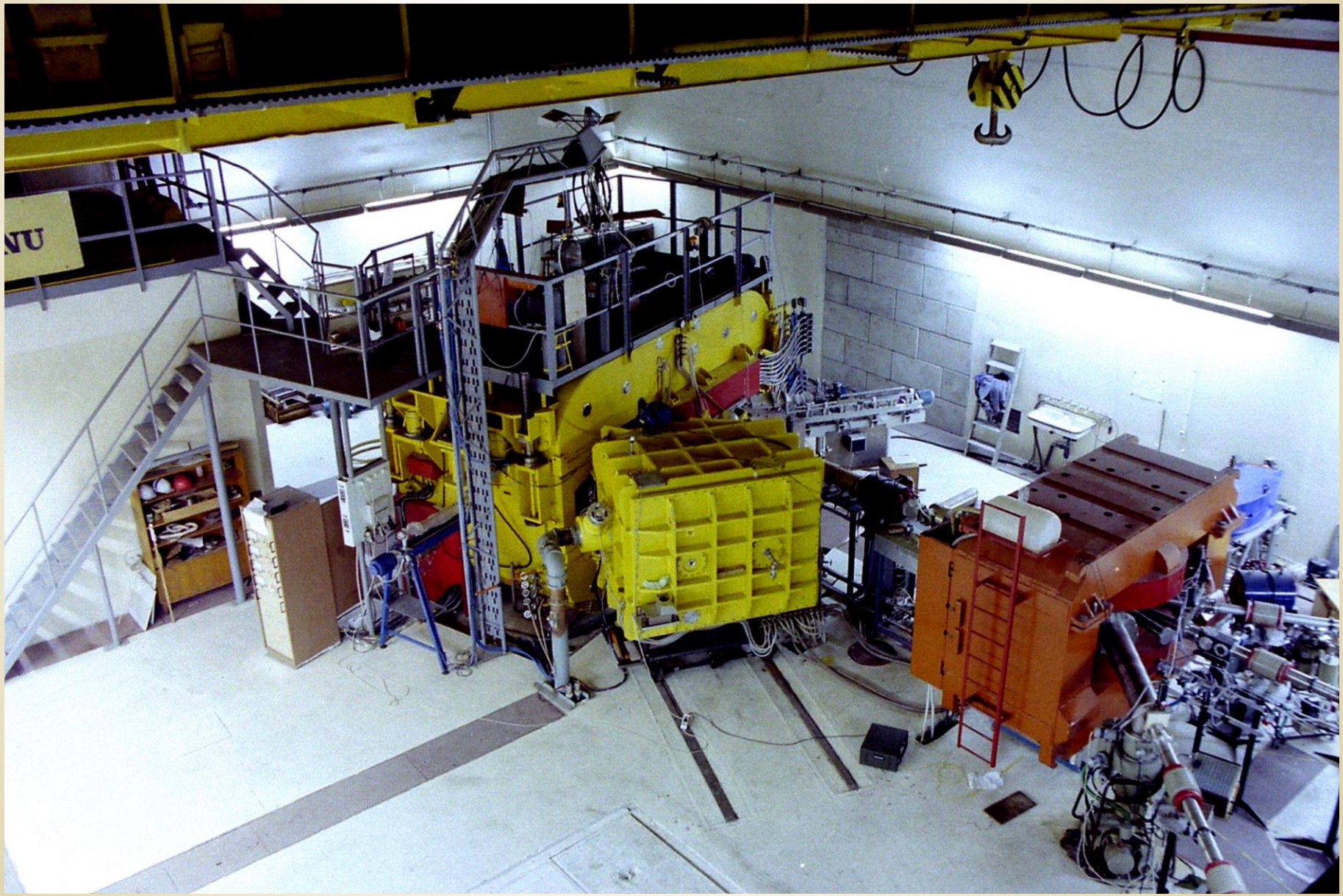
June 11, 1979
Cornerstone Laying Ceremony





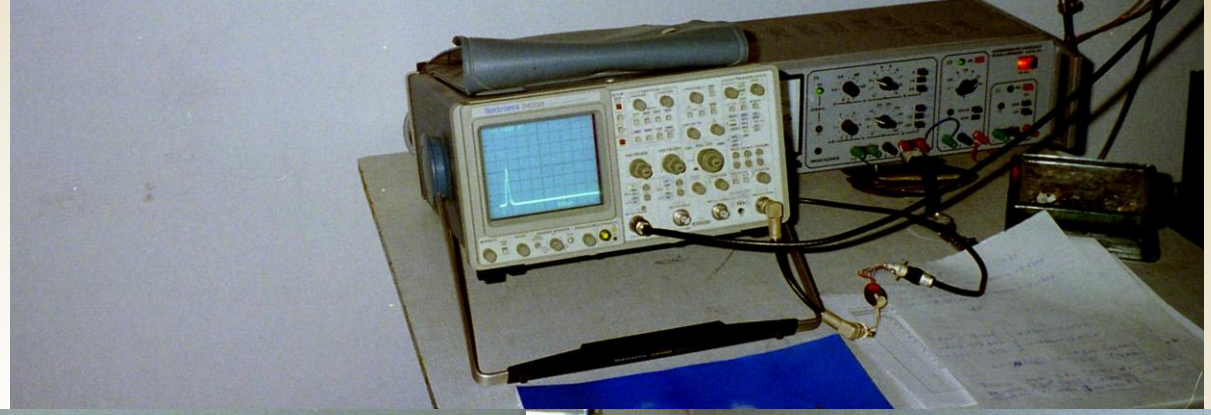
1 – prof. Zygmunt Rybicki, Rektor UW; 2 – prof. Jerzy Kołodziejczak, PAN; 3 - prof. Jerzy Minczewski, dyr. IBJ

CYCLOTRON VAULT



April
1992

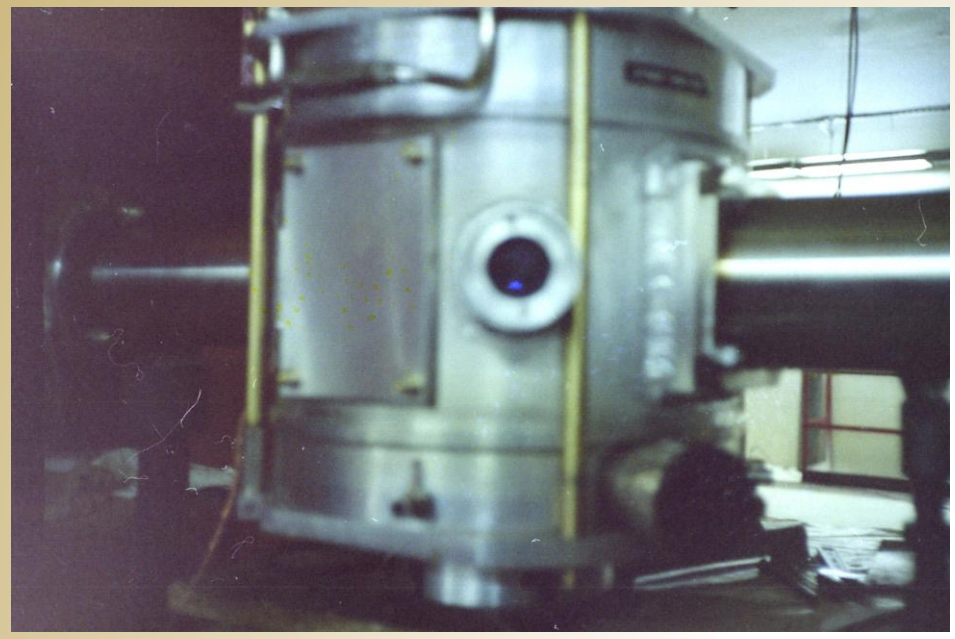
November 22, 1993

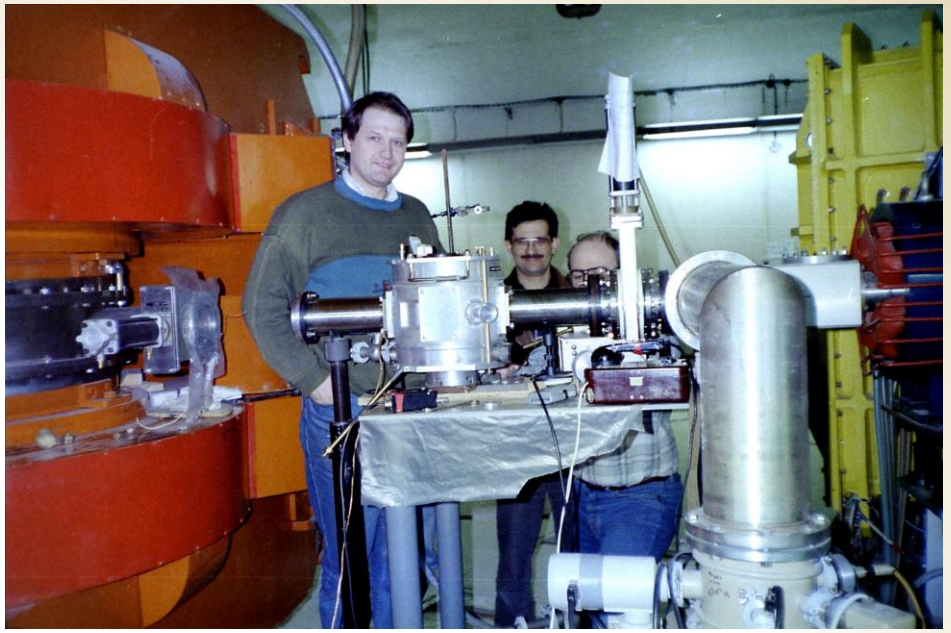


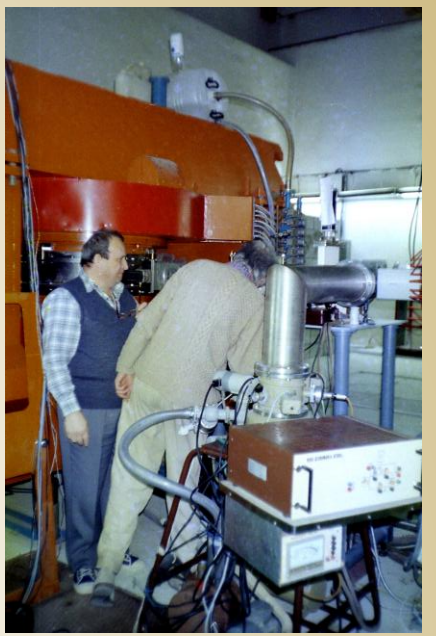


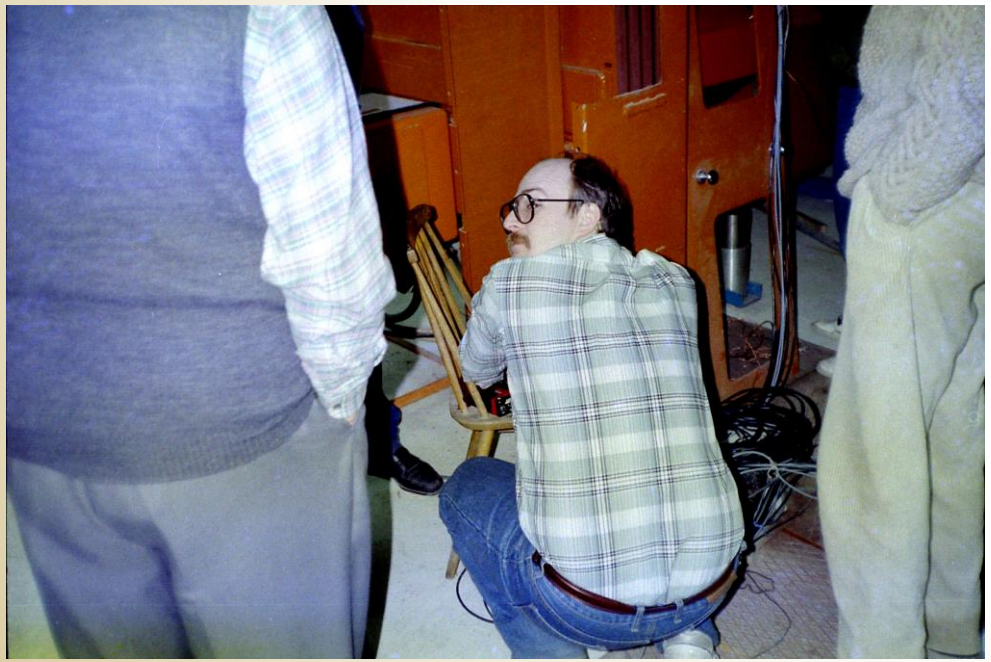


First acceleration of the $^{20}Ne^{+2}$ ion beam at 1.6 MeV/amu inside the cyclotron











First extracted $^{14}N^{+2}$ 31 MeV ion beam from a cyclotron, April 8, 1994

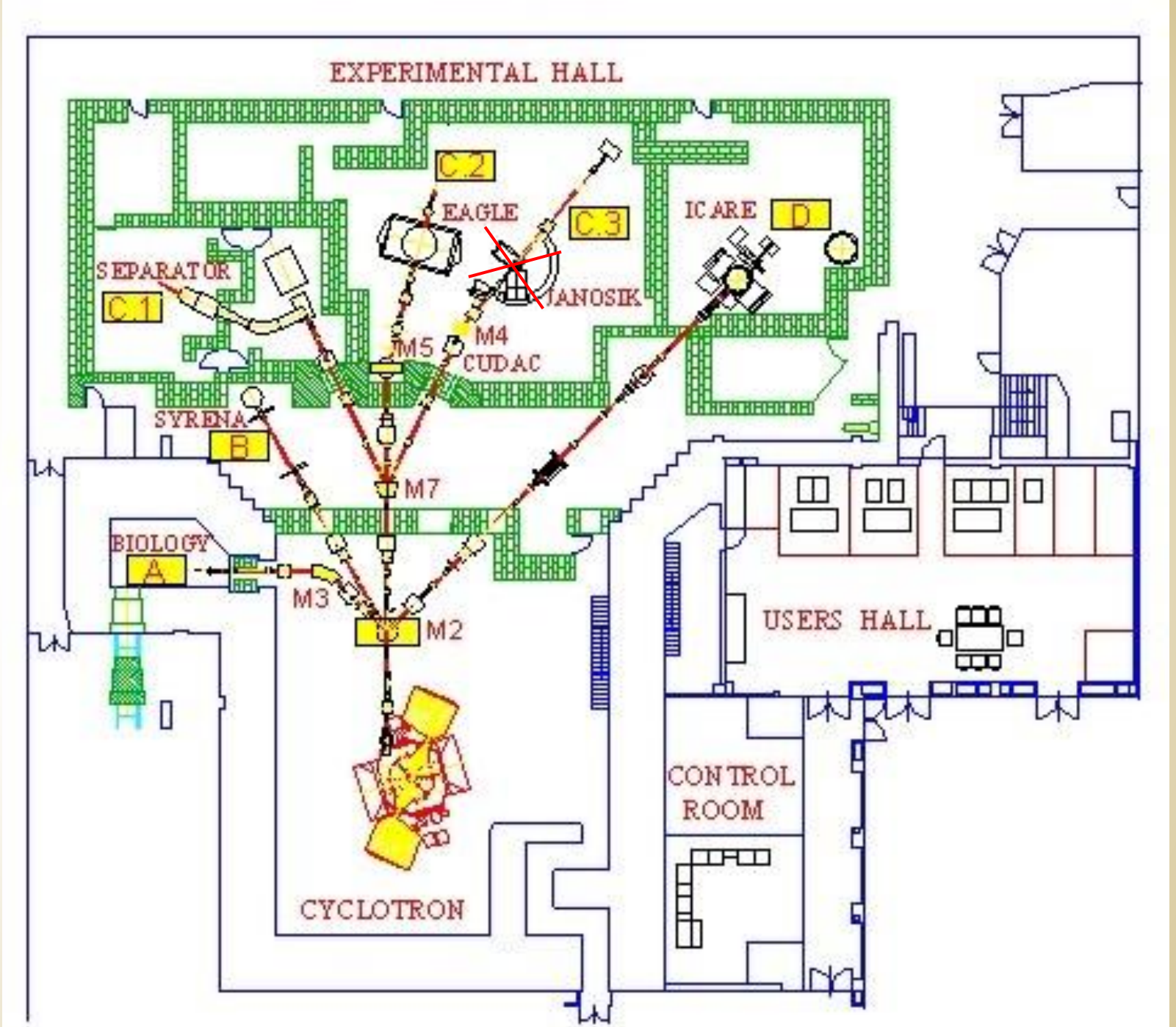
HIL opening ceremony

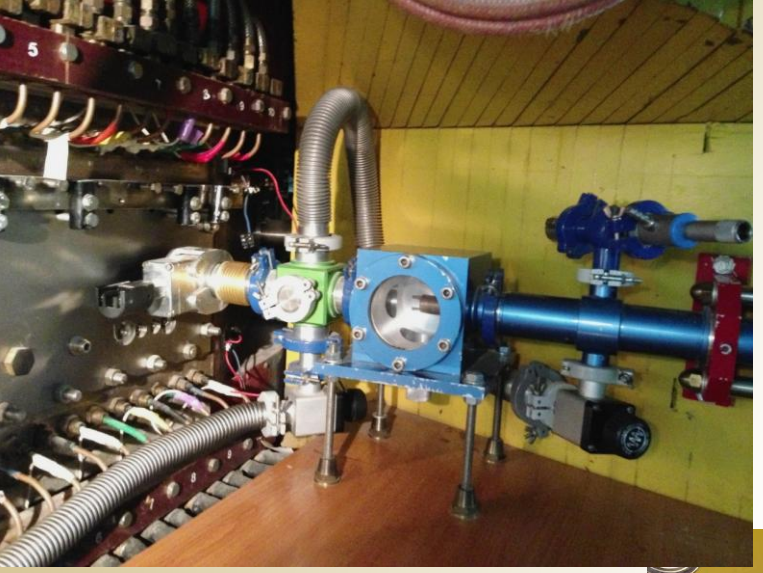
May 20, 1994



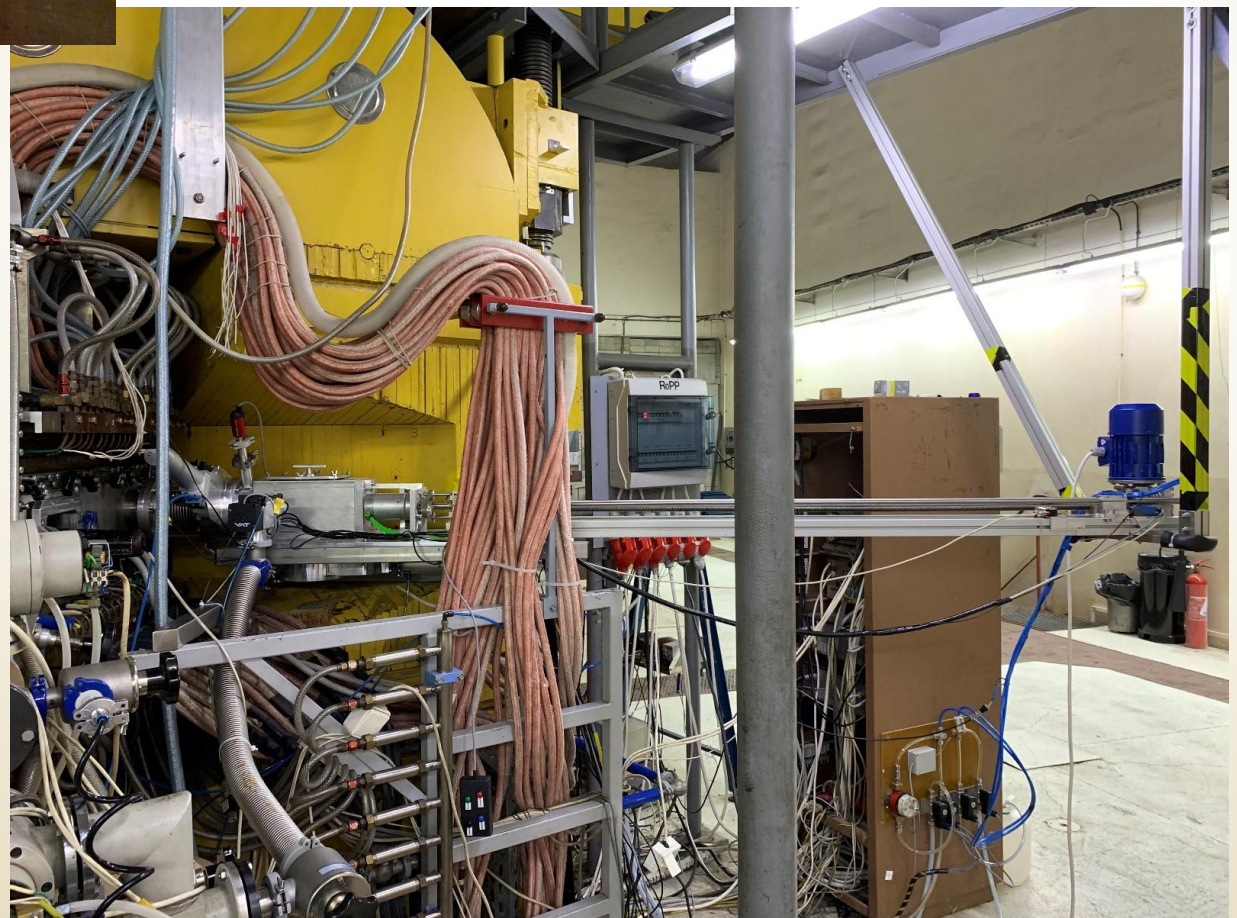
His Magnificence the Rector Włodzimierz Siwiński

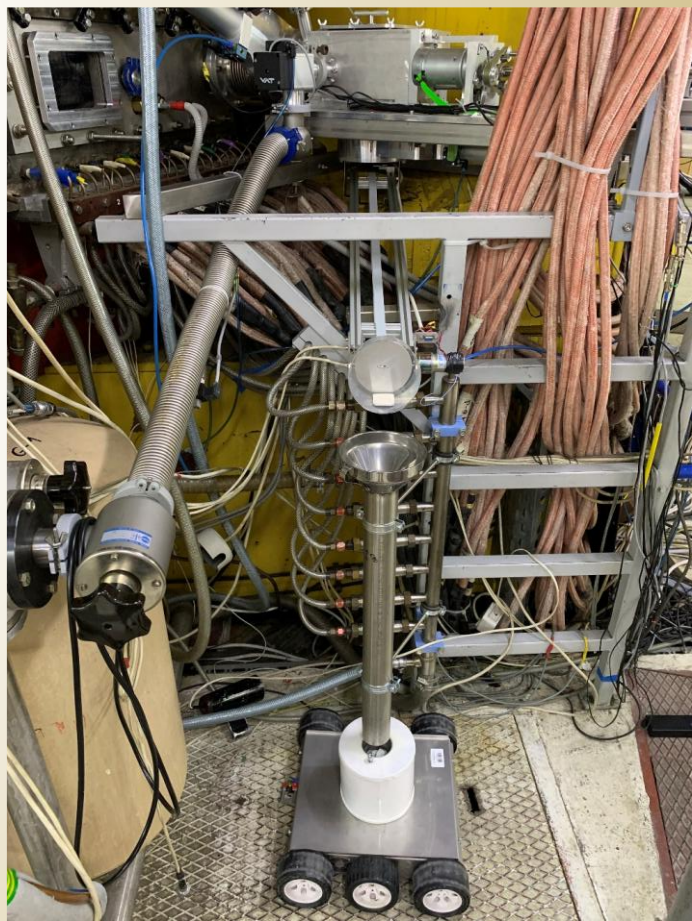
View of the experimental hall and the cyclotron vault





Cyclotron vault – a station for irradiating targets with an internal ion beam





A standalone target system for internal beam irradiation

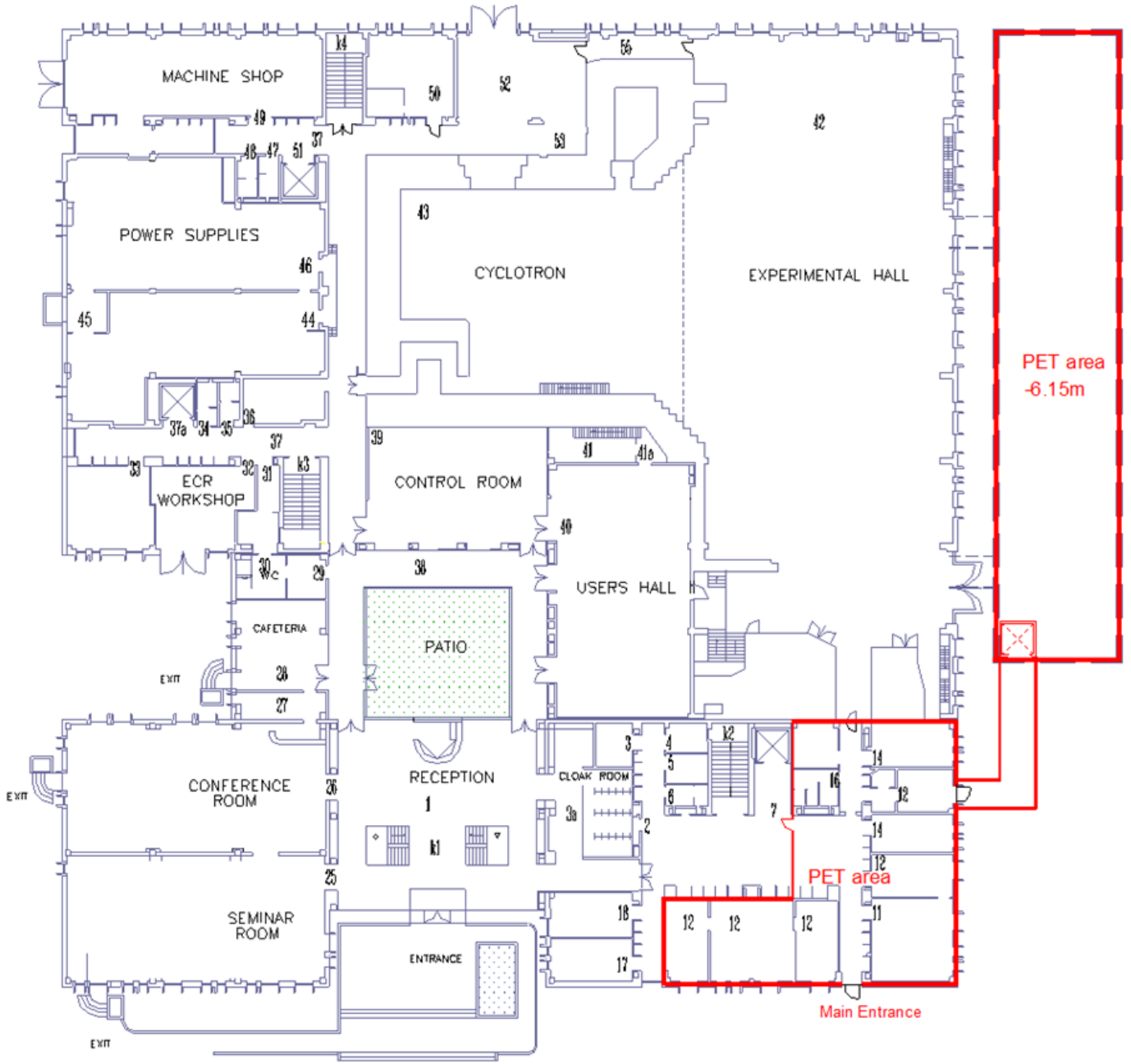
Since several years ago, the Heavy Ion Laboratory has been involved in medical radioisotope production, mainly Astatine-211 element utilizing alfa beam from the U-200P cyclotron $^{209}Bi(\alpha,2n)^{211}At$ ...

... but also isotopes:

$^{40}Ca(\alpha,n)^{43}Sc$,
$^{42}Ca(\alpha,2n)^{44gd}Sc$,
$^{42}Ca(\alpha,2n)\ ^{44}Ti/^{44}Sc$
$^{70}Ge(\alpha,2n)^{72}Se/^{72}As$

RADIOPHARMACEUTICAL PRODUCTION AND RESEARCH CENTER (RPRC)

EXPANDING HIL RESEARCH CAPABILITIES

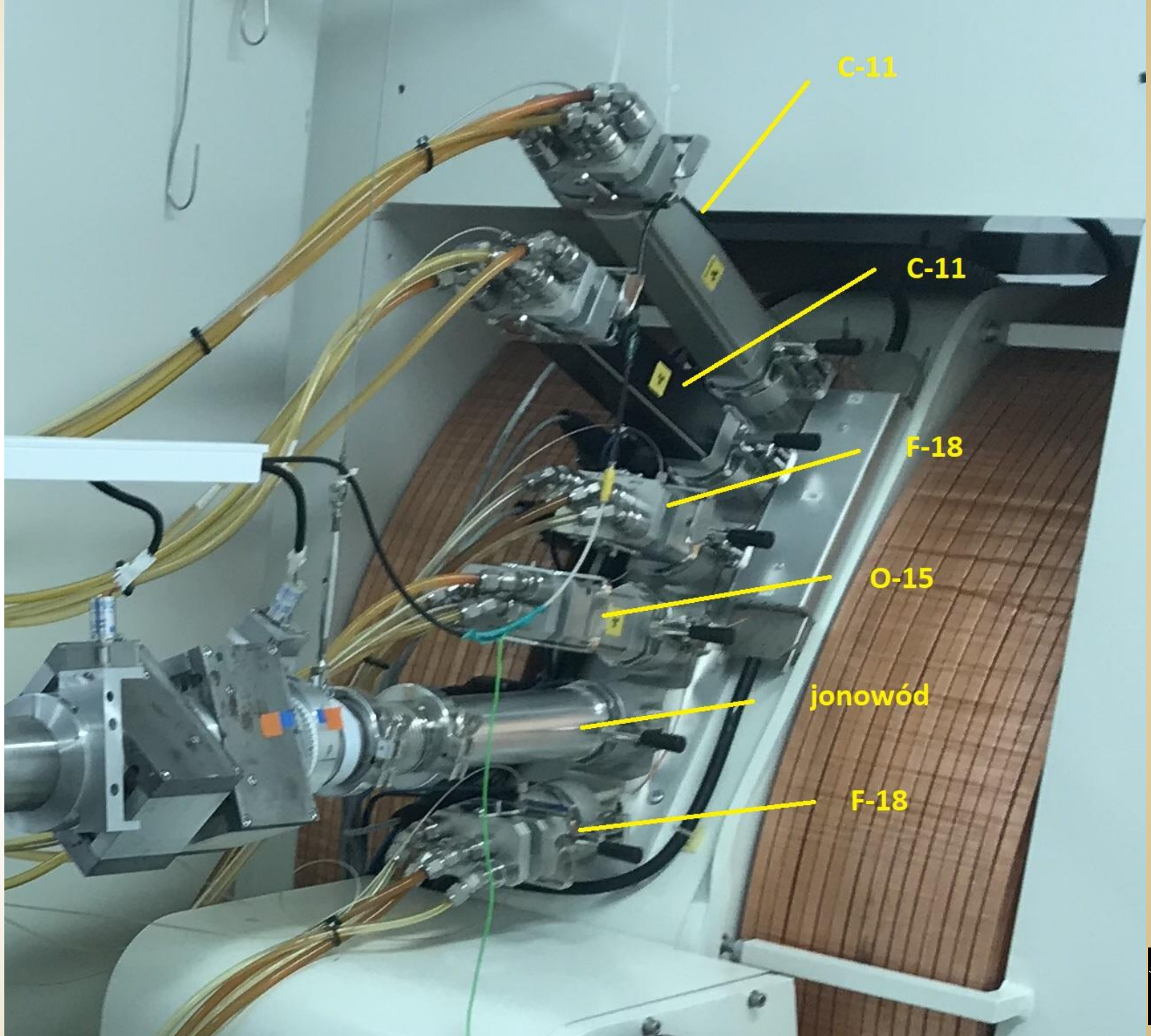


GROUND-FLOOR 0.00 m

high current PETtrace commercial
cyclotron dual beam,

p – 16.5 MeV 80 μA
and
d – 8.4 MeV 60 μA

INAUGURATION **2012**



Alternative Methods for the ^{99m}Tc Production

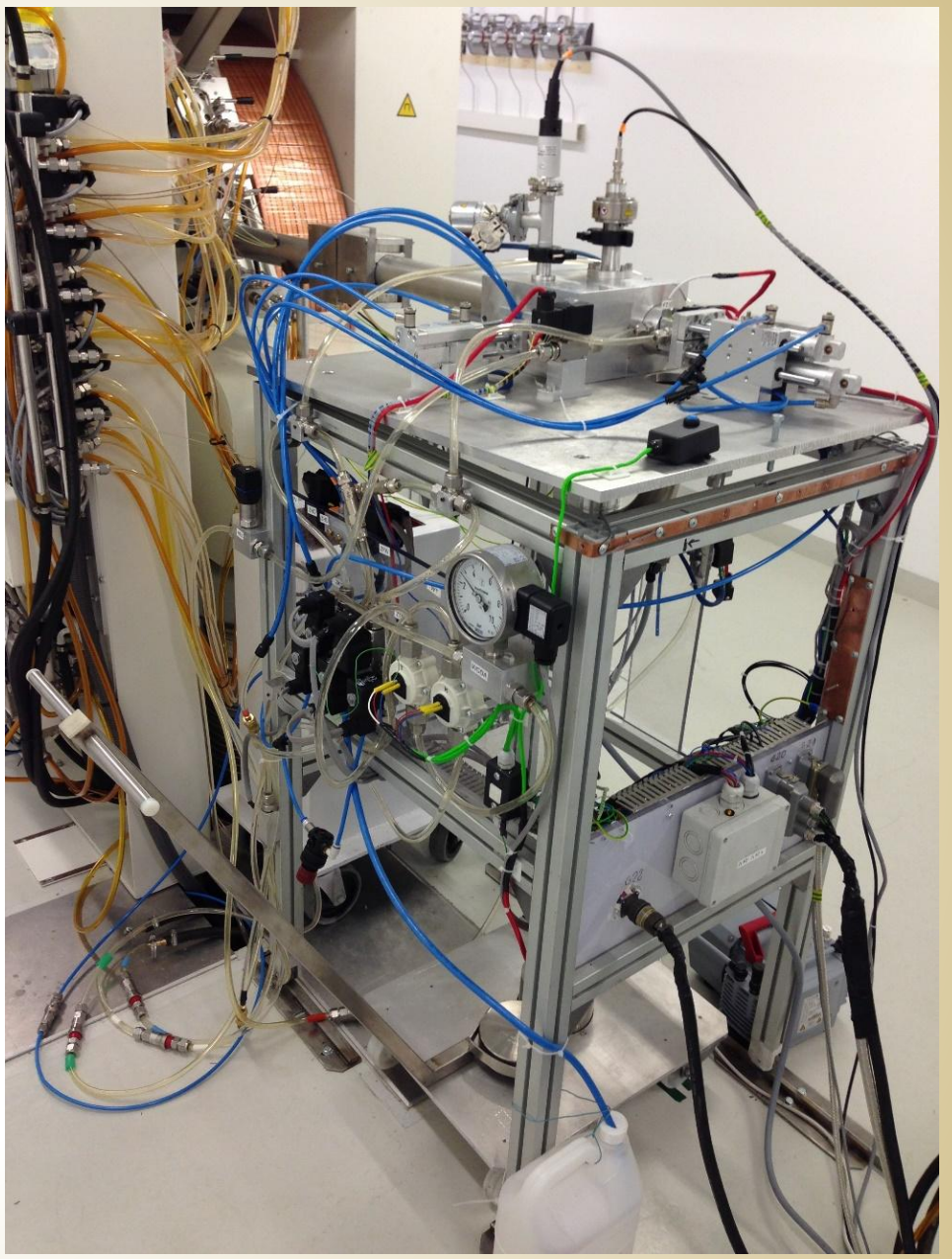
Agreement No PBS1/A9/2/2012 funded by the National Centre for Research and Development

- **The consortium of:**
- **the Polatom – National Centre for Nuclear Research**
  the Institute of Nuclear Chemistry and Technology
  the University of Warsaw
  01.11.2012 – 31.10.2015

^{100}Mo(p,2n)^{99m}**Tc**

2015

A standalone external target system



The grant "The development of methods for production of new radiopharmaceuticals based on Sc radionuclides used in positron tomography (PET)" [PET-SKAND] agreement no PBS3/A9/28/2015 awarded to a consortium, and financed by the National Centre for Research and Development.

2018

Konsorcjum:

Production of:

$^{43}Ca(p,n)^{43}Sc$

$^{42}Ca(d,n)^{43}Sc$

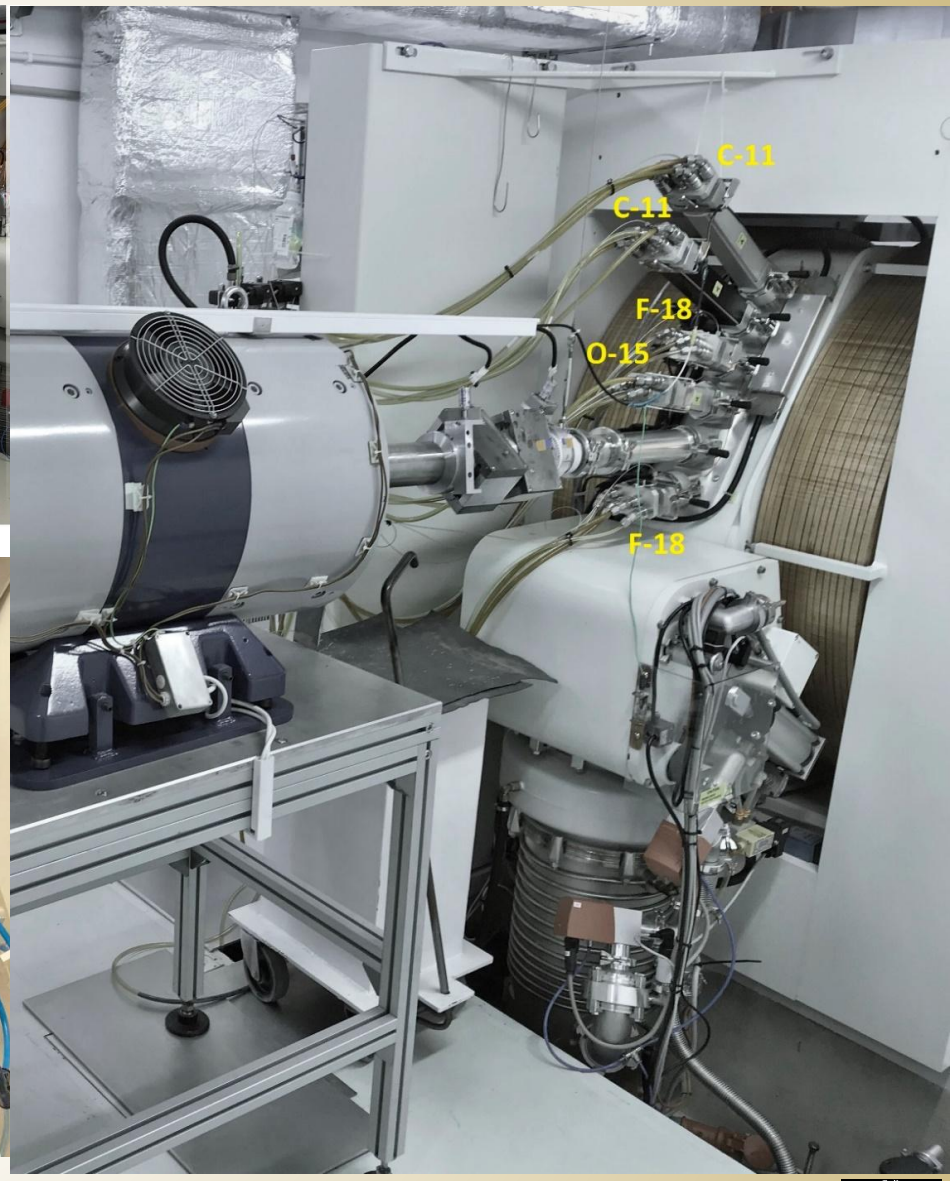
$^{44}Ca(p,n)^{44}Sc$

$^{44}Ca(d,2n)^{44m,g}Sc$

It is protected by RP patent No. 227402







An upgraded standalone external target system

our current activity

HIL's involvement in development of β+γ isotopes production for multiphoton imaging with J-PET

We have been implementing the grant since 2022

"Development of three-photon emitting radiotracers for positronium imaging", Nr DEC-2021/43/B/ST2/02150, NCBR

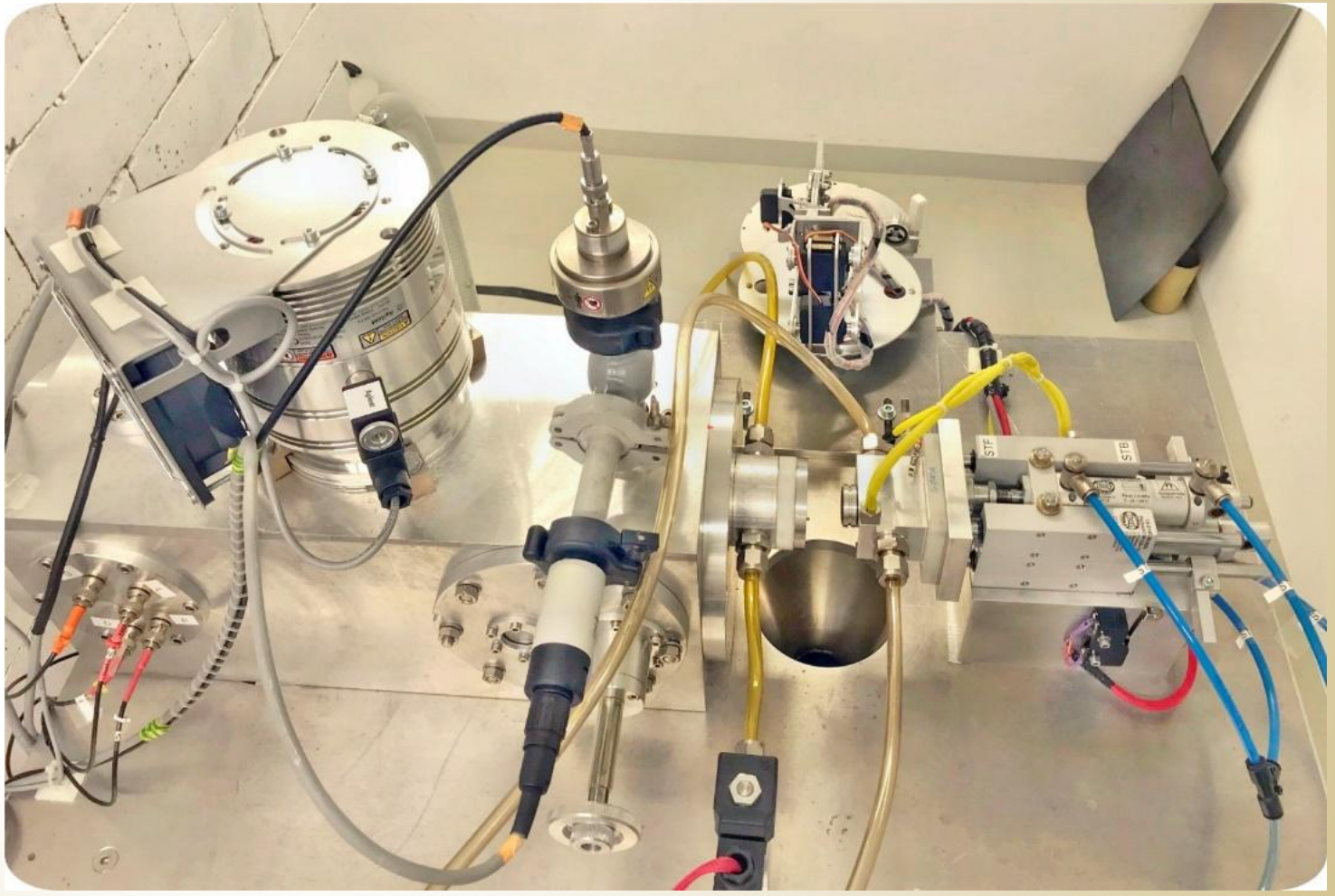
Production of:

$^{43}Ca(p,n)^{43}Sc$

$^{42}Ca(d,n)^{43}Sc$

$^{44}Ca(p,n)^{44}Sc$

$^{44}Ca(d,2n)^{44m,g}Sc$



we have also produced:

^{44}Sc

^{55}Co $^{54}Fe(d,n)^{55}Co$

and

^{72}As $^{72}Ge(p,n)^{72}As$

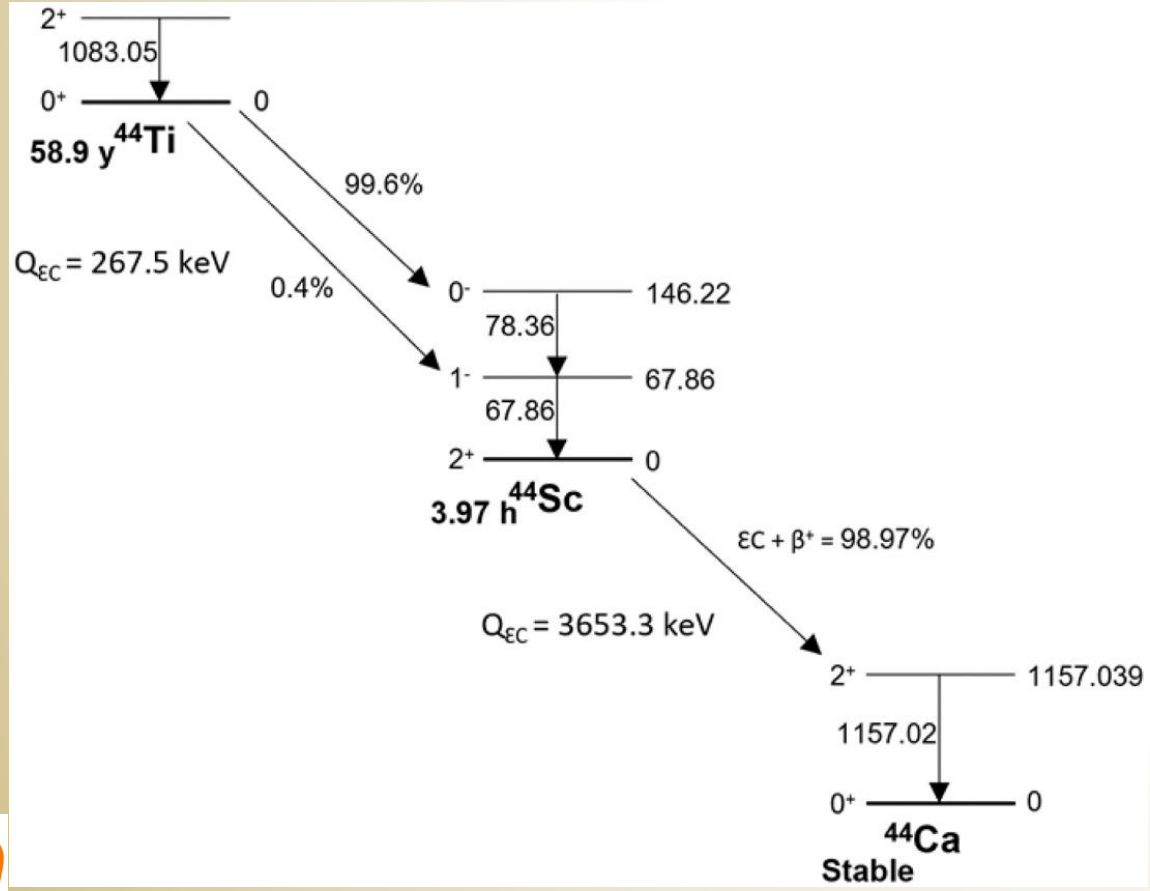
for the need of a novel three-photon tomography system developed at the Jagiellonian University (J-PET)

Spring 2026

We produced the titanium isotope ^{44}Ti through a nuclear reaction

$$^{45}Sc(p,2n)^{44}Ti$$

$^{45}Sc_2O_3$ target	99.5% purity	till 38 MeV	5.04 (MBq/(μA·h))·10^{-6}



^{44}Ti decays by electron capture to ^{44}Sc.

This enables cyclotron-independent production of ^{44}Sc, which then decays via beta decay with high positron emission (94.3%) to stable ^{44}Ca.

$^{44}Ti/^{44}Sc$ generator for the calibration of the J-PET scanner

Ch.E.Schmidt et al. OSTI.GOV Journal Article: Current State of $^{44}Ti/^{44}Sc$ Radionuclide Generator Systems and Separation Chemistry, DOI:https://doi.org/10.2174/1874471016666221111154424

Between 2016 and 2026 we have produced isotopes:

^{43}Sc, ^{44}Sc, ^{44}Ti, ^{48}V, ^{55}Co, ^{56}Co, ^{72}As, ^{89}Zr, ^{99m}Tc, ^{135}La, ^{197}Hg

Thank You Very much for Your attention!

www.slcj.uw.edu.pl