30th anniversary of the Heavy Ion Laboratory of the University of Warsaw and its contribution to the production of medical radioisotopes

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2nd Symposium on new trends in nuclear and medical physics
Marian Smoluchowski Institute of Physics, Jagiellonian University, Kraków, Poland
September 24th - 26th 2025

THE IDEA OF HAVING A CYCLOTRON AT THE UNIVERSITY OF WARSAW

HISTORICAL OUTLINE

IN THE 1930S

THE FIRST WAS A LETTER FROM VERY EMINENT POLISH PROFESSORS ANDRZEJ SOŁTAN AND STEFAN PIEŃKOWSKI ABOUT THE NEED TO HAVE A CYCLOTRON AT THE FACULTY OF PHYSICS OF THE UNIVERSITY OF WARSAW.

Professor Jerzy Pniewski wrote in one of his publications:

"The Second World War interrupted Pieńkowski's advanced efforts to raise funds for the construction of a cyclotron."

In 1972, a decision was made at the government level to build a heavy ion acceleration cyclotron in Warsaw.

The decision was preceded by several years of discussion in the physics community.

THE FIRST CYCLOTRON COMPONENTS WERE MADE IN DUBNA, CCCP, NOW RUSSIA

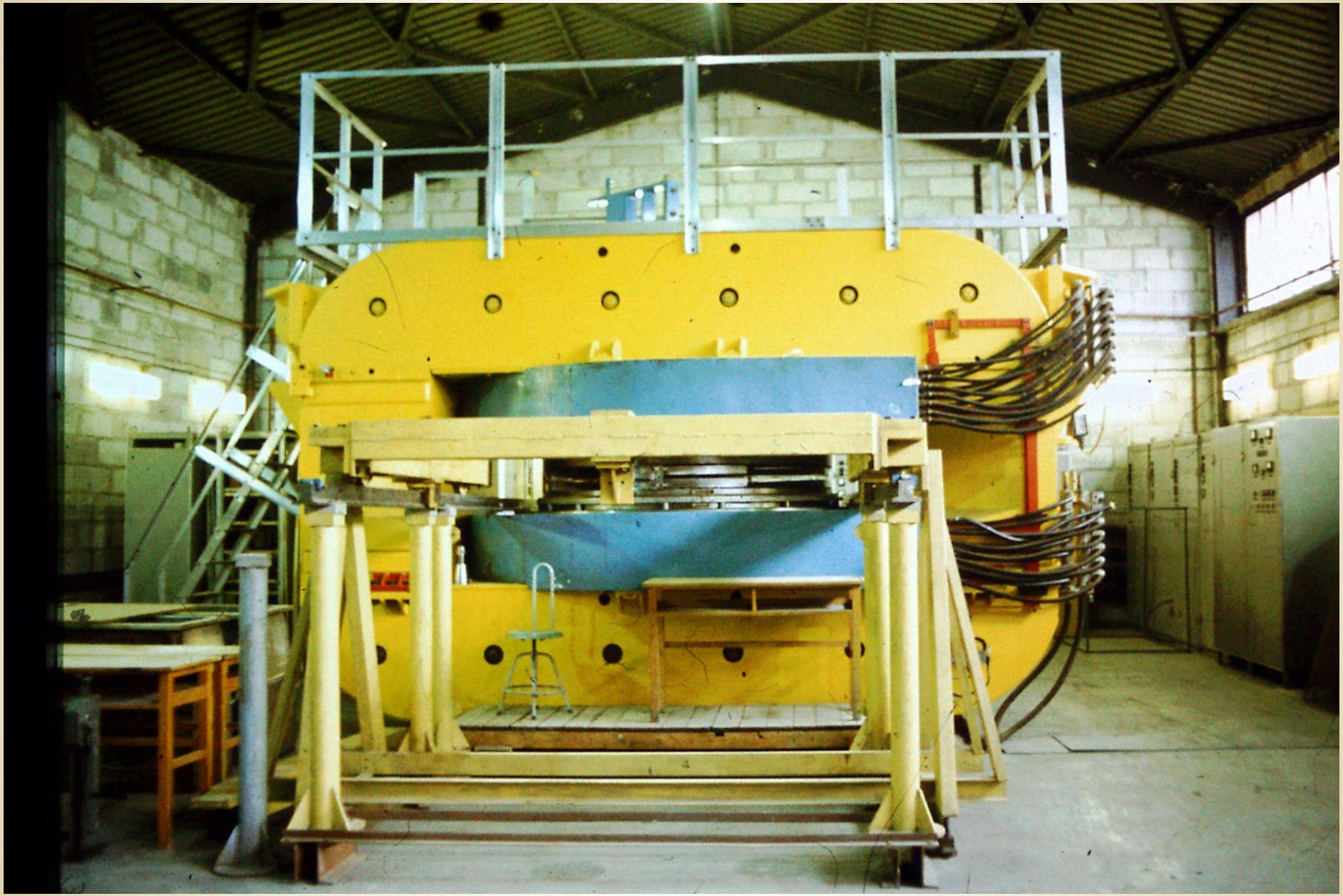
DECEMBER 1972

Preliminary formation of the magnetic field

1 Józef Sura
2 Czesław Wejchert

CYCLOTRON COMPONENTS BROUGHT FROM DUBNA WERE STORED IN A TEMPORARY FACILITY IN WARSAW

DECEMBER 1977

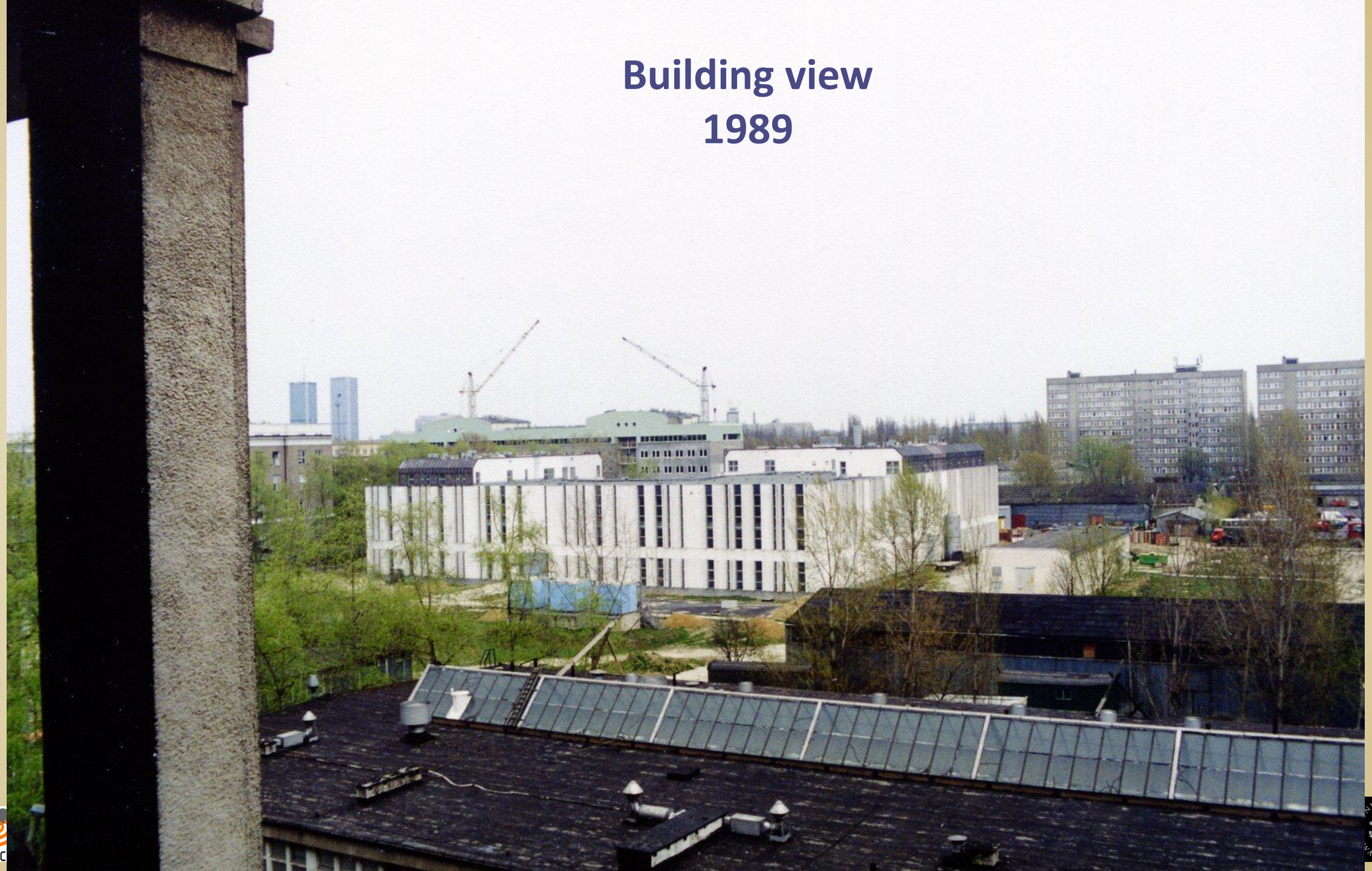


THE BUILDING OF THE HEAVY ION LABORATORY

June 11, 1979
Cornerstone Laying Ceremony

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

Building view
1989

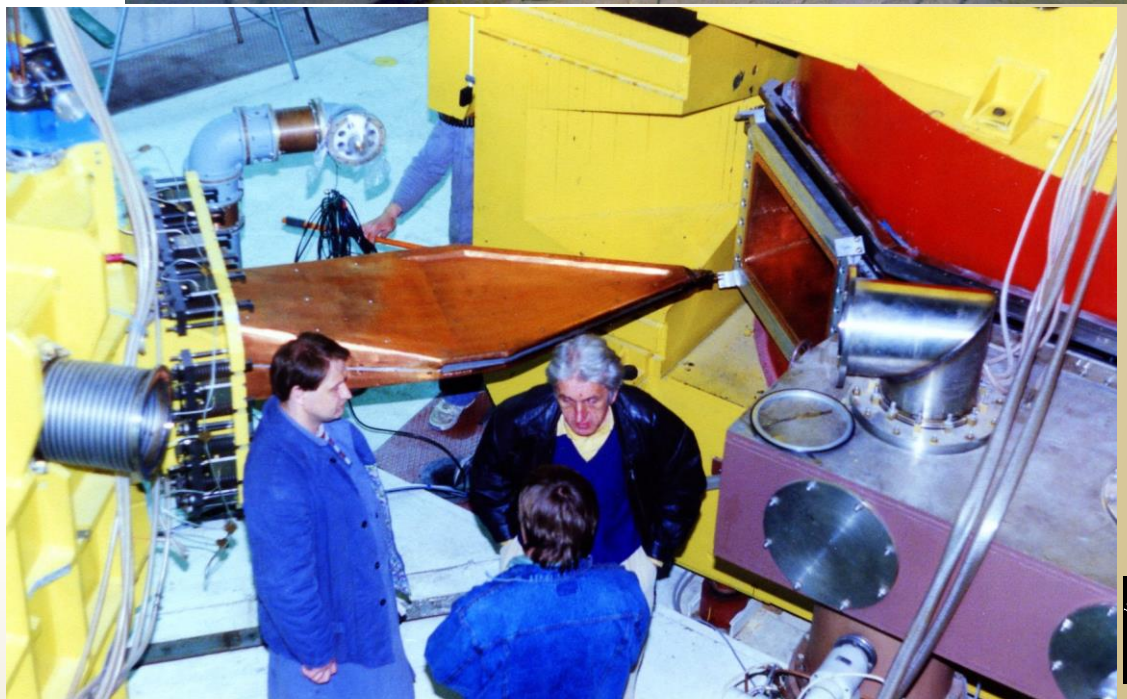


MOVING THE CYCLOTRON U-200P TO ITS FINAL LOCATION

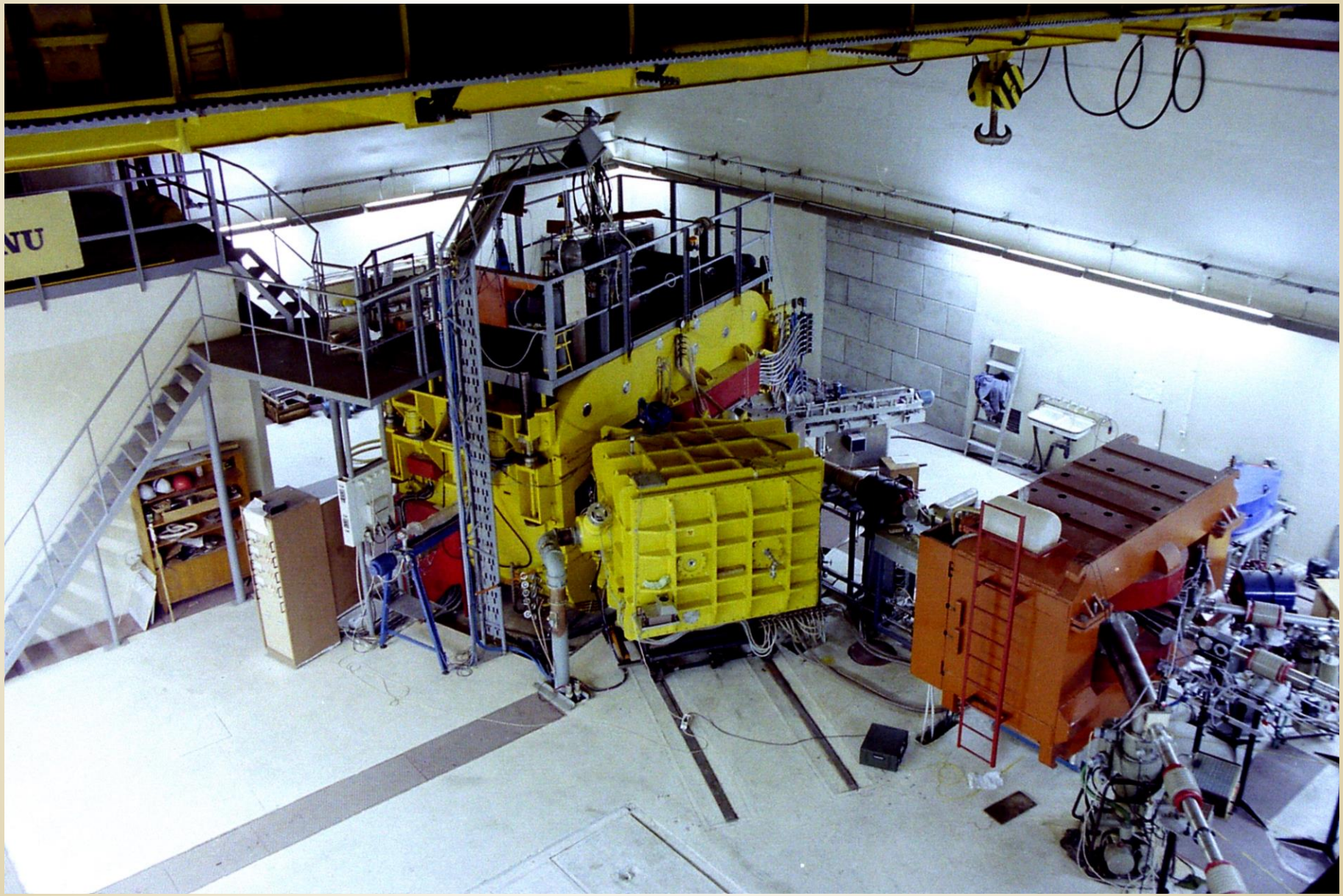
June 1988


9.05.1989.


1

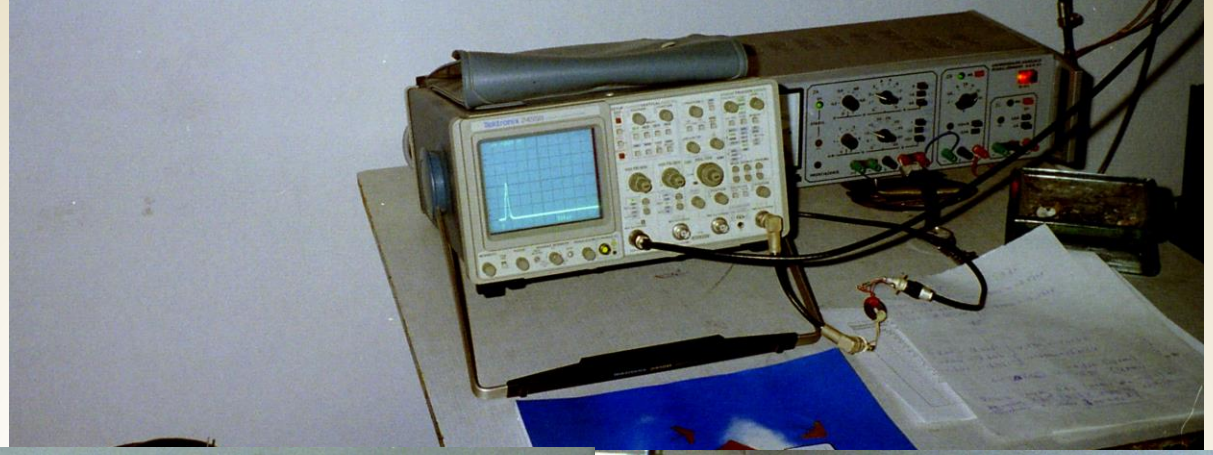


CYCLOTRON VAULT

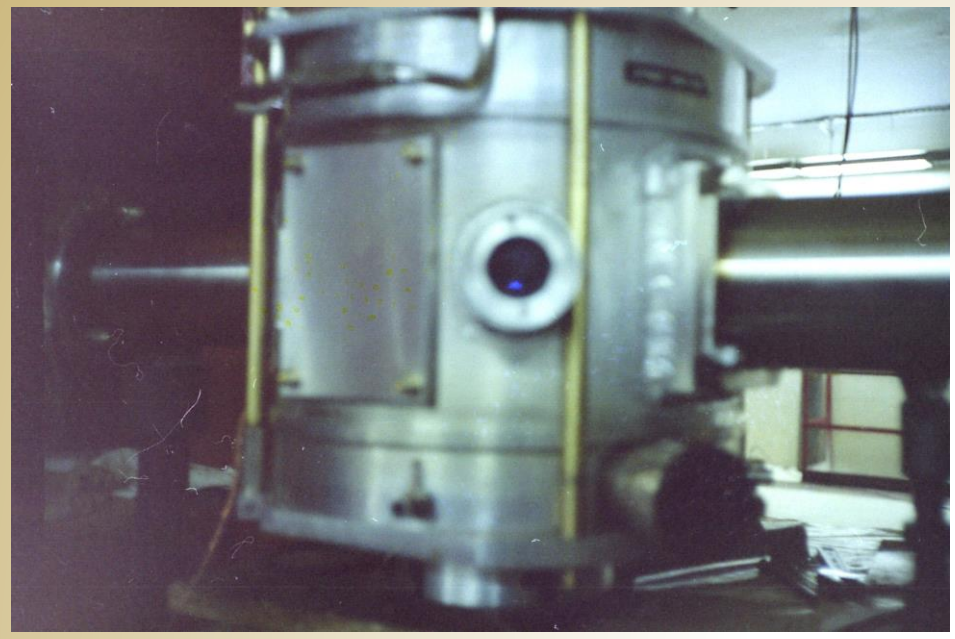


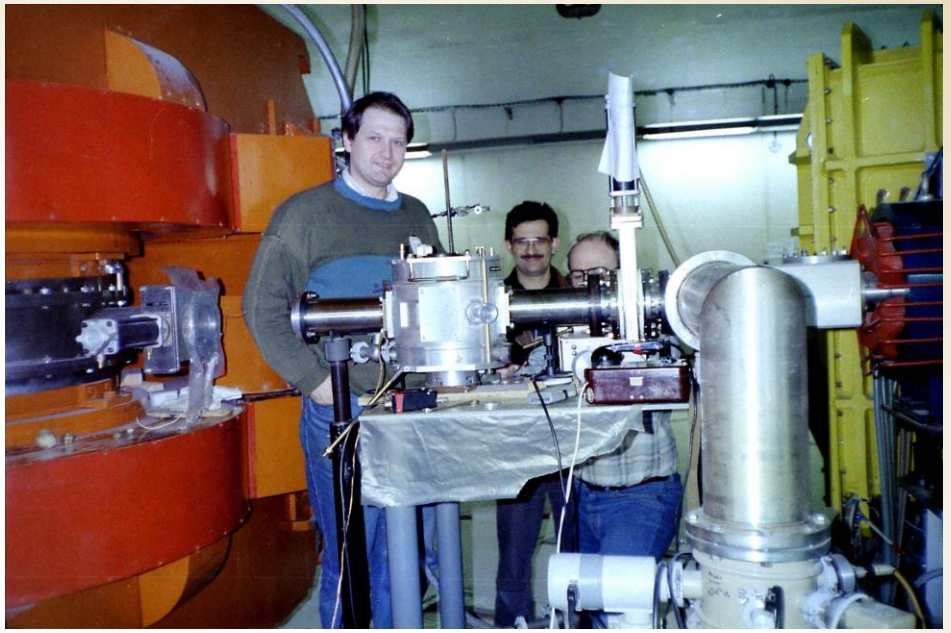
April
1992

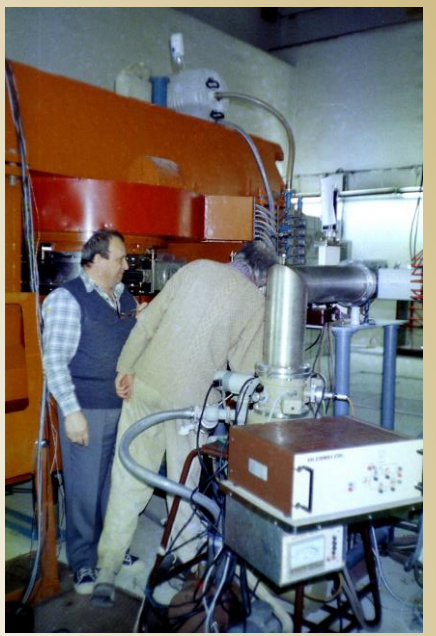
November 22, 1993

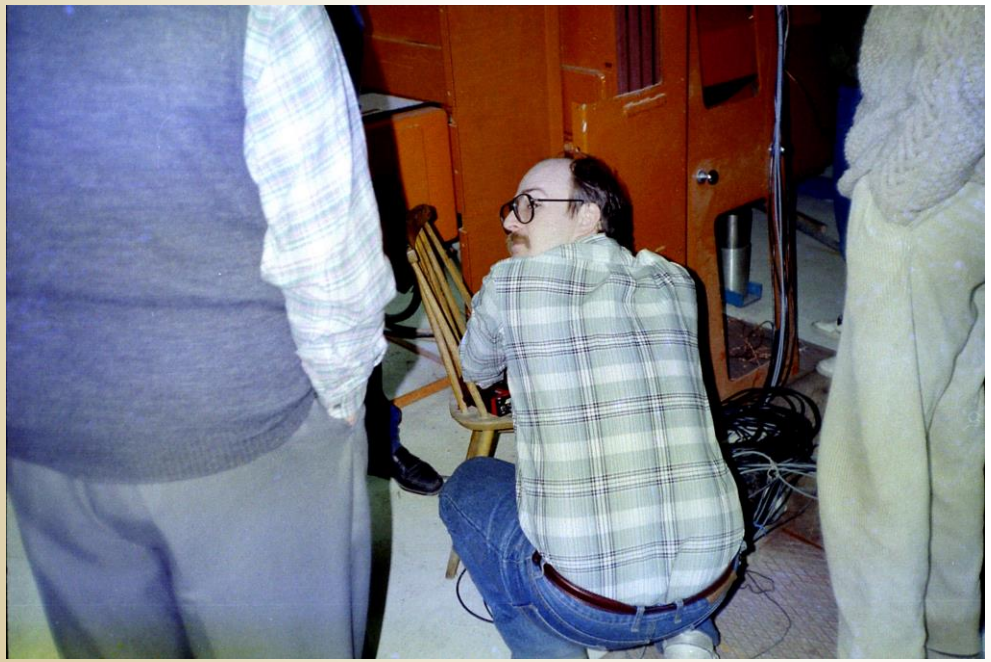


First acceleration of the $^{20}Ne^{+2}$ ion beam at 1.6 MeV/amu inside the cyclotron









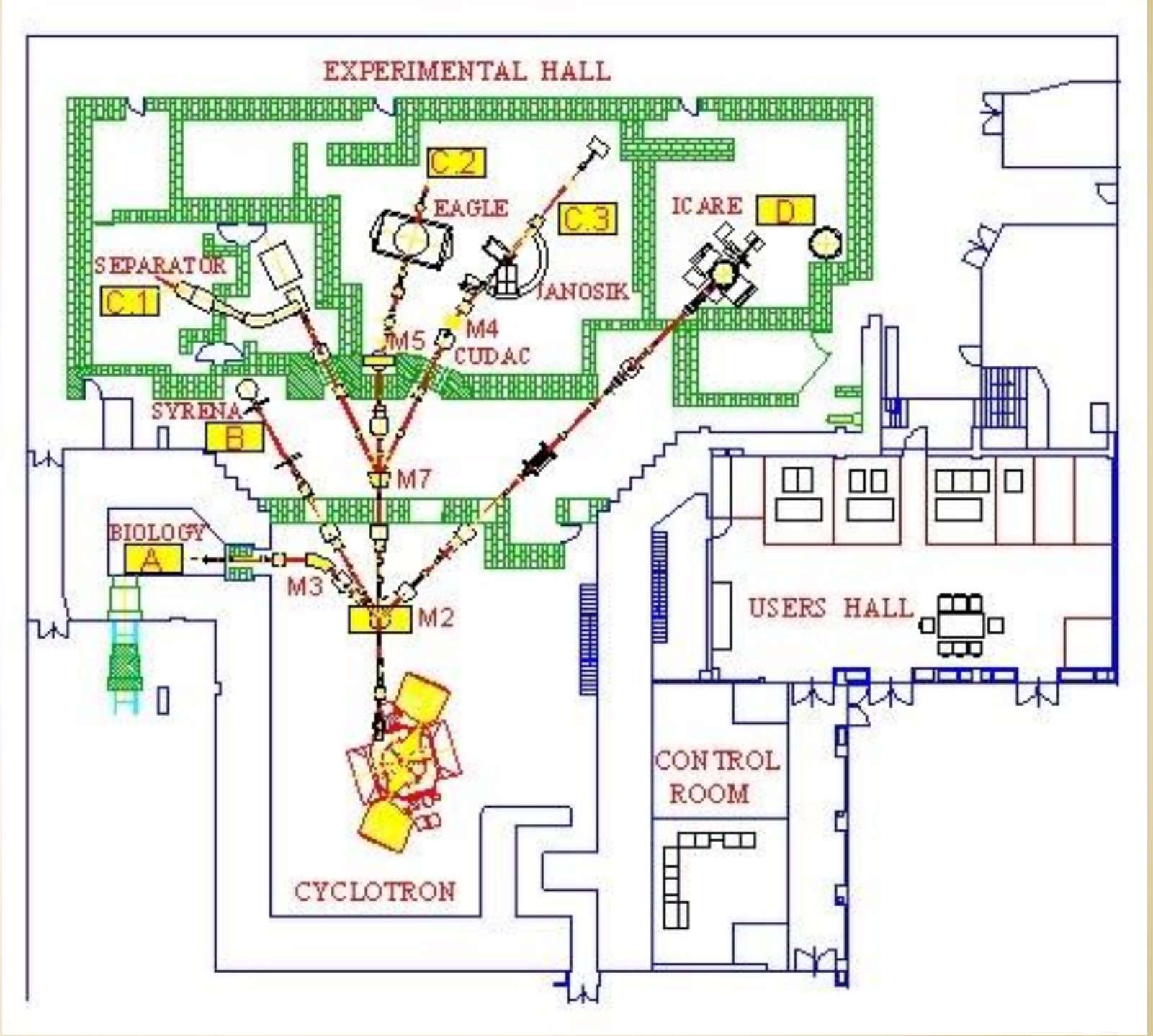
First extracted $^{14}N^{+2}$ 31 MeV ion beam from a cyclotron, April 8, 1994

HIL OPENING CEREMONY
MAY 20, 1994

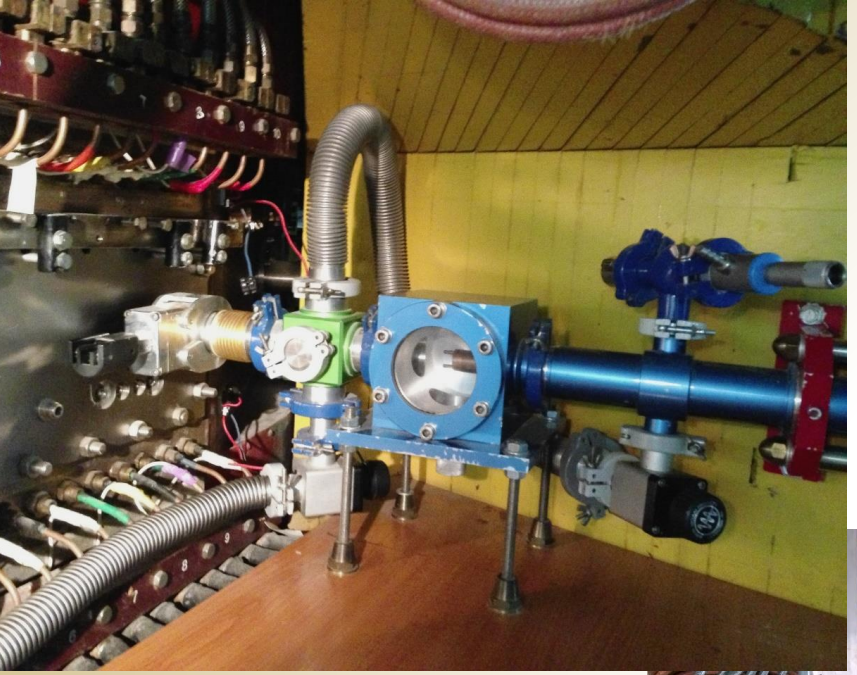
His Magnificence the Rector Włodzimierz Siwiński

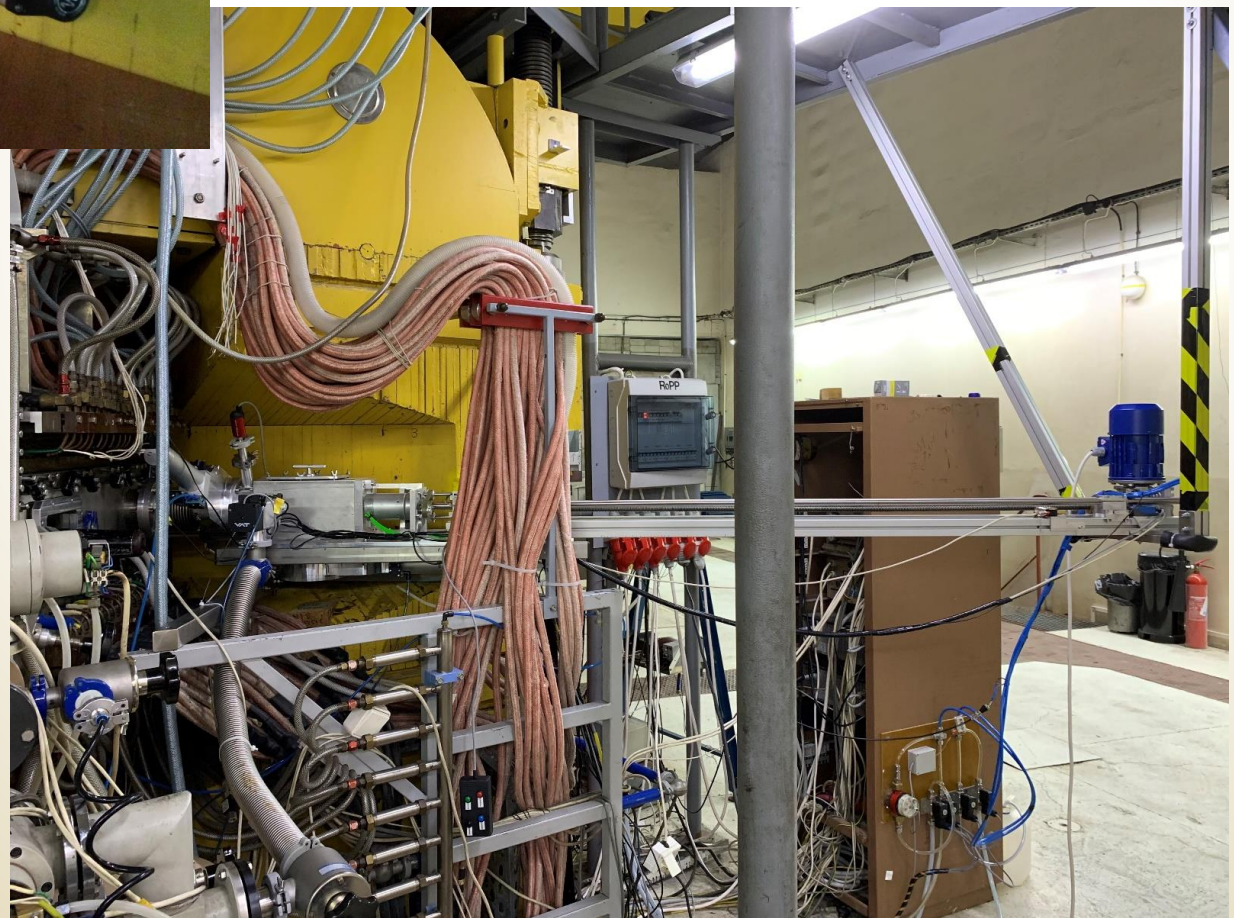
HIL crew

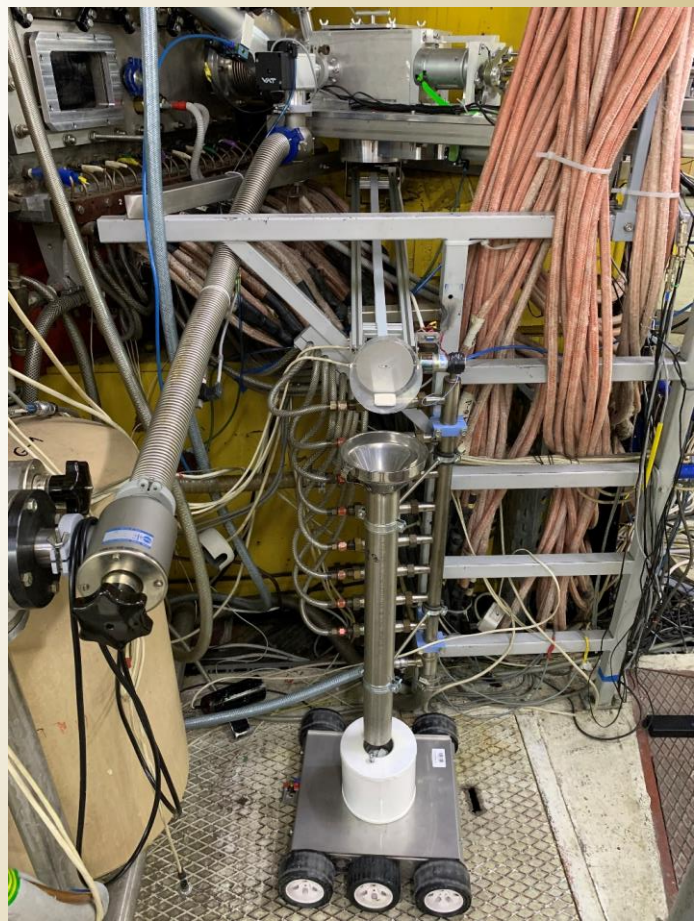
View of the experimental hall and the cyclotron vault



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 $^{209}Bi(\alpha,2n)^{211}At$ ...

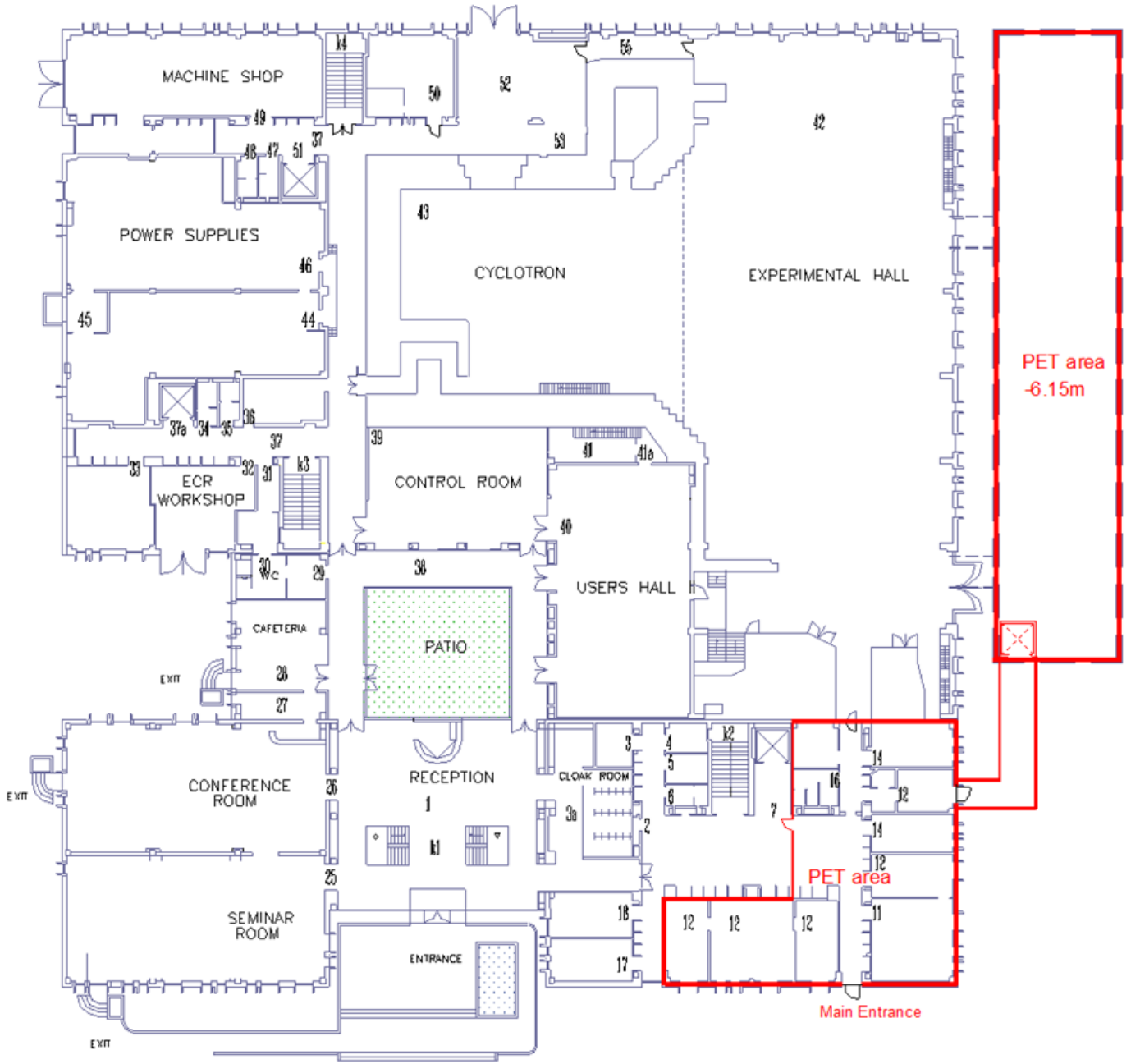
... but also isotopes:

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

RADIOPHARMACEUTICAL PRODUCTION AND RESEARCH CENTER (RPRC)

EXPANDING HIL RESEARCH CAPABILITIES

Contract signing ceremony at the IAEA
October 23, 2007

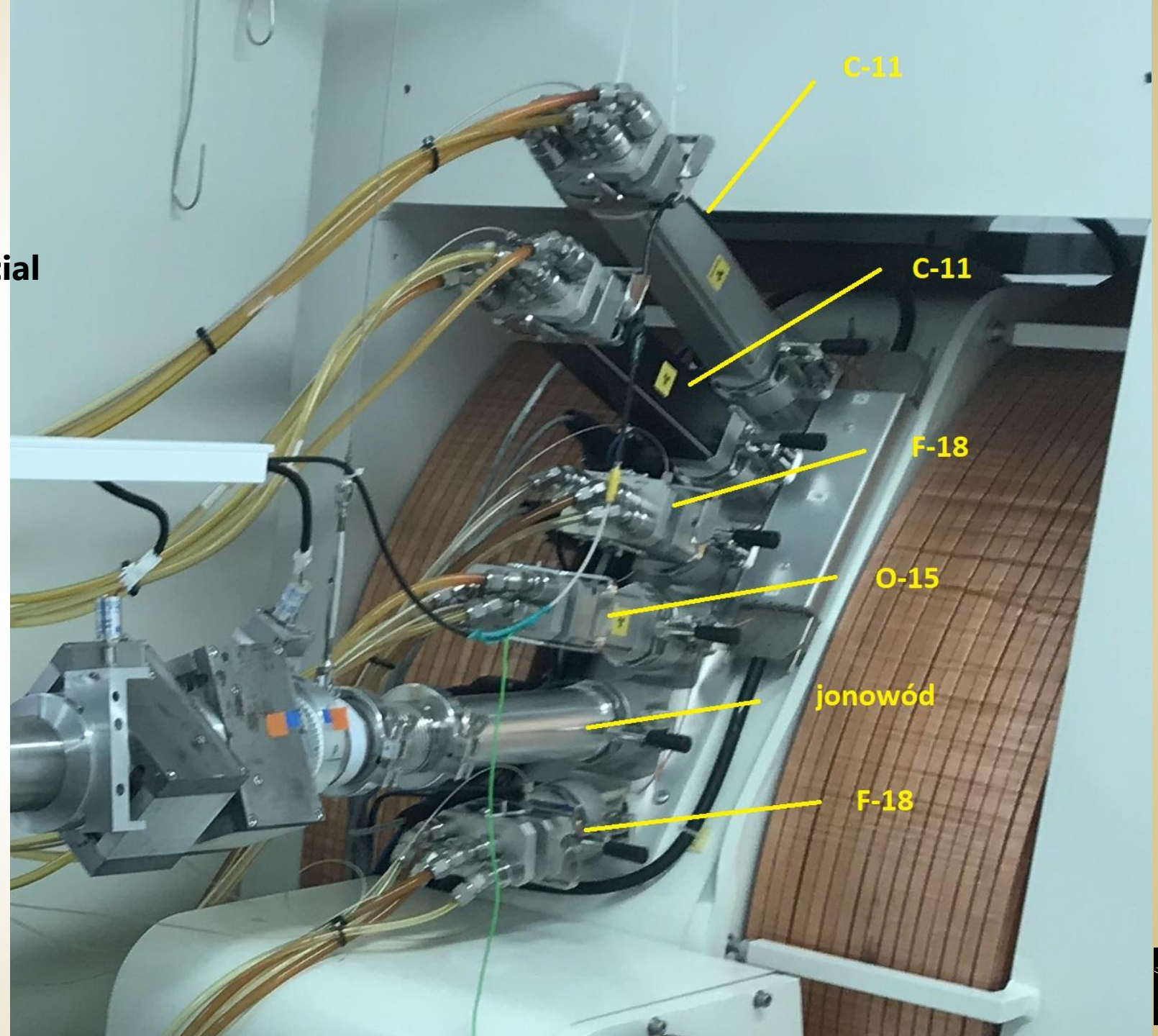


GROUND-FLOOR 0.00 m

with high current PETtrace commercial cyclotron dual beam,

p – 16.5 MeV 80 μA
and
d – 8.4 MeV 40 μA

INAUGURATION **2012**



Alternative Methods for the ^{99m}Tc Production

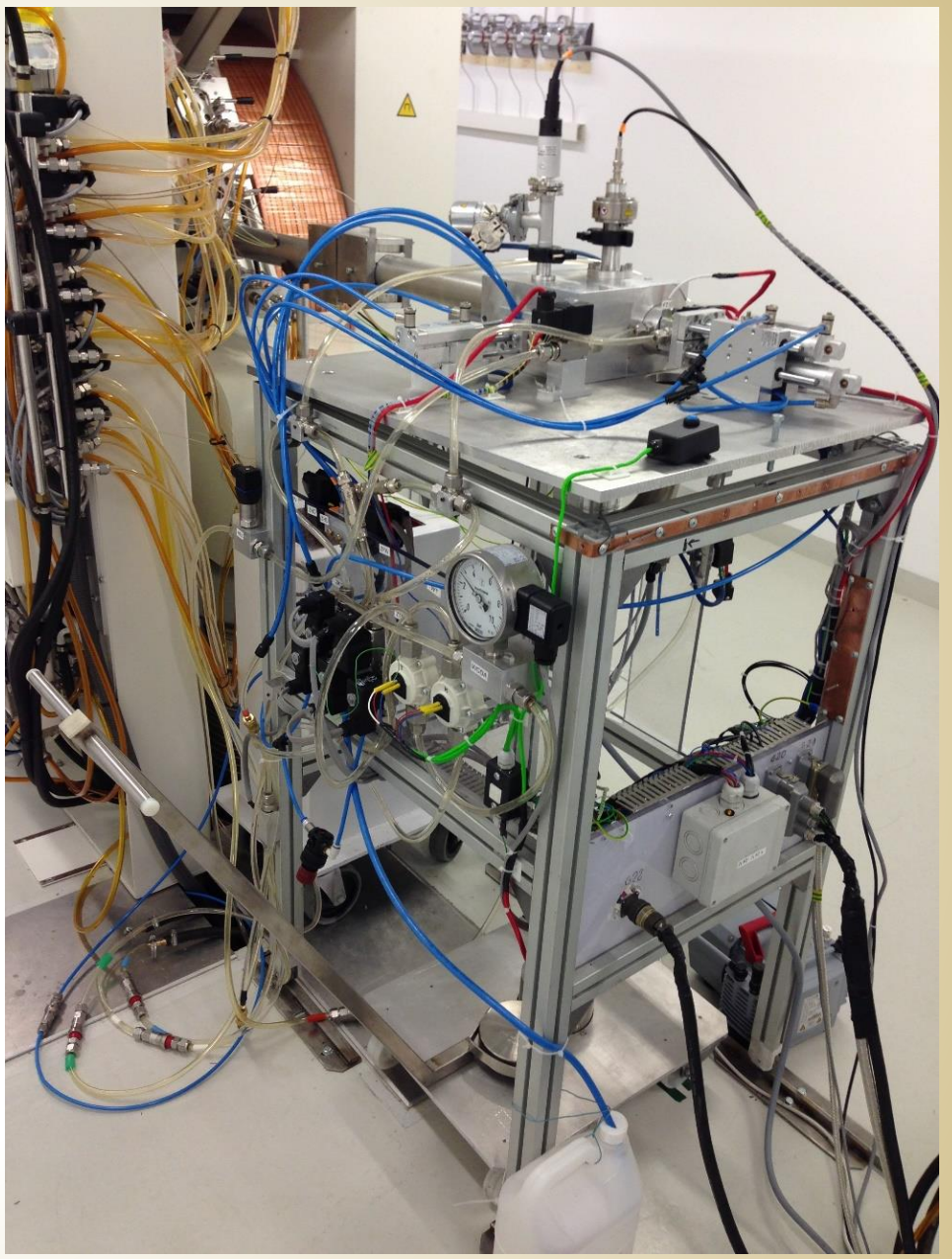
Agreement No PBS1/A9/2/2012 funded by the National Centre for Research and Development

- **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:

ichtj POLATOM HIL ŚLCJ

Production of:

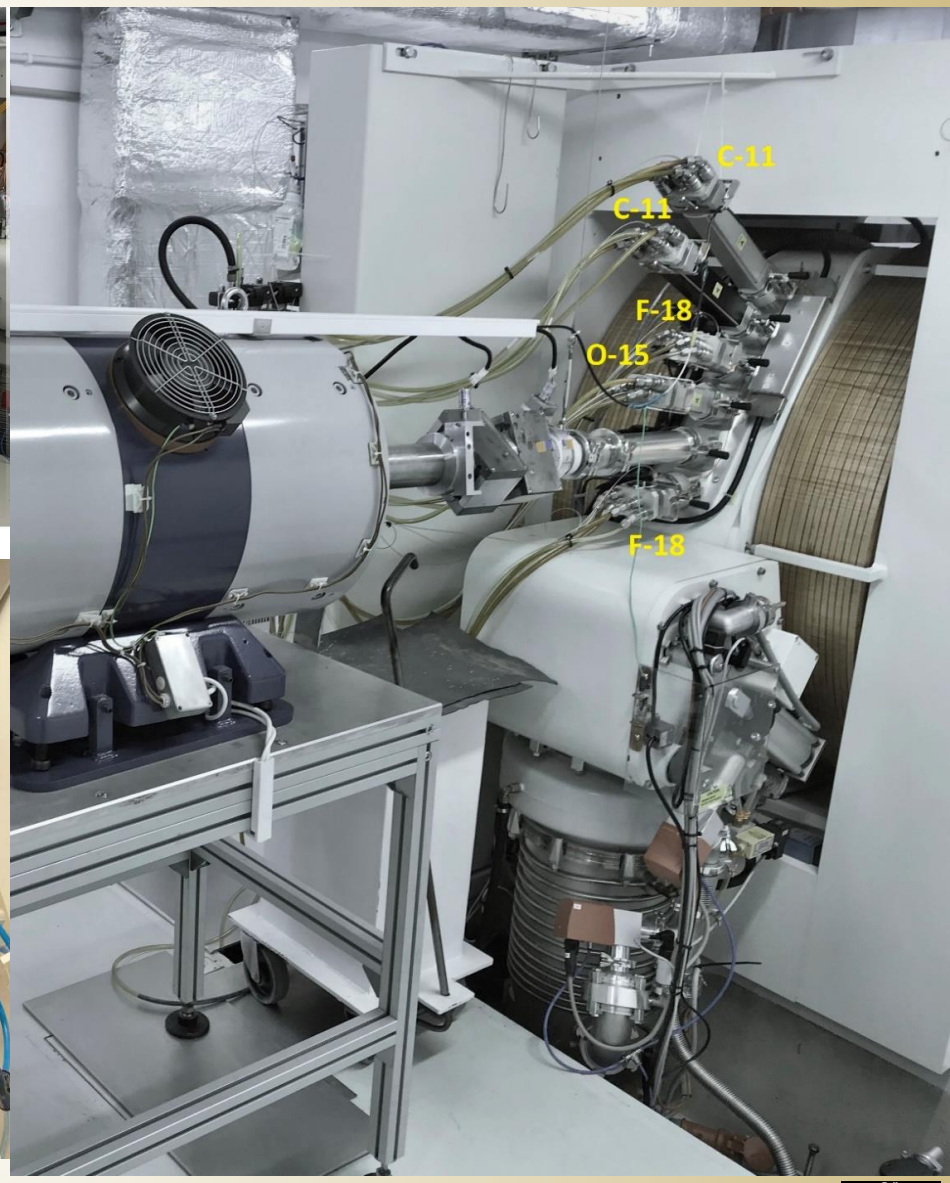
$^{43}Ca(p,n)^{43}Sc$

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

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

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

It is protected by RP patent No. 227402



An upgraded standalone external target system

30 LAT HIL ŚLCJ

UNIWERSYTET WARSZAWSKI

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:

^{44}Sc, ^{55}Co and ^{72}As

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

consortium of

- the Jagiellonian University
- the University of Warsaw
- the Institute of Nuclear Chemistry and Technology

Between 2016 and 2025 we produced isotopes:

^{43}Sc, ^{44}Sc, ^{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