HEAVY ION LABORATORY (HIL)

University of Warsaw, Ochota Science Campus, Warsaw, Poland

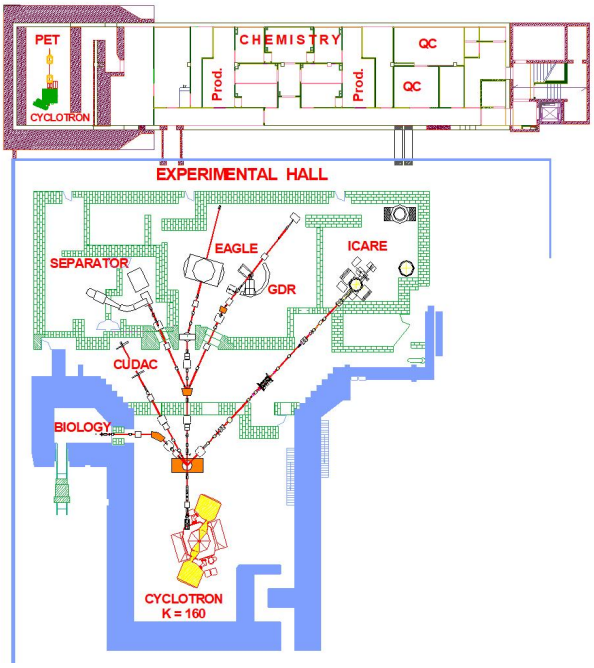
PL 02-093 Warszawa, ul. Pasteura 5a
E-mail: slcj@slcj.uw.edu.pl
Web address: www.slcj.uw.edu.pl
University Unit

Funding sources: University of Warsaw, Ministry of Education and Science of Poland, European Union Programmes

Heads of the facility:
Dr. Paweł J. Napiorkowski, Director
Dr. Jarosław Choiński, Technical Deputy Director
Dr. hab. Leszek Próchniak, Scientific Deputy Director

Scientific Mission and Research Programs:
The Heavy Ion Laboratory is a national nuclear physics facility with around 100 national and foreign users per year. Its mission is *to expand knowledge in the field of nuclear physics and develop its applications in the service of society*. The current research program comprises low energy nuclear physics, radiochemistry, radiobiology, material science and particle detectors development and testing.

Characterization of the facility
Heavy Ion Laboratory is conveniently located on the Ochota Science Campus of the University of Warsaw, not far from the city centre. The facility is equipped with the two cyclotrons. Isochronous K=160 heavy ion cyclotron delivers about 3000 h/year of heavy ion beams with energies from 2 MeV/A up to 10 MeV/A. It is coupled with two ECR ion sources. The second cyclotron is K=16.5 PETrace delivering intense beams of protons and deuterons used for commercial production of the radiopharmaceuticals for Positron Emission Tomography and for production and research on new radioisotopes. The production of the longer-lived radioisotopes for life-sciences applications is also carried on. HIL is an open user facility, serving the needs of scientific community based on evaluation of the merit of the proposed programs. Services provided: target laboratory, mechanical and electronic workshops, library, two conference rooms for 120 and 80 participants, respectively, 12 guest rooms with en-suite facilities and a common kitchen.



Layout of the facility

Facility parameters

Beams delivered by K=160 cyclotron

Ion	Energy (MeV)	Intensity (nA)
^{10}B	51-55	45
^{11}B	40-50	50
^{12}C	38-50	100-220
^{13}C	90	90
^{14}N	32-91	240-1500
^{15}N	43	50
^{16}O	46-120	400-650
^{18}O	100-120	2000
^{19}F	50-66	10
^{20}Ne	45-160	120-1300
^{22}Ne	44-45	260
^{24}Mg	77	120
^{32}S	79-150	50-70
^{40}Ar	90-200	35-40

An internal ^{4}He beam of energy up to 34 MeV and intensity 1 μA is also available.

Beams delivered by PETrace cyclotron:
Protons – 16.5 MeV, intensity 80 μA
Deuterons – 8.4 MeV, intensity 60 μA

Brief and compact table with the facility's major experimental instrumentation and its capabilities:

1. EAGLE array – a gamma-ray spectrometer, which can be easily coupled to ancillary detectors such as an internal conversion electron spectrometer, a charged-particle 4π multiplicity filter, a scattering chamber, and plunger;
2. ICARE – a large multipurpose scattering chamber
3. SEPARATOR – a Scandinavian type on-line magnetic separator
4. CUDAC – a PIN-diode array particle detection system;
5. Irradiation stations with target water cooling;
6. Irradiation station for radiobiology and material science;
7. Low background lead shielded HPGe counters;
8. Radio-isotope laboratory for the radiopharmaceuticals production and research

Nature of user facility:
Heavy Ion Laboratory (HIL) is the largest nuclear physics laboratory in Poland, serving as a national user facility since 1994. It has been Horizon2020-ENSAR2 Transnational Access Facility and presently it has this status in the HorizonEurope-EuroLabs project.

Program Advisory Committee/ Experiment Proposals:
The K=160 cyclotron beam time is allocated by the Laboratory director on the recommendation of the Program Advisory Committee. The proposals are received twice a year in a written form and presented in public. In their ranking the PAC considers the scientific value of the proposal, its expected international impact, its contribution to the teaching process and the previous achievements of the proposers.

Number of actual, active users of the facility in a given year:
About 100 users per year as indicated by the

access record.

Percentage of users, and percentage of facility use:
About 10% of K=160 cyclotron users are from HIL itself. Less than 5% of the beam time is used by the HIL staff alone.

Percentage of users and percentage of facility use from national users:
About 50% of users come from Polish institutions.

Percentage of users and percentage of facility use from outside the country where your facility is located:
About 50% of users come from abroad.

Fraction of the international users outside of geographical region:
40% of international users come from outside Europe.

Users group:
The users group has an elected chair – person, who reports to the Laboratory Scientific Council. The facility users meet 3 times per year on a voluntary basis. No official record of people participating in the users group exists.

Number of a) permanent staff and b) temporary staff (including graduate students and postdoctoral researchers):
a) 80
b) 15

Number of theoretical staff employed at the facility: permanent; postdoctoral, students:
One permanent, one postdoctoral, no students.

Number of postdoctoral researchers:
10

Number of graduate students resident at the facility (>80% of their time):
5

Number of non-resident graduate students with thesis work primarily done at the facility:
5

Involvement of undergraduate students in research (approximate average number at a given time):
20 per year

Special student programs:
An undergraduate Student Workshop of one week duration is organized each year for about 20 participants coming from various Polish universities. Students, supervised by the Laboratory staff, perform various nuclear physics experiments, including the cyclotron operation.
During the Summer up to 7 students from various Physics Faculties take part in one month duration training, participating in experiments conducted by the Laboratory staff.

Future Plans:
1. Higher beam intensities from K=160 cyclotron.
2. Development of new beams, towards Kr.
3. Construction of a capillary line connecting the PETrace cyclotron with the ECR ion source of the K=160 cyclotron in order to accelerate radioactive, short-lived isotopes.
In the long term, replacement of the K=160 cyclotron with a new device that would incorporate improved energy, ion range and beam intensity parameters.