

# HEAVY ION LABORATORY

University of Warsaw, Ochota Science Campus  
Warsaw, Poland

PL 02 093 Warszawa, ul. Pasteura 5a

email: [slcj@slcj.uw.edu.pl](mailto:slcj@slcj.uw.edu.pl)

University Unit

Governmental funds

Web address: [www.slcj.uw.edu.pl](http://www.slcj.uw.edu.pl)

## Heads:

Director: Krzysztof Rusek

Scientific deputy director: Ludwik Pieńkowski

Head of accelerators: Jarosław Choiński

PET project coordinator: Jerzy Jastrzębski

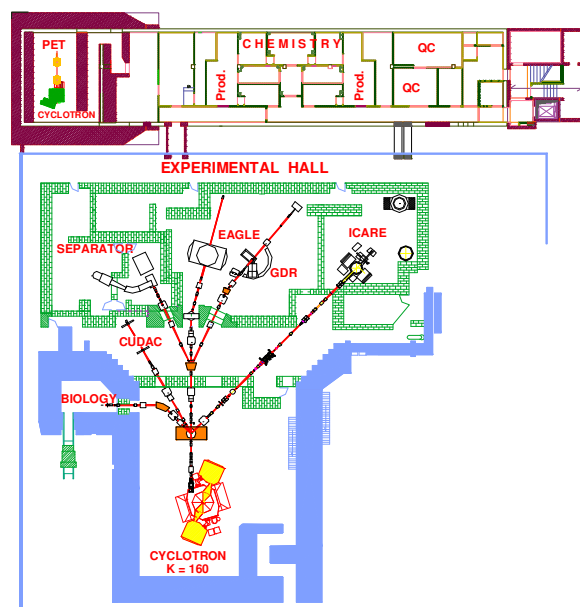
**In a brief abstract (5 – 10 lines) describe the scientific mission and, broadly, the main current and future research programs of the institution/facility:**

The Heavy Ion Laboratory is a “User Facility” with around 100 national and foreign users per year. The isochronous  $K_{\max}=160$  cyclotron delivers around 3000 h of heavy ion beams yearly with energies between 2 and 10 MeV/nucleon. The current research program comprises nuclear physics, atomic physics, material sciences, solid state physics, biology, particle detectors development and testing. For more details see Long Range Plan of Polish Nuclear Physics at

[www.slcj.uw.edu.pl/pnnp/en/52.html](http://www.slcj.uw.edu.pl/pnnp/en/52.html)

Actually the Heavy Ion Laboratory is in its transformation phase to become the Warsaw University accelerator centre, operating two cyclotrons. In 2009 a second commercial proton – deuteron cyclotron ( $E_p = 16.5$  MeV) will be installed in the Laboratory building for the production of – and research on the radiopharmaceuticals for the Positron Emission Tomography (PET). Production of long – lived radiopharmaceuticals for other medical and life–science applications is also foreseen.

**Technical facilities: please provide figures and/or photos providing a technical layout of the facility and its instrumentation, and a visual overview:**



**Briefly characterize the facility:**

- Medium – energy (2 - 10 MeV/nucleon) cyclotron with heavy ion beams;
- Low – energy, high current proton – deuteron cyclotron.

**Provide a compact (exemplary) table of facility parameters (e.g. beam species, intensities, range of energies, special properties):**

Cyclotron	Ion	Energy [MeV]	Extracted current [pA]
K=90 - 160	$^{10}\text{B}^{+2}$	50	4
	$^{11}\text{B}^{+2}$	38 - 55	3 - 4
	$^{12}\text{C}^{+2}$	22 - 50	2 - 20
	$^{12}\text{C}^{+3}$	89.6- 112	0.8 - 12
	$^{14}\text{N}^{+2}$	28 - 50	13 - 143
	$^{14}\text{N}^{+3}$	57 - 110	80
	$^{16}\text{O}^{+2}$	32	5.7
	$^{16}\text{O}^{+3}$	46 - 80	5.7 - 138
	$^{16}\text{O}^{+4}$	90	6.5
	$^{19}\text{F}^{+3}$	38 - 66	1.3
	$^{20}\text{Ne}^{+3}$	50 - 65	11 - 35
	$^{20}\text{Ne}^{+4}$	70 - 120	11 - 35
	$^{20}\text{Ne}^{+5}$	140 - 190	24 - 40
	$^{22}\text{Ne}^{+3}$	44	10
	$^{22}\text{Ne}^{+4}$	132	8
	K=16.5	$^{32}\text{S}^{+5}$	64- 121.6
$^{40}\text{Ar}^{+6}$		80 - 132	2.5
$^{40}\text{Ar}^{+7}$		120 - 172	0.9 – 2.3
$^{40}\text{Ar}^{+8}$		195	0.9 – 2
$^1\text{H}^{+1}$		16.5	> 75 $\mu\text{A}$
	$^2\text{D}^{+1}$	8.4	> 60 $\mu\text{A}$

In 2009 new ECR ion source will be installed extending the variety of accelerated ions.

**If appropriate, provide a brief and compact table with the facility's major experimental instrumentation and its capabilities:**

- GDR multidetector system JANOSIK;
- Gamma - ray, up to 30HPGe multidetector system EAGLE will be commissioned in 2009;

- Two universal scattering chambers CUDAC and SYRENA;
- Charged particle multidetector system ICARE;
- Scandinavian type on-line mass separator IGISOL;
- Irradiation chambers with target water cooling;
- Low background lead shielded HPGe counters;
- Radiochemistry and Quality Control equipment for the radiopharmaceuticals production;

For details see: [www.slj.uw.edu.pl/en/96.html](http://www.slj.uw.edu.pl/en/96.html)

**Is the facility considered to be a user facility (officially and by whom; unofficially?):**

Heavy Ion Laboratory (HIL) was founded jointly by the Ministry of Education and Sciences, Polish Academy of Sciences and Polish Atomic Energy Agency. In the founding agreement the above three authorities enacted HIL to become, from the very beginning a national “User Facility”.

**Does the facility have a Program Advisory Committee or the equivalent, adjudicating experimental 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 ([www.slj.uw.edu.pl/pac](http://www.slj.uw.edu.pl/pac)) in a written form and publicly presented. In their ranking 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 (theses numbers may differ) that come from inside the institutions:**

About 10% of K=160 cyclotron users come from inside HIL. 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 80% of users come from Polish institutions.

**Percentage of users and percentage of facility use from outside the country where your facility is located:**

About 20% of users come from abroad.

**What fraction of the international users is from outside your geographical region (i.e. Asia; Australia & New Zealand; North-America; South-America; Africa; Europe):**

No users from outside Europe.

**Does a formal users group exist for your facility (s) and what is the number of registered members (in general this may be quite different from the number of actual users in a given year):**

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 to the users group exists.

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

- a) 50
- b) 13

**Number of theoretical staff employed at the facility: permanent; postdoctoral, students:**

No theoretical staff is employed at HIL.

**Number of postdoctoral researchers employed at the facility:**

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:**

15

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

20 per year

**Special student programs, e.g. summer programs, student labs etc. (high school, under graduates, graduate students?):**

An undergraduate Student's Workshop of one week duration is organized in March each year for about 20 participants coming from Physics Faculties of Polish universities. Students, supervised by the Laboratory staff are performing various nuclear physics experiments, including the cyclotron operation.

During Summer up to 7 students from various Physics Faculties take part in one month duration training, participating in experiments, conducted by the Laboratory staff.

**Describe any plans you might have and their status for future developments at the facility (major instrumentation; facility upgrades; expansions and new construction etc.):**

Heavy Ion Laboratory is conveniently placed in the heart of the Warsaw University, Polish Academy of Sciences and Academy of Medicine Scientific Campus Ochota. Shortly the intense proton and deuteron beams from a medical cyclotron, equipped with an external beam line will be also available. These beams will be used for the production

of PET radioisotopes, subsequently transformed to radiopharmaceuticals using the commercially available chemistry and quality control modules. This 4 Million Euro project is currently financed by the Polish Ministry of Science and Higher Education, Ministry of Health, EC Structural Fund and International Atomic Energy Agency. The Polish Ministry of Health has also financed the PET scanner, located in the neighboring Medical University of Warsaw. Leading the Warsaw PET Consortium, the Laboratory foresees the development of a large interdisciplinary research program including medicine and life sciences, unique at least in this part of Europe.

For the K=160 cyclotron, a new ECR ion source allowing a substantial increase of the accelerated ion species and masses will be installed in 2009.

**Please provide in brief abstract form any other information you might want included in the report:**

HIL is an open user facility, serving the needs of scientific community based mainly on evaluation of the merit of proposed programs only. 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.