



## INTERNATIONAL WORKSHOP on Production of Intense Beams and Highly Charged Ions

**7 – 9 April 2025**  
**Acitrezza (Catania), Italy**

### SCIENTIFIC PROGRAMME

Open challenges in ion sources  
Fundamental processes and plasma studies  
Production of highly charged ion beams  
Production of high intensity ion beams  
Microwave coupling for future ECRIS  
Beam formation and extraction  
Magnetic system for future ECRIS  
Controls and diagnostics  
Codes and simulations  
Transport of intense beams  
Emerging technologies

### INTERNATIONAL ADVISORY COMMITTEE

Luigi Celona	Chair, INFN-LNS, Italy
Janilee Benitez	LBL, USA
Ralph Hollinger	GSI, Germany
Osamu Kamigaito	RIKEN, Japan
Oliver Kester	TRIUMF, Canada
Atsushi Kitagawa	NIRS-QST, Japan
Hannu Koivisto	JYFL, Finland
Guillaume Machicoane	NSCL-MSU, USA
Vadim Skalyga	IAP-RAS, Russia
Olli Tarvainen	STFC UKRI, UK
Thomas Thuiller	LPSC, France
Richard C. Vondrasek	ANL, USA
Hong-Wei Zhao	IMP, China



## Final Announcement

[agenda.infn.it/e/pibhi2025](https://agenda.infn.it/e/pibhi2025)



**INTERNATIONAL ORGANIZING COMMITTEE**

Luigi Celona	(Chair, INFN-LNS, Italy)
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Thomas Thuiller	(LPSC, France)
Richard C. Vondrasek	(ANL, USA)
Hong-Wei Zhao	(IMP, China)

**LOCAL ORGANIZING COMMITTEE**

Santo Gammino	(INFN-LNS)
Gaetano Agnello	(INFN-LNS)
Antonio Caruso	(INFN-LNS)
Giuseppe Castro	(INFN-LNS)
Grazia D'Agostino	(INFN-LNS)
Loreto Di Donato	(Univ. of Catania)
Ornella Leonardi	(INFN-LNS)
Santi Pavone	(Univ. of Catania)
Virginia Potenza	(INFN-LNS)
Gino Sorbello	(Univ. of Catania and INFN-LNS)
Giuseppe Torrisi	(INFN-LNS)

## ***Conference presentation***

The International Workshop on Production of Intense Beams and Highly Charged Ions (PIBHI2025) will be held in Acitrezza, a small fishing village overlooking the Ionian Sea at 10 km from Catania placed at the foot of the Etna Volcano – the highest and most active of Europe.

The workshop will take place in the halls of the [Grand Hotel Faraglioni](#), with several archaeological and cultural attractions situated in the nearby.

The [Laboratori Nazionali del Sud](#) of [Istituto Nazionale di Fisica Nucleare](#) (INFN-LNS) is in charge of the organization of this event, aimed to tackle specific issues of Ion Sources Science & Technology able to address the solutions to the request of high intensity beams and to reinforce the common ground and synergies among the different actors in the field.

## ***Scientific programme***

The PIBHI 2025 scientific programme will cover themes of ion source science and technology that are relevant to the production of beams for scientific research and for applications.

Hereinafter the main topics are reported:

- Fundamental processes;
- Production of highly charged ion beams;
- Production of high intensity ion beams;
- Microwave coupling for future ECRIS;
- Beam formation and extraction
- Magnetic system for future ECRIS;
- Controls and diagnostics;
- Codes and simulations;
- Transport of intense beams;
- Emerging technologies;

This workshop aims to gather scientists involved in those tasks, to compare different experiences, aiming to solve the problem of the stable and reproducible production of such intense beams as well as of the extraction and transport of space-charge-dominated beams.

*The main scope of the workshop is to stimulate the discussions among the attendees on a several topics of interest by the community, in dedicated round tables which usually are not part of the programme of classical conferences like ICIS or ECRIS.*

## Workshop Agenda

The final agenda of the workshop is included in the following. Participants are encouraged to contribute to one or more topic under discussion collegially in the round tables in agreement with the Chairperson of each topic.

Due to the nature of the workshop, the publication of proceedings is not foreseen, however track of the given presentations and discussions will be kept in the [INDICO page of the workshop](#).

	<i>Sunday 6 Apr.</i>	<i>Monday 7 Apr.</i>	<i>Tuesday 8 Apr.</i>	<i>Wednesday 9 Apr.</i>
08:30		Registration	Chair: H. Zhao	Chair: T. Nagatomo
9:00 - 9:30		Opening session	High frequency ECRIS: results and developments	Beam reliability, reproducibility and stability issues
9:30 - 10:30		Chair: T. Thuiller Open challenges in the ion sources		
10:30 - 11:00		Coffee Break	Coffee Break	Coffee Break
11:00 - 13:00		Chair: O. Tarvainen Beam Emittance: role of magnetic fields and other contributions	Chair: R. Hollinger Extraction and transport of intense ion beams	Chair: L. Sun Intense HCI beam production in HF-ECRIS and microwave coupling role
13:00 - 14:30		Lunch break	Lunch break	Lunch break
14:30 - 16:30		Chair: V. Skalyga (remote) Fundamental processes and plasma studies	Chair: J. Benitez Magnetic systems for future ECRIS	Conference excursion
16:30 - 17:00		Coffee break	Coffee break	
17:00 - 18:30		LNS VISIT	Chair: R. Vondrasek Metallic ion beam production techniques	
18:30 - 20:00	GET TOGETHER	Dinner offered by LNS		Banquet & Closing
20:00 - 23:00				



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**SECOND ANNOUNCEMENT**

**Monday, 07 April 2025**

**OPENING SESSION: 9:00 - 9:30**

Welcome of INFN-LNS Director: Santo Gammino

**MORNING ORAL SESSION: 9:30 - 10:30**

**Chair: T. Thuillier (LPSC) (45'+15')**

**Open challenges in the ion source field**

*Review talk of the main problems/open issues on ion sources with particular care to the ones treated in the workshop.*

**COFFEE BREAK : 10:30-11:00**

**MORNING ROUND TABLE: 11:00 - 13:00**

**Chair: O. Tarvainen (STFC-UKRI)**

**Beam emittance: role of magnetic fields and other contributions**

**Contributions (75'):**

*O. Tarvainen (STFC-UKRI)- What contributes to the emittance of an ion beam?*

*S. Kondrashev (BNL)- Application of pepper pot emittance probe for ECRIS beam studies*

*L. Sun (IMP-CAS)- Emittances with ECRISs: one major challenge to realize high intensity heavy ion beam acceleration with SRF linac*

**Discussion themes (45'):**

*What defines the emittance of an ECRIS? What are the factors contributing to the measured emittance? It is traditionally thought that the magnetic field is the dominating contribution. Still, recent works have shown that the extraction design and plasma meniscus focusing/defocusing can have a very large contribution depending on the charge state.*

**LUNCH (Not Hosted): 13:00- 14:30**





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**SECOND ANNOUNCEMENT**

**Monday, 07 April 2025**

**AFTERNOON ROUND TABLE: 14:30 - 16:30**

**Chair: V. Skalyga (IAP-RAS) Remote**

**Fundamental processes and plasma studies**

**Contributions (50'):**

V. Skalyga (IAP-RAS)- *Fundamental processes and plasma studies*

O. Tarvainen (STFC-UKRI)- *Ion confinement in minimum-B ECRIS plasmas*

V. Mironov (JINR)- *Recent results from NAM-ECRIS simulations connected to the two frequency heating and afterglow*

**Discussion themes: (70'):**

*The characteristics of beams generated by a high charge state ion source critically depend on plasma parameters. An adequate understanding of the electron and ion distribution functions can provide crucial information for performance optimization, facilitating the production of stable high-intensity ion beams, as required by many accelerator facilities.*

*This discussion should also focus on plasma diagnostics, determining which diagnostic tools are most appropriate in specific experimental contexts and identifying which ones might warrant further progress.*

**COFEE BREAK : 16:30-17:00**

**LNS VISIT: 17:00 - 23:00**

*Visit to INFN-LNS: Cyclotron is in assembly phase and access to the accelerator rooms will be partially interdict. Visitor center and new laboratory dedicated to R&D on ion sources will be made available for visit. Dinner will be offered by the LNS director.*



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**SECOND ANNOUNCEMENT**

**Tuesday, 08 April 2025**

**MORNING ROUND TABLE I: 8:30 - 10:30**

**Chair: H. Zhao (IMP-CAS)**

**High frequency ECRIS: results and developments**

**Contributions (60'):**

H. Zhao (IMP-CAS)- *28-45 GHz ECRIS results and development at IMP*

D. Todd (LBNL)- *28 GHz ECRIS results and development at LBNL*

T. Nagatomo (RIKEN)- *28 GHz ECRIS results and development at RIKEN*

**Discussion themes (60'):**

*Practical performance of high frequency ECRIS (>28GHz) and long-term high power (>8 kW) operation*

*Hot electrons and microwave heating issues for high-frequency ECRIS*

**COFEE BREAK : 10:30-11:00**

**MORNING ROUND TABLE II: 11:00 - 13:00**

**Chair: R. Hollinger (GSI)**

**Extraction and transport of intense beams**

**Contributions (60'):**

R. Hollinger (GSI)- *Extraction and transport of intense beams at GSI*

E. Flannigan (STFC-UKRI)- *Space charge compensation of pulsed hydrogen ion beams*

D. Todd (LBNL)- *Extraction and transport of intense beams at LBNL*

O. Tuske (CEA-IRFU)- *Extraction and transport of intense light ion beams*

**Discussion themes (60'):**

*The design of the extraction system of ECRIS or MDIS sources has a huge impact on the source performances (current extracted, emittance, system reliability, etc.).*

*What are the main guidelines and the tools available in such design? What kind of solution may be envisaged for the transport of intense beams from ECRIS or MDIS?*

**LUNCH (Not Hosted): 13:00- 14:30**



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**SECOND ANNOUNCEMENT**

**Tuesday, 08 April 2025**

**AFTERNOON ROUND TABLE I: 14:30 - 16:30**

**Chair: J. Benitez (LBNL)**

**Magnetic systems for future ECRIS**

**Contributions (60'):**

J. Benitez (LBNL)- *Introduction*

L. Sun (IMP-CAS)- *FECR - Update*

J. Benitez (LBNL)- *45 GHz MARS - Update*

P. Ferracin (LBNL)- *Beyond 45 GHz (VENUS with Nb<sub>3</sub>Sn sextupole for FRIB, ECR designs such as Uni-layer concept, option HTS for future ECR) Remote*

**Discussion themes (60'):**

*The magnetic system of future ECRIS envisages the need to operate daily and reliably with high magnetic fields. Limiting factors, technologies, and new magnet solutions are analyzed. Lessons Learned*

**COFEE BREAK : 16:30-17:00**

**AFTERNOON ROUND TABLE II: 17:00 - 18:30**

**Chair: R. Vondrasek (ANL)**

**Metallic ion beam production**

**Contributions (60'):**

R. Vondrasek (ANL)- *Metal ion beam production techniques*

B. Gall (CNRS)- *Mivoc preparation and beams, Inductive oven development, Isotopic metal preparation for HT oven (Ti, Cr) Remote*

L. Sun (IMP-CAS)- *High temperature oven development issues at IMP*

Aleksandr Andreev (GSI) - *Metallic ion beam production techniques at GSI*

**Discussion themes (60'):**

*The production techniques for solid material introduction have evolved over the decades in response to the needs of the scientific community. The need for higher beam intensities and charge states, long-duration runs, and the use of expensive isotopic material have driven the development of new techniques and the refinement of old ones with the constraint of not negatively impacting source performance.*



Wednesday, 09 April 2025

**MORNING ROUND TABLE I: 8:30 - 10:30**

**Chair: T. Nagatomo (RIKEN)**

**Availability, reproducibility and stability issues**

**Contributions (60'):**

*T. Nagatomo (RIKEN)- HCI Beam Production and Challenges at RIKEN*

*L. Sun (IMP-CAS)- Production of intense highly charged metallic ion beams for routine operation*

*D. Todd (LBNL)- VENUS operation and HCI beam production for SHE in LBNL*

**Discussion themes (60'):**

*Beam quality issue of high frequency ECRIS and match with downstream accelerator  
Availability, reproducibility and stability of HCI beams for various elements up to uranium from several facilities worldwide. Requests are usually accompanied by an increasing request of beam intensity to increase the beam power on target.  
The round table focuses on discussing open issues and future upgrades to ensure source reliable operations.*

**COFEE BREAK : 10:30-11:00**

**MORNING ROUND TABLE II: 11:00 - 13:00**

**Chair: L. Sun**

**Perspectives of HCI production in HF-ECRIS and microwave coupling role**

**Contributions (60'):**

*L. Sun (IMP-CAS)- Perspectives in high charge-state ECR ion source development and scope*

*G. Machicoane (FRIB)- Current operational experience with ECR ion sources at FRIB and path forward for high power operation, **Remote***

*X. Wang (IMP-CAS) - Microwave launching studies with the 3rd generation ECR ion sources*



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**SECOND ANNOUNCEMENT**

### Discussion themes (60'):

*The production of high-intensity HCI beams requires mastering several source parameters, the perspectives in high-charge state production of high-frequency sources are treated.*

*Development of new coupling schemes for high-frequency ECRIS belonging to a launching-dominated scenario instead of the classical modal-dominated scenario of second-generation ECRIS.*

*Really needs of 60 GHz or higher frequency ECRIS which means very big challenge to the superconducting magnet and RF coupling?*

**LUNCH (Not Hosted): 13:00- 14:30**

**CONFERENCE OUTING AND BANQUET: 14:30 - 23:00**

### **CLOSING DURING BANQUET**

All round tables will take place from Monday to Wednesday in the hall of the [Grand Hotel Faraglioni](#). The following presentation devices will be made available: LCD screen projector displaying the presentations, a laptop computer operating under Windows will be available for uploading the presentations from memory stick and a laser pointer.

To present and share contributions it is recommended to use the most common software tools such as the MS Office Suite and Adobe Acrobat.

You can upload your presentation onto the conference laptop during the workshop, but all the speakers will be requested to upload the presentations (at the very latest) one session before their scheduled presentation time. Session chairmen will coordinate with the speakers and the assigned working staff. Please contact them just before the session with your talk starts.

Monday morning session speakers are pleased to upload your presentation during the get-together Welcome Reception on April 6<sup>th</sup> or not later than 8:30 in April 7<sup>th</sup>.



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## ***Registration & Hotel accommodation***

The registration form will be also by following the appropriate link in the PIBHI2025 website. The conference fee is payable in Euro (€) and it includes:

- materials of the conference,
- the welcome reception (Sunday 6<sup>th</sup>),
- coffee breaks,
- the conference excursion (Wednesday 9<sup>th</sup>)
- the conference banquet (Wednesday 9<sup>th</sup>),
- visit of the Laboratori Nazionali del Sud of INFN in Catania (Monday 7<sup>th</sup>) . (Dinner offered by LNS Director).

The full fee is € 250,00 while the discounted fee for students and retiree is € 150,00.

Students must send to the address: [pibhi2025@lns.infn.it](mailto:pibhi2025@lns.infn.it), along with their registration form, a letter of support by their Head of Department or Supervisor, specifying their status and eligibility. The accompanying person registration fee is € 150,00 and it includes coffee breaks and all the social events.

The payments should be made exclusively in Euro by credit card following the information reported in the PIBHI website or by bank transfer. On-site payment will be also available.

Numerous solutions are available for the hotel accommodation: several structures are close to the Conference Venue and may be reserved through smart travel assistants. However, a limited number of reduced rate rooms are pre-booked at the Conference venue and in a partner structure [Hotel Malavoglia](#) for 95€ per night breakfast included and tourist tax (a few euros) excluded. The supplement for a second guest in the room is € 35 per night. To book this rooms please contact the hotel via mail: [hotel@grandhotelfaraglioni.com](mailto:hotel@grandhotelfaraglioni.com) citing that the reservations is for the PIBHI 2025 workshop.

The conference venue is around 200 m from the Acitrezza Terminal Bus which can be reached from the Catania “V. Bellini” airport through public transportation. In particular, from the airport, it is needed to use the “ALIBUS” service up to the end of the line “Catania Central Station” (Piazza



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Giovanni XXIII) and from here the regular bus “534” again up to the end of the line “Acitrezza Terminal Bus”.

The ALIBUS is a cheap (€4,00), frequent (20 min.) and almost direct connection service (only a few stops) between Airport and Catania Downtown, while the 534 is a regular bus (€1,20) with much more stops and therefore needing around 60 min. to reach the Acitrezza Terminal Bus.

The workshop organization is evaluating a shuttle service, for a better organization we encourage to add in the registration the arrival and departure time.

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## **Conference venue**

The peculiar landscape of Aci Trezza with its Faraglioni and the proximity to the majestic Mount Etna has nurtured legends and myths over the centuries. The Greek poet Homer, in the IX book of the Odyssey, sets in the Sicilian village the unfortunate encounter between Odysseus and Polyphemus.

Another legend that has reached us is the one where the monstrosity of Polyphemus is linked with the Sicilian village, is the myth of Acis and Galatea. Right on the strip of land between Mount Etna and the Ionian Sea lived a beautiful nymph named Galatea, daughter of Neptune.



The marvelous creature fell in love with the shepherd Acis, and despite being from different worlds, they fell in love. Polyphemus, who lived in those areas, had also fallen in love with Galatea, and once he learned of their love, blinded by jealousy, uprooted trees and hurled a gigantic rock at poor Acis, smashing his body into pieces. It is said that the nymph shed all her tears, to the point of moving the Gods to pity. So they transformed Acis into a river and the nymph into sea foam, so they could embrace for eternity.

Greek mythology also inspired the name of the Cyclopean Isles, mighty basalt sea stacks emerging from the sea in its namesake marine protected area. At sunset, their silhouette against the fiery sky makes for a picture-perfect view.

Don't miss the Baroque-style Church of San Giovanni Battista and the Norman Castle, standing tall above the village. After climbing the steep steps to the castle, you can replenish your energy with a "nivi cunzata", the typical Sicilian granita, or the fresh fish available at the fish market.

## ***VISA Information***

The conferences on ion sources is usually attended by scientists coming from several Countries of the five continents. Participants coming from European Union (EU) can travel in Italy with normal passport or regular identification document. Visitors who come from nations which do not belong to EU must be present in Italy under an appropriate visa. The information presented here will help you to identify the appropriate documentation and to apply for necessary visas.

Several non European Countries have stipulated special agreements protocols with the Italian government, and they do not need any visa. A definitive list of these nationals is not available, because Countries can be added or removed from the list according to the political situation and diplomatic relationships. Citizens of USA, Canada, Japan, Australia and some countries of east Europe and north Africa do not need any visa to enter Italy and Countries of the Schengen area.

We definitely suggest to visit the following link to check if you need a visa:

<http://vistoperitalia.esteri.it/home/en>

The website will give all the instructions to get the visa for your trip.

Please, take note that for some Countries the time needed to get the visas is of the order of 2 months. In any case, visa for tourism purposes should be required. They allow a permanence of 90 days in Italy or other EU Countries.

On request, an official letter of invitation will be sent to any participant for obtaining visa, provided that it does not imply any obligation or funding.

## ***Weather***

Catania enjoys a mild and comfortable climate throughout the year with average temperatures ranging from 5°C during the winter to 32°C in the summer. The weather conditions in April are fairly nice, with temperatures ranging from 14°C to 22°C.





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**SECOND ANNOUNCEMENT**

## ***Social events and entertainment***

### ***WELCOME RECEPTION***

The welcome reception will be held at the conference site on Sunday, April 6, 2025, from 18:30.

### ***VISIT***

A visit to the Laboratori Nazionali del Sud, Catania, will be organized on Monday, April 7th, 2025. An informal buffet will be offered to attendees after the laboratory visit.

### ***CONFERENCE EXCURSION AND DINNER***

The conference banquet and excursion will be organized for the attendees and their companions on Wednesday April 9<sup>th</sup>, 2025.

The conference excursion is being organized on Etna volcano: visits to the summit crater are currently suspended for safety reasons. Etna's activity is unstable showing periods with pyroclastic activity alternated with periods without lava coming out of the effusive mouth. The discussion with authorized volcanological guides to evaluate a safe and enjoyable excursion is under way. Therefore, excursion details will be given under the date. After the excursion, a dinner will be organized on a typical Sicilian wine farm.

Post conference tours can be arranged on demand: most of the old city of Catania is included by UNESCO in the World Cultural Heritage list: the “Late Baroque Towns of the Val di Noto (South-Eastern Sicily)”. Moreover, Agrigento has been elected as Italian Capital of Culture 2025 with timeless beauty of the Temples and natural wonder such as “Scala dei Turchi”.

## ***Insurance***

Attendees have to take care of their health insurance. No responsibility can be taken by the organizers.

## ***Contact information***

For any question, please contact the organization to the e-mail address: [pibhi2025@lns.infn.it](mailto:pibhi2025@lns.infn.it).