

# Workshop on upgrade of HIE-EBIS

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## 1 Overview of the workshop

### 1.1

The workshop to be held at CERN, on 16-17.10.2012 is organized in order to evaluate the key design points for the upgrade of HIE-ISOLDE EBIS. The latest updates will be sent around the participants and made available on the workshop [web page](#). For any suggestions and formal questions please contact the organizers.

### 1.2 Structure of the workshop

The workshop consists of an introductory session (Introduction (**I**) + facility talks (**FT**)), 3 topical sessions (**TI**, **TII**, **TIII**), a guided tour of ISOLDE and REX-ISOLDE and HIE-ISOLDE cavity production and a final summary and collaboration session (**SCS**). For each topical session we have suggested a list of subjects to be addressed by the contributors and be covered during the discussion at the end of the session. The participants are welcome to extend the list.

### 1.3 Participants of the workshop

The list of participants who preliminary confirmed their intention to come (for external guests, the list of CERN participants is a subject of change).

**Table 1:** Participants of the workshop

Name	Affiliation	Contributions	Moderators
D. Voulot	CERN	I.1	
F. Wenander	CERN	I.2	
A. Shornikov	CERN	I.3, SCS.1	
A. Pikin	BNL	FT.1, TII.3, TIII.5	
S. Schwarz	MSU	FT.2, TII.1, TIII.4	
J. Crespo	MPIK	FT.3, TI.2,	
R. Marrs	LLNL	FT.4, TII.2	
N. Nakamura	UEC, Tokyo	FT.5, TI.3	
E. Beebe	BNL		TI
P. Chiggiato	CERN	TI.1	
V. Ovsyannikov	on leave from DREEBIT	TI.4, TII.4, TIII.3	
S. Kondrashev	ANL	TI.5	
R. Becker	University of Frankfurt	TIII.1	TII
E. Donets	JINR	TIII.2	
R. Scrivens	CERN		SCS
R. Catherall	CERN	SCS.2	
A. Dudarev	CERN		
G. Kirkby	CERN		
G. Vandoni	CERN		
J. Bremer	CERN		
G. Tranquille	CERN		
S. Sgobba	CERN		
D. Kuchler	CERN		
E. Mahner	CERN		
J. Lettry	CERN		
T. Giles	CERN		
Y. Kadi	CERN		
A. Polato	CERN		
J. Montano	CERN		
S. Giron	CERN		
M. Hermann	CERN		
N. Jecklin	CERN		
E. Zografos	CERN		

## 2 Introduction session.

### 2.1 Introduction of the workshop and the project framework

**Table 2:** Introduction of the workshop and HIE-ISOLDE project. Speakers and subjects.

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I.0	General introduction, 10 min	Welcome and organization matters.
I.1	<b>D. Voulot</b> , 20 min	HIE-ISOLDE linac upgrade.
I.2	<b>F. Wenander</b> , 30 min	Present REX-ISOLDE charge breeder system.
I.3	<b>A. Shornikov</b> , 30 min	HIE-EBIS design parameters and prerequisite.

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### 2.2 Presentation of close related facilities

Convener **J. Lettry/F. Wenander**

In this session we would like to focus on the machine design and attained performance, the experimental physics behind the machines is beyond the scope of this workshop. To the contributors presenting the facility talks we suggest to use the facility talk as an opportunity to shortly introduce to the audience the subjects they will talk about later during the topical session.

**Table 3:** Introduction of close related facilities. Speakers and subjects.

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FT.1	<b>A. Pikin</b> , 40 min	The RHIC EBIS.
FT.2	<b>S. Schwarz</b> , 40 min	The MSU ReA3 EBIS/T.
FT.3	<b>J. Crespo</b> , 40 min	EBITs at MPIK.
FT.4	<b>R. Marrs</b> , 30 min	The LLNL Super-EBIT.
FT.5	<b>N. Nakamura</b> 30 min	Tokyo Super-EBIT.

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## 3 Topical session I. Vacuum and cryogenics

For all topical sessions there are 5-10 min time slots foreseen for immediate discussion relevant to each particular presentation. For the extended discussion, there is a special time reserved at the end of each session. Participants are always welcome to add new points into the list for the discussion, as well as suggest additional speakers (including volunteering themselves). For the contributors the suggested themes are intended to better understand the expectations of the audience. In case of additional speakers/talks please let us know in advance to take care of administrative matters and improve the organization.

Moderator **E. Beebe**.

List of discussion points for the session.

- Attainable vacuum level for warm/cold bore operated devices.
- Main magnets cryogen filled open/closed cycle vs cryogen free.
- Radiative shields, practical experience of materials, technologies and coatings.
- Use of dry/TMP/ion/sublimation pumps in an EBIS.

- Warm devices: NEG coating (efficiency, mechanical stability)
- Bakeout settings for warm and common vacuum cold systems.
- Cold devices: Common vs separate vacuum for the trapping region and the cryostat.
- Cold devices: Charcoal panels, NEGs, other additional pumping techniques.
- Bakeable cryopumps, baking limits for cryocoolers, bakeable UHV interfaces for cryocoolers
- Beam contamination due to the memory effect.

**Table 4:** Topical session I. Vacuum and cryogenics. Suggested speakers and themes.

TI.1	<b>P. Chiggiato</b> , 15 min	Advanced vacuum technologies.
TI.2	<b>J. Crespo</b> , 10 min	Vacuum system and cryogenics in HD-type EBIT design.
TI.3	<b>N. Nakamura</b> , 10 min	Cryogenics and vacuum at Tokyo Super-EBIT.
TI.4	<b>V. Ovsyannikov</b> , 10 min	Cryogenics and vacuum in Dreebit EBITs.
TI.5	<b>S. Kondrashev</b> , 10 min	Low-contamination rare and exotic beams
Discussion, 45 min		

## 4 Topical session II. Magnet and trap design, ion-ion cooling, emittance and acceptance

Moderator **R. Becker**

List of the discussion points for the session.

- Charge breeding efficiency  $> 10\%$  for VHCI high-Z ions.
- Ion injection. What phase space acceptance to expect?
- Increasing acceptance: a) two fields operation mode á la MSU; b) time varied compression of the beam.
- Beam emittance.
- Vacuum when ion-ion cooling is used/ limitation on the pressure. Compromise between evaporative cooling and CX losses.
- Improving efficiency of the cooling gas ionization for ion-ion cooling. External injection of the cooling ions.
- Status of CB simulation codes, their applicability for VHCI.

**Table 5:** Topical session II. Magnet and trap design, ion-ion cooling, emittance and acceptance. Suggested speakers and themes.

TII.1	<b>S. Schwarz</b> , 10 min	Helmholtz+solenoid configuration at MSU EBIS.
TII.2	<b>R. Marrs</b> , 10 min	Ion-Ion cooling at high ionization factors.
TII.3	<b>A. Pikin</b> , 10 min	Acceptance and emittance studies at RHIC EBIS.
TII.4	<b>V. Ovsyannikov</b> , 10 min	Acceptance and emittance studies at DreEeBIT.
Discussion, 45 min		

## 5 Topical session III. Cathode, gun, e-beam, collector

Moderator **R. Marrs**

List of the discussion points for the session.

- Why hasn't the design values for many high performance machines been attained?
- Cathode choice: lifetime, crystal mounting, reliability, manufacturers, sensitivity to vacuum conditions. In-vacuum cathode recovery procedures: nitrogen poisoning, oxygen activation etc.
- Electron losses in high-compression Pierce configuration (magnitude, localization, ways to estimate and suppress).
- Electron losses in low-compression immersed guns (magnitude, localization, ways to estimate and suppress).
- Electron losses in trapping region and electron assisted desorption.
- Pumping of the cathode region.
- RF generation by high-current beam - is it an issue?
- Electron collector: limits of energy recuperation, secondary electrons, elastically backscattered electrons.
- Safety of a high power electron collector.

**Table 6:** Topical session III. Cathode, gun, e-beam, collector. Suggested speakers and themes.

TIII.1	<b>R. Becker</b> , 15 min	Can 5 A, 150 keV, 20 kA/cm <sup>2</sup> be attained practically in a charge breeder?
TIII.2	<b>E. Donets</b> , 15 min	Can the development from Dubna be applied for an effective high energy high current charge breeder?
TIII.3	<b>V. Ovsyannikov</b> , 15 min	High compression high current guns.
TIII.4	<b>S. Schwarz</b> , 15 min	State-of-the-art high compression guns using BaW cathode.
TIII.5	<b>A. Pikin</b> , 20 min	Can the BNL EBIS current density be increased by a factor of 20? IrCe and LaB <sub>6</sub> cathodes, high-current collector design, experience with large aperture drift tubes.
Discussion 45 min		

## 6 Guided tour of ISOLDE and REX-ISOLDE.

## 7 Concluding Summary and Collaboration session. SCS

Moderator **R. Scrivens**

**Table 7:** Summary and collaboration session

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SCS.1	<b>A. Shornikov</b> , 15 min	What we have learned and our next steps
SCS.2	<b>R. Catherall</b> , 5 min	What can CERN / EU offer to the collaborators

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Discussion 30 min

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