PERLE collaboration board :

DC photogun status

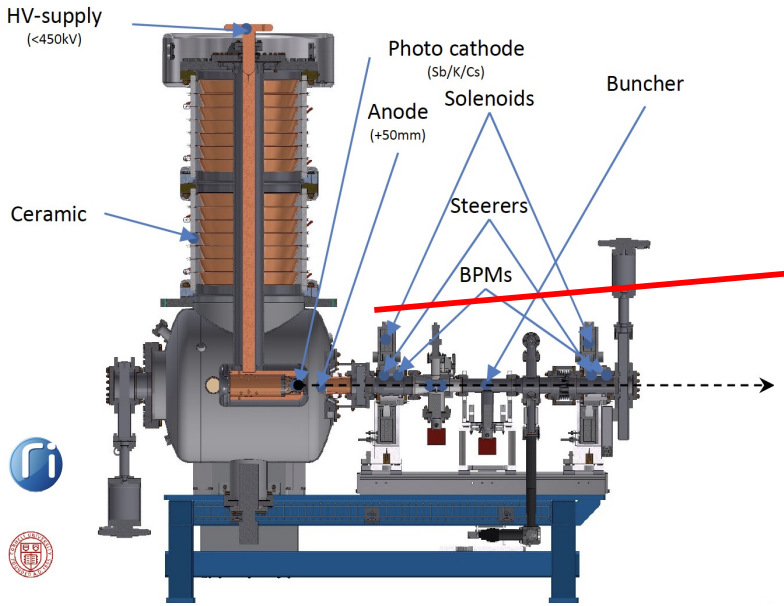
May 28, 2025

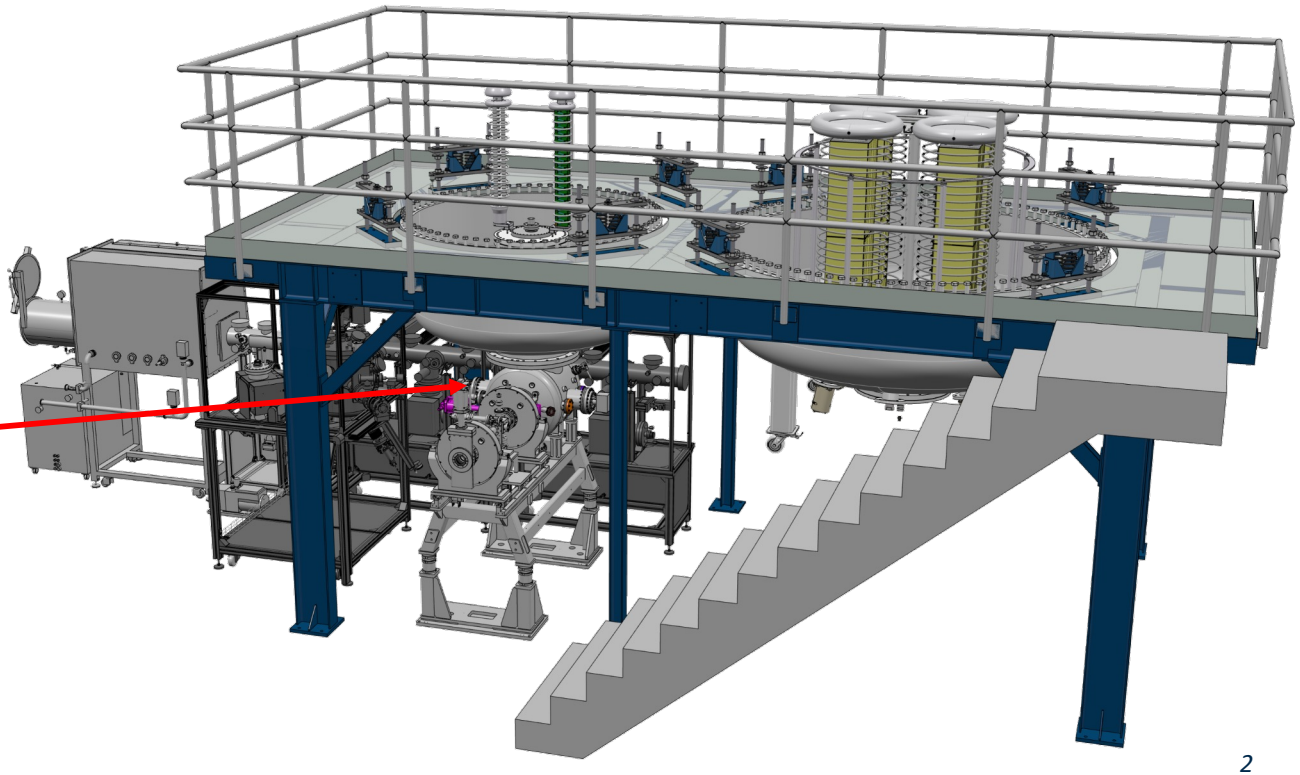
Maud BAYLAC (LPSC), Walid KAABI (IJCLab)

On behalf of the photogun team

Gun status report

1. Photogun chamber and vacuum
2. High voltage
3. Photocathode preparation facility
4. Laser
5. Command-control & security
6. Beam diagnostics

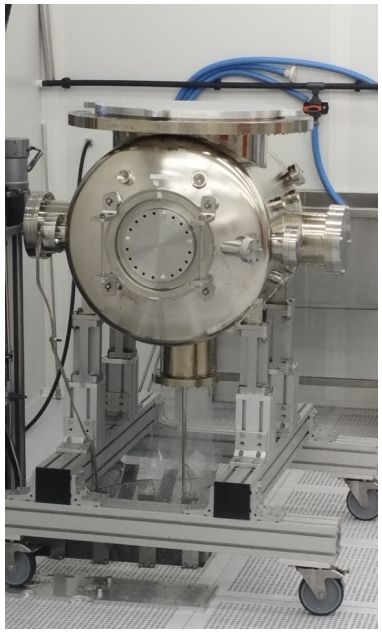


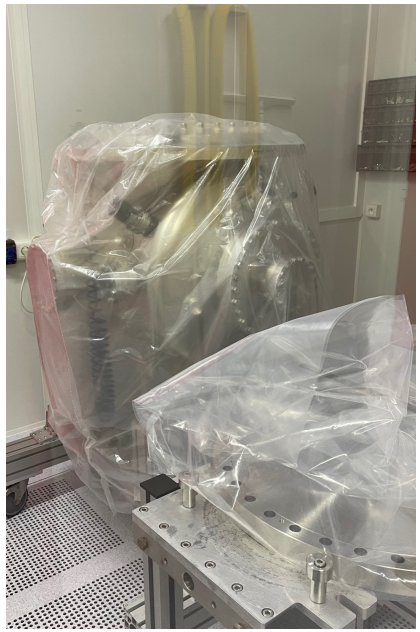


Photogun chamber

- Gun chamber opened in IJCLab cleanroom
- Upon opening of the chamber, black residue which we could not be removed
- Process of High Pressure Rinsing (HPR) was performed in clean room (Supratech)

➔ Chamber clean and ready for assembly





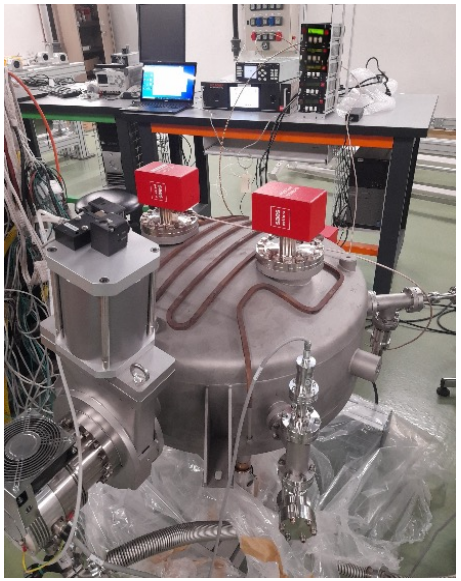
July 24

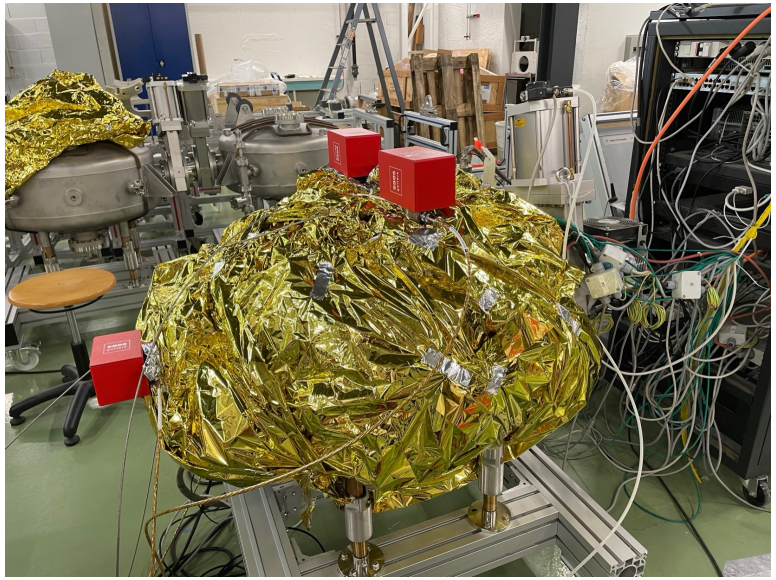
Photogun chamber

- **Mobile clean room required for ceramic assembly**
- **Installed in the igloo, to be cleaned for further gun assembly**

Photogun chamber

- **Additional pumping ordered**
- **All NexTorr pumps tested (combined ionic and NEG) on test chamber to avoid residue in gun chamber**

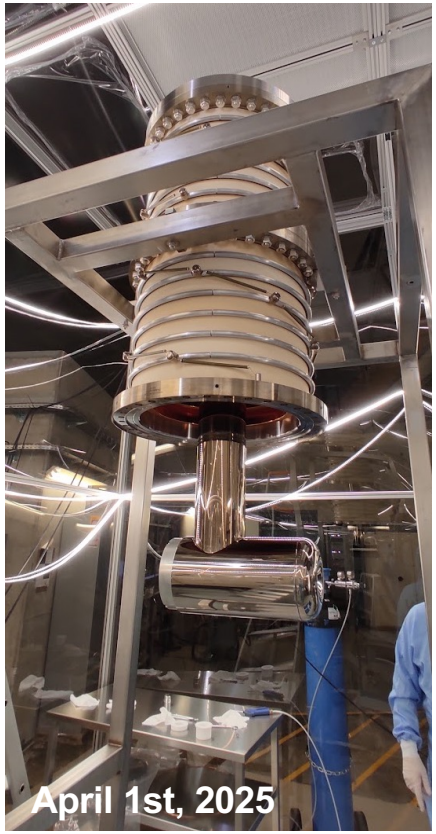




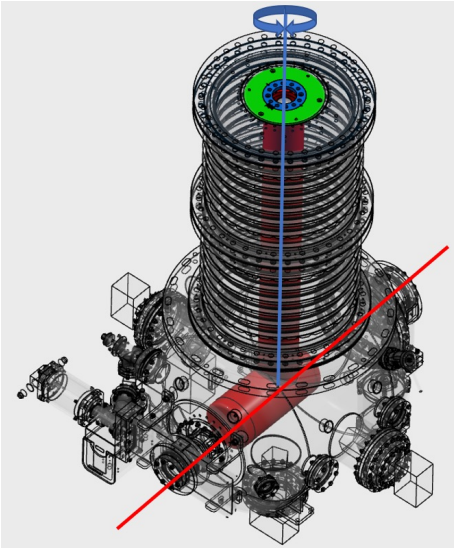
September 24

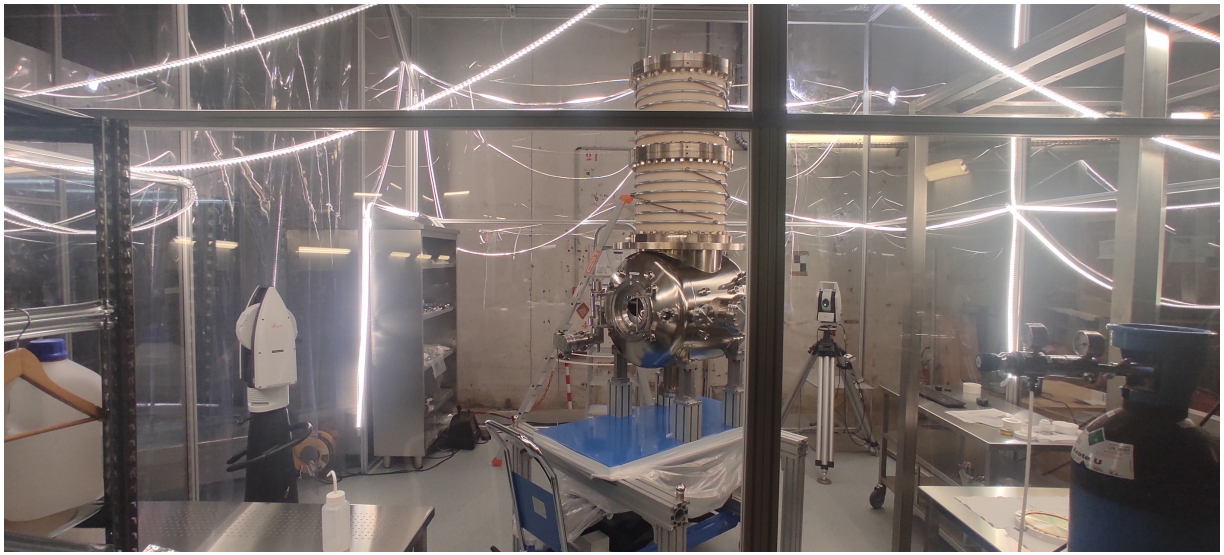
Photogun chamber

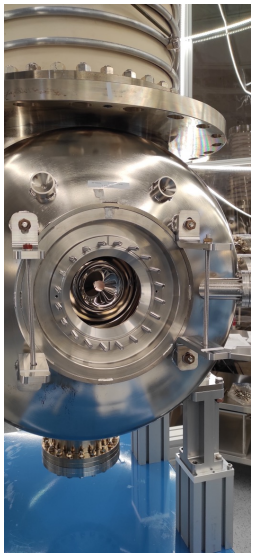
- **Progressive assembly of the gun in the igloo**
  - **Intermediate leak tests**

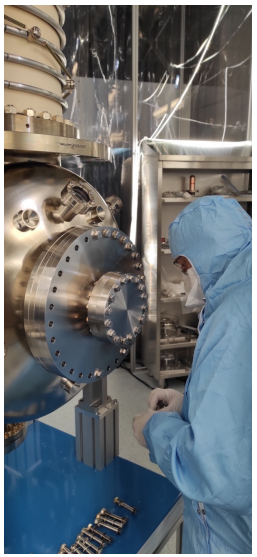


Photogun chamber : alignement







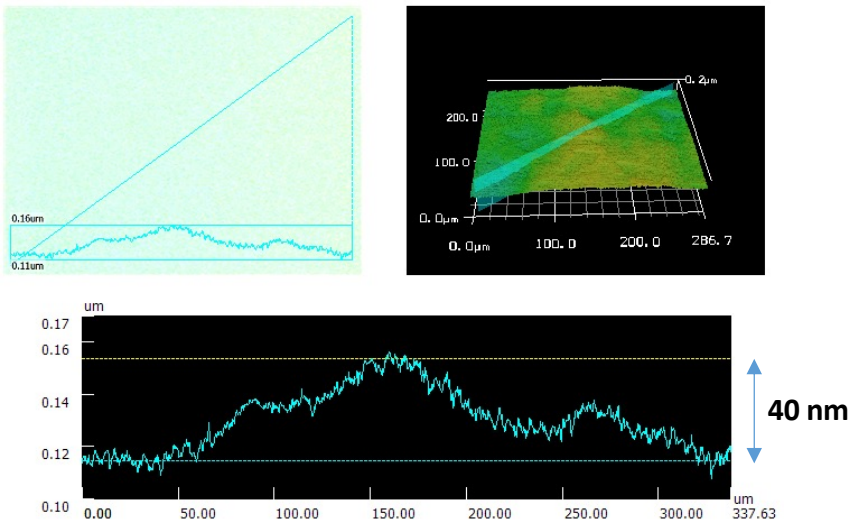


Cathode and anode alignement

- **Few hundreds of mm**

First gun vacuum test

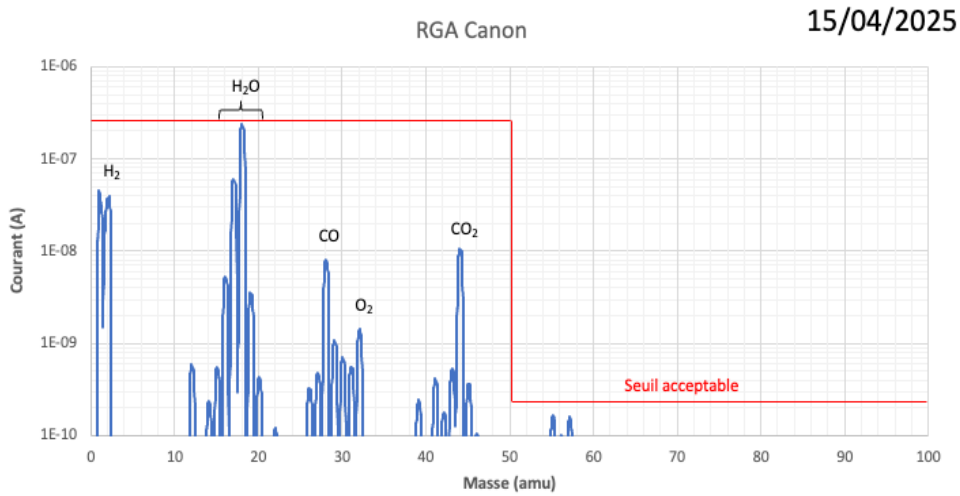
- **First assembly with all pumps, vacuum pumping and leak test (mid april)**
  - Problem with a dirty vacuum fitting, but no contamination detected ➔ vacuum OK
- **Dummy photocathode puck intended for the HV conditionning**
  - best puck selected with microscope (roughness measurement)



Mesure de rugosité sur puck13

Analyse du gaz résiduel du canon – Chambre non étuvé

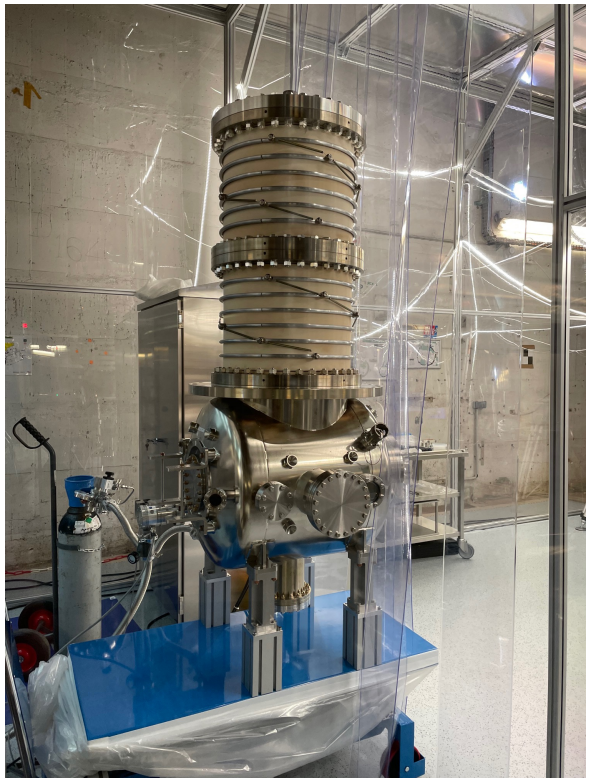
P = 2,34.10^{-7} mbar (eq N_2)

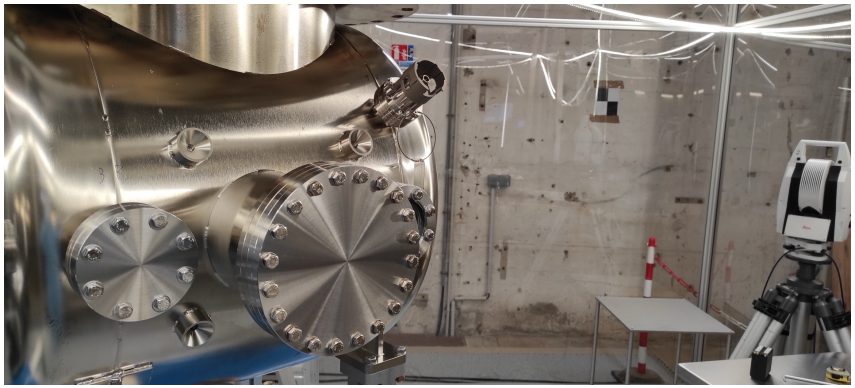


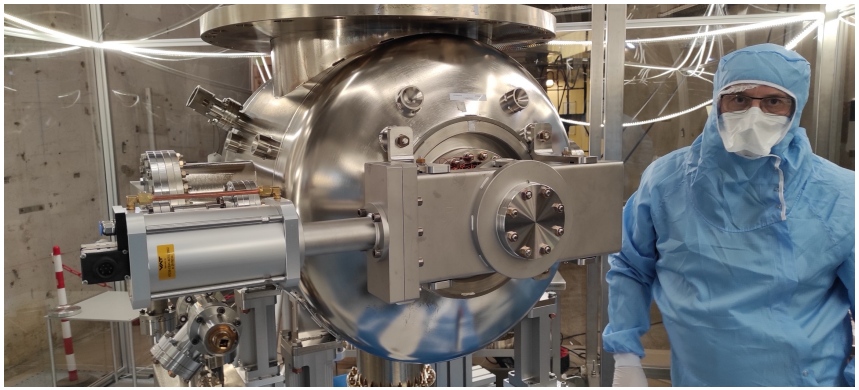
Aucun pic au delà de la masse 50 est supérieur au seuil

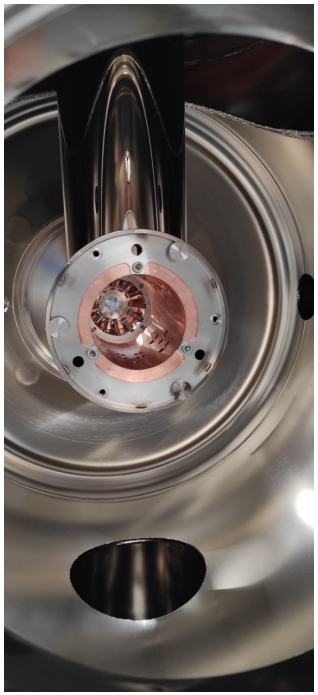
Photogun chamber

- **Dummy photocathode puck in place for HV conditionning**
  - **Leak test OK**





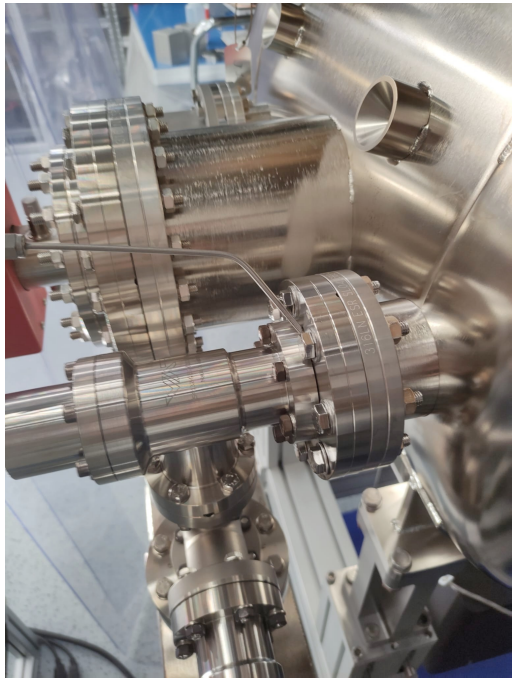




Dummy photocathode puck

Full gun under vacuum

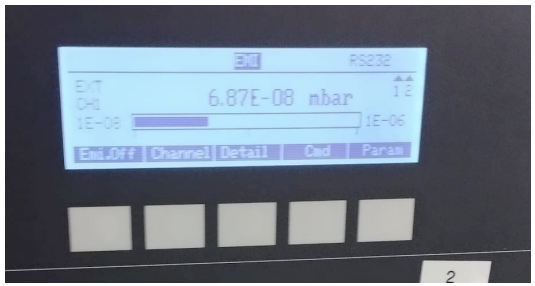
- Gun chamber fully assembled with puck 13, leak tested
- Under vacuum since 26-05
  - Pressure (28-05) : 7×10^{-8} mbar
- Next step : prepare and proceed with bakeout



Leak test

Gun chamber under vacuum (26-05)

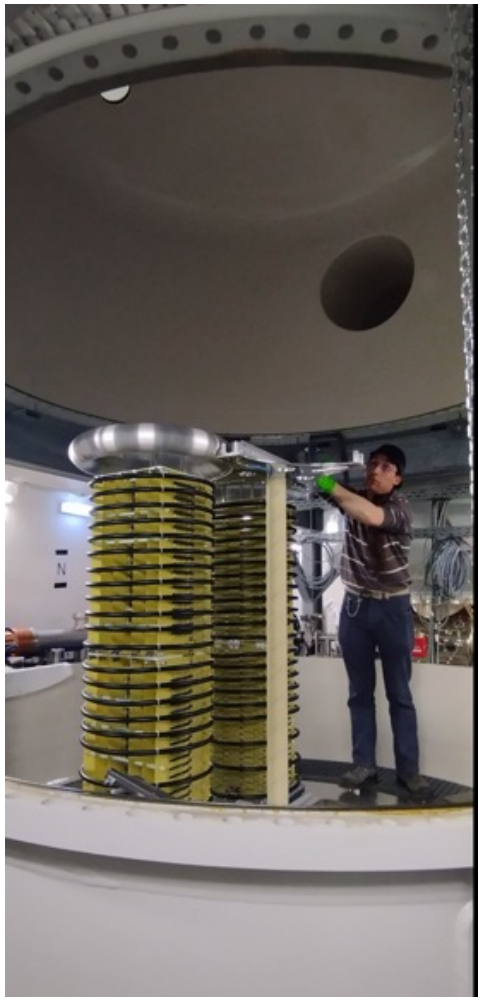
Gun first full assembly with puck 13 (23-05-2025)



Gun chamber pressure (28-05) before bakeout

High voltage

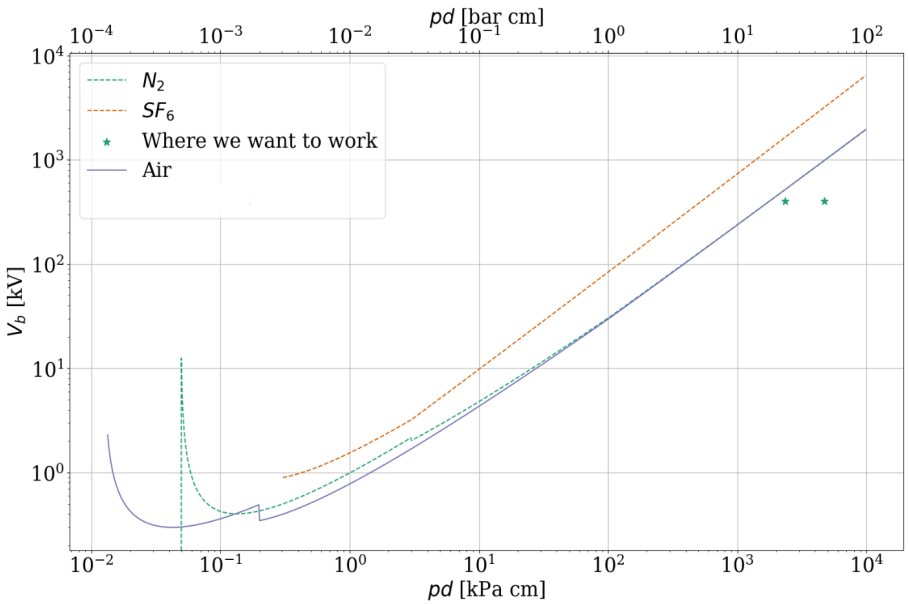
- **HV system assembled and tested in air up to 30 kV (november 2024)**



E. Labussière

High voltage

- **Nuclear safety permit (ASNR) : obtained**
  - tests > 30 kV are now authorized
- **Next step : bakeout of the gun, connection to the HV platform (after final position), vessel filling**
  - Insulating gas
    - N2 to replace SF6, given the margin of the gun and with appropriate pressure
  - Pressure certification of the vessel : underway

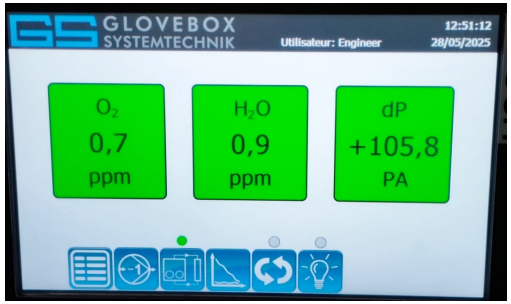


A. Plaçais, M. Baylac, E. Labussière, D. Reynet

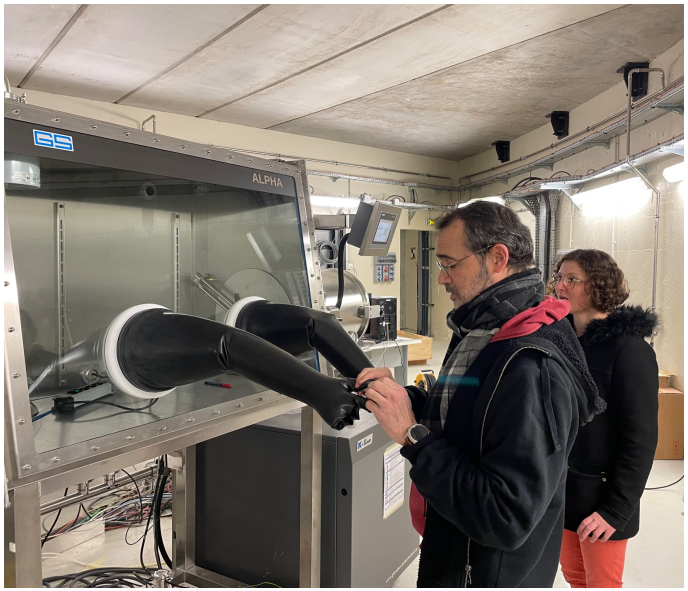
Photocathodes preparation facility (PPF)

- **Photocathode preparation facility for production of**
  - **multi-alkali deposition (CsK_2Sb)**
  - **Cs and K explode in air**

- **Glove box :**
  - **Introduction of chemicals (Cs, K and Sb) to prepare air stable alloy with O_2 and H_2O < 1 ppm**
  - **Chemicals and evaporators are available**
  - **Glove box nearly operational**
    - **Support from glove box company, leaks treated, regeneration of the filters, new O_2 and H_2O sensors**



Glovebox with new sensors (28-05)

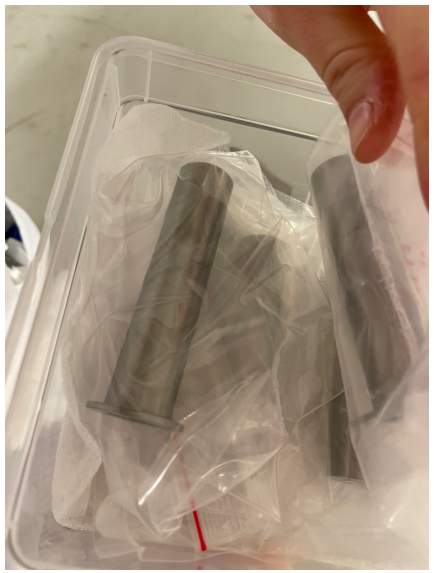


G. Sattonnay, M. Devos, T. Gérardin, J. Demailly, E. Mistretta, J. Yemane

Photocathodes preparation facility (PPF)

- **PPF fully assembled with the glove box**
  - **Deposition chamber (Molecular Beam Epitaxy) under vacuum**
    - **Pressure = 3.10^{-8} mbar before bakeout**

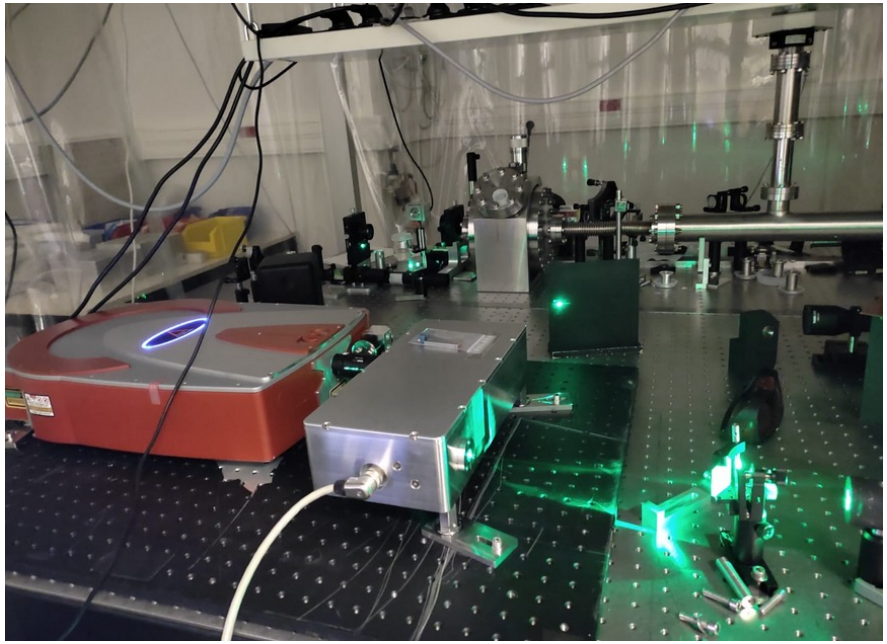
- **Next :**
  - **Motions to be tested, motors to be changed,**
  - **Bakeout of the MBE chamber only first, installation of Sb evaporator only**
  - **First deposition of Sb only for a functional test**
  - **Then deposition of CsK_2Sb for production of a first photocathode**

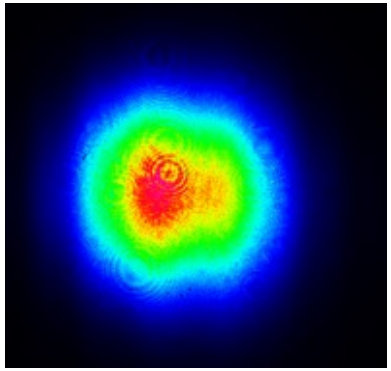


G. Sattonnay, M. Devos,T. Gérardin, J. Demailly, E. Mistretta, J. Yemane

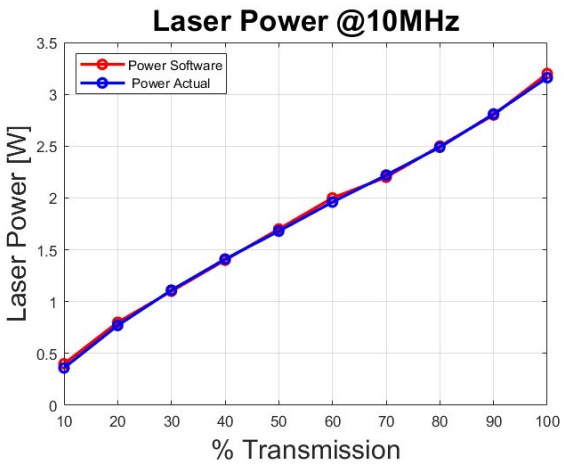
Laser in test lab

- **Green laser (515 nm) from Amplitude**
  - Satsuma model
- **Under test in optical room**
- **Measurements**
  - Power : 1.44W @40MHz, 3.12W @10MHz
  - Diameter @ 79.6 +/- 0.5cm de la sortie laser
- **Next**
  - To be moved to the igloo laser room
  - Optical transport calculations from laser to the photocathode
  - Upgrade and sync module to be purchased





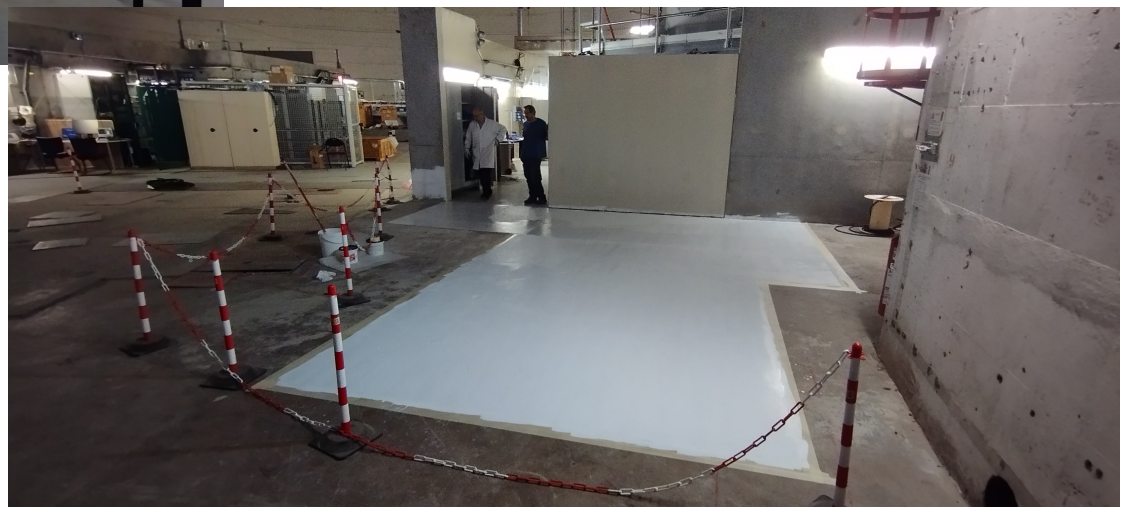
ϕx= 2.131mm
ϕy = 2.221mm



F. Johora

Laser environnement preparation in the igloo

- **Floor preparation, shielding installation and hole drilling**



Laser environnement preparation in the igloo

- **Clean room installation for the laser and air treatment system**

Laser environnement preparation in the igloo

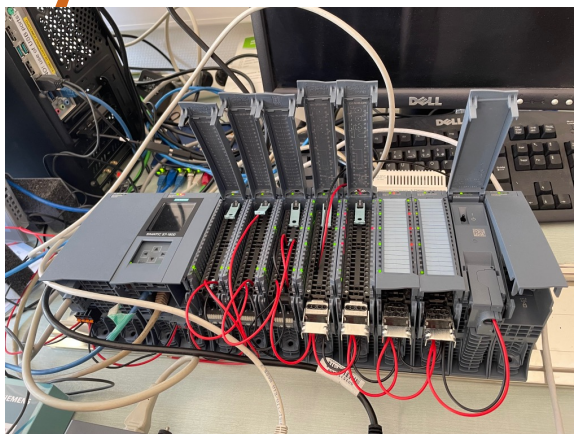
- **Installation of optical table and covers**

D. Reynet, S. Brault, O. Frossard

Command control and security

- **Siemens PLC purchased**
- **List of signal updated**
- **Adaptation of the existing source codes to the PERLE gun underway for command-control and machine protection by IJCLab**

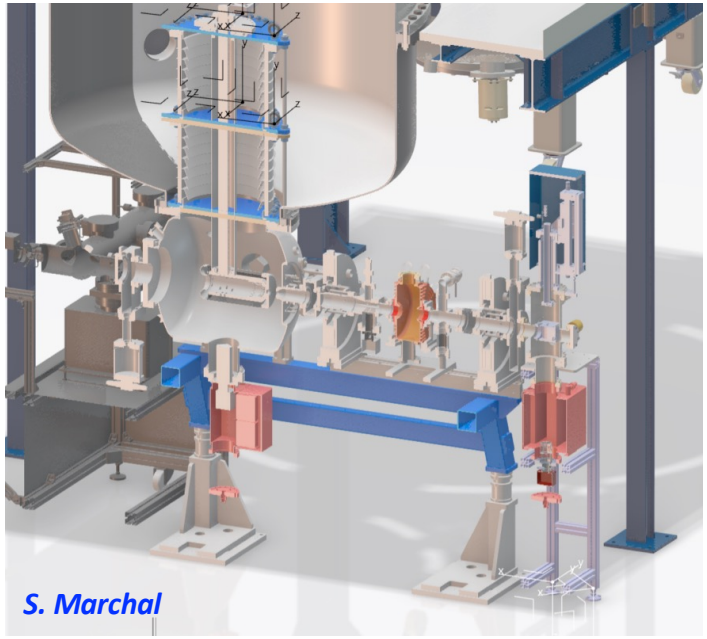
- **Personal Safety System under preparation by a laboratory in Orsay (IRSD)**



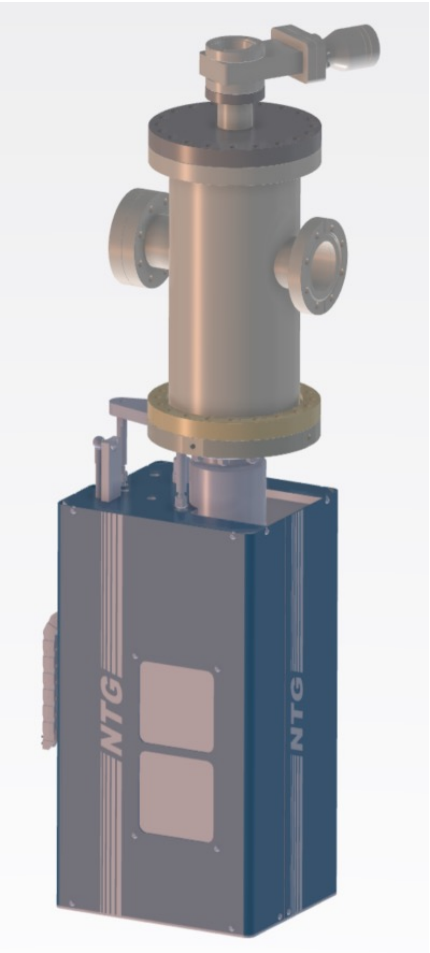
O. Dalifard, V. Dalifard

Diagnostics

- **Faraday cup ordered**
  - **To be delivered by September**
- **Design of th interface chamber for the Faraday cup finalized**
- **BPM tested**



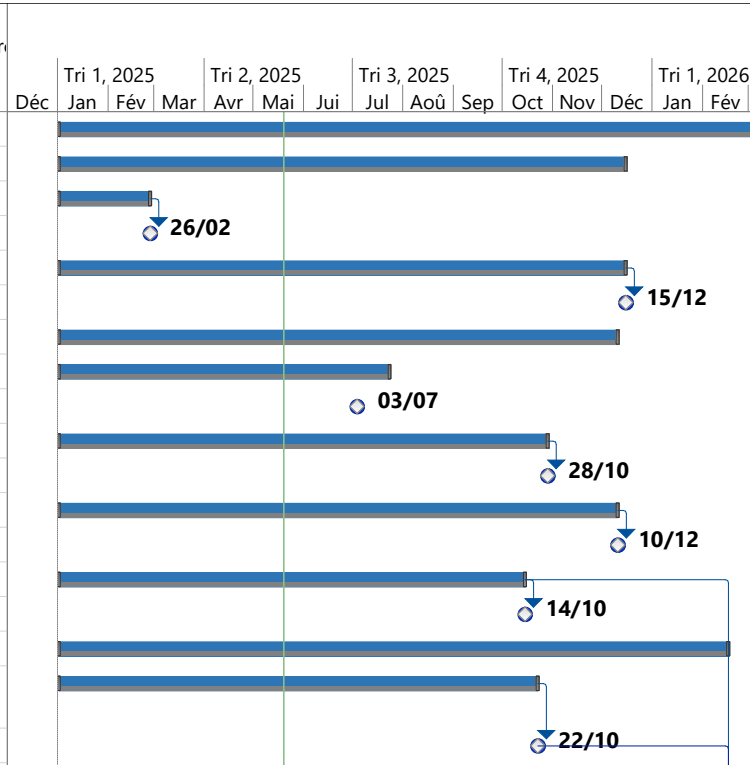
S. Marchal



M. Ben Abdillah, F. Fournier

Planning

N°		WB	Mo Tâcl	Nom de la tâche	Durée	Début	Fin	Prédéce	Noms ressour
1		**1**		**Injector**	**675 jours?**	**Jeu 02/01/25**	**Jeu 09/09/27**		
2		**1.1**		**Laser**	**240 jours**	**Jeu 02/01/25**	**Lun 15/12/25**		
3	✓	**1.1.**		**Laser studies**	**40 jours**	**Jeu 02/01/25**	**Mer 26/02/25**		
6		1.1.		Jalon Laser operationnel	0 jour	Mer 26/02/25	Mer 26/02/25	3	
7		**1.1.**		**Laser dans l'IGLOO**	**240 jours**	**Jeu 02/01/25**	**Lun 15/12/25**		
14		1.1.		Jalon laser operationnel dans l'IGLOO	0 jour	Lun 15/12/25	Lun 15/12/25	7	
15		**1.2**		**Gun**	**237 jours**	**Jeu 02/01/25**	**Mer 10/12/25**		
16		**1.2.**		**Montage Gun**	**139 jours**	**Jeu 02/01/25**	**Mer 23/07/25**		
32		1.2.		Jalon vide canon	0 jour	Jeu 03/07/25	Jeu 03/07/25	25	
33		**1.2.**		**Systèmes de pilotage et sécurité**	**207 jours**	**Jeu 02/01/25**	**Mar 28/10/25**		
43		1.2.		Jalon systèmes de pilotage et sécurité	0 jour	Mar 28/10/25	Mar 28/10/25	33	
44		**1.2.**		**High Voltage**	**237 jours**	**Jeu 02/01/25**	**Mer 10/12/25**		
53		1.2.		Jalon High Voltage on cathode	0 jour	Mer 10/12/25	Mer 10/12/25	44	
54		**1.2.**		**Faraday Cup**	**197 jours**	**Jeu 02/01/25**	**Mar 14/10/25**		
59		1.2.		Jalon Measurements operational	0 jour	Mar 14/10/25	Mar 14/10/25	54	
60		**1.3**		**Photocathodes**	**279 jours**	**Jeu 02/01/25**	**Lun 16/02/26**		
61		**1.3.**		**Installation et mise en fonctionnement provisoire de la PPF**	**203 jours**	**Jeu 02/01/25**	**Mer 22/10/25**		
73		1.3.		Jalon production photocathode test	0 jour	Mer 22/10/25	Mer 22/10/25	72;61	



➔ Without major issue, all subsystems of the gun and the PPF should be functional end of 2025/early 2026

Risk project CNRS

- **Funded obtained in October 2025 from CNRS through its risk & impact project :**
  - **1 M€+ 2 M€ after milestone (go/nogo)**

- **Project progress review after 6 months**
  - **May 27, 2025**

- **Scientific report to produce at the end of the year to complete the milestone**