

BeamLab activities at IPNO

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R&D Targets and Ion Sources group



General Informations :

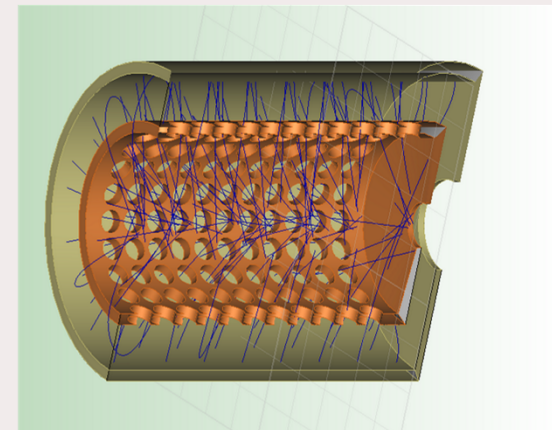
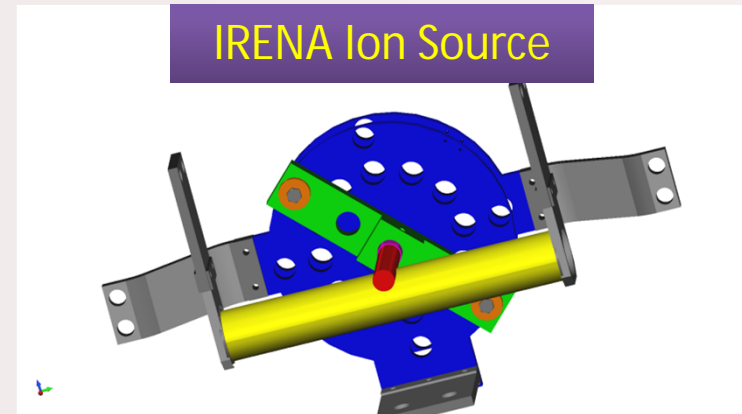
- Beamlab postdoc hired since february 01, 2018 (18 months): **Ailin ZHANG**
- Master internship position (April-june 18 / 4 months) was carried out in the framework of Beamlab task
- A new materials science engineer position will be hired soon (2 years CNRS contract)

Task 1: Efficient ion sources for difficult ISOL beams

Motivations :

Very promising potentials of the 1st & 2nd prototypes

- **Optimization studies:** Thermionic emission studies and beam extraction for IRENA ion source
 - computer simulations are going on with Lorentz-3EM Code (postdoc work)
 - The space charge effect is the dominant process in the operation of the IRENA ion source : actually, many models dealing with space charge compensation effect are under investigation (Postdoc work)
 - Beam extraction will be investigated by the Lorentz code and an optimized configuration of operation will be proposed (Postdoc work)
 - Simulation results will be presented in EMIS 2018
 - Ionization efficiency measurements with IRENA ion source for different are foreseen for 2019



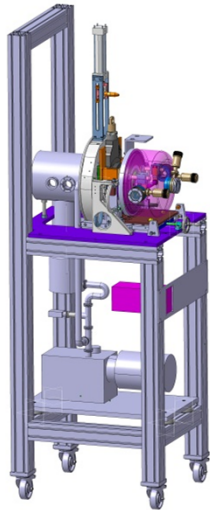
Required equipment : Emittance meter !!

Task 2: Material compatibility in reactive gas atmospheres

- **Transfer line devices:** simulations and thermal optimization with ANSYS code of the transfer line device for beam productions @ALTO.
- Campaigns of temperature measurements are planned for 2018 & 2019

New thermal test bench status @ ALTO : STATE OF PROGRESS

- Engineering design completed
- Pumping system already purchased and available
- Mechanical fabrication and C&C developments are well advanced

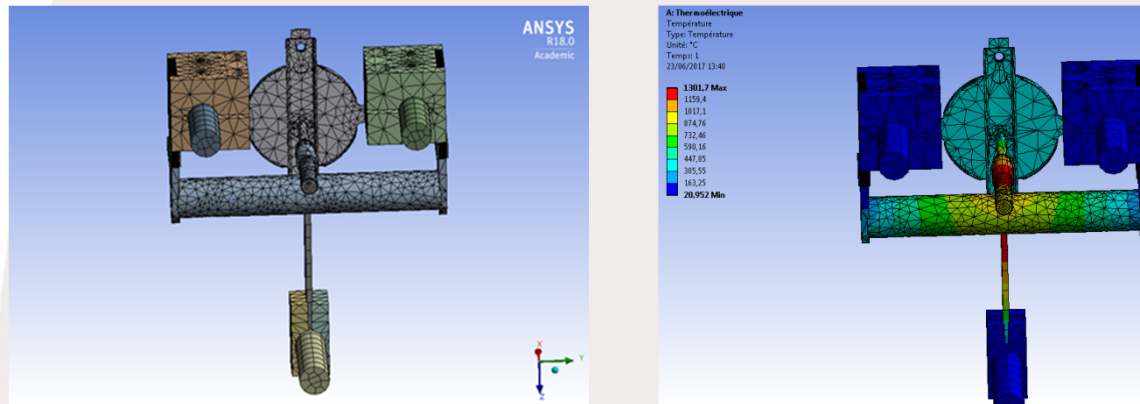


Commissioning in 2018...



Task 2: Material compatibility in reactive gas atmospheres

- Thermal optimization simulations with ANSYS code have been initiated in the frame work of an master internship position (May 2017 – July 2017).



- We thank the great collaboration of LNL team to have provided us with input data for ANSYS code
- We are looking for a support from our laboratory for ANSYS activities. Otherwise simulations will be shared with the post-doc works and if needed an new master internship position in 2019.
- **Goal : Optimizing all thermal schemes for the different ion sources used for ALTO for RIB production.**

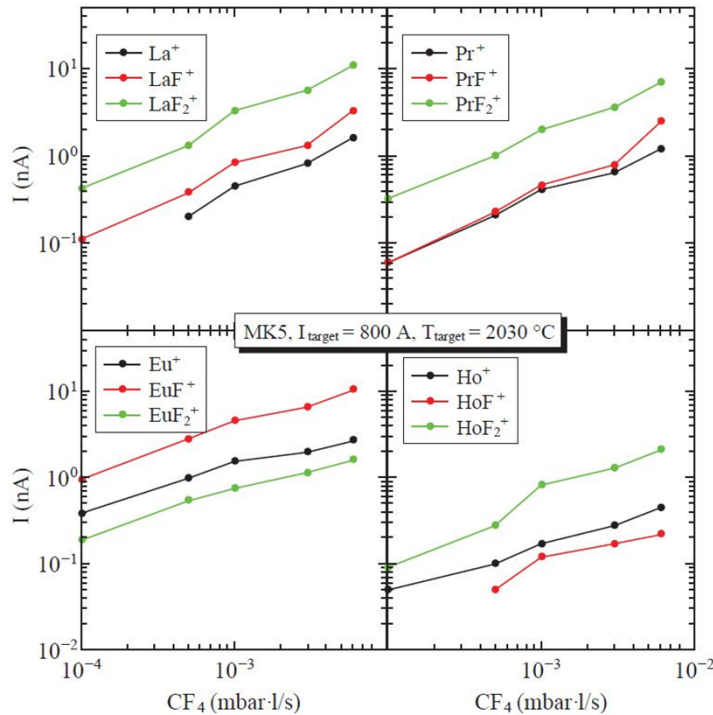
Task 3: New molecular beams

Motivations :

- Off-line tests on the SIHL mass separator was successful for producing rare earth beams by Fluorination
- We need to learn more about Fluorination and ionization processes

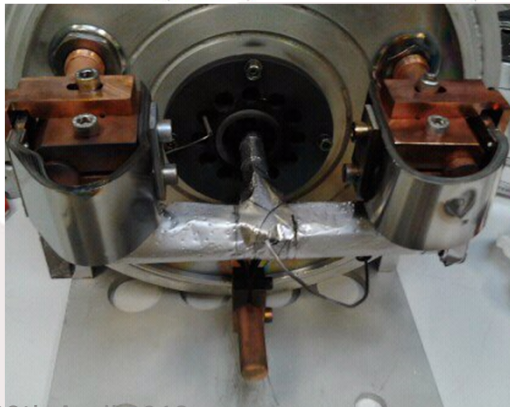
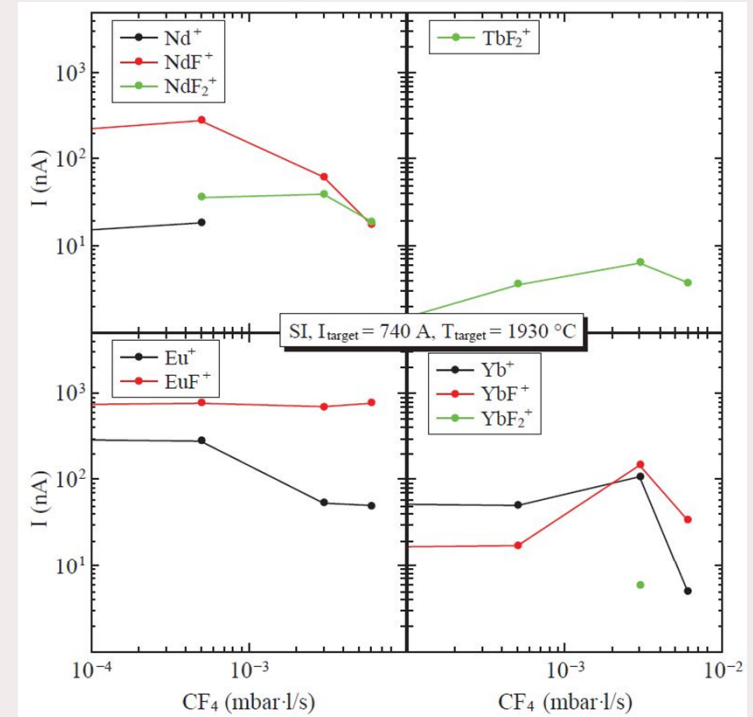
Task 3: New molecular beams

Off-Line tests



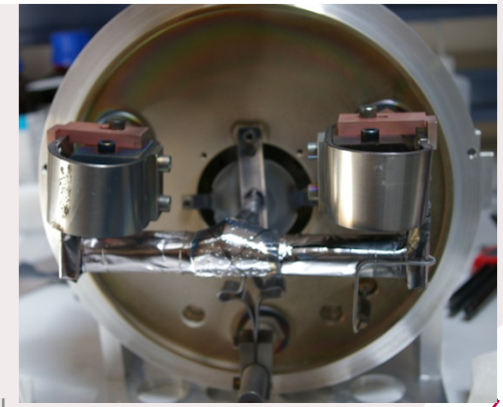
MK5: the more CF₄ injected, the higher the intensity of the lanthanide beams

SI: more CF₄ injected → beam intensities collapse



03th April 2018

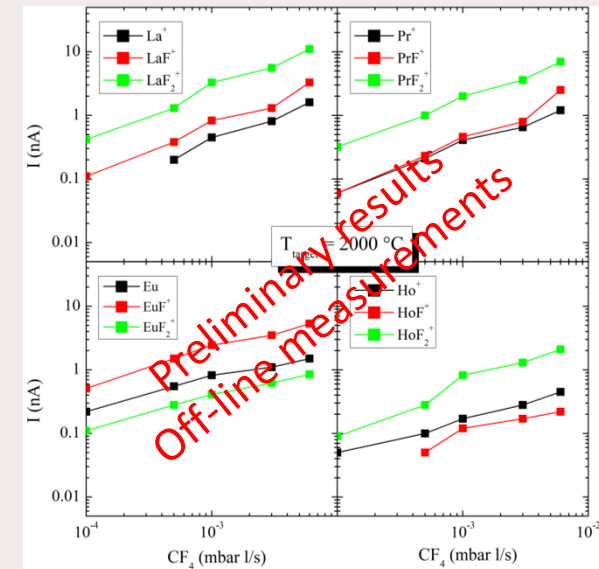
Measured beam intensities with the SI ion source are clearly higher than those measured with the MK5 ion source



Task 3: New molecular beams

- **Future actions:**

- Optimization of process parameters for the On-line production of rare earth elements by fluorination →
 - New system of gas feeding is under development : best control et reliable measurement of gaz flow rate in the TIS
 - Experiment with the PARRNe mass separator postponed on November 2018 (lack of human resources at the ALTO facility)



Work will be done with the collaboration of the nuclear physics group Nester

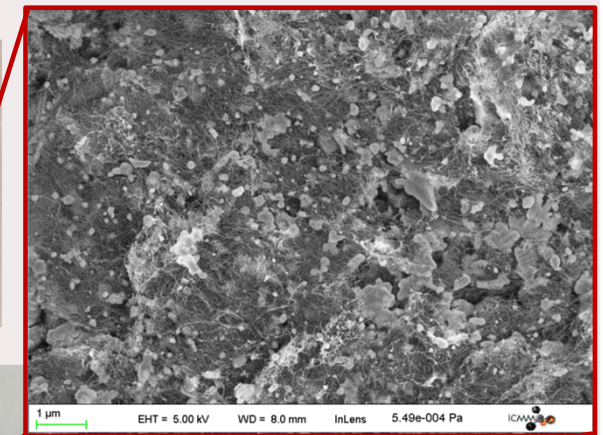
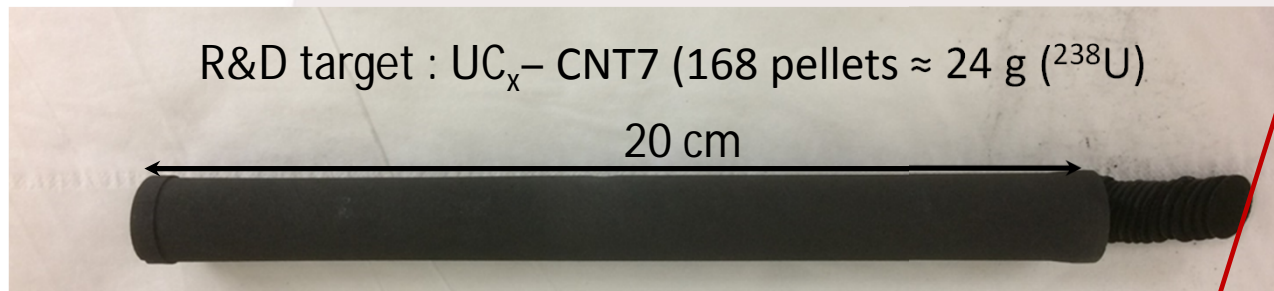
Task 4: Specific target designs for non-volatile elements

Motivations

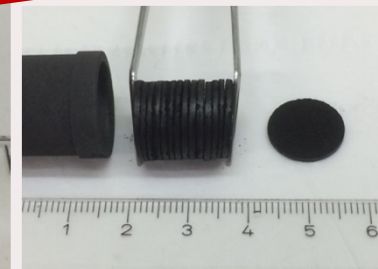
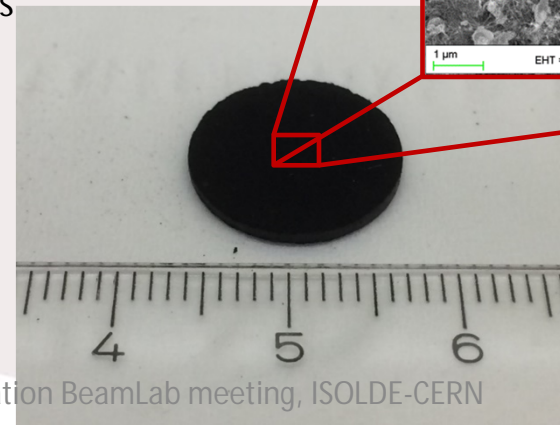
- New design of target for photofission process but shorter
- Fragments release
- we have limitations on the amounts of nuclear waste detention imposed by the French nuclear safety authority

New target structure tested on-line @ ALTO (October 2017) :

- Target developed in the framework of a Phd work (Julien Guillot)



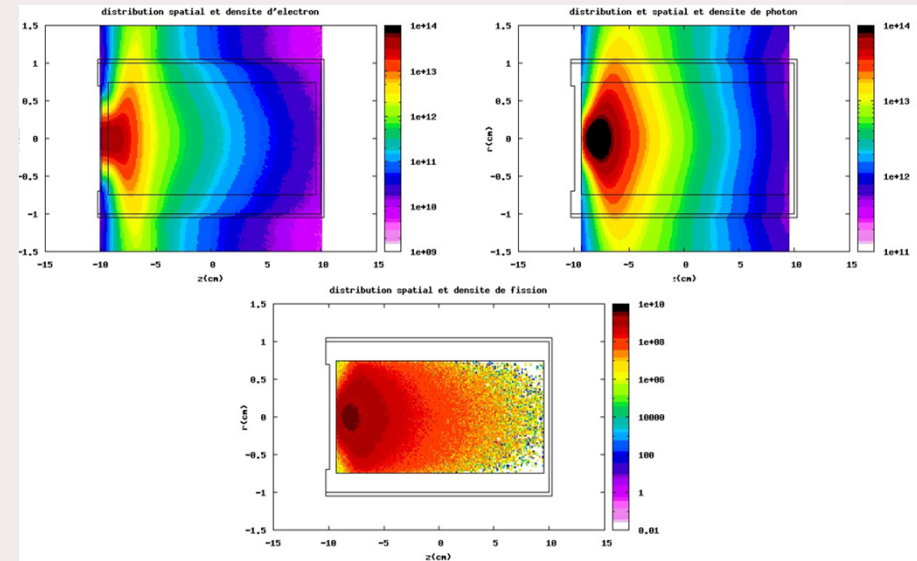
- ~ 50 % of uranium less than conventional UC_x targets
- ++ Nuclear wastes storage capacity
- Production result analyses are in progress
- Primary conclusion : *This nano structure is more suitable for the production of elements with very long diffusion time (Cs, Rb...) → To be confirmed*



Task 4: Specific target designs for non-volatile elements

- ACTIONS

- Continue FLUKA MC simulations to investigate target production with shorter geometries
- Developing new protocol of fabrication (if needed) for larger pellets
- ANSYS thermal simulations to investigate target thermal behavior and benchmarking measurements
- On-line tests @ ALTO facility with the collaboration of the nuclear physics group Nester are foreseen for the end of 2019.



A new materials science engineer position (2 years CNRS contract) will be hired soon
 → UCx Activities will be shared with it ...