# JRA 2 “ActILab”

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I Gunther PSI
H Franberg- Delahaye GANIL

# Tasks

| | | |
|---|---|---|
| **D-JRA02-1** | **Novel synthesis of actinide targets (Task 1: Synthesis of new actinide targets)** | **41 jan 2014** |
| M-JRA02-1.1 | Synthesis of actinide targets by sol-gel method - 'chimie douce' | 38 |
| M-JRA02-1.2 | Synthesis of nanostructured actinide targets | 38 |
| **D-JRA02-2** | **Characterization of new actinide targets (Task 2: Characterization of new actinide targets)** | **41 jan 2014** |
| M-JRA02-2.1 | Characterization of structures | 38 |
| M-JRA02-2.2 | Characterization of thermal properties | 38 |
| **D-JRA02-3** | **Characterization of irradiated targets in hot cell (Task 3:Actinide targets properties after irradiation)** | **46 jun2014** |
| M-JRA02-3.1 | Characterization of irradiated materials in hot cell | 44 |
| **D-JRA02-4** | **Isotope release properties and modelling Task 4: Online Tests of Actinide Targets** | **46 jun2014** |
| M-JRA02-4.1 | Analysis of online tests of new actinide targets | 44 |
| M-JRA02-4.2 | Effect of beam time structure on online tests | 44 |

# Actinide ISOL Target R&D Laboratory

| Participants laboratory | Persons-months per participants | Budget k€ |
|---|---|---|
| GANIL | 8 | 38 |
| LNL/INFN | 20 | 72 |
| ISOLDE/ CERN | 21.5 | 113 |
| IPNO/ CNRS | 19 | 55 |
| PSI | 7 | 58 |
| **total** | **75.5** | **336** |

- Task 1: Synthesis of new actinide targets
  - ISOLDE/ CERN
  - LNL/ INFN
  - IPNO/ CNRS
- Task 2: Characterization of new actinides targets
  - ISOLDE/CERN
  - LNL/INFN
- Task 3: Actinide target properties after irradiation
  - ISOLDE/CERN
  - PSI
- Task 4: Online tests of Actinide Targets
  - ISOLDE/CERN
  - GANIL
  - IPNO/CNRS

# List of deliverables

- ***D-JRA02-1 : Novel synthesis of actinide targets –***
  - ***prototype - month 41 (Feb 2014)***
- ***D-JRA02-2 : Characterization of new actinide targets –***
  - ***report - month 41 (Feb 2014)***
- ***D-JRA02-3 : Characterization of irradiated materials in hot cell***
  - ***report - month 46 (Jun 2014)***
- ***D-JRA02-4 : Isotope release properties and modelling –***
  - ***report - month 46 (Jun 2014)***

# Contracts opened for ActiLab

- ISOLDE/CERN
  - Post-Doc 24 months
- PSI
  - Permanent staff (hot-cell laboratory and  analysis group)
- LNL/INFN
  - Post-Doc 24  months
- GANIL
  - Post-doc 8 months

# Activities and general dates

## Meetings

- Kick off meeting 20 Jan 2011 (IPNO)
- 24 Nov 2011 (PSI)
- 24 mai 2012 (Italie)
- Jan 2013 (GANIL)
- Dec 2013 (LNL/INFN)

## Experiments

- CERN
  - UCx HD target 2011
  - New UCx target developed at CERN Dec 2012
- PSI
  - Scheduled June 2013
- IPNO
  - March 2013
  - Scheduled Dec 2013

On-going activities..

# ACTIVITIES IN EACH LABORATORY


- On-line tests of:
  - HD UCx targets
  - LD nano structure targets
- Synthesis of new actinide targets
- Characterization of targets before irradiation
- Characterization of targets after irradiation (at PSI)
  - Aging of the materials under irradiation

Alexander Gottberg, Thierry Stora

# Upgrade of Ucx Laboratory at CERN

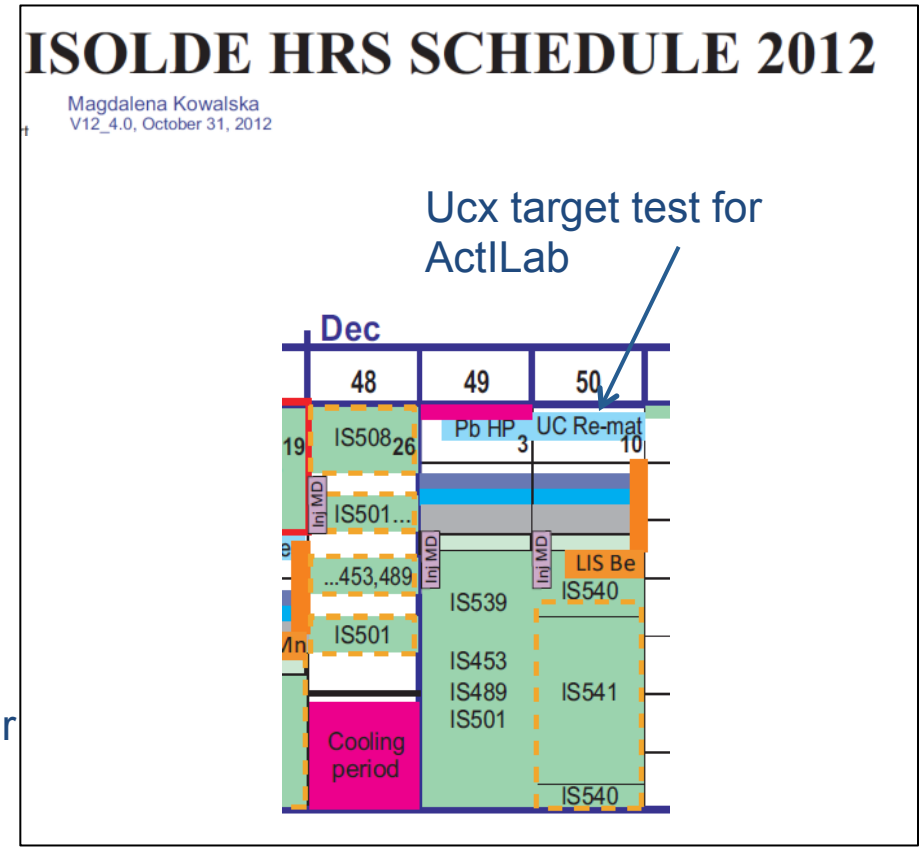
Dedicated target unit for characterizing the thermal evolution of the UC based material (sintering, degree of carbothermal reduction)

Two separated α-, β-, γ- fume cabinets for
1. production
2. development

High speed tungsten carbide ball-impact grinder with gas temperature and pressure control unit.

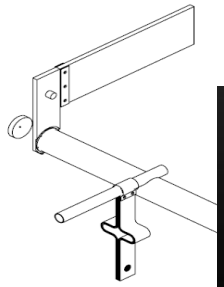
BET for measurement of open porosity and of grain size of pressed-powder pellets.

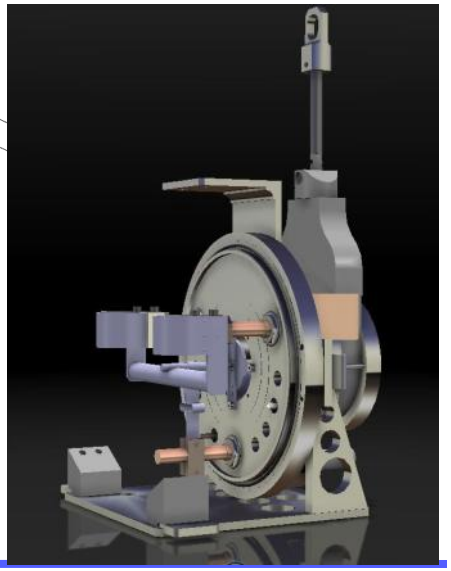
Dual wavelength laser particle size analyser for particle sizes between 1nm and 5mm.



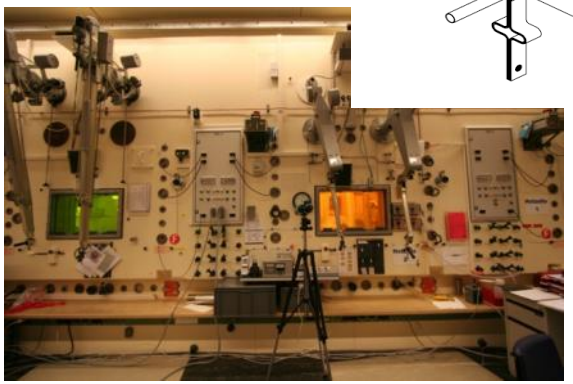
- Exchange of drawings, dummy samples with CERN
- Target selection (activities, dose rates)
- Discussion of extraction procedure and waste handling
- Transport organisation
- Transport of an irradiated target between CERN and PSI

- Dismantling of the target holder in the hot cells
- Transfer of the target container
- Design a storage container for the UC samples (inert gas conditions)

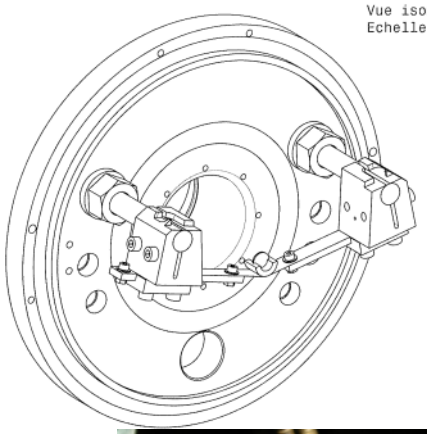




- **FIRST EVER DISMOUNTED IRRADIATED $UC_X$ TARGET**



- Synthesis method of the Ucx targets
  - Optimization of the protocol to elaborate the pellets
- Characterization techniques
  - X-ray diffraction
  - Hydrostatic Weighting
  - He Pycnometer
  - Hg Porosimeter
  - BET
  - SEM
- Carburization effects
- Release properties of the targets
  - On-line irradiations – off-line measurements
- On-line experiment planned




S Tusseau-Nenez, C. Lau

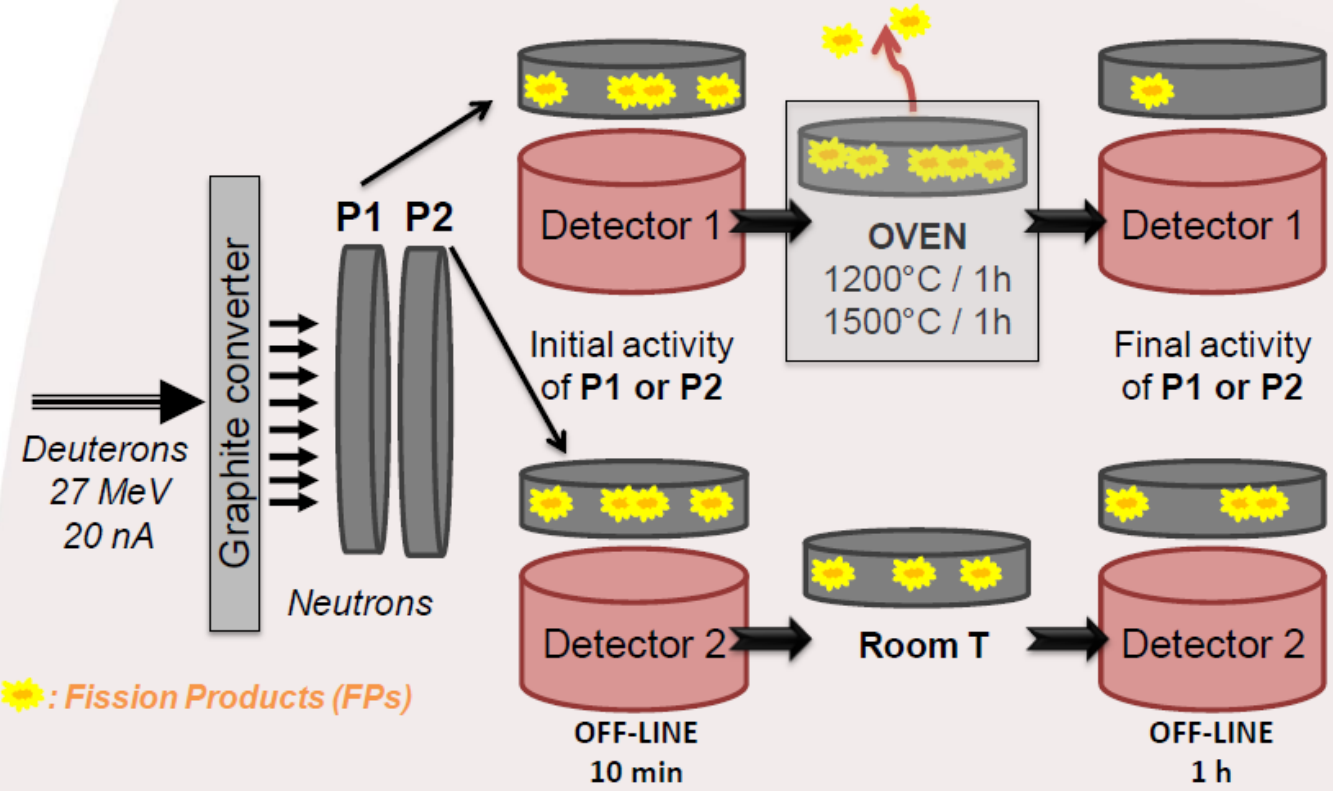
# Extension of the target laboratory



Temporary installation of equipment for synthesis and characterization

# RELEASE MEASUREMENTS

**Release properties of UCx samples : amount of fission products remaining after heating**

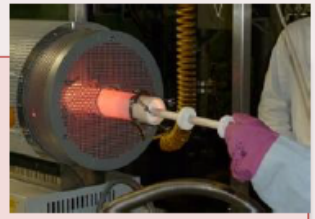



**Irradiation conditions:**

- Irradiation time :20 min
- Cooling time : 40 min

**Heating conditions :**

- 1200°C or 1550°C during 1h
- Primary vacuum
- Cooling down to 70°C ⇨ avoid any pyrophoritic phenomenon in air, waiting time : 30 min



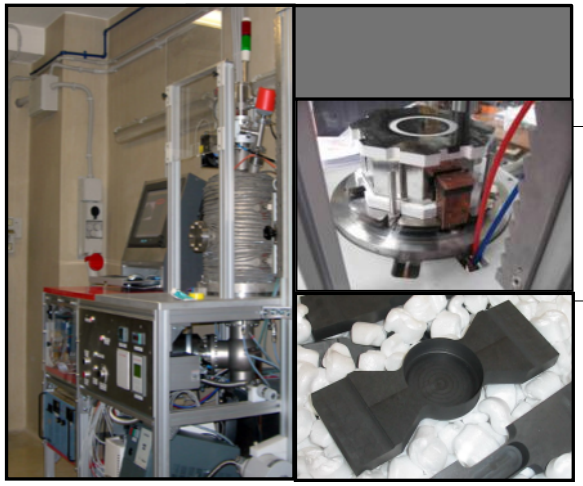
# Installation of a new Ucx laboratory at LNL

UCx Laboratory

Decontamination room

Devices: glove box , fume hood , high vacuum furnace

# Production of $UC_X$ samples

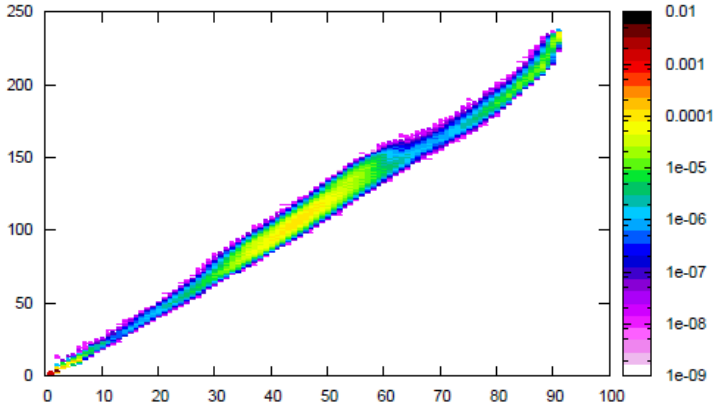


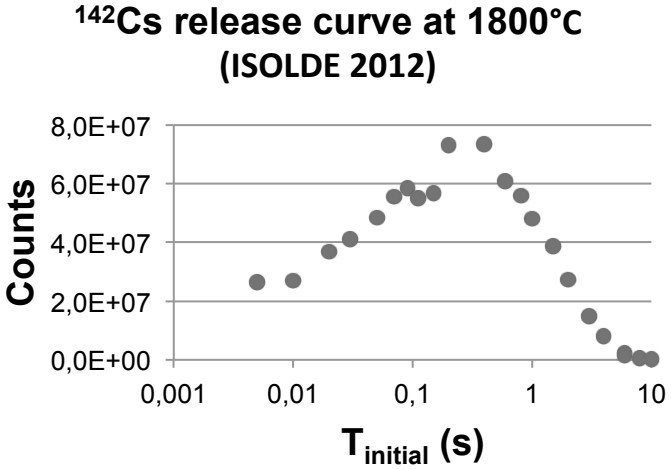
$UC_X$ Vacuum Furnace (up to 2000 °C), to be moved to LNL

Reduce and homogenize the grain size of oxide and carbon source → selection and control of the precursors

- Vibratory micromill and sieves purchased (grain size down to few μm) to treat small quantities of precursors

- FLUKA simulations
  - Low density powder (LD): 1.5 g/cm$^3$
  - High density powder (HD): 11 g/cm$^3$
  - Low density pellets (LDP): 3.5 g/cm$^3$,
  - High density pellets (HDP): 12 g/cm$^3$,
- Participation in experiments
  - ISOLDE CERN Dec 2011
  - ISOLDE CERN Dec 2012
  - ALTO IPNO March 2013
- Analysis of the experiments
  - ISOLDE CERN Dec 2011
  - ISOLDE CERN Dec 2012
  - ALTO IPNO March 2013




- Yield comparison after release from both targets

Joanna Grinyer, Hanna Franberg-Delahaye, Pierre Delahaye


•For results please see the presentation of A. Gottberg

•The collaboration continues see the presentation of C. Lau !

# THANK YOU FOR YOUR ATTENTION