Status and perspectives for medical isotope production at MEDICIS

Charlotte DUCHEMIN
on behalf of the MEDICIS collaboration

MEDICIS run coordinator: Charlotte DUCHEMIN (Joined the team on 1st of August 2019)
Predecessor: Joao Pedro RAMOS (until mid-July 2019)

MEDICIS Class A labs coordinator: Laura LAMBERT

ISOLDE Workshop and Users meeting 2019
5th & 6th of December 2019
The CERN accelerator complex long-shutdown n°2

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**MEDITCIS is operating during LS2!**

Running offline with **external sources** provided by Institut Laue Langevin ILL (reactor) and the ARRONAX cyclotron

**Shutdown**

**Beam commissioning**

**Physics**

**Technical stop**
What do we receive from our partner facilities?

ARRONAX
Nantes, France

Institut Laue Langevin
Grenoble, France
Cyclotron C70 – Nantes, Fr
Protons between 30-70 MeV
Natural Gadolinium foils
25 µm thick

Gd-nat(p,xn)Tb-155 production cross section

First collections performed with a Gd foil inserted inside the target
Rhenium boat

Target #645M in the ARRONAX hot cell

Radiochemistry now performed at Arronax after irradiation to reduce the ratio Tb/Gd

B. Crepieux & E. Barbero (EN-STI-RBS)
Institut Laue Langevin

• Vials filled with enriched material – Er-168, Yb-174, Pt-194
• Irradiated by the neutron flux of the ILL reactor (50 to 56 MW);

\[
\text{Er-168}(n,\gamma)\text{Er-169} \quad \text{Yb-174}(n,\gamma)\text{Yb-175}
\]

• Shipped to CERN;
• Vial opening + transfer into target → performed at CERN;

Automatic system developed by B. Crepieux (EN-STI-RBS)
MEDICIS Facility overview
2019
MEDICIS Facility overview 2019

- Test of ILL vials opening
- Montrac® monorail system maintenance
- Water cooling on MEDICIS frontend
- MEDICIS storage shelves
- Commissioning of the fume hood
- Extraction electrode replacement: new concept validated after repeatability tests
MEDICIS Facility overview 2019

- Ventilation
- Robot
- Test of sample transfer
- Laser MELISSA

April

- Endoscopy analysis of frontend
- Extraction electrode mechanical issue

May

Delay until beginning of July
MEDICIS Facility overview 2019

- Reception of new electrode, installation and offline tests
- 26th of June beam permit signed by EN-STI group leader
- 2 vials received from ILL → 1xEr-169 for collection + 1xPt-195m for HUG
- 2nd of July: first collection from external sources
- 3 additional sources of Er-169 received from ILL
- 4 weeks - 307 hours of collection
- Total of 140 MBq of Er-169 collected
- Distributed to PSI and NPL

Limit: no proton beam operation
MEDICIS Facility overview 2019

- First importation of irradiated Gd from Arronax (second external source)
- Low activity source for first tests
  - Collection of 95 kBq of Tb-155
- Busy month!
  - 2nd source from Arronax: 1x irradiated Gd
  - 4 sources from ILL: 2x Er-169 + 2x Yb-175
- And in between ...
  - around 1400 visitors

- Reports from collaboration members
- Status updates of experiments
- New proposals and future upgrades discussed
• 4 sources from ILL → 2x Yb-175 for collection + 2xPt-195m for HUG
  • 208 MBq of Yb-175 collected for PSI

• Period of tests at MEDICIS
  • Including Gd & Tb resonance studies performed by the LASER experts from EN-STI-LP & KU Leuven;
  • From ARRONAX side, development of their radiochemistry steps to reduce the proportion of Gd in the sample.

• 2 sources from Arronax -> 2x irradiated Gd for Tb-155 collections
  • Radiochemistry steps post-irradiation
    • 1\textsuperscript{st} Tb-155 collection → cancelled due to issues after a CERN wide power cut
    • 2\textsuperscript{nd} Tb-155 collection → ongoing ...
Summary of the 2019 collections at MEDICIS

2 External sources
ARRONAX
Nantes, France
Institut Laue Langevin
Grenoble, France

3 Radionuclides collected at MEDICIS
Tb-155
Yb-175
Er-169

4 Research Institutes received activity
KU Leuven / SCK (BE)
PSI (CH)
NPL (UK)
HUG (CH)

15 collections
922 hours
15 weeks of operation
870 MBq in total collected this year

15 weeks of operation
870 MBq in total collected this year

8 Targets
Re-used up to 3 times

8 Targets
Re-used up to 3 times
MEDICIS outlook for 2020

• MEDICIS **technical stop** foreseen until end of February

• **LS2** continues next year – **no proton** beams

• Need of **external sources** provided to MEDICIS next year

- **Cyclotrons**
  - ARRONAX will continue to provide Tb-155 for next year
  - PSI: possibilities to produce Tb isotopes from their proton beam
  - New external source: Riga Nuclear Medicine Center – 18 MeV cyclotron

- **Reactors**
  - ILL in shutdown until mid-2020
    - New irradiated vials will arrive at MEDICIS by autumn 2020
  - Pakistan Atomic Research Reactor or (PARR) – **under discussion**

• Tests to collect long-lived actinides from targets irradiated one year ago at ISOLDE for Target and Ion Source Development
PRISMAS-MAP: PRoduction of high purity isotopes by MAss Separation for Medical Application

Project proposal
Next H2020-INFRA call

Inspired from the NIDC

thierry.stora@cern.ch
A BIG THANKS TO ALL THE PEOPLE, GROUPS, SERVICES, INSTITUTES ... INVOLVED IN MEDICIS!

- Project management
- Operational RP and safety
- Engineering, Target assembly and handling
- LASER, Robot, Operations and Controls

Collaboration institutes
γ-spectrometry and shipping
Radiochemistry
MEDICIS Promed H2020 contract #642889

THANK YOU FOR YOUR ATTENTION!
BACK-UP
The MEDITICIS program is driven with input from the collaboration

2nd Coll. Board – 3rd Oct 2108
3rd Coll. Board – 20th Mar 2019
4th Coll. Board – 18th Sep 2019

Biomedical research in Theranostics

Project proposal to the MEDITICIS Collaboration board

44Sc production with 18 MeV cyclotron and study of scandium-labeled peptide based ligands for clinical use

MED015 RSU
44Sc production with 18 MeV cyclotron and study of scandium-labeled peptide based ligands for clinical use

MED016 Huéla hospital
Theranostic radiolabeled nanoparticles for ovarian cancer by folate receptor targeting

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