PAUL SCHERRER INSTITUT



Dorothea Schumann :: Paul Scherrer Institute

WP3: Target Preparation for Improvement of Nuclear Data Measurements

SANDA REVIEW meeting, 30.11.2022



- Task 3.1: Intensification of the "producer user interaction" Task coordinator: PSI, partners: JRC
- Task 3.2: Fostering the network of target makers Task coordinator: JRC, partners: PSI
- Task 3.3: Target production

Task coordinator: JRC, partners: PSI

Task 3.4: Development of an isotope separator

Task coordinator: PSI, partners: UMAINZ, ILL

| Partner number and short name | WP3 effort |
|-------------------------------|------------|
| 13 - JRC | 15.20 |
| 21 - PSI | 27.00 |
| 28 - UMAINZ | 24.00 |
| Total | 66.20 |

Task 3.1: Intensification of the "producer – user – interaction"

Workshops

Inviting potential target users to discuss the boundary conditions for their specific experiments Teaching potential users that:

- The success of their experiment depends on the quality of the target
- The preparation of high-quality targets takes time
- A budget for target preparation should be foreseen in any proposal
- Radioactive targets require special care and additional money concerning transport, storage and waste disposal

Former events: ERAWAST I (2006), ERAWAST II (2011) as well as the CHANDA workshop (2015)

Next workshop tentatively planned for spring 2020; second one in 2022

Bilateral meetings producer - user

Detailed discussions on specific experiments User contacts producer; parts of the travel costs will be covered

| 21 PSI | Cost | Justification | | |
|--------------------------|-------|---|--|--|
| | (€) | | | |
| Travel 22500 | | Support for the travel of participants in the meetings for the targets | | |
| | | producer coordination in WP3, 20 person*trips at 1000 euros each plus 5 | | |
| | | person*trips at 500 euros each. | | |
| Equipment | | | | |
| Other goods and services | 2500 | For certificate of financial statement | | |
| Total | 25000 | | | |

Task 3.2: Fostering the network of target makers

- Main collaborators at present: Jyväskylä, GSI, GANIL, Uni Warshaw, IPNO, IFIN-HH, Uni Mainz; look for new partners in Europe
- Extend the network to facilities outside Europe (Oakridge; Argonne, Capetown)
- Use synergies with existing platforms (INTDS): next conference: INTDS2020 20.-25.9.2020 at PSI
- Establish a joint database of target preparation facilities and enriched isotope suppliers
- Support education of young researchers (short and longer-term visits) Equipment sharing
- Knowledge exchange (workshops, meetings)

| 13 JRC | Cost (€) | Justification |
|-----------------|----------|--|
| | | |
| Travel | 29000 | 4000 for travels to meetings, 4 person*trips at 1000 euros each, of the project plus 25000 to support for the travel of participants in the meetings for the targets producer-user interaction in WP3, 25 person*trips at 1000 euros each. |
| Equipment | | |
| Other goods and | 27000 | 2000 for the organization of a workshop and 25000 for the support to the |
| services | | E&T course |
| Total | 56000 | |



A limited number of targets can be produced according to requests from collaboration members.

Both PSI and JRC will be responsible for the manufacturing of the final target. The target manufacturer will be in close contact concerning the special requirements of the envisaged experiment using the possibilities of user-producer interaction provided in the frame of task 3.1.

Resources will be allocated according to the effort. Target requests can be submitted to the TP task leader. Both requests related to energy (minor actinides, ²³³U, ²³⁹Pu or fission products like ⁷⁹Se) and non-energy applications (for instance ¹⁷⁹Ta) will be considered. Each target request will be evaluated on the basis of the relevance of the target and the possibilities of the TP facilities.

During the first 12 months of the project, target request from collaborators will be collected and evaluated. As an essential milestone, the decision on which targets can be manufactured will be made after this time span.

Total budget 150 k€ (75 k€ JRC, 75 k€ PSI)



Task 3.4: Development of an isotope separator

Production of isotopically pure targets by dedicated mass separation Exploration of innovative efficient and selective ionization procedures

Applications: cross section measurements for

- Nuclear-energy related isotopes
- Nuclear astrophysics

2 subtasks:

Site preparation in Hotlab of PSI-PSIDesign development of the machinery for specific applications-UMAINZ

Total budget: 245 k€ (160 k€ UMAINZ, 65 k€ PSI, 20 k€ ILL - subcontract)



Deliverables and Milestones

| Deliverable Number ¹⁴ | Deliverable Title | Lead beneficiary | Type ¹⁵ | Dissemination level ¹⁶ | Due Date (in months) ¹⁷ |
|-------------------------------------|---|------------------|--------------------|-----------------------------------|--|
| D3.1 | Report on the meetings performed in the frame of ("Producer – user – interaction") | 21 - PSI | Report | Public | 36 |
| D3.2 | Report on the meetings performed in the frame of "Network of target producers" | 13 - JRC | Report | Public | 42 |
| D3.3 | Report on produced targets | 13 - JRC | Report | Public | 30 |
| D3.4 | Documentation of the design of a mass separation tool for target preparation | 28 - UMAINZ | Report | Public | 48 |
| D3.5 | Documentation of the site specification for installation of a mass separator in the Hotlab of PSI | 21 - PSI | Report | Public | 36 |

Milestones:

| MS27 Scheduling regular user – producer meetings | PSI | February 2020 |
|--|-----|---------------|
| MS28 Scheduling regular target - maker meetings | JRC | February 2020 |
| MS29 Decision on targets to be manufactured | JRC | February 2021 |



Task 3.1: Intensification of the "producer – user – interaction"

MS27 Scheduling regular user – producer meetings PSI February 2020

Has been done till end 2019!

Was obsolete in March 2020



User – Producer interaction – SANDA I



10 contributions on isotope and target production / characterization8 contributions on applications and target requestsall abstracts submitted



30.3. – 3.4.2020 at Paul Scherrer Institut Villigen Due to Corona postponed to 6.-8.7.2020, cancelled

1st SANDA – user – producer – interaction meeting

Paul Scherrer Institut :: 5232 Villigen PSI :: Switzerland :: Tel. +41 56 310 21 11 :: Fax +41 56 310 21 99 :: www.psi.ch



Workshop SANDA II (18.8.2021)

Session 1 Target production and characterisation

| JRC-Geel targ | G. Sibbens (JRC) | | | |
|--|---|-----------------------------|--|--|
| Isotope proc | E. Maugeri (PSI) | | | |
| Isotopic thin | films preparation laboratory for nuclear physics; IFIN-HH, Bucharest, Romania | N. M. Florea (IFIN-HH) | | |
| Session 2 | Applications (SANDA I) | | | |
| 243-Americiu | um targets for the study of neutron induced fission cross section at the n_TOF facility | Z. Eleme (Univ. Ioannina) | | |
| of CERN | | | | |
| Need in radio | pactive targets for fission studies at NFS | D. Tarrio (UU) | | |
| Session 3 | Applications (SANDA II) | | | |
| Test of a novel Frisch-Grid chamber, and measurement G. Lorusso (N | | | | |
| of the ²³⁶ U(n | g) cross section | | | |
| A ⁵⁹ Ni target | for neutron-induced gamma-ray spectroscopy | C. Michelagnoli (ILL) | | |
| A ¹⁷⁹ Ta target for (n,gamma) spectroscopy relevant for the astrophysical origin of ¹⁸⁰ Ta C. Michelagnoli (ILL) | | | | |
| Production o | L. Tetley (Uni York) | | | |
| ¹⁰ B targets fo | r the production of ¹¹ C in deuteron induced reactions | J. Benlliure (Uni Santiago) | | |
| Preparation of | C. Guerrero (CNA) | | | |
| and transmis | sion experiments for criticality safety | | | |
| Radiative cap | oture measurement on ⁷⁹ Se at n_TOF:sample preparation and future perspectives | C. Domingo-Pardo (IFIC) | | |
| First measure | irst measurement of ⁹⁴ Nb neutron cross section C. Domingo-Pardo (IFIC | | | |
| at n_TOF: Sa | mple preparation and future perspectives | | | |





2020/21

SANDA workshops for target production: Part I and II



Dorothea Schumann; Goedele Sibbens SANDA WP3 - Target Preparation for Improvement of Nuclear Data Measurements 2020/21

Book of abstracts

Integration of all contributions (SANDA I and II)

Talks and abstracts available on the webpage: https://indico.cern.ch/event/1064846/

Basis for the decision on targets which can be produced

Decision at collaboration meeting in 2021: Use part of the money allocated for meetings for additional target manufacturing



Task 3.2: Fostering the network of target makers

MS28 Scheduling regular target - maker meetings JRC February 2020

Has been done till end 2019! Was ob

Was obsolete in March 2020

INTDS2020 (September 2020) had to be cancelled. PSI was ready for the performance, but the situation in most of the other countries didn't allow travel. Since personal contacts are important, we preferred to postpone the conference instead of conducting it online.



nt/7834/

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Sep 25 – 30, 2022

Switzerland Europe/Zurich timezone

30th Conference of the International Nuclear Target Development Society INTDS 2022

Knowledge exchange via e-mail and remote meetings

INTDS2022 could be performed!

https://indico.psi.ch/event/7834/ Around 80 participants from Africa, Asia, Europe and North America 12 sessions 51 scientific contributions Proceedings in EPJwoc awaited mid 2023 Next conference scheduled for autumn 2024

| General Information |
|---|
| Scope |
| Important Dates |
| Topics |
| Program at a glance |
| Book of Abstracts |
| Venue |
| Abstract Information |
| Proceedings |
| Social Event and visit of PSI facilities |
| Registration |
| Visa Information |
| Timetable |
| Accommodation and Restaurants |
| Financial Support |
| Invited Speakers |
| Participant list |
| Scientific Advisory Committee |
| Local Organisation Committee |
| How to get to PSI |
| Poster |

General Information

Dear Colleagues,

We are pleased to announce that next the INTDS conference will be held at the Paul Scherrer Institut, Switzerland, on <u>September 25-30, 2022</u>



INTDS Website

Conference Site Auditorium, PSI West, Forschungsstrasse 111, 5232 Villigen, Switzerland



Task 3.3: Target production

MS29 Decision on targets to be manufactured

JRC February 2021

Was done after the second workshop SANDA II in August 2021 based on the proposals submitted to the two workshops:

20 target requests.

- 12 target requests are finished and the targets are delivered. PSI contributed with 4 and JRC with 8 requests.
- 5 target requests are pending (PSI has 4 requests under discussion and JRC has 1 request pending because the equipment to produce the requested targets is not commissioned yet)
- 2 target requests were cancelled (isotope production is currently not feasible; project withdrawn from SANDA) and 1 is on hold (Preparation for further use, no experiment envisaged).



Task 3.4: Development of an isotope separator

Site preparation in Hotlab of PSI

- 1 room for sample preparation and target production
 - Permission for working with α-emitters obtained, equipped with fumehoods, measurement technique, radiochemical devices etc. glovebox installation ongoing
- 1 room for separation facility
 - Former Pu-zone, remainings from former users have to be measured for clearance, conditioned, and disposed of.
 - Problems with supply chains and waste disposal capacities
 - Work will be delayed

Design development of the machinery for specific applications (UMAINZ)

 Finished, report will be delivered in time (already partly reported in 18-months-report)



Simulations for Isotope Separator (UMAINZ)

Boundary condition:

limited amount of starting material (different to ISOL facilities like ISOLDE) Aim:

high transmission

(on cost of mass resolution) high current for preparative operation



Cross section of the ion extraction region of RISIKO for three ion current settings in the different panels. The atomizer/ionization oven is on the left and the tip of the extraction electrode on the right. Distances are given in millimeters and the ion flux on a relative logarithmic color scale. Shifting of the ion beam focus is clearly visible.



Transmission and mass resolution of the RISIKO setup for different ion currents and a test beam composed of arbitrary masses 149, 150, 151 u at a 1:1:1 ratio. Left: 100 nA, Middle: 1μ A, Right: 10 μ A total beam. The top panels display the horizontal beam profile and the bottom panels the mass composition of the beam. The ion beam in front of the slit is displayed in blue and downstream of the slit in orange.

Results and further studies:

Simulations show that ion currents up to 10 µA are possible, however with a certain loss in mass resolution. Qualitative experimental studies at the RISIKO facility Optimization of source parameters; new, adapted simulation Specification for the separator magnet Technical blueprint for the layout of the separator components



Deliverables and Milestones

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|-------------------------------------|---|------------------|--------------------|-----------------------------------|--|-------------------|
| D3.1 | Report on the meetings performed in the frame of ("Producer – user – interaction") | 21 - PSI | Report | Public | 36 | Delivered Oct. 22 |
| D3.2 | Report on the meetings performed in the frame of "Network of target producers" | 13 - JRC | Report | Public | 42 | pending |
| D3.3 | Report on produced targets | 13 - JRC | Report | Public | 30 | delivered Oct. 22 |
| D3.4 | Documentation of the design of a mass separation tool for target preparation | 28 - UMAINZ | Report | Public | 48 | expected in time |
| D3.5 | Documentation of the site specification for installation of a mass separator in the Hotlab of PSI | 21 - PSI | Report | Public | 36 | 12 months delay |

Milestones:

MS27 Scheduling regular user – producer meetings MS28 Scheduling regular target - maker meetings MS29 Decision on targets to be manufactured PSI February 2020 delivered Oct. 22

- JRC February 2020 delivered Oct. 22
- JRC February 2021 delivered Oct. 22



Task 3.1: Intensification of the "producer – user – interaction"

Task coordinator: PSI, partners: JRC in time, 1 more workshop (online) envisaged for discussing results and learned lessons Deliverable 3.1 and MS27 fulfilled

Task 3.2: Fostering the network of target makers

Task coordinator: JRC, partners: PSI

in time, next INTDS conference in 2024 Deliverable 3.2 pending, MS28 fulfilled

Task 3.3: Target production

Task coordinator: JRC, partners: PSI

in time, a few more targets can eventually be made. Deliverable 3.3. and MS27 fulfilled

Task 3.4: Development of an isotope separator

Task coordinator: PSI, partners: UMAINZ, ILL design concept in time, site preparation delayed Deliverable 3.4 expected in time, Deliverable 3.5. delayed