

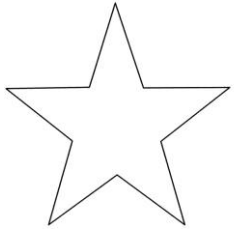


WP 3 HIGHLIGHTS

"Solid Targets"

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Task 3.1



PI: Roberta Spartà (INFN)

Participants:

- **University of Cologne (GER)**
- **Centre national de la recherche scientifique (FRA)**
- **ATOMKI (HUN)**
- **Horia Hulubei Institute of Physics and Nuclear Engineering (ROM)**
- **Istituto Nazionale di Fisica Nucleare (ITA)**
- **Università degli Studi di Enna Kore (ITA)**
- **Università degli Studi di Padova (ITA)**
- **Università degli Studi di Milano (ITA)**

Collect the *know-how* of European labs to **develop & test** special solid targets required for the experimental study of nuclear reactions of astrophysical interest

ultra-pure material targets *for low reaction yields* to be studied to avoid parasitic reactions on impurities

noble gases targets
He and Ne (cannot create solid compounds)
→ implanted into a host material
key reactions for s-process nucleosynthesis in evolved stars

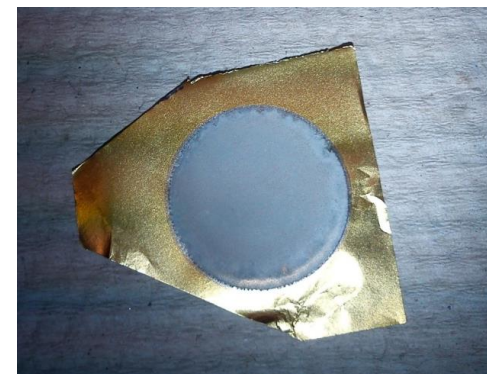
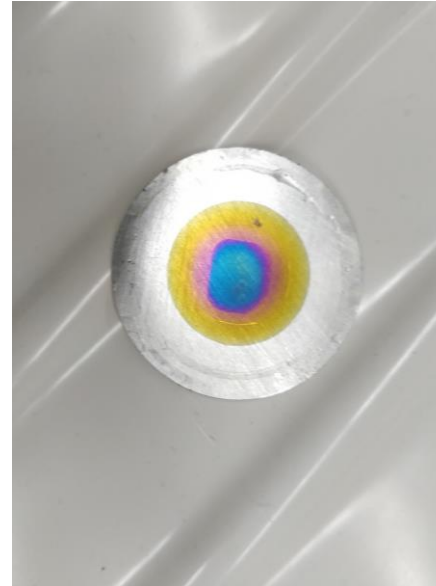
+ a service for the community:
standardized testing of the produced targets (including contaminant checks and stability tests)

Institute for Nuclear Physics of University of Cologne

Target laboratory

In-house target production via:

- Electrolysis
- Evaporation
- Rolling of self-supporting foils



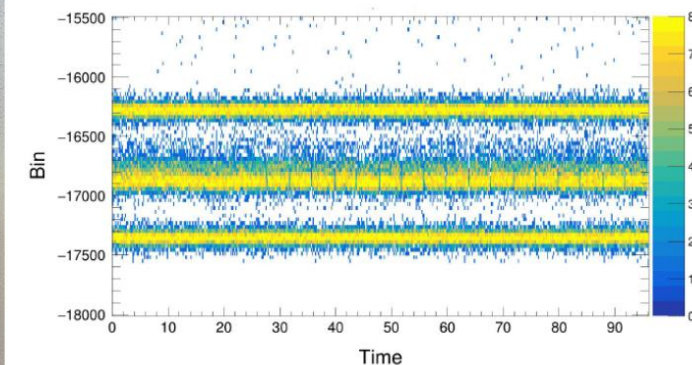
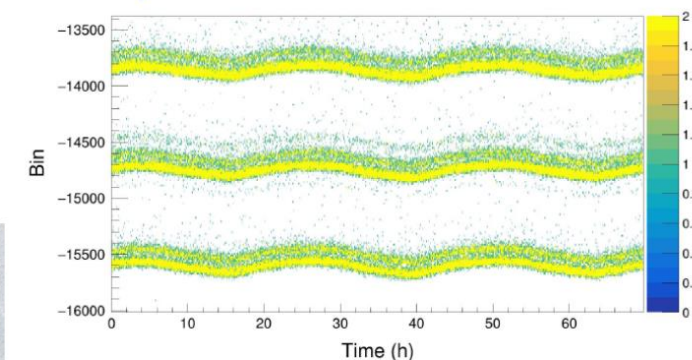
F. Heim & A. Zilges

Target Thickness Measurements

- Large surface, self supporting targets
- Transmission measurements with alphas (~ 5 MeV)
- 5-10% uncertainty for $40 \mu\text{g}/\text{cm}^2$ carbon foils
- Automated scan on and off beam spot
- Standard fixed target and large diameter target holders
- Support with characterization of targets at IPHC/CNRS Strasbourg



temperature drift correction





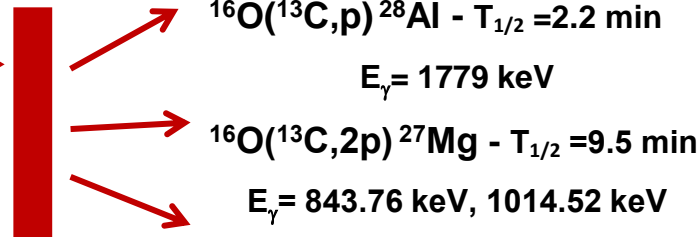
- **PRODUCTION:** vacuum evaporator with two material heating option (resistive and electron beam bombardment): thin layer of targets, also isotopically enriched
- **ANALYSIS:**
 - Non-destructive: Nuclear Resonance Analysis; Rutherford Backscattering Spectroscopy, PIXE
 - Destructive: secondary neutral-particle/ion mass spectrometry (SNMS/SIMS)

Horia Hulubei Institute of Physics and Nuclear Engineering

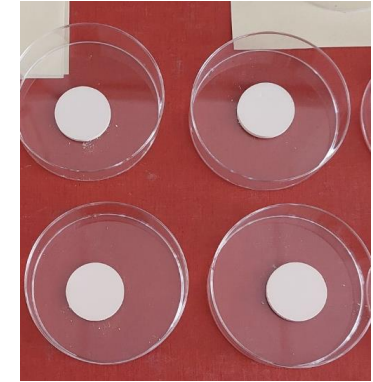


Self-supported CeO₂ solid thick targets (0.8 - 1 g/cm² thickness and 2 cm diameter), prepared by tablet pressing method using the Atlas™ Automatic 25Ton (25T) Hydraulic Presses.

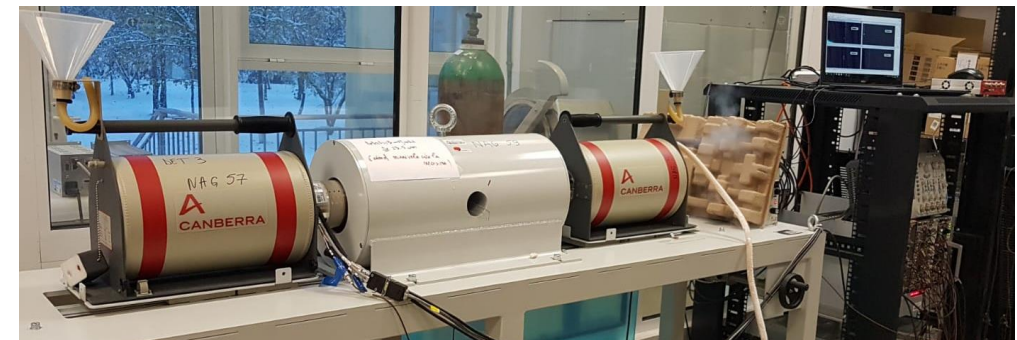
Most recent: measurement of the activation channels produced with the reaction $^{13}\text{C} + ^{16}\text{O}$



$^{13}\text{C}^{3,4,5+}$ beam @ 5 - 15 MeV and 0.2 – 3 eμA



gamma deactivation spectra
measured with BEGe station



N. Florea

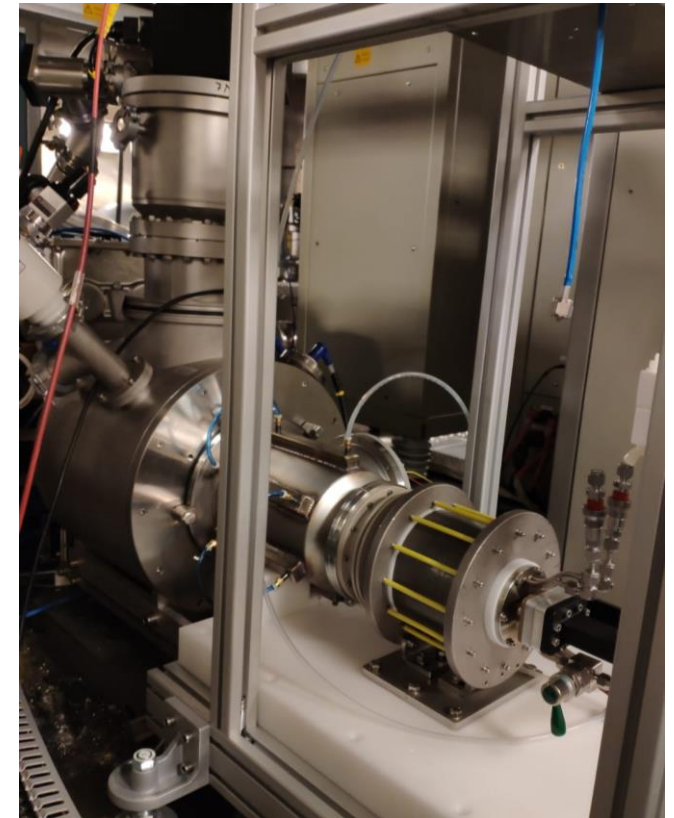
TEFLON TARGETS

- **INNOVATIVE** rolling technique starting from commercial TEFLON;
- Thickness not lower than $1000 \mu\text{g}/\text{cm}^2$
- Disomogeneity 20%

Noble gas targets

NESTOR ECR ion source

- installed on the 450 kV platform for production of noble gases negative ions for the Tandem Accelerator



R. Spartà

SALVIA project (Setup for AnaLysis with MeV accelerators of Isotopic tArgets and their preparation)

- Production of ^{14}N thin target for LUNA collaboration via magnetron sputtering:
 - ZrN
 - TiN
 - TaN
- High purity Ta and Mo thick coatings for **contaminations reduction** (γ background reduced)
- Production of deuterated targets (ZrD_2)
- Ion Beam Analysis with ERDA, EBS, PIGE

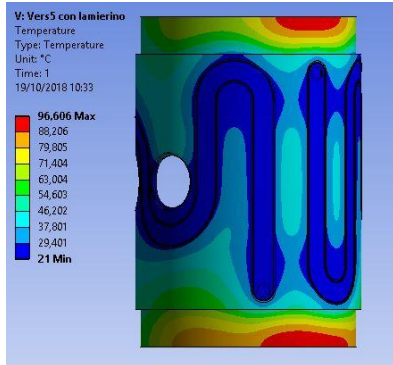
M. Campostrini

Study of hydrogen desorption from carbon targets (HEAT)

The main source of beam-induced background for $^{12}\text{C}+^{12}\text{C}$ direct cross section measurements is the interaction of ^{12}C beam with ^1H , ^2H contaminations in target.



The **HEAT** project is developing a procedure to reduce H contaminations by heating the targets up to 1200°C .



Beam

Chamber directly water cooled
(cooling coil engraved in chamber walls)

45° (NRA)

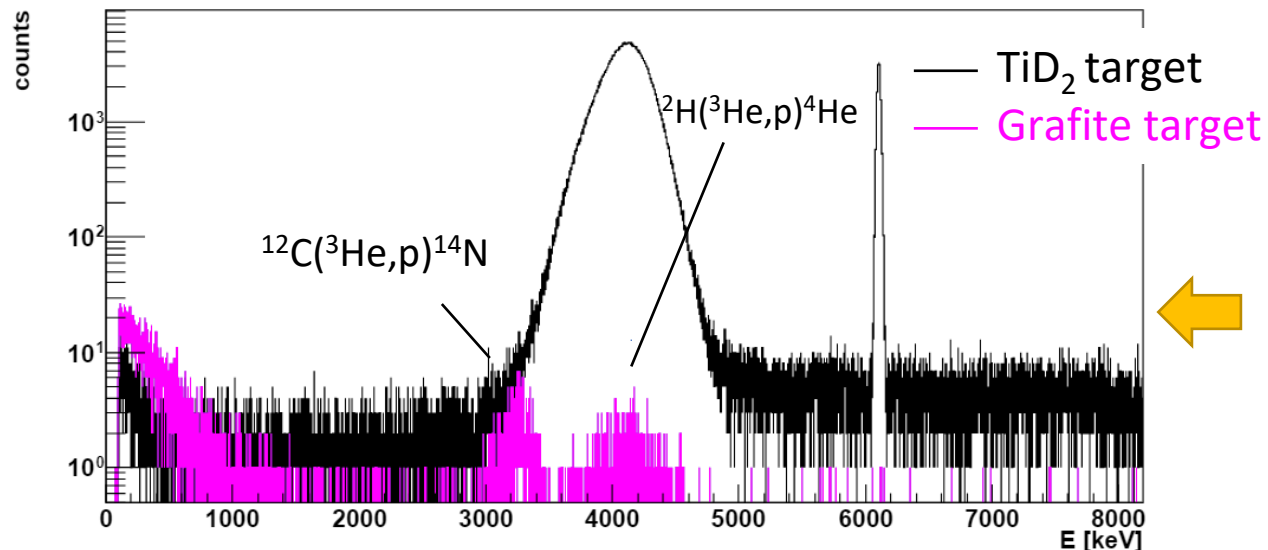
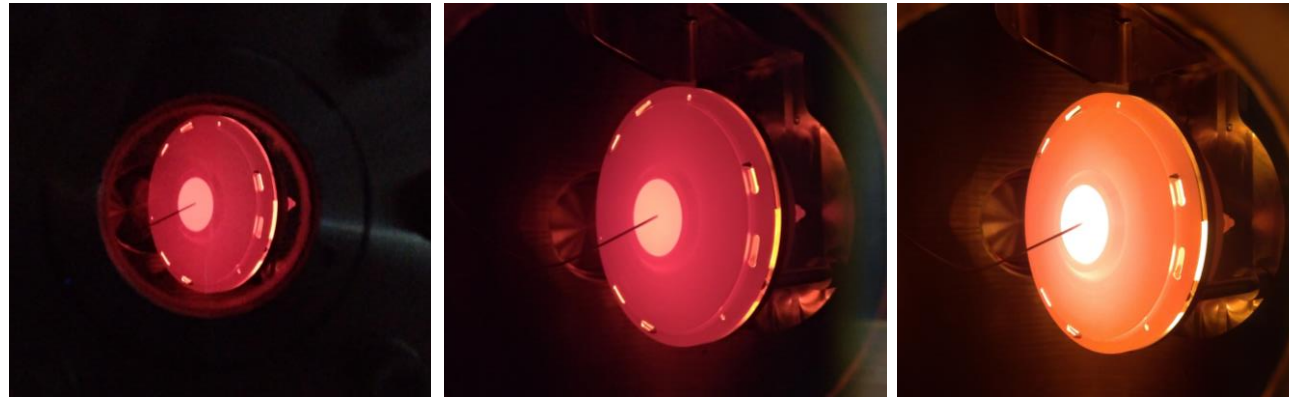
150° (ERDA)

Programmable heating
system with target holder



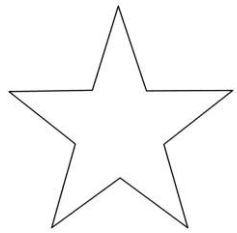
Università degli Studi di Padova and Milano

Study of hydrogen desorption from carbon targets (HEAT)



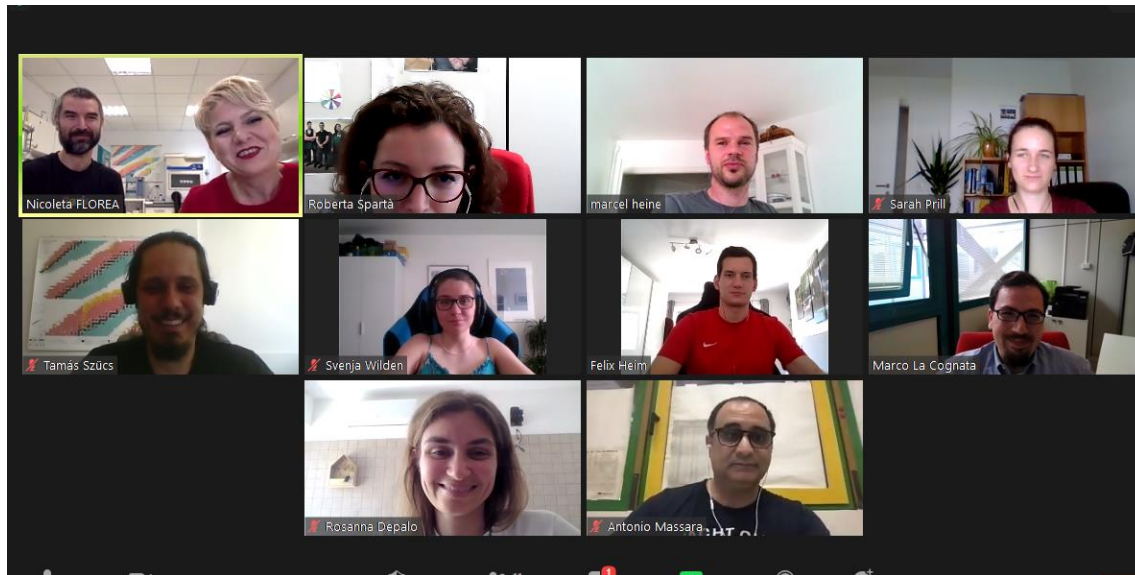
In the first tests, H contamination level was assessed using **Nuclear Reaction Analysis**, with the $^2\text{H}(^3\text{He},p)^4\text{He}$ reaction.

So far, we have reached a factor of ~ 3 reduction in H contamination, more tests will be performed in the future.



Solid
Targets for
Astrophysics
Research

Task 3.1



Started working on the 1st deliverable:

Report on the experimental techniques used for solid target production
as a status of the art of our labs' techniques and possibilities

This report + a map of the facilities will be the base for the target characterization service map to be proposed on the INFRA website

THANK YOU!