A Update on the Physics Division Target Laboratory: (CATS)

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"A unique asset of the ANL program is their target manufacturing capabilities. This expertise at ANL allows highly specialized targets to be prepared for various beam experiments at many laboratories. It is important that these capabilities be maintained given the continuing demands for such targets."
Report of the NSAC Subcommittee on Low Energy Nuclear Physics, November 15, 2001

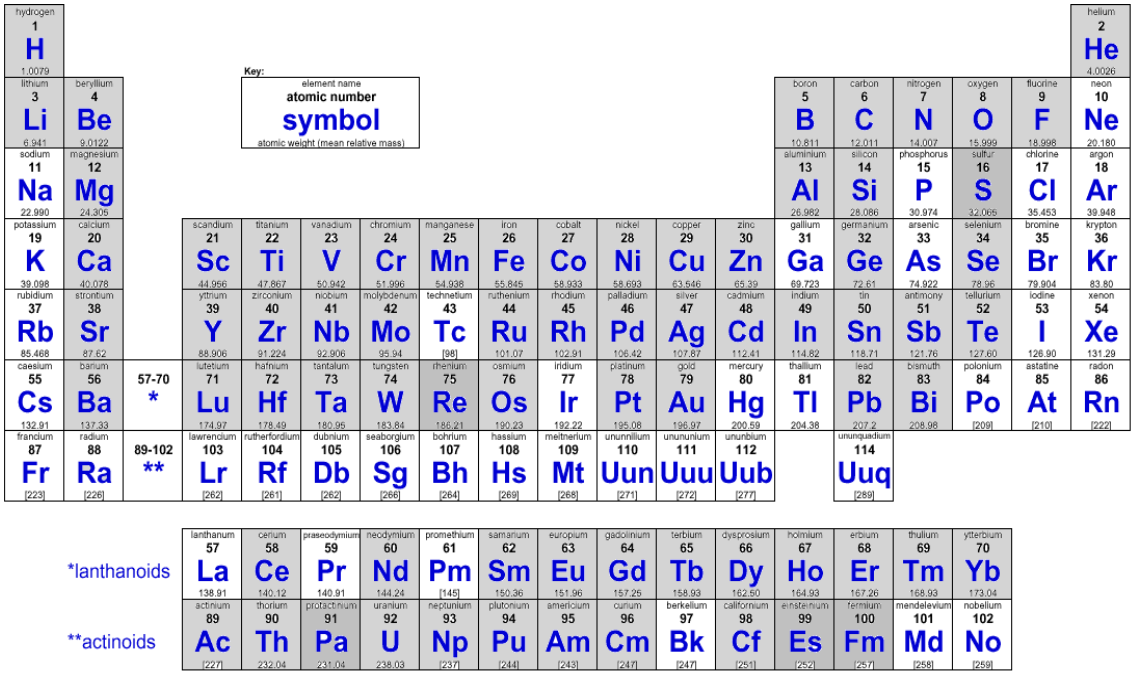
Outline of the Talk

- Introduction
- Physics Division CATS Initiative
- New Electron Beam Deposition System
  - Upgrades to the Intlvac Evaporator
- Refurbishment of the Target Laboratories
- Outreach & Target Library
- Future Plans

Physics Division Target Laboratory

- Introduction & Overview

The Physics Division operates a target development laboratory that produces targets and foils of various thicknesses and on substrates, depending on the requirements, for experiments performed at ATLAS.



The targets are prepared from both naturally occurring materials and stable isotopes that are supplied either in pure, elemental form or as chemical compounds. Targets are made not only for the Physics Division but also for other divisions at the Laboratory **and occasionally for other laboratories and universities.**

*for a description of the target lab, see - NIMA **282** (1989) 191-193, NIMA **362** (1995) 201-204*

" Finally, an urgent need that cuts across the whole experimental program now and in the future is the capability to have enriched stable isotopes for targets and the manpower and expertise to fabricate these essential targets. After investing so significantly to create such exotic beams together with building the sophisticated detector systems needed to record the reaction signals, we must not forget that without the right target, an experiment will not be successful. This target capability has largely been ignored by most laboratories, but is critical to the future of our subject. This issue must be considered and discussed as the community moves to new and upgraded RIB facilities." HRIBF White Paper, January, 2010

Physics Division Target Laboratory

- Introduction & Overview

Home | News | Division Information | Research | Seminars & Events | ATLAS | Search Argonne ...

Argonne > Physics > Targetlab

Target Laboratory

Personnel
Techniques/Capabilities
Target Request Form
Recent Publications
Picture Gallery

INTDS Homepage
FRIB - Point of Contact for Thin Targets

Techniques and Capabilities

The target development laboratory includes state-of-the-art equipment used for thin-film fabrication. The available techniques consist of multiple resistive heating, focused ion beam sputtering, glow-discharge plasma deposition, electron beam and electron bombardment evaporation, electro-deposition and mechanical rolling. The evaporators are maintained under high vacuum and each vessel contains a quartz-crystal film-thickness monitor with deposition rate indicators. Also included are movable shutters, quartz-lamp substrate heaters and thermocouple temperature sensors, allowing for complete process monitoring during target deposition.

Vacuum Evaporators

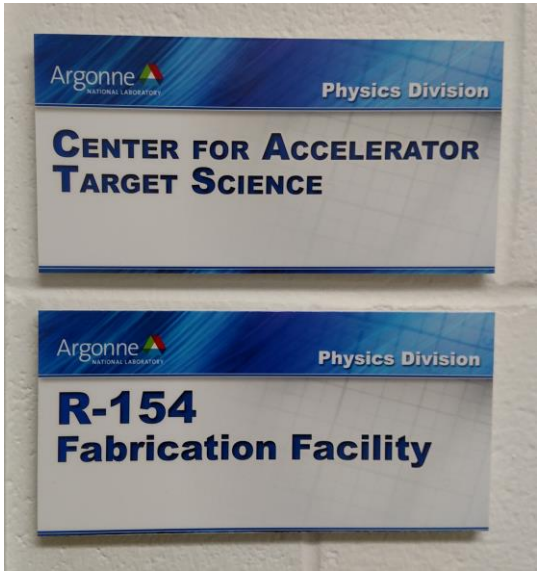
- Electron Beam Gun Evaporator
- NRC 3117 Evaporator - Mortar Source
- Intelvac Nanochrome Deposition System

Auxiliary Equipment and Techniques

- Rolling
- Electrodeposition
- Alpha Particle Counting System
- Target Storage Facility
- Other Laboratory Apparatus

http://www.phy.anl.gov/targetlab

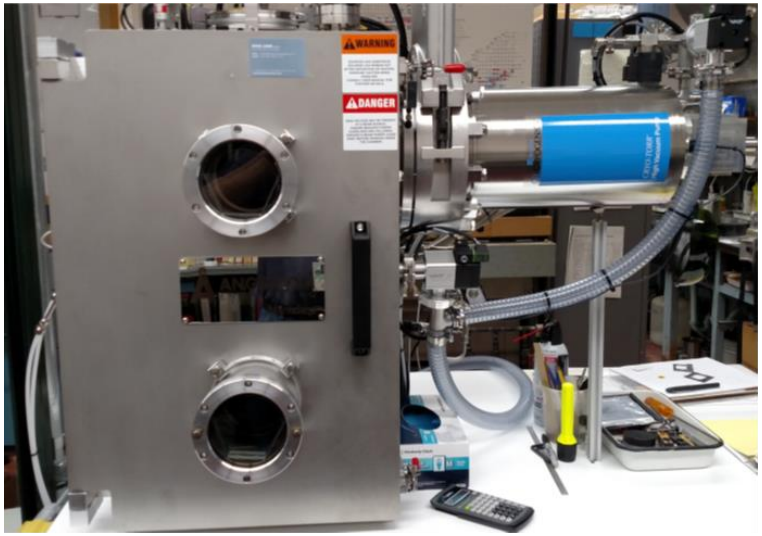
Physics Division CATS Initiative

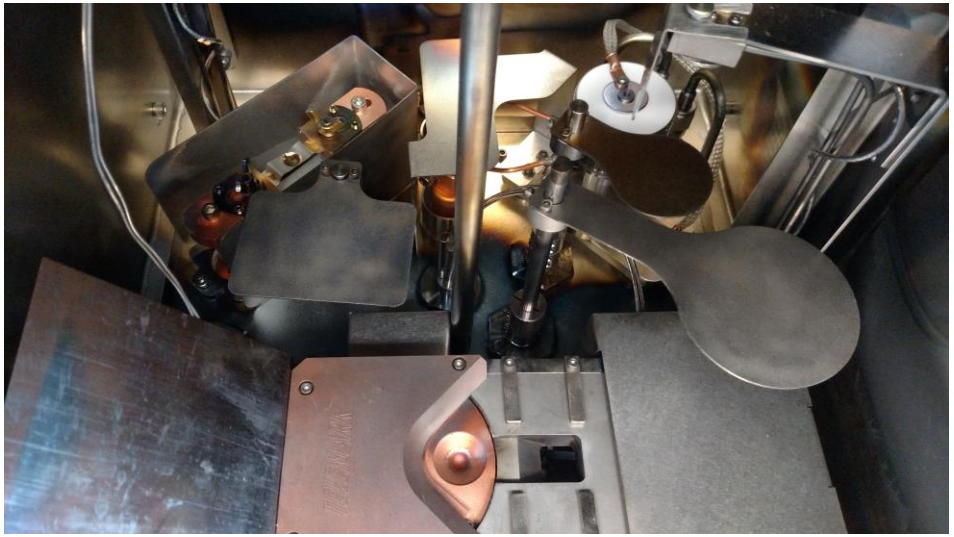


- Center for Accelerator Target Science
  - DOE NP Proposal
  - Full endorsement of the Low Energy Community
- MANPOWER
  - Little time for new research directions or community outreach (target requests)
  - Additional Personnel – Postdoc (Nuclear Chemistry) it's in the budget
- EQUIPMENT
  - Major equipment purchase (New Electron Beam Evaporator System)
  - Needed maintenance and upgrades – restore and enhance capabilities
  - New target initiatives (C-14, Actinides, targets for secondary beams)
- FACILITIES
  - Infrastructure repairs and improvements
  - Target Lending Library
    - Co-Op Student involvement

New Electron Beam Deposition System

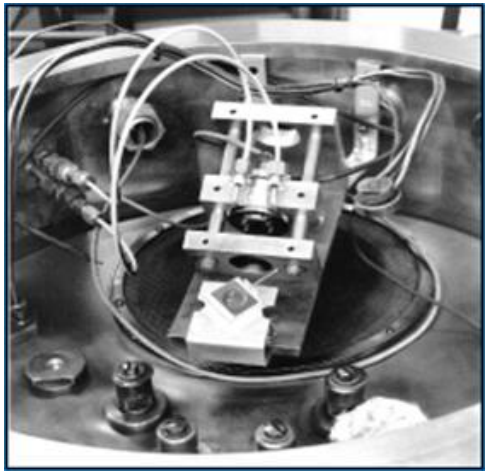
- The centerpiece for CATS was the acquisition of a new, state-of-the-art vacuum deposition system from Angstrom Engineering. This multi-purpose evaporator is primarily for electron beam deposition; containing two sources, along with an additional thermal evaporation capability. The new system contains an electron beam source, an electron bombardment source (for high-temperature oxide reductions) and for co-deposition, a standard thermal source as well. It has replaced TWO existing deposition units which were previously deployed in the lab. This machine now has been operational for nearly a year and after some initial and necessary modifications, is being used extensively for target production.





Upgrades to the INTLVAC Evaporator

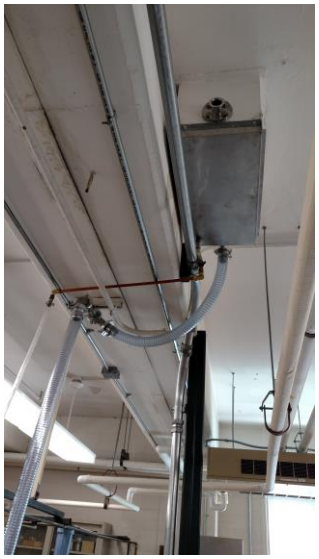
- In addition to the above procurement, an upgrade was performed on the control system for the 2nd Target laboratory evaporator, the INTLVAC Nanochrome deposition system. The original control hardware for this system had become obsolete. INTLVAC provided a new Control System and computer upgrades for a modest cost. Also, at this time the original thermal boat power cables were swapped out with new ones. Once completed, the new, improved system and computer control offers increased flexibility and brings the system up-to-date to match our new capabilities.



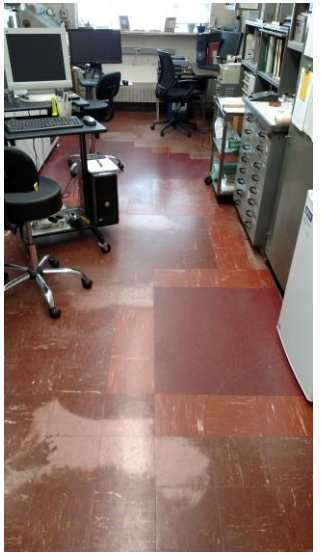
- Other minor changes included modifying one of the viewports to accept the vacuum target transport modules for coupling of targets to the experimental systems at ATLAS (i.e. Li, Ca targets) This apparatus also contains sputtering capabilities (Hall Ion Source) for Ion Assisted Deposition (IAD) as well as possible co-deposition scenarios. Plans are underway to retrofit the small Saddle-field Ion Sputter Source also within the chamber – making this a versatile sputtering platform for targets.

Refurbishment of the Target Laboratories

- The overhead fluorescent lighting was replaced with new LED bulbs. New ergonomic chairs and stools were purchased. The damaged floor tile in the target lab had been replaced and with the removal of the two evaporators more floor repairs were undertaken.



- Also undertaken was the upgrade of the vented exhaust for the lab forepumps. The old, leaking, ceiling ventilation connections were removed and replaced with sealed sheet metal to prevent the roof leaks and standard KF connectors installed. Vacuum hose and pump connections now exist for the two deployed evaporators. This is still a work in progress as eventually the vacuum targets storage systems will also need to be connected to this exhaust.



Refurbishment of the Target Laboratories

Our original home-built electron beam system has been relocated to the ATLAS Hot Lab for possible use in the production of THIN ^{14}C foil targets. There it has have access to a glove box for target preparation and mounting.

Physics Division Radioactive Material Handling Facility

- Radioactive Materials Handling Laboratory
  - Receiving Incoming Shipments
  - Manipulating Sample Material for Targets & Sources

The dual glovebox has been cleaned of rad waste and refurbished with new intake filters. New gloves have been fitted restoring functionality to the second side to make possible ^{14}C work. The standalone hood was reorganized for work with natural U and Th metals and powders.

Outreach to the Community - Target Library

- Targets and Separated Isotope *(WNSL Isotope Inventory.pdf)*
  - Lab space identified, set aside.
  - Perfect project for student involvement
  - Hope to make them available to the low-energy community

Yale targets at ANL

Los Alamos targets

WNSL Los Alamos Targets.pdf

Brookhaven targets

WNSL Brookhaven targets.pdf

Outreach to the Community - Recent Development

- Available Equipment
  - SputterBell ion source
  - Model 350 duoplasmatron plus einzel lens
  - Variable ion beam energy from 5keV to 25keV.
  - Integrated beam current of 2 mA at 20 keV using Ar.
  - The minimum spot size is 4 mm
  - Ideal for making thin targets of refractory elements
- University of Rochester – Target Lab
  - Liquidating equipment – needs space
- Current plan is to bring it to ANL
  - Store until needed?
  - Prefer it to go to a good home
    - One of the ARUNA Labs?

The International Target Community

www.intds.org

- International Nuclear Target Development Society
- Worldwide network of membership.
  - Established and maintains a listserve for online queries
- Encourages the sharing of techniques developed, or being developed.
  - Biennial international conferences
  - Maintains an extensive online Bibliography
- Publishes the techniques of target preparation and related topics.
  - Conference proceedings are online (NIM, JRNC)
  - Annual Newsletter
- Mentor people new to target preparation.
  - Frank Karasek Scholarship
- Provides modest financial support for INTDS conference attendance.

INTDS current involvement:

- President (2012-2016)
- Member of the Editorial Committee
- Newsletter Editor (‘03 to present)

Physics Division Target Laboratory - Future Directions

- Future Directions, GRETINA, AGFA, REAx

fribusers.org/3_GROUPS/18_TARGET/target.html

FRIB Users Organization

FACILITY FOR RARE ISOTOPE BEAMS

Breaking News | FRIB Science | FRIB Info | Working Groups | Theory Users | Gather-ings | JOIN ! | Organi-zation | Home | FRIB Site

Target Lab

- What kind of targets and applications will be needed for FRIB?
  * Thin foils and films
  * Thick targets for fast beams
  * Stripper foils
  * Foils for detector windows and gas cells
- How and where will these demands be met?
  * Dedicated target lab as a part of the FRIB complex
  * Expand upon facilities already established at MSU
  * Another location as "Lead Target Lab"
  * Commercially available opportunities

Description

This Working Group is focused on setting up a Target Laboratory for the in-house fabrication of thin films, windows, special radioactive sources, and related items needed for experiments at FRIB.

For More Information *[Point of Contact]*

Contact John Greene, ANL, Greene at anl.gov.

Acknowledgements

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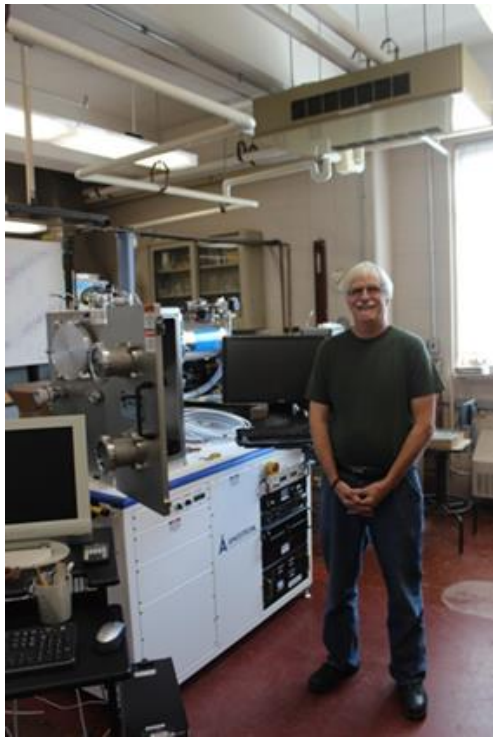

"The availability of the needed target making capabilities, and a trained workforce, is a must for successful experiments at FRIB, and at other accelerators."
Report of the Scientific Advisory Committee, February 20-22, 2010