

# THE ARGONNE TARGET LIBRARY



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# THE ARGONNE TARGET LIBRARY

## ABSTRACT

- As part of the proposal to DOE-NP for the Center for Accelerator Target Science (CATS) initiative, one of the objectives was to develop an inventory of existing targets that will serve as a pool available to the community. Targets collections have been recovered from Yale University due to the closing of their Tandem Accelerator Facility. In addition, accumulated targets from target preparation in the Physics Division over several decades have also been assembled with the intent of providing them to whomever would have a use for them. Space has now become available to compile, catalog and house these collections. Thus, the Argonne Target Library has been established and its progress and outlook will be discussed in detail.



Building the Library Space

- **INTRODUCTION AND MOTIVATION**
  - CENTER FOR ACCELERATOR TARGET SCIENCE (CATS)
  - THE CLOSING OF THE YALE TANDEM
  - THE PHYSICS DIVISION TARGET COLLECTION
- **THE ARGONNE TARGET LIBRARY**
  - SPACE ESTABLISHED
  - FURNISHINGS FOUND
  - THE PHYSICS DIVISION TARGET ARCHIVES
- **THE COLLECTIONS**
  - THE WRIGHT NUCLEAR STRUCTURE LABORATORY
  - THE PHYSICS DIVISION TARGET LABORATORY
  - VARIOUS MISCELLANEOUS COLLECTIONS
- **CURRENT PROGRESS AND OUTLOOK**
  - RECONSTITUTING THE YALE TARGETS
  - FINISH CATALOGING THE COLLECTIONS
  - TARGET LIBRARY OPERATIONS AND WEBSITE
- **CONCLUSION**

# INTRODUCTION AND MOTIVATION

## Let's pose the question "Why a Target Library?"

- During the course of ATLAS target preparation – many targets are produced.
  - at first as “practice” depositions employing stable materials
  - when using isotope – as many targets as possible are made
- These targets naturally accumulate – plus targets brought here.
  - perhaps to be used again in future experiments
  - loathe to throw any targets away (especially isotope!)
- Many target laboratories therefore have large supplies of “unused” targets
  - 30 years ago – Thomas remarked “**why don't we have a listing and make these targets available?**”
  - during the '90's Folger @ GSI built an indexing target storage system
- On a very small scale some of these targets have been made available
  - former ANL colleagues (and others) have periodically been provided targets
  - and we entertain making new targets (on a case-by-case basis)

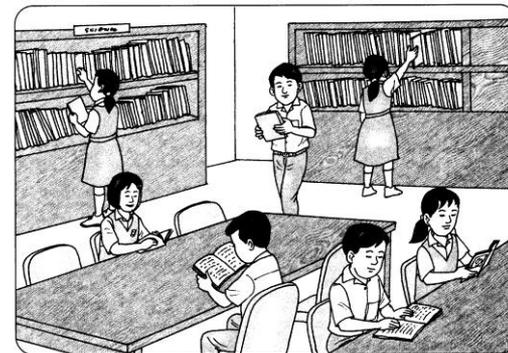


Practice targets stored  
in R-154 Target Lab

# INTRODUCTION AND MOTIVATION

## “In Addition ...”

- Due to budget cuts many Accelerator Facilities have ceased operations.
  - forcing some former “target labs” to also shut down
  - responsible folks have realized the value keeping their target collections
- Labs with AND without target making capabilities have benefitted.
  - from obtaining these targets for re-use
  - but, for the most part, **these collections are generally unknown**
- This has recently been discovered in the case of the WNSL Tandem closing.
  - the Yale target lab was cleaned out and many targets recovered
  - several collections of targets were also obtained (for re-use?)
- One objective of the CATS Proposal would be to collect such targets.
  - develop an **inventory of these target collections**
  - **make them available** as a pool to the low-energy community



Brookhaven  
targets recovered  
from WNSL

# INTRODUCTION AND MOTIVATION

## Center for Accelerator Target Science (CATS)



- It was proposed to create a National Center for Accelerator Target Science (CATS) based on the existing target development laboratory at ANL.
- The objectives of the center are as follows:
  1. Serve the low-energy community by producing targets whenever possible by either manufacturing them or by directing requests to other facilities best able to perform the task
  2. Train individual investigators and students in target making in order to provide a workforce capable to address present and future needs
  3. Carry out R&D activities dedicated to novel production techniques and optimization of existing ones
  4. **Develop an inventory of existing targets that will serve as a pool available to the community**

# INTRODUCTION AND MOTIVATION

## The Closing of the Yale Tandem

Physics Div. targets returned to ANL



- Three days (Dec. 2013) were spent at WNSL (Yale U.) to organize the target facilities and recover whatever targets might be worth saving.
- Many of these targets originated in the PHY Division Target Lab!



Organized into targets worth saving.  
Returned to ANL

# INTRODUCTION AND MOTIVATION

## The Closing of the Yale Tandem

- In addition, at Yale, there were **ALREADY** collections of targets from both Brookhaven (BNL) as well as Los Alamos (LANL).
- These were carefully packed and shipped to ANL.



Arrival of targets at ANL



Los Alamos targets



*WNSL Los Alamos Targets.pdf*



Brookhaven targets

*WNSL Brookhaven targets.pdf*

# INTRODUCTION AND MOTIVATION

## The Physics Division Target Collections

- Three decades of target production in support of ATLAS experiments have accumulated into a formidable inventory and currently reside in M-057 storage.
- In addition, a large collection of stable “practice” target preparations also exists in the Target Lab R-150, along with targets we intend to keep in “circulation.”
- We plan to use the Yale collections as a learning “Test Bed” for the cataloging and handling of this large target inventory.



Argonne targets stored in M-057

# THE ARGONNE TARGET LIBRARY

## Space Established

- Room P-114 The 3 MeV Van de Graaff Control Room
- As we first found things



# THE ARGONNE TARGET LIBRARY

## Space Established

- Cleaned out and floors waxed
- New LED Lighting



# THE ARGONNE TARGET LIBRARY

## Furnishings Found

- Shelving and cabinets for target collections
- Wall units for Target Archives
- Furniture, desks and bench workspace



# THE ARGONNE TARGET LIBRARY

## The Library Layout

- Shelving and cabinets for target collections
- 6 Cabinets (WNSL & Yale Targets)
- 8 set of shelves (ANL Targets)
- 3 Sets of glass cabinets (future)



TARGET LIBRARY CABINET DIAGRAM

LANL-1	LANL-2	BNL
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MISC.	YALE-2	YALE-1
Future	Target	Storage

Argonne Group Targets

A7	A8
A5	A6

Misc. Argonne Targets

A4	A3
A1	A2

Shelves & Cabinet Layout (looking North)

# THE COLLECTIONS

## The Wright Nuclear Structure Laboratory

- Unpacking, sorting and reconstituting the various collections shipped to ANL from the WNSL.
- New network connection and computer desk for target cataloging.

Unpacking the shipments from WNSL



Entering the Yale targets into the database



# THE COLLECTIONS

## The Wright Nuclear Structure Laboratory

- In addition to the targets we expected, we were surprised to discover another cabinet worth of various miscellaneous targets and foils.
- This collection had not previously been archived or cataloged at Yale and included numerous glass desiccators containing targets.

Various miscellaneous targets and glass desiccators shipped to ANL from Yale



# THE COLLECTIONS

## The Physics Division Target Laboratory

- The Physics Division Target Collections have yet to be cataloged.
- In the process of beginning to compile these now.

Argonne targets still needed to be organized and compiled





# CURRENT PROGRESS AND OUTLOOK

## Reconstituting the Yale targets

- The BNL Target Collection (now at ANL)



Roughly 338 targets

Stand A				
Number	Element	Mass number	Thickness	Backing
1	LiF		200	30 C
2	C		850	-
3	C		20	-
4	C		20	-
5	C	12	-50	-
6	C		10	-
7	C	12	40-50	-
8	N	15	100	10 C
9	Mg	26	-200	-
10	Mg	26	10	20 C + 1 Bi
11	Mg	26	10	20 C + 1 Bi
12	Mg	26	10	20 C + 1 Bi
13	Al		75	Polystyrene, overcoat 10 Au
14	Al	Pure	400	Crème Cote
15	Al	Pure	400	Crème Cote
16	Al		815	-
17	Al		10	-
18	Al		1	-
19	Al	Spot	100	20 C
20	Al		20	overcoat 10 Au
21	Al		75	overcoat 10 Au
22	Al		450	-
23	Al		450	2 Au
24	Al	Pure	400	Crème Cote
25	Al		160	-
26	Al	Spot	81	20 C
27	Al		1	-
28	Si	28	10	20 C
29	Si	28	10	20 C
30	SiO <sub>2</sub>		150	-
31	Ca	48	98	20 C
32	Sc		3.85	-
33	Ti	Nat	500	5 mil Ta
34	Ti	Nat	500	5 mil Ta
35	Ti	46	1.02	F=4cm <sup>2</sup>
36	Ti	48	1.04	F=3cm <sup>2</sup>
37	Ti	50	1	F=3cm <sup>2</sup>
38	Mn	Nat	108	Polystyrene
39	Fe <sub>2</sub> O <sub>3</sub>	Nat	36	20 C
40	Co	59	23	20 C
41	Co	59	62	20 C
42	Co	59	28	20 C
43	Co	59	28	20 C
44	Co	59	23	20 C
45	Ni	60	50	20 C
46	Ni	60	0.00002"	-
47	Ni	60	50	5-10 C

# CURRENT PROGRESS AND OUTLOOK

## Reconstituting the Yale targets

- The LANL Target Collection (now at ANL)



Roughly 920 targets

PAD 1

Jar #	Target	$t \left( \frac{\mu\text{g}}{\text{cm}^2} \right)$	Backing
1	$^{28}\text{Si}$	80	20 C
2	Si	50	
3	Si	50	
4	$^{28}\text{Si}$	100	50 C
5	$^{30}\text{Si}$	70	30 C
6	Si	2.8-3.3 $\mu\text{m} - 0.7 \frac{\text{mg}}{\text{cm}^2}$	
7	$^{28}\text{Si}$	80	20 C
8	$^{30}\text{Si}$	70	30 C
9	$^{30}\text{SiO}_2$	100	
10	$^{28}\text{Si}$	80	20 C
11	$^{28}\text{Si}$	80	20 C
12	Si	25	8 C

PAD 2

Jar #	Target	$t \left( \frac{\mu\text{g}}{\text{cm}^2} \right)$	Backing
1	$^{24}\text{Mg}$		20 C
2	$^{26}\text{Mg}$	50	10 C
3	$^{24}\text{Mg}$	100	30 C
4	$^{24}\text{Mg}$	150	
5	$^{26}\text{Mg}$		
6	$^{26}\text{Mg}$	<100	
7	$^{26}\text{Mg}$		20 C
8	$^{26}\text{Mg}$	60	20 C
9	$^{26}\text{Mg}$	50	30 C
10	$^{25}\text{Mg}$	50	
11	$^{26}\text{Mg}$	2500-3000	
12	$^{25}\text{Mg}$	35	20 C

# CURRENT PROGRESS AND OUTLOOK

## Reconstituting the Yale targets

- The Yale Target Collections (Now at ANL)



Misc. Yale targets  
Y001-Y166 already  
cataloged

Yale target “groups”  
awaiting compilation



# CURRENT PROGRESS AND OUTLOOK

## Finish Cataloging the Collections

- The Collections so far ...
  - WNSL Brookhaven targets.pdf
  - WNSL Los Alamos Targets.pdf
  - Misc. Yale targets.mdb
- Still need to be compiled ...
  - Yale target Groups.xls
  - Argonne targets Groups.xls
  - Misc. Argonne targets.mdb
  - Misc. Other targets.doc
- May standardize perhaps on .pdf's
  - Investigate library software
  - Or some other database

Argonne targets still  
needed to be organized  
and compiled



# CURRENT PROGRESS AND OUTLOOK

## Target Library Operations and Website

The Argonne Target Library

### LIBRARY RULES

#### – Proposed...

- i) individual target requests will be limited to one specified target and up to two targets shipped if possible – (one for a spare).
- ii) priority will be assigned to domestic requests and of those, being DOE (& NSF) investigators will be addressed first.
- iii) wherever possible a user supplied FedEx account will be needed for shipping.
- iv) a vacuum target transport container may be necessary (such as those marketed by MicroFoil, Inc.)– it should be supplied in advance by the requestor.
- v) any future approved rules employed as they arise.

#### – Visitors

- Controlled access?

### ▪ *nothing has been finalized ...*



Target shipping containers

# CURRENT PROGRESS AND OUTLOOK

## Target Library Operations and Website



www.intds.org

- New CATS website
- Build out happening now
- Should link to the Library
- from there to the Collections
- Also from [www.INTDS.org](http://www.INTDS.org)

*In the end the success of this Library Project will depend on*

**COMMUNICATION:**

- *This talk*
- *INTDS2018 (MSU)*
- *Website*

The screenshot displays the website for the Center for Accelerator Target Science at Argonne National Laboratory. The page features a navigation menu with categories like RESEARCH, GROUPS, FACILITIES, INSTRUMENTATION, PUBLICATIONS, NEWS & EVENTS, and PHY AT WORK. The main content area includes a 'Facilities' sidebar listing various research facilities, a central image of the target development laboratory, and descriptive text about the facility's operations and equipment. The text describes the production of targets and foils for experiments at the ATLAS accelerator, the use of various materials and isotopes, and the advanced equipment used for thin-film fabrication. The page also lists administrative and related research contacts.

# CONCLUSION

- In conclusion, the Argonne Target Library is now coming online. Once the catalogued collections are compiled and completed, they should become rapidly available through a link from the CATS website. We anticipate a slow and steady demand for these targets once established. The mechanism for target check-out should quickly be realized once underway. Hopefully, this vast wealth of unused targets may again become available to the low-energy community for use in nuclear physics experiments.



The Physics Division  
Target Archives

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