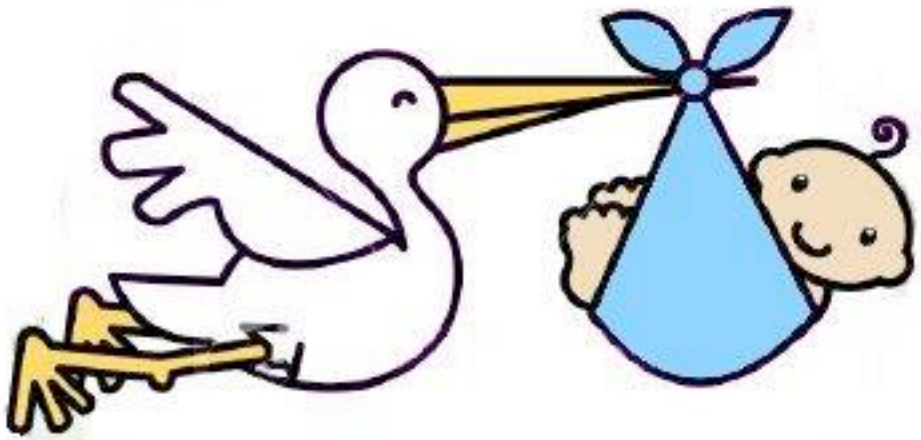
Experiences with “Generic” R&D Performed at Fermilab, Particularly at the TallBo Facility

Janet Conrad, MIT

Jan 21, 2016

Where do new detectors come from?



(DOE view)

TallBo is an LAr teststand located at PAB (on the tour!)

More info in Bruce's talk!

You insert your experiment from top, attached to the lid.
You can bring external items like the IU hodoscopes shown here.
Has purification, fibers, feedthroughs, monitors -- many useful items!
(But TallBo does not have a field cage, cathode and wire chamber)

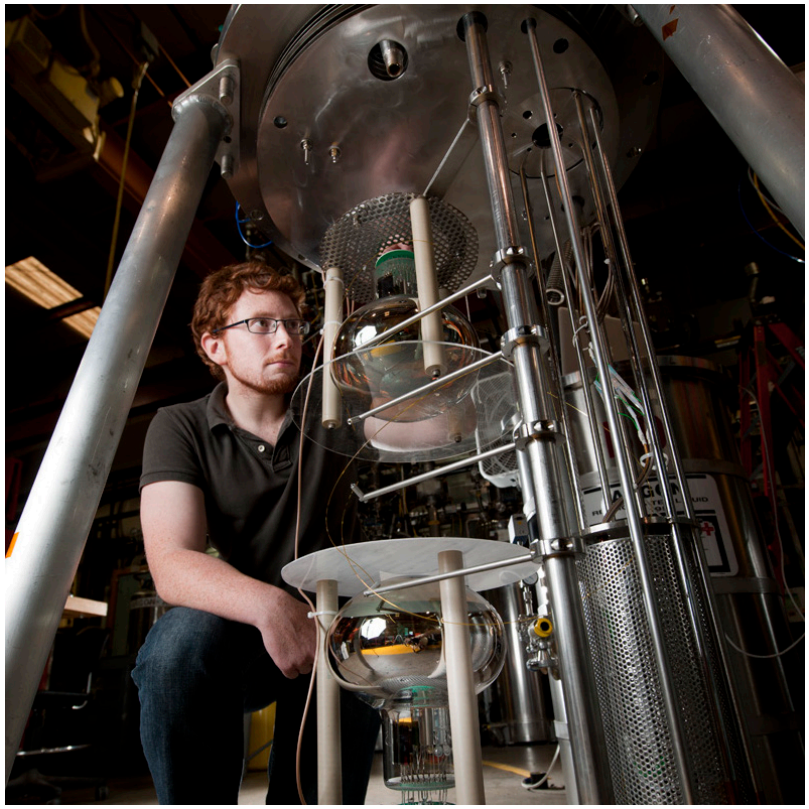
TallBo history and my group's role:

I have a group that is in <u>residence</u> here working on MicroBooNE.

We had reason to construct a cryogenic light teststand called "Bo" for a vertical slice test for MicroBooNE.

Bo was Ben Jones' project

The Bo cryostat existed.
It was adapted for light collection by removing the TPC and being fitted w/ light collectors →



Once we had Bo, we had a nice facility for "Generic R&D" that could grow.

Bo grew up into TallBo for LBNE, adapted by Indiana University

MIT students and postdocs have papers, major talks and prizes on their CVs because of the R&D we've done in (Tall)Bo in the last 5 years.

Christie Chiu	undergrad
Gabriel Collin	grad student
Amy Greene	
Christina Ignarra	
Teppei Katori	postdoc
Ben Jones	
Jarrett Moon	
Zander Moss	
Matt Toups	
Taritree Wongjirad	

This summer add: Matt Lindsey, Stefano Vergani

“Generic R&D”...

May be curiosity-driven:

The Effects of Dissolved Methane upon Liquid Argon Scintillation Light

JINST 8 (2013) P12015

B.J.P. Jones[a,*], T. Alexander[b], H.O. Back[c], G. Collin[a], J.M. Conrad[a], A. Greene[a], T. Katori[a], S. Pordes[d], M. Toups[a].

We setup Bo to dissolve in nitrogen, to make an absorption measurement needed for MicroBooNE.

Why not study methane too? After all, you can drift in methane-Lar mixtures. What happens to the light in this environment?

Later we found out this was also valuable to DarkSide...

“Generic R&D”...

May be emergency-driven:

Testing of High Voltage Surge Protection Devices for Use in Liquid Argon TPC Detectors

JINST 9 (2014) P09002

J. Asaadi[a], J.M. Conrad[b], S. Gollapinni[c], B.J.P. Jones[b*], H. Jostlein[d], J.M. St. John[e], T. Strauss[f], S. Wolbers[d], and J. Zennamo[g].

On MicroBooNE we discovered a serious HV breakdown issue:
Breakdown from field cage to ground could destroy our resistors.

Time to solve this was short. We needed to try ideas quickly & effectively
→ varistors worked for surge protection!

This work involved employing Bo, the universal gas analyzer, and a lot of other available equipment out at PAB.

“Generic R&D”...

May be “I wish my experiment were better” driven:

Anode-Coupled Readout for Light Collection in Liquid Argon TPCs

Accepted to JINST

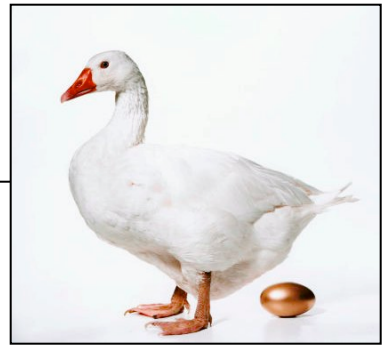
Z. Moss, M. Toups, L. Bugel, G.H. Collin, J.M. Conrad

This is a method for reading out light collectors in DUNE for free
by making use of the wire chamber readout,
freeing up lots of $$$ for more collectors,
and reducing complexity.

This was developed at MIT, but next round tests are in TallBo in April.

Generic R&D has been good for my group...

* Students thrive outside of "project"
* Small author lists – real recognition
* Productive use of time from delays of projects.
* Students and postdocs gain unique skills.



Generic R&D is good for Fermilab:

Demonstration of a Lightguide Detector for Liquid Argon TPCs

Nucl.Instrum.Meth. A640 (2011) 69-75

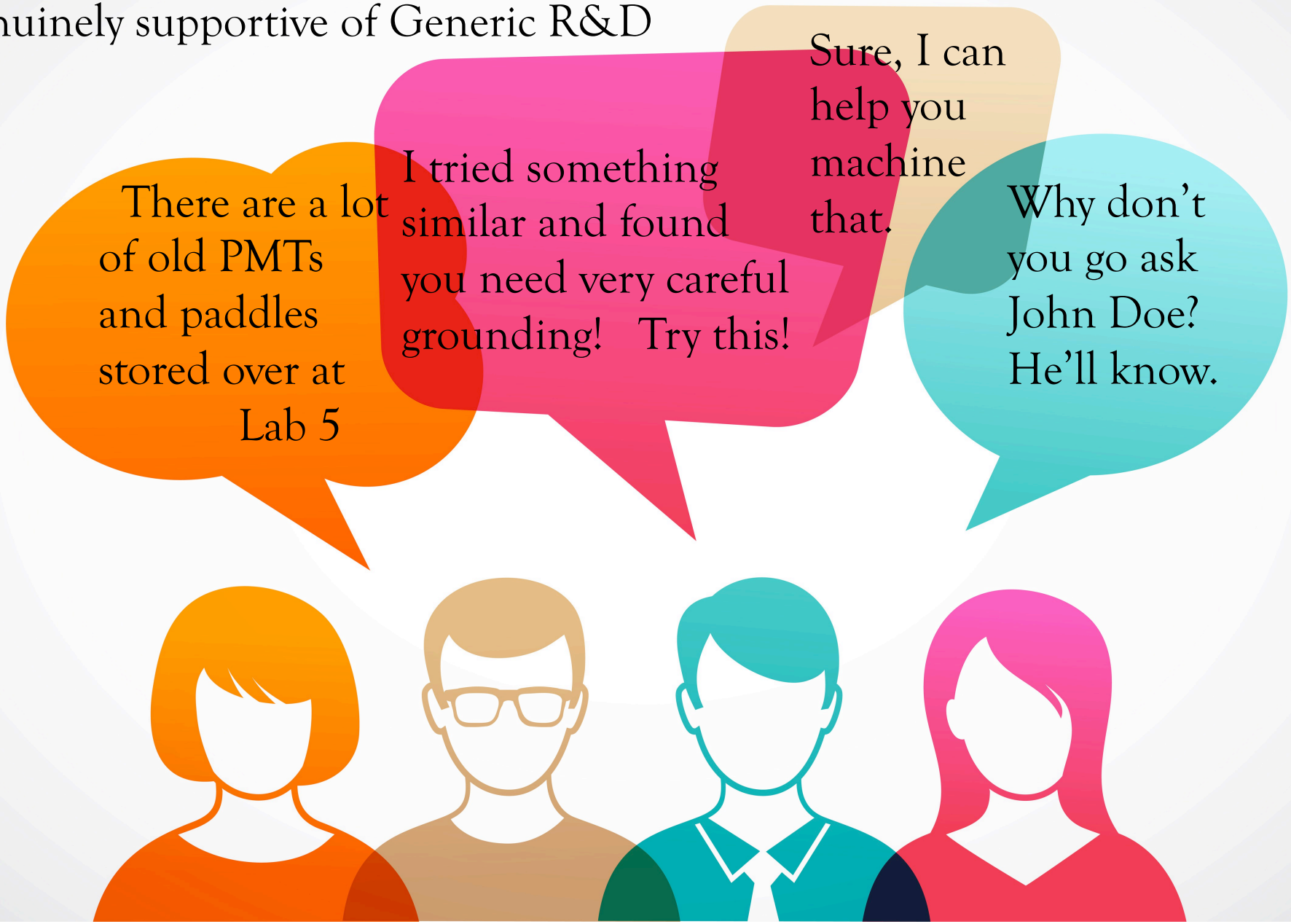
L. Bugel, J.M. Conrad, C. Ignarra, B.J.P. Jones, T. Katori, T.Smidt and H.-K. Tanaka[1]

Ideas that work out can become important to "the mission," which is why DOE & Fermilab should support Generic R&D!

A great aspect of a lab facility like Bo is that it is constantly improving, as more people come and use it and add features to it.

This will not happen in your lab at your university.
Every improvement there must be paid for and installed by you!

Another great aspect of working here:
A lot of employees at Fermilab are genuinely supportive of Generic R&D



But there are some people here who are not comfortable…

With Generic R&D…

1. The ideas are outside of the norm.
2. The approach is unlikely to be linear.
3. There is likely to be a lot of iterations.
4. Quick turn around on tests is required.
5. The answer may be "this doesn't work."

This is not consistent with the "project" oriented mentality that is now embedded at Fermilab and DOE….

I think we frighten some of the management.

Fermilab

Office of the CRO

CRO TECHNICAL SCOPE OF WORK FOR R&D

Light Collection R&D, Fall 2015

[Date of Issue]

[Expiration Date filled in by Division Management]

TABLE OF CONTENTS

Note this is a public document, provisions to protect the document can be made with the host division.

Table of Contents

This document presumes that <u>you know well</u> what you will be doing and what you will need, from the start.

Fermilab/DOE needs Generic R&D.

Fermilab needs some control over work done here.

But the “project approach” fails in this context,

What is a lab to do?

A lesson from Big Bang Theory...

In order to track Generic R&D,
the lab needs an interactive/quick-reaction tracking system
instead of the TSW approach.

I suggest:
An electronic log book of ongoing and foreseen needs and issues,
updated on reasonable timescales TBD at the start,
easy (and short) to fill out

Maybe others here have better ideas. Lets discuss!

Other cautionary points...

Realistically, Generic R&D will be at the bottom of facility-use priority
unless it arises from an emergency on an experiment.

Generic R&D is often done on a shoestring budget by summer students
Housing on site the summer is a major problem,
Running experiments take housing priority.
I doubt Generic R&D will get any priority.
Off site housing is very expensive.

With these last few points made, let me reiterate:

I am choosing to work here because there are many good aspects!

* most <u>especially the lab people who love Generic R&D</u> and are consistently there to help!
* as well as the facilities, which are state of the art, and always improving

I am voting with my feet by doing Generic R&D at Fermilab!

Thanks!