

Double Chooz Calibration Hardware Work at ANL

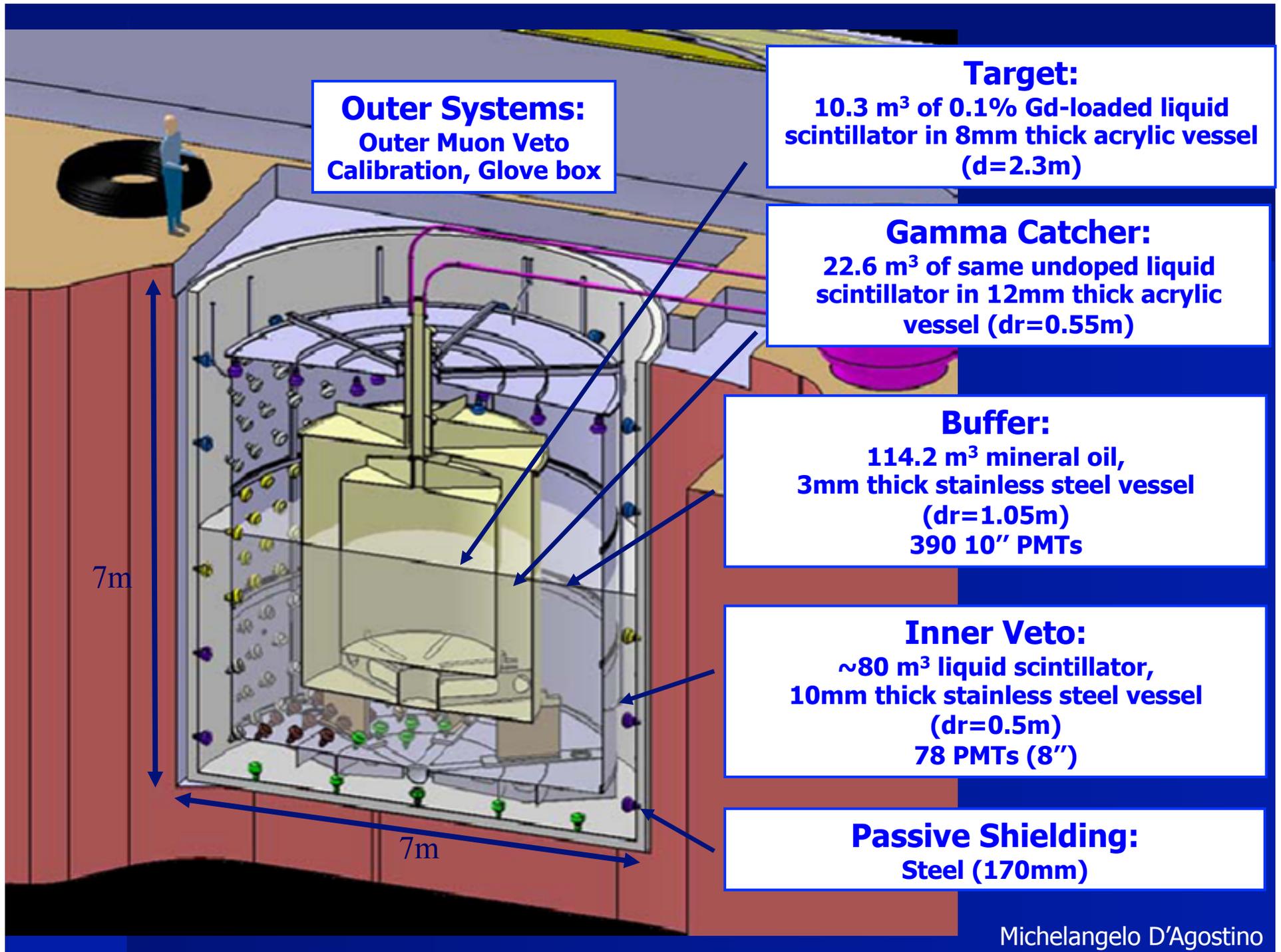
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Argonne National Laboratory**

DOE Review

May 2011

Double Chooz Calibration

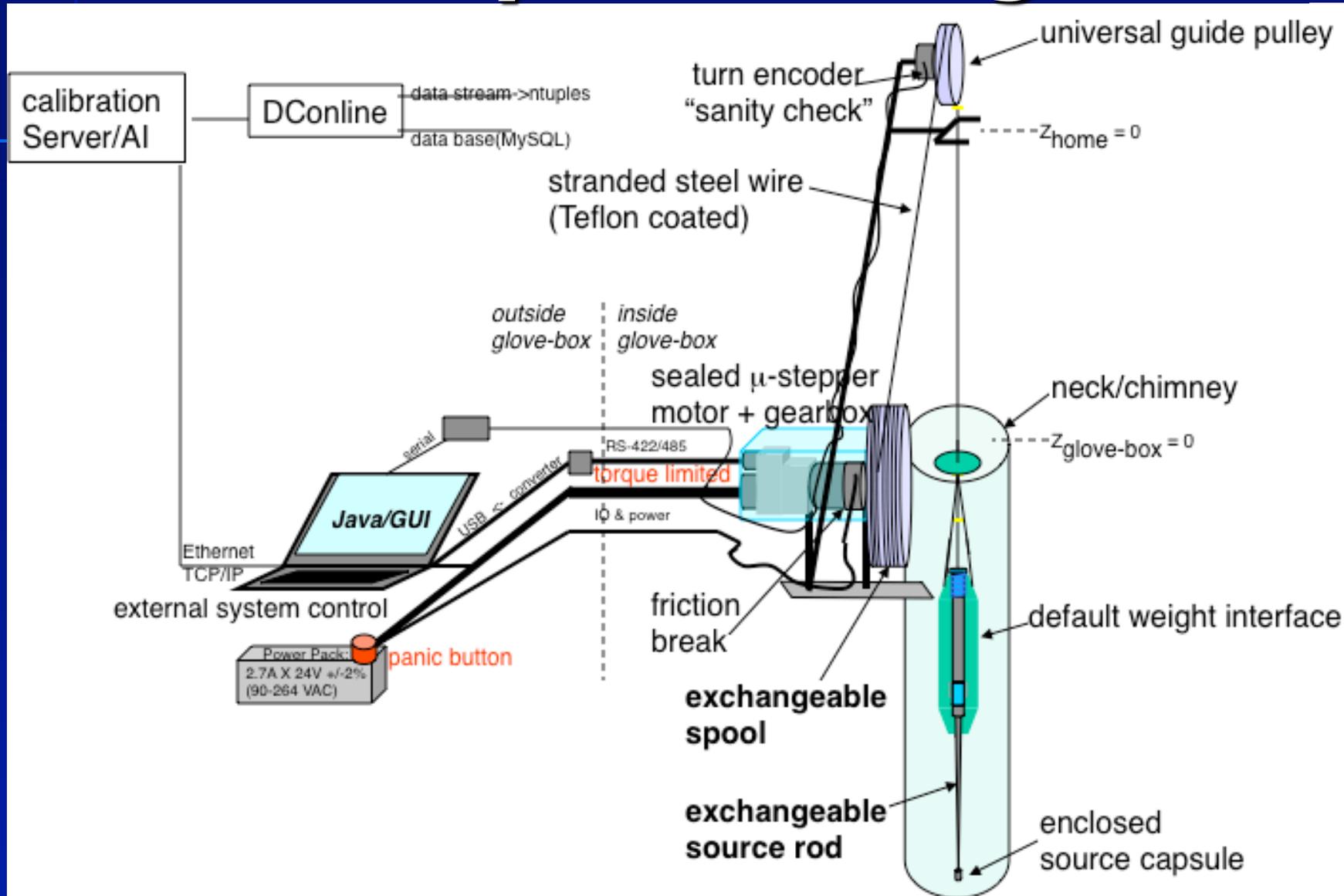
- inverse beta decay detection efficiency should be calibrated to 0.5%
- energy scale should be calibrated to 1% for γ, e^+ and to 20% for n's
- to do this, we need to deploy a variety of sources throughout the volumes of the detector
 - permanent tubes for gamma catcher and buffer volumes (Alabama and Saclay)
 - z-axis system for target central axis (ANL)
 - articulated arm for full target calibration (ANL and Drexel)
- cosmogenics for calibration before and in between source deployments (talk by Z. Djurcic)



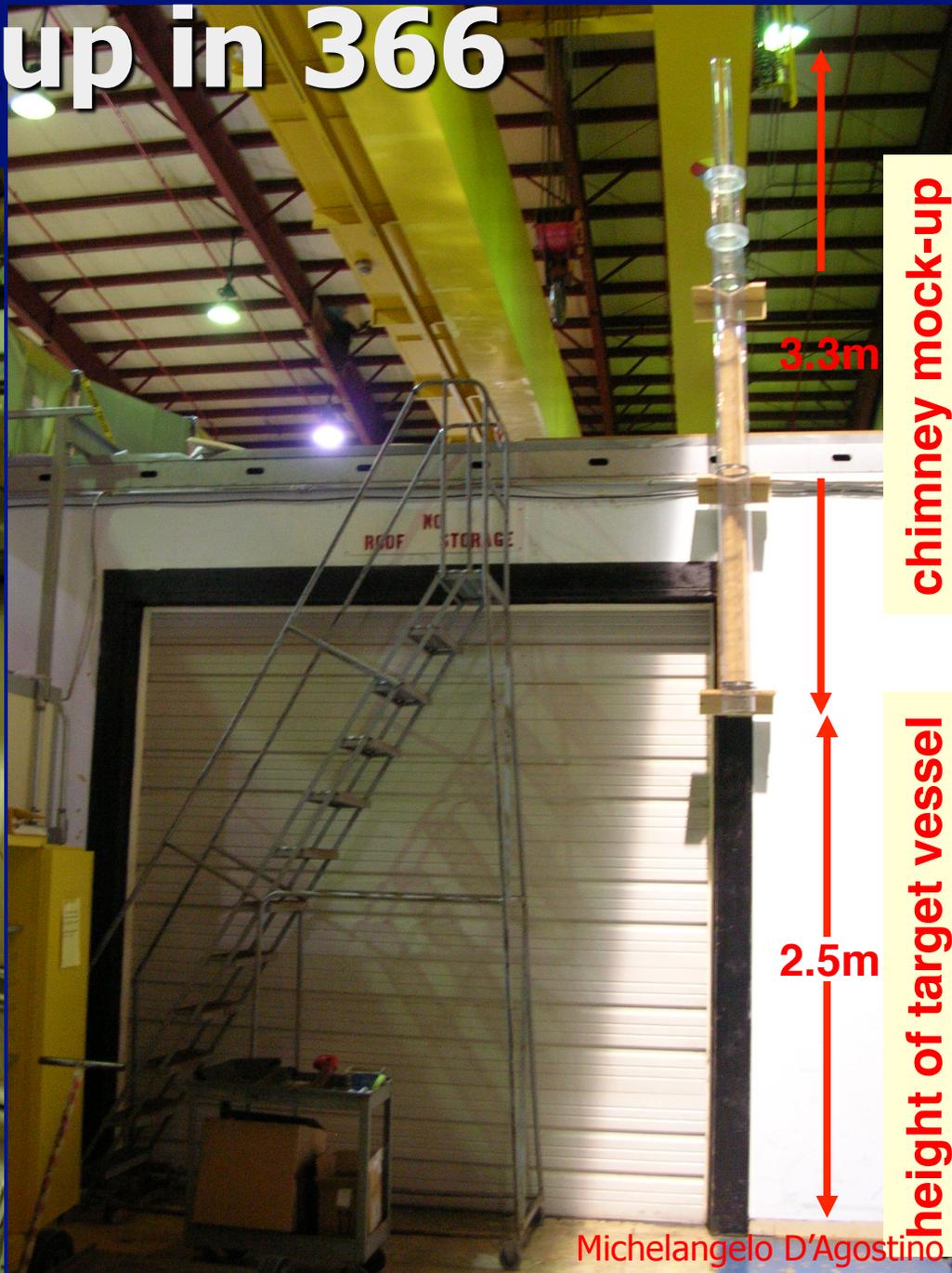
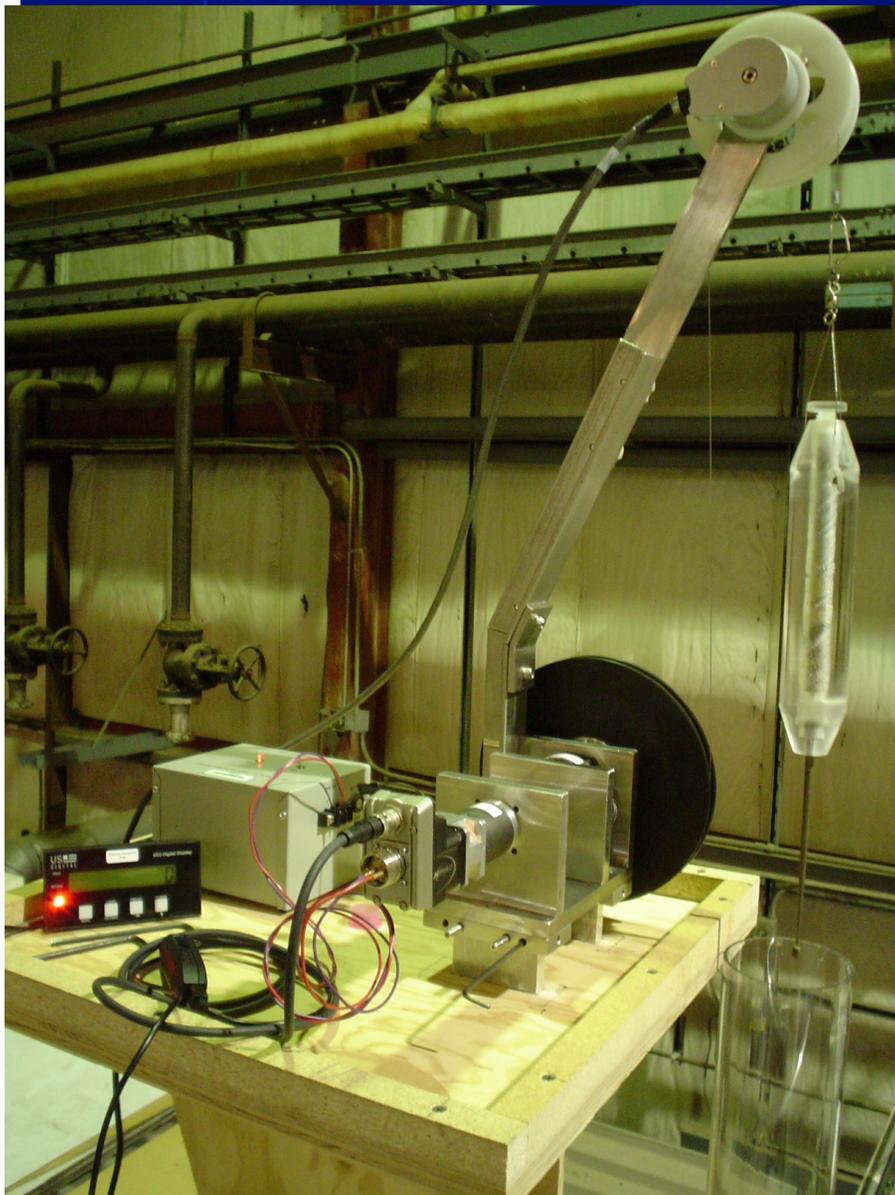
Z-Axis System Design

- strict materials requirements to ensure stability of Gd-doped scintillator
 - special acrylics, electropolished stainless steel, and lots of compatibility testing
- must be fast (for potential daily deployments) and easy to use through thick glovebox gloves
- interchangeable source rods
- able to deploy laser diffuser ball and LED flasher as well

Z-Axis System Design



Chimney Mockup in 366



chimney mock-up

height of target vessel

Michelangelo D'Agostino

Ease of Operation By Shifter

Move

mm

Current Position

1234.23 mm below home

1234.23 mm above target center

1234.23 mm above target bottom

1234.23 mm motor-encoder diff.

Zero System

Messages

Welcome to the Z-Axis Deployment System!!

STOP

Location

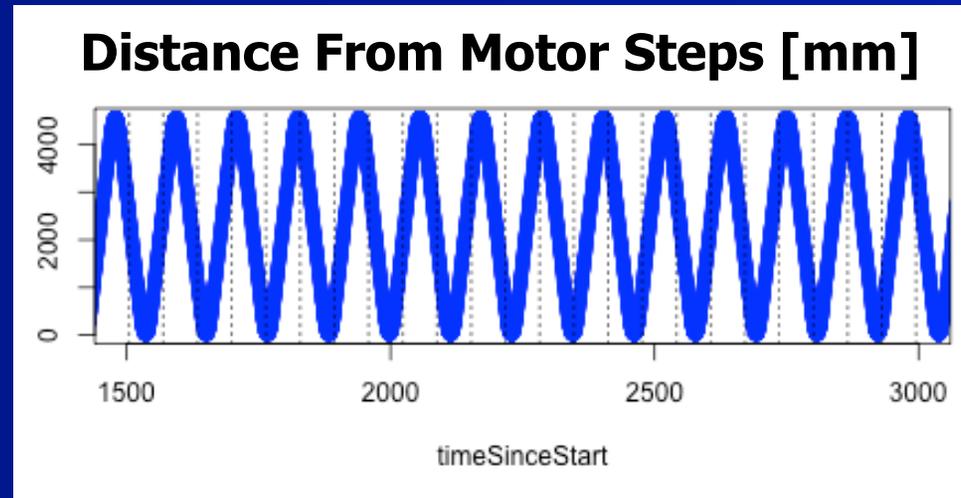
Home

T Center

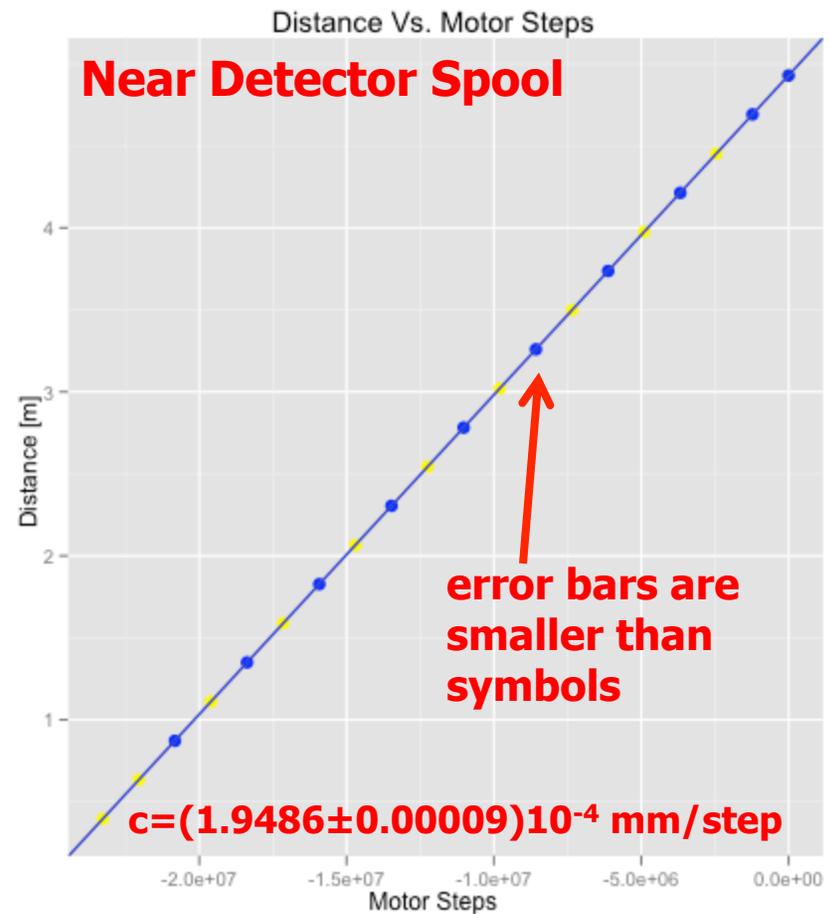
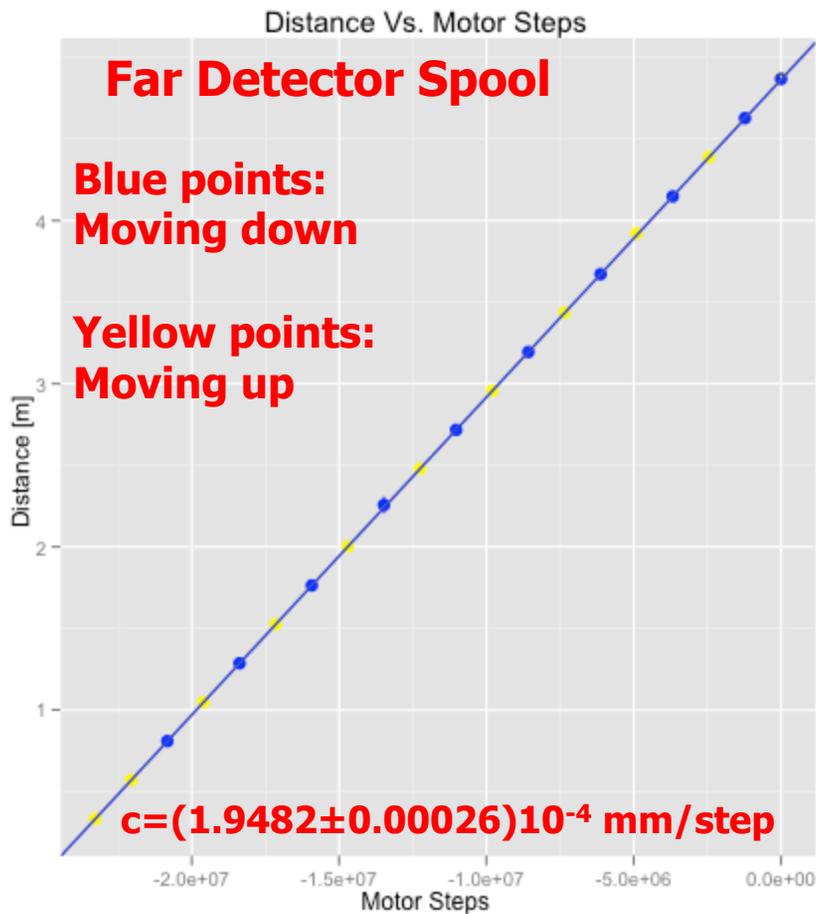
T Bottom

Testing at Argonne

- The z-axis was consistently operated and tested at Argonne for over two years with no problems:
 - run up and down chimney mockup many hundreds of times
 - verified reproducibility: source always returns to the same physical position to better than a millimeter
 - verified stability over many, many up and down roundtrips



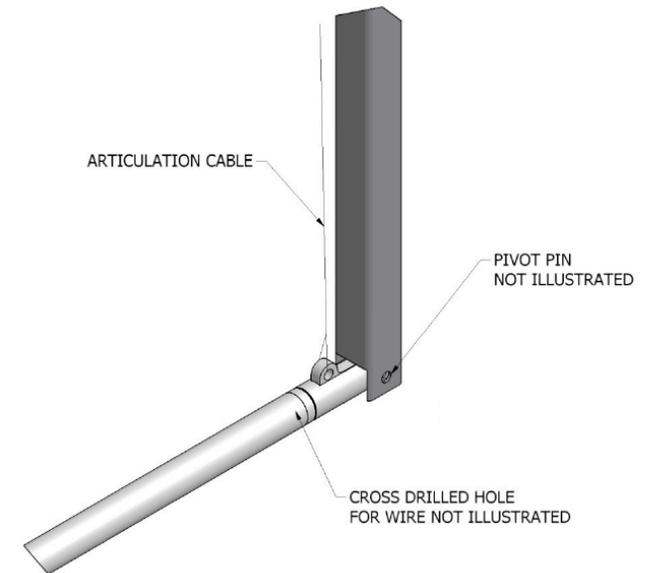
Position Calibration

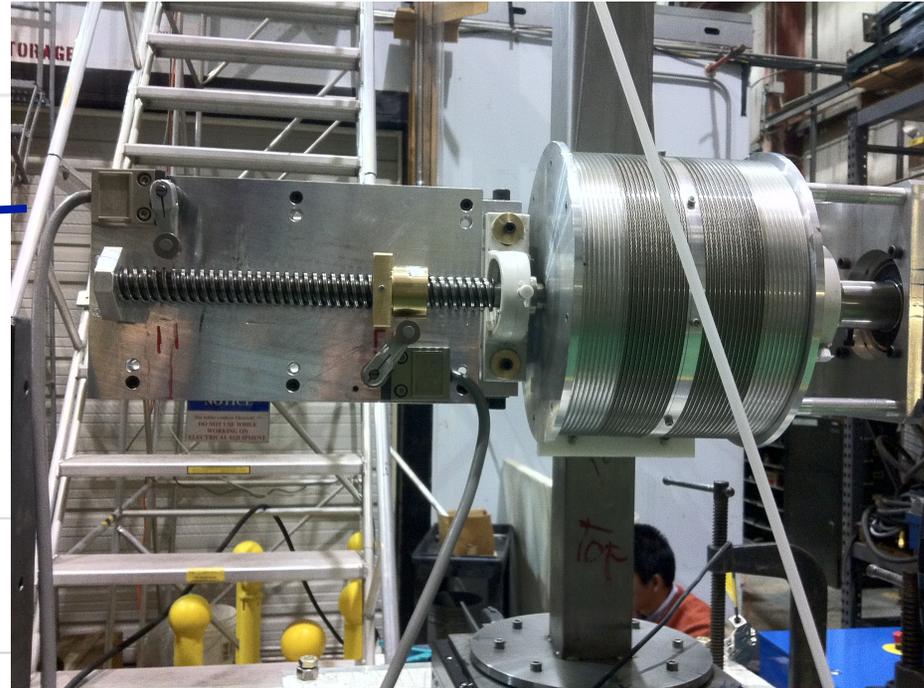
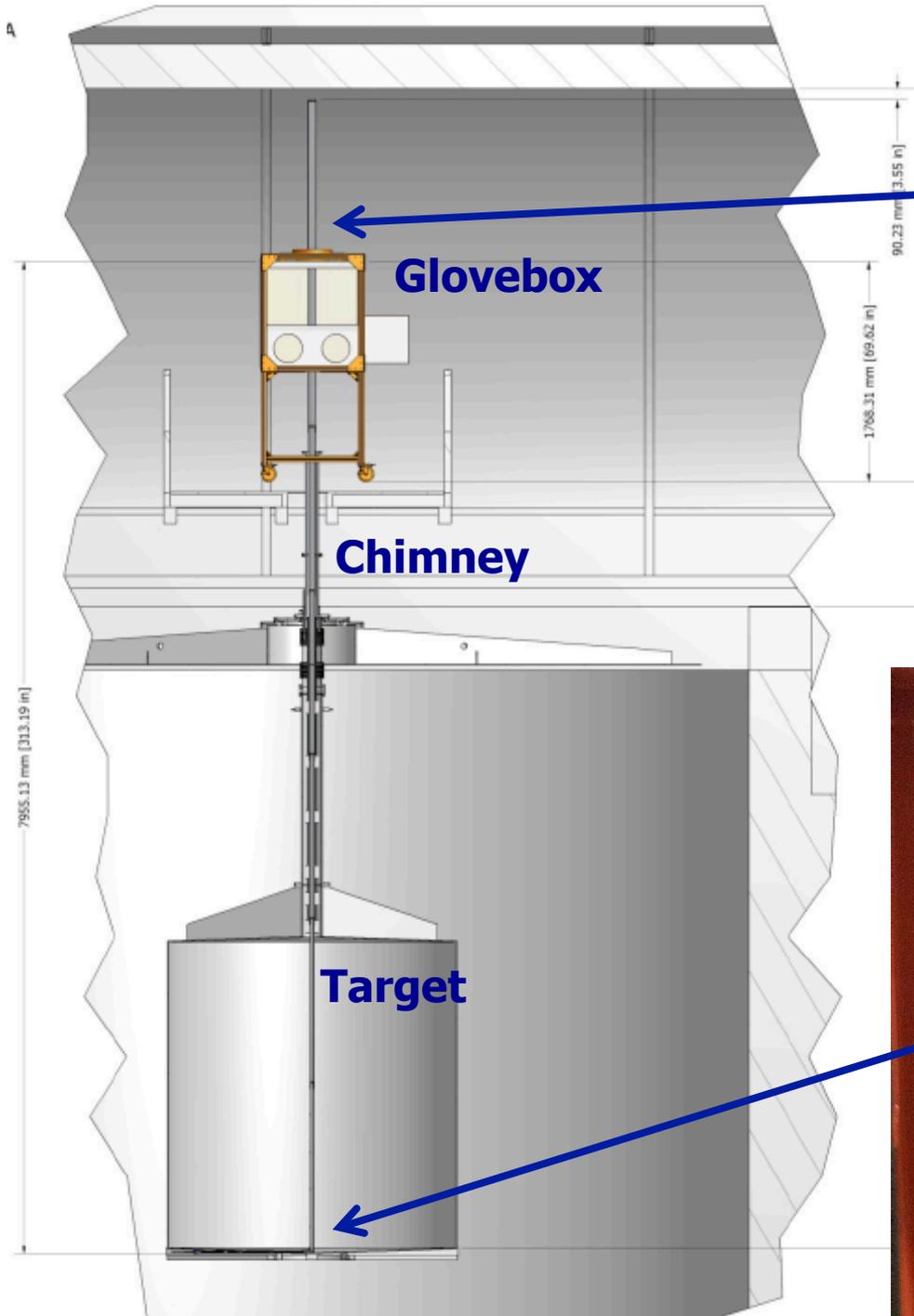


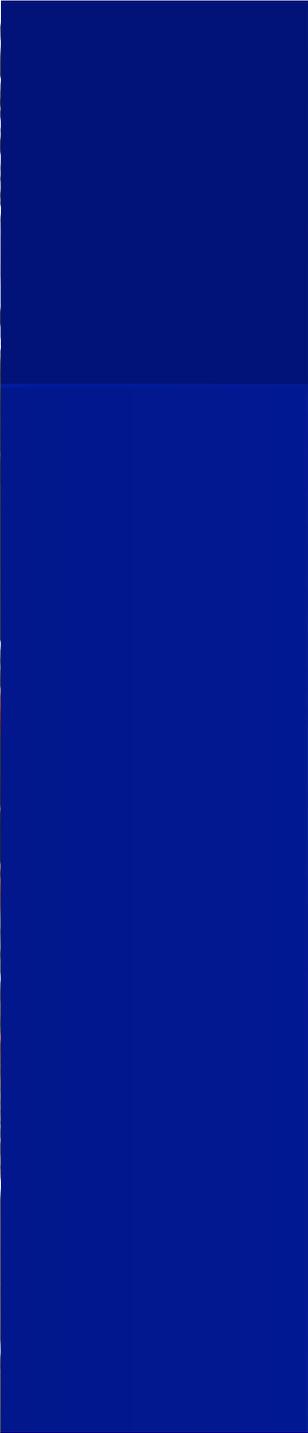
Fits give a statistical error on the position of 0.9 mm over a 7 m deployed distance.

Articulated Arm

- for off-axis calibration, we have the articulated arm, which is capable of deploying a source throughout the full target volume
- design, construction, and testing of the AA are being done at ANL
- telescoping sections deploy down in depth
- at the end, variable length segments can be articulated with a cable to swing out to 90°
- everything is mounted on a turntable capable of rotating 360°







Installation Plans

- The z-axis installation and initial calibrations are expected in July, followed by intense analysis for first θ_{13} publication in this autumn.
- The articulated arm will be reviewed by collaboration engineers soon and could be deployed as early as next summer.

