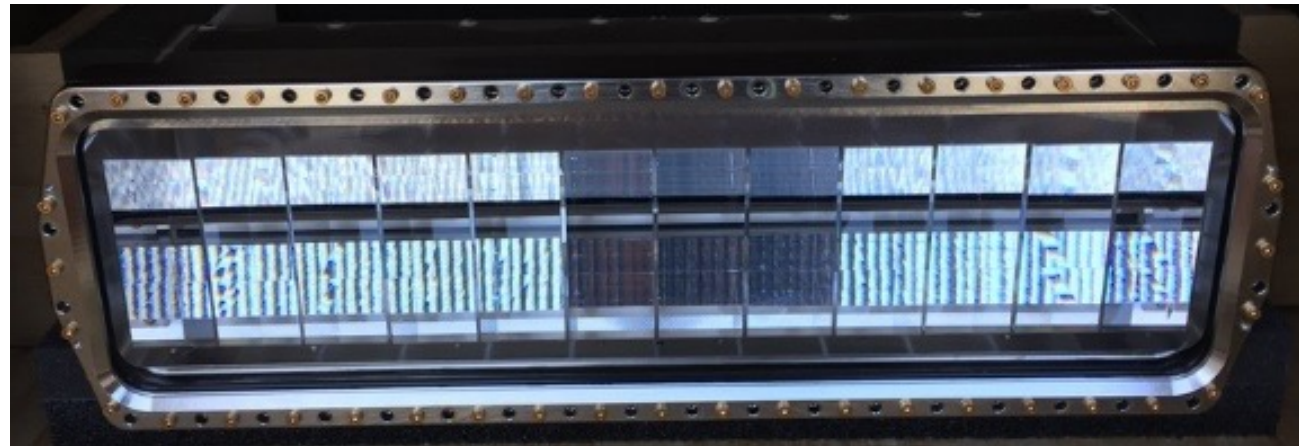


# BaBar DIRC bars for ePIC hpDIRC



Greg Kalicy

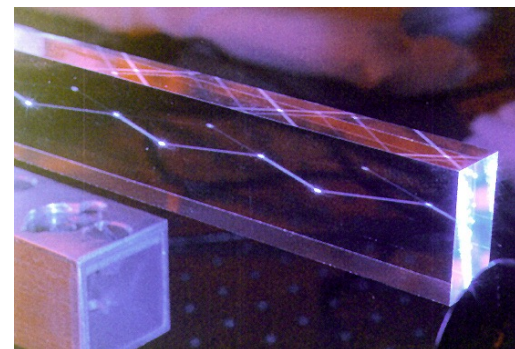
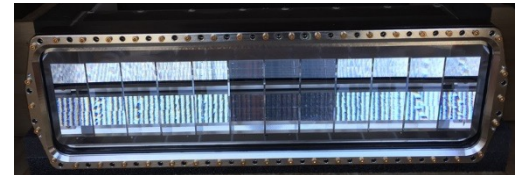


# REUSE OF BABAR DIRC BARS

- BaBar DIRC finished operation in 2010 SLAC/DOE made DIRC bars available for reuse
- 4 bar boxes awarded to us and installed as GlueX DIRC in 2018
- Remaining 8 boxes awarded to us to be used as EIC DIRC, could yield up to 384 short bars (360 needed for ePIC hpDIRC active area)

Bars were polished to  $\sim 5\text{\AA}$  with non-squareness  $< 0.25\text{-}0.4\text{ mrad}$

- $1\text{\AA} = 10^{-10}\text{ m}$  ( $0.5\text{\AA}$  is radius of hydrogen atom)
- $1\text{ mrad} \approx 0.06^\circ$

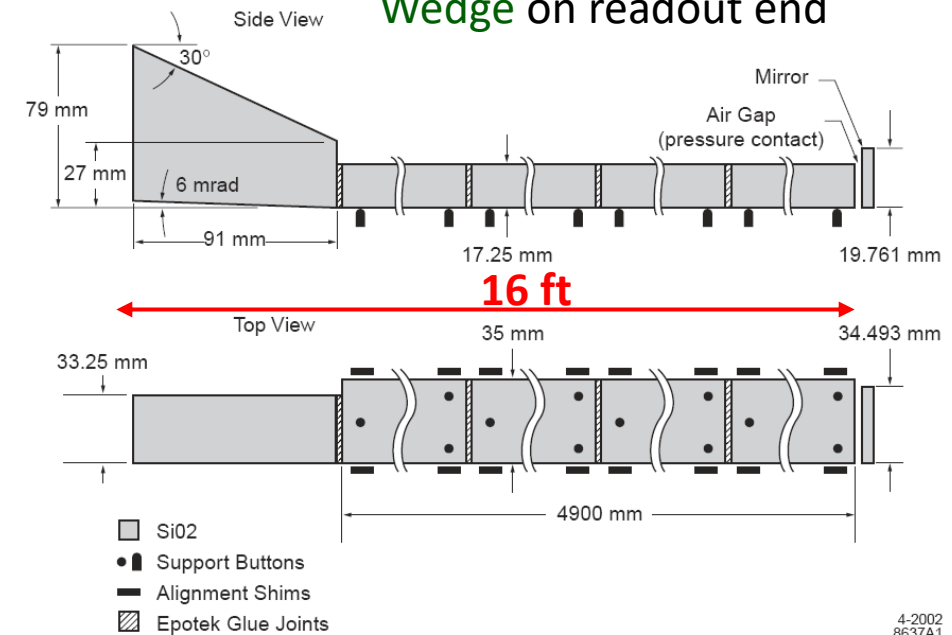
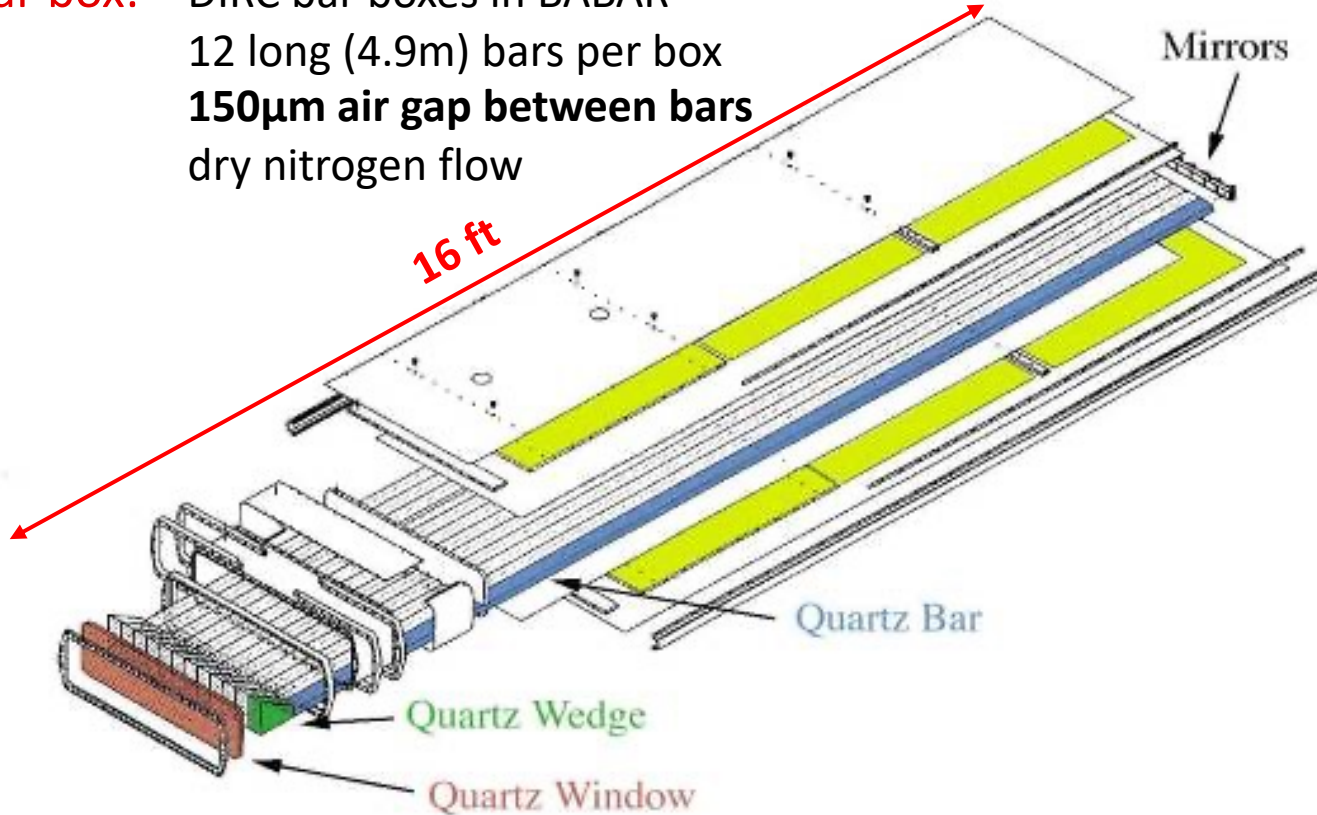


# BABAR DIRC BAR BOXES



**Bar box:** DIRC bar boxes in BABAR  
 12 long (4.9m) bars per box  
**150µm air gap between bars**  
 dry nitrogen flow

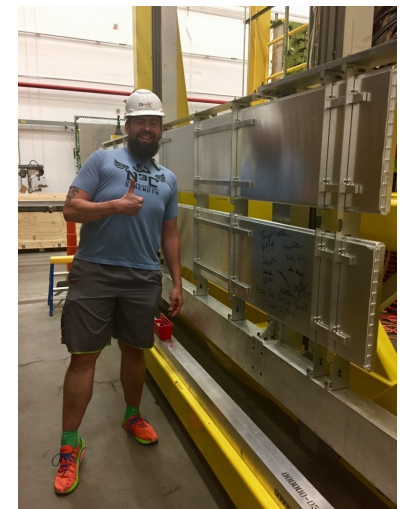
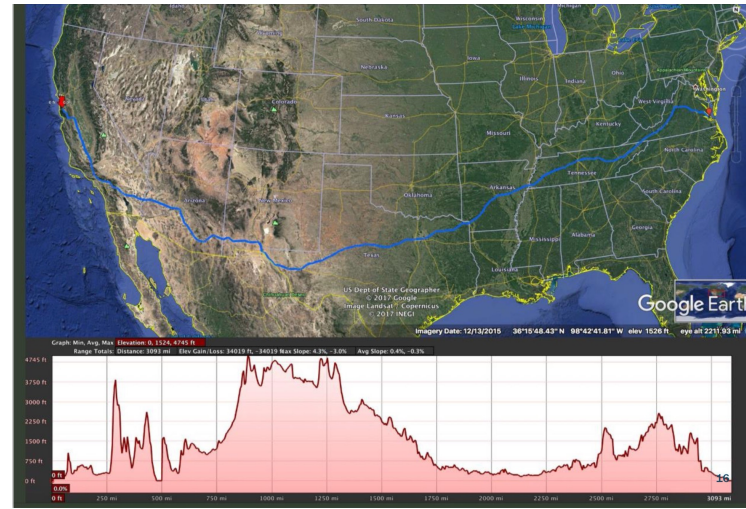
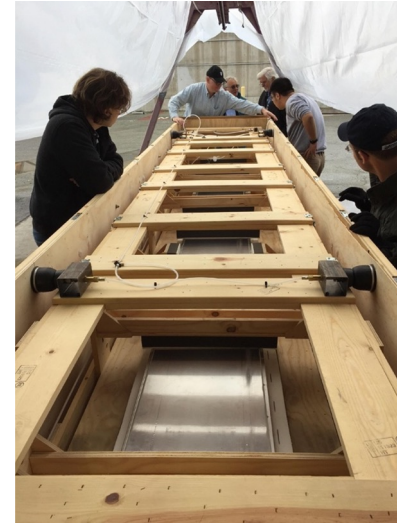
**Long bar:** 4 short (1.225m) bars  
 Mirror on forward end  
**Wedge** on readout end



4-2002  
8637A1

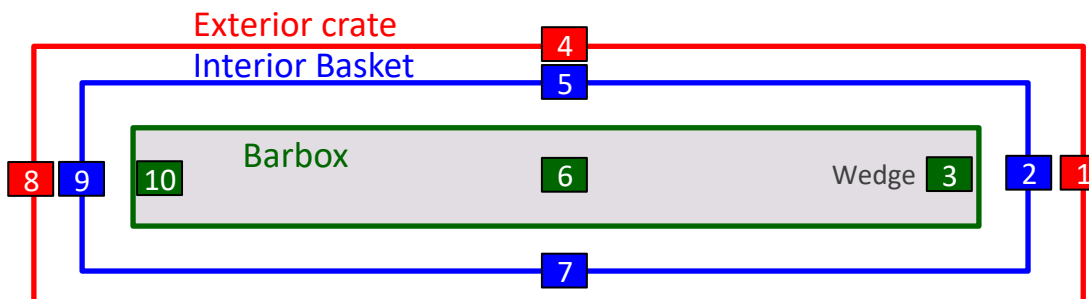
# FIRST 4 BABAR DIRC BAR BOXES

- **Successful GlueX bar box transport** in 2017/2018: wooden crates and shock absorption trays, air-ride and temperature controlled trailers

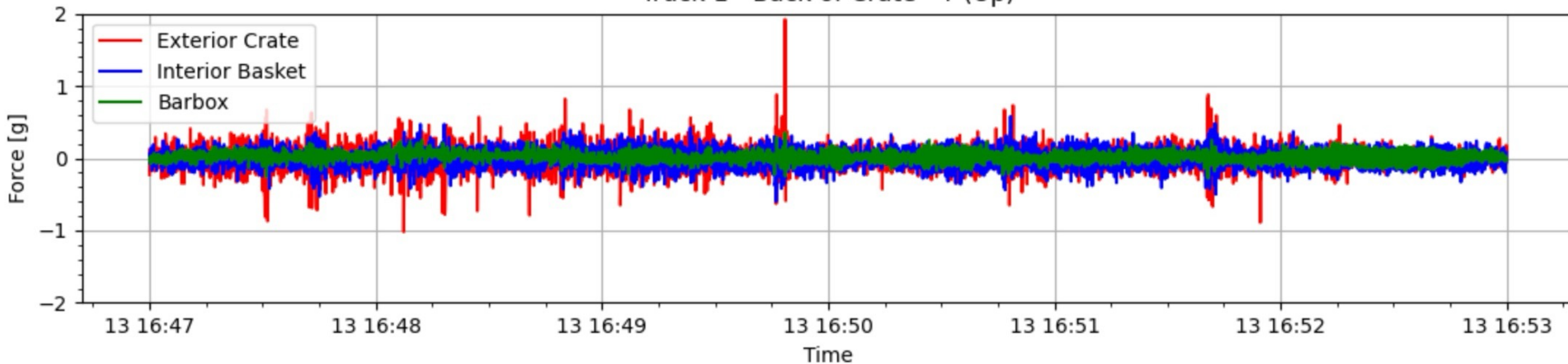


# DIRC BARBOX TRANSPORT CRATES

- Shocks absorbing foam
- Hydraulic shocks
- Air shocks
- Shock absorbing donuts
- Air-ride, temperature control trucks
- Low attitude road from SLAC to Jlab
- Goal: Keep shocks on Barbox below 1g

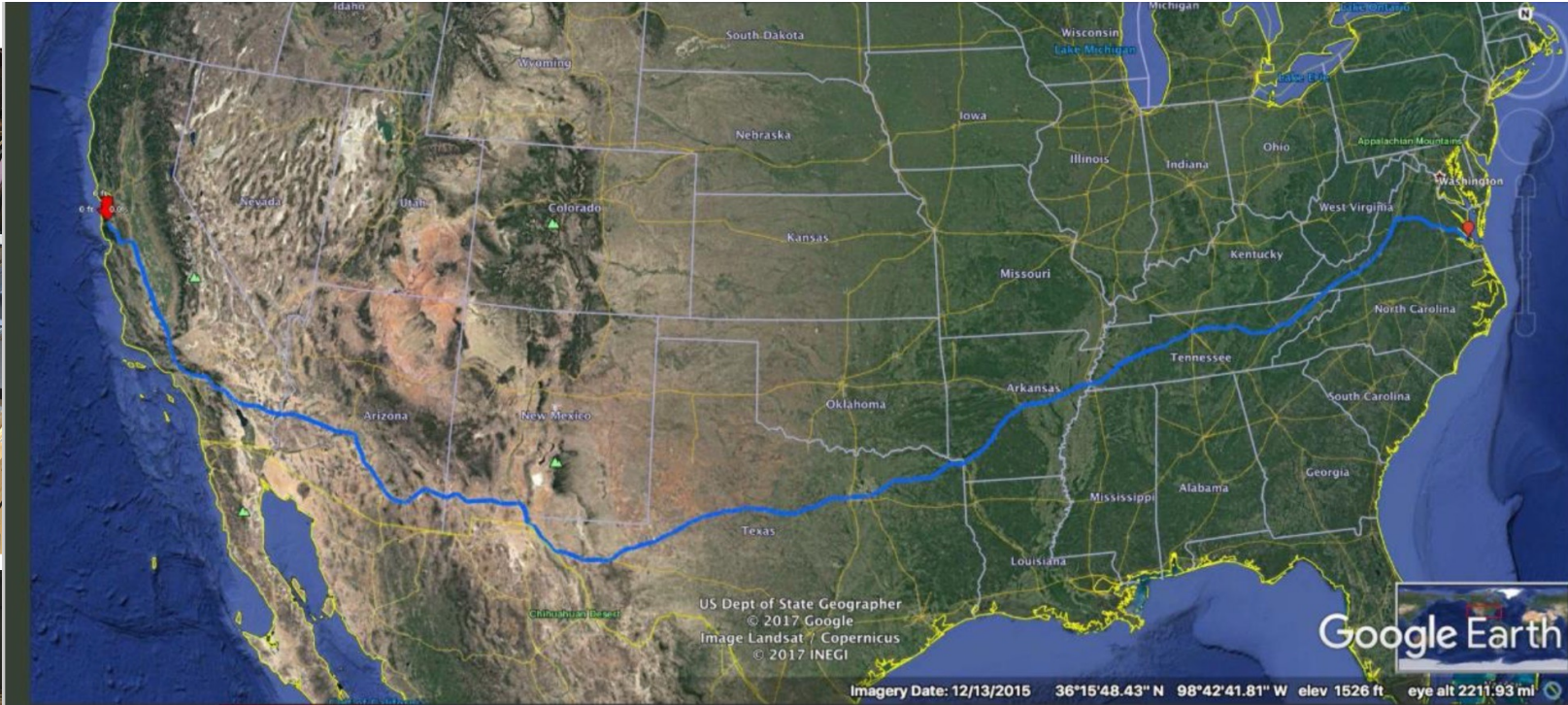


Truck 1 - Back of Crate - Y (Up)



# BABAR DIRC BAR BOXES ROAD TO JLAB

- Successful GlueX bar box transport in 2017/2018: wooden crates and shock absorption trays, air-ride and temperature controlled trailers



# LOADING BABAR DIRC BAR BOXES



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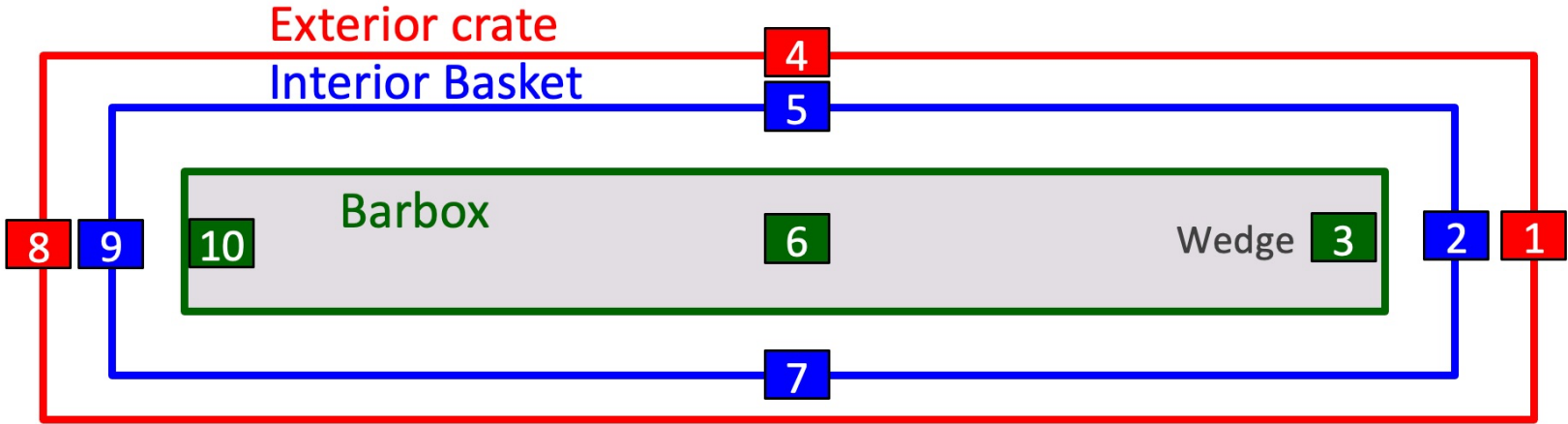
# BABAR DIRC BAR BOXES TEST RIDE



# BABAR DIRC BAR BOXES RIDE



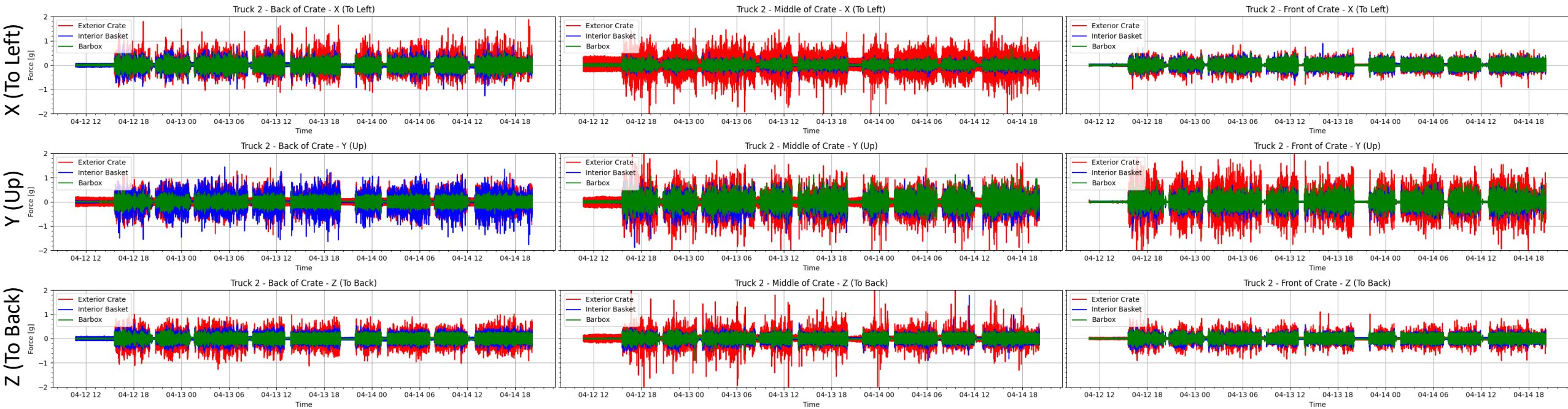
# BABAR DIRC BAR BOXES RIDE



Back of Crate

Middle of Crate

Front of Crate



# BABAR DIRC BAR BOXES IN JLAB



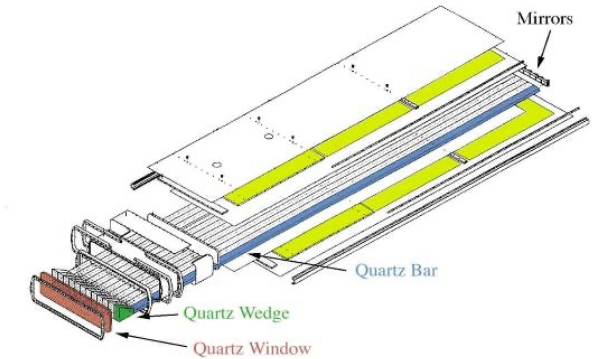
# BABAR DIRC BAR BOXES IN JLAB



# DISASSEMBLY OF BABAR DIRC BARS

- Bar boxes will be disassembled into individual bars at JLab (starting in July/August 2024)
  - Never done before, working on detailed plan
  - Aluminum covers will need to be "open", glue joints between bars dissolved
- Optical quality of bars after disassembly will be evaluated in QA DIRC lab, located next to disassembly tent
- QA DIRC lab close to ready for commissioning
- Reference DIRC bars (never used in BaBar) from SLAC available for commissioning and as reference
- QA Lab will consist of three parts:
  - Cleaning/inspection station
  - Darkroom with laser setup to measure quality of DIRC bars
  - Storage (long and short-term)
- Reflection coefficient measurement to evaluate surface quality

Schematic of BaBar bar box



DIRC labs under construction at JLab



Bar cleaning station to the right (not visible on photo)



# QA OF BABAR DIRC BARS

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*Laser Lab (Installation in progress)*



*DIRC labs under construction at Jlab EEL108*

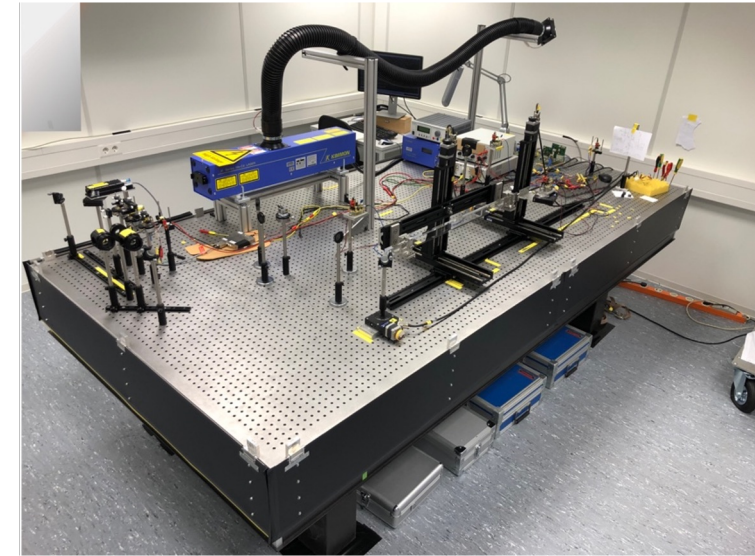


*Bar cleaning station to the right (not visible on photo)*

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Laser lab at GSI

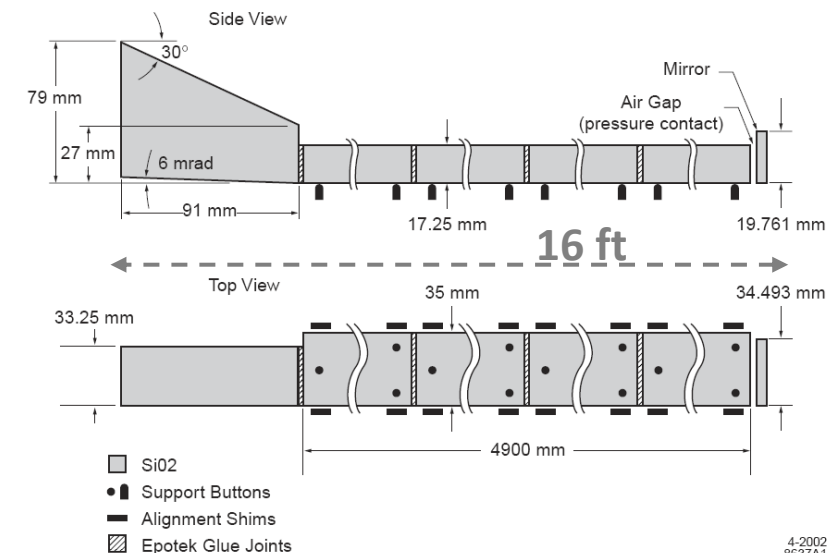
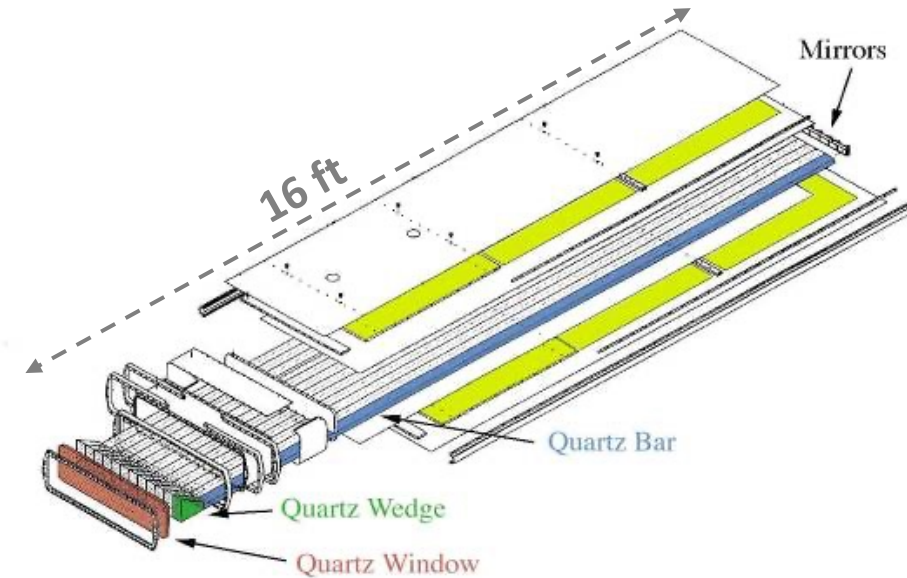


PANDA DIRC bar in GSI laser lab



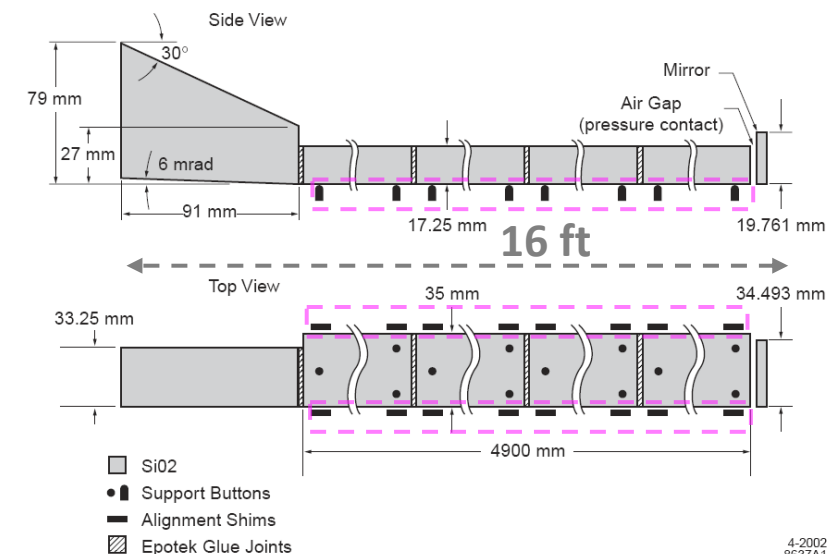
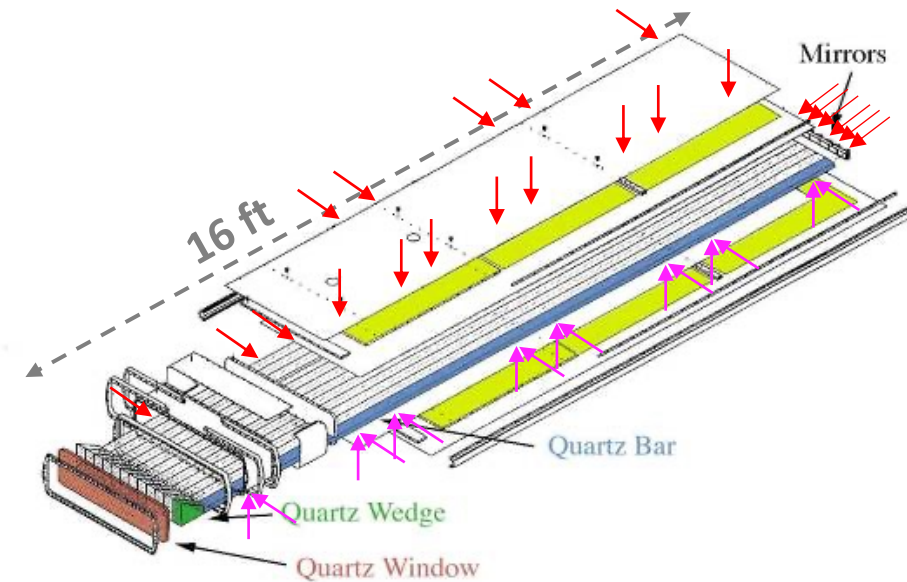
# BABAR DIRC BAR BOXES - FEW RELEVANT FACTS

- 4 short (1.225m) bars are glued end-to-end to create long bar
- Each long bar is glued to mirror on one end and Quartz Wedge on the other end
- All Quartz wedges in single box are glued to one Quartz Window
- ~150 $\mu$ m air gap between each bar  
**(very tight space for disassembly)**
- Each long bar supported at 8 points along the long surfaces.  
Two long sides are rested against fixed plastic buttons,  
two other long sides pressed by spring loaded screws.
- Spring loaded screws pressing mirrors against bar ends.
- All outside screws are fixed with glue  
**(has to be softened before loosening screws)**



# BABAR DIRC BAR BOXES - FEW RELEVANT FACTS

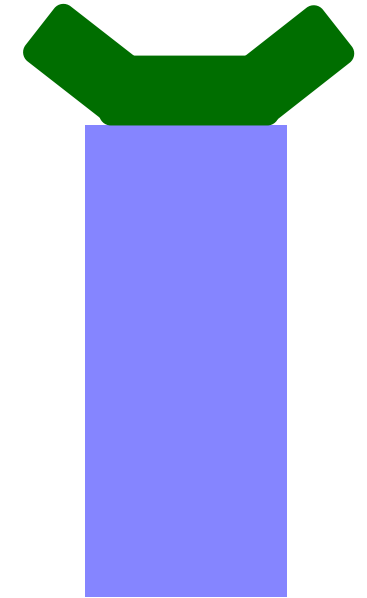
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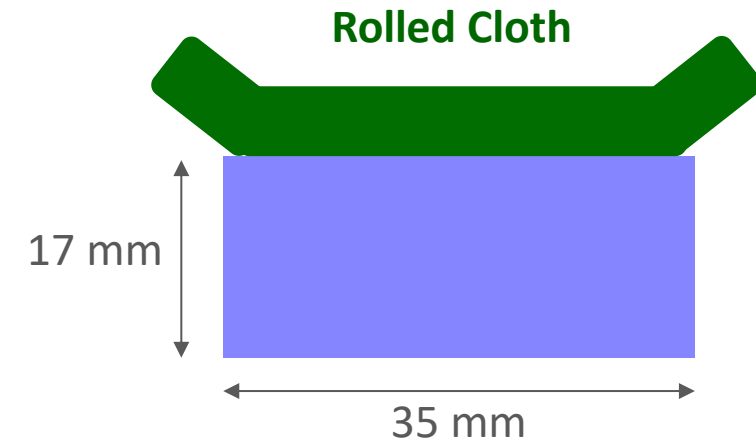
# DIRC BARS CLEANING

- **Cleaning of DIRC bars is time consuming and presents significant risks:**
  - One can not touch any long edge of the bar (chips very easily causing significant photon loss – making bar unusable)
  - Any residue left on the bar (dust, smudge of drying detergent) impacts significantly reflectivity
- **Cleaning procedure:**
  - **Rolled Berkshire Superpolx SW cloths** were used for cleaning in BaBar, PANDA, and GlueX
  - Combination of HASTILITE and DI water for initial cleaning
  - Ultra-pure acetone and isopropanol for final cleaning to dry surface has to be done along full surface (can not really start from middle without leaving smudge)
- The goal will be to remove all glue from bar after softening it with heat and avoid any pollution to the bars

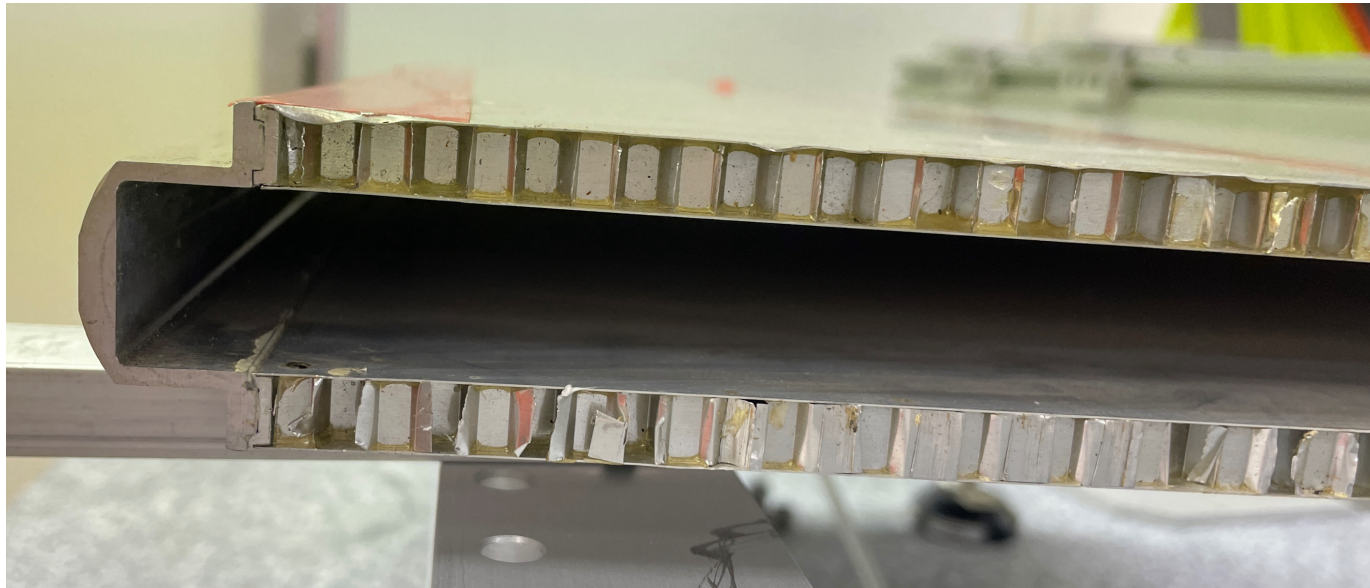
Superpolx SW cloths



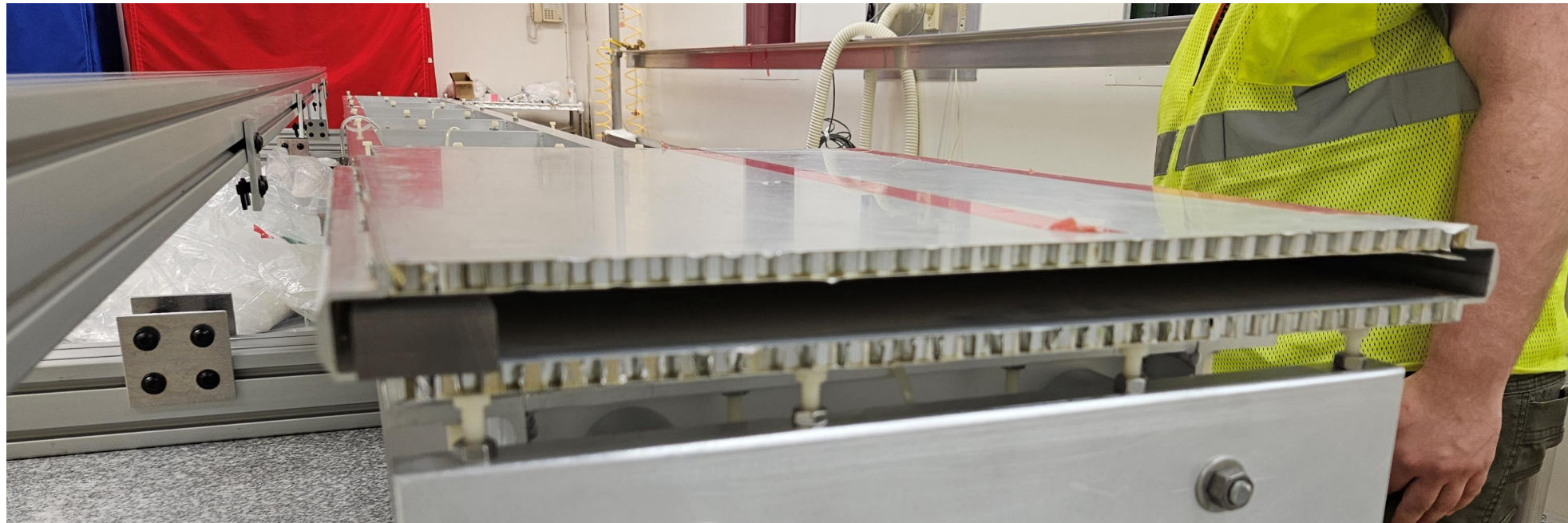
DIRC Bar



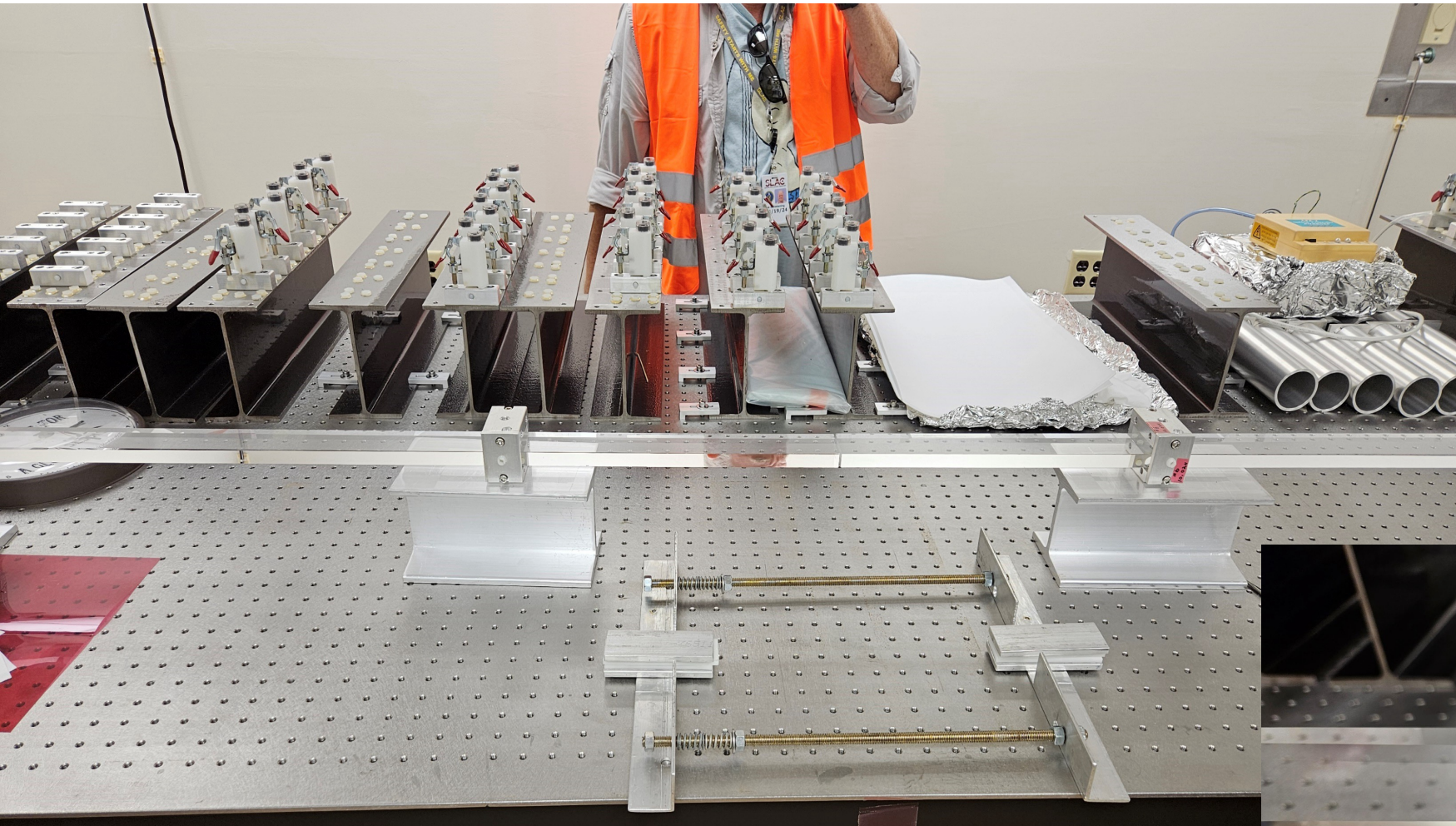
# BABAR DIRC BAR BOXES – LESSONS FROM SLAC



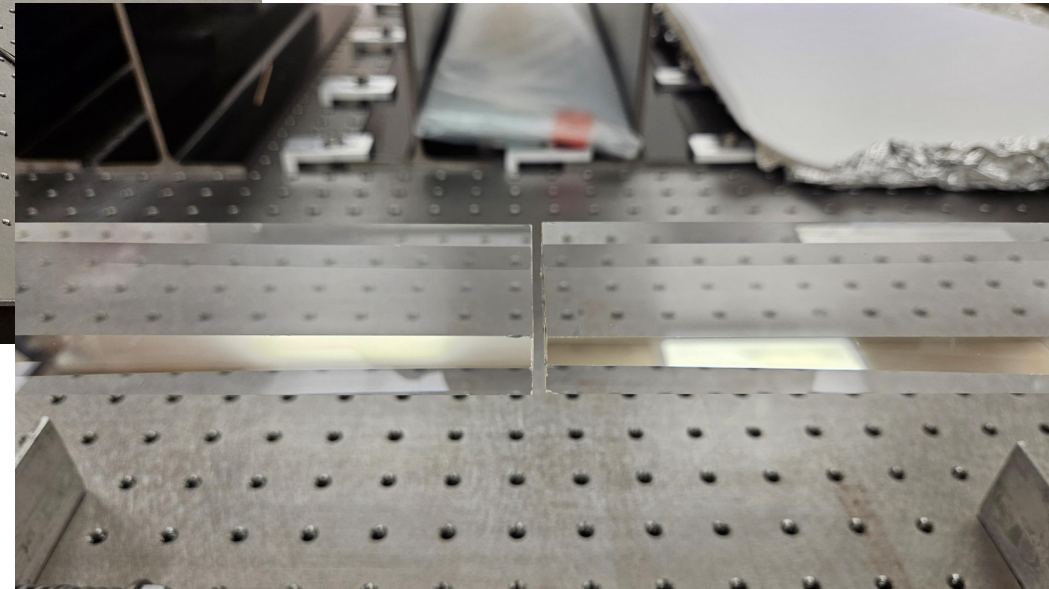
Aluminum DIRC bar box skin



# BABAR DIRC BAR BOXES – LESSONS FROM SLAC



Separated bars with heat gun



# SUMMARY

- Validation of reusing BaBar DIRC radiator bars is main remaining step towards TDR readiness
  - Successful transportation of bar boxes done in April 2024
  - Preparations for disassembly are in progress
    - Tests on glue, glued samples
    - Building large support structure with precise CNC cutting system
  - Disassembly and validation of optical quality in summer 2024
  - Decision on reuse of the BaBar bars expected by late fall 2024
- Invaluable support from Jlab management, DSG group, and EIC technicians!
- Support from SLAC expert that built the boxes and did some successful tests helpful for the disassembly process

