

BigBite Timing Hodoscope SBS Weekly Meeting Update

Hall A Jefferson Lab



Ralph Marinaro

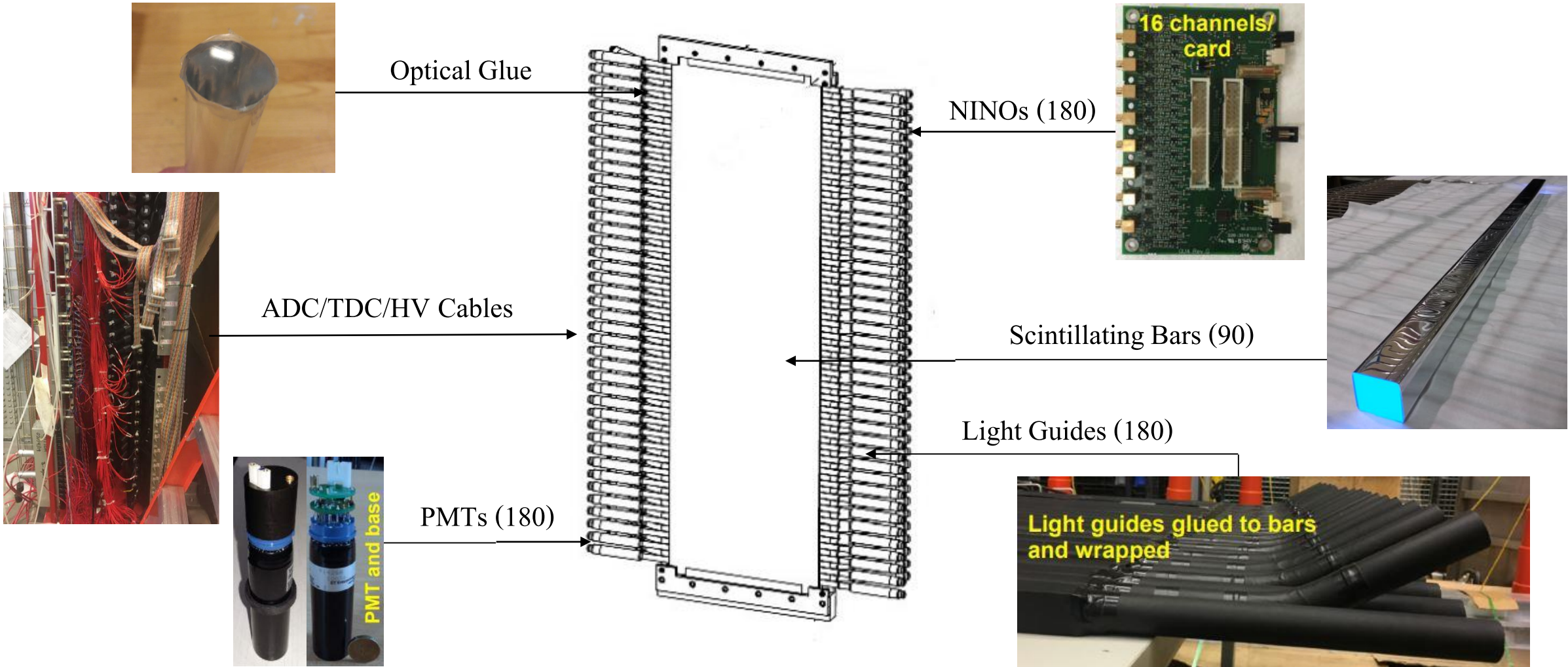
University of Glasgow

September 21, 2020

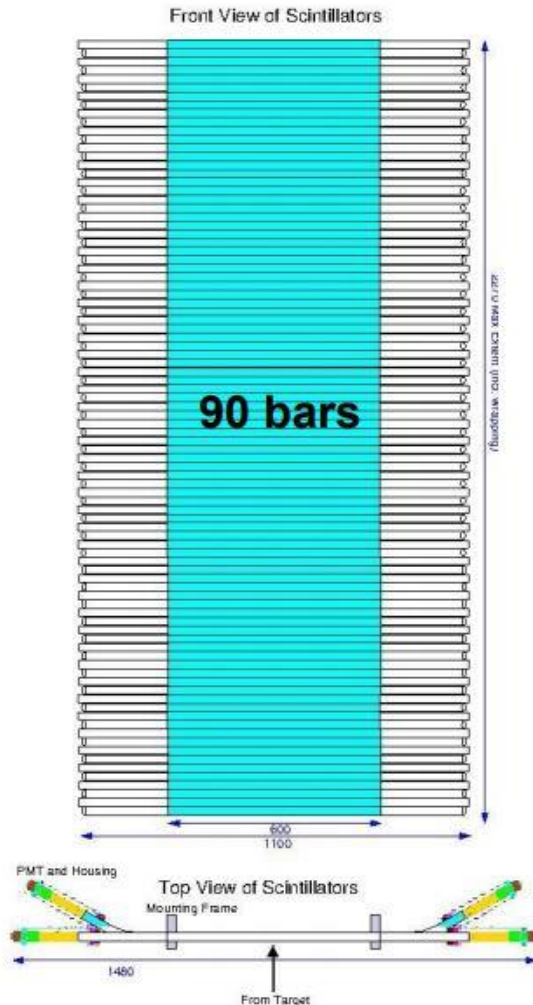


University
of Glasgow

Detector Design



Construction History



Item	Status
90 scintillator bars/light guides	Glued/wrapped. On site pre-Aug 2015.
200 PMTs and bases	Procured 2016. On site Jul 2017. Tested Jun/Jul 2018.
180 PMT assembly parts	Final parts on site May 2018.
PMT/mu metal assemblies	Final testing/assembly completed Jul 2018.
Assemblies fitted to bars	Completed Jun/Jul 2018.
Final bar assemblies checked	Jul 2018 initial bar tests/checks using oscilloscope/cosmics.
PMTs gain matched	Initial, very rough matching performed via oscilloscope w/ cosmics Jul 2018. Await tests with DAQ.
Stacking of bars	Stacked Fall 2018. Some need repair, will need to be re-stacked spring/summer 2020.
Construction HV distribution boxes, 4 48chan HV multiway cables, 200 short 2m HV cables, LV distribution box, LV cables	1st quarter 2019. On site early summer 2019.
Initial cabling of HV and LV installed and tested to be working ok	Completed summer 2019.
De-stacking of bars and start of repairs	Re-routing of cabling, improvements to PMT assemblies etc, tests of repair procedures, Winter - Spring 2020 and on-going

Problems - PMTs



- 20 broken glue joints on right hand side
- 7 broken glue joints on left hand side
- Photos taken as of December 2019
- Caused by bumping against PMTs
- Choice of smooth surfaces not sufficient for long term wear
- No external protection for PMTs

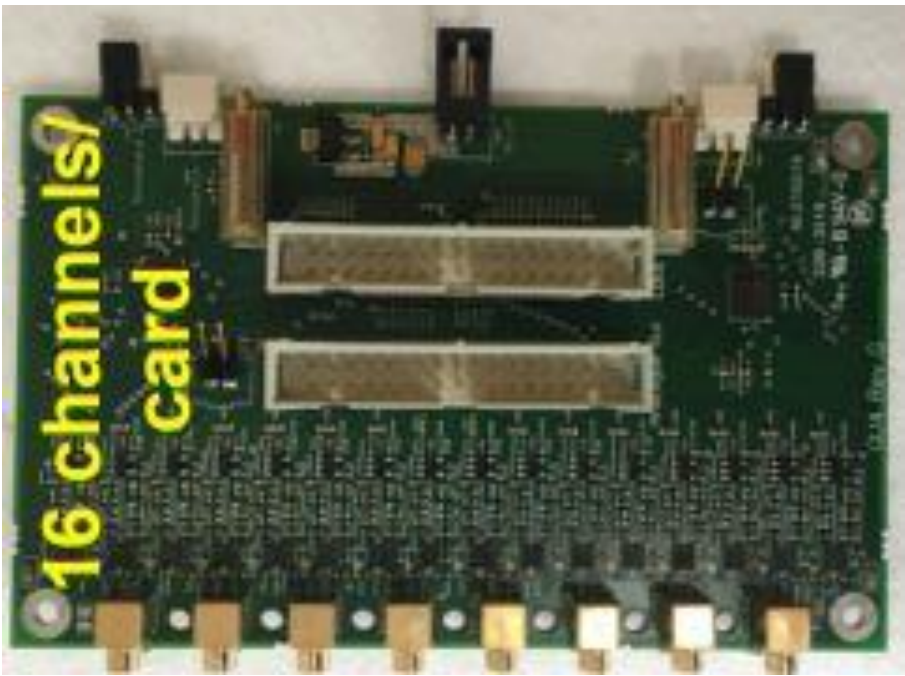
Solutions →

- Study conducted by Rachel at Glasgow*
- Tests with roughened surface conducted with same optical glue
- Decided to roughen surface of light guide and scintillating bar
- Additional guarding attached preventing future accidents
- Flexible supports between PMTs for extra reinforcement

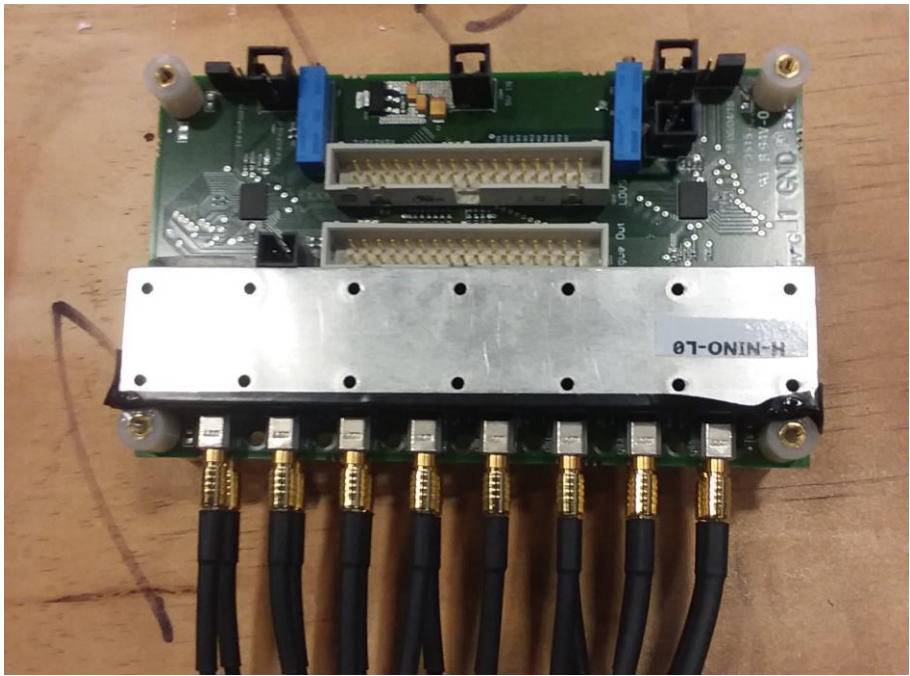


*see presentation from summer 2020 SBS meeting, written report available from Rachel

Problems - NINOs



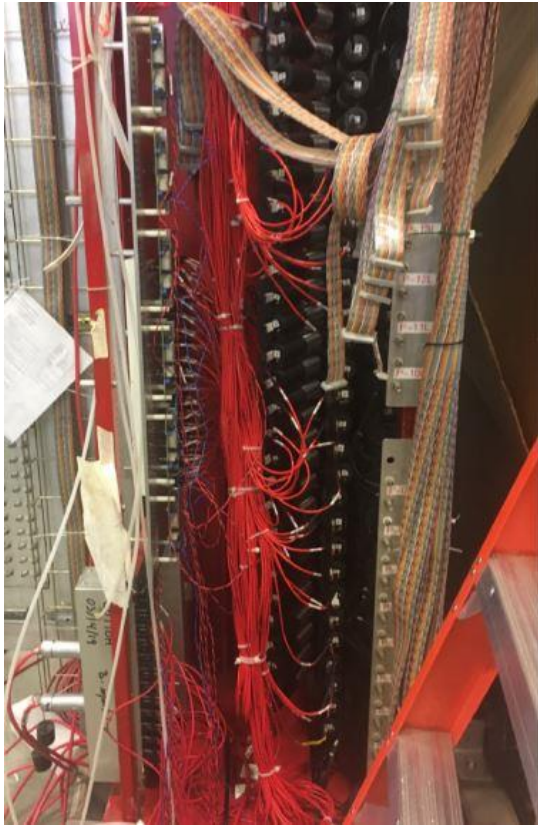
Solutions
→



- Not enough solder on connector joints from Zott manufacturer on pins
- Prone to damages from screw attachments which secure card to frame plate

- Extra structure added to improve connector joints for more reliable signal
- Support clamps around screws to disperse pressure over larger area to prevent cracking

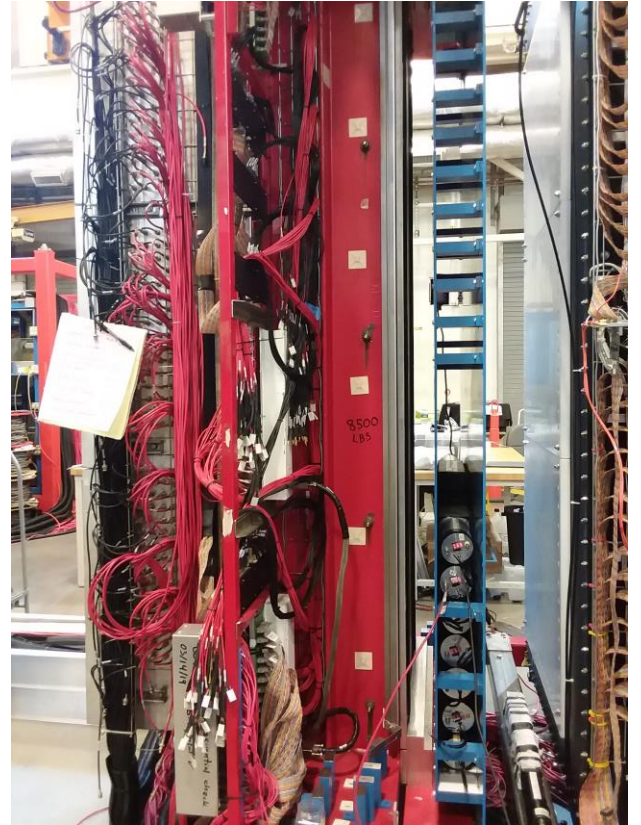
Cabling and Electronics



Summer 2019



December 2019

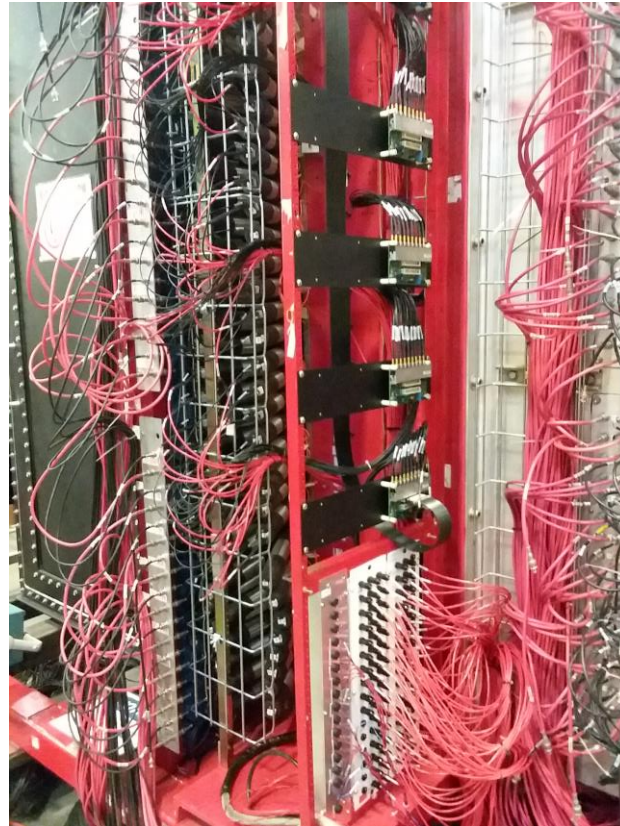


Present

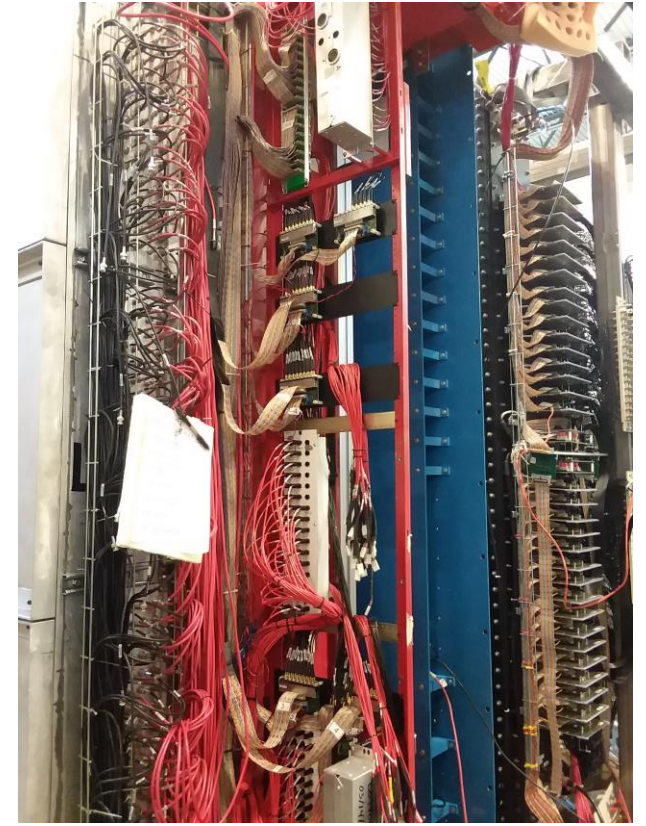
Cabling and Electronics



Summer 2019



December 2019



Present

Laser Test - Setup

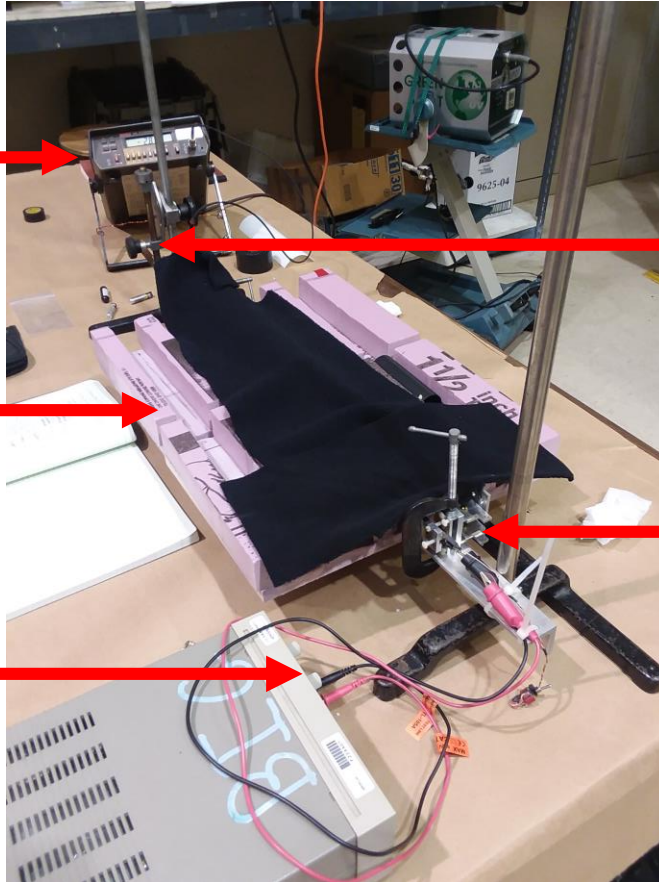
Ammeter



Light Guide Holder



5V Power Supply



Photodiode



Red Laser



Laser Test - Results

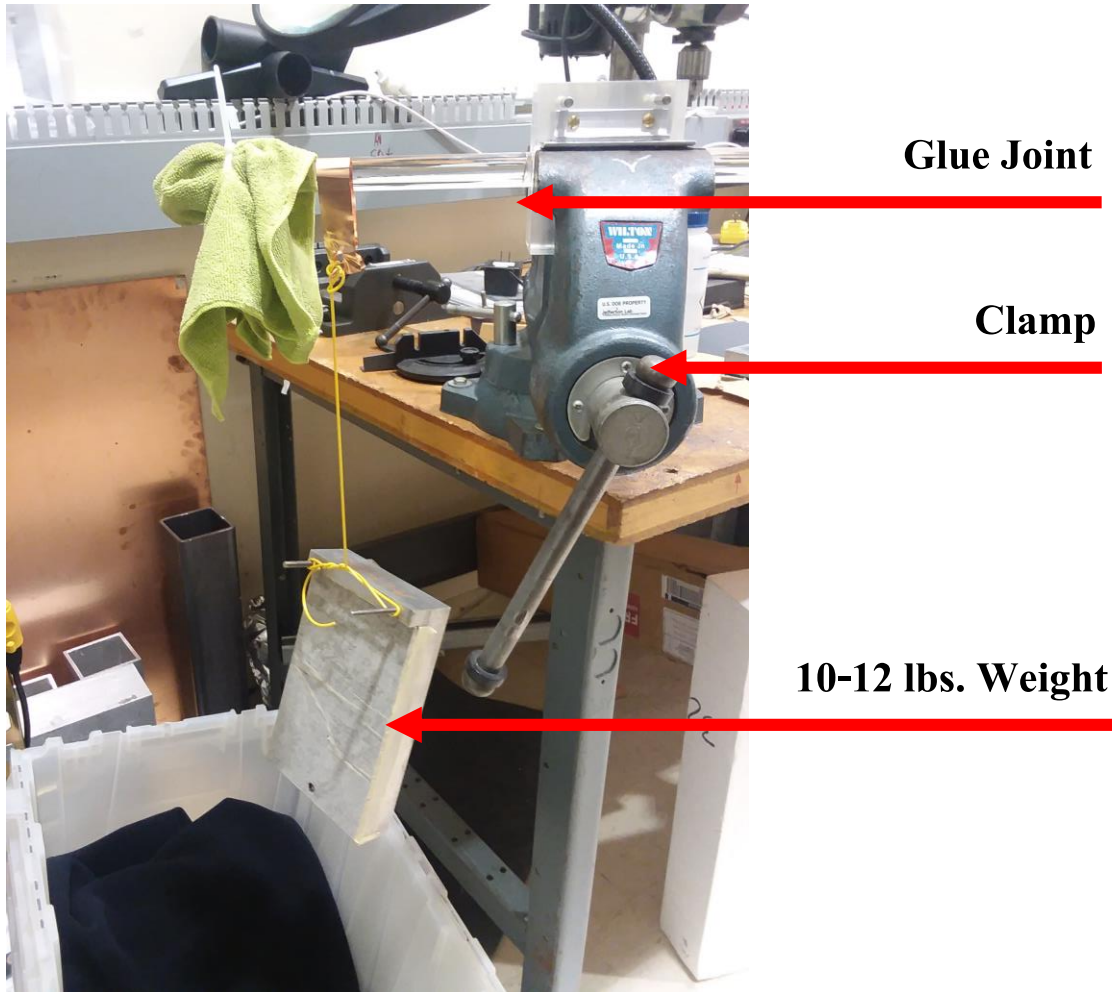
	Current	Transparency
Resting	0.018 μ A	-
Resting w/ Laser	3.311 μ A	-
Single L.G. (smooth)	2.632 μ A	86.7%
Double L.G. (smooth)	2.141 μ A	65.9%
Double L.G. (smooth w/ glue)	2.626 μ A	81.9%

- Transparency reduced by **5.54%** between single light guide (smooth) and double light guide (smooth w/ glue)
- Proof that chosen optical glue minimally reduces transparency for polished light guides

	Current	Transparency
Single L.G. (rough)	0.882 μ A	25.3%
Double L.G. (rough)	0.672 μ A	19.2%
Double L.G. (rough w/ glue)	2.619 μ A	81.0%

- Transparency reduced by **1.71%** between double light guide (smooth w/ glue) and double light guide (rough w/ glue)
- Proof that roughness (400 grade) minimally reduces transparency, glue fills abrasions, agrees with Glasgow results Feb. 2020

Stress Test



- Setup comprised of two light guides with roughened surfaces glued together, glue joint positioned directly on edge of clamp
- 10 and 12 lbs. weights were tested after varying 1-inch interval distances from joint
- Found that neither 10 lbs. nor 12 lbs. weights could break glue joint with 400 grade roughness
- Joint had to be weakened with alcohol bath, finally broke using 18 lbs. weight
- Proof that new method of roughening light guide surface combined with optical glue is sufficiently strong
- Lower grades of roughness available for testing, but 400 grade is best for strongest glue joint

Production – Soaking



Before

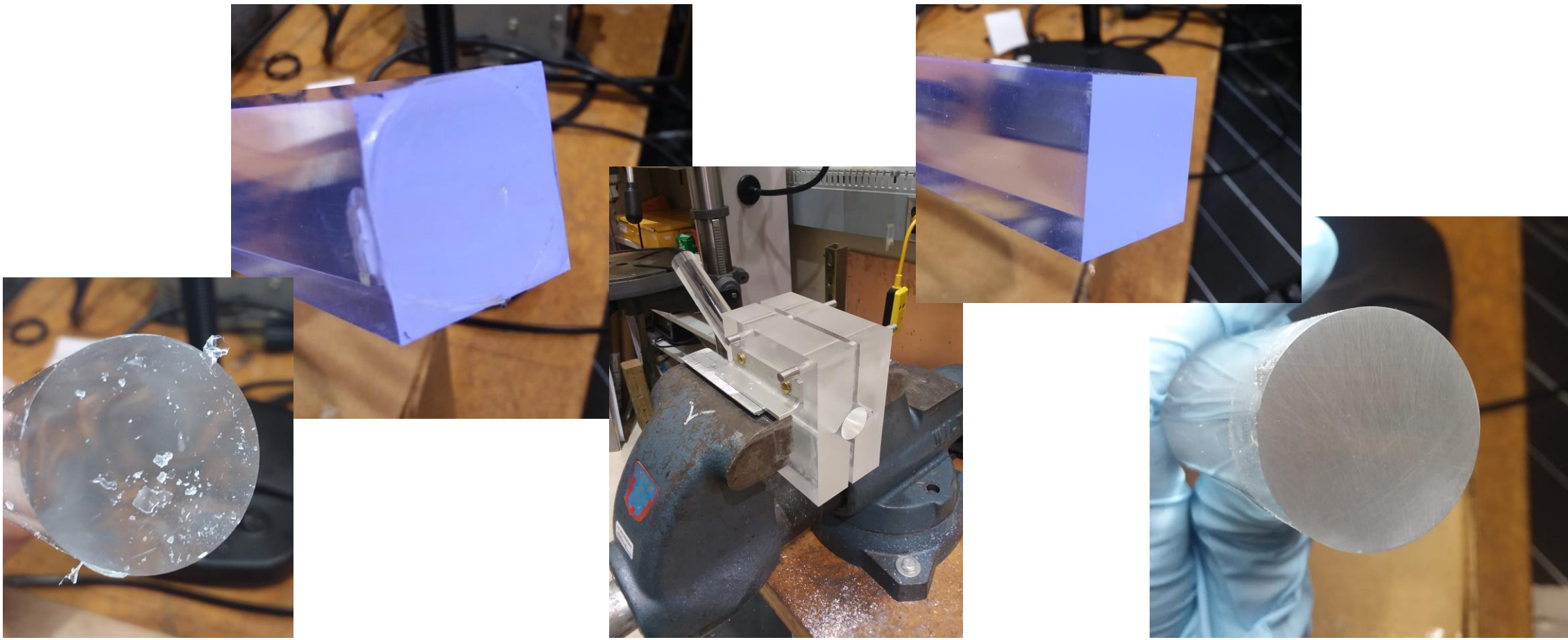


During



After

Production – Sanding



Before

During

After

Production – Gluing

Point of Contact

UV Light Source

Scintillating Bar

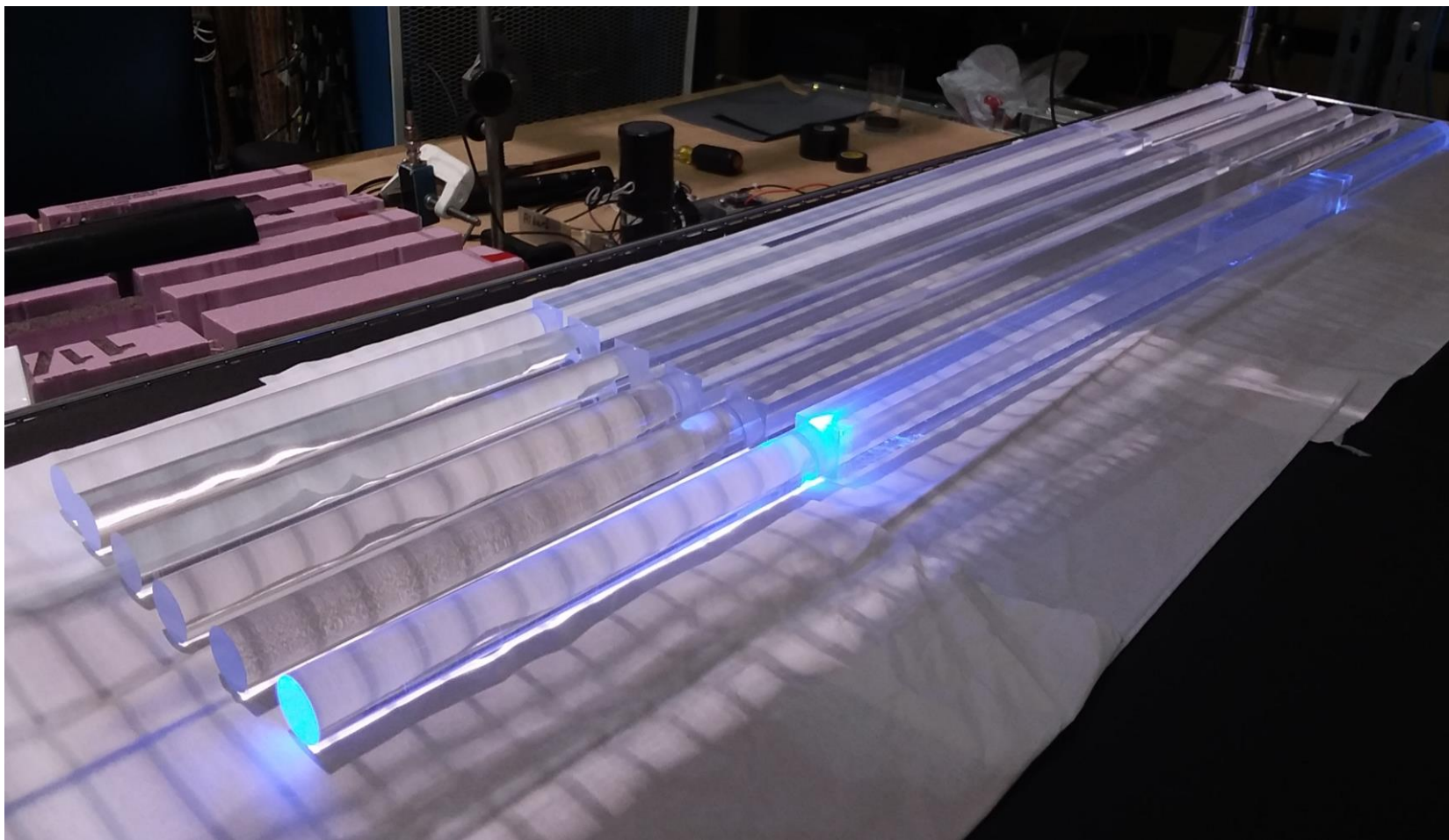
Light Guide

Holding Apparatus

Operating Pedal



Result (for now)



Summary

- Repairs on-going
- Several tests performed to determine best repairs procedure
- Procedure set up as:
 - Clean in bath, roughen in jig, glue in jig
- So far 20 bars completed - estimate about 2-3 weeks remaining
- Wrapping procedure in development, then light tight bars

- DAQ
 - Initial install of v1190 TDCs in VME crate started at beginning 2020 but will require on site expert to help in completion of DAQ set up and cosmic trigger/pulser set up for testing repaired bars
- Software
 - Starting to implement hodoscope in SBSOffline and database requirements etc. but on-going