

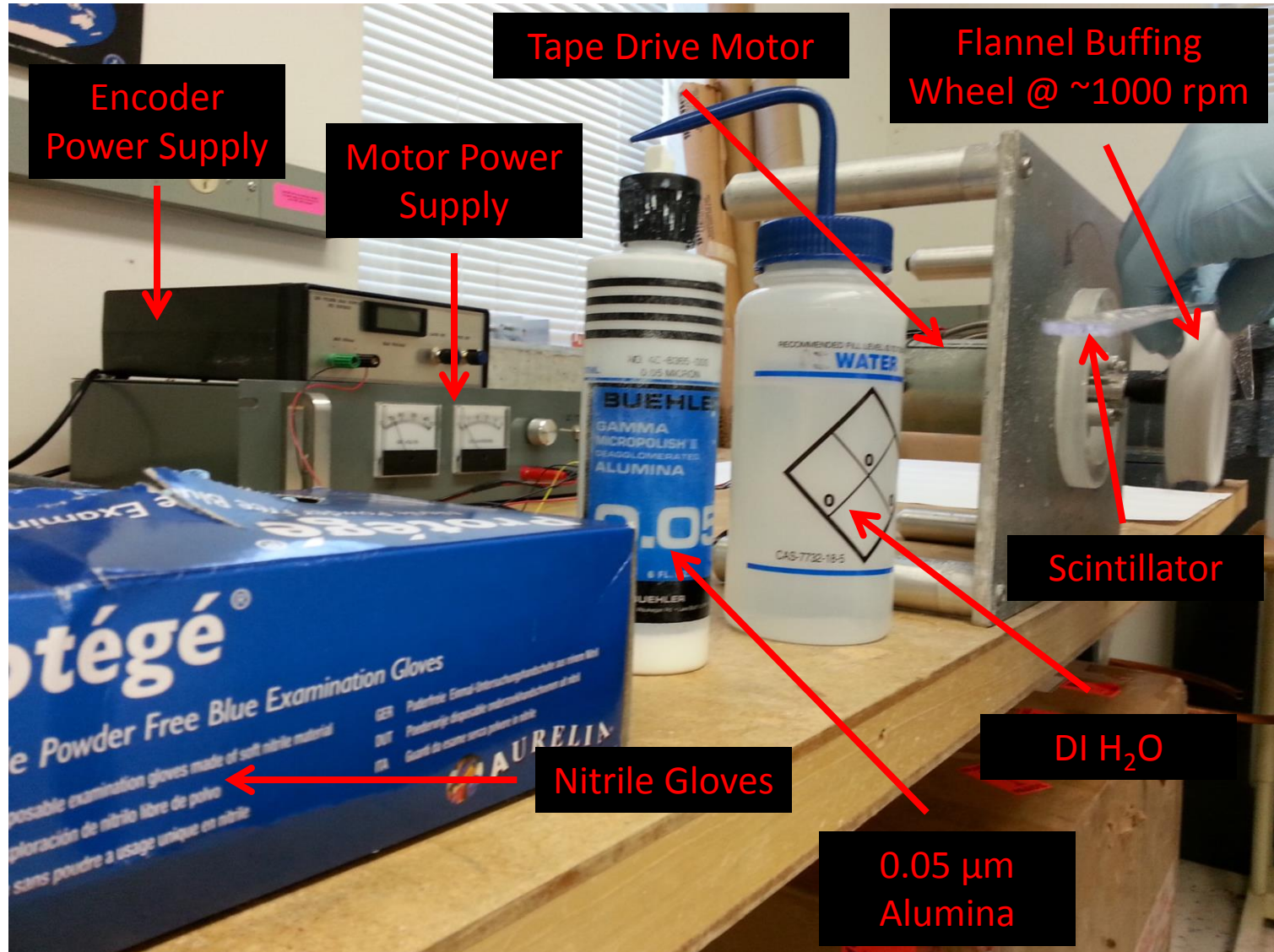
Polishing Tests

06/28/14

Recap

- 50 Machined scintillators have defects on surfaces
 - High density, localized scratches in bend and $\frac{1}{4}$ from upstream end in straight section
 - Long scratches along surface of entire scintillator
 - Uniform haze is present across entire length of scintillator
- Polishing may allow us to recover the surface quality we expect
 - Also might remove any undesired chemical deposits on the surface of the scintillator

Polishing Trials (Setup)



Polishing Trials (Speed Monitoring)

- Utilizing Tape Drive motor to drive the flannel buffing wheel
- Measured the number of pulses per rotation from the encoder
- Use NIM counter to measure number of pulses per second and convert to RPM for speed monitoring
 - $8000 * 0.12 \approx 1000$ rpm
- Ensures consistent buffing speed for each user & scintillator

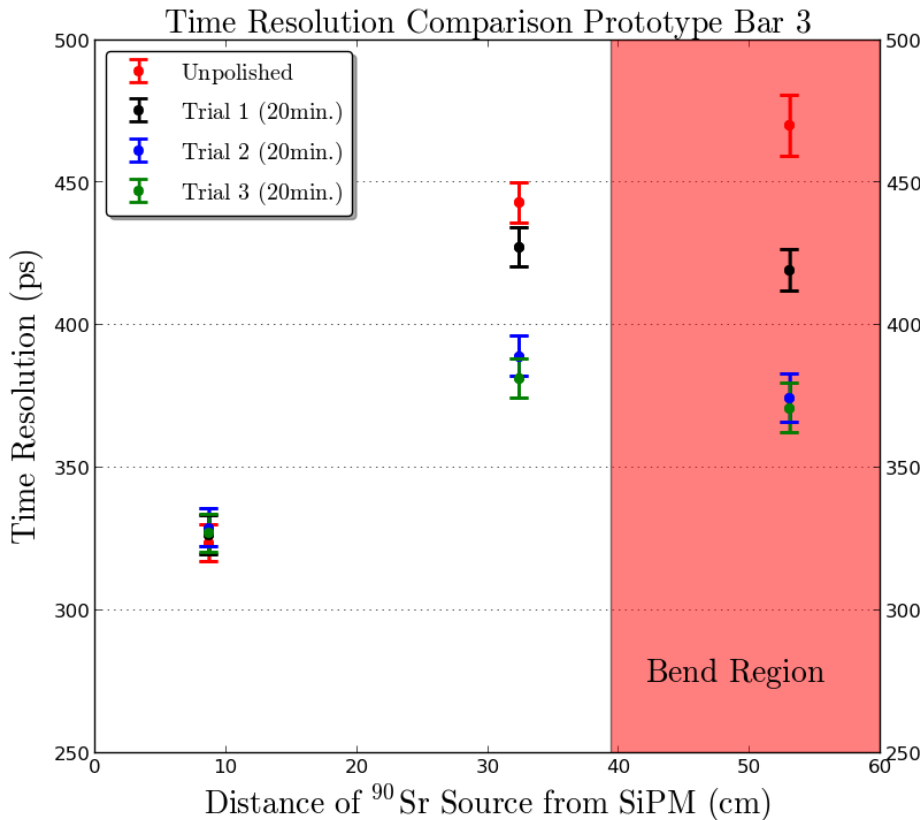


Polishing Trials (Polishing)



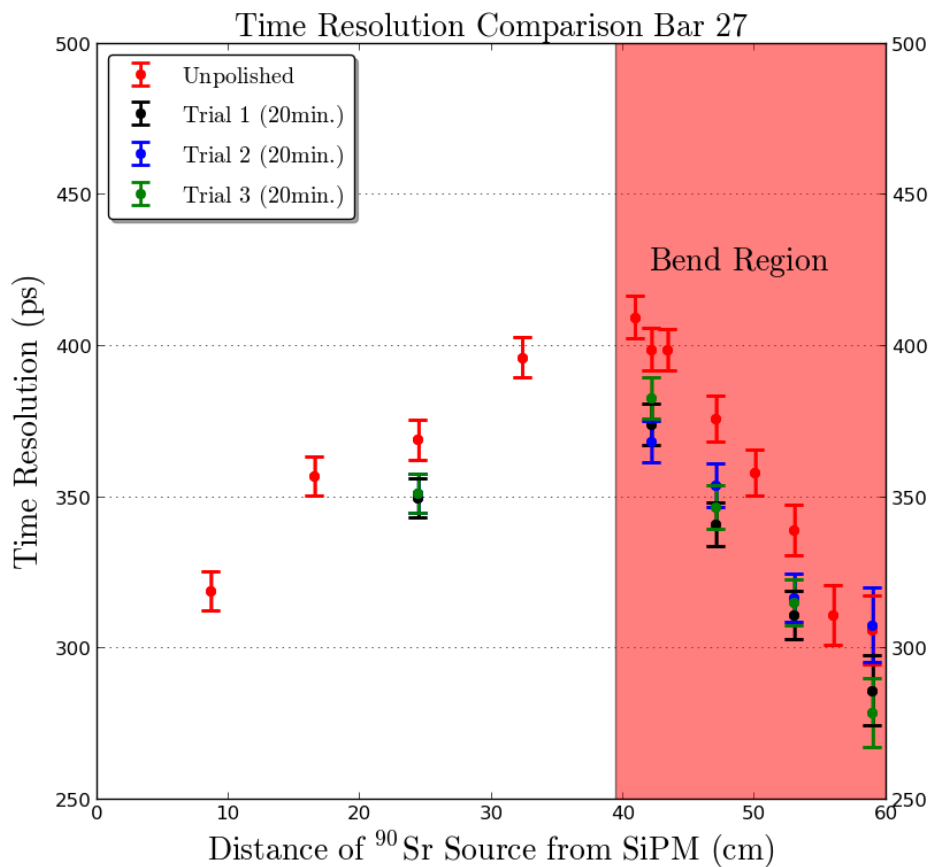
- Scintillator and buffing wheel are kept cool and wet at all times
 - Easy to achieve with low buffing speeds (< 1500 rpms)
- Polish in 20 minute intervals (~ 1000 rpms)
 - 10 min in straight section
 - 10 min in bend and nose
- Polish both sides of scintillators with equal time and attention
- Lightly polish the edges in order to remove any potential chemical residues
 - ≈ 1 min per edge along entire length of scintillator

Polishing Trials (Prototype Bar 3 Results)



- Prototype Paddle 3 was heavily scratched during wrapping test
- Scratches on surface are considerably worse than the surface quality of the 50 machined scintillators
 - Bar 3 was handled improperly with medical examining gloves and exhibits localized crazing
- Average Time Resolution across entire length of paddle
 - Unpolished: 412 ps
 - Trial 1: 390 ps
 - Trial 2: 363 ps
 - Trial 3: 359 ps
- ~ 100 ps improvement in the nose region

Polishing Trials (Paddle 27 Results)



- Paddle 27 received an initial rating of Poor
 - High density scratches in nose and straight section
 - Numerous scratches along entire length of scintillator
 - Large chip on the edge of the nose section
- Average Time Resolution
 - Unpolished: 361 ps
 - Trial 1: 332 ps
 - Trial 2: 339 ps
 - Trial 3: 334 ps
- Polishing (after 2 trials) rid the surface of virtually all fine scratches
 - Only scratches that remained were the deep scratches
 - 0.3 μm Alumina might help with this
 - If it weren't for the large chip on the edge of the nose section this scintillator would receive a grade of Excellent
- Possible to recover $\approx 25 - 50$ ps with current polishing methods

Polishing Trials (New Supplies)

- In House
 - 3 Soft flannel buffing wheels
 - 3 (not so soft) cotton buffing wheels
- In Transit from Allied High Tech Products (should arrive today)
 - Alumina Suspension, De-Agglomerated, 0.3 Micron, 32 oz. (950 mL)
 - May be able to remove deeper surface scratches
 - Alumina Suspension, De-Agglomerated, 0.05 Micron, 32 oz. (950 mL)
 - Proven to remove haze and fine surface scratches
- Polishing methods have yet to be finalized
- Will most likely consist of 2, 20 minute intervals of polishing
 - 20 minutes for the straight section
 - 20 minutes for the nose section
- More tests are required for finalizing the polishing procedure