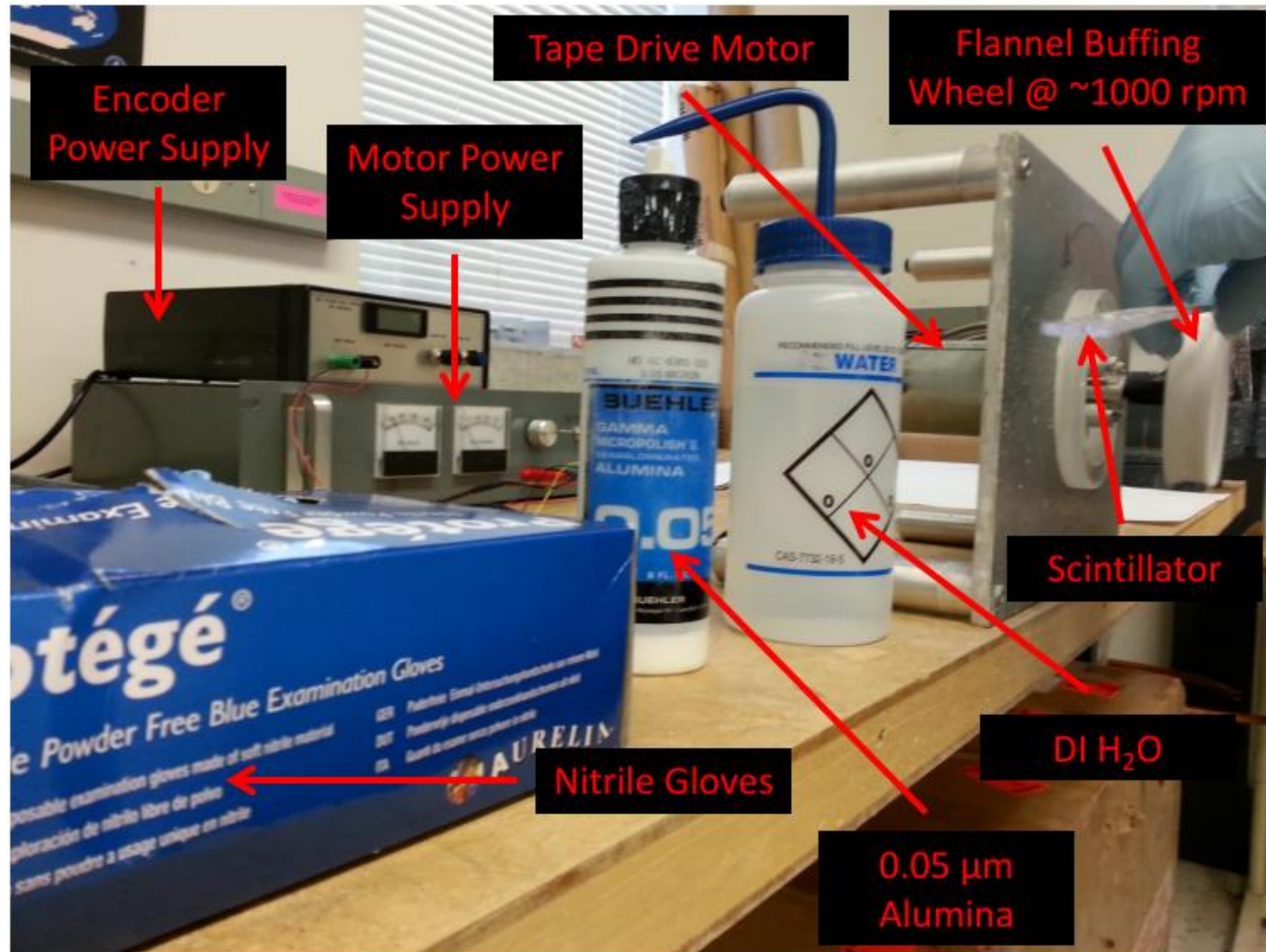


Polishing and Testing

07/10/14

Previous Polishing Methods

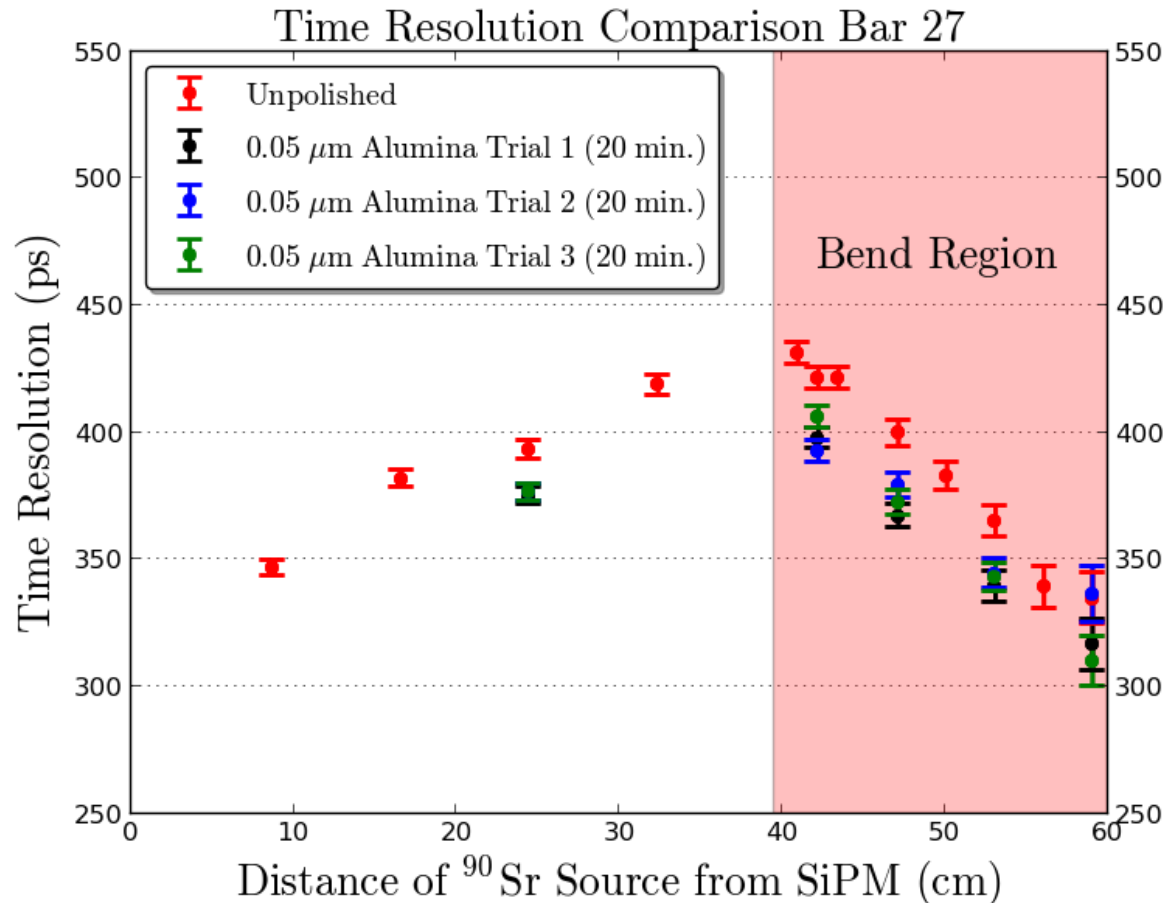


Previous Polishing Methods (Cont.)



- Scintillator and buffing wheel are kept cool and wet at all times
 - Achieved with low buffing speeds (< 1500 rpms)
- Polish in 20 minute intervals (~1000 rpms)
 - 10 min in straight section -> 0.05 μm Buehler Alumina
 - 10 min in bend and nose -> 0.05 μm Buehler Alumina
- Polish both sides of scintillators with equal time and attention

Paddle 27 Results (Old Polishing Methods)

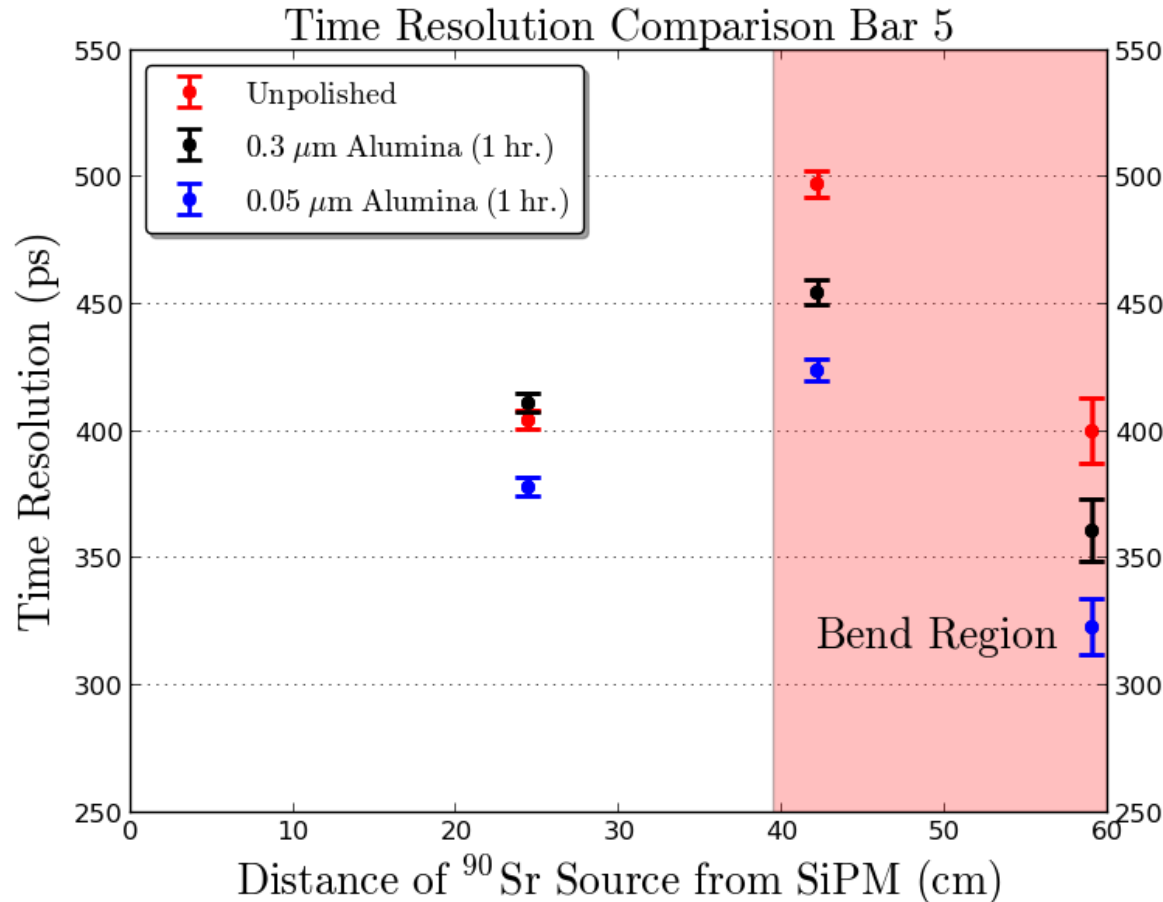


- These data have not been corrected for the trigger (≈ 30 ps reduction)
- Paddle 27 is one of the better bars in the lot of 50
- Average Time Resolution
 - Unpolished: 361 ps
 - Trial 1: 332 ps
 - Trial 2: 339 ps
 - Trial 3: 334 ps
- Polishing after 2 trials rid the surface of virtually all fine scratches
- Possible to recover $\approx 25 - 40$ ps with previous polishing methods

Current Polishing Methods

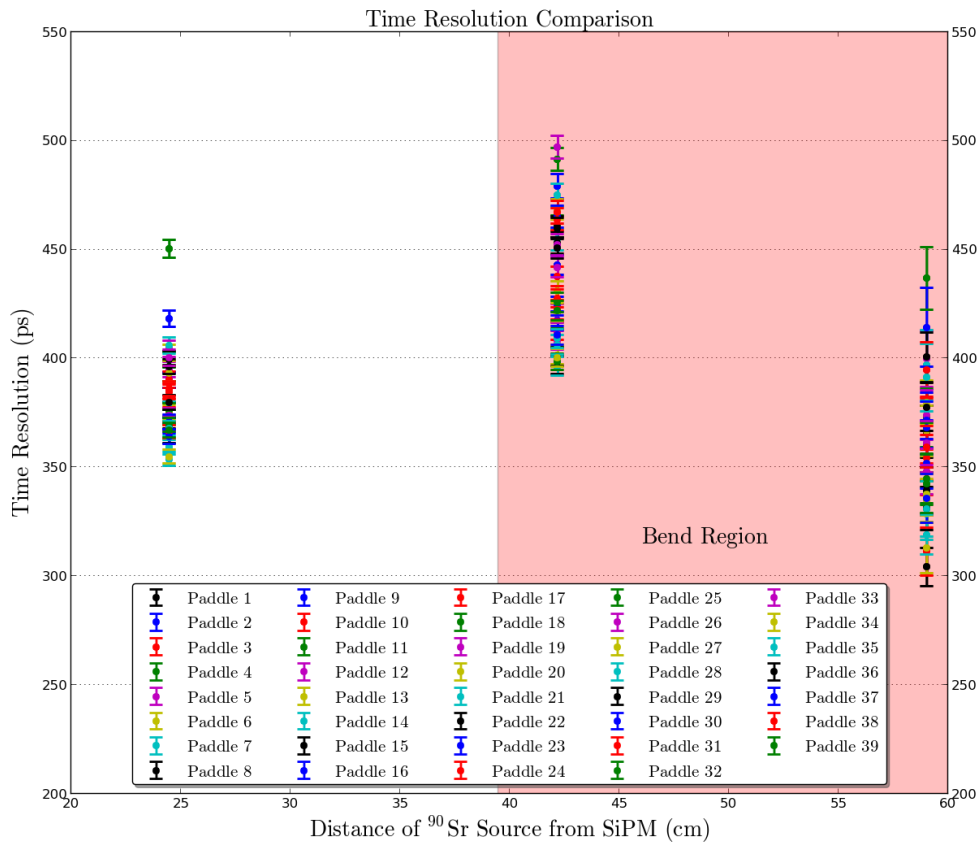
- Same basic setup as before
- Scintillator and buffing wheel are kept cool and wet at all times
 - Achieved with low buffing speeds (< 1500 rpms)
- Polish in 1 hour intervals (~1000 rpms)
 - First polish with diluted 0.3 μm Allied Alumina
 - 30 min in straight section
 - 30 min in bend and nose
 - If Comet Tails (< 2 mm scratches incurred during the polishing process) exist then 0.3 μm Alumina is applied to a glass cleaning cloth and polished by hand until the micro-scratches are removed
 - Second polish with diluted 0.05 μm Allied Alumina
 - 30 min in straight section
 - 30 min in bend and nose

Paddle 5 Results (New Polishing Methods)



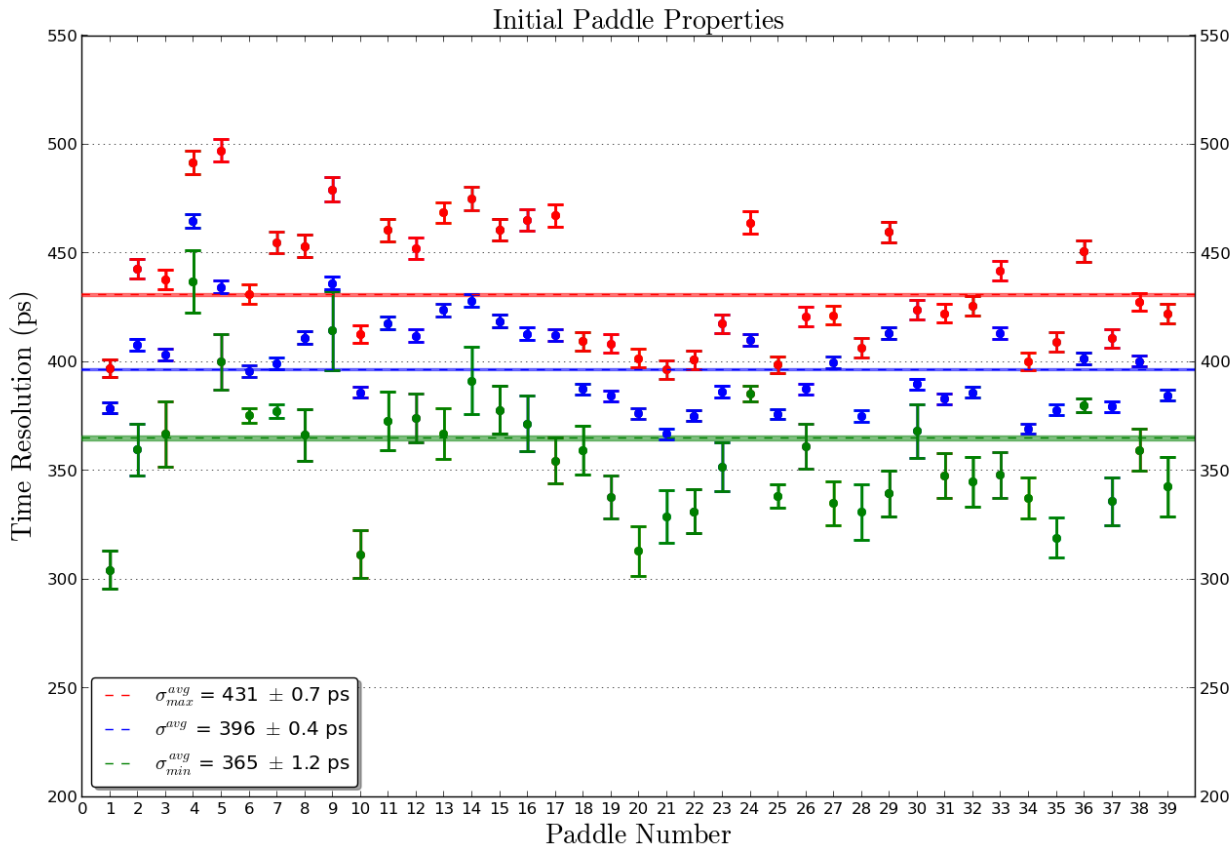
- These data have not been corrected for the trigger (≈ 30 ps reduction)
- Paddle 5 is one of the worst bars seen to date
 - High density scratches in the nose and straight section
 - Numerous deep scratches along the entire length of scintillator
- Average Time Resolution
 - Unpolished: 434 ps
 - 0.3 μm Alumina: 409 ps
 - 0.05 μm Alumina: 375 ps
- Only scratches that remain on surface are the deep scratches that will most likely be unrecoverable
- Possible to recover $\approx 25 - 75$ ps with current polishing methods

Initial Tests of 30 Unpolished Paddles



- These data have not been corrected for the trigger (≈ 30 ps reduction)
- Large Spread of timing resolutions in the bend is due to varying magnitudes of high density scratches in the bend region
- The nose region also suffers from a large spread in timing resolution
 - This is a direct result of the bend region
 - The nose section also suffers from a varying magnitude of scratch damage
- Polishing the worst bar (paddle 5) has made it comparable to the performance of our best bars

Initial Tests (Cont.)



- These data have not been corrected for the trigger (≈ 30 ps reduction)
- **Top: Max Time Resolution**
- **Middle: Avg Time Resolution**
- **Bottom: Min Time Resolution**
- These data allow us to easily determine the worst bars in the lot of 50
- $\approx 15\%$ (5) of the paddles are “unusable” to date
 - These bars will be used for polishing technique development
- Once a technique is finalized:
 - Polish the good scintillators
 - Wrap them in AL Foil
 - Fully test each scintillator