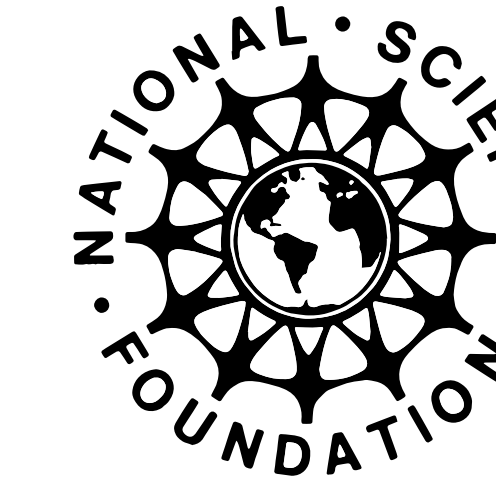


Needle Tapering

for Improved Biopsy Performance



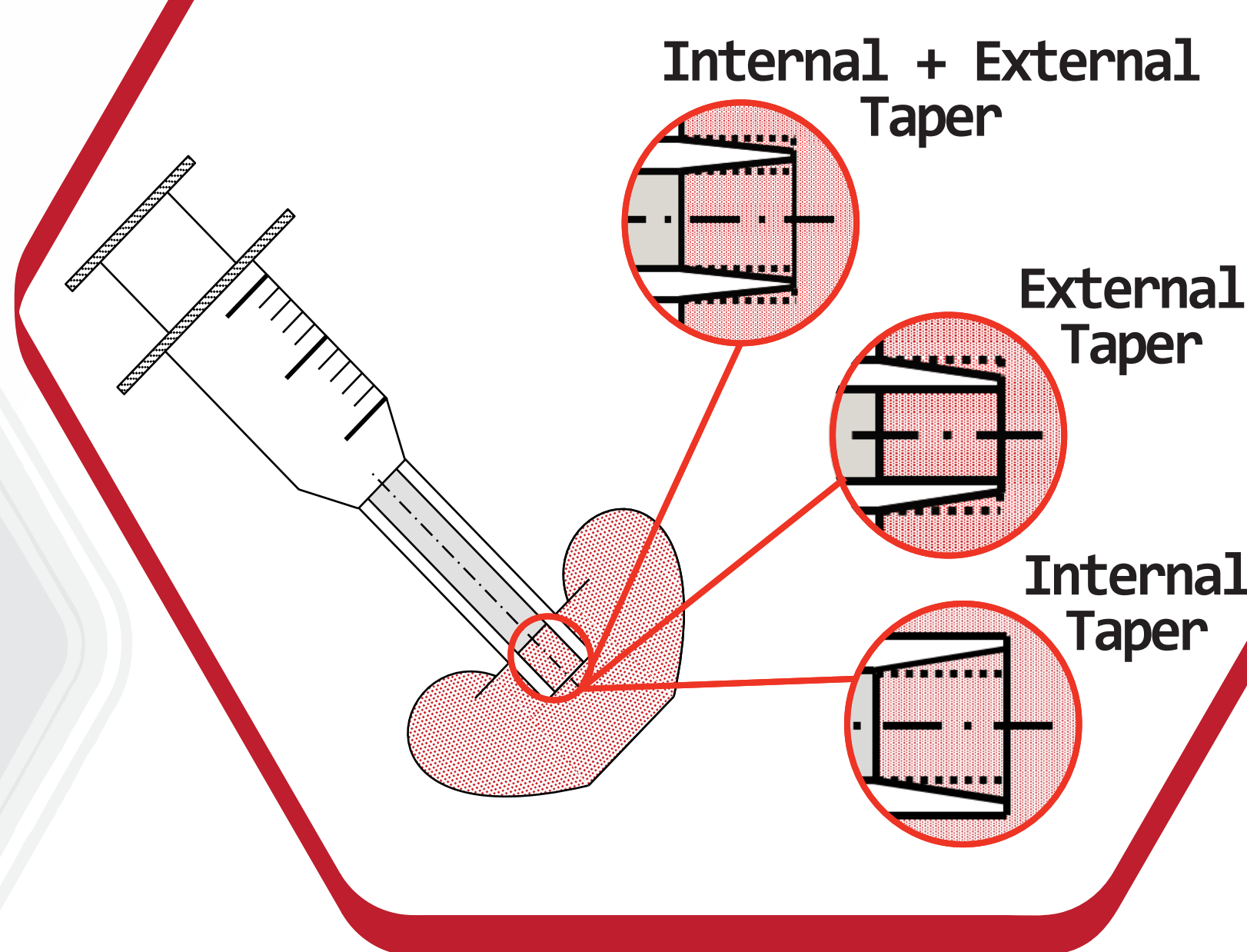
Adrian Piedra

Dr. Hitomi Yamaguchi Greenslet

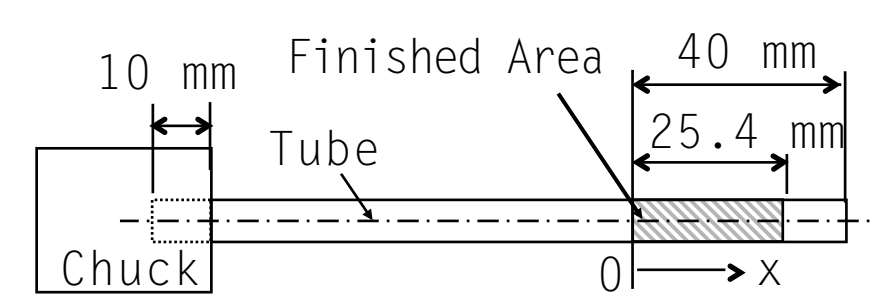
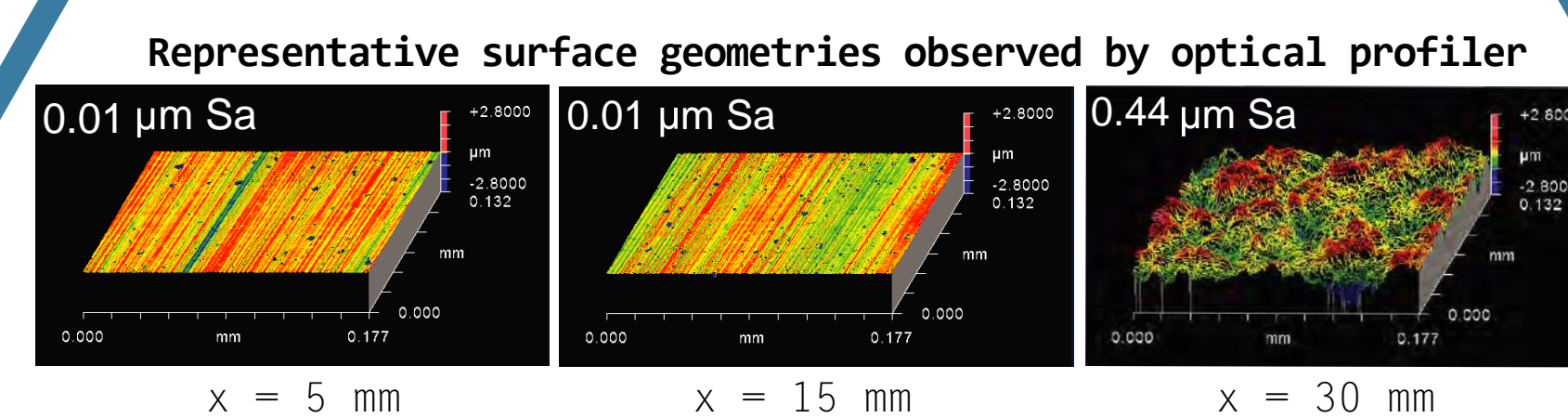
Dept. of Mechanical and Aerospace Engineering, University of Florida, Gainesville, FL

DESIGN

Needle Tapering Design

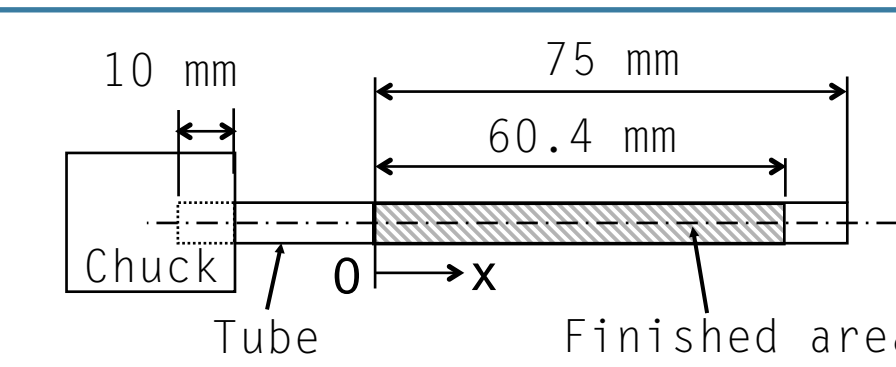
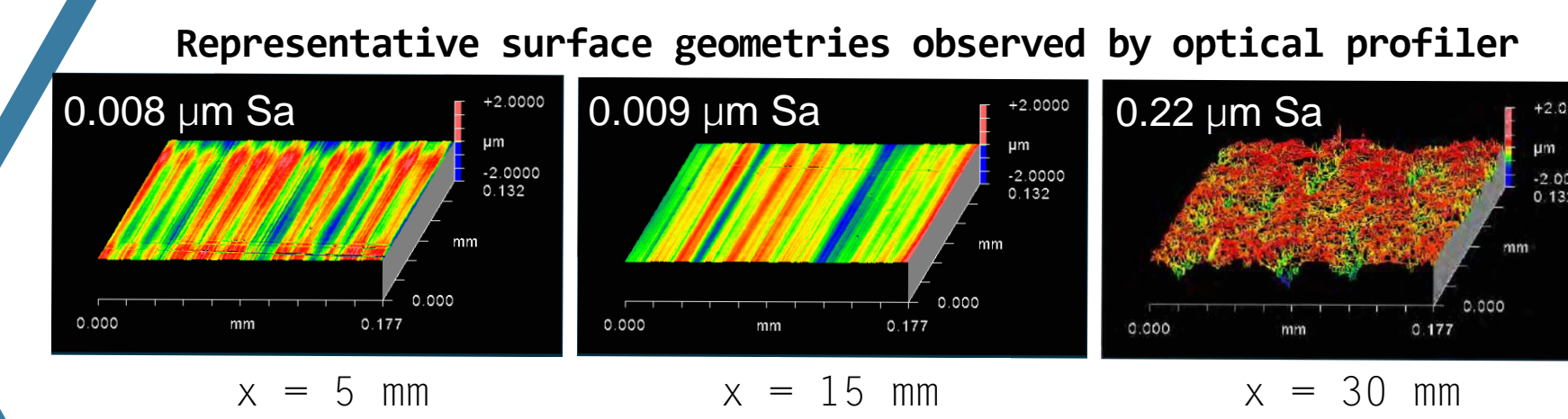


Internal Surface Finishing



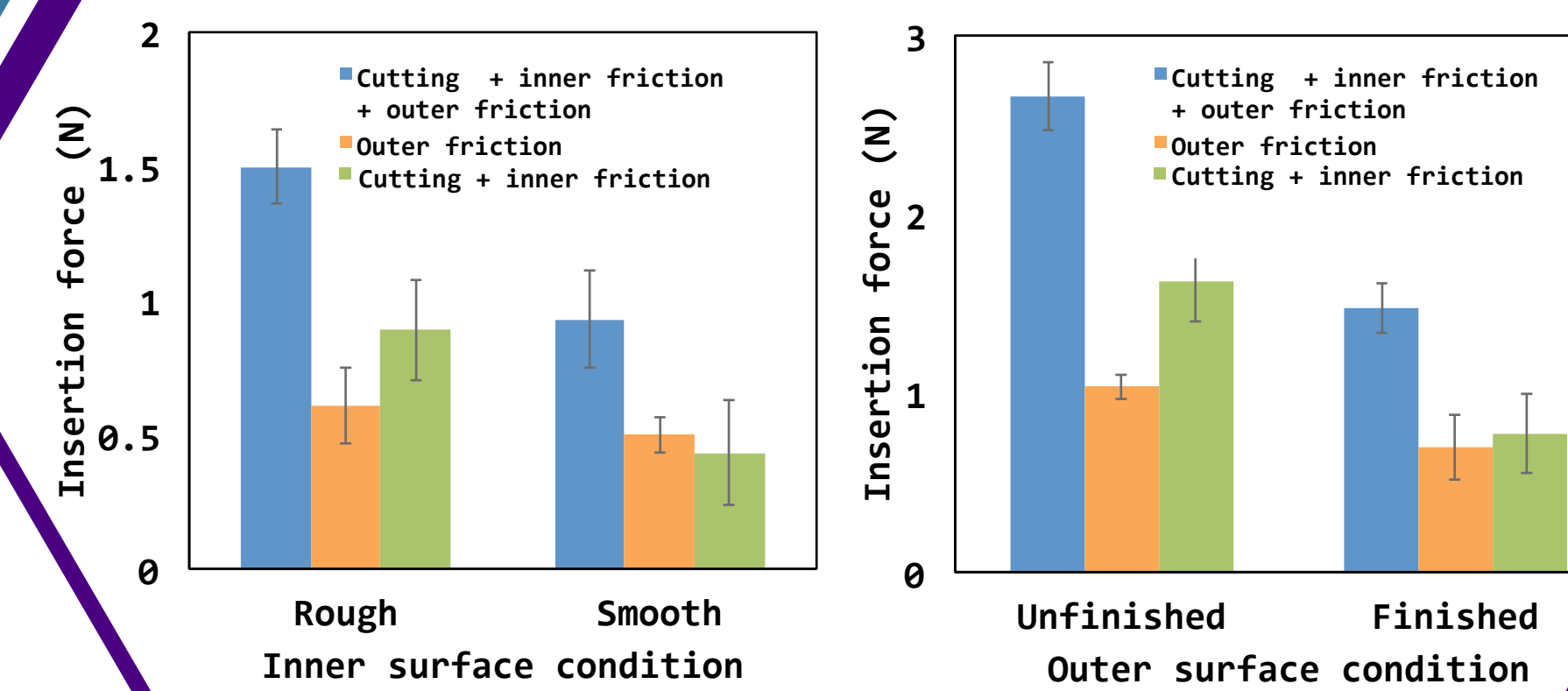
Magnetic particles:
Iron particles: 149-297 μm dia., 9.4 mg
Abrasive: Magnetic abrasive: 80 μm mean dia., 2.4 mg

External Surface Finishing

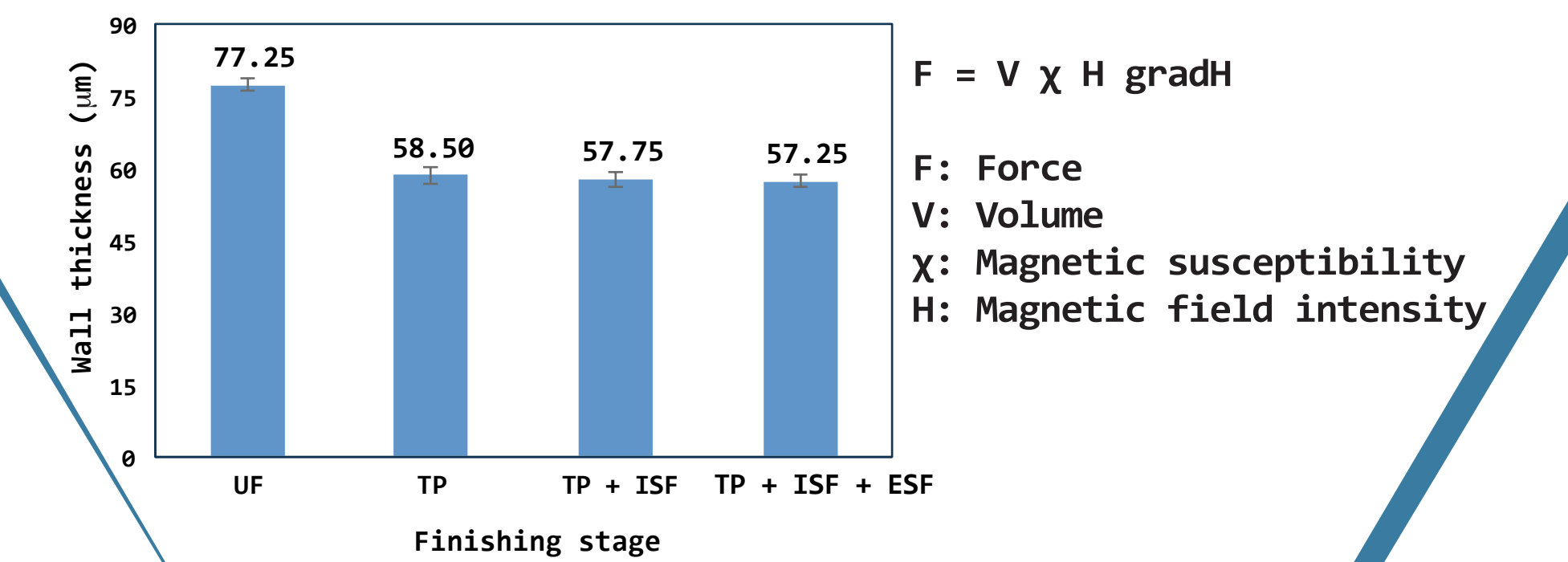
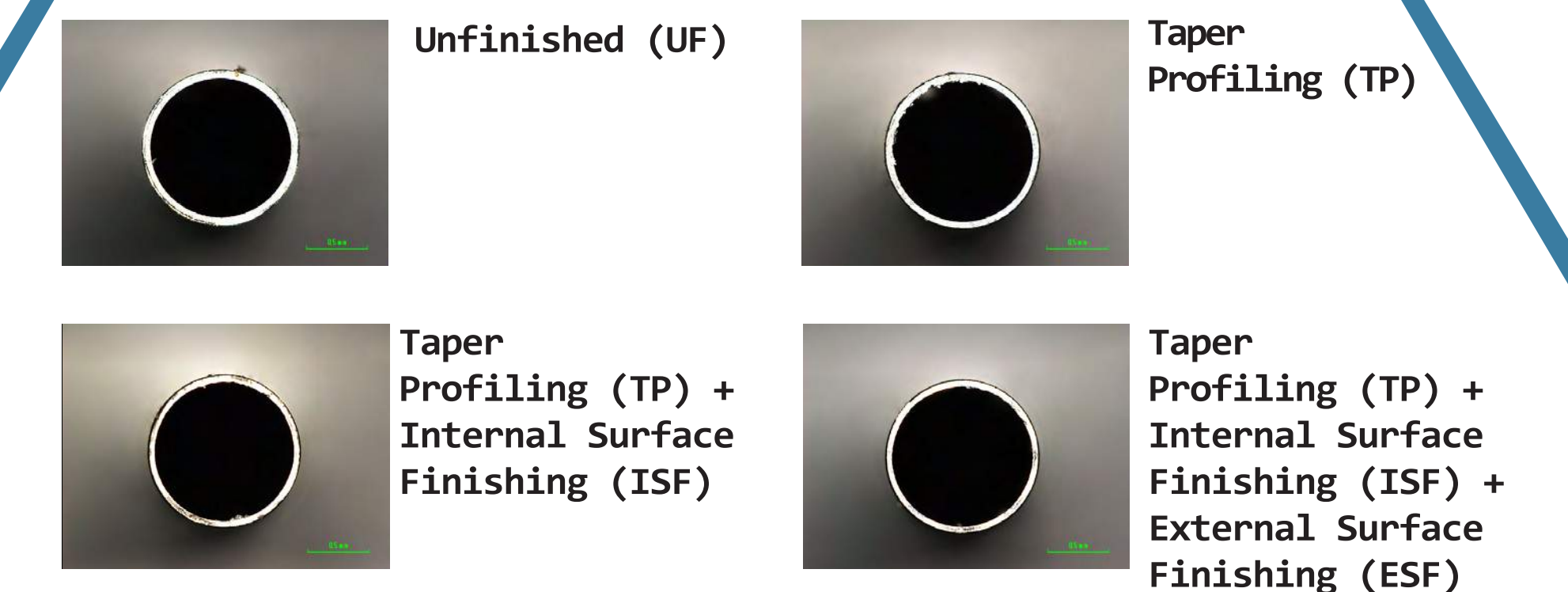


Abrasive:
Diamond paste: 4-8 μm dia., 2 mg
Reapplied with lubricant after every 2 min of finishing time

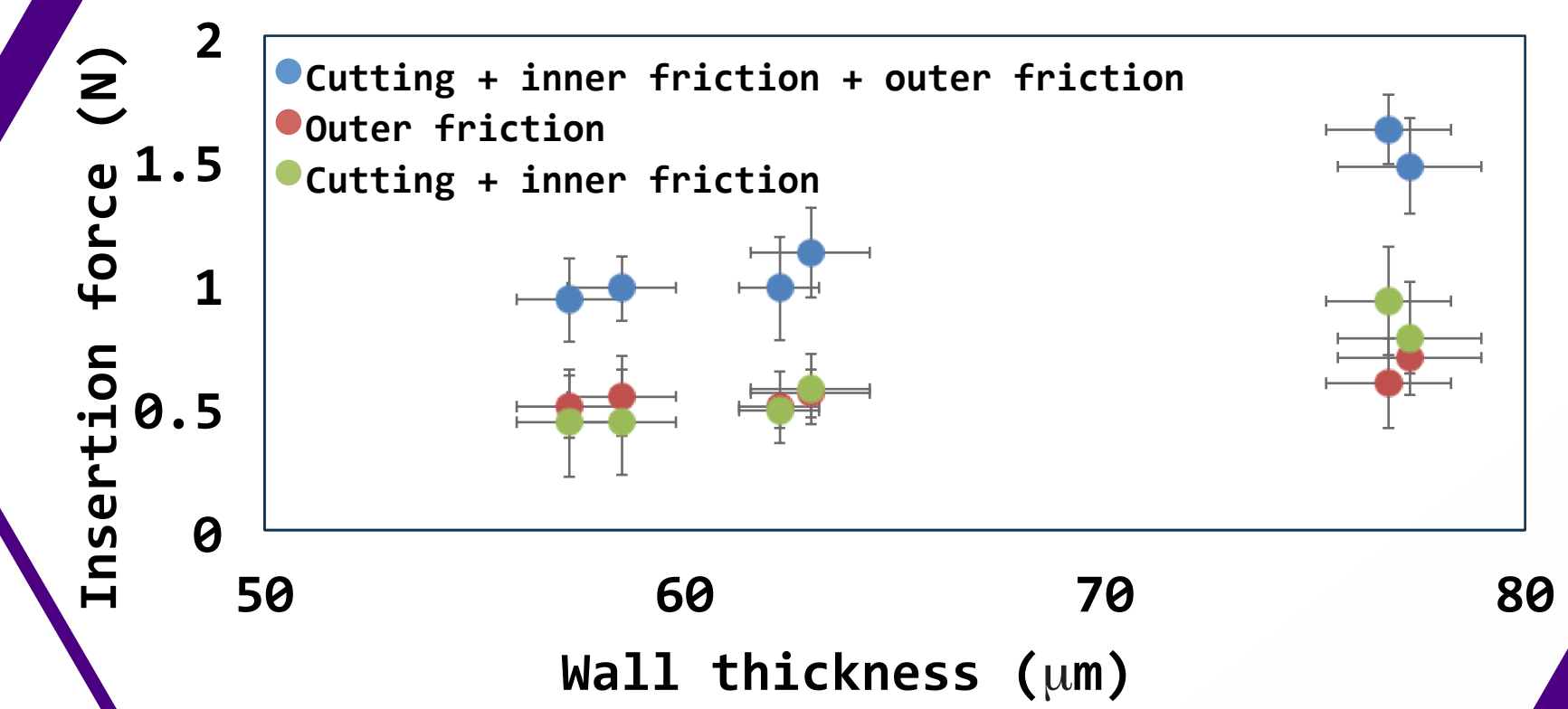
Surface Geometry Effects



Wall Thickness Removal

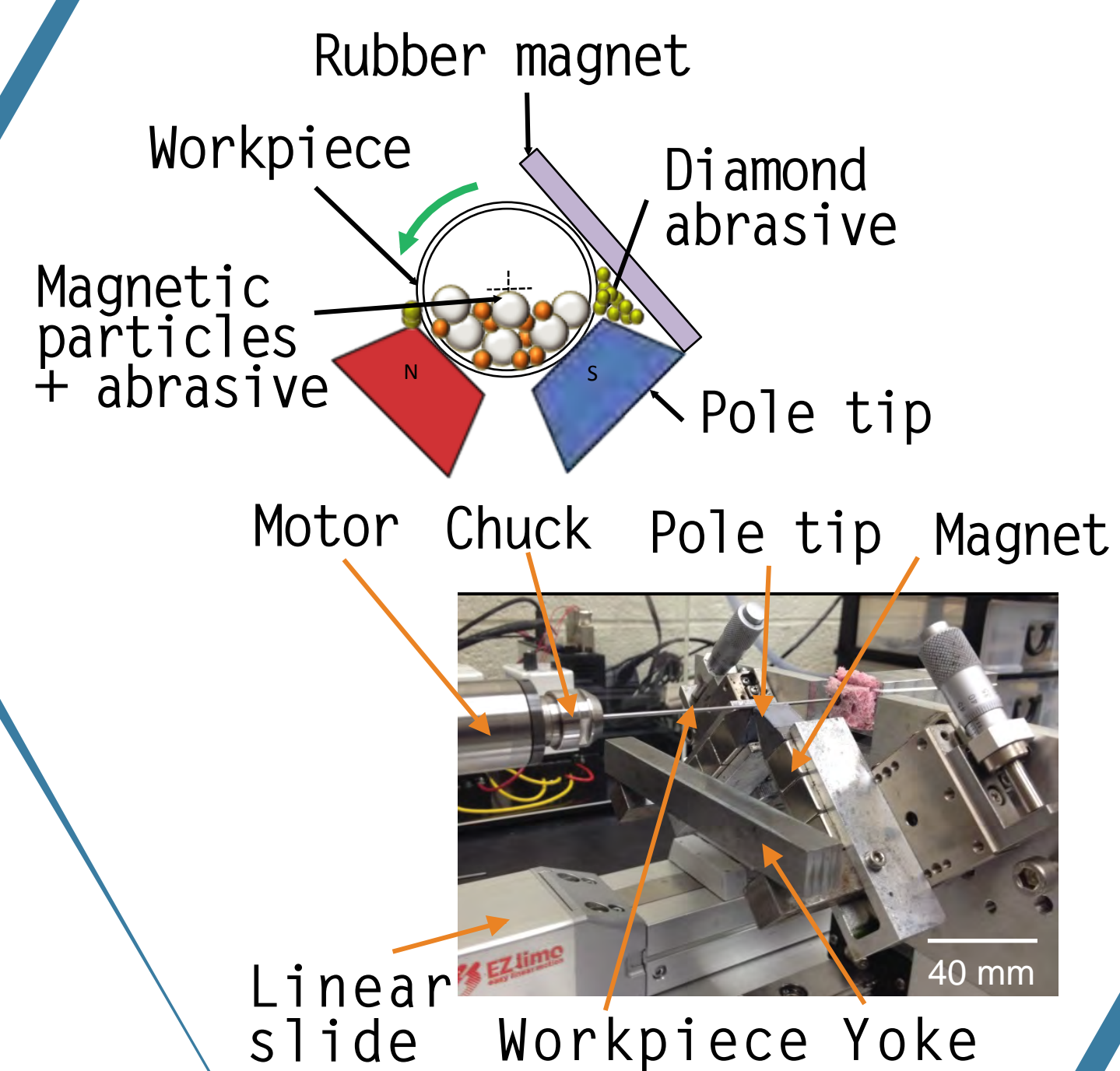


Edge Geometry Effects

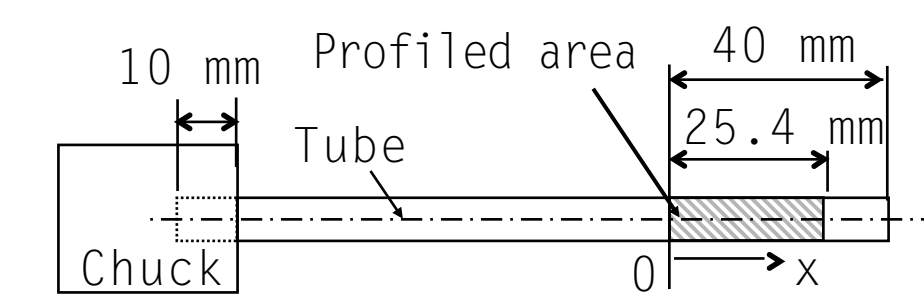
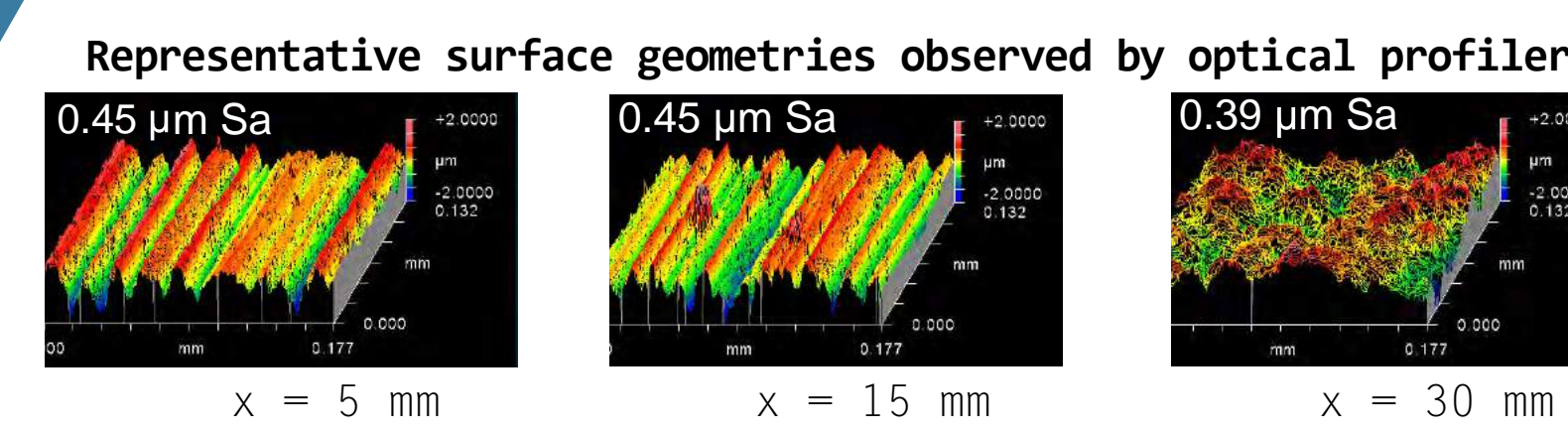


MANUFACTURE

Magnetic Abrasive Finishing



Taper Profiling



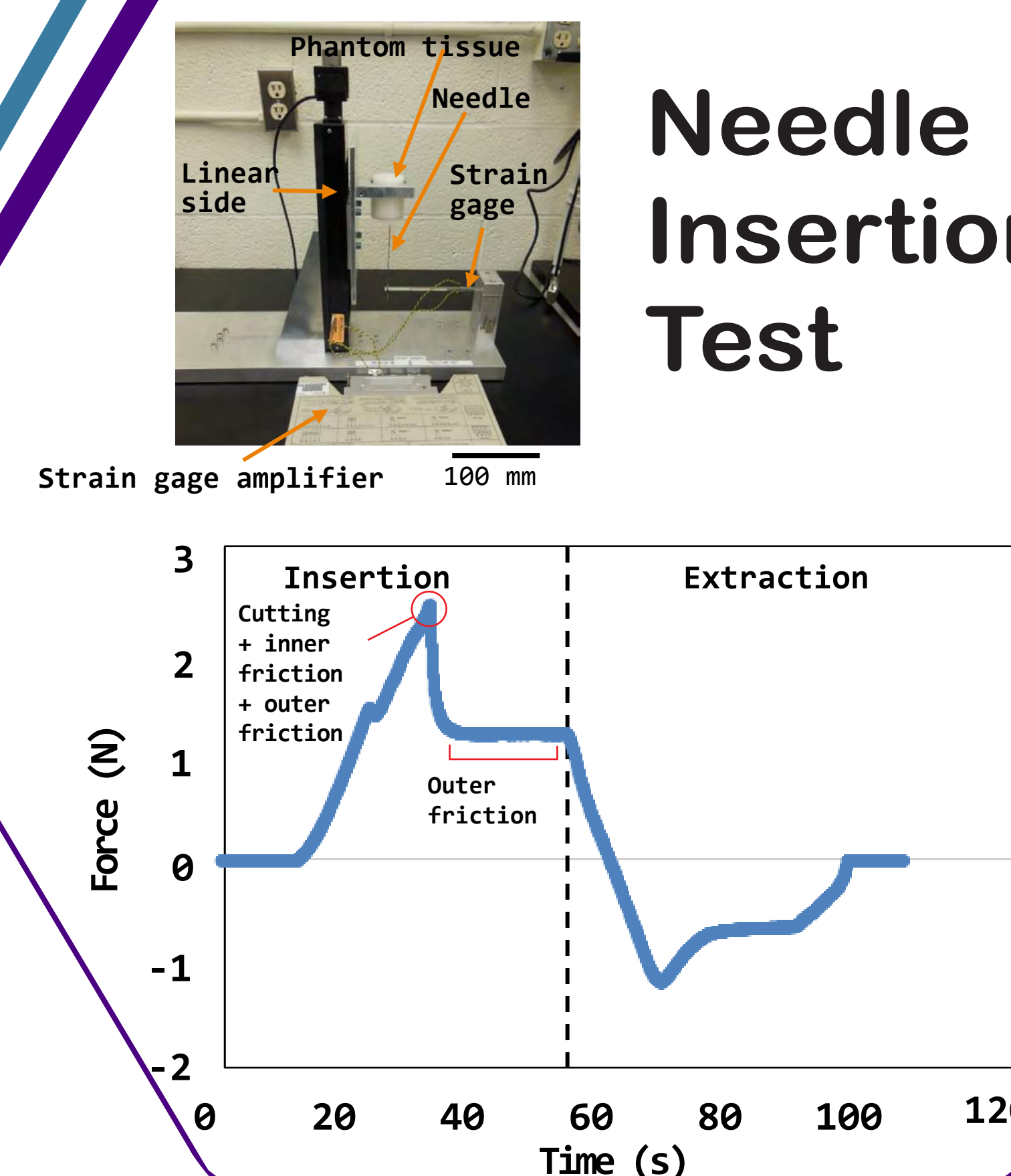
Magnetic particles:
Steel grit: 350 μm mean dia., 8.5 mg
Abrasive:
Magnetic abrasive: 80 μm mean dia., 2.1 mg
Diamond paste: 100-125 μm dia., 1.2 mg

Experimental Conditions

	Taper profiling	Internal surface finishing	External surface finishing
Workpiece revolution	30000 min ⁻¹	10000 min ⁻¹	
Workpiece	18 gauge 316 stainless steel tube (∅1.27x∅1.14x100 mm)		
Magnet feed (feed rate, length)	0.59 mm/s, 12.7 mm		2.22 mm/s, 47.7 mm
Finishing time	8 min	6 min	

TEST

Needle Insertion Test



Conclusion

Needles with a small wall thickness and smooth inner and outer surfaces generate smaller insertion forces than needles with larger wall thicknesses and rougher surfaces.

Acknowledgement

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