

Lawrence Livermore National Laboratory

Fiber Probe

PDV Workshop

October 23, 2012

This work performed under the auspices of the U.S.
Department of Energy by
Lawrence Livermore National Laboratory under Contract
DE-AC52-07NA27344
See page 5,6,14



Ralph Hodgin

Chadd May, Don Hansen



Objective

- Design a simple, easy to use PDV probe which can
 - Be used to measure small Kapton and Aluminum flyer velocities and their impact pressure in LiF
 - Require *No adjustments* – just plug it in and run the test



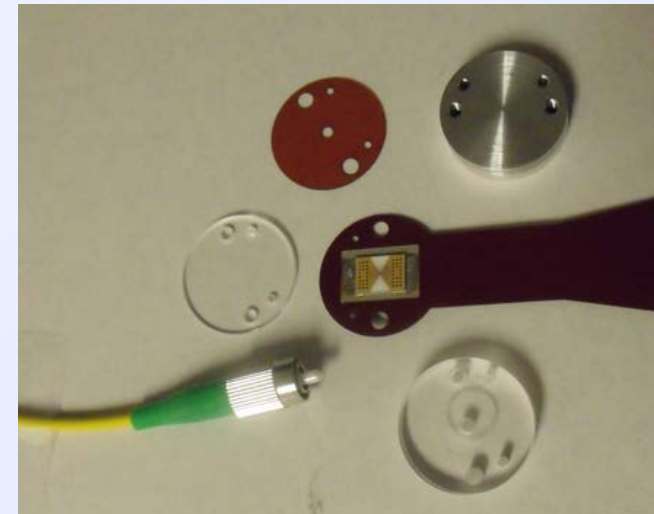
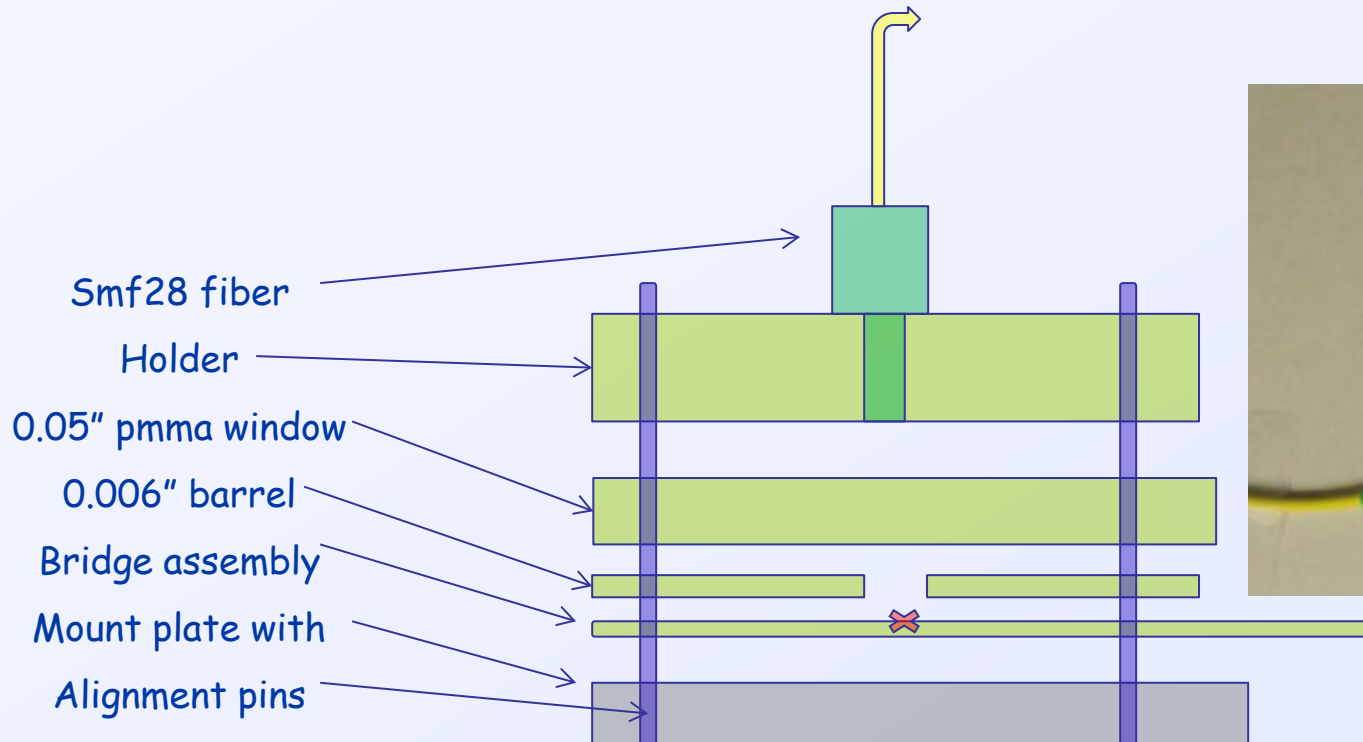
Off the shelf SMF28 fiber cable

- Would a standard patch cord fiber work?
 - It is cleaved for a -60 back-reflection
 - Cheap! No probe.



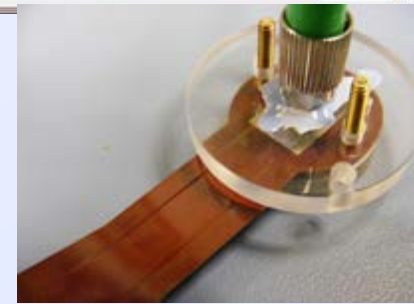
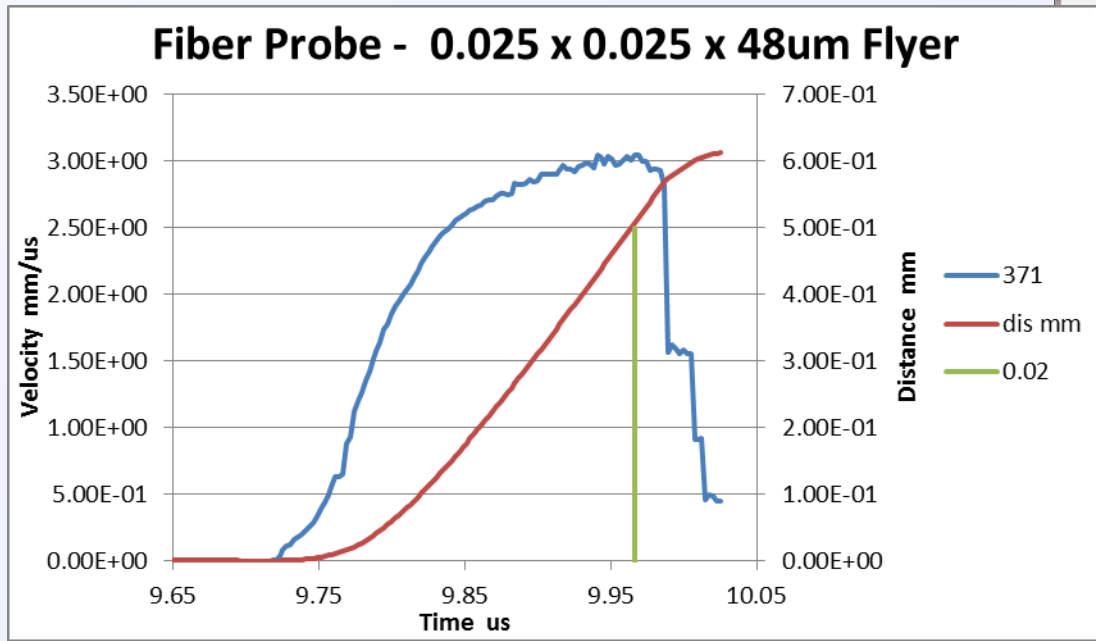
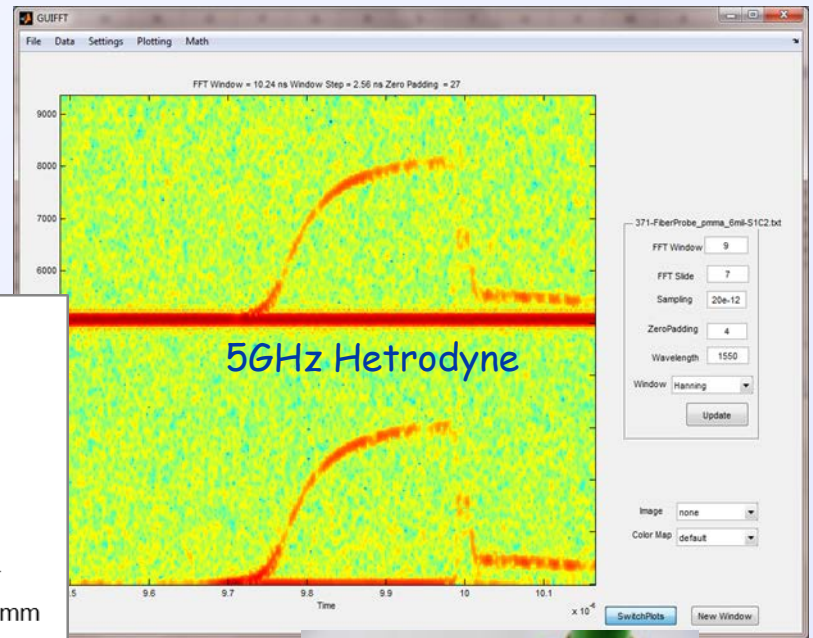
Fiber Probe Assembly

- Fiber probe is directly over the bridge in contact with the pmma window



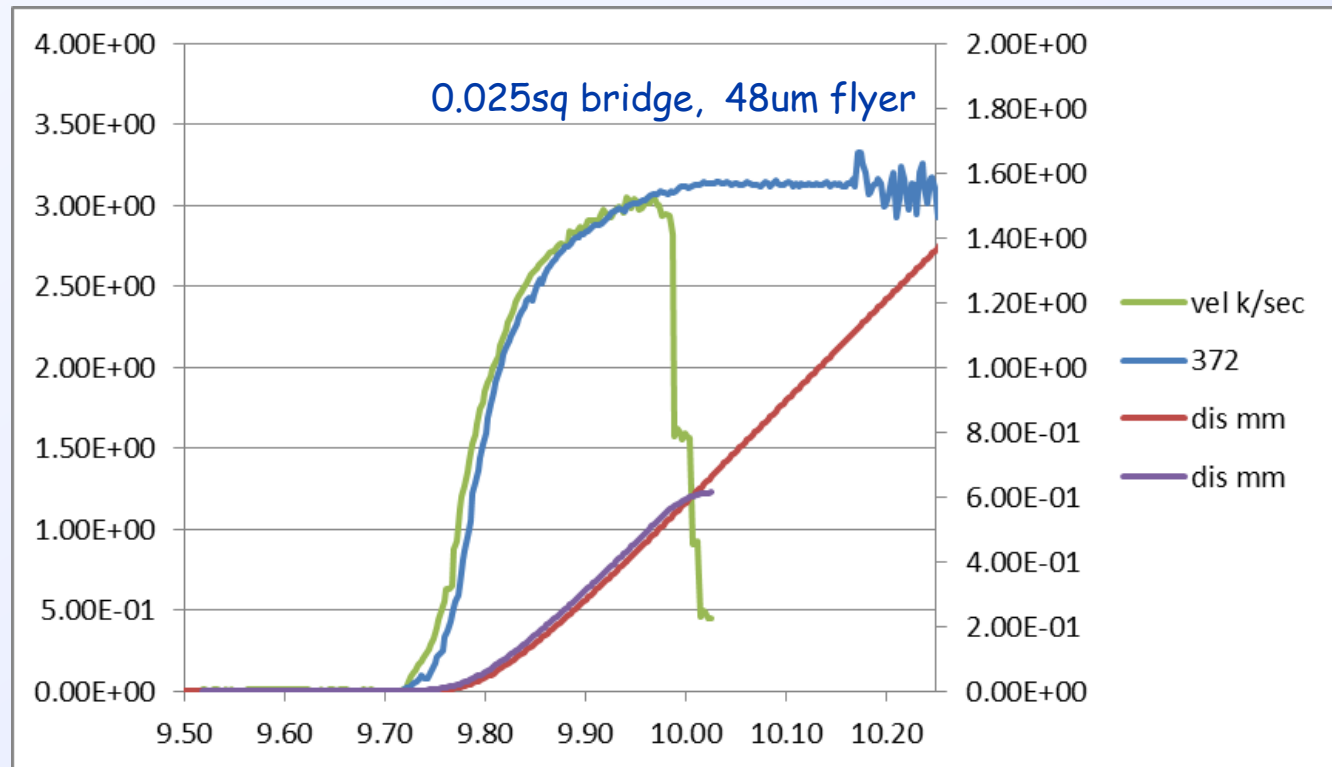
For a 0.025 mil diameter flyer, 2mils thick impacting PMMA, Fiber Probe gave excellent results

Good Results!



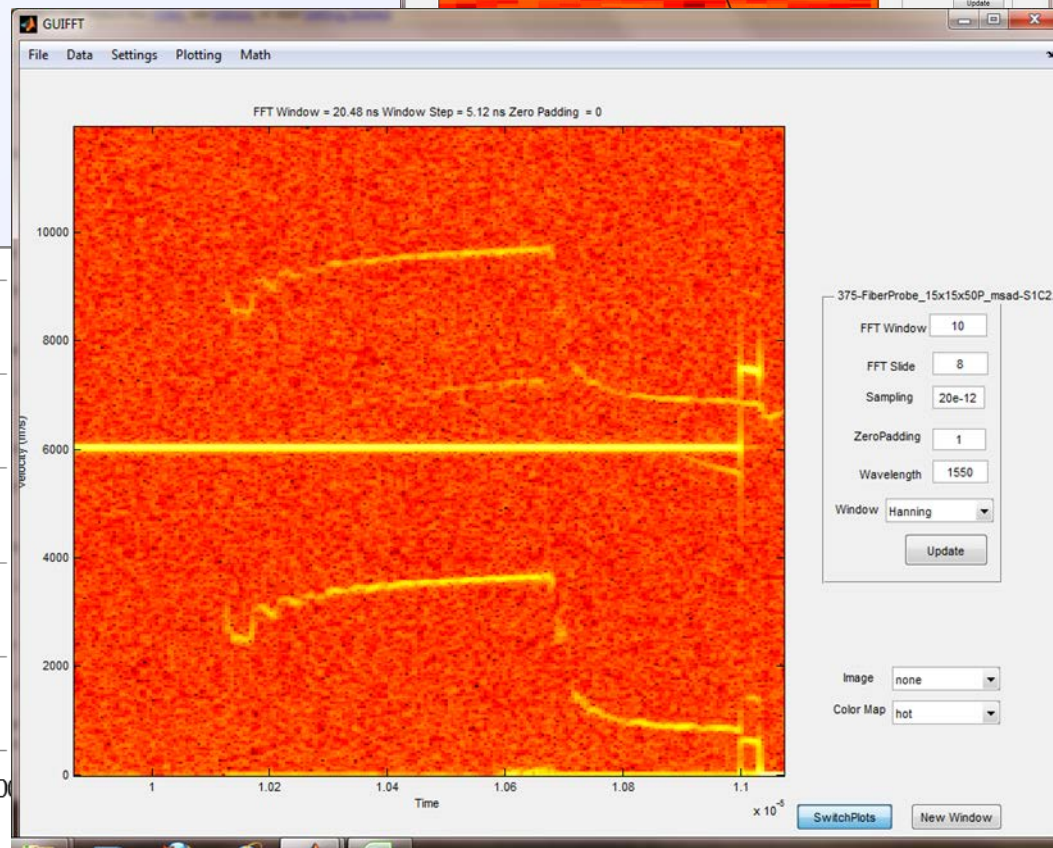
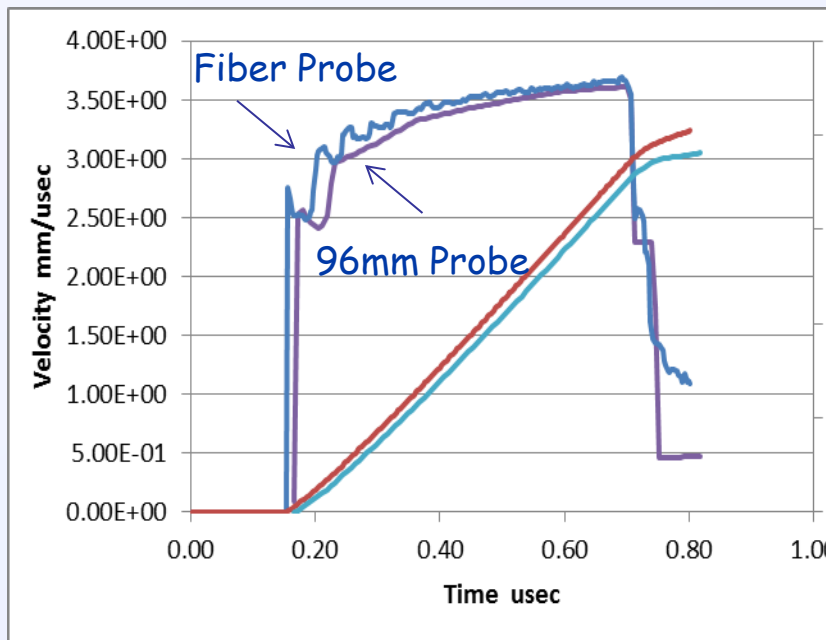
Fiber Compares well with data from a 10.5mm Probe

- Repeated the test with a 10.5mm probe, free flight



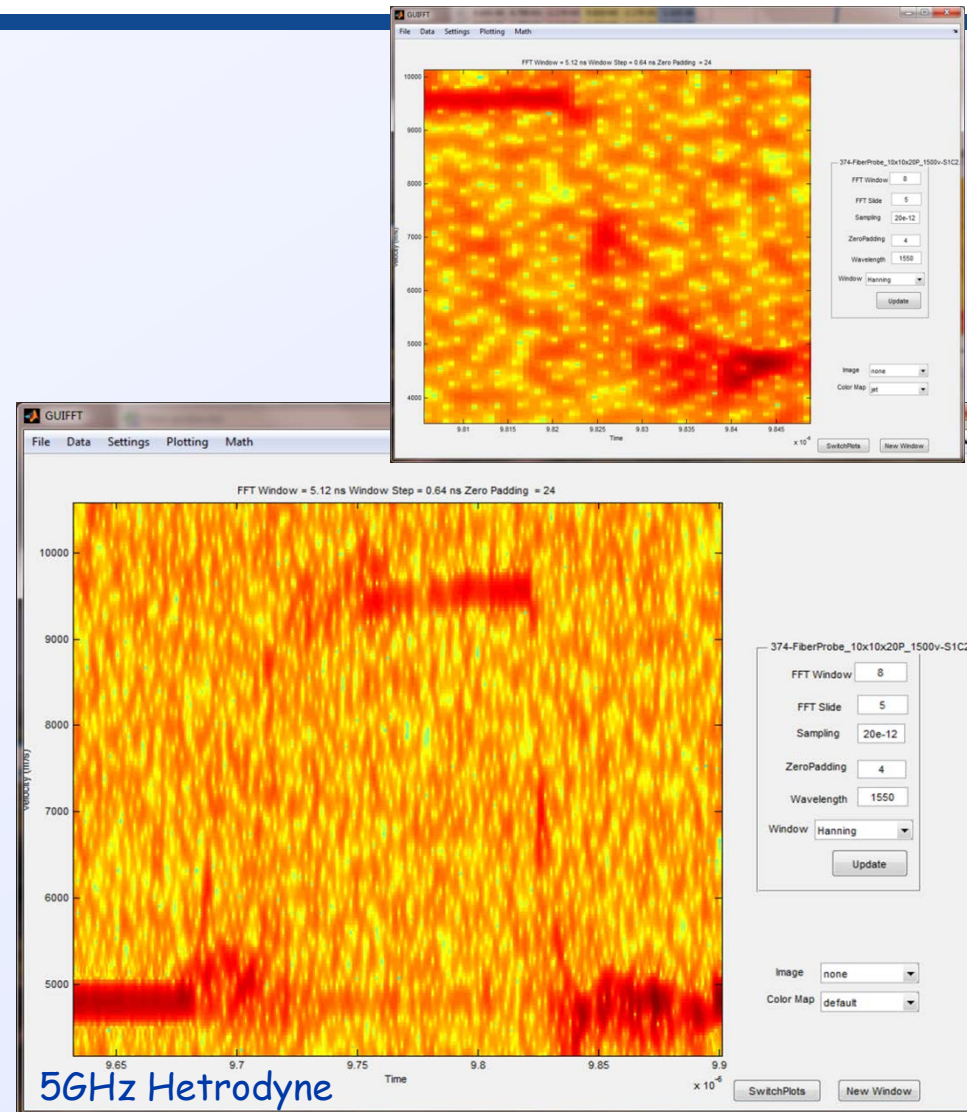
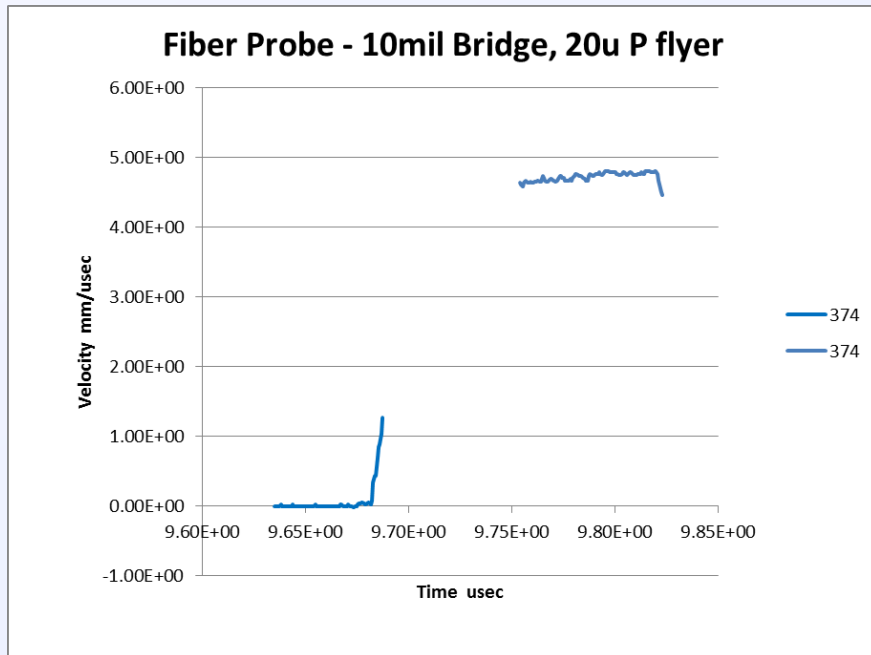
Explosive Driven Flyer

- Good Velocity & Impact Pressure
- Compares well with previous tests



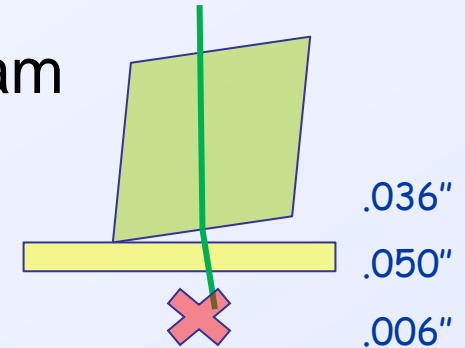
Smaller Flyer – 10 mil diameter, 20 μ m thick Parylene Flyer

- Good Impact Velocity
- Impact Pressure Pulse



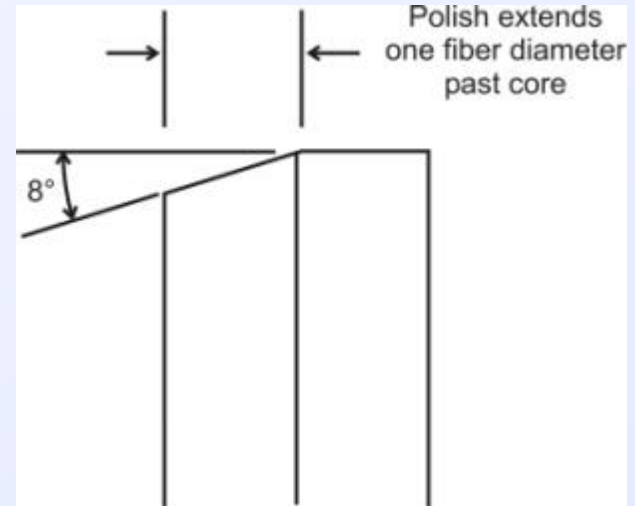
Beam Angle for APC polish fiber

- The 8 degree cleave causes the laser beam to exit at an angle
- The smaller flyer test only recorded the impact velocity as it came into the beam
- With an 8 degree cleave, the fiber is 0.036'' from the PMMA window.
- The distance from the fiber to the Target is 0.092'



AFC Polish

- Angled Flat Polish Connector
- Very small gap to the pmma window
- Fiber to target
 - 0.050'' window
 - 0.006'' barrel

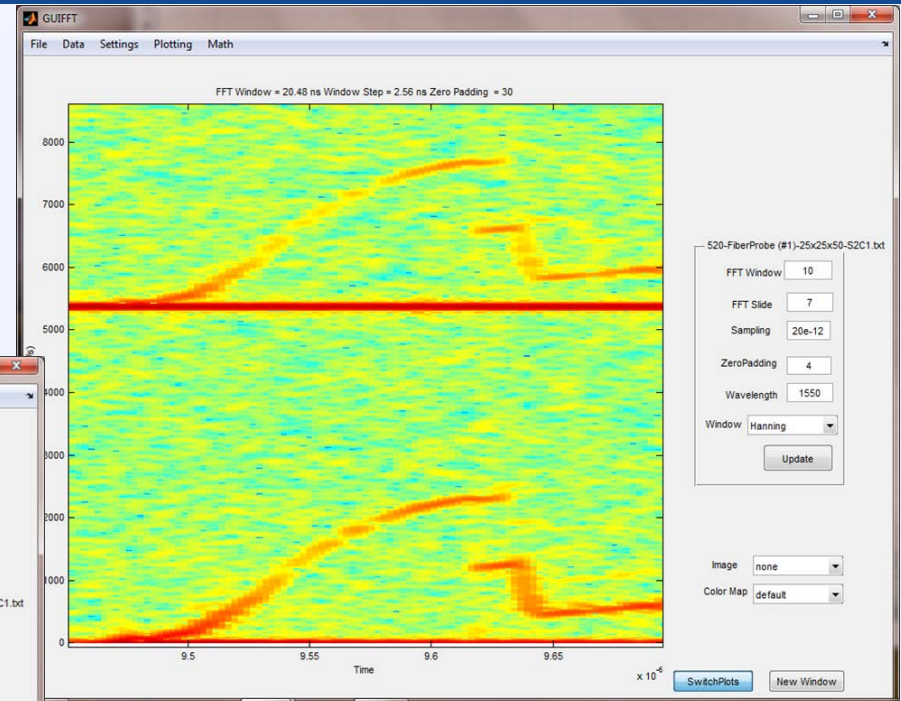
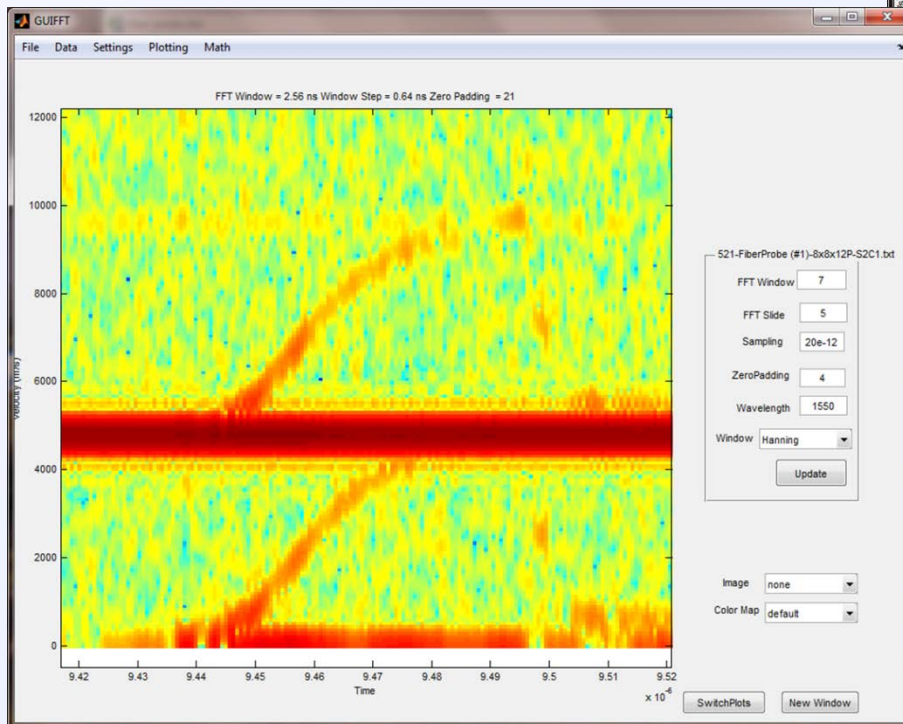


http://www.ozoptics.com/ALLNEW_PDF/APN0006.pdf

AFC Polish Results

- Resolved problems measuring the velocity of a smaller flyer

0.008x0.008"x 12um



0.025x0.025x50um

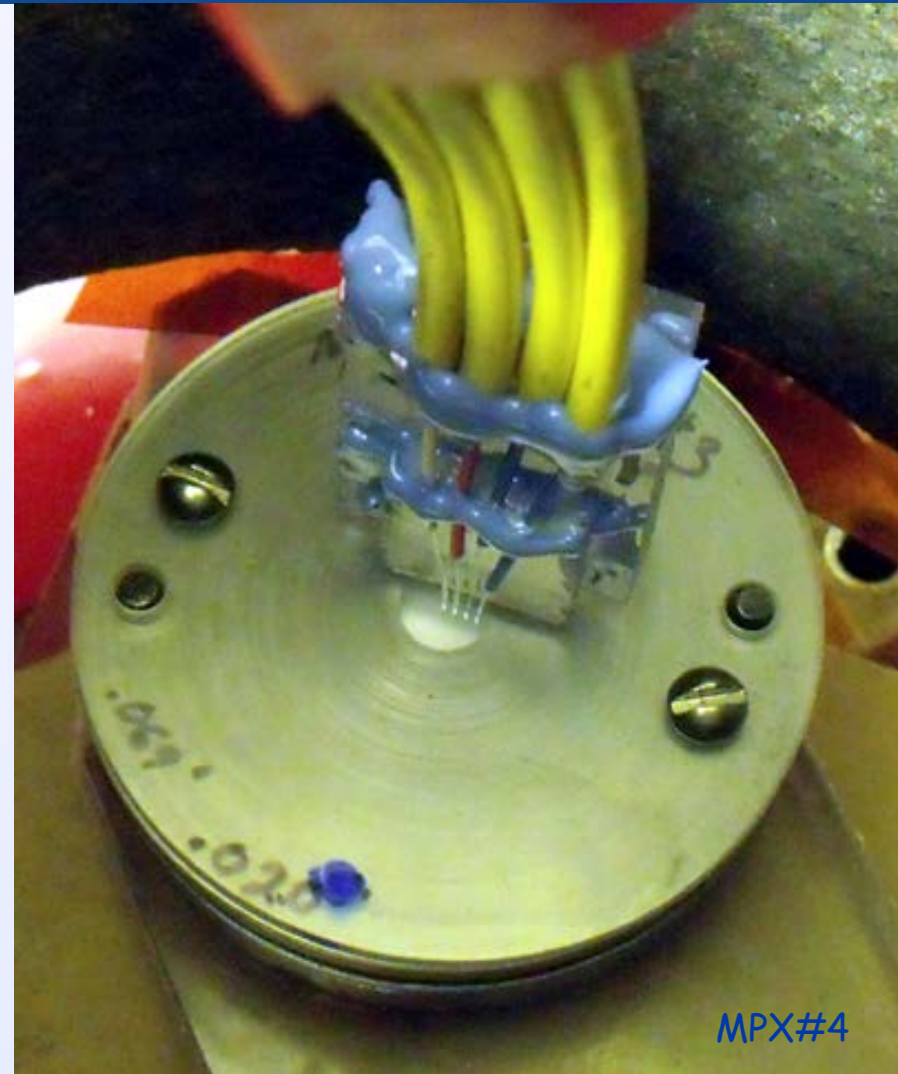
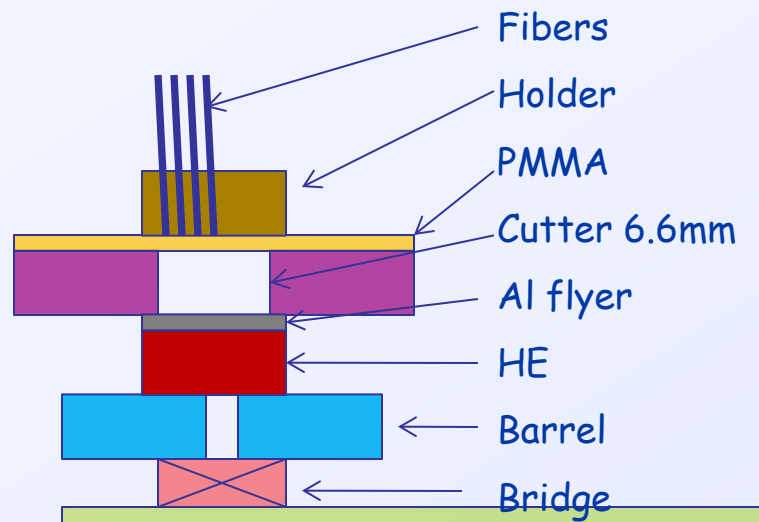
Conclusions

- An off-the-shelf APC fiber can work as PDV probe
 - With proper hardware -- No alignment needed
- AFC polish fibers place the Fiber Probe closer to the target
- The beam angle affects the point of measurement



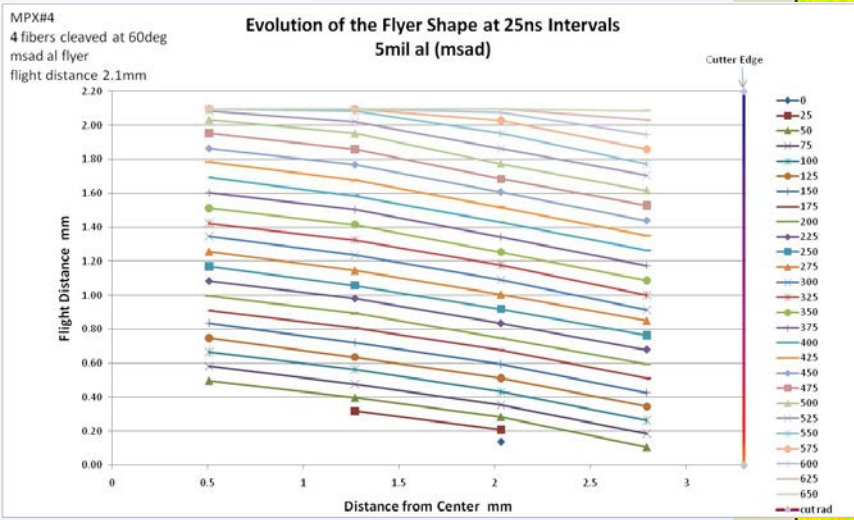
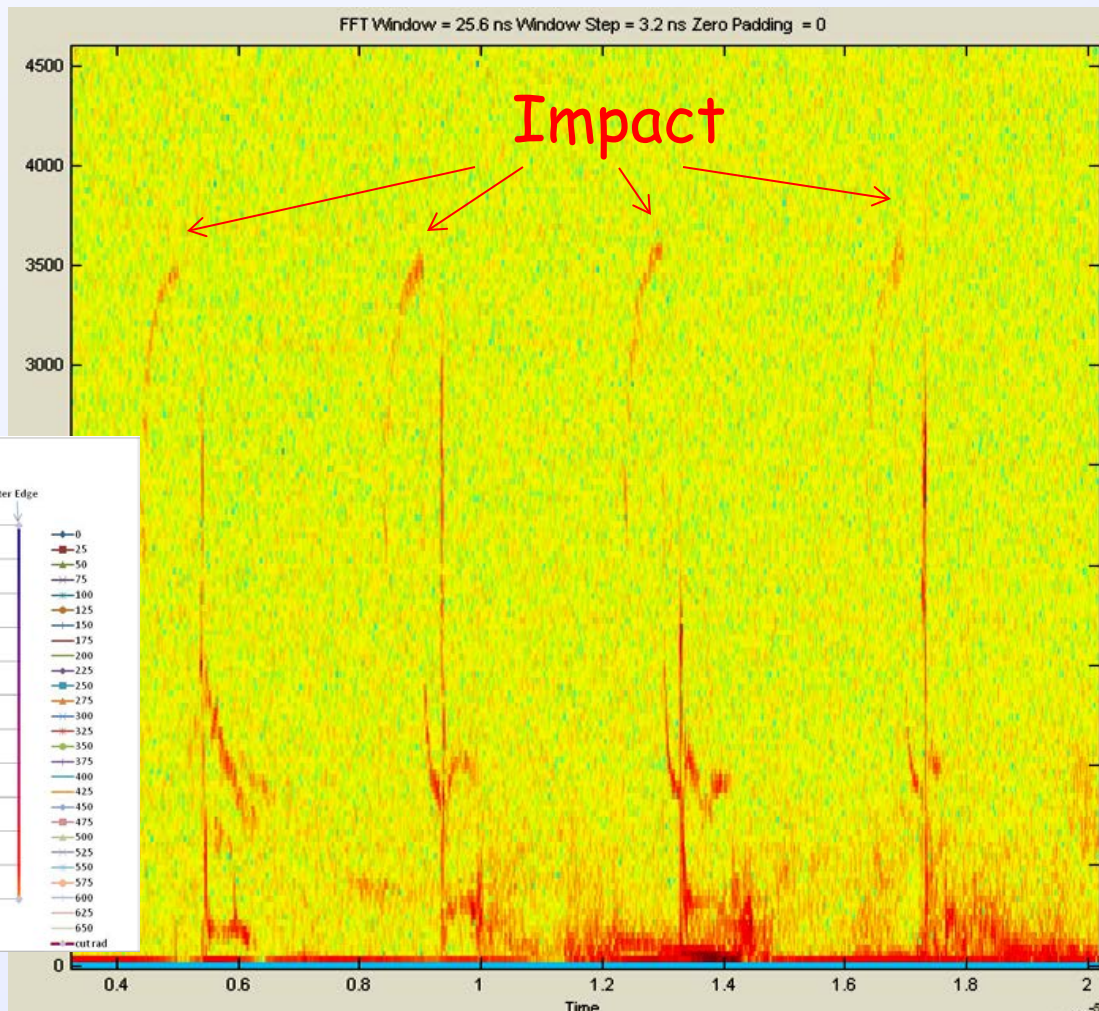
Bare Fibers have been used to measure Velocity

- 4 single mode fibers
- Fibers inserted flush with back of pmma holder
- Spaced at 762um (.030")
 - .5, 1.3, 2, 2.8mm from Center



4 Bare Measuring the Velocity of a Al Flyer

1. Fibers cleaved at 8deg. For -60db backreflectance (BRF)
2. 4usec delay between each fiber
3. Lateral Fiber Spacing: 762um
4. Target = Al MSAD flyer
5. 2.1mm flight distance



Evolution of the Flyer Shape

MPX#4



Bare fiber

- Bare fibers work well for recording velocity
- But they are not easy to work with
 - Small
 - Fragile
 - Have to be Cleaved

