

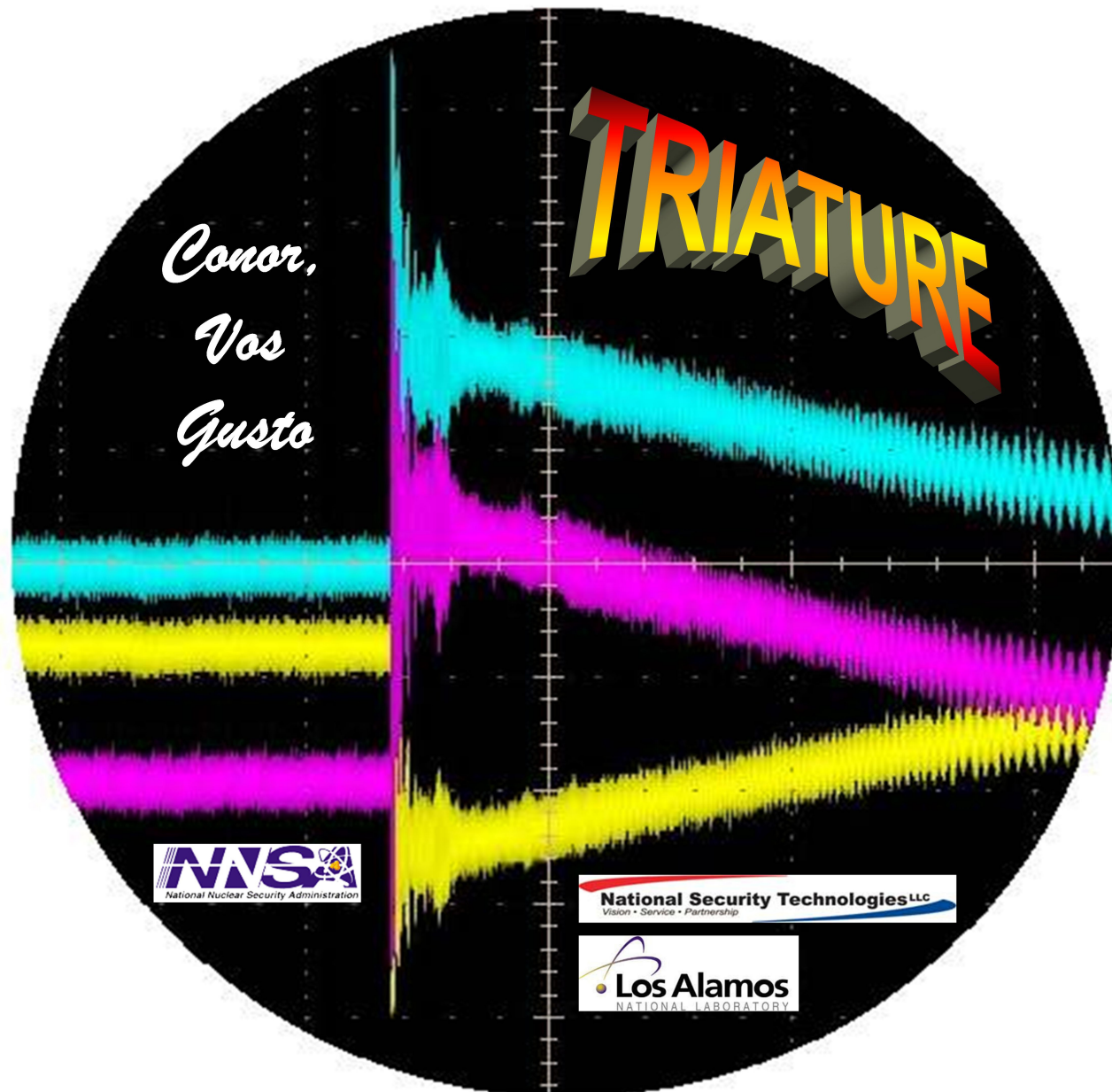
Triature Doppler Velocimeter (TDV)

NSTec

Cenobio Gallegos, Matthew Teel, Vince Romero, Adam Iverson, Araceli Rutkowski, Abel Diaz, Tom Tunnell, Bart Briggs, Mike Berninger, Fred Sanders, Brent Frogget, Doug Devore, Brian Cata

LANL

David Holtkamp, Brian Jensen



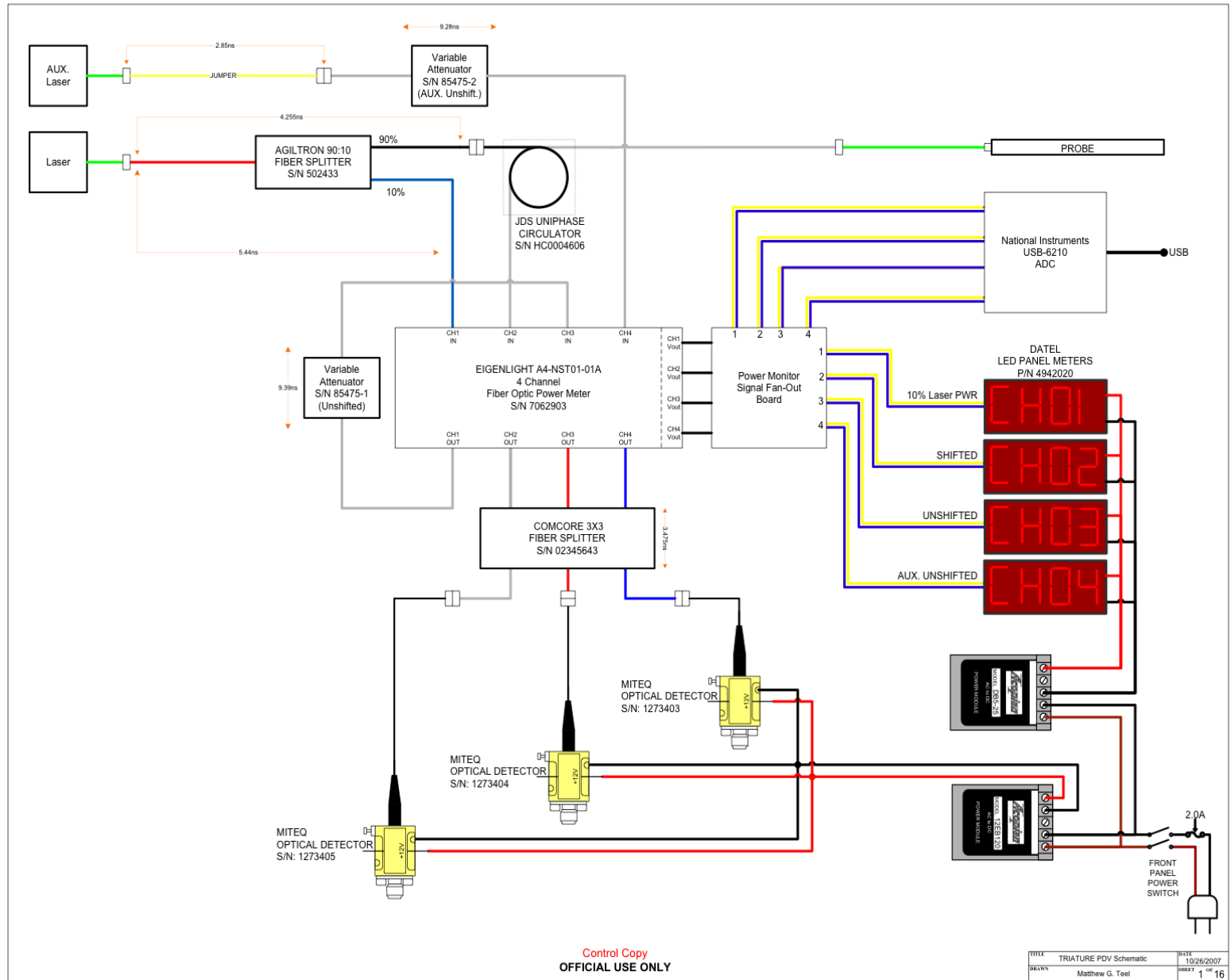
OBJECTIVE

- **SET UP A REPEATABLE FAST SHOCK SOURCE.**
- **COMPARE DIFFERENT PROBE RESPONSE.**
- **TAKE DATA WITH MULTIPLE PDV/TDV SYSTEMS.**
- **DEVELOP SOFTWARE TO PERFORM FFT ON MULTIPLE PDV/ TDV SYSTEMS (QUICK LOOK IN THE FIELD).**
- **COMPARE RESULTS OF PDV/ TDV DATA.**
- **COMPARE VISAR VS. PDV/TDV.**
- **RETRIEVE DATA FROM NEW SLAPPER.**

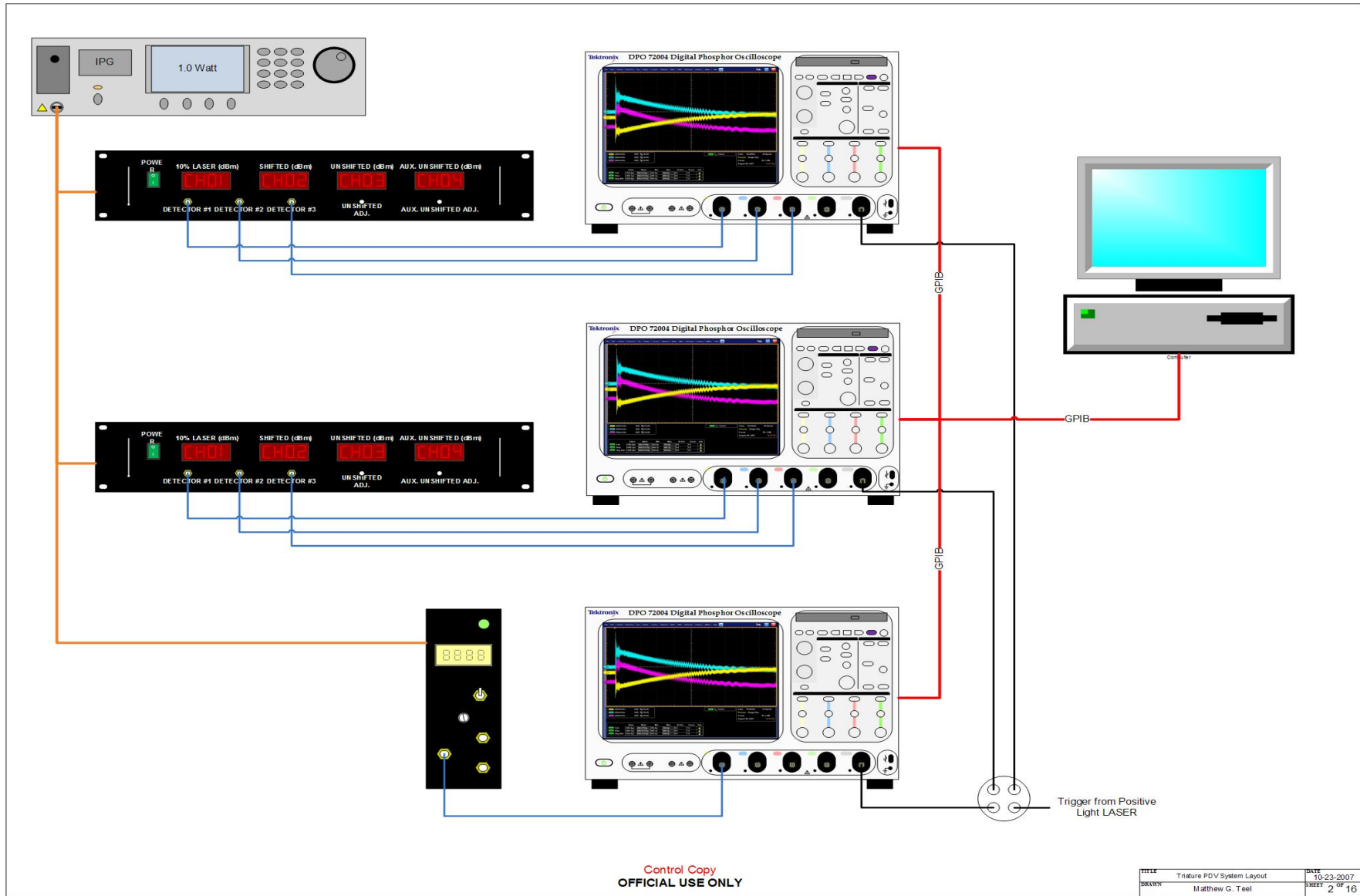
TDV

- **TDV IS A PHOTON DOPPLER VELOCIMETER (PDV) WITH THREE IDENTICAL OUTPUTS THAT ARE SEPARATED IN PHASE BY 120°.**
- **THE PHASE SHIFT IS ACCOMPLISHED BY USING A 3 X 3 SINGLE MODE SPLITTER. THE FUSING PROCESS IN THE CONSTRUCTION OF THE 3 X 3 SPLITTER HAS THE INHERENT PROPERTY OF THE OUTPUT FIBER SIGNALS TO BE 120° OUT OF PHASE FROM EACH OTHER.**
- **BY APPLYING THE QUADRATURE CONCEPT, IMPROVED TEMPORAL RESOLUTION IS OBTAINED WHERE A SINGLE PDV CHANNEL SUFFERS, DUE TO THE INHERENT LIMITATIONS OF THE FAST FOURIER TRANSFORM (FFT) ANALYSIS.**

Triature System Diagram



TDV / PDV LAYOUT



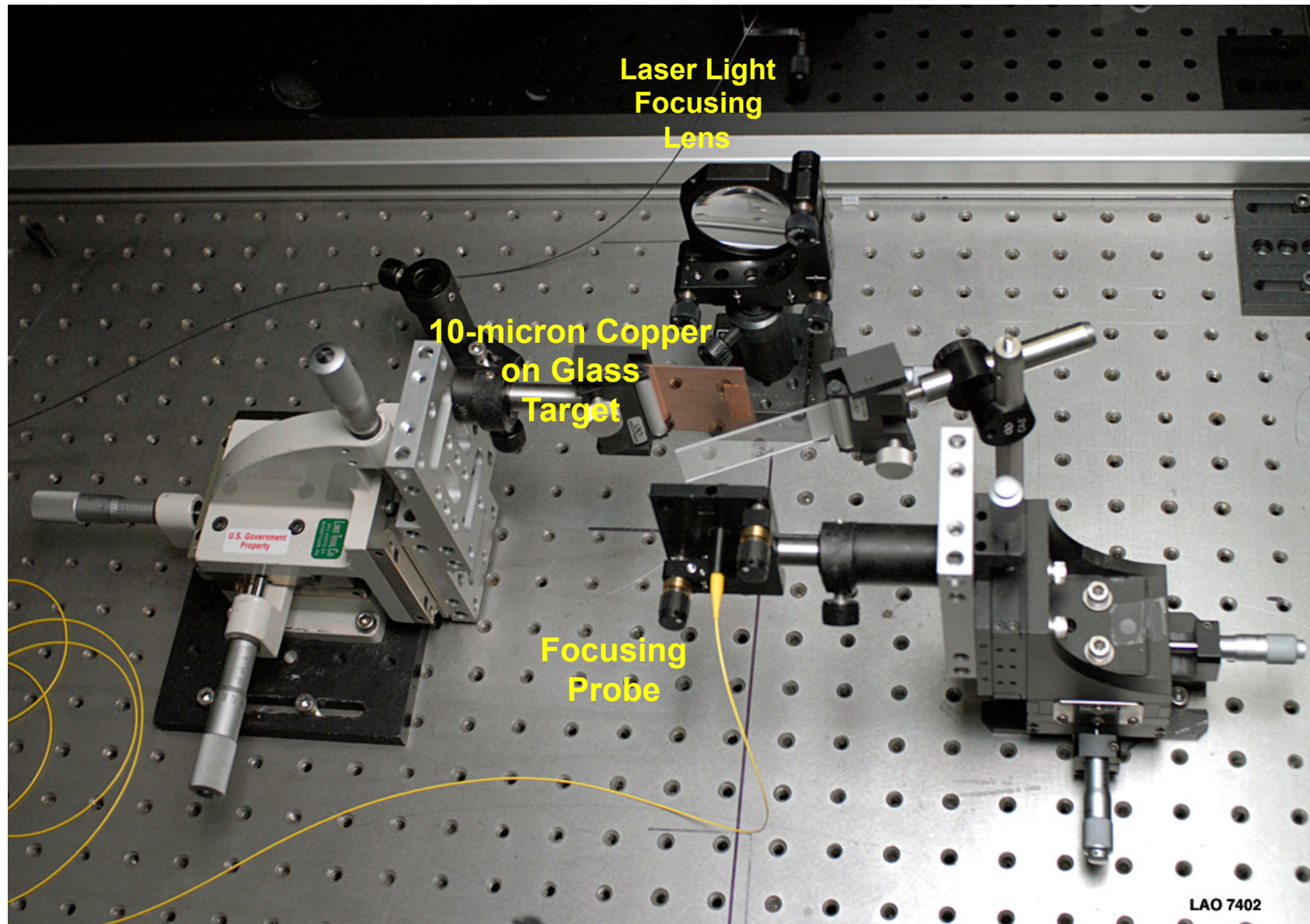
Laser-induced Shock

- **A 60-mJ Positive Light laser with 200-ps rise time and 300-ps FWHM pulse at 532 nm.**
- **Target: 10-micron-thick Copper or Aluminum layered on a 49X49X1mm glass plate.**
- **Probe: Bare fiber probe, Light Path Collimated probe, Oz Optics Focused probe, and new Brent Frogget designed TDV/Visar probe.**
- **PDV/TDV light source: IPG 1550-nm, 2-W laser.**

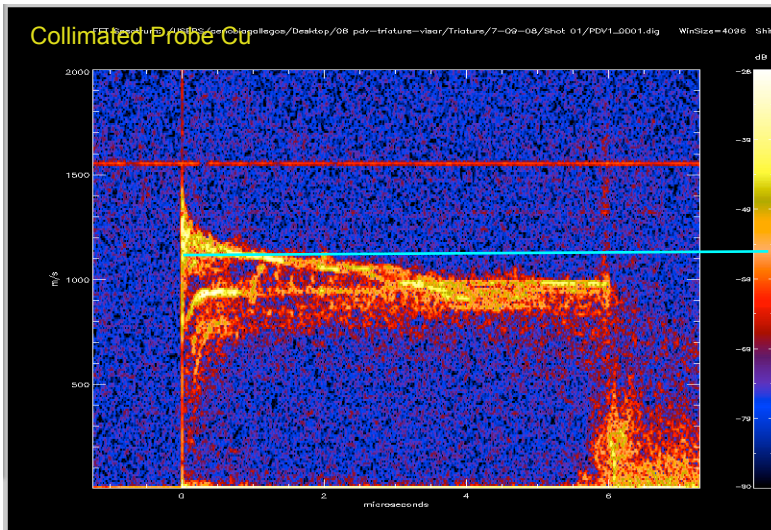
Positive Light Laser

Pulse: 200-ps rise time and 300-ps FWHM 60mJ at 532 nm

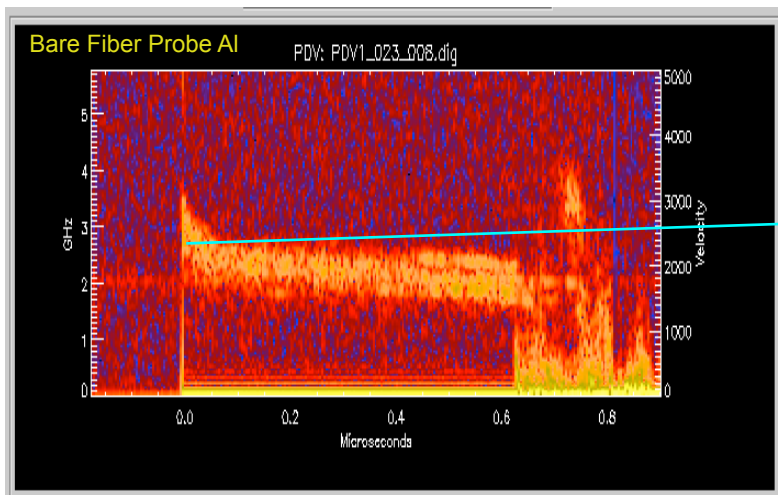
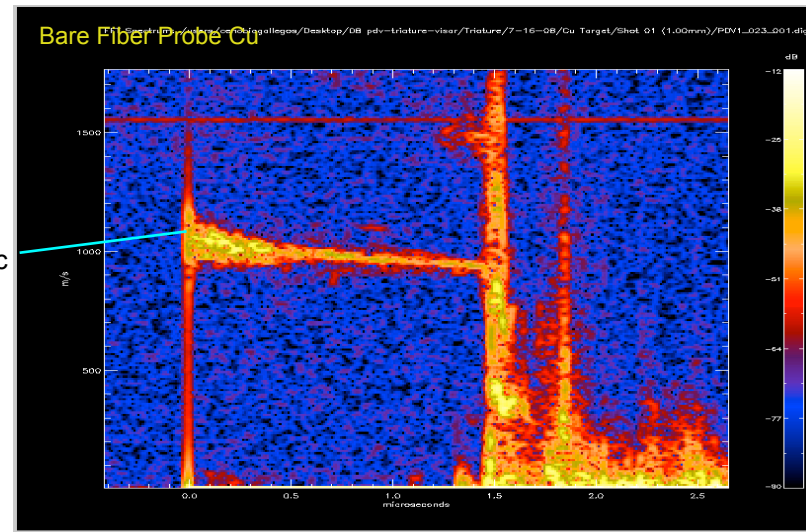




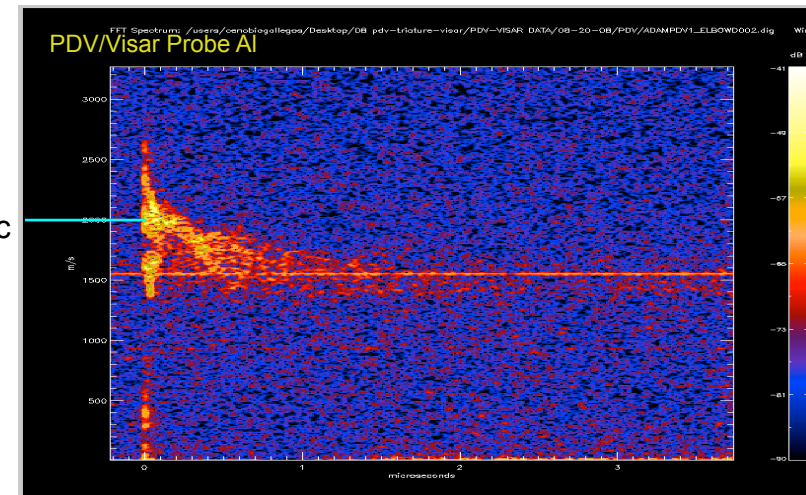
PDV DATA



1.1KM/sec



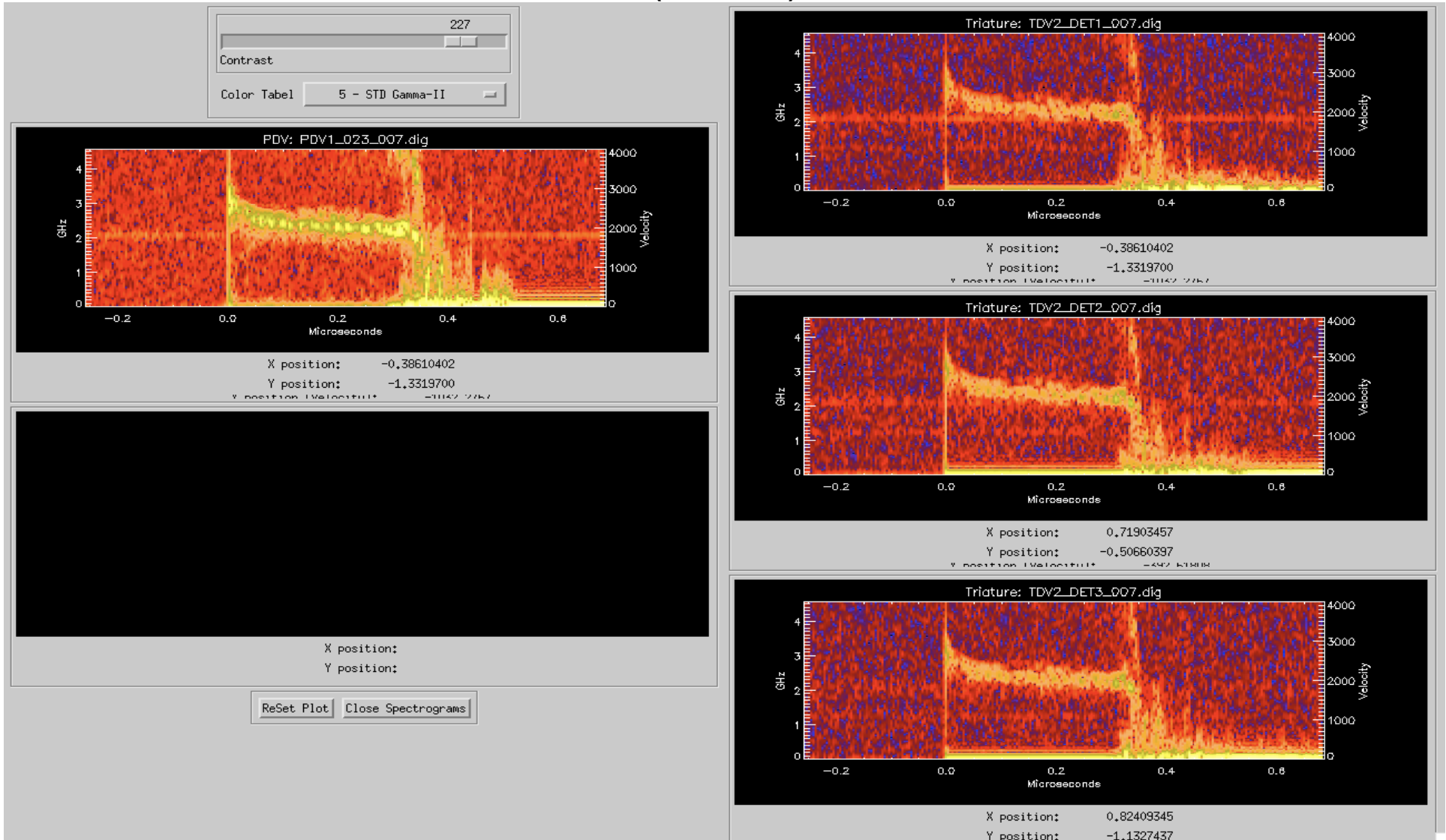
2KM/sec



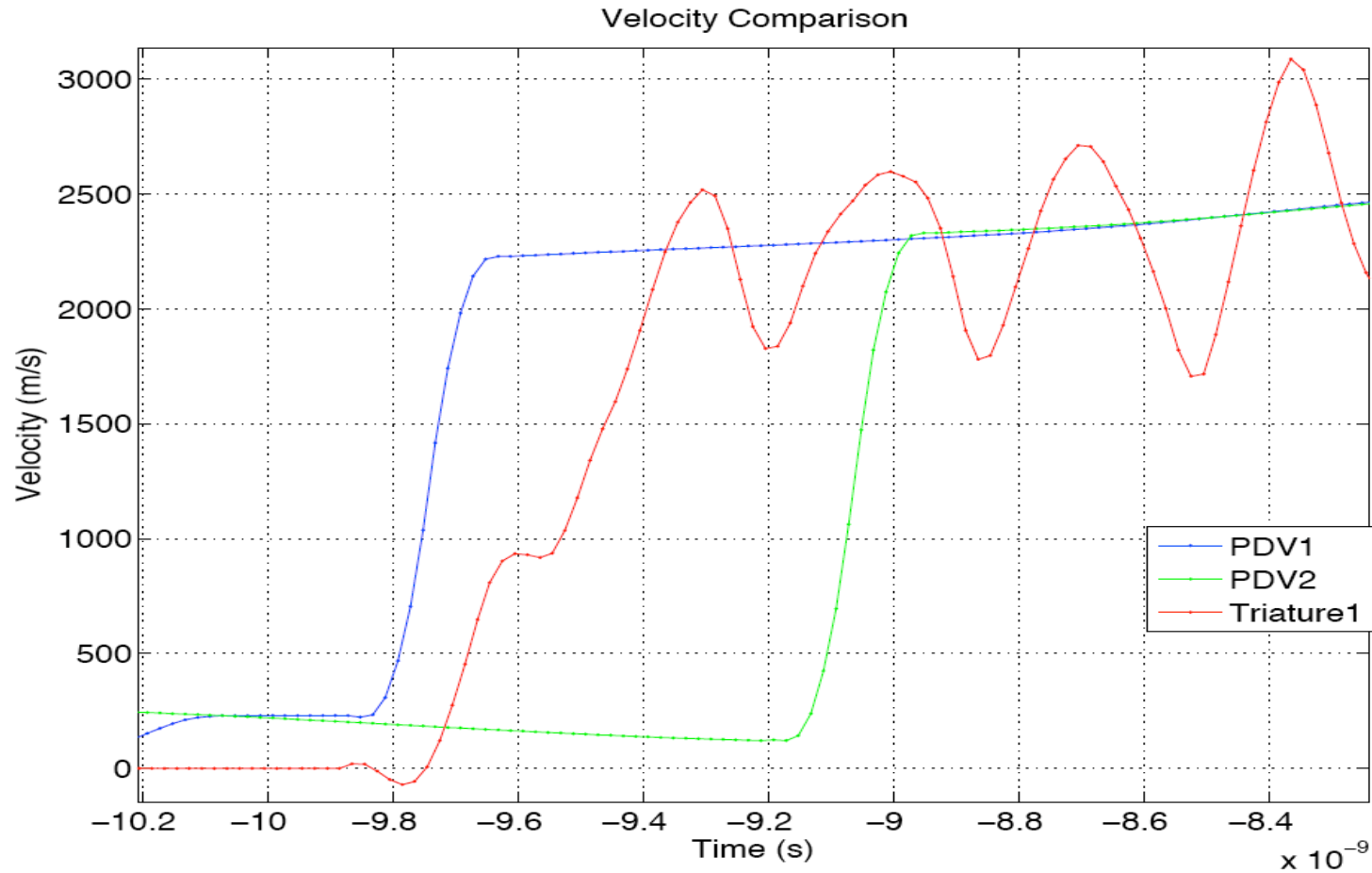
PDV/TDV COMPARISON

- **THE SETUP PRODUCED DATA ON THE PDV/TDV FROM THE SAME PROBE.**
- **THE PDV SYSTEMS ARE OF THE MODULAR DESIGN.**
- **PDV1 HAS A 13GHZ MITEQ DETECTOR.**
- **TDV HAS THREE 20GHZ MITEQ DETECTOR.**

MULTILOT FFT OF PDV1, TDV 2 Det 1,2,3 (Able Diaz)



VELOCITY COMPARISON PDV/TDV



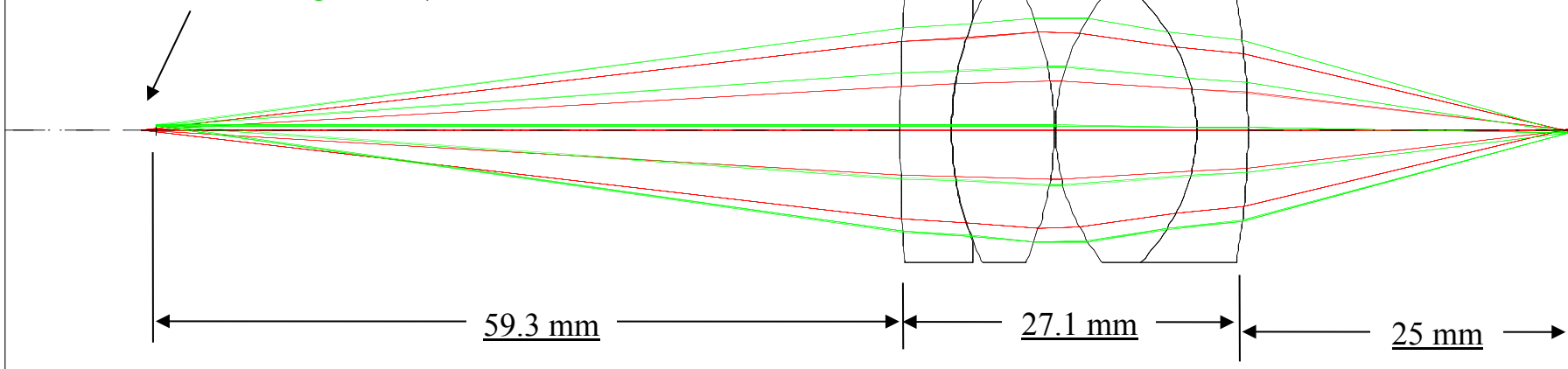
PDV/VISAR (Brent Frogget) probe with two large NIR doublets

(one PDV and one VISAR fiber traced)

Edmund Optics 45804
60-mm fl, 25-mm diameter NIR doublet

Edmund Optics 45800
35-mm fl, 25-mm diameter NIR doublet

Fiber bundle
(PDV angle polished,
VISAR fibers flat polished)



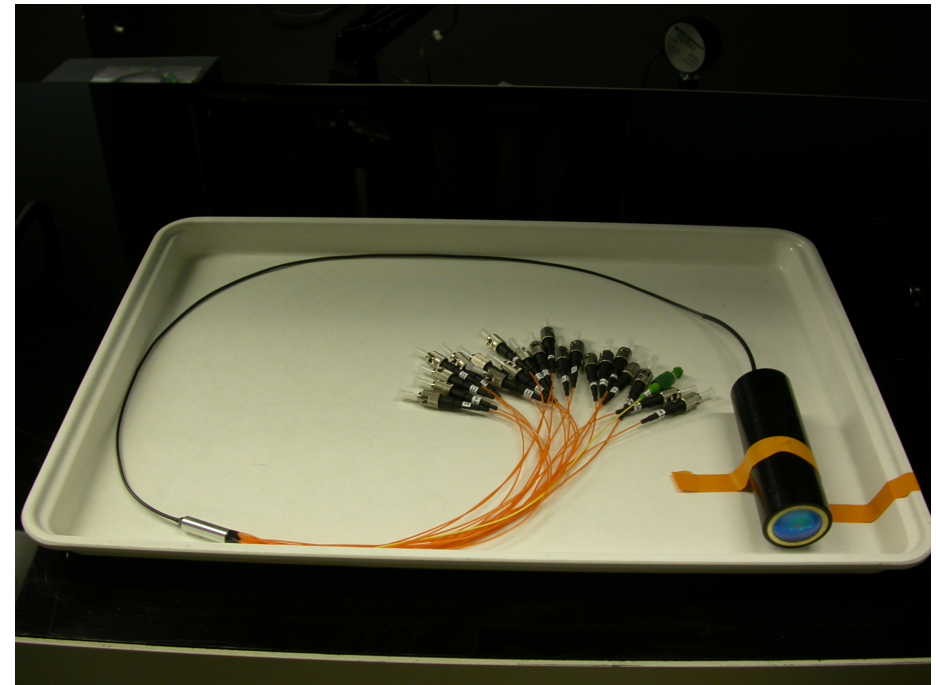
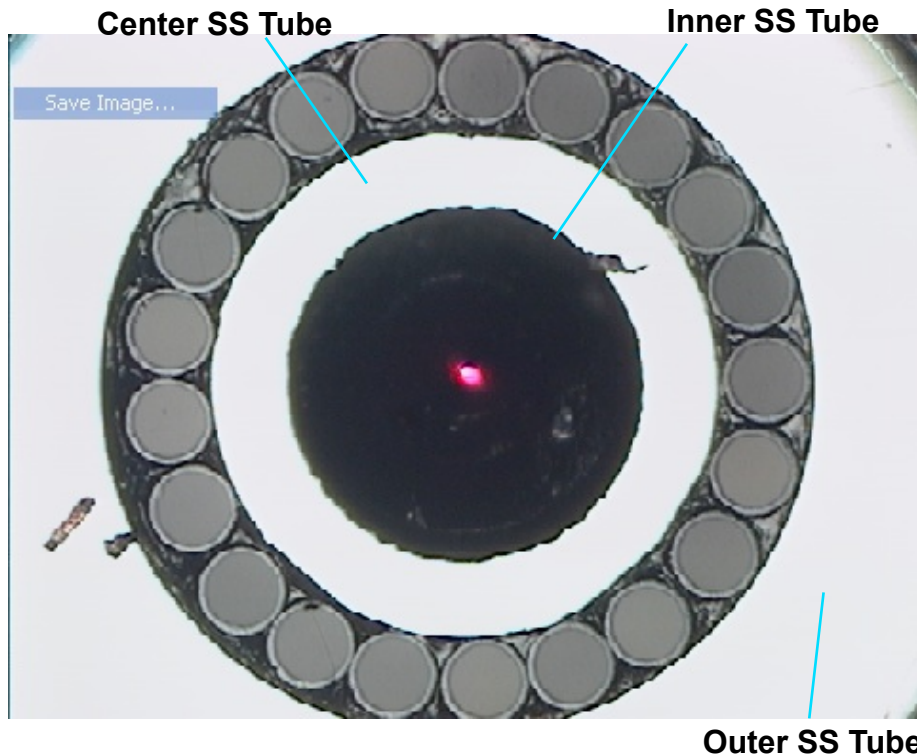
PDV/VISAR NIR 60/35 vpdvg.len

Positions: 1-2
Scale: 2.00

12.50 MM

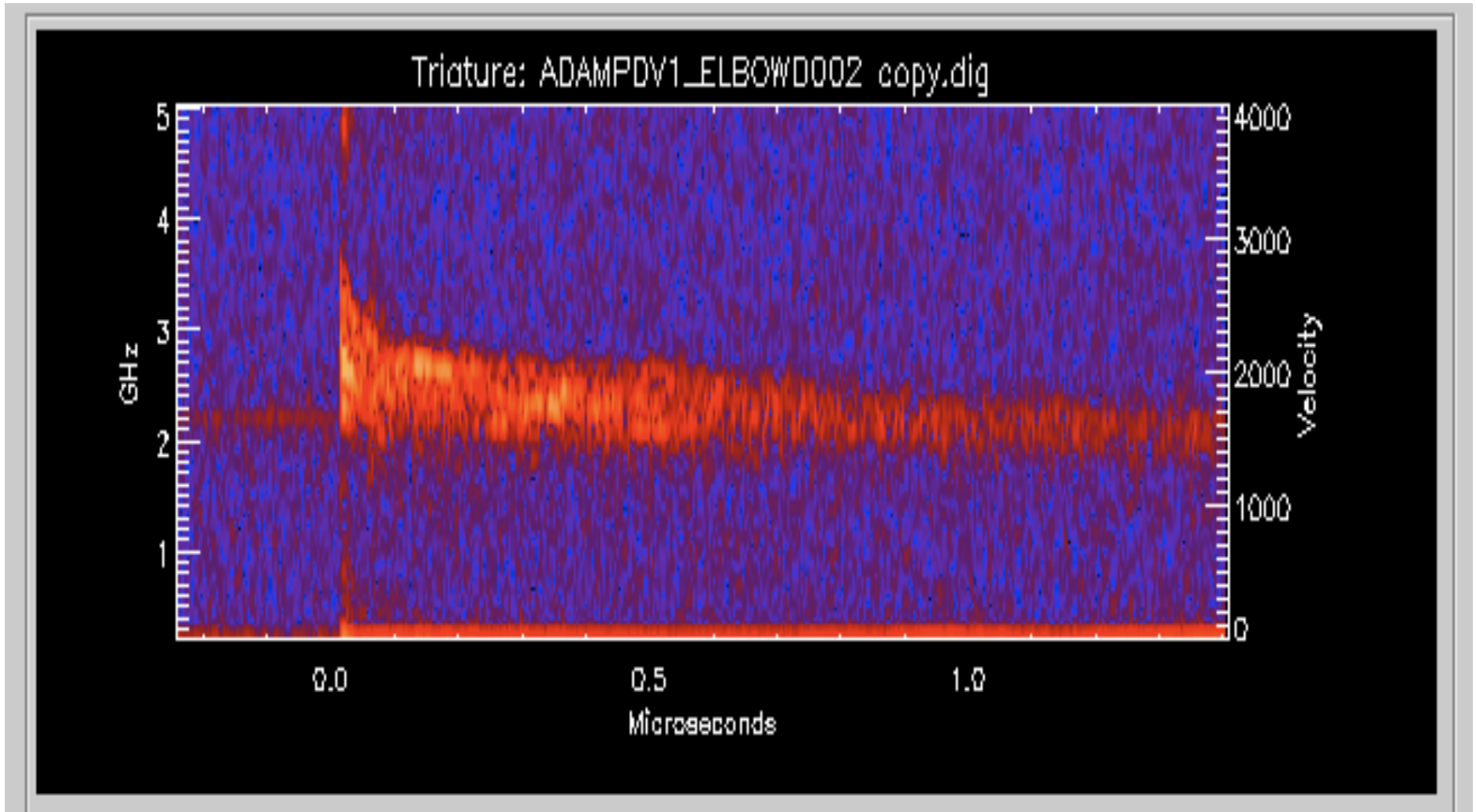
BCF 10-Jun-08

PDV/VISAR PROBE



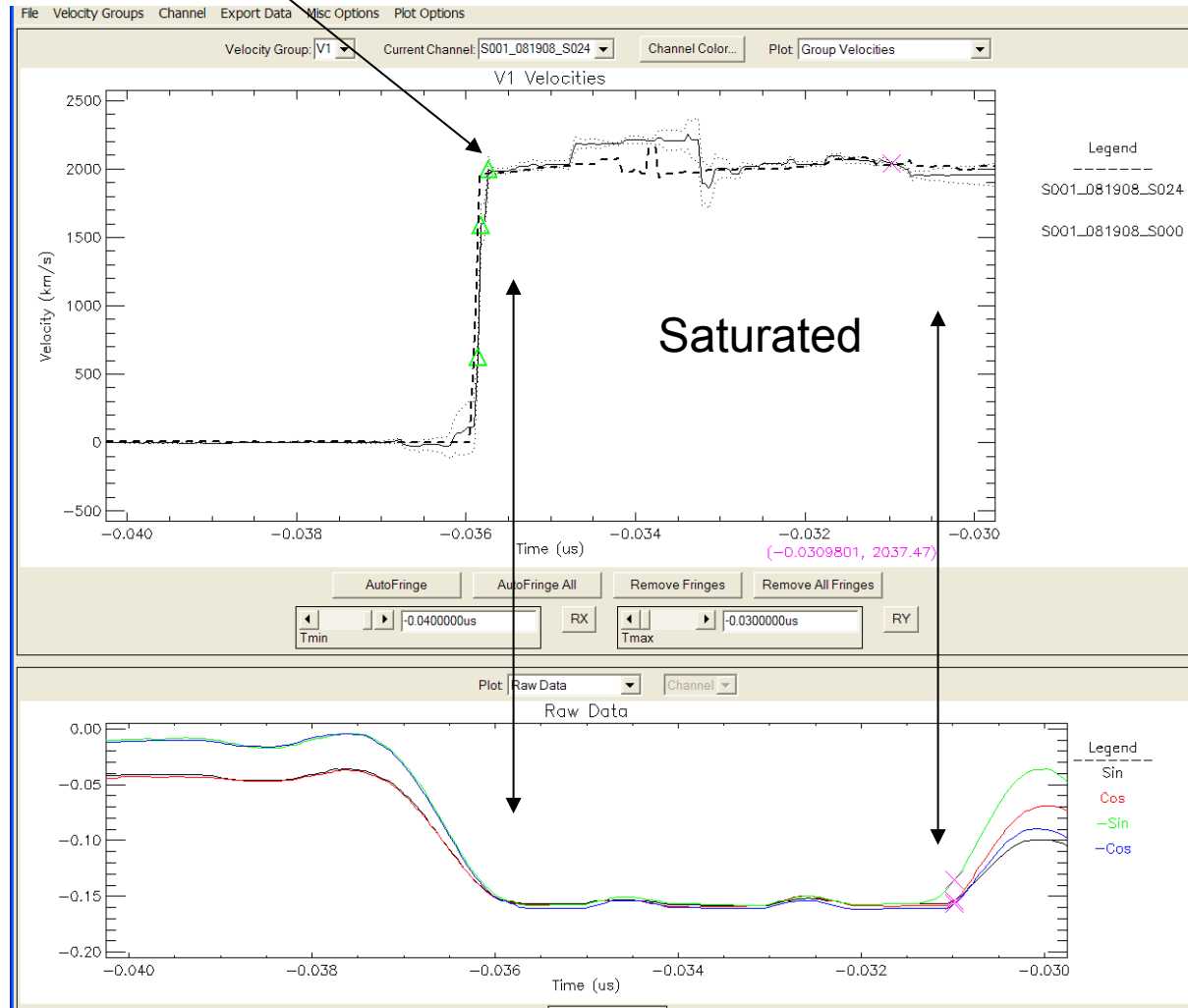
- **OUTER 21 FIBERS ARE 100/125 μ M.**
- **INNER FIBER IS A SINGLE MODE FIBER ANGLE POLISHED AT 8 $^{\circ}$.**
- **SINGLE MODE FIBER IS FOCUSED SEPARATE FROM 100 μ M FIBER.**

PDV/VISAR PROBE ALUMINUM TARGET

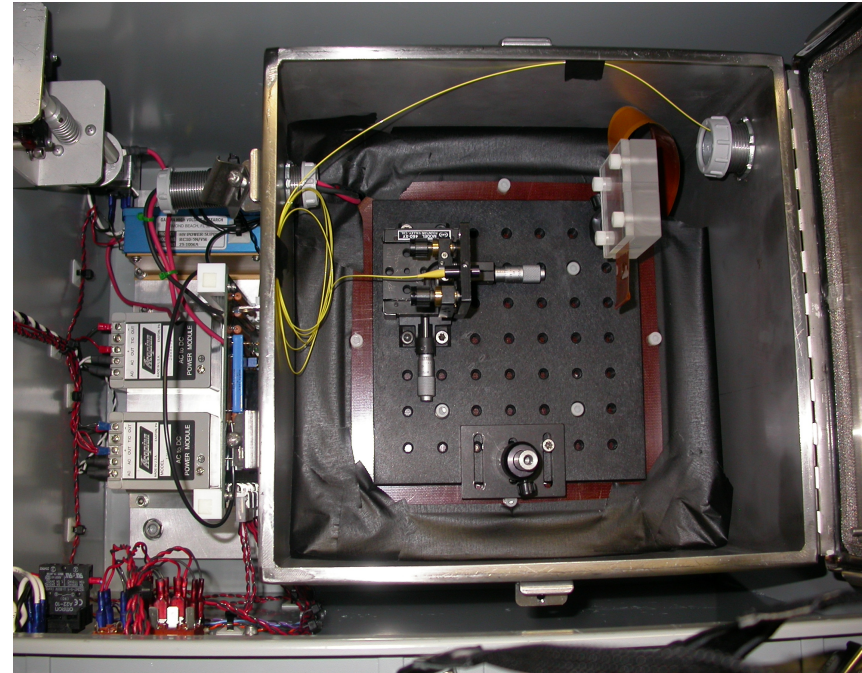
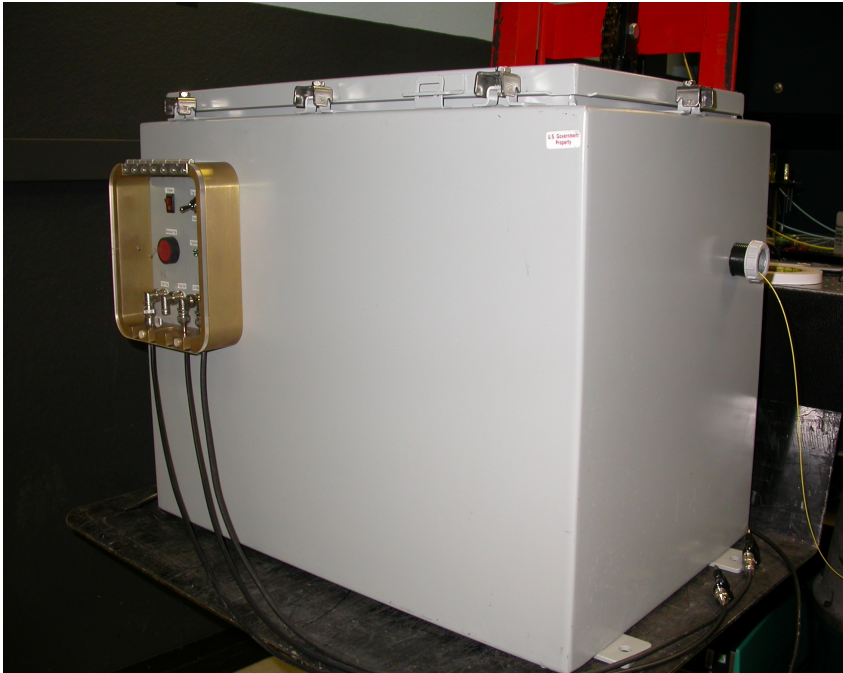


2008-20-08 shot 1

Fringes not added past this point in time.

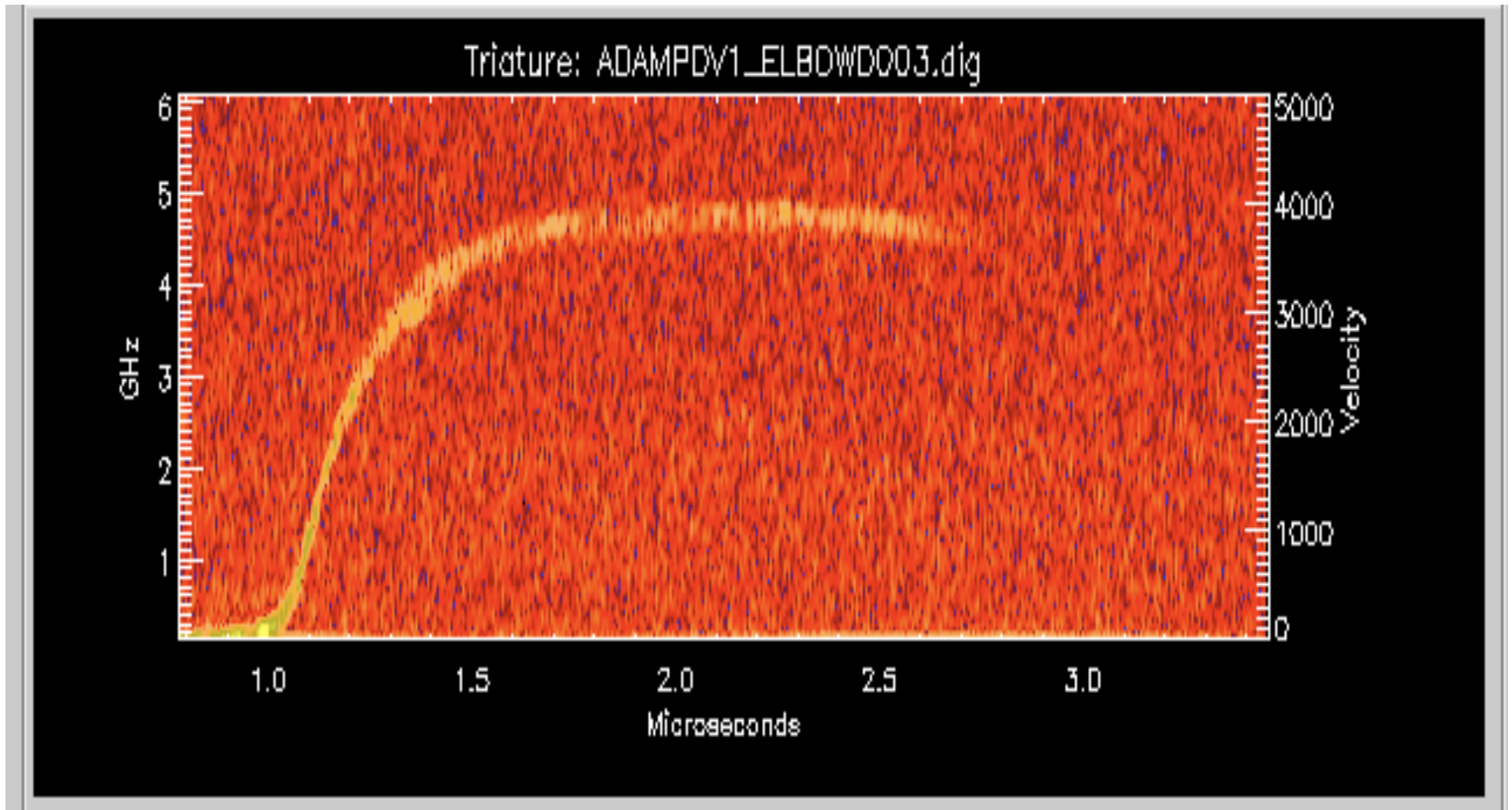


SLAPPER



- **DESIGNED AND BUILT BY BART BRIGGS**
- **5 μ F AT 4.6 KV GENERATING APPROXIMATELY 14.5KA**
- **SLAPPER IS .05" X .25"**

PDV SLAPPER DATA



CONCLUSION

- **THE POSITIVE LIGHT LASER IS A REPEATABLE SHOCK SOURCE FOR PDV TESTING.**
- **DIFFERENT PROBES DO NOT PRESENT ANY SUPRISES.**
- **ALUMINUM TARGET HAS MORE NOISE.**
- **A MULTI-PLOT FOR PDV QUICK LOOK WORKS WELL.**
- **PDV AND TDV CAN DO BETTER THAN ONE NS RESOLUTION.**
- **VISAR LIMITED TO DETECTOR AND RECORDING BANDWIDTH.**
- **NEW SLAPPER SYSTEM WORKS WELL AS A PORTABLE VELOCIMETER SHOCK SOURCE.**