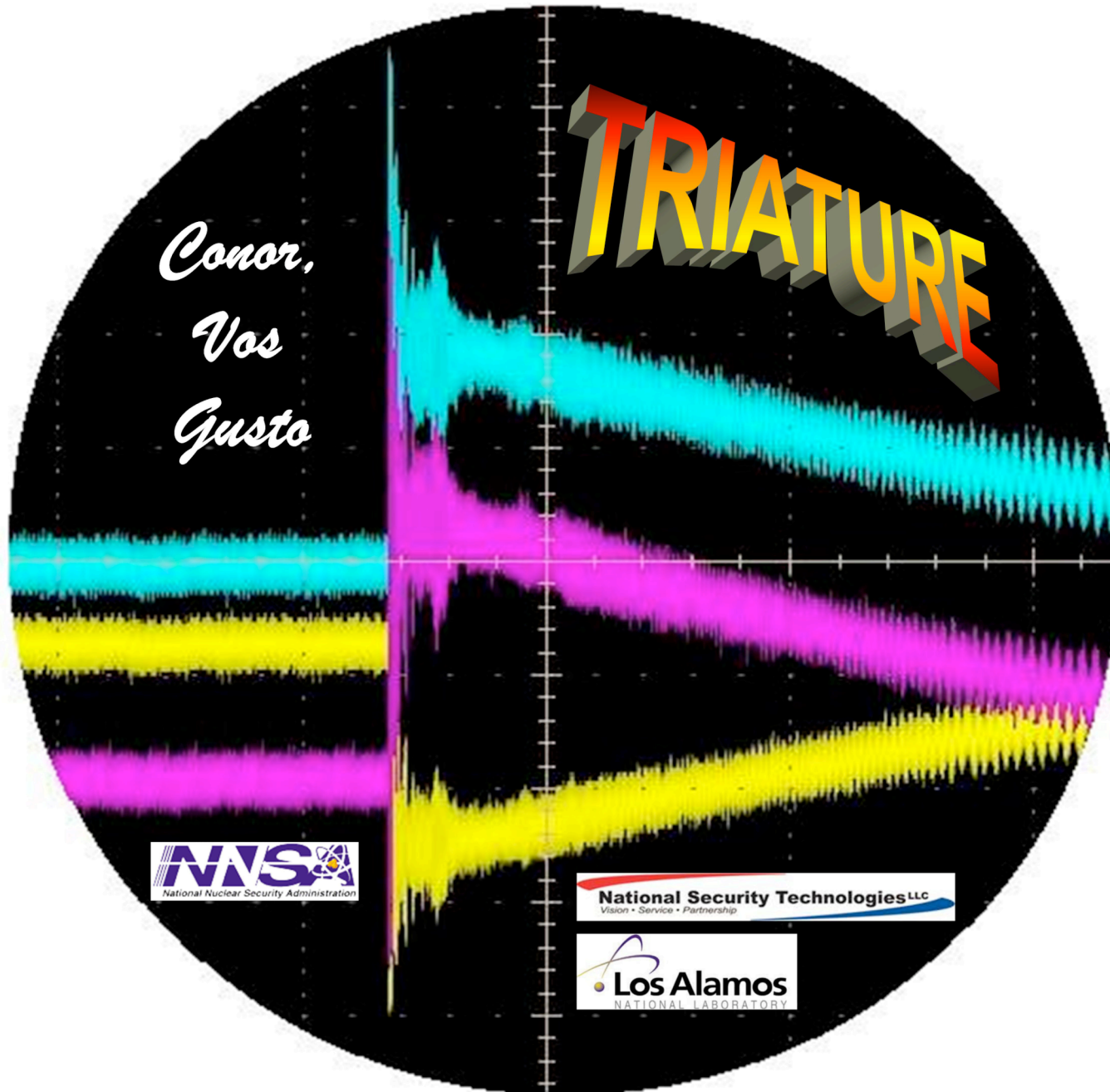


# Triature Doppler Velocimeter (TDV)

Cenobio Gallegos, Adam Iverson, Tom Tunnell, Matthew Teel,  
Douglas O. DeVore, and Bruce Marshall  
NSTec

David Holtkamp, LANL

PDV Workshop  
August 2007



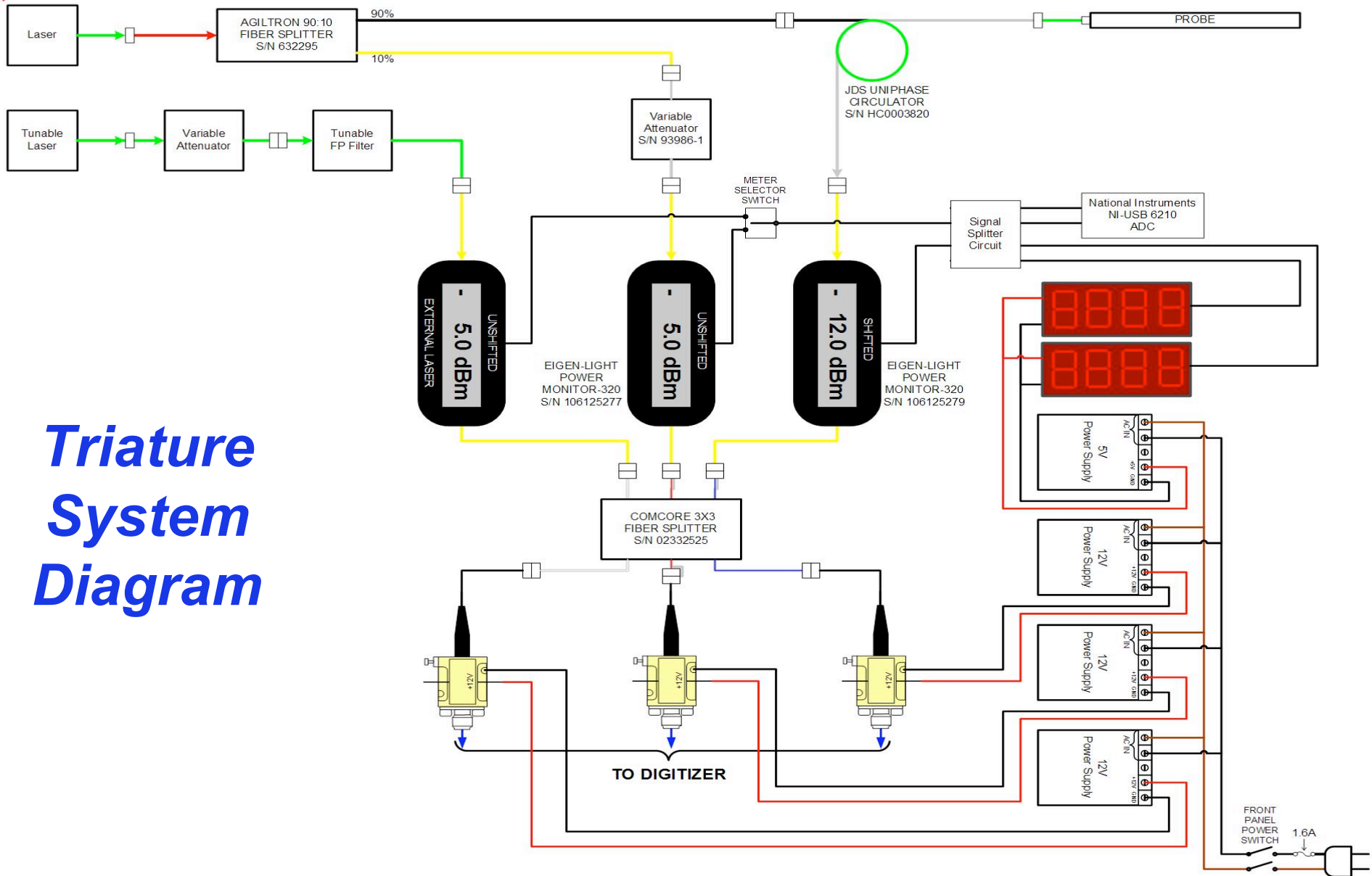
- **What is the Triature Doppler Velocimeter (TDV)?**
- **How does it work?**
- **Why use a TDV?**

# TDV

- **TDV is a Photon Doppler Velocimeter (PDV) with three identical outputs that are separated in phase by  $120^\circ$ .**
- **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  $120^\circ$  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 sliding Fast Fourier Transform (FFT) analysis.**
- **Optical down conversion can also be implemented to increase the ability to measure hundreds of kilometers per second.**



**Diagnostic**  
Drawing Title  
Control Copy



# Triature System Diagram

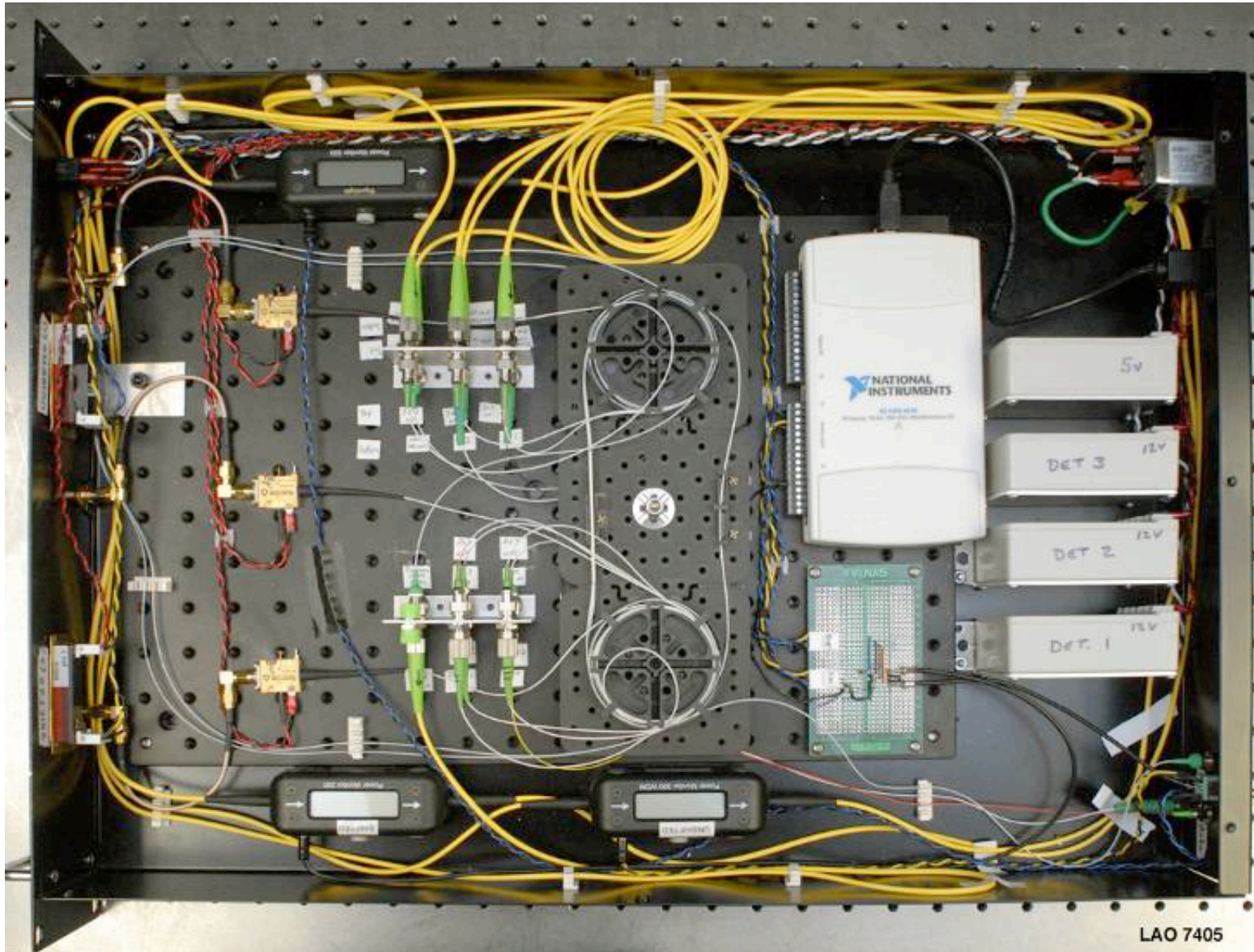
Experimenter Signature: \_\_\_\_\_

Date: \_\_\_\_\_

DRAWN	DATE	TITLE
Matthew G. Teel	07-12-2007	BAROLO Triature w/External Laser
DIAGNOSTIC ENGINEER	DATE	One Line
Cenobio Gallagos	07-12-2007	
PRINCIPAL EXPERIMENTER	DATE	DOC#
Cenobio Gallagos	07-12-2007	

SHEET 1 OF 3

# Triature Layout

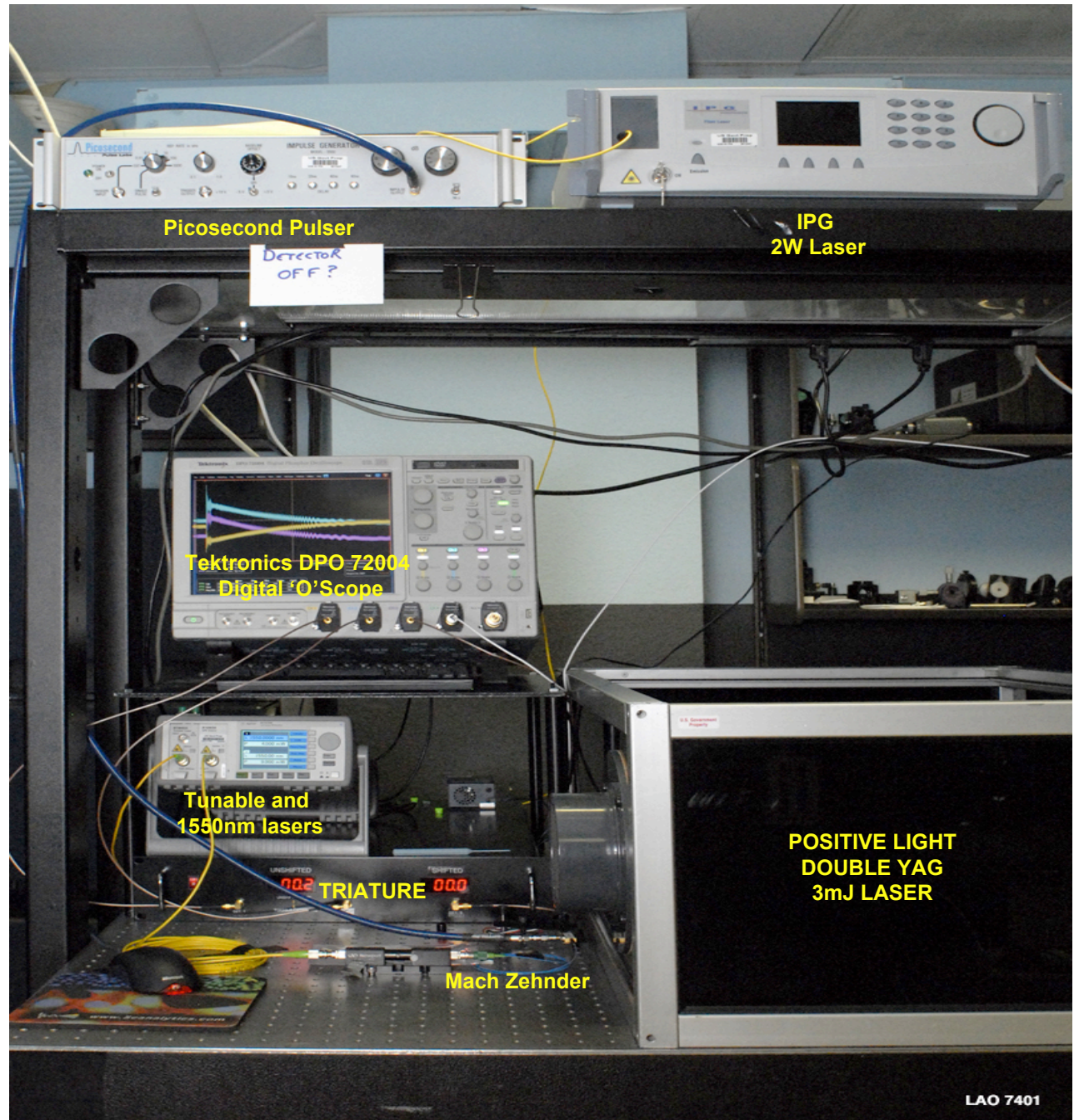


## Calibration

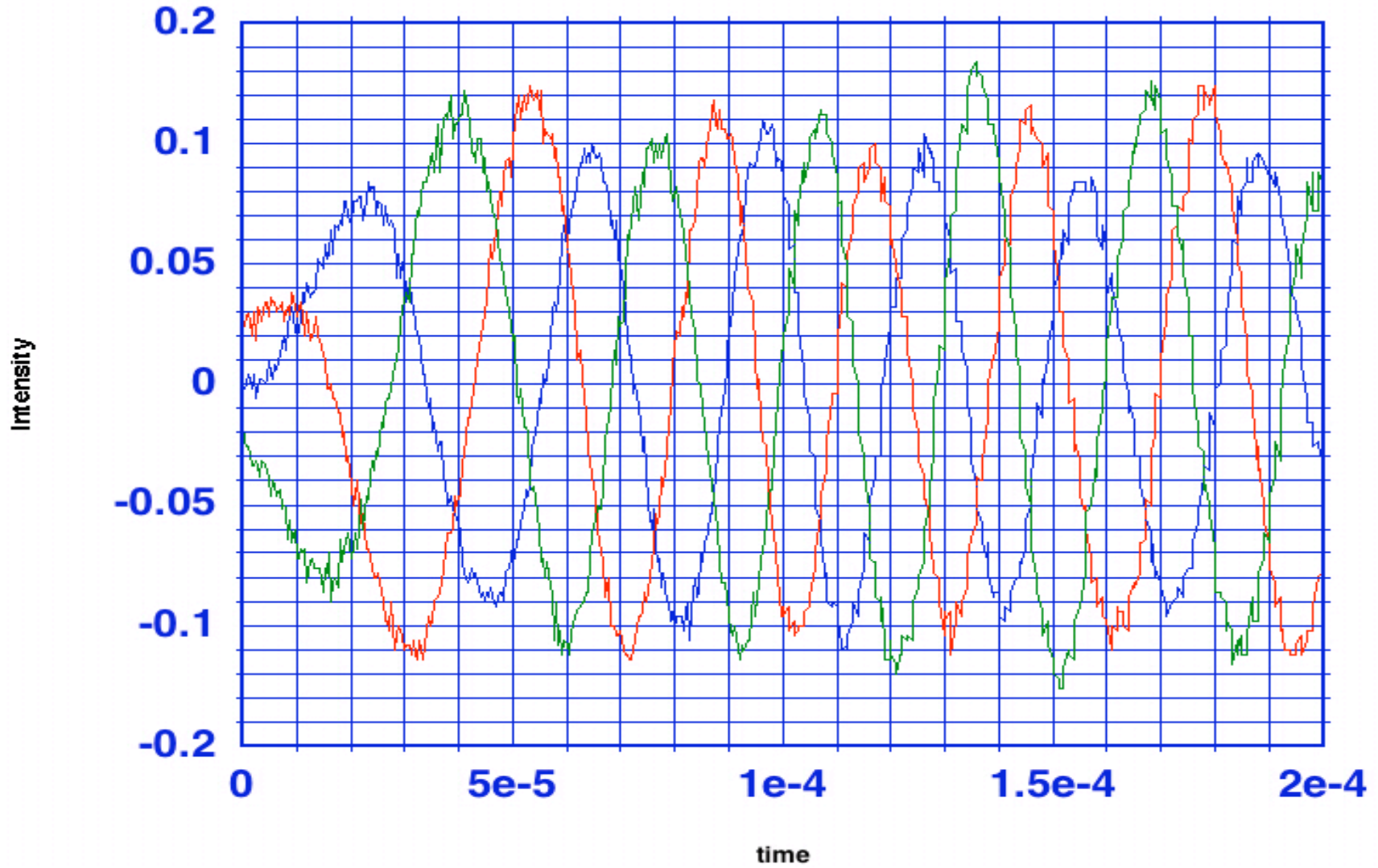
- **Triature was calibrated with an AGILENT 1550-nm laser and an AGILENT tunable 1550nm laser.**
- **The tunable laser simulated the Doppler shifted light from 1550 nm to 1449.5 nm at a 0.01-nm step.**
- **Tom Tunnell used this calibration data to develop the TRIATURE analysis software, Adaptive Down Conversion (ADC).**
- **A 45-picosecond pulse onto a Mach-Zehnder interferometer was applied to the Triature.**



# Laboratory Setup for Picosecond Pulse Test and Laser-induced Shock

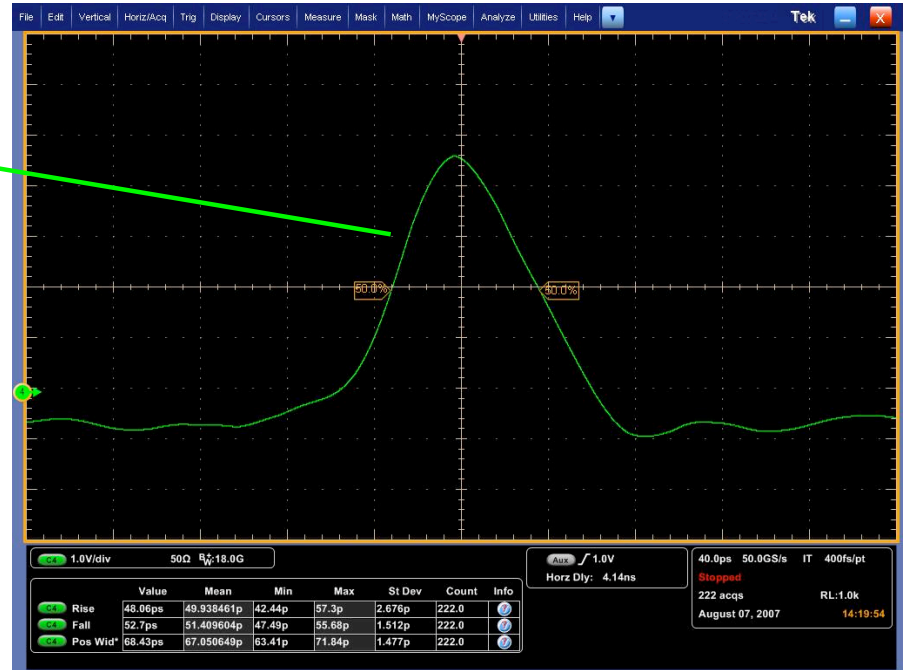


## Triature Phase





**Picosecond Pulser**  
**45-ps rise time**  
**68 ps FWHM**



**Pulse out of a Mach-Zehnder interferometer**  
**41-ps rise time**  
**60 ps FWHM**



**Pulse out of the TDV**  
**41- ps rise & 68 ps FWHM**  
**39- ps rise & 66 ps FWHM**  
**43- ps rise & 68 ps FWHM**

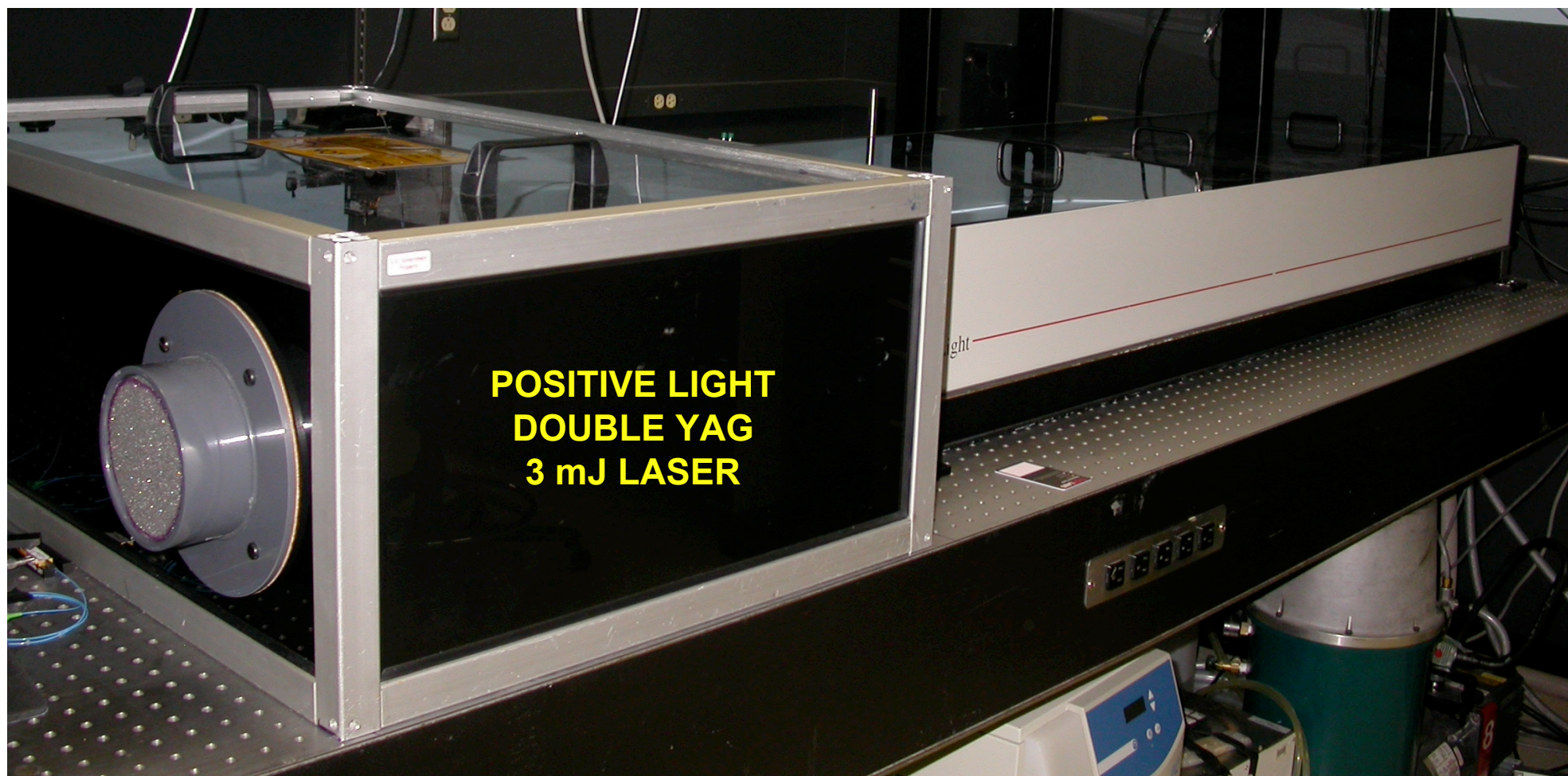


## Laser-induced Shock

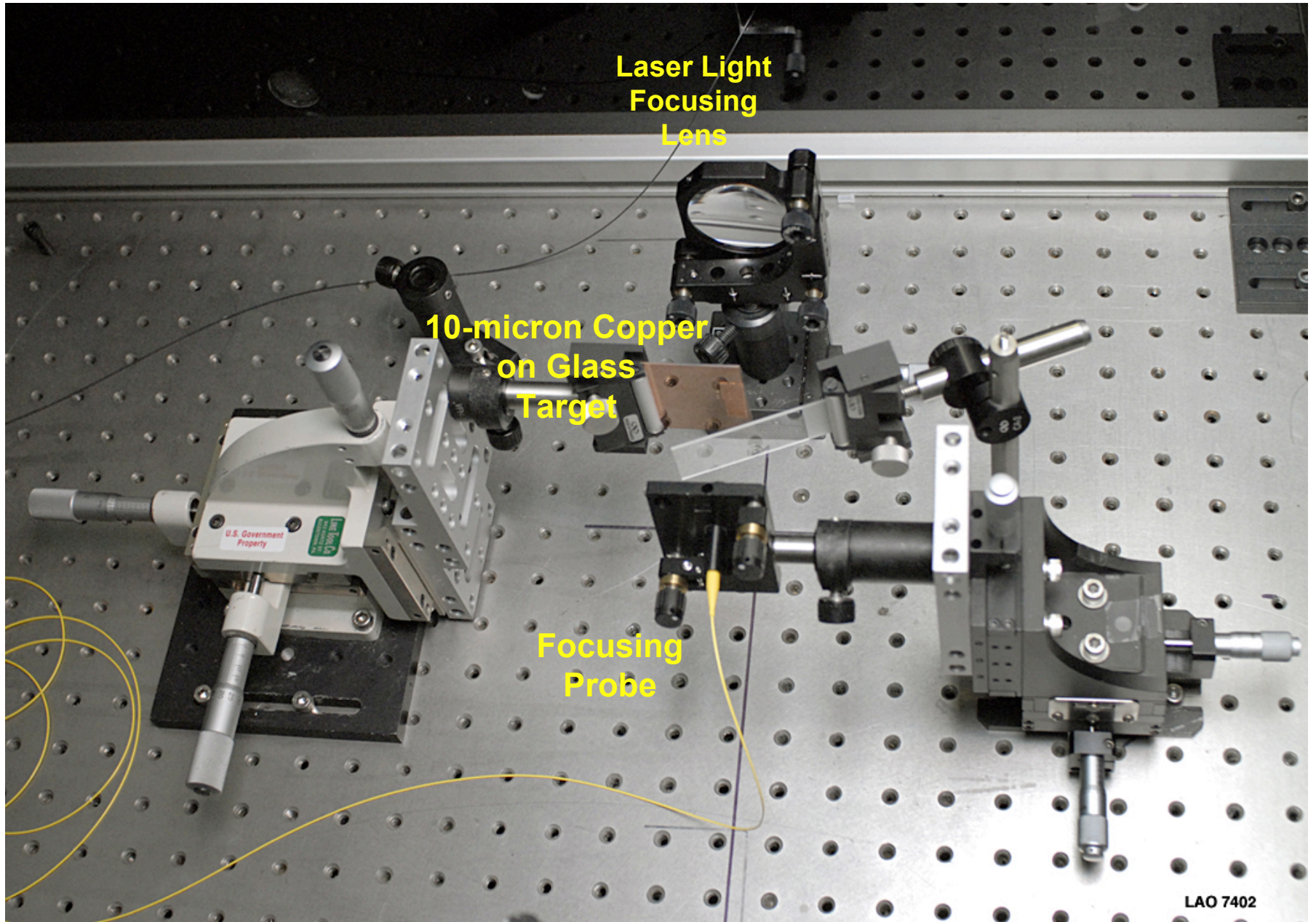
- **A 3-mJ Positive Light laser with 190-ps rise time and 400-ps FWHM pulse at 532 nm**
- **Target: 10-micron-thick copper layered on a glass plate**
- **Probe: single-mode fiber aligned to a lens with a focal point of 48 mm**
- **Triature light source: IPG 1550-nm, 2-W laser**

## Positive Light Laser

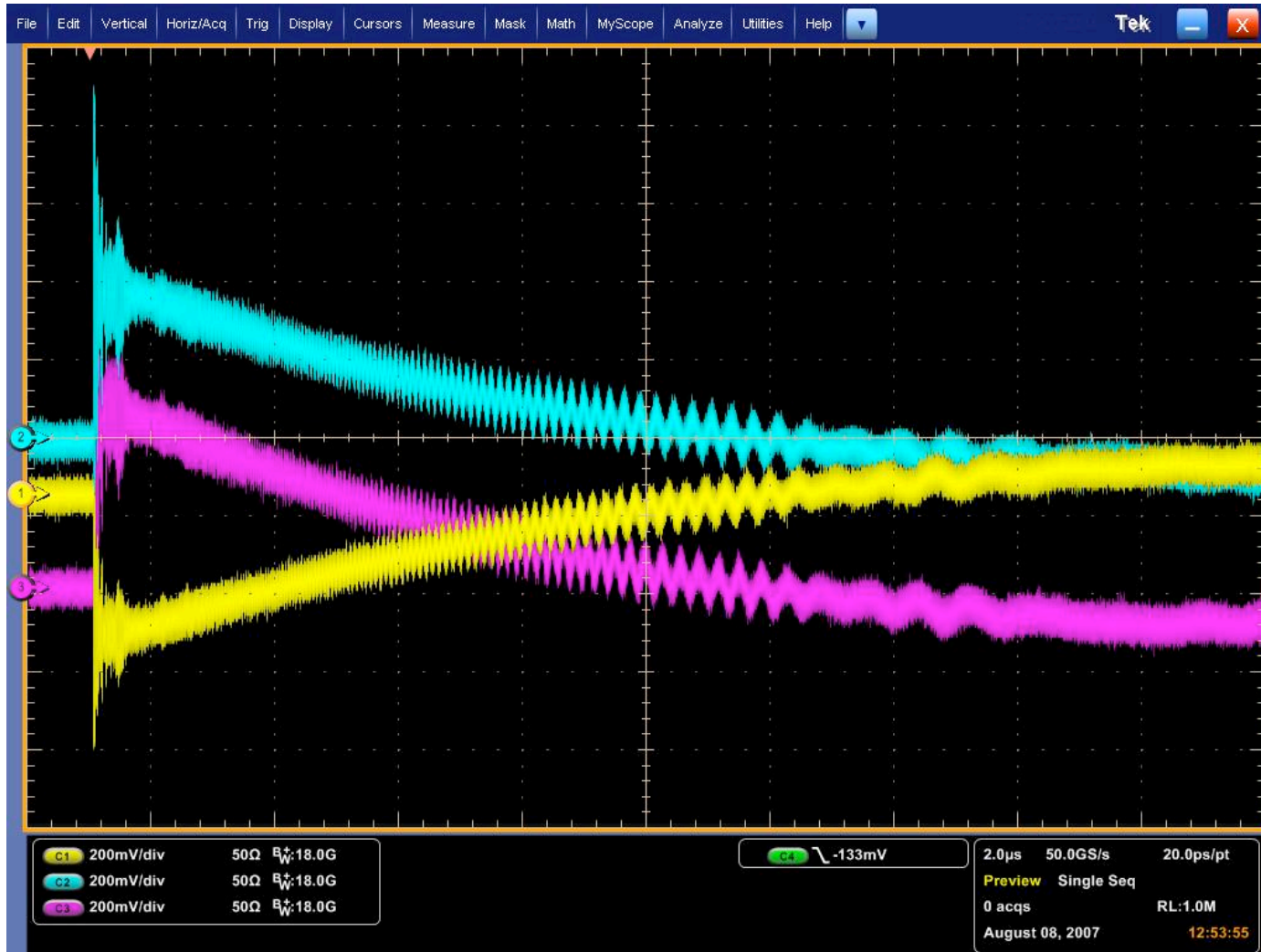
Pulse: 190-ps rise time and 400-ps FWHM at 532 nm







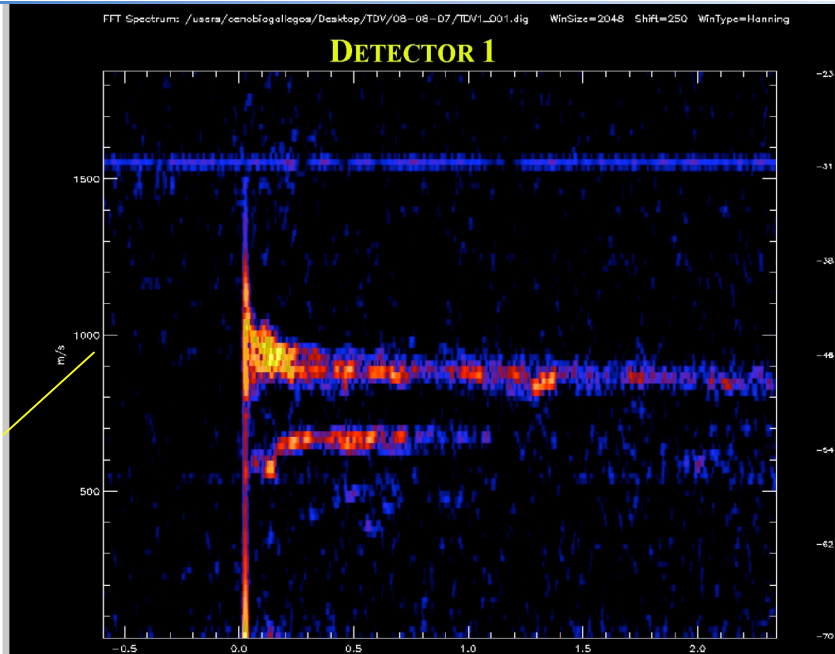
# Triature Data from Shock Source



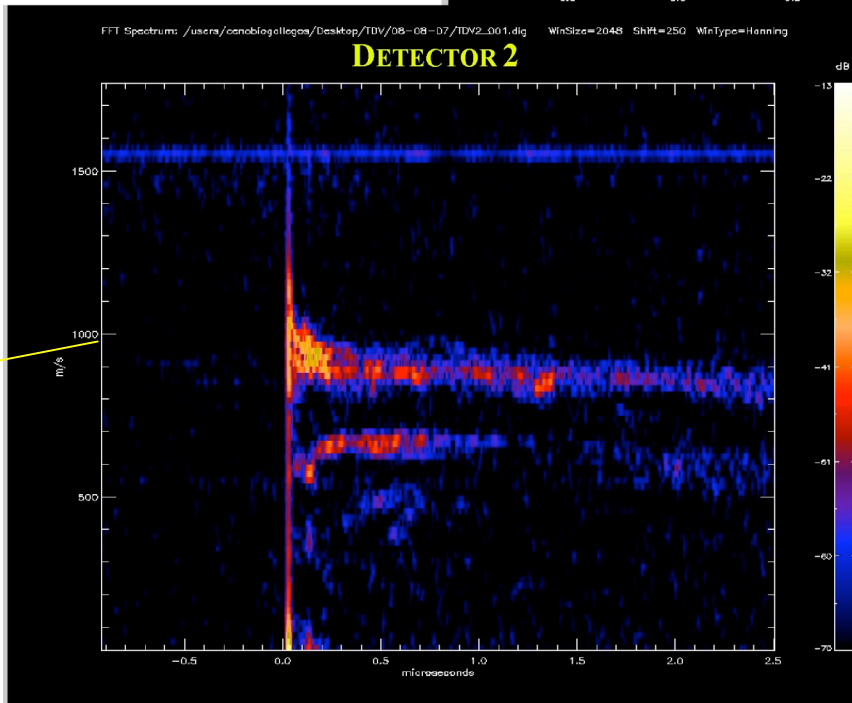


# FFT of each triature channel

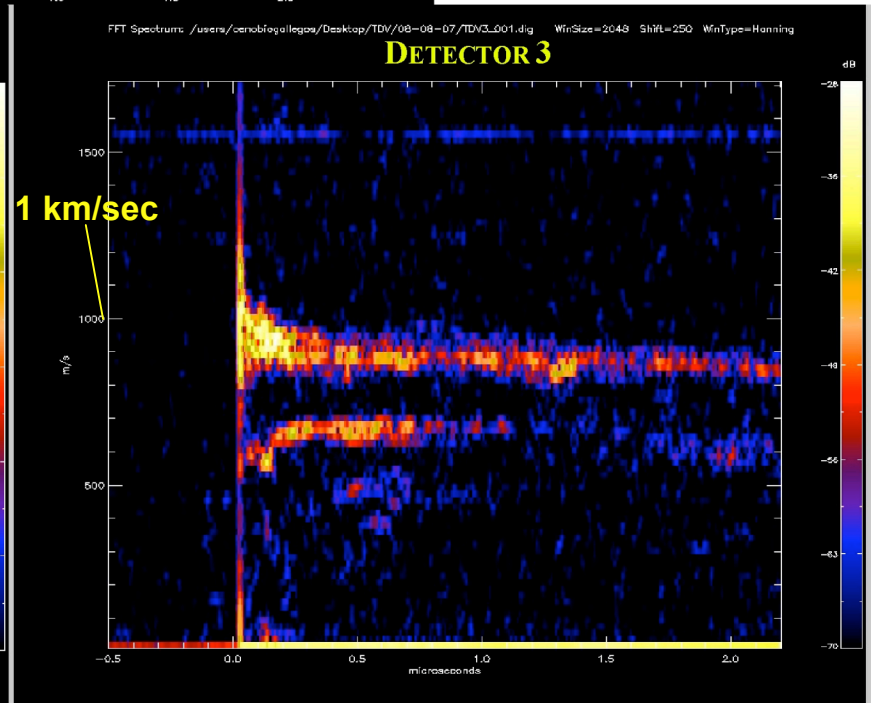
1 km/sec



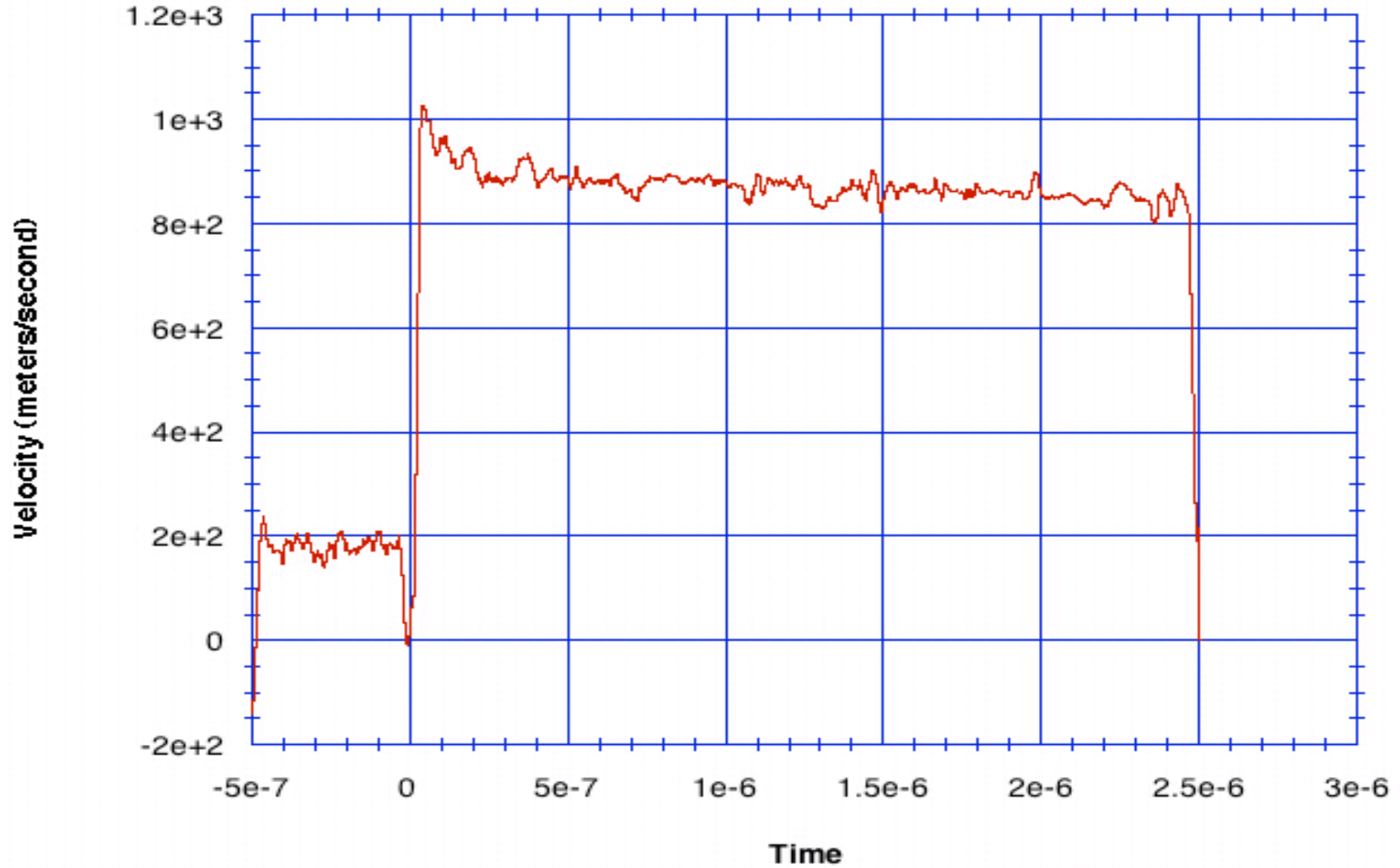
1 km/sec



1 km/sec



## Adaptive Down Conversion of TRIATURE Data



# Conclusion

- **Triature works**
- **Analysis software is being developed**
- **A comparison of TDV with fast VISAR at higher velocities needs to be done**
- **Optical down conversion needs to be tested**