Session VII. Airborne LIDAR Technology

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Solid-State Coherent Laser Radar Wind Shear Measuring Systems

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Fourth Combined Manufacturers' and Technologists'

Airborne Wind Shear Review Meeting

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SOLID-STATE COHERENT LASER RADAR

WIND SHEAR MEASURING SYSTEMS

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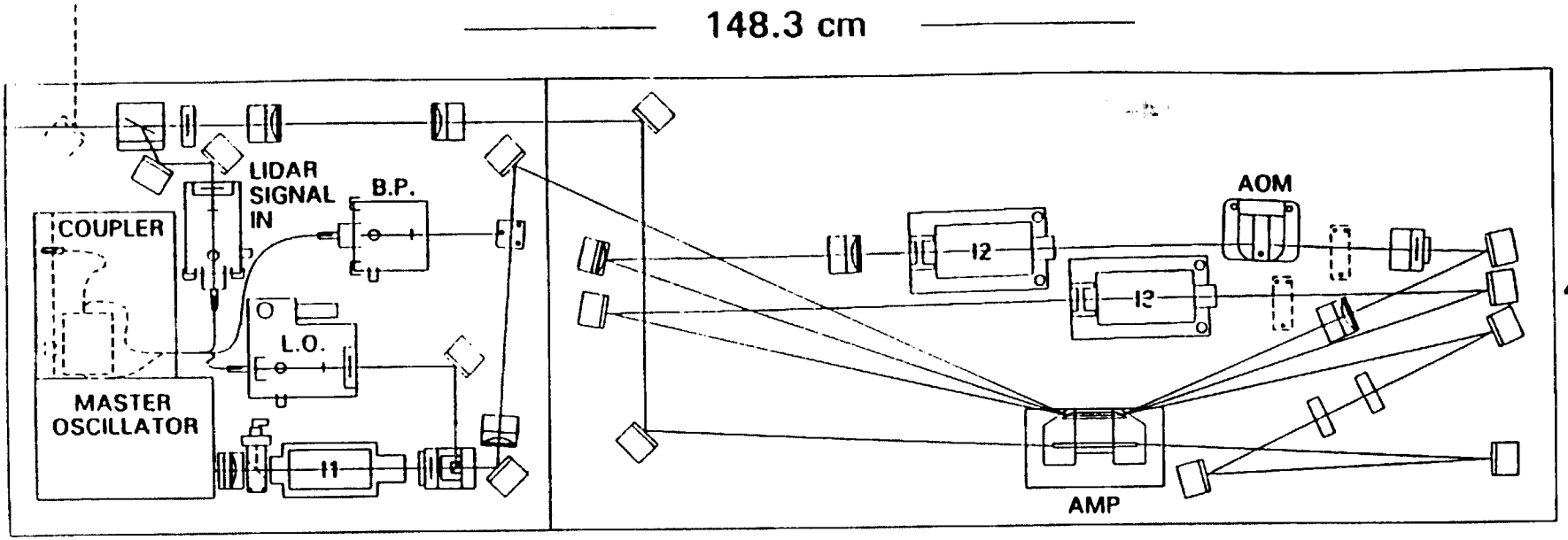
Coherent Technologies, Inc. was established in 1984 to engage in the development of coherent laser radar systems and subsystems with applications in atmospheric remote sensing, and in target tracking, ranging and imaging. CTI focuses its capabilities in three major areas:

- Theoretical performance and design of coherent laser radar systems
- Development of coherent laser radar systems for government agencies such as DoD and NASA
- Development of coherent laser radar systems for commercial markets

1.06 MICRON SOLID-STATE COHERENT LASER RADAR SYSTEM

- MOPA CONFIGURATION
- MAXIMUM PULSE ENERGY 200 mJ/PULSE
- PULSE DURATION 0.1 - 10 μs (adjustable)
- PRF 0.1 - 20 Hz
- TRANSMIT APERTURE 10 cm (20 cm also available)
- PROCESSING BANDWIDTH ~100 MHz (50 m/s)
- REAL-TIME DATA ACQUISITION, PROCESSING, AND DISPLAY



: λ/2 PLATE

: MIRROR, HR 1um

: LENS

: KINEMATIC MOUNT

: POLARIZERS

I1-I3: FARADAY ISOLATOR

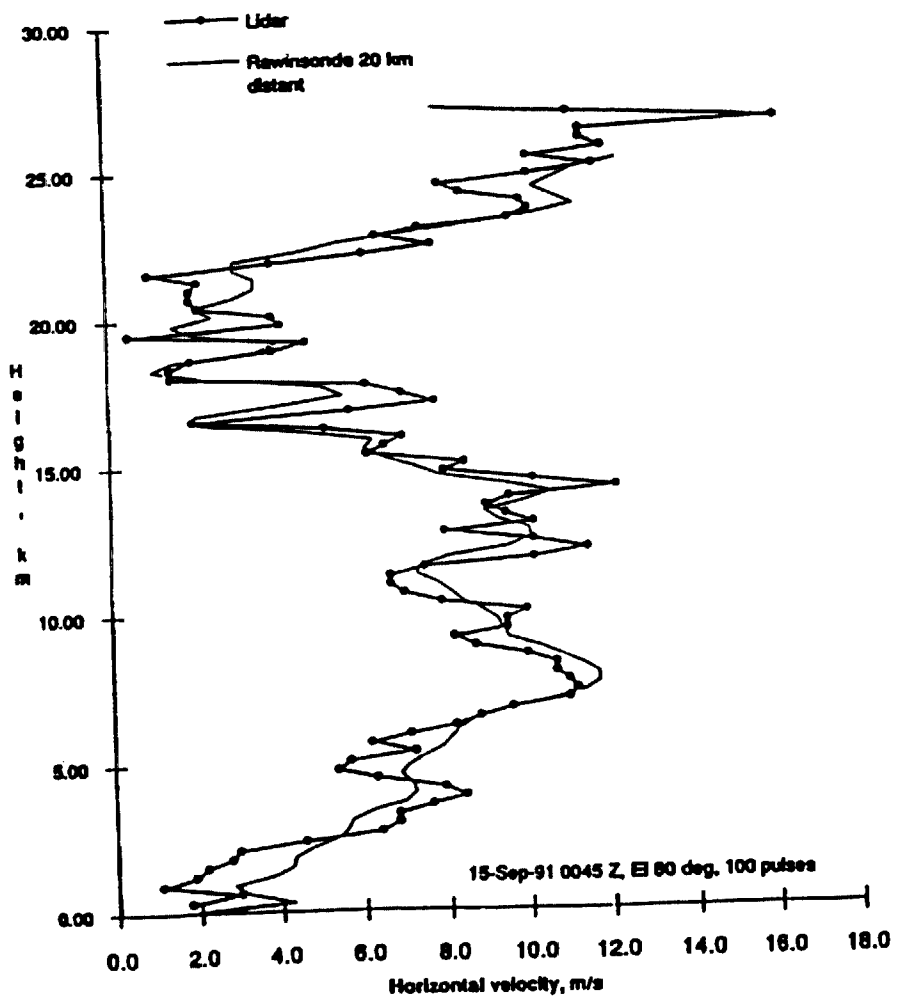
: CYLINDER LENS

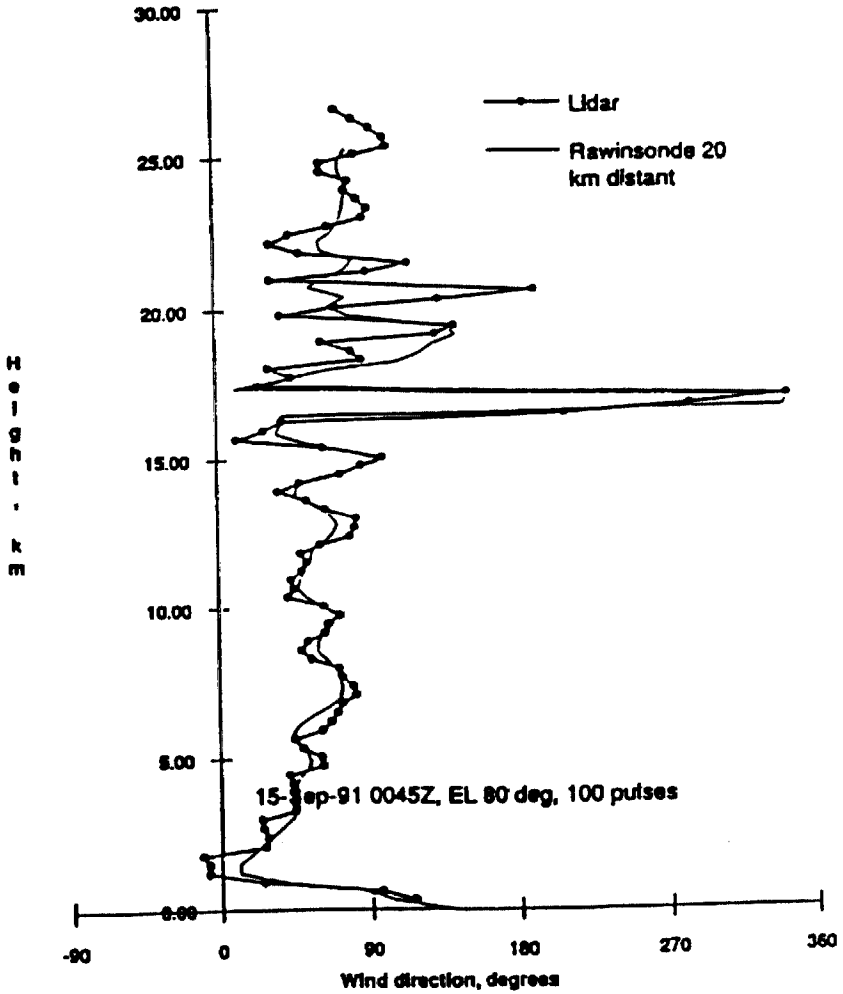
L.O.: LOCAL OSCILLATOR INPUT

B.P.: BACK PROPAGATOR INPUT

AOM: ACOUSTO-OPTIC MODULATOR

WIND MEASUREMENT USING 1.06 MICRON SYSTEM





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FLASHLAMP-PUMPED 2.09 MICRON SOLID-STATE COHERENT LASER RADAR SYSTEM

- Tm,Ho:YAG
- INJECTION-SEEDED (MO/SO) CONFIGURATION
- MAXIMUM PULSE ENERGY ~50 mJ/PULSE
- PULSE DURATION ~150 ns @ 50 mJ, ~220 ns @ 22 mJ
- PRF ~6 Hz
- TRANSMIT APERTURE 10 cm
- PROCESSING BANDWIDTH ~50 MHz (50 m/s)
- REAL-TIME DATA ACQUISITION, PROCESSING, AND DISPLAY

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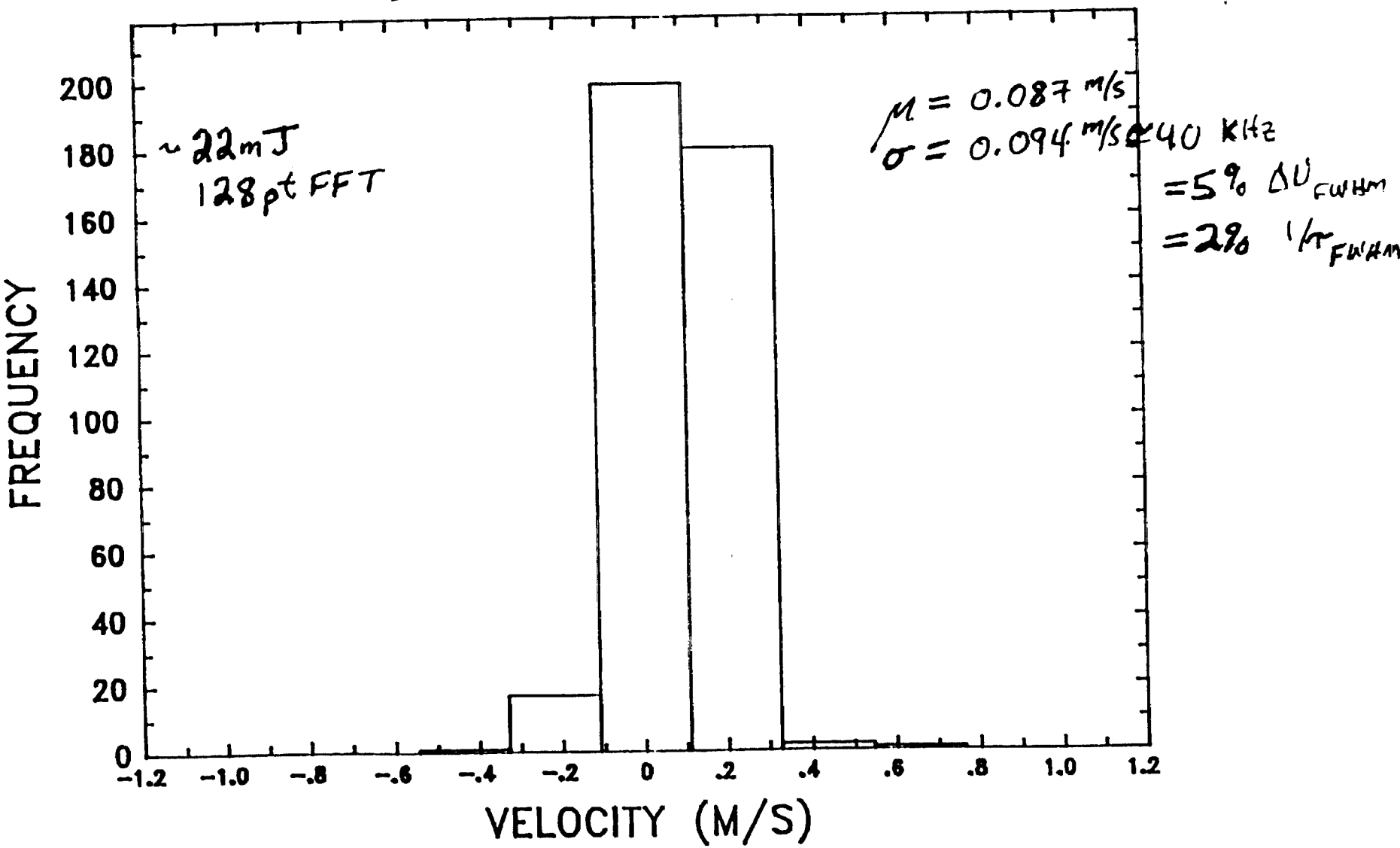
SMHVORTEX-3

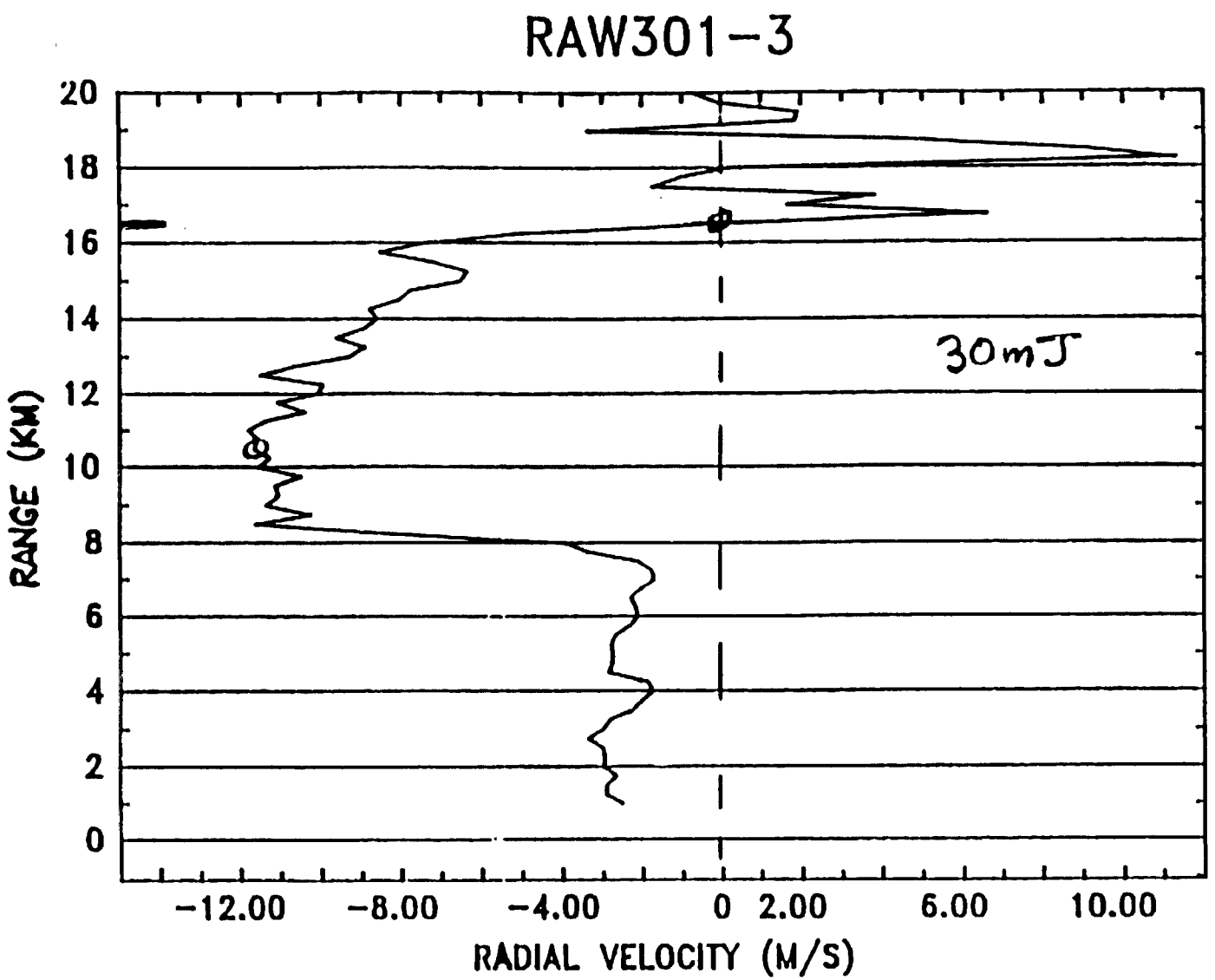
400 SHOTS–14 km HILLSIDE

no shot editing

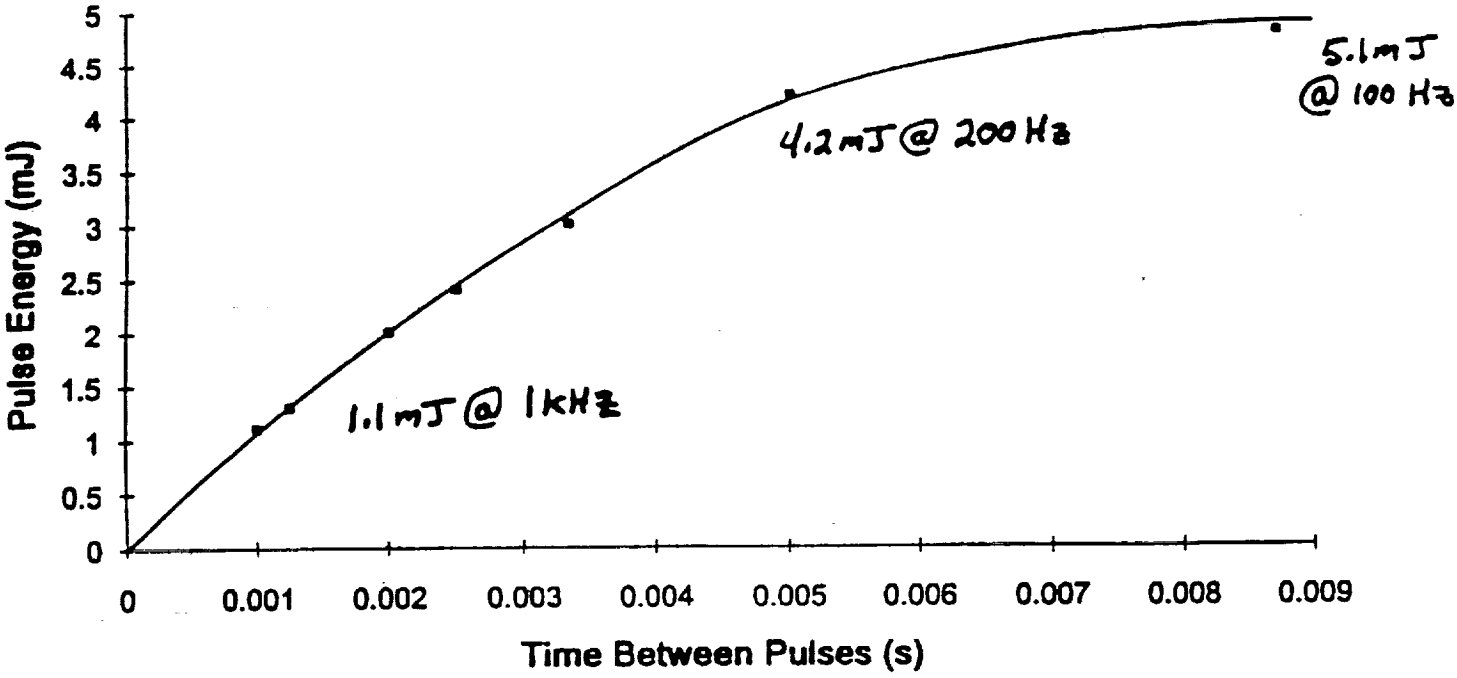


3-1-91

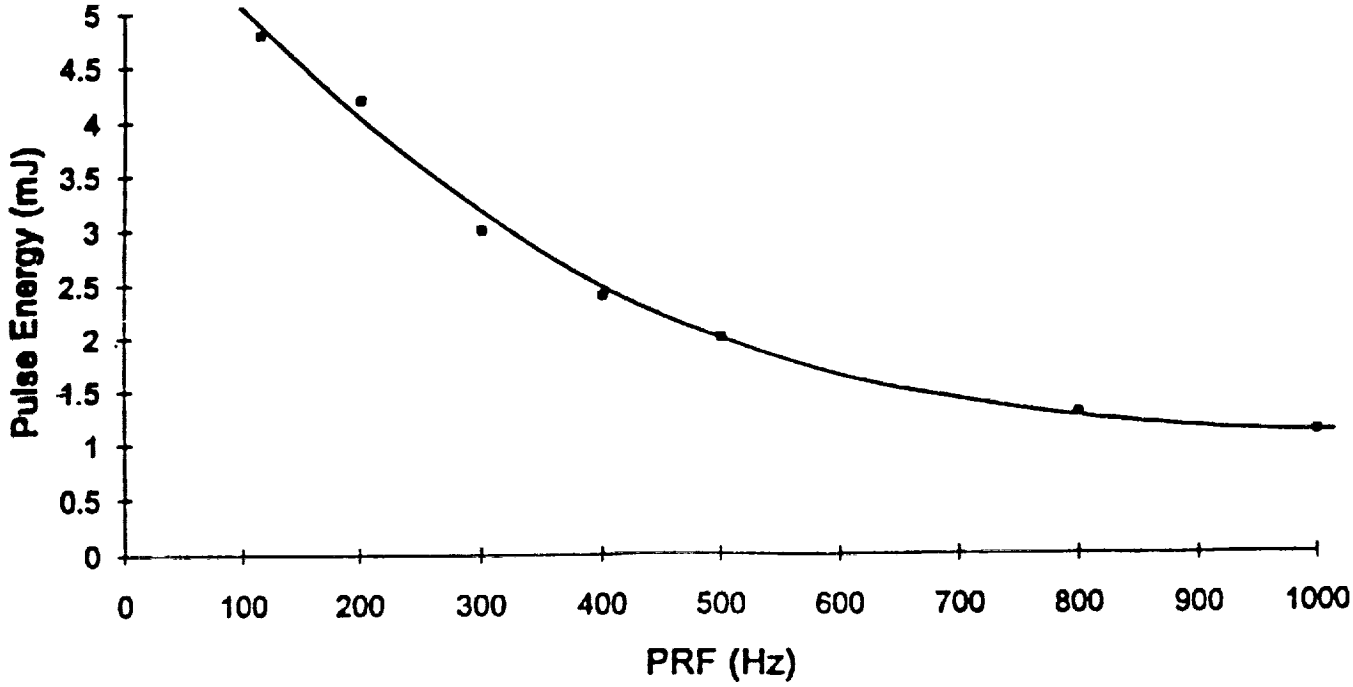
10 shots
128 pt FF



Pulse Energy vs. Time Between Pulses



Pulse Energy vs. PRF



CONCLUSIONS

- A RELIABLE GROUND-BASED 2 μm COHERENT LIDAR HAS BEEN DEMONSTRATED

- DIODE-PUMPED 2 μm LASERS AT POWER LEVELS > 10W AND PULSE ENERGIES OF > 100 mJ HAVE BEEN DEMONSTRATED

- THE POTENTIAL FOR COMPACT EYESAFE ALL-SOLID-STATE COHERENT LASER RADAR SYSTEMS HAS BEEN DEMONSTRATED USING DIODE PUMPING (Complete transceiver @ 1-2 W avg. power requires ~ 1 ft^3)

Q: Roland Bowles (NASA Langley) - Is the material damage problem solved with solid state two micron technology? Particularly if you pump it reasonably hard, like five or ten millijoules?

A: Milt Huffaker (Coherent Technologies) - I think it is. We have researched those materials and had special materials developed, and those materials have proven themselves as damage free.

Q: Roland Bowles (NASA Langley) - So that problem is behind us?

A: Milt Huffaker (Coherent Technologies) - Right.

Q: Roland Bowles (NASA Langley) - What about the availability of diodes that would put us up around the fifty to one hundred millijule capability?

A: Milt Huffaker (Coherent Technologies) - Well the diodes are there, the question right now is the cost.

Phil Brockman (NASA Langley) - We have 64 diode arrays, at 300 watts each, on order right now for Langley. They cost us $300,000 dollars when we ordered them.

Q: Roland Bowles (NASA Langley) - Is Sony making these?

A: Milt Huffaker (Coherent Technologies) - Spectra Diode Labs is the main developer here in this country. We have been using 3 watt diodes and they are working on 10 watt diodes. The technology is changing and every six months it will be cheaper.

Q: Roland Bowles (NASA Langley) - But when does it stabilize to the point we can think about practical two micron airborne systems?

A: Milt Huffaker (Coherent Technologies) - As I mentioned, we have demonstrated in the lab an all diode pumped transmitter, to the energy and power we are talking about.

Q: Roland Bowles (NASA Langley) - So we are ready to do a point design on an airborne instrument and go.

A: Milt Huffaker (Coherent Technologies) - I think we are now ready to implement that, in my opinion.

Session VIII. Passive Infrared Technology