# Optical Receiver Module Evaluation for PDV

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# Design Goals

- Design an optical PDV receiver by integrating optical components (optical splitters, circulator, attenuator, etc) with the MITEQ optical detector in a single modular package.
- PDV module must be easy to use and adjust.
- Design the PDV receiver module so that it can be fabricated using contract manufacturing.

Acknowledgements

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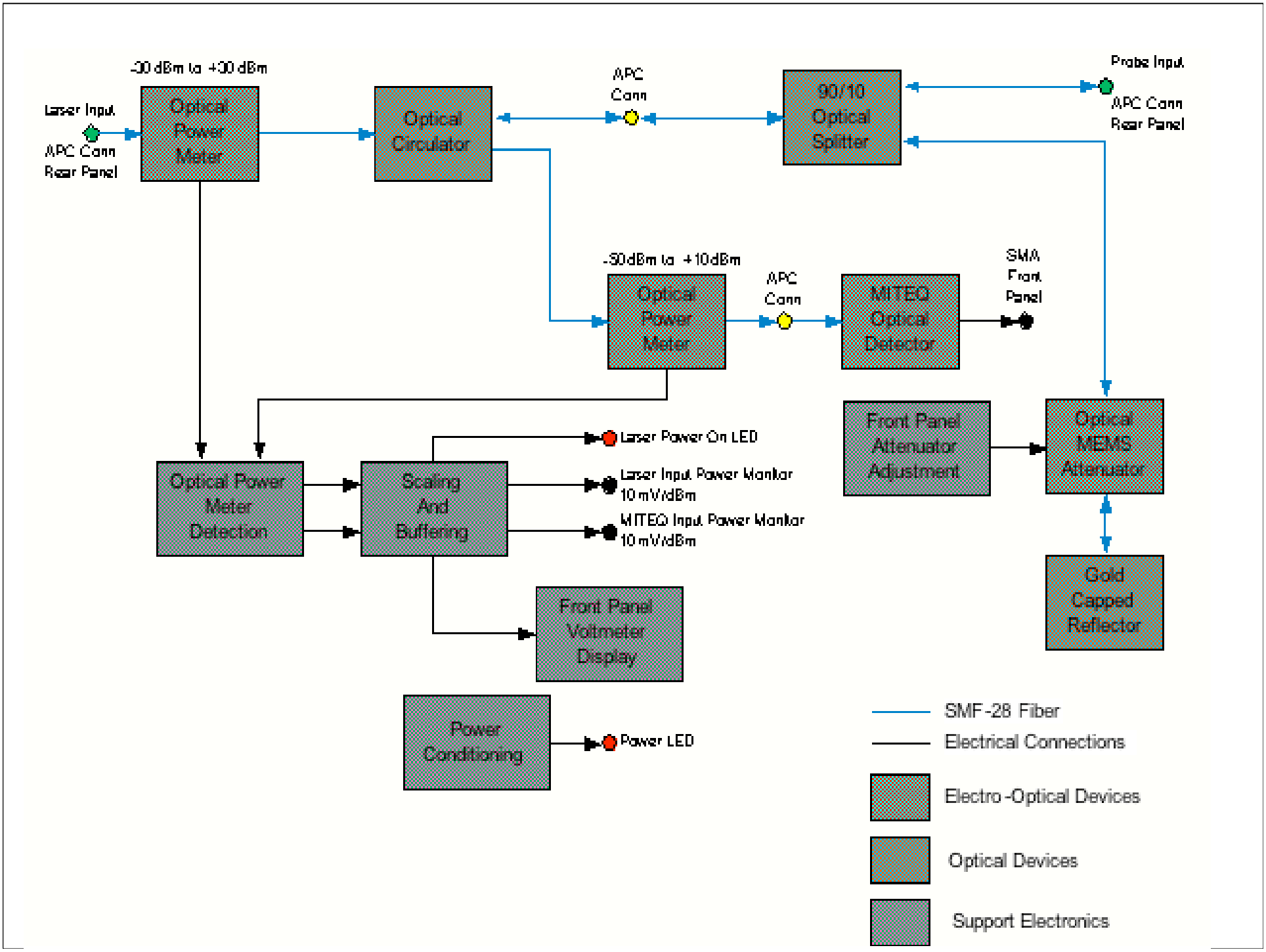
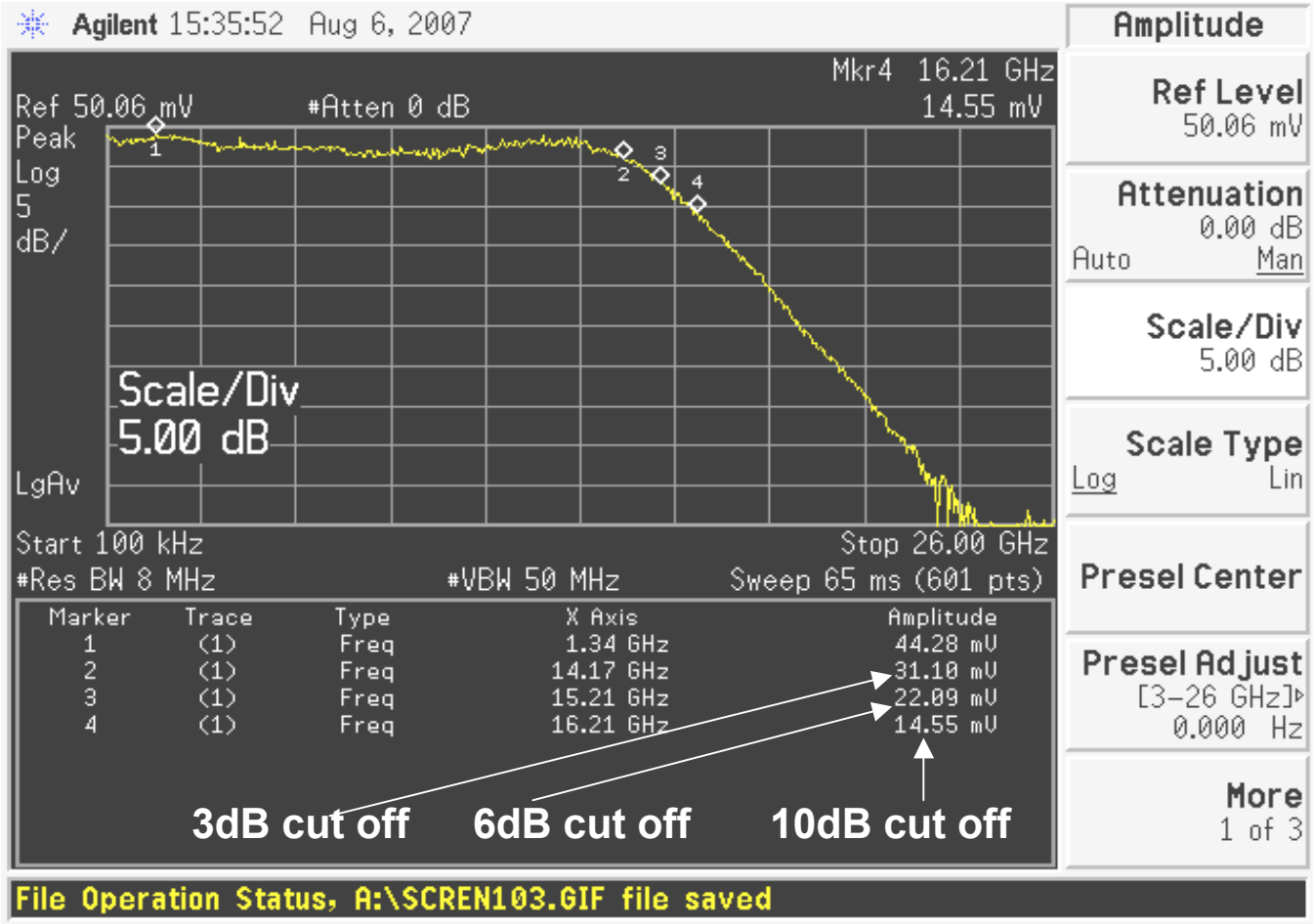
LANL

Dave Holtkamp

# 8-Channels of PDVs
# 3U Rack Mount


-30 dBm to +30 dBm
Laser Input
APC Conn
Rear Panel
Optical Power Meter
Optical Circulator
APC Conn
90/10 Optical Splitter
Probe Input
APC Conn
Rear Panel
-30dBm to +10dBm
Optical Power Meter
APC Conn
MITEQ Optical Detector
SMA Front Panel
Optical Power Meter Detection
Scaling And Buffering
Laser Power On LED
Laser Input Power Monitor 10 mV/dBm
MITEQ Input Power Monitor 10 mV/dBm
Front Panel Voltmeter Display
Front Panel Attenuator Adjustment
Optical MEMS Attenuator
Gold Capped Reflector
Power Conditioning
Power LED
SMF-28 Fiber
Electrical Connections
Electro-Optical Devices
Optical Devices
Support Electronics

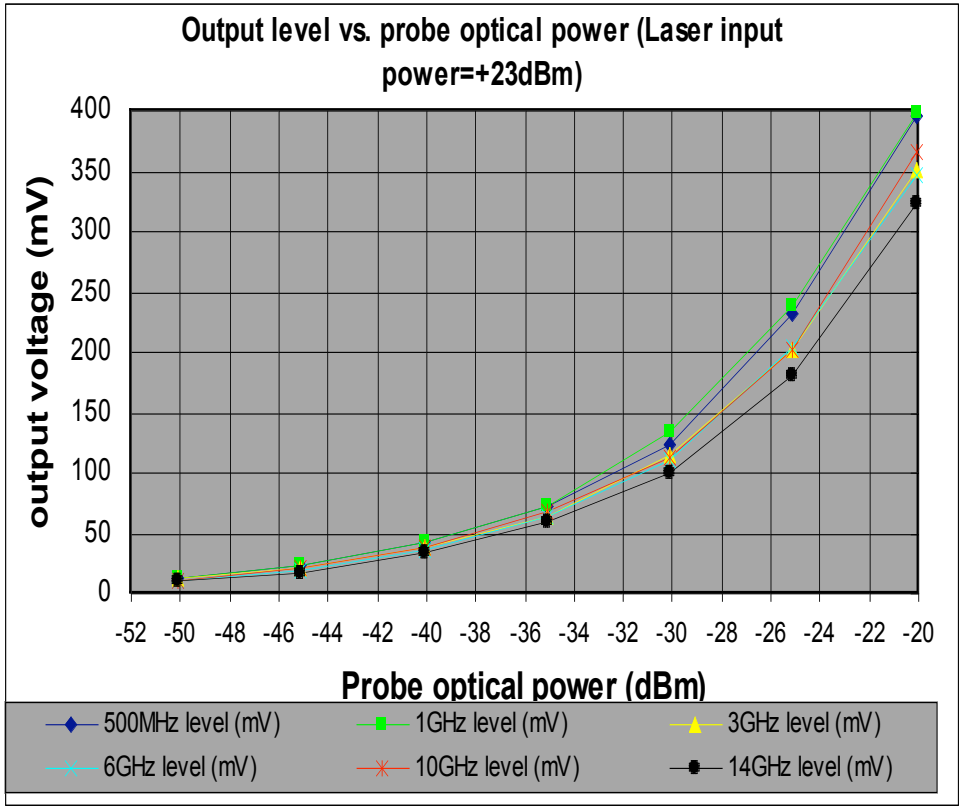
# PDV Receiver swept-wavelength Frequency Response using Agilent's tunable and IPG lasers



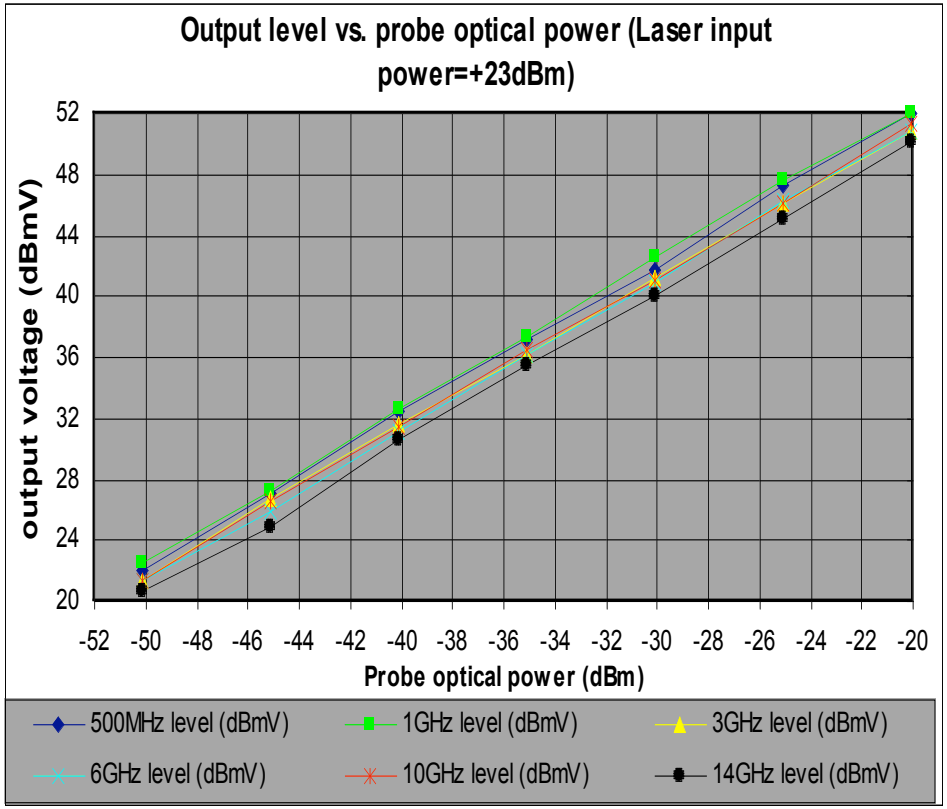

- Not all MITEQ detectors have a 3dB cutoff at 14GHz.
- MITEQ detectors have a specified 3dB cutoff at 13GHz.
- Each MITEQ detector has a different optical to electrical conversion gain.

# PDV Receiver Output Level

## Linear scale



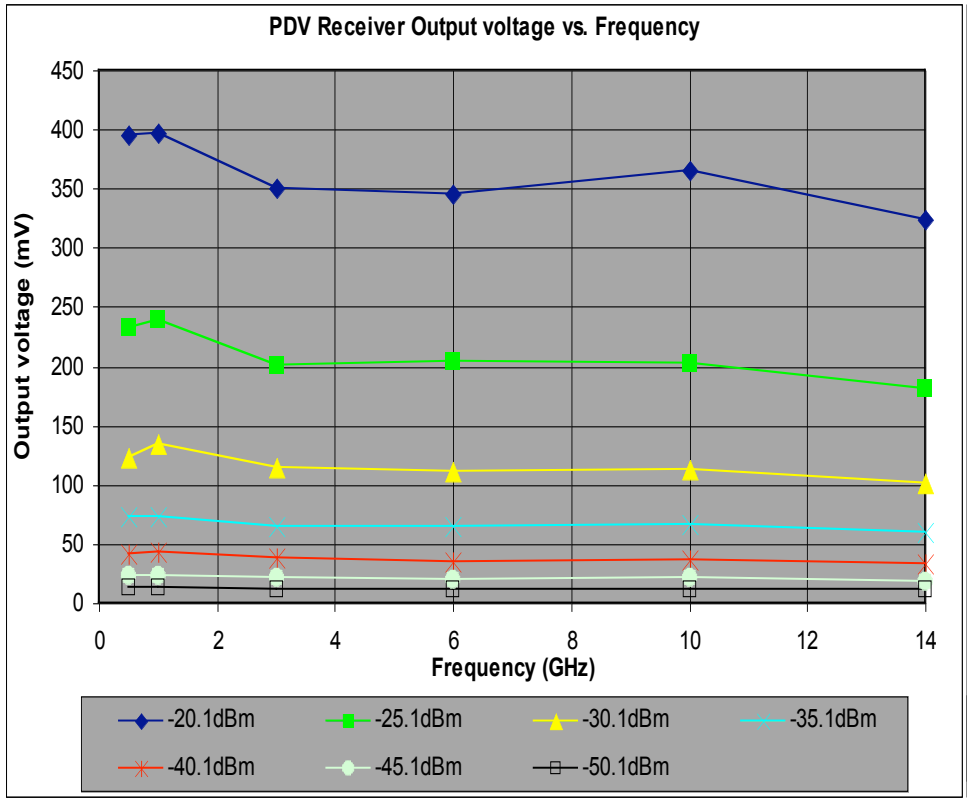

## Log scale



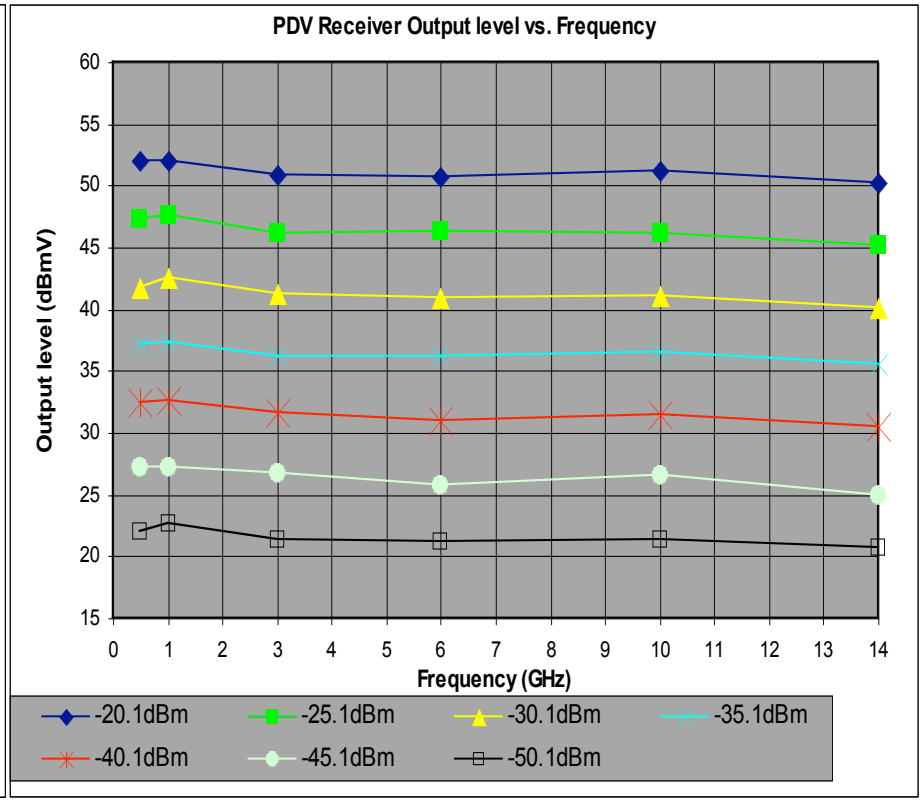

- The output level is lowest at 14GHz because of the 3dB frequency cutoff.
- The output level can be calculated from the unshifted (laser input) and shifted (probe) optical powers at the MITEQ detector and its optical to electrical conversion gain.
- Digitizer input range can be set from the calculation.

# PDV Receiver Frequency Response for different probe optical powers

## Linear scale



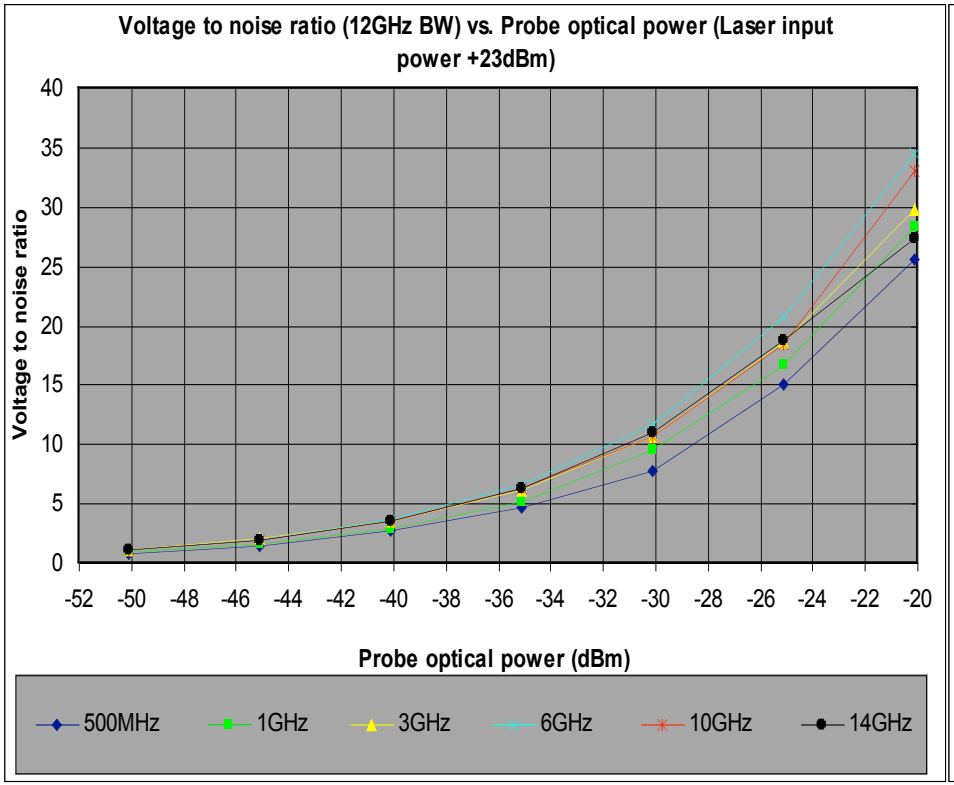

## Log scale



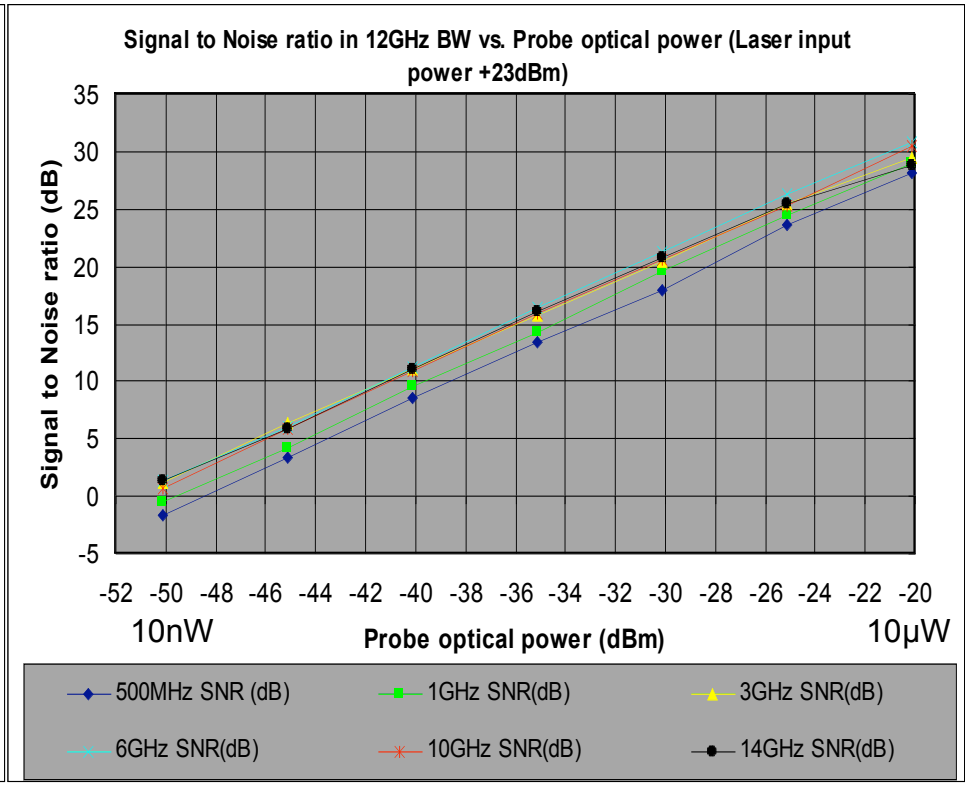

- As expected, the frequency response remains approximately the same for different probe optical powers.
- 1dB change in the optical power at the probe input will cause about 1dB change at the output.

# Optical Receiver Signal to Noise ratio in 12GHz Bandwidth

## Linear scale

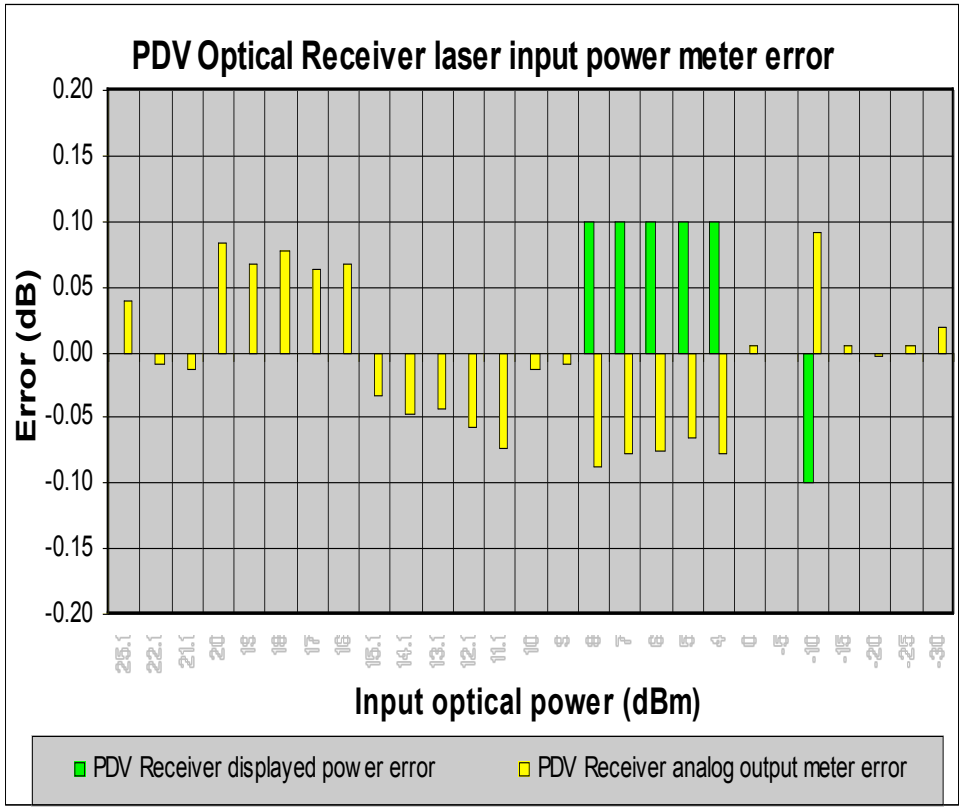


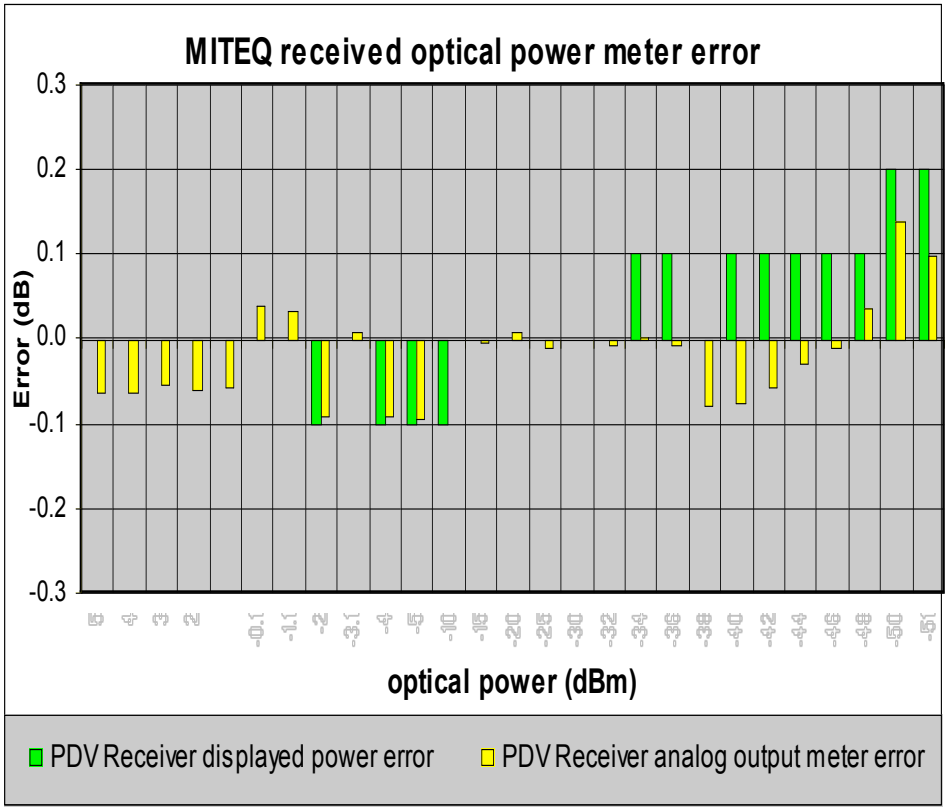

## Log scale




- Signal to noise ratio is affected by the receiving system bandwidth; the higher the bandwidth the lower the signal to noise ratio.
- A negative SNR just means that the signal will be indistinguishable from the system noise.
- Unshifted (laser input) light at the optical receiver is at 0dBm
- Dynamic range: 40 – 50 dB

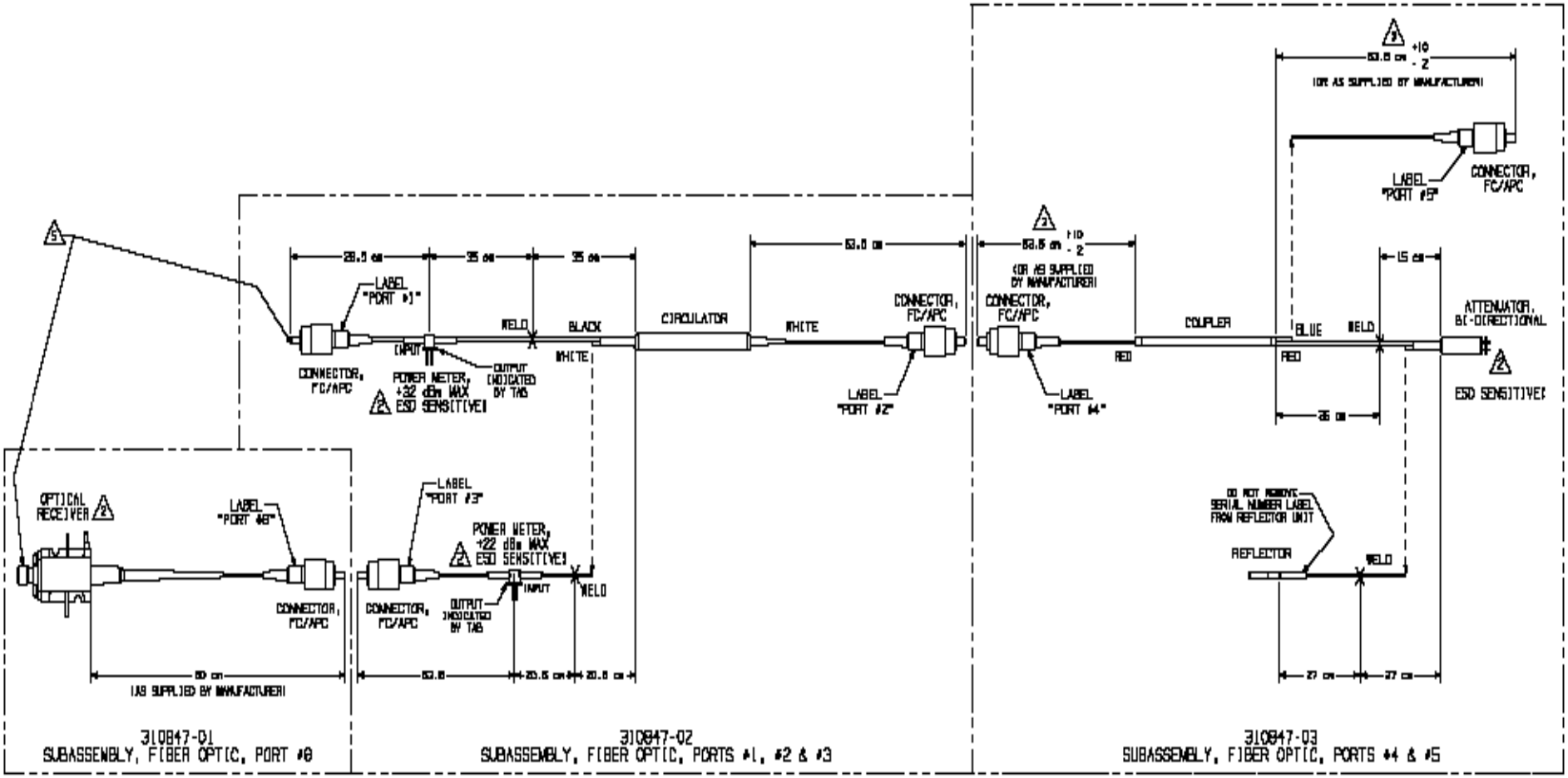
# PDV Receiver Optical Power Meters Error



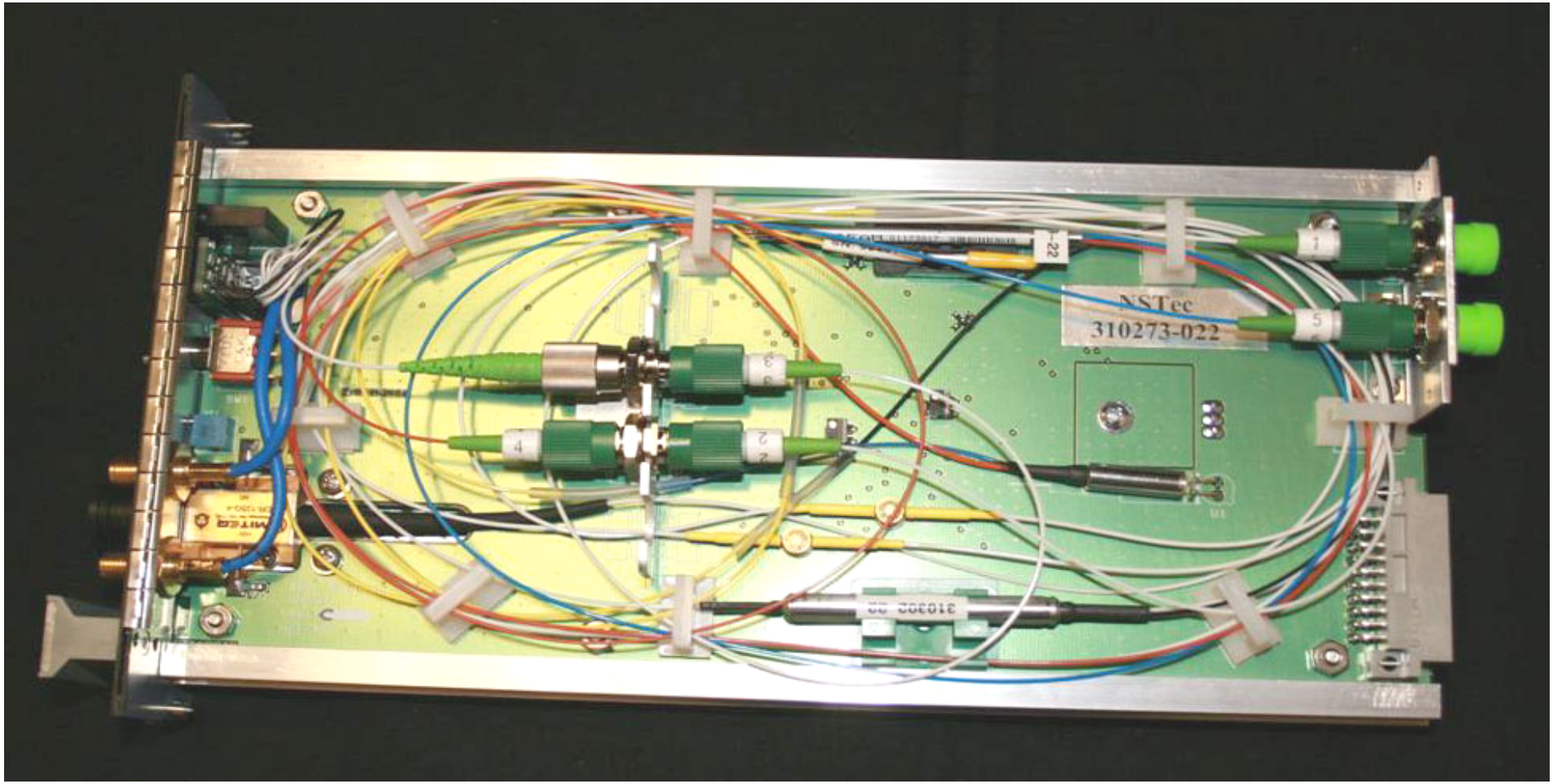

- Eigenlight's in line power meters have been used in most of the PDV systems.
- Eigenlight meter has been used as a baseline for the PDV receiver power meters evaluation.
- Eigenlight meters have an absolute accuracy specification of ± 0.2dB.

# Optical Assembly Diagram




Optical fibers are trimmed and welded as indicated on the above drawing.

# PDV Optical Receiver Module Top View



# PDV Optical Receiver Module Front View

# Projected Cost for Budgetary Purposes

- Power Supply and Rack $5K
- PDV Module $9K
- Rack with 8 PDV Modules $77K
- Rack with 4 PDV Modules $41K
- First delivery – 6 months
  - No contract manufacturer has been identified
  - Contract will have to go through the “purchasing” process

# Conclusions

- Modules can be easily replaced.
- System can be totally fabricated using contract manufacturing.
- Facilitates the implementation of a PDV system.
- There's a performance record associated with each module.
- Performance over temperature is work in progress.
- Dave Holtkamp has used this system to collect Hydro data.

## Contact Information

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# QUESTIONS