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

NSTec
  David Esquibel
  Eduardo Rodriguez
  Howard Dexter
  Doug Devore
  Vince Romero
  Claudio Lopez
  Adam Iverson

LANL
  Dave Holtkamp
8-Channels of PDVs
3U Rack Mount
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.
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.
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**

Voltage to noise ratio (12GHz BW) vs. Probe optical power (Laser input power +23dBm)

<table>
<thead>
<tr>
<th>Probe optical power (dBm)</th>
<th>Voltage to noise ratio (dB)</th>
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<tbody>
<tr>
<td>-52</td>
<td>40</td>
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<tr>
<td>-50</td>
<td>35</td>
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<td>-48</td>
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<td>-38</td>
<td>5</td>
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<tr>
<td>-36</td>
<td>0</td>
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</tbody>
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**Log scale**

Signal to Noise ratio in 12GHz BW vs. Probe optical power (Laser input power +23dBm)

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- 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
- 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.

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QUESTIONS