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Spectral dependence of CPV current generation in the San Gabriel Valley

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Outline

- Measured and Modeled Solar Spectra in Monrovia
  - Is there a way to directly correct for spectrum in a power measurement
- Transmission of the Optical Path
- Measurements of Isotype CPV units and comparison with full TJ current production

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Direct Spectrum Measurements

- Performed using Ocean optics fiber-coupled USB spectrometer
- Spectrometer outfitted for 350-1000nm operation
- Fiber input is calibrated using spectrally calibrated light source, ‘collimated’ using baffles
- Calibrated output can be directly compared to AM1.5D spectrum, integrated with QE to give expected current generation of top/middle junctions
- Generate a correction factor to estimate spectral effects on current generation

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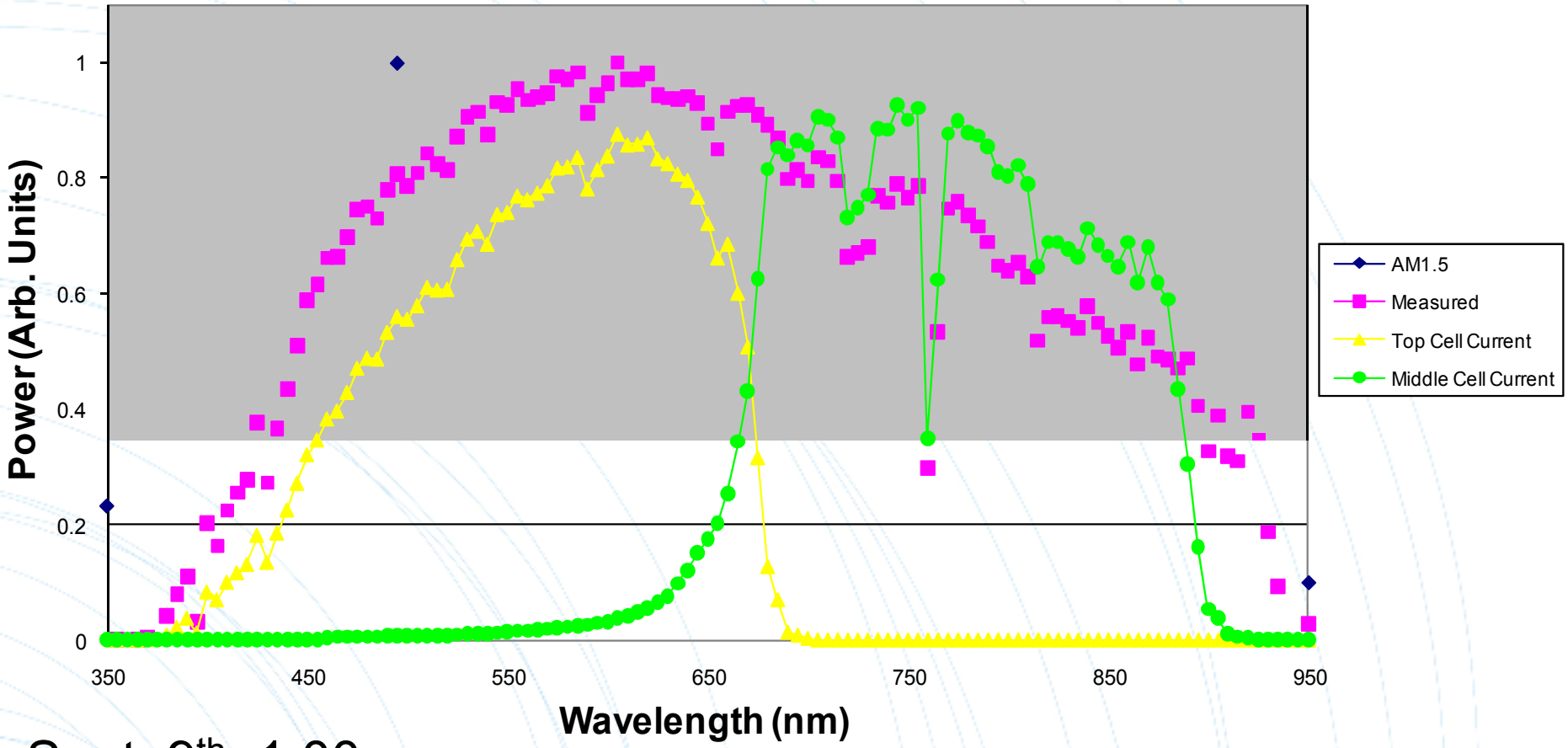
Measured Solar Spectrum



Sept. 9th, 1:00 pm

Direct				Through Optics			
	Top	Middle	Ratio		Top	Middle	Ratio
AM1.5	6.110183	6.326033	0.982643	AM1.5	5.4470991	5.684606	0.978663878
Measured	9.770425	10.81377	0.949313	Measured	8.8365355	9.721431	0.952317219
				Output Correction Factor			**1.03**

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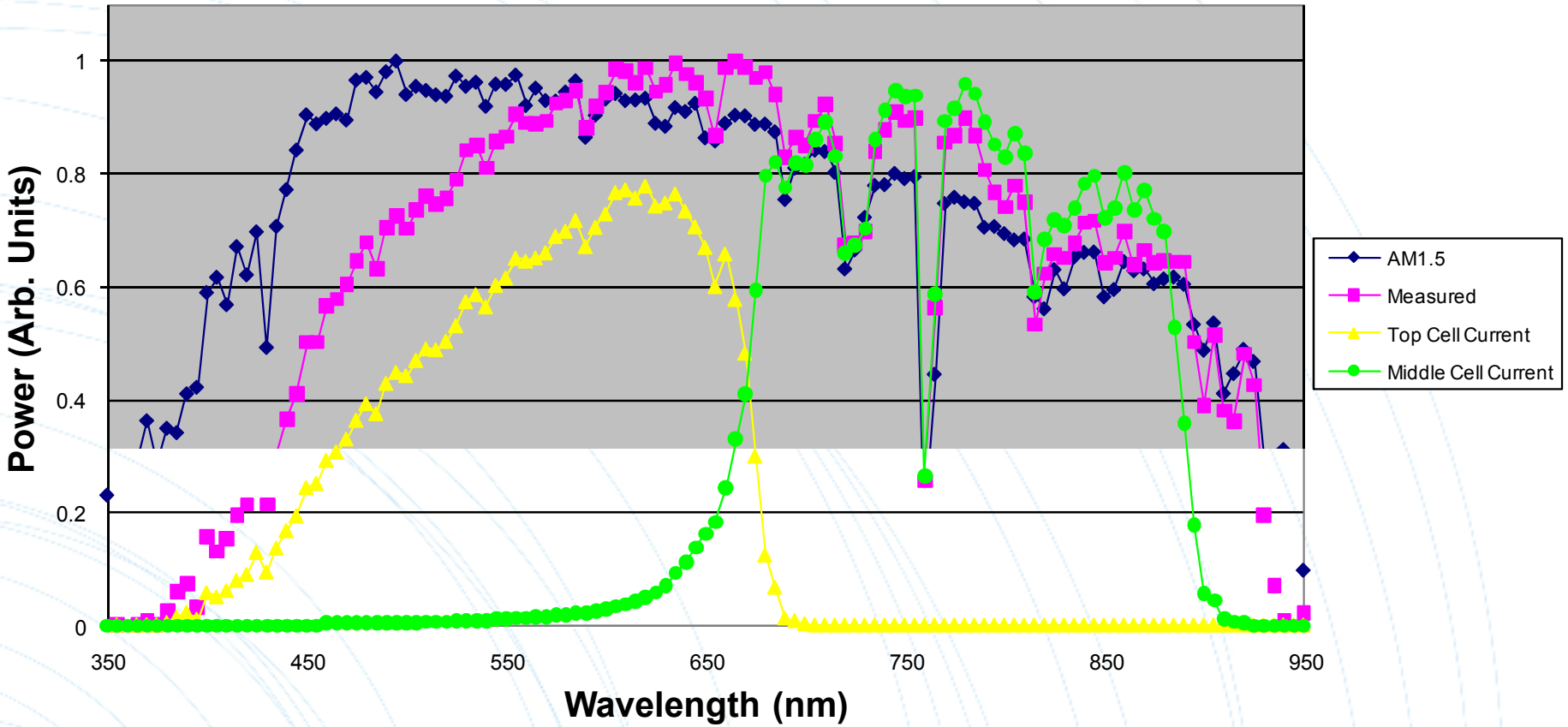
Measured Solar Spectrum



Sept. 9th, 9:30 am

Direct				Through Optics			
	Top	Middle	Ratio		Top	Middle	Ratio
AM1.5	6.110183	6.326033	0.982643	AM1.5	5.4470991	5.684606	0.978663878
Measured	5.536455	7.361426	0.858506	Measured	5.0085128	6.61561	0.861744643
				Output Correction Factor			**1.14**

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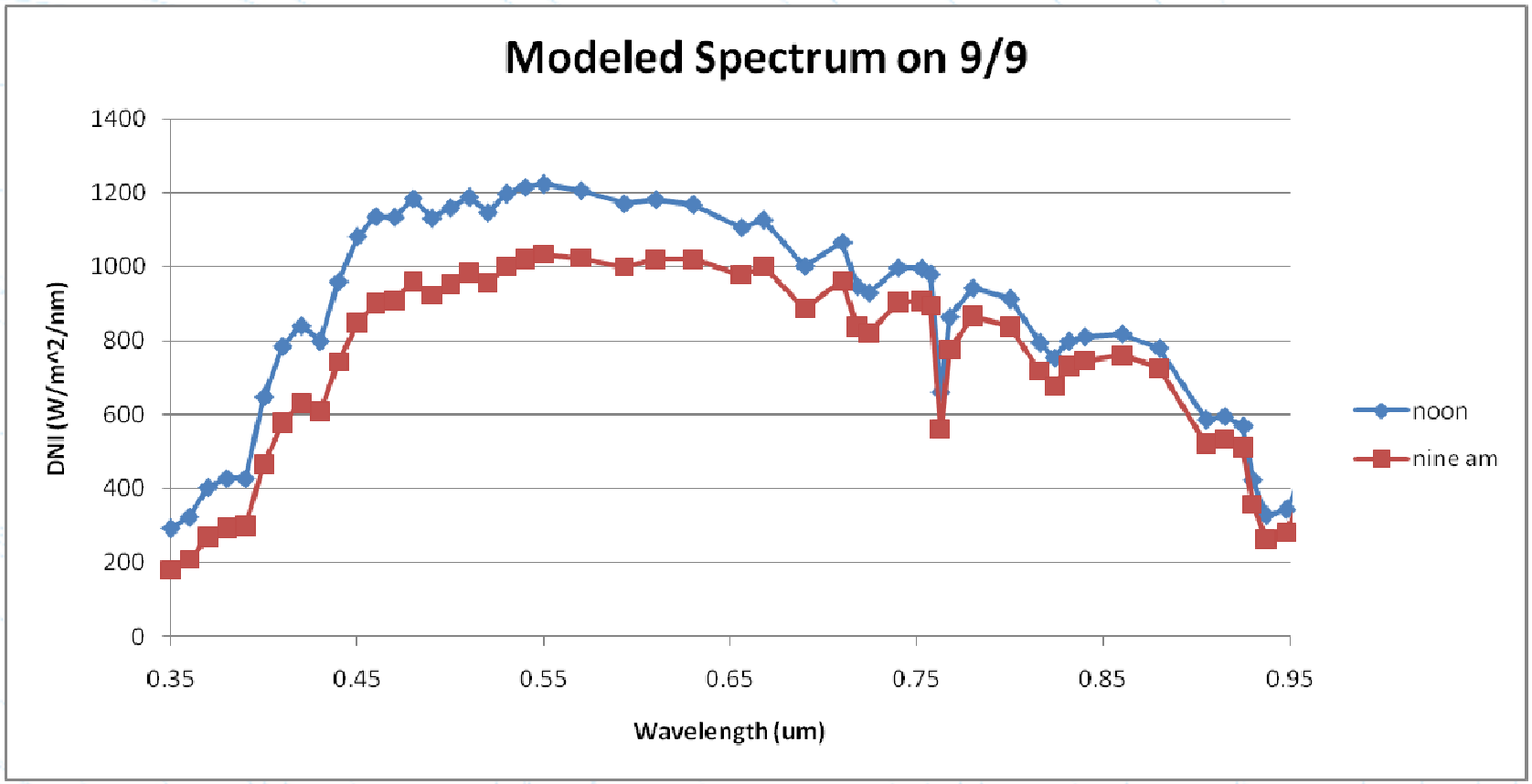

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Issues with Direct Spectrum Measurements

- Difficulty in calibrating
- Processing the spectral data was somewhat time consuming as a result
- Correction factors were not always well correlated with on sun measurements (see point 1)
- This technique was left, in favor of measurement of isotype cell current generation under Soliant Energy optics

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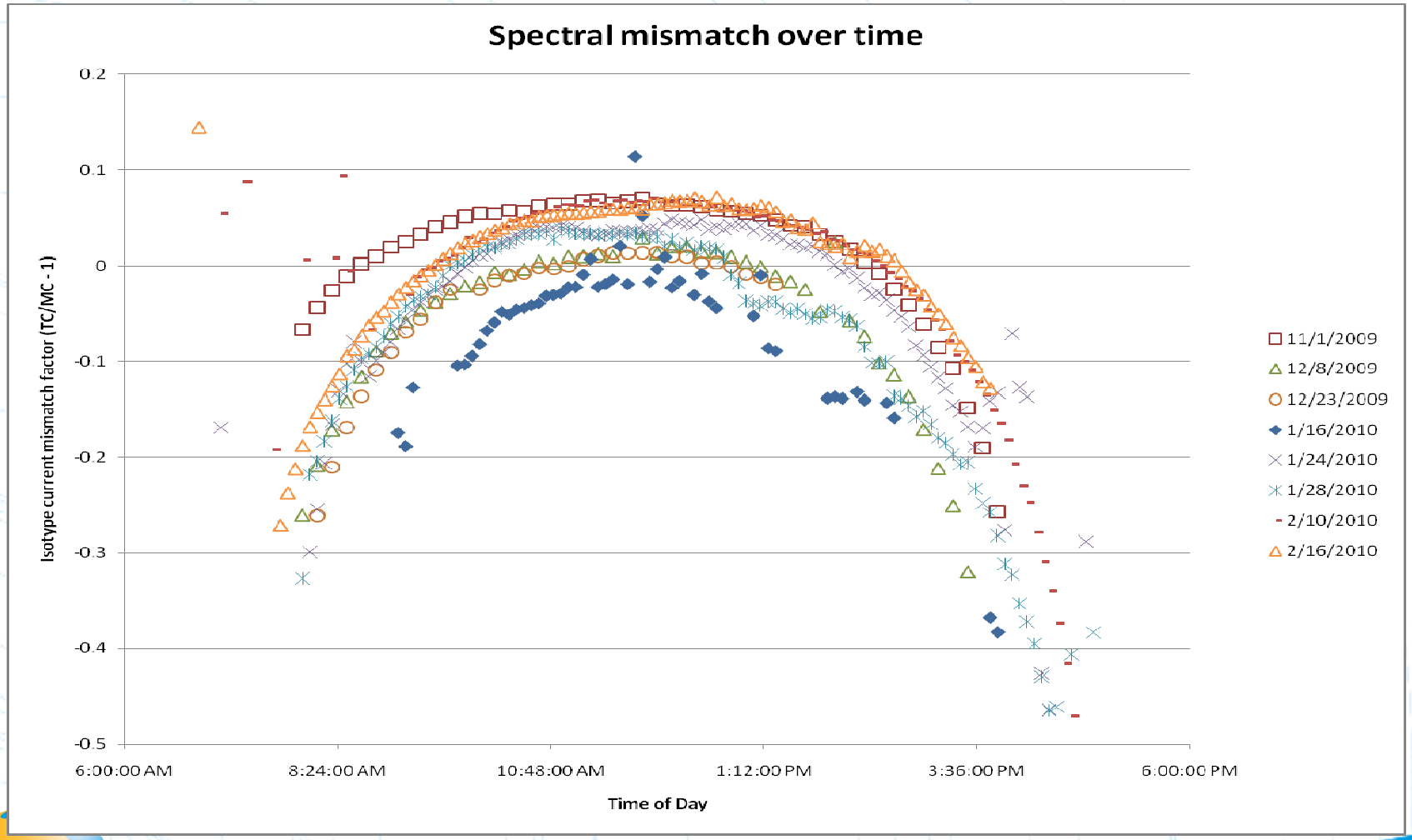
Isotype module current production



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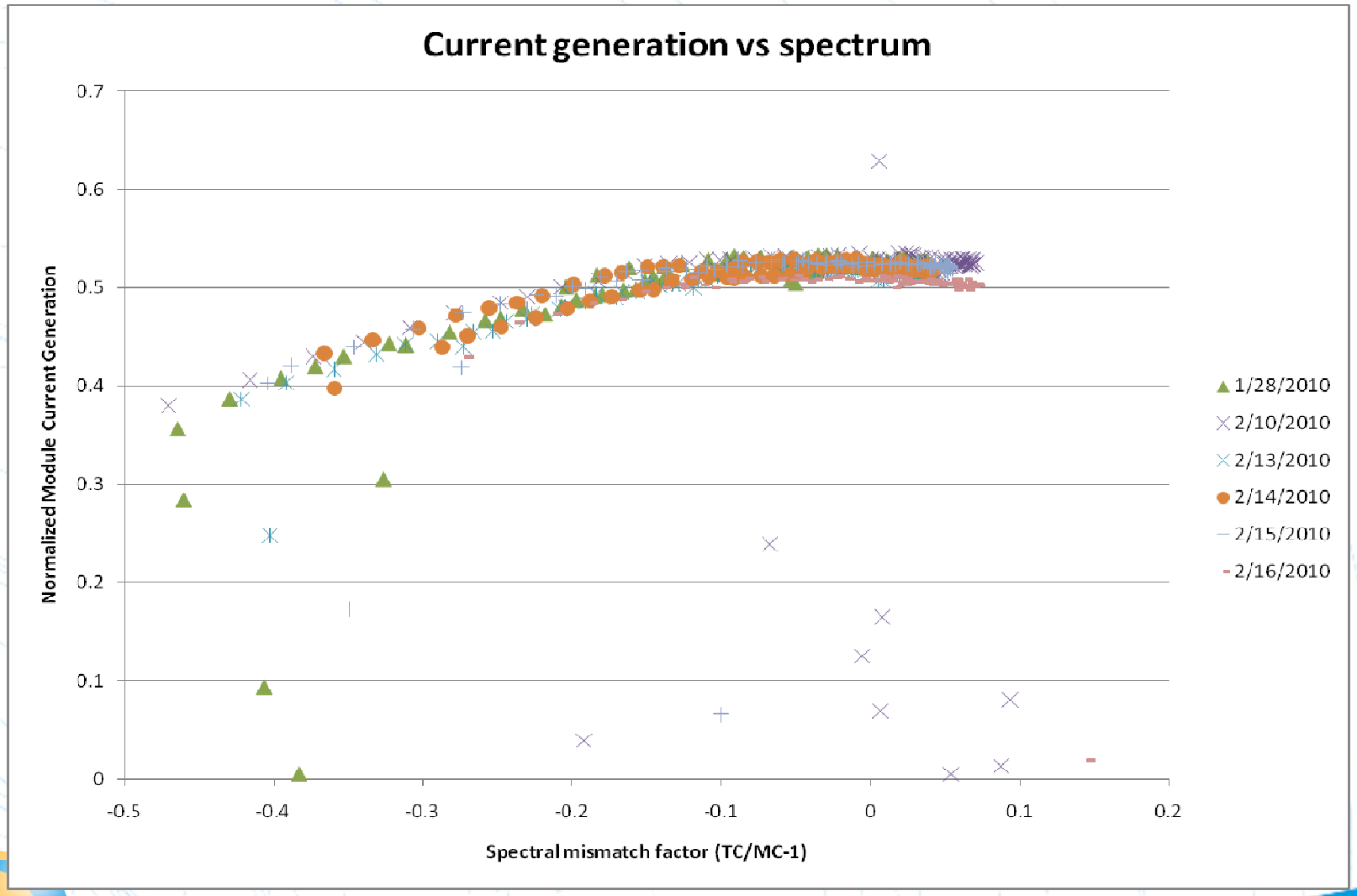
Current Production vs. Isotype current ratio



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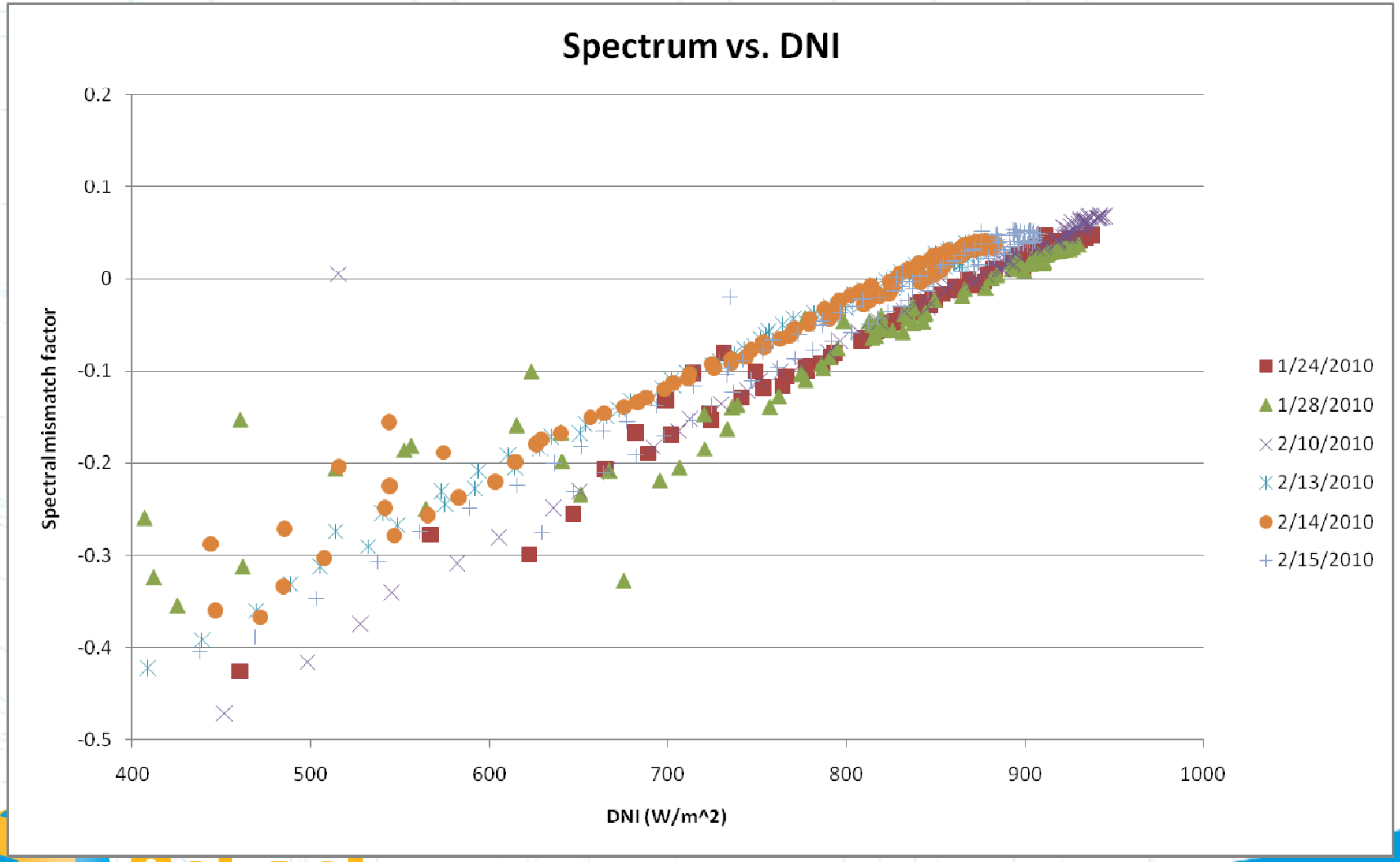
Spectral mismatch vs. Incoming DNI



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Next Steps

- Generate proper model for effects of spectrum on CPV module performance
  - Is the isotype module measurement robust?
  - Can the spectrometer give us more/better information?
- Look for site dependence in performance due to spectral variations

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