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Title:	NACHOS-NASA-LED Circuit Operation
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NACHOS-NASA-LED Circuit Operation

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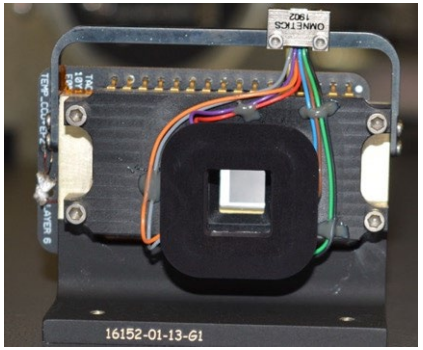
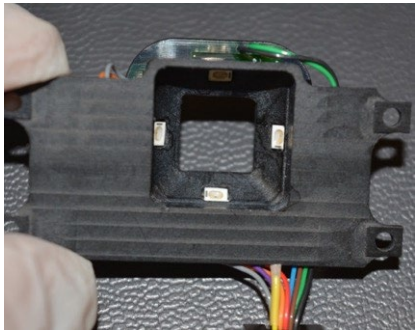
NASA

LED-based onboard CCD non-uniformity calibration

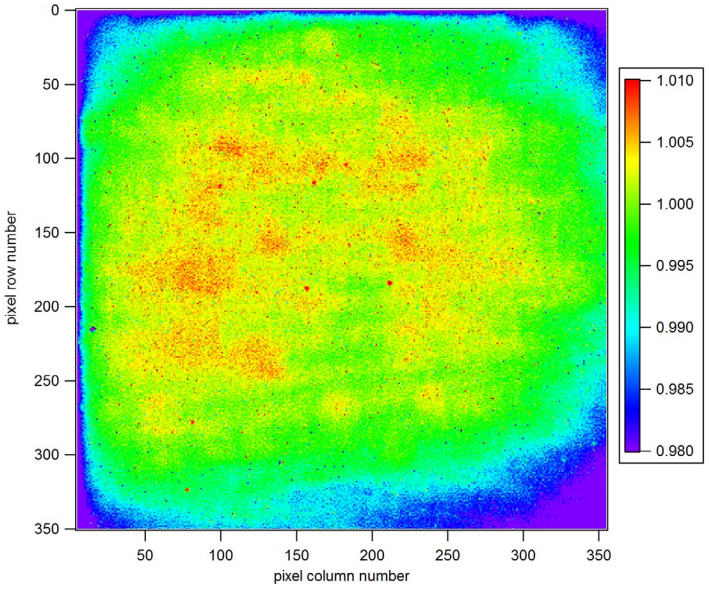
- CCD module, with zero-order baffle and calibration LEDs:

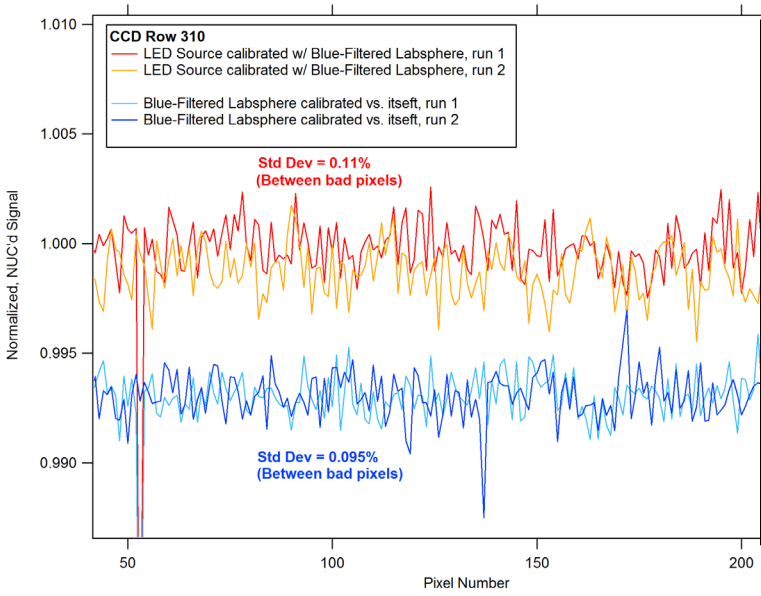




- This is used for an on-board relative calibration and not an absolute calibration

- Uniformity of LED illumination, calibrated against external uniform source (Labsphere):

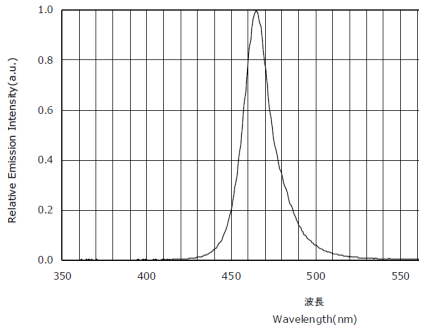


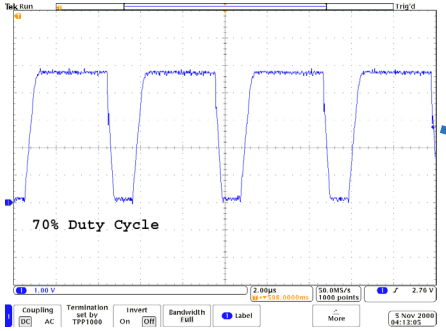


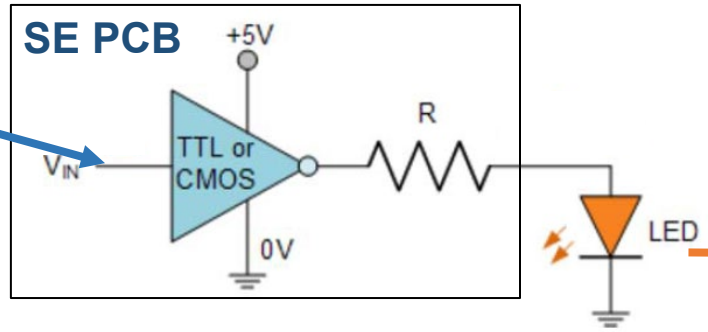
LED Electrical Operation

- **Circuit is based on a design where it is used for operational verification of a gamma ray detector**
- **Each LED has a matching resistor**
- **Each OpAmp drives two LEDs**

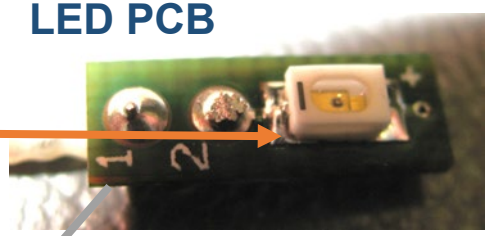
Nicchia NSB100BT Blue LED Spectrum



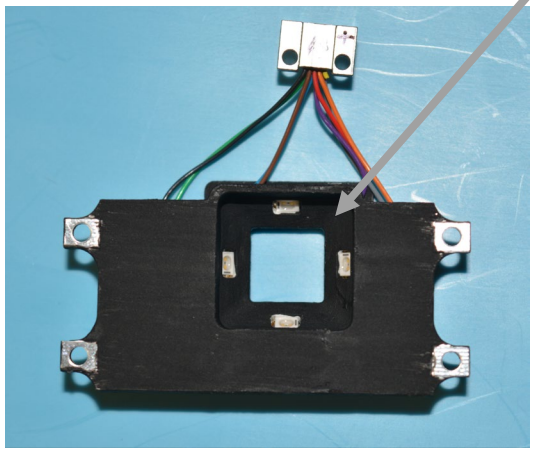




LED PCB



Four LED boards are mounted in the CCD housing and are used to uniformly light the CCD



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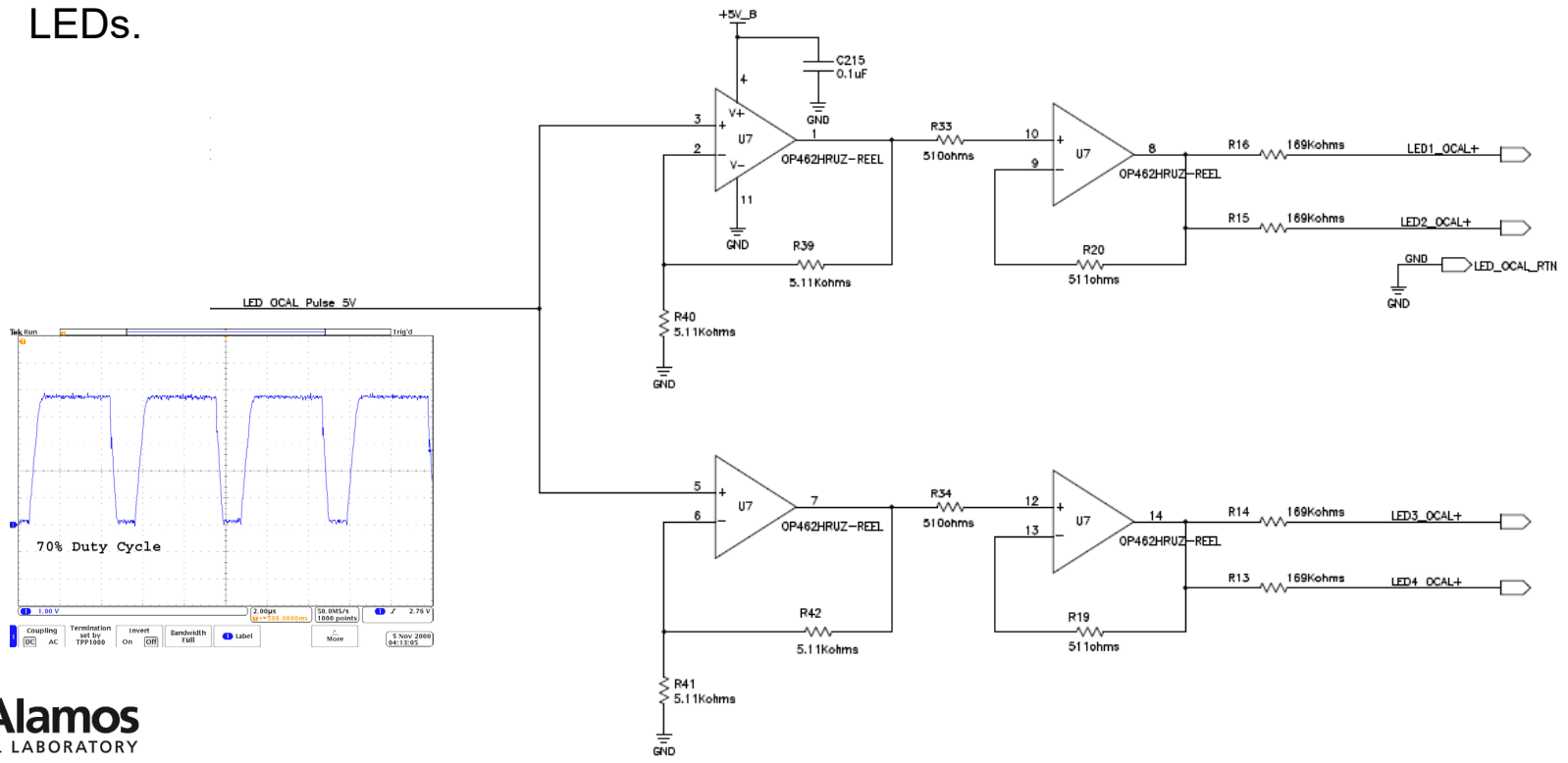
LED Circuit Operation

- **The LED control signal comes from the FPGA and is scaled to 5V.**
  - LED luminosity is controlled via pulse width modulation of this signal.
  - A higher PWM duty cycle results in more average current to the LED and more radiant energy to the CCD
- **The LED circuit from the PWM signal and onward is shown below.**
  - Opamps circuits are used to buffer the signal and control the current supplied to the LEDs.



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