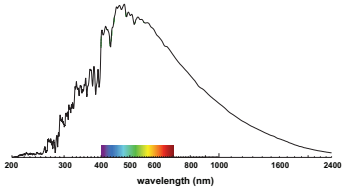
Compact Solar Spectral Irradiance Monitor (CSIM)

PI: Erik Richard, LASP-Univ. of Colorado

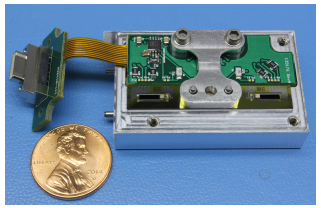
Objective

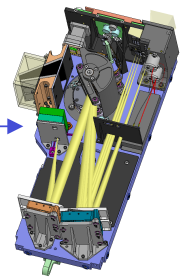
- Develop a compact solar spectral irradiance (SSI) monitor that is a cost-effective and low risk alternative instrument that allows for considerable implementation flexibility, high calibration accuracy and improved performance stability over the present technology
  - Performance goals: 0.2% uncertainty (k=1) absolute, SI-traceable spectral accuracy (200-2400 nm) with 100 ppm relative stability
  - Reduction of mass to 1/10th and volume to 1/20th of current TSIS SSI instrument
  - Technologies include simplified optical components and commercially available electronic and electro-optic subsystems to achieve a large cost reduction
- Achieve a flight-qualified instrument ready for demonstration on small satellites, including U-class satellites

Solar Spectral Irradiance (SSI)

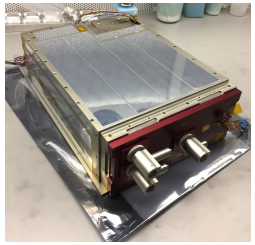


CSIM CnT Bolometer ESR

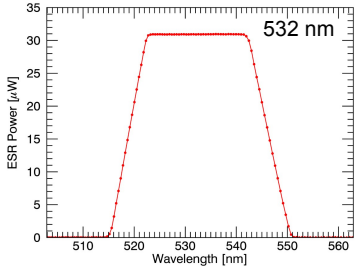




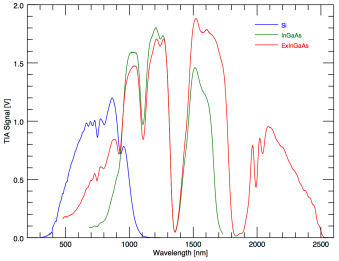
Complete CSIM 6U CubeSat



ESR spectral point-spread function (SRF:Cryo calib. - NIST Traceable)



Full Photodiode Heliostat scan



Accomplishments

- Designed, built, and tested a 6U compatible flight-like CSIM radiance instrument
- Qualified and life-tested the shutter and prism rotation drive mechanisms for space operation
- Developed, performance tested, and calibrated a novel Electronic Substitution Radiometer (ESR) based on Si-substrate and Carbon Nanotube absorber.
  - Demonstrated noise performance 3x lower than TSIS SIM at 284 pW at measurement frequency.
- Built and tested a Xilinx FPGA with embedded MicroBlaze micro-processor board for controlling the instrument using LASP developed flight software
- Tested the solar response performance of the photodiode detectors in the LASP Heliostat
- Demonstrated CSIM preliminary radiometric calibration against the NIST-traceable cryogenic radiometer.
  - Results demonstrate a calibration to < 0.25% absolute
- Successfully completed CSIM environmental test for thermal-vacuum, thermal balance tests, and launch survival vibration

Co-I's/Partners: D. Harber, M. Snow, J. Harder, LASP; N. Tomlin, M. Stephens, J. Lehman, NIST

TRL_{in} = 3 TRL_{out} = 6

ESTO Earth Science Technology Office