Acceptance testing and characterization of the VIS-RSS slated for permanent deployment at the SGP site

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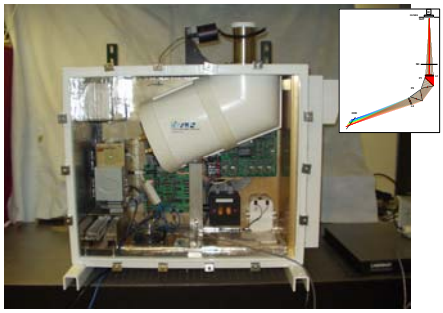
Introduction

The RSS originally was developed at ASRC. Several versions of RSS's were deployed at SGP and NSA ARM sites. The performance of UV and VIS-NIR prototype RSS was discussed at:

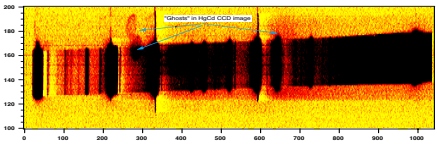
Kiedron, P.W., L. Harrison, J.J. Michalsky, Jr., J. Schlemmer, and J.L. Berndt, Data and Signal Processing of Rotating Shadowband Spectroradiometer (RSS) Data, *2002 Annual Meeting of SPIE, Seattle, Washington, July 10-11, 2002*

Kiedron, P. W. , L. H. Harrison, J.L. Berndt, J.J. Michalsky, A.F. Beaubien, Specifications and performance of UV rotating shadowband spectroradiometer (UV-RSS), *SPIE's 46th Annual Meeting,San Diego, Ca, 2001, SPIE Proc. 4482*

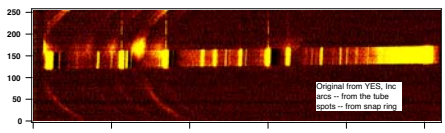
This technology with a new opto-mechanical design was transferred to YES, Inc. The first unit ever built by YES, Inc. was purchased by ARM in 2001. Its acceptance testing and characterization are being performed at ASRC. Because several serious problems were discovered the complete characterization and deployment are being postponed.

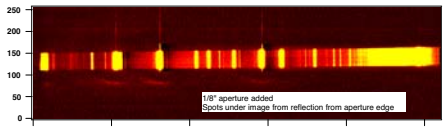


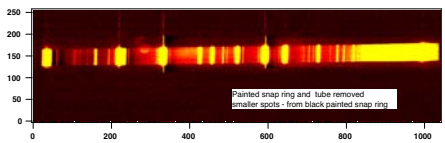
Tracking Ghosts and Scattered Light
November-December 2001

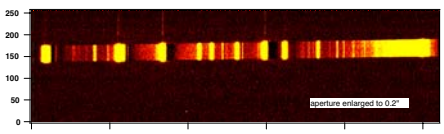


In the image of Hg-Cd lamp on CCD "ghosts" were observed. We have traced them to improper apertures, baffles and lens mount in the fore-optics. The "ghosts" were removed after some shiny surfaces were painted black and by adding additional apertures that removed some non-axial reflections.

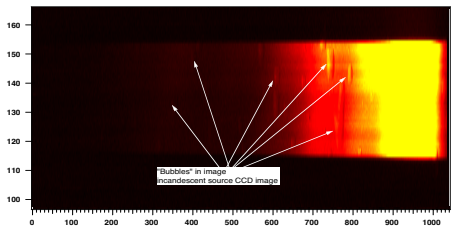


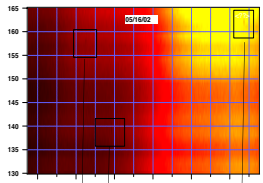


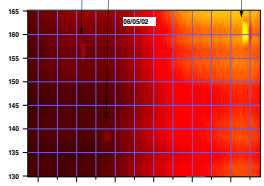




Oil Condensation on Cooled CCD
January 2002 - September 2002

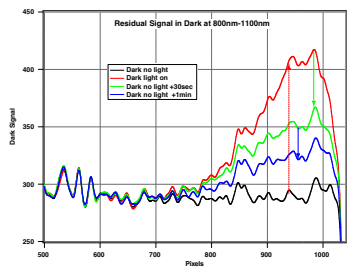


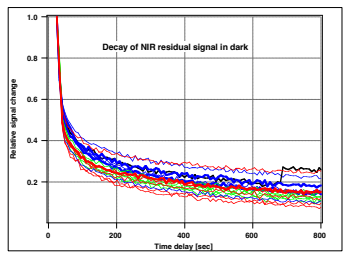




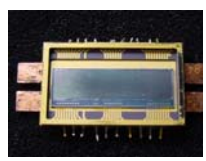
In the image of incandescent lamp on CCD we have observed apparent "bubbles" that were not present several months before. Oil drops were found on the CCD. Together with YES, Inc. we performed various experiments to trace the source of the out-gassing oil. We purged the heated casting with dry nitrogen and collected out-gassed solids. Different casting impregnation method were tried. First solutions failed when we observed condensation growth over one month of RSS operation. Subsequently, YES, Inc. found new casting impregnation method, replaced thermal compound with indium solder and added an active charcoal filter. This version of instrument was delivered to ASRC in September 2002.

CCD Contamination: Thermoluminescence
December 2002 - February 2003

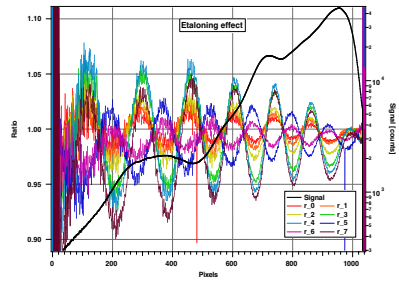


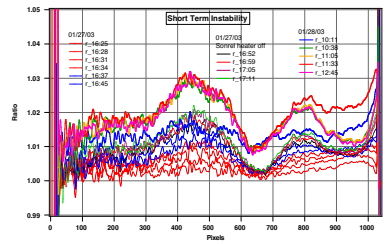


A new effect was observed in the dark signal (closed shutter). After exposure to light with open shutter a subsequent close shutter readout contains residual signal in the NIR range. This signal is relatively small but proportional to the irradiance during open shutter measurement. The magnitude of residual signal decays exponentially. This effect has all attributes of thermal luminescence. We suspect that the CCD got contaminated when cleaned in alcohol to remove oil droplets. We found new small droplets of oil on the CCD. This CCD was replaced with a new one.



Radiometric Stability
January 2003-Present





Two color glass filters (UG-3 and BG-14) are used to reduce signal dynamic range. The filters were located between integrating cavity and slit. The filters were not cemented. A strong etaloning effect in the air gap between the filters was observed that was dependent on ambient temperature. The etaloning effect was removed when filters were cemented but radiometric stability still did not meet specifications. Apparently temperature stabilization of the filters was insufficient. We have decided to move the filters closer to the lens (between lens and shutter) where a better temperature control is expected.

Characterization

Resolution and stray light in the RSS is comparable to that of earlier ASRC-built prototypes and the readout noise is better by 2-3 factor. The latter is because YES, Inc. implemented an analog dual-slope integrator prior to A/D conversion.

After the RSS is rebuilt a complete characterization will be performed: (1) departure from linearity, (2) noise, (3) wavelength stability, (4) wavelength assignment, (5) radiometric stability, (6) radiometric calibration and (7) two dimensional angular response.