SALT Development Report
To The SALT BEC
As At 2015 January

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1. Scope 1
2. Management and Meetings 1
3. Calibration System Upgrade 2
4. RSS Focus Gradient 4

1. Scope

This reports on work carried out since the 2014 Nov Board meeting in Pune, India.

2. Management and Meetings

Much time has been spent since 2014 Nov on management meetings, as well as 1-to-1 meetings with relevant personnel, relating to the unification of Astro Ops and Tech Ops to form one SALT Ops unit under the direction of Chris Coetzee. Details can be provided on request.

In addition, a SALT review meeting was held on 2014 Dec 8 at which all available personnel involved in SALT Operations were present. The agenda was as follows:

(i) SALT Ops re-organization: Ted, Mike, Chris	(10 min)
(ii) Recent SALT Board meeting: Mike	(5 min)
(a) Fault tracking: (Steve+Christian)	(10 min report; 5 min discussion)
(b) Updates on ongoing projects (All)	(10 min total; 5 min discussion)
(c) New Calsys (Eric + Darragh):	(10 min report; 5 min discussion)
(d) RSS focus gradient (Darragh):	(5 min report; 5 min discussion)
(e) RSS Collimator (Ockert + Petri)	(10 + 5 min report; 5 min discussion)
(f) Payload progress (Janus)	(5 min report; 5 min discussion)
(g) Stray light, RSS other work (Keith)	(10 min report; 5 min discussion)
(h) SAMS 7-seg testing (Hitesh)	(10 min report; 5 min discussion)
(i) HRS status update (Lisa)	(5 min report. 5 min discussion)
(j) Improving communication	Darragh to kick start: 10 min
(k) Prioritization of issues	Petri to kick start: 10 min

A zip file containing the presentations is attached.

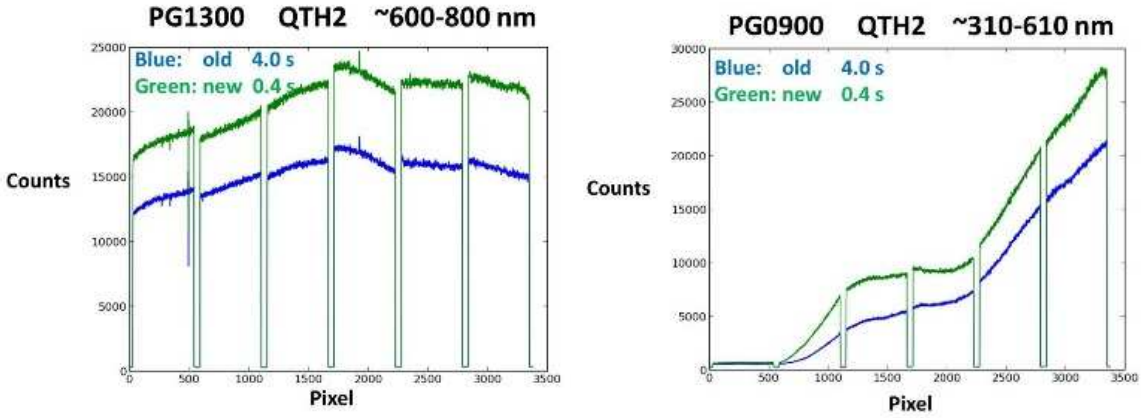


Fig. 1: First results from testing the new Calsys: spectroscopic flats

3. Calibration System Upgrade

Most of my efforts were spent on assembly, installation and testing of the new Calsys. As at the time of the IUCAA Board meeting, all parts had been delivered and assembly was about to begin. This was completed and installation on the telescope took place by early December.

The first test results concentrated on spectroscopic flats, two examples of which are shown in Fig. 1. In these plots, two sets of data are shown, one in blue, the other in green. The blue line refers to the performance of the old Calsys with the exposure time indicated. The green line refers to the new Calsys, also with the exposure time indicated. The axes show counts versus RSS detector pixel number – the gaps between the amplifiers are evident as 5 dips. The approximate wavelength range is indicated and the light source was a QTH lamp. **The key point to note from these plots is that the numbers of counts in the new Calsys, under the same setup as the old, are larger than in the old, despite the fact that the exposure times are 10 times shorter, indicating an apparent factor of 10 improvement in efficiency**. Fig. 1 shows just two examples but all gratings in blue and red configurations were tried and the result was the same for each one.

Especially pleasing is the improvement in the right panel in Fig. 1 which shows much improvement in the deep UV of perhaps a factor of 20.

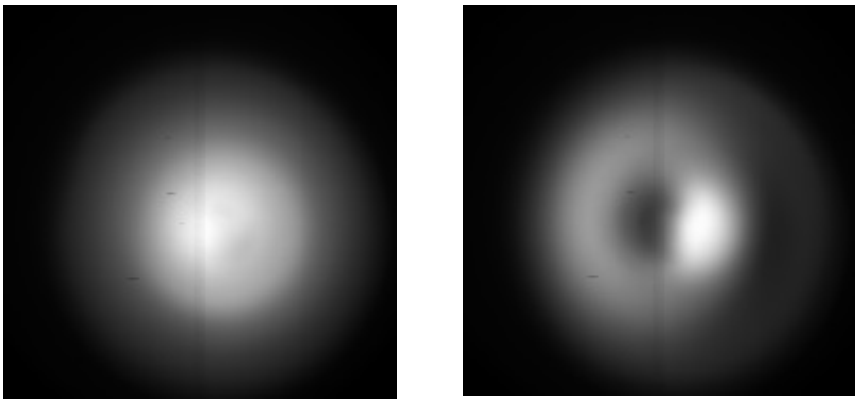


Fig. 2: Imaging flats from the new Calsys

Unfortunately, the huge apparent success of the performance of the new system was moderated by the appearance of imaging flats as shown in Fig. 2. These images indicate the light distribution over the Salticam focal plane. There are two liquid light guides in the Calsys and the left image in Fig. 2 from one light guide shows a far more peaked distribution than is acceptable, falling off by more than a factor of 3 from the centre of the science field to the edge. In the right image, the light distribution is roughly donut-shaped with a bright spot on the right hand side.

Initial efforts, shortly before the Christmas break, to diagnose the cause of these problems were only partially successful. Applying diffusers to one end of the liquid light guides did not improve the situation materially. However, the cause of the peculiar light distribution in the right hand image of Fig. 2 was shown to be due to a bend radius for the light guide which was too small (despite it being the same as in the old Calsys).

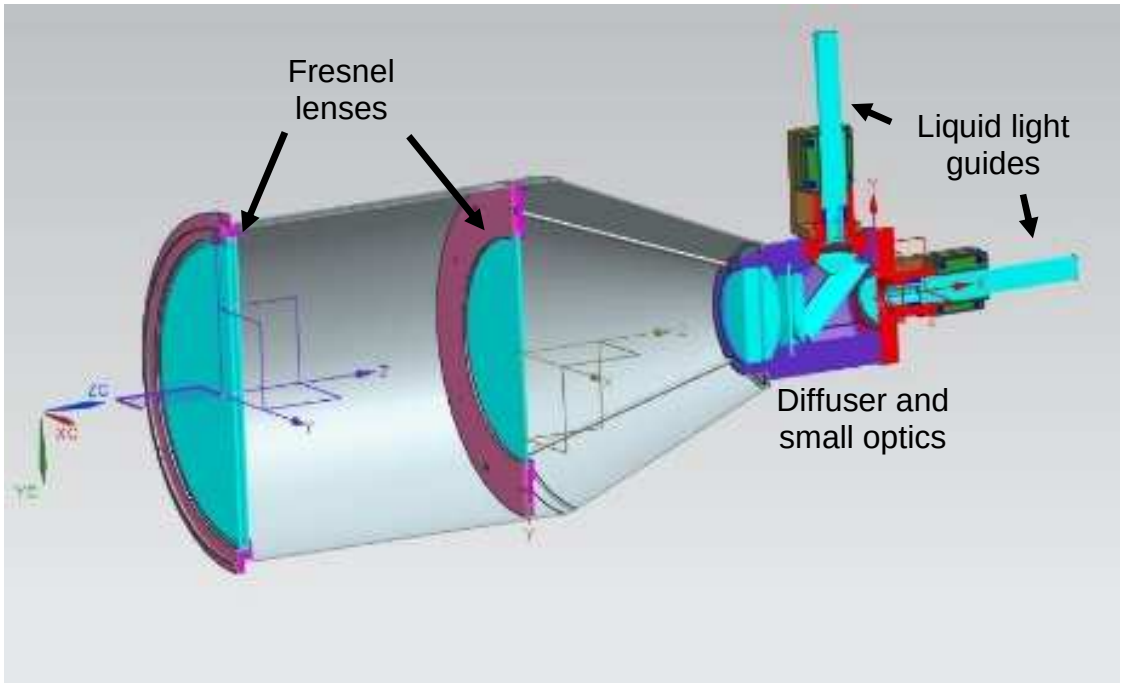


Fig. 3: Design of the new SALT Calibration System

Further investigation immediately after the New Year showed the cause of the peaked light distribution as being due to a non-uniform angular distribution of light emerging from the light guides into the Calsys and therefore causing a non-uniform illumination of the diffuser as indicated in Fig. 3. The illumination distribution on the diffuser is imaged on to the telescope focal plane by the Fresnel lens system + SAC.

Experiments involving ad hoc adjustments to the interface where the light guides enter the Calsys (coloured green and red in Fig. 3) showed that it was possible to achieve a much more uniform light distribution. Fig. 4 indicates that the light in the new configuration will decline to only about 65 per cent of the peak brightness from center to edge of the science field, which is satisfactory. Unfortunately, this change will redistribute the light from the centre to further out in the science field and reduce the peak intensity from an improvement with respect to the old system by a factor of only 2.5, instead of 10. This explains the almost unbelievable x10 improvement of the new system compared to the old.

After consultation with the SALT Astronomers, it was agreed that a factor of 5 improvement would be acceptable. This can be achieved by replacing the beam splitter next to the liquid light guides in Fig. 3 by a small elliptical mirror which will be mounted on a rotating actuator and select the light from the relevant light guide, both of which will be mounted at 90 deg to the optical axis of the unit. This will avoid throwing away 50 per cent of the light from the light guides.

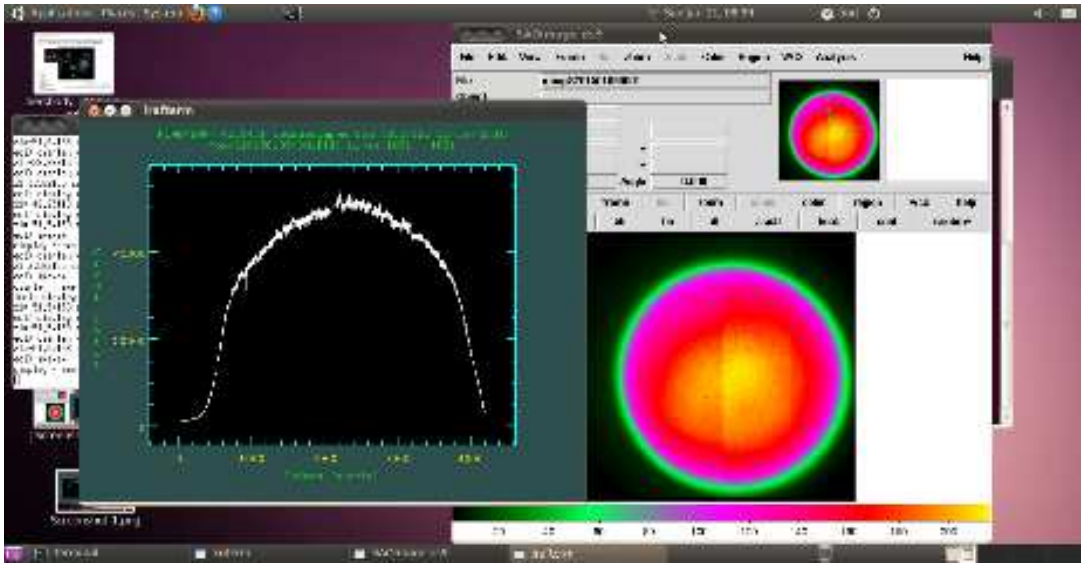


Fig. 4: Expected performance of the modified new SALT Calibration System

All this will require a redesign of the mechanical interface where the light guides are inserted (shown as green and red in Fig. 3. It will also require procurement of an elliptical mirror and suitable actuator, as well as developing software to enable control of the actuator by the SALT operator. This work is about to begin at the time of writing and a time scale for its completion is not yet available. In the meantime, the SALT Astronomers are preferring the performance of the new system rather than go back to the much less efficient old system.

In conclusion, when the extra work is complete, we can be confident that:

- The new Calsys will have a light distribution over the focal plane which is acceptably uniform.
- The throughput will be a factor of 5 better than the old system, leading to much shorter arcs (exposures times for which currently range up to 60 sec for RSS and 30 min for HRS).
- The throughput in the UV will be substantially larger than a factor of 10.

I am very grateful to Martin Wilkinson, Jonathan Love, Timothy Fransman, Vic Moore, the SALT Astronomers and the SAAO mechanical workshop who rendered great assistance at various stages of this work.

4. RSS Focus Gradient

A significant amount of my time was taken up with helping to fix the RSS focus gradient. This became apparent after the re-installation of the instrument following the optical service. Its cause is unknown (simulations showed that any misalignment of the collimator cannot cause such a

gradient). Diagnosis is most easily carried out by through-focus imaging the pinhole mask and adjusting the tip-tilt mounting on the detector. Bizarrely, after adjusting out the imaging focus gradient, there was still a small spectroscopic focus gradient. No one, including Ken, understands how this is even possible. Most of the problem was eliminated by Christmas and efforts to fix the spectroscopic gradient are ongoing.