

SALT BEC #60

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SALT OPERATIONS REPORT

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EXECUTIVE SUMMARY

This report focuses on the integrated SALT operations activities and Special Projects since BEC meeting # 59 of 31 July 2015. Chapter 1 will discuss the most important joint activities and results achieved during this period. Chapter 2 will discuss the astronomy operations in more detail with observing statistics of the running semester, and Chapter 3 the technical operations.

There were 13 SALT papers published since May when papers statistics were last reported in more detail (there were 7 in August and September), and the tally for the calendar year is 28. Observations for the semester stands at a pleasing 806 compared to 629 at this stage during the previous winter semester, and we already beat the previous highest record of 798 of a full semester.

Astronomy Operations – All instruments, operated nominally. The Fabry-Perot dual-etalon mode is due to be commissioned soon, though MR etalon has degraded. The RSS polarimetry mode is ready to start on-sky tests in October. In addition to normal programs, DDT programs have also been successful in producing papers. HRS pipeline activities are on a back-burner due to lack of resources, but some progress has been made nevertheless.

There are 15 programs with all their blocks completed and 4 more are above 90%. P1 and P2 Block completeness are at 65% and 52% respectively, exactly where our Simulations predicted them to be (100% cannot be reached due to the way time is allocated, just over 70% is a maximum for P1s).

Science time on the telescope for the reporting period is 36% against a target of 45%. That was mainly due to the foul weather we had during July and September.

Technical Operations – Highlights were the installation of a new Rho motor which reduced the rho tracking error significantly with the result that the rho guidance is much improved. It also eliminated the rho following error faults that used to occur regularly due to the previous motor being overloaded. It also eliminated rho spikes in the following error. These spikes caused track set-up failures during slewing of the telescope. The LR etalon has been installed and the mechanical mounting has proven to be stable. The LR Fabry Perot LR mode is now in routine operation. All hardware, such as the beamsplitter installation, beamsplitter and waveplates testing and software testing have been completed for the commissioning of the RSS polarimetry mode.

Downtime of the telescope, due to technical problems and operational mistakes during night operations (collectively defined as Telescope Downtime), was 9,5% compared with a target of 7% and a original very ambituous specification of 3%. The most important positive technical issue worth mentioning is the fact that the routine maintenance program is now in full operation. The downtime was mainly due to a problem that occurred with the upgrade Rho motor drive and unforeseen wiring issues. Full details of sub-system faults will be reported as part of the Board meeting paper.

CHAPTER 1

INTEGRATED SALT OPERATIONS:

The integrated SALT Ops team have spend Monday 28 September with Ted Williams and Lizette Labuschagne to review a draft SALT strategy document drafted by Lizette. It was followed by a project priorities review meeting, chaired by Petri Vaisanen. This meeting is an extention of the meeting that the late Darragh O'Donnoghue to prioritise efforts that will improve the telescope throughput and especially data quality and is held every half a year.

Both these meetings were very productive and their outputs will be presented to the Board in November for consideration. The project priorities will help to shape the budget since all major projects

are coming to an end by, at the latest, 30 April 2016, after which senior people will have to be redeployed or, as a last resort, retrenched.

The P0 projects of the past half-year were found to have had very good progress. Lower priority projects, while not necessarily having progressed significantly, had not been forgotten. On the whole this approach is successful: we can knock off issues when everyone agrees on their high priority while simultaneously keeping track of issues needing to be done over longer periods.

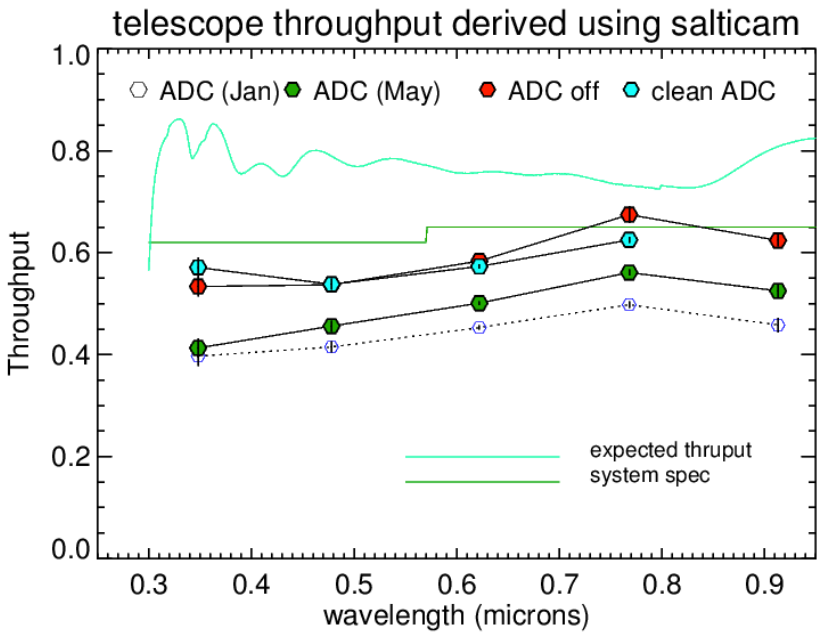
The new Projects Table with new priorities and assigned leaders is submitted as part of BEC documents. A longer document listing the Projects from March 2015 with status updates and plans from September onwards is also submitted (partially in draft form).

CHAPTER 2: ASTRONOMY OPERATIONS

2.1. SALT and ADC throughput

A series of on-sky burst-mirror throughput tests were done in May and June, before and after the ADC was cleaned, and also while the ADC was off the telescope. We concluded the following:

1) Keeping the ADC clean is of great importance. We gained nearly 20% in the red and nearly 30% in the UV by cleaning it.
2) Removing the ADC does not make a significant difference vs. just having it clean.
3) The absolute level of telescope throughput is now similar to the best values during 2006 and 2011. But still lower than expectation of a clean system. Speculation: if cleaning the ADC makes this effect, and remembering the huge effect of the RSS optics clean, what would we get if we cleaned (some of) the SAC mirrors?
4) The increase of light on RSS was, roughly, only half of the Salticam increase. This is probably a sign of RSS slowly losing its thoughput, it's now almost a year from its clean.



2.2. HRS Pipeline

While everyone recognizes that an HRS pipeline is extremely important for SALT science output, not very much has been done during this reporting period due to lack of resources and the decision in the May Board not to support it. We have flagged it as P0 at this stage to get together a resource request. We obviously would want to keep it as P0 for actual work as well, but will not be able to do that without extra resources. Nevertheless, there is some progress from Ast Ops:

A) There are three document drafts working towards defining the requirements of resources: 1) A high level doc which attempts to just list things we need to to (SALT software module requirement June2015.docx). It is NOT a design doc, and the timescales listed there are crude estimates. 2) User specifications already drafted by Darragh with Astro Ops (HRS-pipeline-userspecs_dod.docx). 3) Éric's follow-up on the previous one, a draft delving more into the details of what is needed in the HRS pipeline (HRSPipelineHigh-Leveldescription.pdf).

B) In parallel Steve C. had worked on a PySALT version reducing LR/MR/HR (not much progress since June). It can be used only by the developer and has not been independently tested. This version is essentially now Steve's private project for the benefit of RSA collaborators, or any individuals striking a deal with him.

Recently, however, Mike agreed to use contingency (?) funds to hire a local astronomer for 3 months to run Steve's HRS pipeline, starting November, on any new and previous data sets. This may show the maturity of pipeline and facilitate defining a work plan for a fully functional and supportable pipeline. We do stress that it WILL need extra funds and resources, and absolute must if pipelines still are a P0 project.

Note that Steve Crawford's time is fully occupied in other high-priority tasks and projects (the whole SALT data management, Primary data reduction pipeline, daily data delivery, TAC process, and importantly our newly defined P0 project on Automatic Data Quality, and his own science) at least for the next half year, which we cannot take him out of. We need at the very least one full time developer, and two if all the observing modes are to have a pipeline over the next two years.

2.3. Instrument status

Salticam is in normal operations.

RSS is in normal operations.

- **Long-slit** remains the workhorse mode, 25 of the 28 SALT papers published this year so far use long-slit. Stable.
- **MOS** has been regularly used as well. There was a slight increase in the number of MOS blocks in 2015-1 from the all-time-low in 2014-2. The 2nd ever MOS paper was published
- The Low Resolution (LR) etalon used during **Fabry Perot** observations is fully operational. The High Resolution (HR) etalon has been installed and is being aligned with the LR for dual mode observations. Our goal is to have it commissioned to use in November in the beginning of 2015-2. Unfortunately the spectral resolution of the Medium Resolution (MR) etalon is degrading significantly, and repairs may be needed. It has been removed, and FP/MR users have been notified that they can convert MR blocks to either LR, HR, or LS/MOS, depending on their science.
- The **polarimetry** mode is being commissioned and will be completed in the next few months. All hardware is installed and tested, the software required to submit polarimetric observations and to operate the instrument has been implemented. We are at the verge of starting both closed-dome tests and on-sky polarimetric standard star observations. Our goal (albeit optimistic) is to have enough data analysed and understood to be able to make the mode available in the Call for 2016-1 in December. Polarimetry science verification can still proceed into 2016. Steve Potter leads the commissioning.

BVIT has been used little, and always by the designated expert user, Marissa Kotze.

HRS is also in normal operations and has been very stable since October 2014. The highlight of the reporting period is obviously the fact that the instrument has now been handed over to SALT, and we have been able to start the necessary modifications to software to correct bugs and make it conform better to our system.

2.4. Observing statistics

[For exact definitions of different parameters, see the Asto Ops BEC report from March 2015]

Observing Statistics for SALT Semester 2015-1 to date							
Month	**Night Length (hr)**	**% Weather downtime**	**% Technical downtime**	**% Engineering Time**	**% Science Time**	**% Obs efficiency**	**% Shutter Open Time ****
May 2015	10.72	38%	5%	11%	45%	93%	21%
Jun 2015	11.04	49%	4%	6%	40%	85%	18%
Jul 2015	10.88	56%	5%	6%	33%	91%	14%
Aug 2015	10.28	50%	7%	7%	36%	88%	18%
Sep 2015	9.38	60%	12%	3%	24%	95%	13%
Mean	**10.46**	**50%**	**7%**	**7%**	**36%**	**90%**	**17%**
Spec		*45%*	*3%*	*7%*	*45%*		

** Shutter open time still does NOT INCLUDE HRS!

Notes:

Weather in July and September was unseasonably bad, contributing to a larger weather downtime than long term average (45%) for the winter season so far.

Large **technical downtime** in September was due to Tracker Rho-stage issues wiping out 3+ nights in a row. Otherwise the level has been lower than for many semesters this period.

The effect of night-time SAMS tests is clearly seen in **engineering time.** From the 13% used in 2014-2 it has decreased significantly to an average of only 7% due to SAMS first starting to operate "in-between-blocks" rather than taking up dedicated time, and then by early August stopping altogether with enough (encouraging) data having been gathered.

2.5. Science time

The fraction of science time has been 36% for the semester so far. This is typical. The worse than average weather has been compensated by better than long-term average downtime otherwise. However, note that the number of Blocks completed is actually the highest ever: We currently stand at 805 on October 4th, with the previous record 798 from a full semester of 2013-2.

More analysis of this and all science time aspects will be made for the Board once we are actually finished with 2015-1. Just a quick interesting fact here: after 5 months of the Semester, we are remarkably close to the prediction made using Semester Simulations (using downtime values from the last semester which were slightly larger) back at the start of the Semester.

	Percentage Now (after 5/6 months)	Simulation for full 2015-1
P1 time	65	67
P2 time	52	55
P3 time	50	52

Finally, as requested by the BEC earlier we report here the historical Completed Science Time Fraction per Partner over the past 2.5 years, from Semester 2013-1 until end of September 2015. The values refer to the average and standard deviation of the 5 values of the relevant 5 semesters. Several partners are quite close to expectation though no partner share guiding of observations have ever been attempted. Fluctuations are the largest, unsurprisingly, for the smallest partners. Some partners do appear to systematically either under or over-perform, and SALT Ops is able to often tell what the reasons are - more analysis will come later.

	Avg comp [%]
GU	54 ± 25
UW	67 ± 20
RSA	117± 14
UNC	97 ± 55
UKSC	157 ± 38
DC	88 ± 12
RU	81 ± 7
POL	125 ± 18
UC	77 ± 67
HET	55 ± 21
AMNH	141 ± 71
IUCAA	149 ± 27

2.6. Refereed Papers

In the 5-month period May – September there were 13 published refereed SALT papers. The year total formally stands at 28 currently, a couple more can be found from the ADS with the formal publication date in Oct-Nov.

Of those 13 papers during this reporting period 9 include data from time allocated by RSA, 2 each by POL and UKSC, and 1 from GU, and 1 was a DDT proposal (total is not 13 since there are collaborative programs). Looking at the author lists, the situation is similar, with 10 having RSA authors, and HET and RU featuring once in addition to UKSC and GU. Of the 13 SALT papers 8 have SALT Astro Ops members in the authorship.

More statistics covering the whole calendar year will be provided for the Board meeting.

2.7. Director's Discretionary Time usage since May 2015.

2015-1-DDT-006. Sep 2015.	Bartlett	UCT/RSA	1847s	Confirmation Spectra of the new transient SMC X-2	TBD, data taken last week.
2015-1-DDT-005. Sep 2015.	Koen	UWC/RSA	1637s	Possible counter-part of an X-ray and a neutrino detection	ATel.7993, 2015
2015-1-DDT-004. Aug 2015.	Buckley	SAAO/RSA	4756s	Determining the nature of the X-ray pulsar 2S1553-542	Paper draft in prep. Data combined with Townsend DDT from 2014-2.
2015-1-DDT-003. Jul 2015.	Jha	RU	10800s	SALT Spectroscopy of an Extremely Luminous Supernova	Paper submitted to Science.
2015-1-DDT-002. Jun 2015.	Buckley	SAAO/RSA	5923s	SALT-DDT Observations of an Unusual Eclipsing White Dwarf Binary	Good results, early draft. But scooped by another group.
2014-2-DDT-006. May 2015.	Aydi	SAAO/RSA	3210s	Aiming to identify a possible Nova/symbiotic star using SALT spectra	Paper submitted to MNRAS.

At this time, with one month to go, we have used 7.8h of the available 10h DDT time. This investment will produce at least 2 papers, likely more.

In addition, a paper was published in MNRAS during the reporting period from observations featuring 2014-2 DDT time.

2.8 Help to PIs

Astro Ops sent a SALT community wide letter in May to offer help in data reductions or anything else PIs might need to get data to published papers. This resulted in disappointingly little response, only 3 questions, 2 of them needing (quick) data analysis and reduction help (which was given).

CHAPTER 3: TECHNICAL OPERATIONS:

Highlights:
Highlights were the installation of a new Rho motor which reduced the rho tracking error significantly with the result that the rho guidance is much improved. It also eliminated the rho following error faults that used to occur regularly due to the previous motor being overloaded. It also eliminated rho spikes in the following error. These spikes caused track set-up failures during slewing of the telescope. The LR etalon has been installed and the mechanical mounting has proven to be stable. The LR Fabry Perot LR mode is now in routine operation. All hardware, such as the beamsplitter installation, beamsplitter and waveplates testing and software testing have been completed for the commissioning of the RSS polarimetry mode.

Primary Mirror: 12 Segments were swapped during August and September**.** Five of the central 7 segments have coatings older than a year. Segment 1 will get special attention during the sensor installation process that will start in earnest during November because all other segments are aligned to it.

RSS-VIS: polarimetry – please refer to Astronomical Operations above. All technical preparations and software have been completed.

Tracker: the tracker has been working reliably apart from the Rho drive problem that kept the telescope out of commission for ~3 nights. An Incident Report is being compiled to get to the root cause of the problem. It caused 53,5 % of the downtime with the Payload following at 18,6%.

Software solutions: Research into alterative control system solutions for telescope subsystems continues with successful review of the National Instruments Compact-RIO hardware architecture as the planned platform for the new RSS Guider. Reducing spurious alarms and warnings has also been a priority mini-project with improvements already apparent. The complete re-write of the building management system (BMS) is progressing well with live system-in-the-loop tests scheduled to start by the end of the year.

Maintenance: the systemised maintenance system has been fully implemented and is in daily use. Important items that received attention were the structure pintle bearing, dome drives and shutter bogeys.

Electricity Saving: Lack of senior manpower capacity have brought those actions to a temporary halt until April 2016. However, a consulting engineer has been tasked to do some preliminary study and we are waiting for his report.

The Failure Mode Effect and Criticality Analysis (FMECA)
No red items have been mitigated in this period but one more item, the SALTICAM Frame Transfer Mask & Drive located in the evacuated dewar was identified, giving 16 red items, 4 of which cannot be mitigated further by Tech Ops. The remaining 12 will be mitigated in time as projects come to completion.

The SAC degradation and its detrimental effects on throughput has been identified as a risk but not added to the FMECA. The issue has been added to the Action List of the SALT Operations meeting but, on Darragh's advice, parked for the moment since it will be quite a big job to clean the SAC.

TOIL: with the activities on the telescope stabilizing, this figure stands at 1542, down from 1636 at BEC meeting #59

Discounts: negotiated for financial year to date is >R81000.00

PROJECTS:

Separate reports have been filed for the SAMS, Tracker Upgrade and RSS New Guider projects. The RSS Throughput project was put on hold in order to determine various options going forward, including funding sources.

NIR – LOCAL ACTIVITIES:
Since the unfortunate death of Darragh, Martin Wilkinson has taken temporary charge of the interface meetings with Wisconsin and coordinating events at SALT. Attention is being given, by Tech Ops, to the enclosure design for the instrument.

HEALTH AND SAFETY:

No safety incidents to report. The Health and Safety Committee for the Site has been reconstituted and has held its first meeting. These meetings co-ordinate all safety issues on site. The Tech Ops team went for refresher fire-fighting training to keep up their competency in this regard. The Astro Ops staff will undergo such refresher training during next year when their certificates lapse. Keith Browne went for Fall Arrest Training to keep up his competency in this regard. A safety audit, by an accredited company, was commissioned to determine the progress since the previous formal audit was done in 2008. No major issues were raised. Some paperwork, especially the delegation of duties as prescribed by the Occupational Health and Safety Act needs to be reviewed and updated. That is in process.

MANPOWER ISSUES:

Grant Nelson, the full time mechanical engineer on the Tracker Upgrade project, has resigned effective end of September 2015, mainly due to the uncertainty caused by the project coming to an end and no new projects envisioned for him to work on. He will not be replaced, except we have contracted him for a small amount of his time to provide continuity on an as required basis. His tasks wil be redistributed to already highly loaded individuals like Raoul van den Berg, Ockert Strydom, Eben Wiid and Wouter Lochner. The saving will be in the order of R225,000.00

It is foreseen that other senior staff working on the Tracker Upgrade project may also resign before project completion due to the same situation. This will put us in somewhat of a predicament and the project end date might become under pressure.

The RSS new guider will need support through to March 2017 since it started late (3 months) due to resources being required and diverted to higher priority projects such as SAMS. A new project plan is being reviewed and the manpower requirements will be included in the Board report and budget submission. As decided by the Chair of SALT and the SAAO Director, optical design activities will be developed in-house. Janus Brink is studying the application of Zemax in this regard and some of his software duties will be delegated to others. This new challenge for Janus is motivating to him and he is keen to develop his skills in that direction. He has been studying optics via the distance-learning program of the University of Arizona for the last year. However, his inexperience in this field increases the risk on this project because it is somewhat unrealistic to expect him and his team to step into Darragh's big shoes and do it right the first time. So a larger provision will be required to cover foreseen risks on this project.

RECOMMENDATIONS:

1. The Board is strongly recommended to fund at least as many of the highest priority projects in the separately filed Priority Project report, as can be afforded, in order to achieve 2 objectives:
    a. Improve the data quality and throughput of the telescope
    b. Motivate and retain senior staff