SALT BOARD MEETING #38

9-11 November 2015 at Johannesburg, South Africa

SALT OPERATIONS REPORT

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EXECUTIVE SUMMARY

This report focuses on the integrated SALT operations activities and Special Projects since Board meeting # 37. The integrated SALT operations, which started on February 2, 2015 when the previous Tech Ops and Astro Ops were combined under one manager, is now well established and operating smoothly. 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 and Chapter 3 the technical operations.

The following key metrics can be taken note of:

1. Topping the refereed SALT paper count of 31 from 2014. See Figure 1.
2. The publication rate since beginning of science operations is similar to that of VLT and Gemini (normalized per telescope), see Figure 6. However, the increase is not as significant as it has been for the last two years. In particular, despite 2 years on the telescope and a quarter of science time spent on HRS observations for the last year and a half, there are no published results from HRS yet. Also, over SALT lifetime, only four partners with a combined share of somewhat more than 50% have published 90% of the papers.
3. Currently SALT is the lowest cost per refereed science paper "science machine" if compared with other large observatories (normalized to number of telescopes). See the separate paper titled "SALT – A Cost Effective Science Machine: Statistical Evaluation of Publications" by A.C Schröder, P. Väisänen and S.M Crawford.
4. The outstanding achievement was breaking the previous record of observed blocks during any semester (798) during the night of 3 October. The new record is 929 blocks.
5. The highest ever P1 time completion fraction. Program completeness is similar to the previous semester. We recommend a change in allocation philosophy to keep P0-P2 completeness high while simultaneously maximising program completeness not to limit paper production. See Figs. 4 and 5 and Recommendations.
6. The lowest ever downtime due to problems (technical and operational).
7. The successful acceptance and hand over [from Durham] of the HRS as a SALT instrument.

The following highlights can also be taken note of: start of RSS polarimetric on-sky commissioning, FP dual-etalon commissioning, further progress in the use of Simulations for efficient operations.

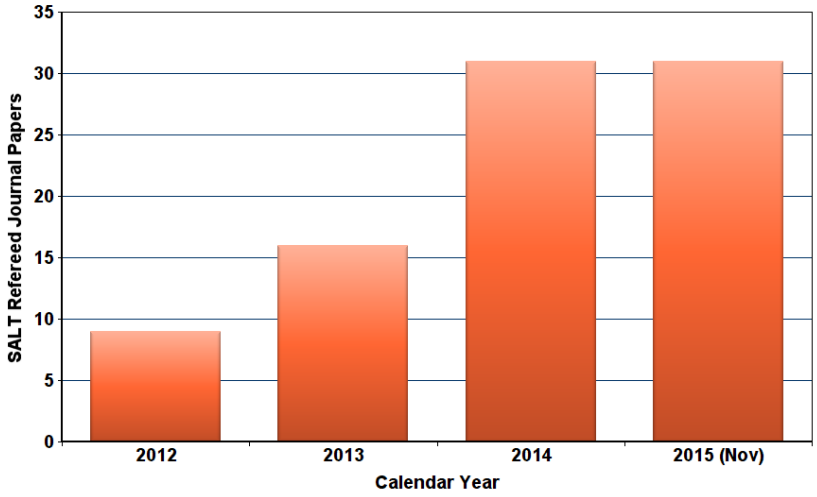


Fig 1: SALT Refereed Journal Papers per Year (2015 incomplete for Nov-Dec).

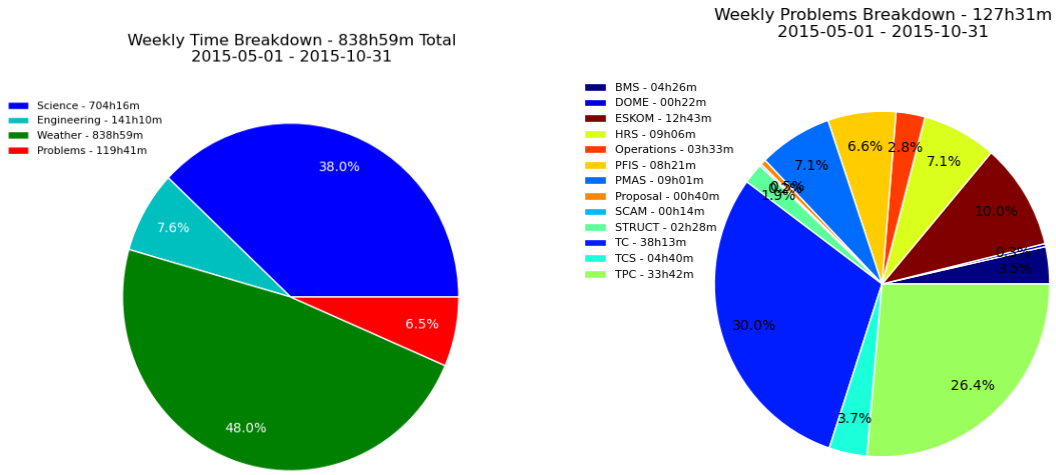


Fig 2: Breakdown of time usage over the 2015-1 semester, and the breakdown of problems downtime per sub-system.

Astronomy Operations – Science time on the telescope for the past Semester was 38% (see Figure above), similar than other winter semesters. Weather downtime was, in fact, the worst in three years, but that time lost was offset by lowest-ever technical downtime and the time spent on engineering and commissioning being kept below planned levels. Together with more efficient operations, this resulted in the record number of observations and record block completeness percentages. Program completeness received less attention this time around with the focus shifting to P0-P2 blocks only, and it remained at a similar ~30% completeness as last time.

Instrument-wise, RSS/Fabry-Perot came back on-sky after a troublesome 2014, including significant amount of low-resolution etalon observations for the first time. The medium-resolution etalon, however, was removed late in the 2015-1 semester. HRS continued to function in a stable manner, it accounts for about one quarter of all SALT observations. HRS pipeline development is still pending with a lack of resources.

Technical Operations – A major milestone during the reporting period was the successful installation of the Y-drive anti-gravity drive. It will be able to support the extra weight of the RSS-NIR once fitted on the telescope. A new technology and more powerful Rho-motor was also successfully fitted and it has improved the Rho guidance by reducing the Rho tracking errors significantly. This motor was specified to be installed during the Rho-drive upgrade, but the installation date was moved forward since it was a low risk intervention resulting in a huge improvement. Also, the downtime of the telescope due to technical problems and operational mistakes made during night operations (collectively defined as Problems) has dropped to **6.5%** for the semester, which is a new **record low** for any semester to date. The figure for the previous reporting period was ~8%. This can partially be attributed to the telescope technical baseline being fairly stable over the period and the positive effects of the systemized maintenance program starting to bear fruit. The constant monitoring and feedback received via the dashboard also played its part to keep the team informed of their actions and its effects.

It is clear that the most troublesome sub-systems are Tracker (30,0%), followed by the Payload (26,4%) and the HRS FIF and guider (7,1%). These sub-systems are getting special attention in the Project Priorities initiative since they are a composite of many smaller issues. Note also that power grid issues (“ESKOM”) contributed a significant 10% of technical downtime.

CHAPTER 1

INTEGRATED SALT OPERATIONS:

The Board directed at its 37th meeting that the Mission of SALT Operations is:

> *SALT must produce the maximum possible completed P0, P1 and P2 observing blocks per semester containing quality data so that partner PIs can produce quality science*

In order to achieve the above mission, a 5 point plan was devised and progress against it can be reported as follows:

1. Members of the Board and Astro Ops communicated the best practice for utilizing the telescope to their TACs and PIs after the Board meeting in June. It is too early to tell whether it had impact on the throughput. The effect of modifications done on the time allocation percentages etc. will only be known at the end of 2015 semester 2.
2. Scheduling short and long term - Implemented scheduling tools to support the completion of P0, P1 and P2 blocks. Actual observation statistics for the completed semester indicate that the results correlate well with the simulations done before the semester started, and have driven up the high priority time completeness. Refinements of the simulation and scoring tools are in process. A tool is now available to PIs that will predict what the chance is for a certain observation to be successfully conducted. Hopefully that will lead to PIs choosing alternative targets with and improved chance of being observed.
3. 10m Telescope performance – the team reviewed the project Priorities document that was put together under DoD's leadership some time ago. Petri Vaisanen has filed **a separate report** in this regard with the current status and a table summarizing the new projects proposed and their priorities. The systematic maintenance process has been implemented and, as reported above, has already contributed to reducing downtime. SALT Ops has also been involved in defining and informing a strategy document to guide short, medium and long term decisions taken for the future productivity of SALT.
4. Performance Metric Tracking System – use the Dashboard and Fault Tracker systems are in full operation and the results are formally reviewed during the weekly SALT Operations meetings. Decisions are made and actions are taken to direct operational and project priorities to meet goals.
5. PIs – Discussions with PIs regarding how SALT Operations can support them, if required, and encourage them to publish papers once they have received completed proposals from SALT. Very few PIs took them up on that offer. However, South African PIs have been publishing regularly and also the majority of the papers. NO PAPERS based on HRS observations have been published. This is most disturbing and should receive urgent attention by the Board and PIs.

In summary, the uniting of Astronomy and Technical Operations into one unit has given rise to more effective management control, far better communication, new initiatives in performance monitoring, and a united approach to prioritizing improvement projects. As reported above, the fruits of these actions are already visible.

CHAPTER 2

ASTRONOMY OPERATIONS

While performing routine observations and SALT system performance checking, PI support, and software tool development, Astronomy Operations personnel have continued to develop ways to operate SALT more efficiently. Semester Simulations and Block Probabilities for PIs have been introduced and implemented, and analysis of past semesters has continued. Astro Ops offered help to the PIs in SALT data reductions. In addition, the RSS polarimetric mode commissioning continued to on-sky observations and an initiative has started to host a laser frequency comb for HRS. HRS pipeline development has not progressed much, but a resource plan and a budget are presented.

SALT SCIENCE

A. Semester 2015-1:

The visual below shows the nightly time breakdown of the Semester, the overall breakdown was presented in Fig.2.

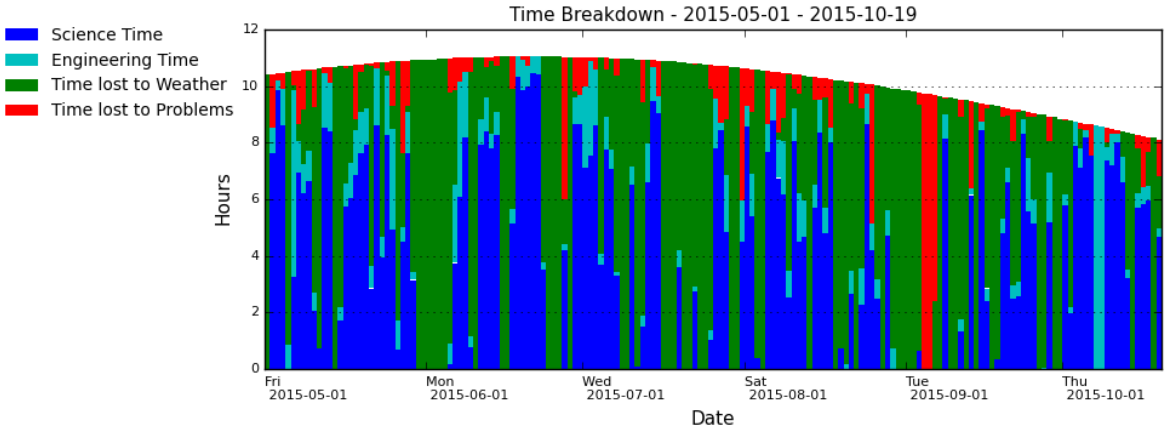


Fig. 3: Semester Time Breakdown

Time breakdown: Measured purely by the available 38% science time (defined as time between the end and beginning of twilight minus weather, engineering, and technical downtime), the past SALT semester turned out to be very typical to winter semesters. However, the weather downtime at 48% was worse than typical, with July and September especially bad months. That loss was offset by low technical downtime which at 6% is lower than average and down from the 8% and 10% of the last two semesters, showing the growing maturity of the system. Also, since SAMS testing did not need much on-sky time anymore, nor was there significant on-sky commissioning, engineering time returned to less than 8% compared to 12% and 14% of the last two semesters.

Priority block and program completeness: The 38% of available science time was used efficiently with an all-time record of 929 blocks observed. A total of 21 programs, or 30% of all, were fully completed in 2015-1. This is slightly better than for 2014-2, the best semester to date, as seen in the Figure below, though the 90% completeness is less than previously.

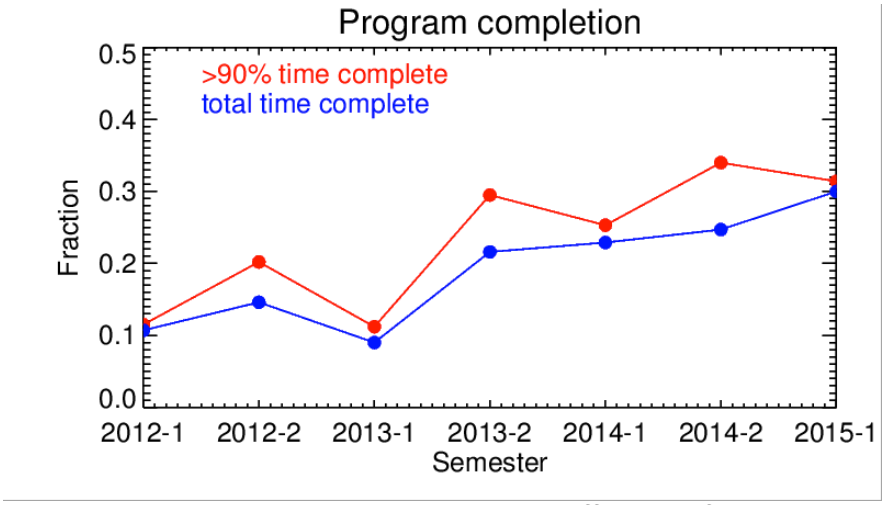


Fig. 4: Program completion using two different definitions.

As the Board #37 decided that a more important metric would be the P0-P2 time completeness, the Block Scoring algorithm used at the telescope for nightly scheduling was adjusted accordingly. The end result is, as shown below, that both P1 and P2 fractions are going up. In fact the P1 fraction is an all-time record with 80% of P1 time finished to-date. At the same time the gradual historical climb of P3 time ended. A by-product of the latter is the little or no-growth trend in the program completeness above, as many programs still are split up in multiple priorities.

The figure below also shows with the black dashed line the fraction of used P4 time of the total observed science time. At around 10% level, this semester has seen more than **70h hours of P4 time completed**. Most of this time is *not* used in particularly poor conditions, but P4 is taken merely because there is nothing else available in the queue, sometimes due to Moon or mediocre seeing conditions. In fact, in September it turned out there sometimes were not even P4 blocks visible in the queue, triggering Astro Ops to request extra P4 blocks from PIs. Astro Ops has now allowed unlimited P4 block submissions for any accepted SALT program.

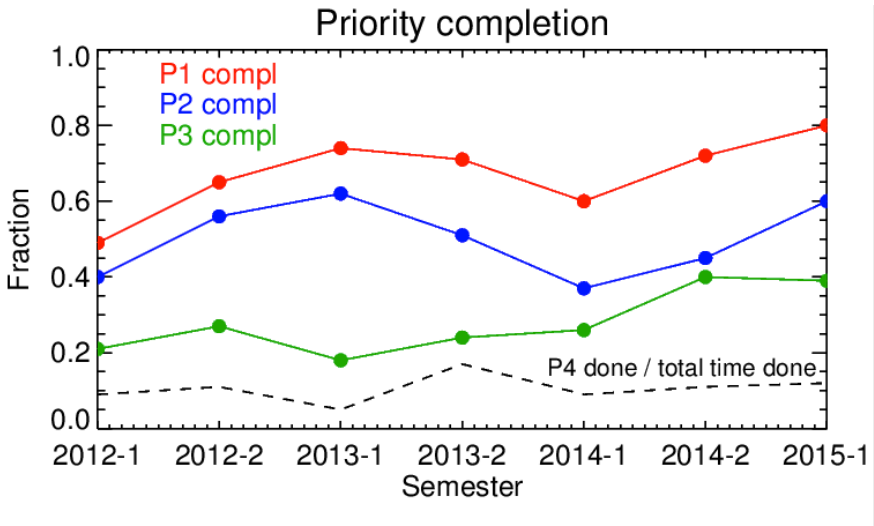


Fig 5: Priority Block Completion per Semester. The dip around 2013-2014 semesters is due to HRS commissioning and the RSS fix.

B. Semester 2015-2:

60 Proposals were accepted for the new Semester 2015-2 starting in November.

C. Director's Discretionary Time programs:

A list of recent DDT programs was given as part of the BEC #60 SALT Ops report. With two more over the last week of October, eight DDTs were approved in 2015-1 for a total of 10.1h. Two of these have submitted refereed papers already, and at least one other is in preparation. Another two have published ATels. During the reporting period, since June, one refereed paper was published using DDT proposal data from Semester 2014-2.

D. Publications:

In the 5 month period May – September there have been 13 refereed SALT papers. The year total stands at 28 currently, and three more can currently be found from the ADS with the formal publication date in Nov-Dec. Thus, we have at least matched last years tally of 31 papers, and most likely will go a little over that.

Refereed papers is a crucial metric by which the success of SALT is measured. An updated Figure comparing SALT to other 8-to-10-m class observatories at the same development stage, normalized by the number of telescopes is shown below. We hoped to get some 40 papers for 2015 to continue a solid climb. But even with a number close to 30 SALT still is on a promising path, with citation counts per paper at more than 15, a respectable number in this early phase.

However, the next one or two years will be crucial in showing whether SALT is able to progress, or whether there is an inherent limit that it can achieve with a small user community. Though it is a challenge to attract new users, it is crucial that it be done with positive news and results, since otherwise there is a danger of stagnating the science output even if everything would be working technically. This is one of the major challenges of SALT.

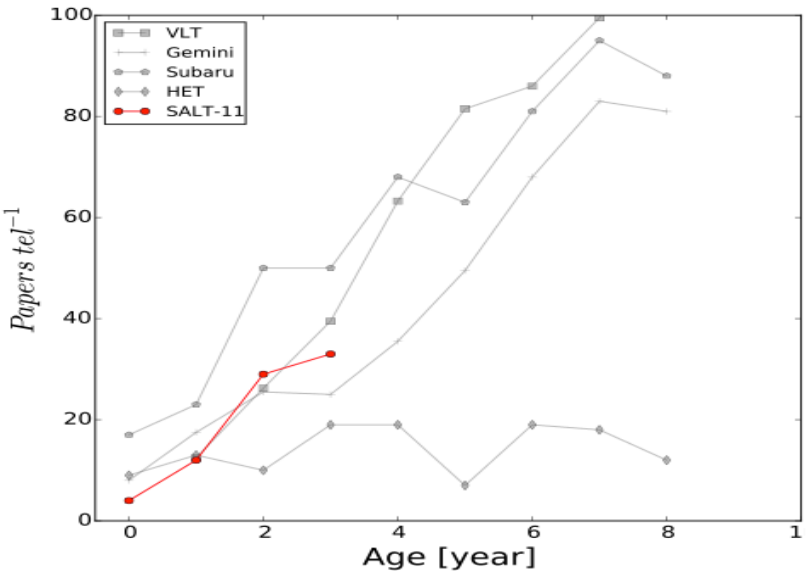


Fig. 6. Papers per telescope. The red curve shows SALT as counting from 2012, with a last point set to a guesstimate of 34 papers for 2015 (S. Crawford).

Of those 31 papers that have come out this year so far, 19 include data resulting from time allocated by RSA (61%), and 6 and 5 by UKSC and POL, respectively. RU has two papers, and couple of other partners one each. It is these same four partners mentioned that also dominate the overall SALT paper production since the beginning, whether counted in absolute terms or scaled by shares. Anja Schröder at SAAO has studied the publication record in detail from the first 120 SALT papers: Her contribution to the proceedings of the SALT Science Conference has also been **submitted as part of the Board papers.**

Of the papers in 2015, one is based on Salticam slotmode data, one is RSS/MOS, two are RSS/FP papers, while all the rest (90%) are RSS long-slit papers. Similarly, 90% of all SALT papers since 2012 are based RSS data, and overwhelmingly long-slit, highlighting the workhorse mode of SALT. In

particular, despite 2 years on the telescope, there are no published results from HRS yet, though 24% and 28% per cent of science time was used for HRS this semester, and the previous one, respectively. We obviously hope this will change soon after even a rudimentary pipeline is funded.

A list of SALT papers is available at http://astronomers.salt.ac.za/data/publications/

As mentioned in Chapter 1 SALT Operations wishes to facilitate paper production by concentrating on the quality of SALT data, and helping, where resources allow, PIs to reduce and analyse their data. In this spirit 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. It resulted in disappointingly little response: only 3 questions, 2 of them requiring (quick) data analysis and reduction help, which was given.

ASTRONOMY OPERATIONS ACTIVITIES

A. HRS pipeline

It is now two years since HRS installation, with no HRS papers published yet. Clearly current ways to effectively reduce HRS data and provide a pipeline are not working. SALT Ops has included a salary for a post-doc level person in the survival mode Budget scenario. SALT Ops has flagged this as a P0 project, which absolutely must happen to keep up credibility with the HRS instrument. A document detailing the required work and the kind of expertise needed, as well as time-line estimates is ***submitted as a separate document*** *to the Board. (The latest BEC meeting also received a User Requirements Document as well as a more general Pipelines high-level plan, these are available on request.)*

There has not been very much progress, apart from the documents mentioned above, during this reporting period, due to lack of resources. Steve C. had worked on a PySALT prototype 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, we used some left over funds to hire a local astronomer, Anja Schröder, for 3 months to run Steve's HRS pipeline. She will start in November on any new and previous data sets. We hope this may show the state of the current pipeline and facilitate defining a work plan for a fully functional and supportable pipeline. We stress this is NOT a coding and development position, a functional pipeline WILL need extra funds and resources. 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.

B. Block Scoring and Probabilities

We are now using Block Scoring at the telescope to help in scheduling, and it has been further developed since then. Blocks in the active queue are scored based on for example:

- TAC allocated priority
- Remaining visibility and remaining visits
- Completeness of the block
- Completeness of the program

The SA has the ability to both view and sort the blocks according to the total score and also to run a program which automatically selects an optimal queue for the night based on the choices and filters on atmospheric conditions and time of the search. The parameters in the algorithm are determined based on the philosophy that it is better to finish things once started, while also concentrating on P0-P2 blocks (a P3 will for example never override a P2, even if it was close to completing an program, based on the Board decision). The parameters are easily adjustable and we learn continually.

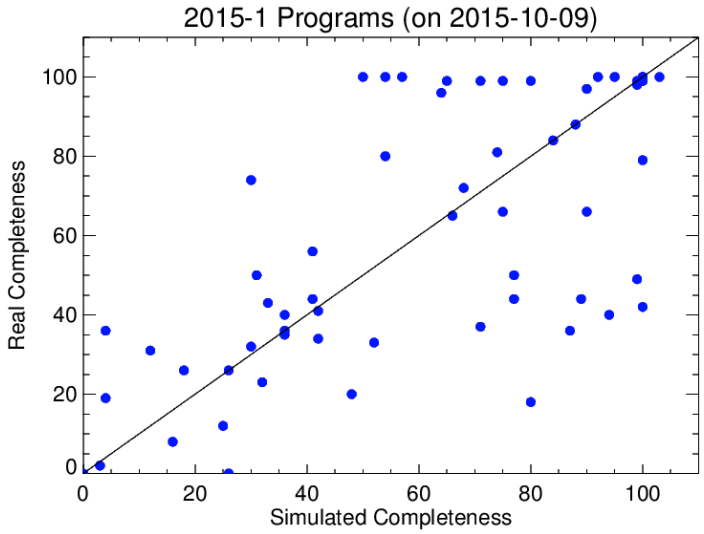
Additionally, a new functionality was added to the Web Manager where the PIs can view the "probability" of their Block getting done. The number is based on the seeing and moon constraints, number of available tracks and number visits, the observability (or tightness) of the requested track, and crucially the live competition in the queue for the same visibility. It is hoped that the tool will educate he PIs on what kind of observations make sense and which don't. The functionality is also available in phase-1 for the benefit of the TACs, if they wish to use it, on target-by-target basis.

C. Semester Scheduling and improving efficiency:

It is difficult to improve on the numbers of either program or priority block completeness – this was shown in the previous Board meeting based on the Semester Simulation studies. There are inherent bottlenecks due to the Blocks competing with each other following the time allocations resulting in non-uniform target distributions.

SALT Ops has a recommendation on how to strive to be more effective in simultaneously concentrating on high priority blocks and producing full datasets for PIs to publish more, as well as to streamline metrics. This is presented in the last section, see *Recommendations*.

Meanwhile, we had run a Semester Simulation for 2015-1 before it even started. The real fractions of completed P1 to P3 time are very close: they are, in fact, slightly above the predictions due to better than assumed downtimes. Figure 7 below show results on the program level. The Simulation values on the x-axis were derived using random weather and downtime, though with the total amounts of them set to now-known values. The plot compares the simulation to reality for 2015-1 on October 9th. There is a strong correlation (r=0.68). The "extra" points at real 100% are due to Ast Ops having a preference to finish of programs when they get to within 1 or 2 remaining blocks. Conversely, there are half a dozen programs which fared worse than expected and reasons for it will be investigated.



The main message of the plot is how close the simulations are to reality. In the future, we can use them to predict what will happen. This will give us the *opportunity to concentrate on programs in the beginning which are allocated as high priority but which have a danger of not getting done*. On the other hand, data like these clearly will show which types of programs work, and which don't. We are able to say which programs will very likely never be finished. We hope to communicate the analysis results to PIs and TACs, to strive for more effective use of SALT time.

Fig. 7: Completeness of 2015-1 programs on October 9th, comparing a Monte Carlo simulation to reality.

D. Science by the Astronomy Operations team:

The SAs and other team members have continued producing their own science. There have been 23 refereed papers published by team members so far in 2015 (including one in Nature). 17 of these papers are based on SALT data. There have been half a dozen MSc and PhD students supervised by the team members, with one PhD graduation during the reporting period. There are several SALT related Press Releases and other News items prepared by the team members available on the SALT Web-pages.

INSTRUMENTS and TELESCOPE

A. SALTICAM is operating nominally.

B. RSS is in normal operations.

- **Long-slit** remains the workhorse mode, 28 of the 31 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 decreased (by factor of 2-4, data are still sparse) Reduced rotational drift after the Rho-stage upgrade on the tracker is good news for MOS.
- The **Fabry Perot** Low Resolution (LR) etalon is fully operational and calibrated and has been in significant science use for the first time ever, in fact. 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 has degraded 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. The first on-sky polarimetric standard star observations just started in mid-October. 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, with consulting help from Ken Nordsieck and SALT Ops support from Éric, Encarni, and several individuals in Tech.Ops.
- **Straylight** analysis has continued to monthly standardized tests to find any new light leaks, which often develop after work around the payload. The goal is to keep baffling good at all times and any straylight at the level of readout noise.

C. HRS is in normal operations and has been very stable since October 2014. Of all science blocks in 2015-1, 24% were done with HRS, down slightly from the 28% of 2014-2.

- The highlight of the reporting period is obviously the fact that the instrument has now been officially handed over to SALT. The Acceptance Committee gave the Board its evaluation and recommended acceptance, which the Board then did. The final payment is waiting for Durham to provide the last accounting details. After acceptance, SALT Ops has been able to start the necessary modifications to software to correct bugs and make it conform better to our system.
- As requested by the Board, Éric has analysed data taken in August to determine the accuracy of HRS. The temperature variation of the optical bench is the main effect that now affects the stability of HRS. This causes a variation of the position of the lines on the order of 0.02 pixels over a period of 6 hours. Once corrected for that effect, the rms of the accuracy of the position of the lines is 0.001 pixel. This confirms that the RT 13 item on the acceptance report is a PASS. The 0.001 pixels accuracy translates to a theoretical radial velocity accuracy of 1.6m/s using the HS mode. This means that item RT15 is also a PASS, indicating a further PASS for the item RT14. See figures below.
- Note however that no on-sky determinations of achievable RV accuracy have yet been determined due to lack of systematically reduced HRS data.

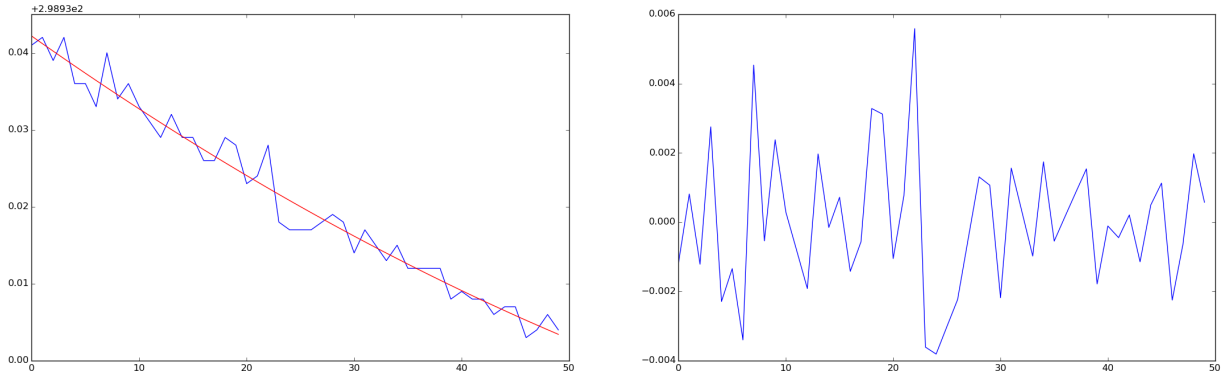


Fig. 8: HRS Velocity Stability - Left: the relative drift (in pixels) over 6 hours of the internal ThAr lines in HS mode. The drift correlates with the temperature of the optical bench. Right: If the trend is taken out, the remaining rms of the line positions is of the order of 0.001 pixels, or about 1.6 m/s for a theoretical radial velocity accuracy of the HS mode.

- A bake and pump of the two HRS CCDs was performed in May-June. The Blue was done when the gas of the cryo-tider was topped off. A month later, as a precautionary measure, and to ensure that both CCDs would be simultaneously in the same state, the red was also baked. Since then, no hardware problems have been encountered. Specifically, we have not seen any of the temperature/pressure runaways that were experienced last year that lead to significant loss of science time.
- There are plans for a temporary ***Laser Frequency Comb*** installation on HRS during 2016. It would serve as a technology demonstrator of extremely precise wavelength calibrations for the team building it in Edinburgh for their bid to provide it for E-ELT. They need a telescope to use it on, and will cover all costs. In exchange for providing a platform, SALT could use the system for HRS HS-mode calibrations for 3 months. The community has been informed of the plan and anyone with science ideas how to make use of it is encouraged to contact Astro Ops. It is planned that up to 20 hours of on-sky time would be used for it during April-June 2016, coming from reserved engineering time allocations. See a **separate report filed by Éric Depagne** for more details.

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

E. 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:

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.

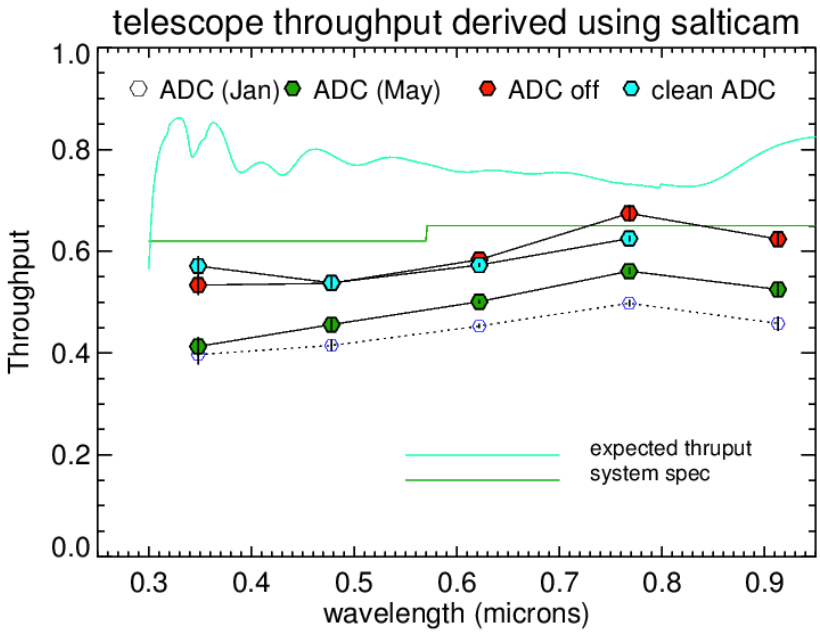


Fig. 9: SALT throughput measured in June with and with the ADC, and after the cleaned ADC.

RECOMMENDATIONS and REQUESTS

During the May Board meeting a change to 40:40:20 breakdown of the P1/P2/P3 time allocation was agreed, with the P3 time then multiplied by a factor of 3 resulting in an overall over-filling of the queue by 1.4. The effects of this will only be seen in the 2015-2 semester. The 2015-1 semester still ran with the old over-filling factor of 1.15 resulting in the queue too empty too often. *Nearly 70 hours of P4 time has been taken this semester, mostly in fine weather conditions when nothing else has been available.* The semester simulations convincingly show that not finishing even high priority blocks is due to the clustered on-sky distribution of the targets. It will be interesting to see if the higher over-filling factor of the queue in 2015-2 will change this.

Also, it will be remembered that a proposal that TACs allow only a single Priority per Program was not accepted. One of the objections to this scheme was the fact that many small partners have such small times available per Priority that it would become difficult to comply with the restriction. The purpose of the suggestion was to increase program completeness, in an effort to increase the number of publishable results. Conversely, it was argued that program completeness does not matter so much, PIs are happy just getting useful data over semesters. So, instead, SALT Ops was instructed to concentrate on maximizing P0-P2 completeness.

Indeed, we have now pushed P1 to 80% and P2 to 60%. But, programs as a whole still suffer from surprisingly low completeness at around 30% (Fig 4). PIs are now generally publishing 2013-2014 data with program completeness rates at a similar level, and it may by symptomatic that papers did not go significantly up this year (Fig. 1). We still believe it is harmful to SALT not to get more solid programs done. We should also cater for those users (e.g. post-docs, graduate students) who *need* their data within a semester and cannot wait for a multi-semester trickle.

Hence, we suggest an alternative, which we believe would work at various levels:

While P0, P1, P2 splitting would still be possible, those programs cannot include P3 time.

We see the following advantages:

- P0-P2 block completion will still be maximized, the SALT Ops goal does not change.
- High priority program completeness will simultaneously also be enhanced.
- Statistics and performance goals will become streamlined. As is seen from Figs. 4 and 5, high P1-P2 completeness does not correlate with high program completeness,

creating confusion about how we are doing and what to aim for.
- PIs and TACs would be encouraged to think of high priority programs that they really do wish to finish. (P1 carry-overs could be thought of in the future.)
- PIs and TACs would be encouraged to think how to use P3 time most productively, best suited for filler time: e.g. longer term survey programs with large numbers of optional targets and/or ones with loose constraint.
- Since P0-P2s are now allocated 80% of available time, it should be enough to have whole programs there even for smaller partners.

The only drawback would be the case where a partner wants to put most or all of their time into a large program. We believe the inconvenience of having to split a case like that into formally separate “high” and “low” priority programs would be a small price to pay for the advantages above.

CHAPTER 3
TECHNICAL OPERATIONS:

Primary Mirror: 28 segments, compared with a target of 36, have been coated since the last Board Meeting. Segments 1, 2 and 3 have coatings older than a year since they were not disturbed during the SAMS testing lasting from September 2014. The PM was regularly washed with CO2.

RSS : The LR etalon is performing adequately, The HR etalon is installed on the telescope and is being commissioned. The MR etalon had to be removed since it has suffered damage to its coatings and has significantly degraded in spectral resolution. Since the overhaul and rework of the slitmask mechanism the reliability of the mechanism has greatly improved and rarely is a cause for technical downtime. Some minor reliability issues still remain on RSS and will be addressed as resources become available.

Tracker: has operated at an acceptable standard although the reliability has dropped; since May 2015 it has been the most unreliable system on the telescope. Until the tracker upgrade is completed and the teething problems are sorted out, lower reliability can be expected from the Tracker. As reported at meeting #37 the installation of a new Rho motor and its more advanced servo amplifier, as specified for Rho-drive upgrade, has been installed. It resulted in much smaller Rho-tracking errors and much better Rho guidance. Unfortunately, as it goes with such major changes, it was not without its teething problems. Almost 3 nights were unfortunately lost due to unforeseen and unknown cabling problems latent in the wiring of the original installation. The Y-antigravity upgrade was installed in October, the improved antigravity system takes more load off the Y-drive reducing the wear on the clutch in turn lowering the downtime and maintenance on the Y-drive. The motor, gearbox and cable drum is now situated at the bottom end of the Y-truss and can easily be maintained without endangering the primary mirror. The old system was situated at the top end of the Y truss, which is marginally situated above the primary mirror.

Glycol leak Detection System: This system is now fully installed and its ATP has been completed. This system detects leaks in the instruments and payload and turns-off the glycol that feeds the tracker, rotating structure, payload and instruments. A second phase has been kicked-off. This system will detect catastrophic leaks, e.g. supply pipes bursting and couplings becoming undone, and shut the tertiary glycol system off completely.

Software solutions: Research into alterative control system solutions for telescope subsystems (especially Payload and RSS PXI) to improve maintainability is ongoing with assistance from National Instruments, SA. As part of this initiative the control software of a number of subsystems has been ported to Linux and is undergoing testing. Real-time Linux embedded control systems are proving to be a viable alternative to PC-based control and has been adopted as the platform of choice for the RSS guidance system upgrade. In parallel the virtualization of many SALT control room user interface computers is also envisaged – reducing the risk of obsolescence and improving reliability.

Fraction of Time Lost Due to Technical Issues: as reported in Chapter 1, it averaged 6,5% for the semester with the high of 12,3% in September and a low of 5,4% in April. The September figure was largely due to the ~3 nights lost after the Rho-drive faulty wiring incident. The HRS guider also proved to be unreliable due to its cable wrap not performing as well as it should. A modification will be done soon and a re-design will be implemented in March 2016. After the Tracker the Payload has been the largest contributor to technical downtime

Maintenance: 114 Maintenance tickets were issued by the maintenance system during the reporting period and 111 were completed. These actions have improved the reliability of especially mechanical sub-systems and electro-mechanical mechanisms.

Electricity Saving: SAAO is nearing the completion of its electrical capacity upgrade and distribution on the plateau. It includes a powerful enough generator that will be able to run *inter alia* all SALT systems and instruments, This includes the chiller which will give us the opportunity to mitigate some of the effects that the PM suffers during prolonged power outages. The generator must still be coupled to provide SALT its power once the medium voltage switchgear has been commissioned. No more work was done on the solar electric system. 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.

TOIL: A graph has been included from the date of the previous Board Meeting until end of September 2015. The TOIL figure now stands at 1552 hours, down from 1788 at the previous meeting.

Discounts: negotiated during the financial year to date stands at a healthy R81,000.00

PROJECTS:

Separate reports have been filed for the SAMS, Tracker Upgrade and RSS New Guider projects. Ockert has been redeployed to the SAMS team and allocated the role as SAMS System Engineer to ensure that the Primary Mirror Alignment System, of which the SAMS form a part, is being adequately produced, installed and tested. He has done a sterling job to develop the sensor bonding tools. The tools supplied by FOGALE Nanotech were found inadequate for mass production.

CALSYS
Has been successfully implemented and is in daily use.

NIR
After Darragh's sad demise, Martin Wilkinson has taken on the leadership of the NIR from SALT's point of view. Regular video- and or teleconferences are being held and interfaces between SALT and the NIR are being addressed. The biggest concern is the shortage of funding to commission the instrument on site. The option of installing the instrument in the spectrograph room instead of on the telescope has been approved by the Board. The University of Wisconsin has taken over the design of the collimator and the fiber IFU to feed it.

HEALTH AND SAFETY:
Most of the Tech Ops team members have received refresher fire fighting training to uphold their certification in this crucial skill. Keith Browne and Janus Brink received refresher training in working at heights to uphold their certification in this important skill.

MANPOWER ISSUES:

Grant Nelson, the mechanical engineer on the Tracker Upgrade project has resigned effective 1 October. He will not be replaced since the project ends in March 2016 and his tasks allocated to various, already overloaded team members.

Deon Bester who worked on the PMAS software since it inception has decided not to accept our offer to contract him for further work on this system when the SAMS are fully instrumented and tested for acceptance. This is a risk and we have assigned a seasoned professional software engineer, Paul Rabe, to take over that responsibility. Paul is a Tech Ops FTE.

The planning of the future application of especially senior personnel, after the completion of current projects, has been carefully considered and then incorporated into the HR Plan. The HR Plan forms the basis of the 2016-17 budget and is included in the Board papers. The Board is urged to support the HR Plan to the maximum affordable scenario.

RECOMMENDATIONS:

1. The Board is urged to support the HR Plan to the maximum affordable scenario in order to retain senior manpower and prevent the telescope from stagnating, becoming less competitive and atrophy.