SALT
Newsletter

August 2025

Table of Contents

Editor: Anja C. Schröder

Cover image: At the SALT shutdown. -- *Credit*: Lisa Crause

Letter from the Head of Astro-Ops

Dear SALT Community,

Since the last edition of the newsletter, there have been several developments — some positive, others challenging. The 2025 telescope-wide shutdown was successfully completed in mid-May, with the main focus on correcting the tilted primary mirror. Please see the dedicated article for more updates. While that effort was successful, we also discovered that the mirror coatings in the Spherical Aberration Corrector are degrading, severely impacting telescope throughput. We are currently exploring different solutions and will provide an update in the next newsletter. In the meantime, the instrument simulator will be kept up to date to reflect any further loss in throughput.

We also managed to complete a longstanding project: manufacturing and testing a new suite of RSS longslits to replace the older ones. I am pleased to announce that these were put into circulation shortly after the shutdown. Interested readers can find more information in the article by Tasheen and Lee. Additionally, this edition includes some updates on NIRWALS and the new RSS detector project.

I am also pleased to announce that we welcomed a new AstroOps software developer, Phelokazi Dube, who joined the team in July. We are excited about the skills and energy she brings to the team. Please see the “Meet the Team” article in this newsletter, where Phelokazi introduces herself.

SALT is also approaching a huge milestone this November — we will be celebrating the telescope’s 20th anniversary since its inauguration. We are planning something special for this occasion and will share more information closer to the time, so please keep an eye out for that.

Lastly, it is an honour to be appointed Head of SALT Astronomy Operations. I am excited about the impact and opportunities this position holds. It is a privilege to be part of the wider SALT team, and I sincerely thank you for the warm congratulations and support I have received since the announcement. I look forward to working with you in this new role.

Until next time,
Danièl

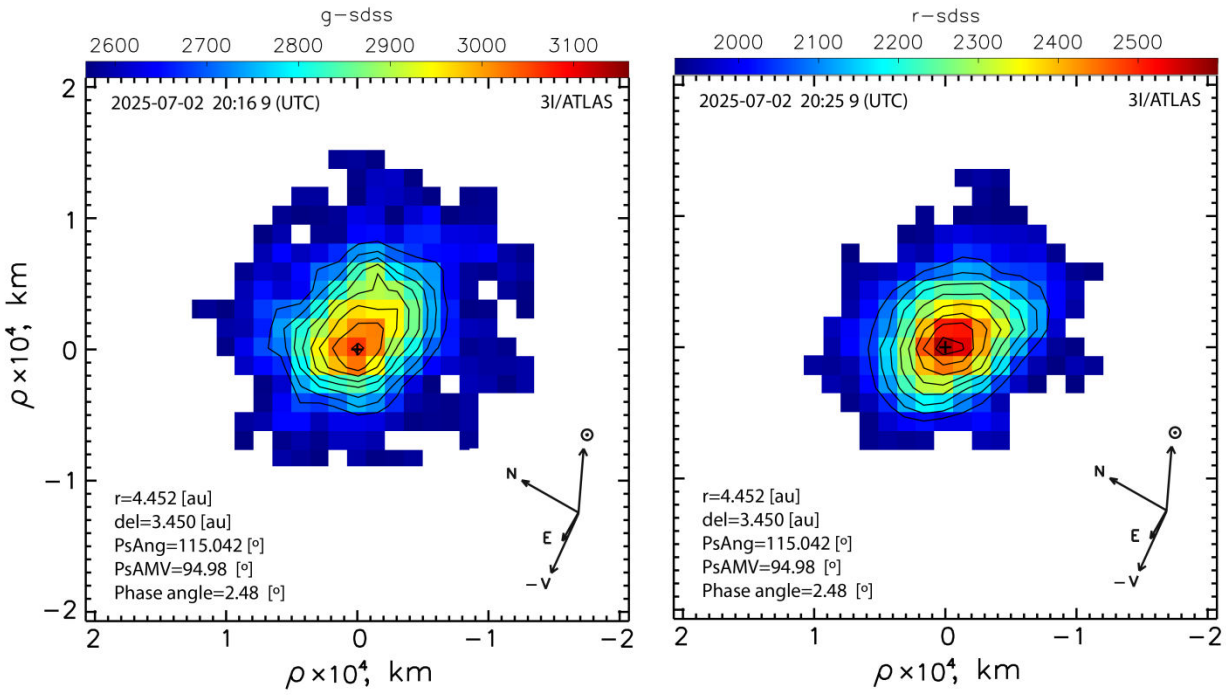
SCIENCE HIGHLIGHT

SALT observes the Third Interstellar Comet 3I/ATLAS

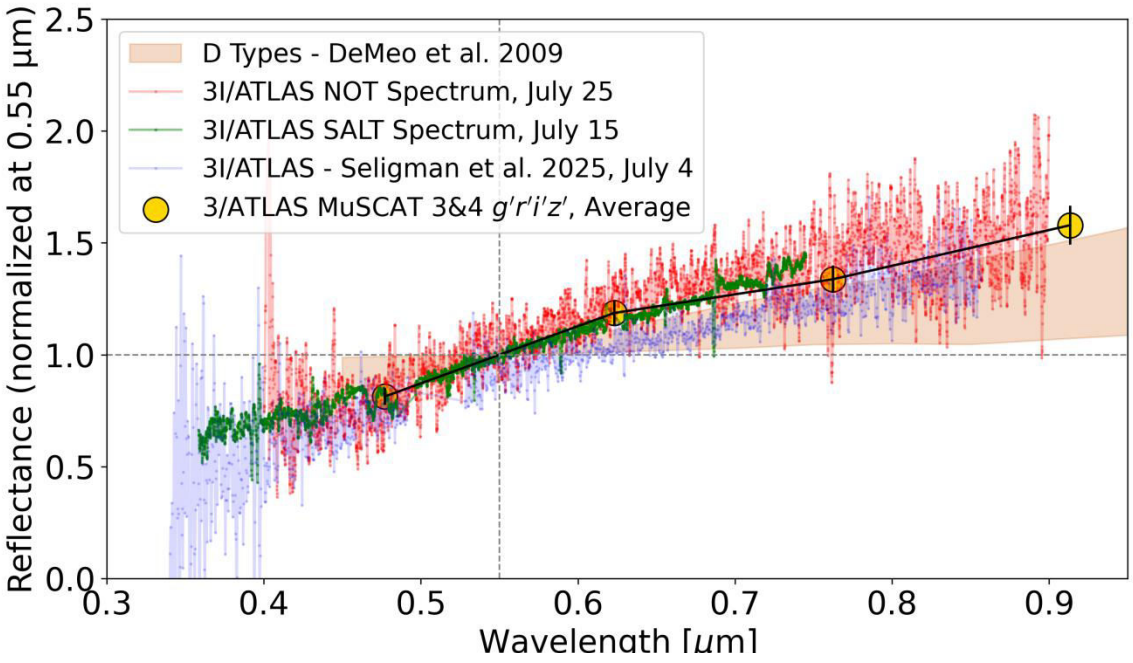
by Tomasz Kwiatkowski (A. Mickiewicz University, Poland)

We report on SALT/RSS spectroscopy of the interstellar comet 3I/ATLAS, the second known object of this type. Complementary photometry was obtained with the 1.0-m Lesedi telescope, also located at SAAO.

Observations were challenging because the comet moved against the Milky Way and the coma frequently blended with background stars. For this reason, out of 12 2-minute RSS spectra only 6 were finally used.



Extracted images of the comet, obtained in the SDSS g and r bands with the 1.0-m Lesedi telescope at SAAO. The arrows point in the direction to the Sun, North, East, and the negative velocity vector of the comet as seen on the plane of the sky.



SALT/RSS spectrum of the comet, obtained with the PG700 during a 12-minute exposure (green line). For comparison, we also plot the 2.5-m Nordic Optical Telescope (NOT; red line), and the 2.2-m UHT (Seligman, 2025) spectra (grey line), which, albeit more noisy, show the evolution of the slope. A mean spectrum of a primitive, D-type asteroid is also presented (shaded region). Yellow filled circles indicate photometric fluxes in four passbands. All datasets are normalised to 0.55 μm.

The analysis of the SALT spectrum shows a slope of 21.1 ± 0.2 %/μm on 15 July 2025. This is an increase from the 17.1 ± 0.2 %/μm slope observed by Seligman et al. (arXiv: 2507.02757) on 4 July. This progressive reddening over time suggests an evolving surface or coma composition.

Results of the SALT observations were combined with photometry and spectroscopy of several other telescopes and submitted to A&A Letters. Such studies are essential for characterising the physical properties of interstellar material and solid body formation in other planetary systems.

This programme demonstrates SALT's rapid response and coordination with on-site facilities to obtain timely observations of transient targets — capabilities that will be essential for following up discoveries from the Vera C. Rubin Observatory (LSST) in the coming years.

Authors of the note are: Tomasz Kwiatkowski, Sofiia Mykhailova, Nicolas Erasmus, Oleksandra Ivanova (with thanks to Danièl Groenewald for help with finding the cometary spectrum among several spectra recorded in the slit).

Published as Santana-Ros, T. et al (2025), A&A Letters (submitted), https://arxiv.org/abs/2508.00808

SALT maintenance shutdown

The 2025 SALT shutdown took place from 24 March to 13 May 2025. In addition to the welcome opportunity to service each of the instruments, as well as the tracker payload's rotating structure, a key focus of this shutdown was to tackle a puzzling problem with the primary mirror array. We also took the opportunity to inspect the coatings on some of the spherical aberration corrector (SAC) mirrors at prime focus. We already knew that two of the four mirrors are in bad condition, but unfortunately their coatings have deteriorated signify-cantly since they were last seen back in 2020 and so the urgency of replacing the SAC has now increased dramatically!

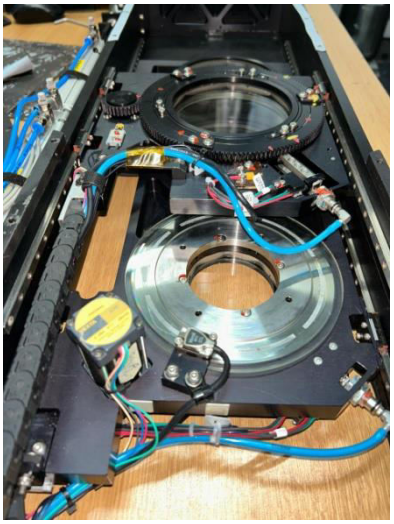
The atmospheric dispersion compensator, moving baffle and pupil mask could also be inspec-ted and serviced much more easily than when they are installed at the bottom of the payload. Similarly, the various mirrors within the rotating structure (including the SALTICAM and Auxiliary fold mirrors, as well as the three mirrors that comprise the Offner relay that forms the RSS slit-view system) could be accessed and cleaned while the payload was on the ground. Obsolete electronics could be removed and components that needed replacing were easily reached and tested before the payload was re-installed on the tracker at the end of the shutdown.

ADC before cleaning.

The HRS cryostats were each given a pump-and-bake treatment to improve their vacuum integrity. NIRWALS was warmed up to allow a careful inspection of all the hardware inside the thermal enclosure, to ensure that no mechanisms have been quietly wearing or otherwise misbehaving over the past several months since we were last in there. A basic mechanical service was done on the relevant components, contractors came out to service the refrigerant systems for the thermal enclosure, and the infrared detector also received some routine maintenance while the telescope was offline. Both the SALTICAM and RSS shutters needed replacing, and much work went into getting those tricky mechanisms to operate correctly prior to re-installation. The SALTICAM optics were cleaned and issues with the filter magazine received attention. We were pleased to find that the RSS collimator doublet and triplet optical assemblies that were installed in 2023 are still in excellent condition, but the temperamental RSS waveplates had to be serviced and extensively tested as they can only be accessed when the spectrograph is on the ground. Work was also done on the RSS slit-

Mechanicals Nico (left) and Eben (right) simulating different weight distributions within the payload.

mask elevator and various motors, plugs and encoders, electronics racks, the glycol leak detection system and the two probes that make up the RSS auto-guider, to improve the instrument's overall reliability. Unfortunately, the RSS detector's cooling system turned out to have lost its refrigerant gas, likely when everything was disconnected at the start of the shutdown. We only discovered this once the instrument was back on the telescope, when we attempted to cool it down to its operating temperature. This added a couple of stressful days when SALT was already back online as it was necessary to replace various components, then comprehensively leak-test the entire system before recharging it with the required refrigerant gas. After all that, the cooling proceeded smoothly and RSS was online from 17 May.



The RSS waveplate mechanisms being tested.

Midst all of those tasks, the major focus of the 2025 shutdown was the global adjustment (in tip, tilt and piston) of the entire SALT primary mirror array. This was necessary to correct the problem of having many segments (in the upper-right corner of the array, as viewed by incoming photons) being too close to the truss, and others (in the lower left) being too far away from it. This was an entirely new task that no one at SALT, or at our sister telescope (the HET in West Texas), had ever attempted and thus it was an extremely daunting undertaking. We have yet to establish why/how the array got like this (we are still investigating a few possibilities), but our priority for the shutdown was to resolve the issue, the underlying cause can be understood later!

Establishing a workable plan for this process relied on drawing in external expertise that included François Strümpfer (who was part of the SALT image quality team during the SAC repair in 2009 — 2010), Herman Kriel (the HET Operations Manager, who left SALT back in 2009), Jerry Martin (the retired HET primary mirror specialist), John Booth (the retired HET chief engineer) and a few other members of the HET operations staff. The various Zoom conversations and brain-storming sessions we had eventually yielded a plan that we could begin executing at the start of April.

The SALT mechanical team drove the actual mirror tilting process, with calculations being done daily to work out the required adjustments to be made to the various segments. The mirror guys then literally

Nicolaas and Nico installing a mask on the central segment,

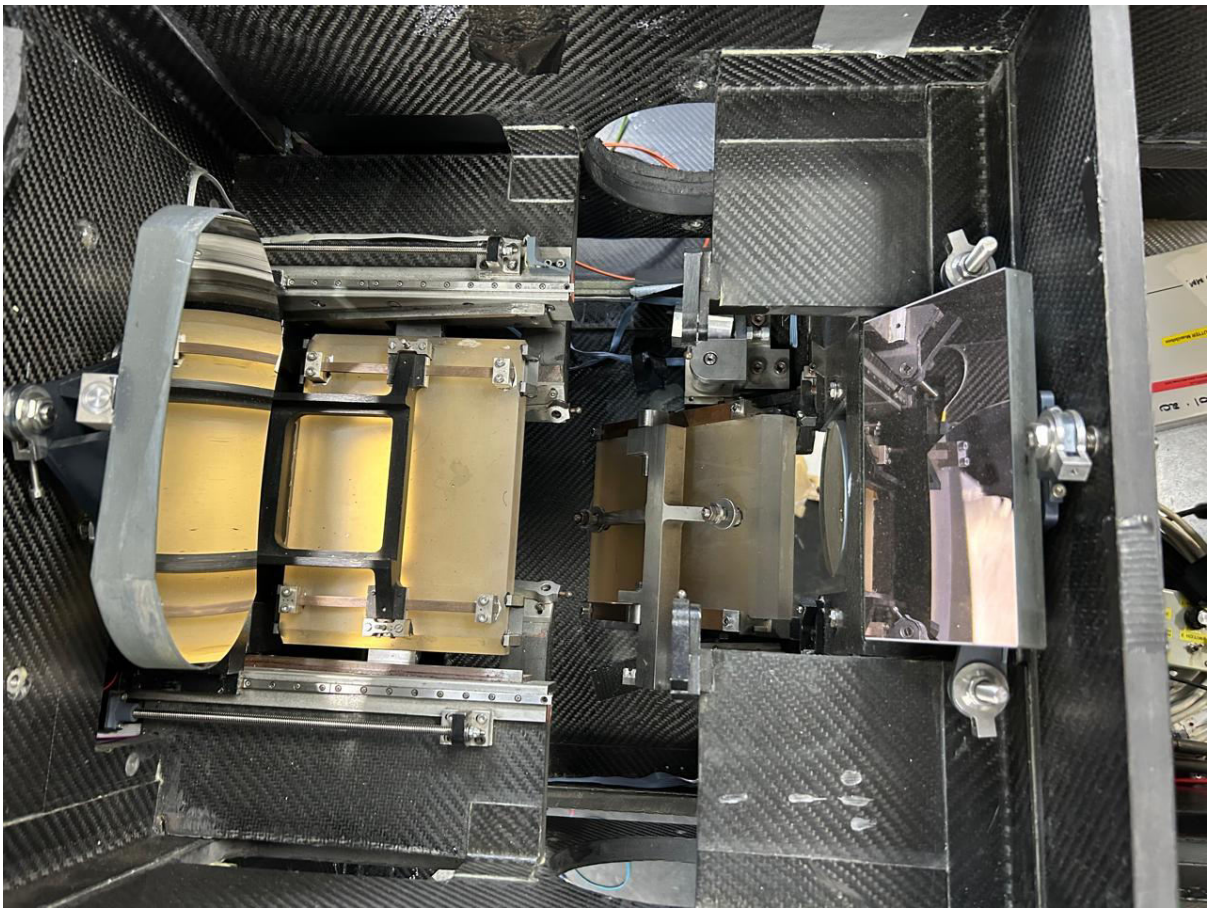
spent several weeks climbing around in the mirror truss each day, making carefully-controlled 3-point adjustments to the 273 M30 bolts that provide coarse positioning of the mirror mounts. Not wanting to risk "losing control" of any of the segments, we opted for an iterative approach that would allow us to stay within the ±4 mm travel range of the linear actuators attached to each segment (which provide the fine adjustment needed for the mirror's closed-loop segment alignment control system). This approach was highly labour-intensive, but it was worth it to ensure that we did not lose track of any of the segments. Since the actuators are mounted with a 1 in 13 ratio, each 1300 micron piston adjustment only yields a 100 micron mirror movement at the edge of the array, so the 40 iterations (typically involving about 50 segments per day) that were done over the 5-week period ultimately yielded a 4 mm change at each extreme of the array, along with a change in the tip/tilt of the central segment. The envisioned tip and tilt adjustments were checked periodically with spherometer measurements made from the cherry-picker during the day and, when weather permitted, with mirror alignments during the night. Alignments done after a week of multiple iterations per day took 6 or 7 hours, as the return spots from many of the segments had to be hunted down in tip and tilt (compared to normal mirror alignments that typically take about half an hour). We also encountered several control and software problems during this period, but we ultimately managed to get the mirror alignment instrument up in the centre of curvature (CCAS) tower re-positioned to find the adjusted primary mirror and we were able to make the necessary static offset measurements (to align the tracker to the primary using equipment set up in the CCAS tower) at the beginning of May.

SPIFFY image from the CCAS tower, showing defocused return spots from individual segments after bursting the array.

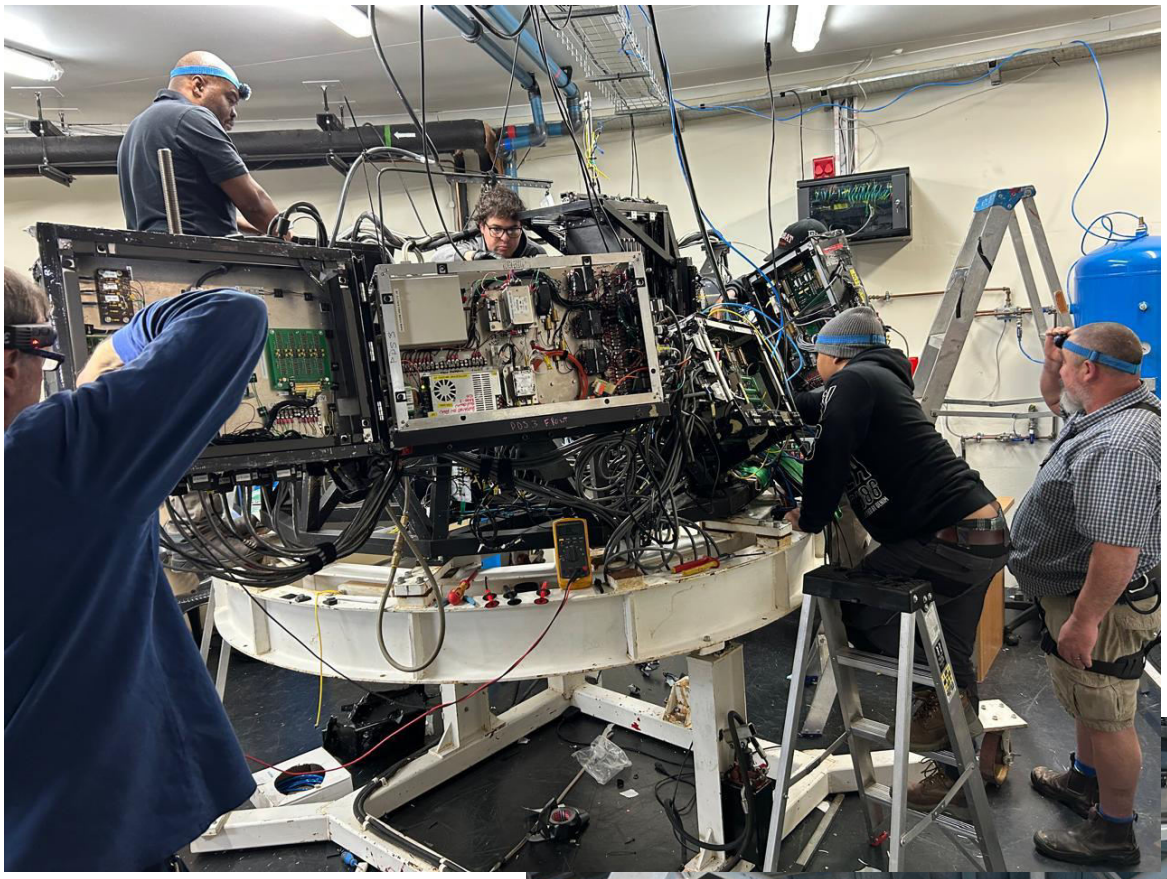
The IT and software teams also played a critical role in the shutdown, taking advantage of the opportunity to perform various important tasks (like migrating virtual machines and cloning physical ones) and testing all of the changes without the sort of pressure that inevitably goes with doing such things during normal operations. Much effort also went into assorted software improvements and migrations on multiple systems throughout the telescope to improve stability, reliability and operational efficiency. Hardware configurations from numerous controllers were also archived in the version control repository for documentation purposes, and the latest versions of engineering software were checked into version control to ensure consistent deployment and versioning across all active software engineering modules.

Although this was an incredibly busy and slightly chaotic time up there, it also provided an ideal opportunity for people to visit the telescope and get to see what goes on behind the scenes to make SALT work. This included having access to hardware and optics that would ordinarily not be visible. As a result, we ended up showing countless visitors around, mostly over the weekends — ranging from SAAO staff and students, to visiting observers, groups from high-tech companies in Cape Town, journalists, overseas visitors, friends, family, and even the residents and staff from the old age home in Sutherland! Lastly, the 2025 shutdown served as a massive team-building exercise, for the Tech Ops team in particular. Nothing like a demanding but critically important shared endeavour, packed with interesting puzzles and challenges, to rally behind and pull together for. It was a joy and a privilege to be a part of all that and it's hugely satisfying that we got through and learned as much as we did — great stuff!

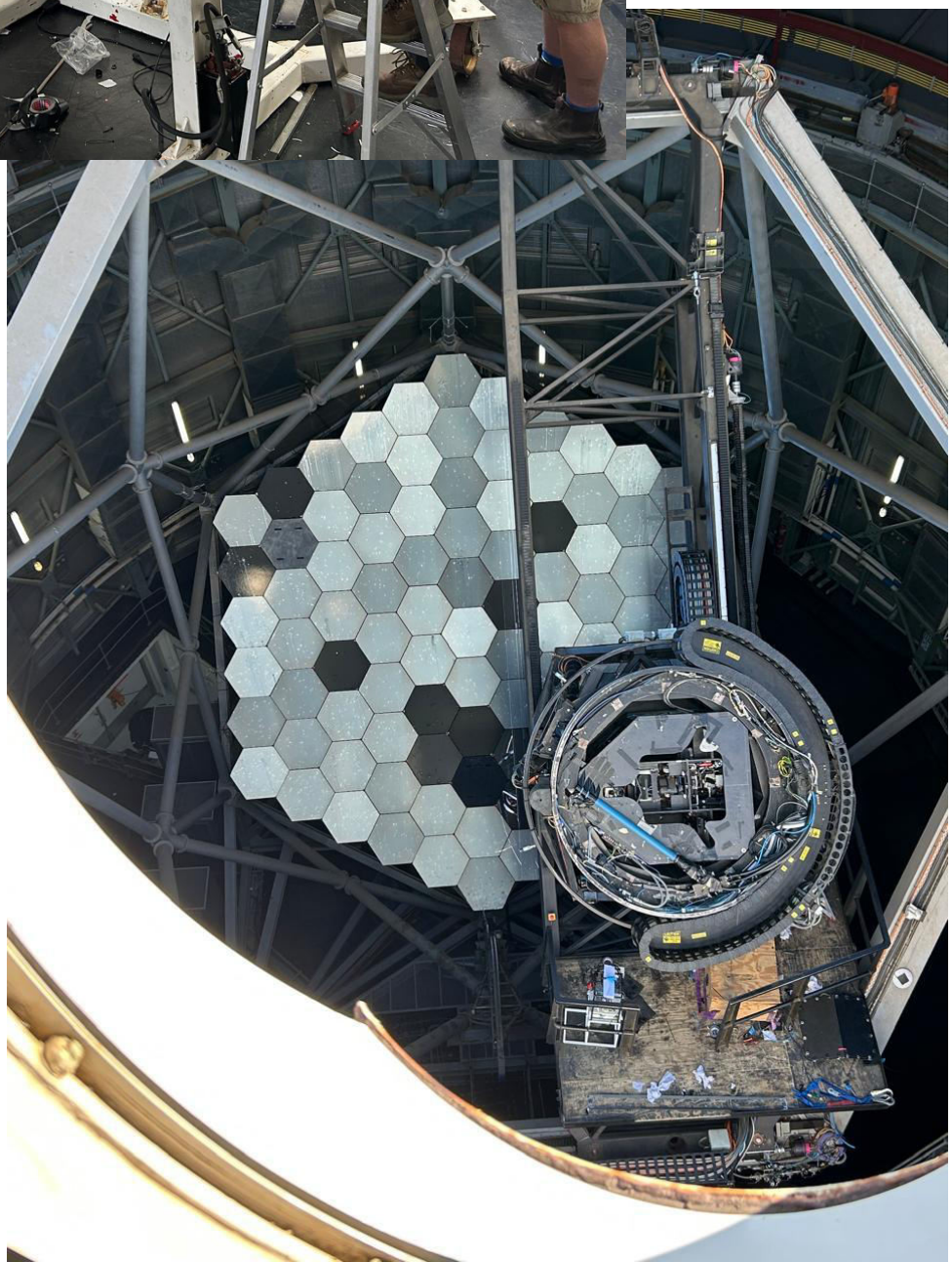
Mirror team preparing for the day's M30 adjustments.



Payload optics after being cleaned.



RSS getting plenty of attention from the team.



A rare daytime view of the array from up in the CCAS tower.

Lisa Crause.--

RSS longslit

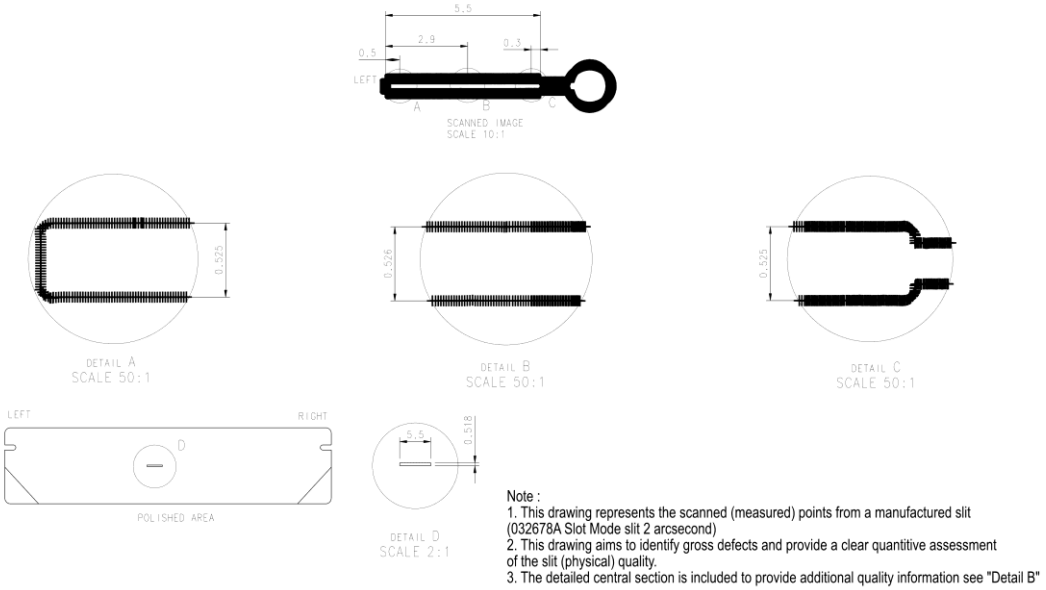
All new longslits have been produced by the SAAO workshop, with the exception of a few spares. The deliveries include:

- Longslits
- Polarimetry Slits
- Frame Transfer Slits
- Slot Mode Slits

Great care was taken during the production, with certain items being rejected due to certain quality criteria not being met. The engineering verification part of this includes a measurement under an optical comparator (to check for slit straightness) and a set of measurements under the Renishaw 3D measurement machine (to check for flatness). The production has been a success overall. The following slit parameters were derived from the existing batch which is mostly in operational use:

- Typical straightness levels of slits are within 10µm and mostly within single digit ranges, with a few defects accounting for the "typical" specification;
- Flatness levels on all (reflective) acquisition surfaces are within 50µm;
- Reflectivity levels are improved relative to the "original" slits.

Being of stainless steel construction and amenable to cleaning, these should have a very long lifespan.



Techincal drawing of a longslit, representing the detailed measured (scanned) points of the slot mode slit, showing the "keyhole", used as an entry point for the manufacturing, and representing a true reflection of the quality levels of the slit (physical characteristics)

This measurement can only be undertaken with one class of machine, that is, an optical comparator, see https://en.wikipedia.org/wiki/Optical_comparator

The datapack and drawings can be used long term to manufacture against and are configured within the SALT configuration system (Siemens Teamcenter). Each slit has a unique identifying number in this system.

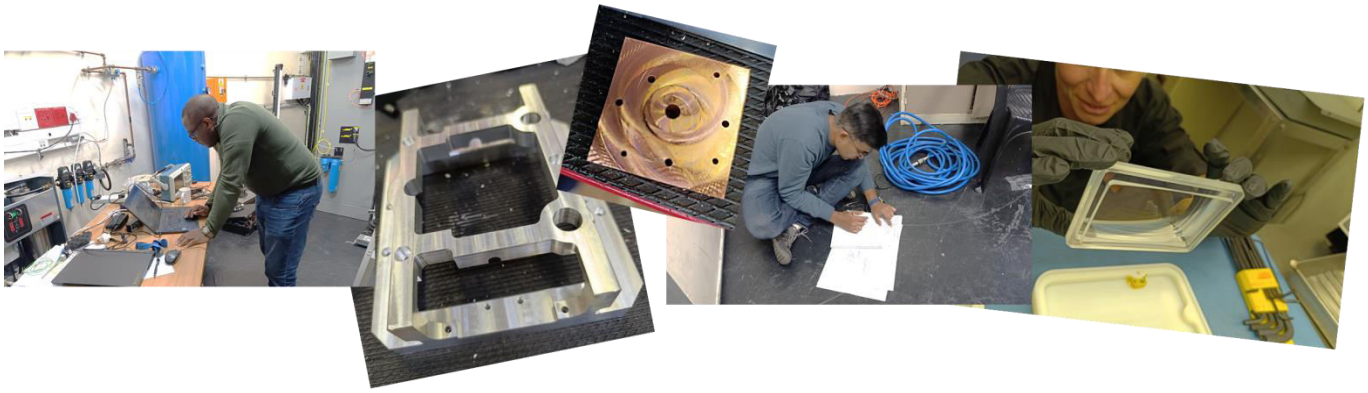
The inspection reports are all completed and configured within the configuration system. They can be used to troubleshoot during the lifespan of the slits. As an example, if the slits were ever to be damaged for whatever reason, these reports can be used as a basis to compare a new measurement against, to assess damage levels, and to use as a basis for replacement.

From the Astro Ops perspective, the new slits were tested on RSS and accepted into full operations in May 2025, and they have been in regular use since June. The SALT astronomers have reported that all the slits used in the past two months have looked good. We have also had no complaints from PIs receiving their datasets using these new slits. In this case — no news is good news! The "old" slits have either been relegated to spares, if they are still in reasonable condition, or retired completely where they are no longer of high enough quality to use for science.

Tasheen Naicker & Lee Townsend.--

RSS detector

The project to replace the RSS detector is proceeding rapidly through the manufacturing and detailed development stage, with cryostat parts being machined in the SAAO workshop and procured parts streaming in. Software development is in full swing, with imaging driver functionality demonstrated in late June. The project team expects to commence lab integration in the last quarter of 2025, with readiness for telescope integration planned for late in the first quarter of 2026. The operations team will review the risks and determine the most appropriate shutdown window, taking into account semester planning. Telescope integration is planned in two phases, with physical and functional integration scheduled first, after which a period of science commissioning will take place wherein calibration and pipelines will be assessed and refined.

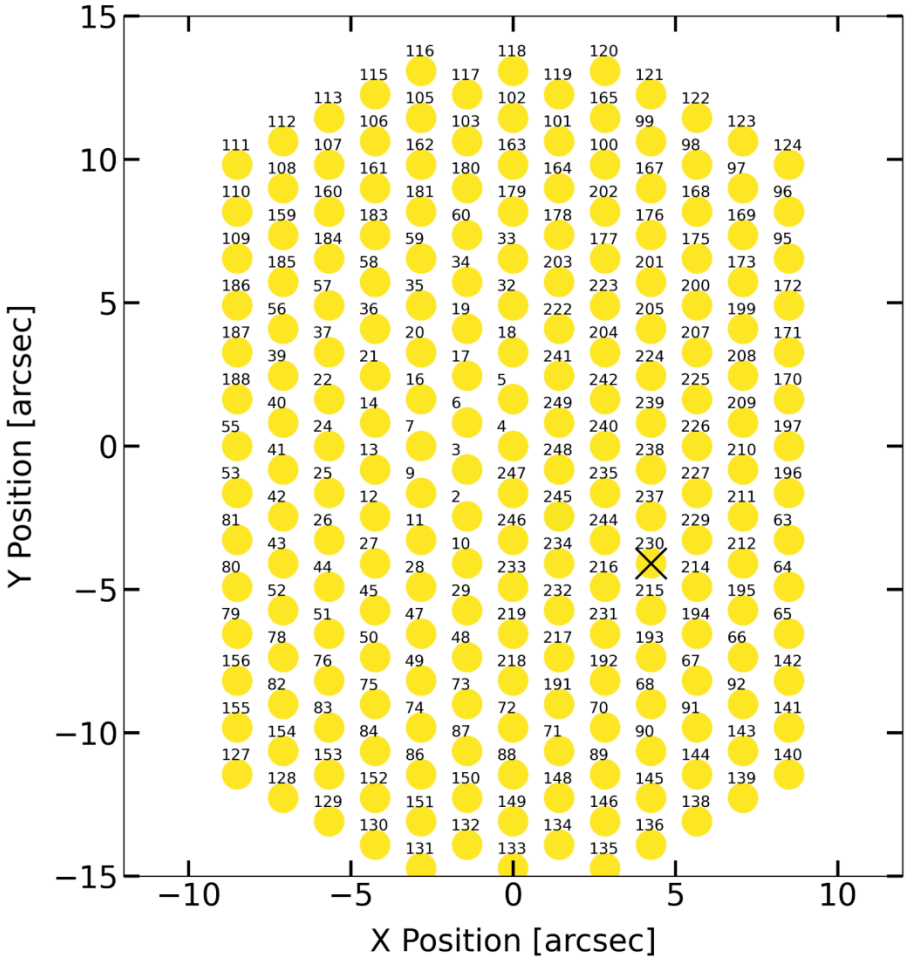


Kathryn Rosie.--

NIRWALS updates

We have been analysing various detector characteristics such as the dark current and its stability, and refining the identification of and behaviour of problematic pixels. We have also been testing the data processing and reduction software, and working through the science verification process. Therefore the instrument has only been available for science to the instrument team and through special request. The results of the analyses will be evaluated before the instrument is made fully available for science observations again. The timeline for this is yet to be confirmed. During the recent shutdown the cooling system was serviced, and we are improving various software related to NIRWALS proposals and operations.

During various testing we discovered that one of the science fibres has stopped transmitting light, the team is investigating the cause of this. The affected fibre is slit ID #230, see image below for the relative position of the fibre compared to other fibres in the object bundle. The IFU centering will be updated to reduce the impact of this on science observations.

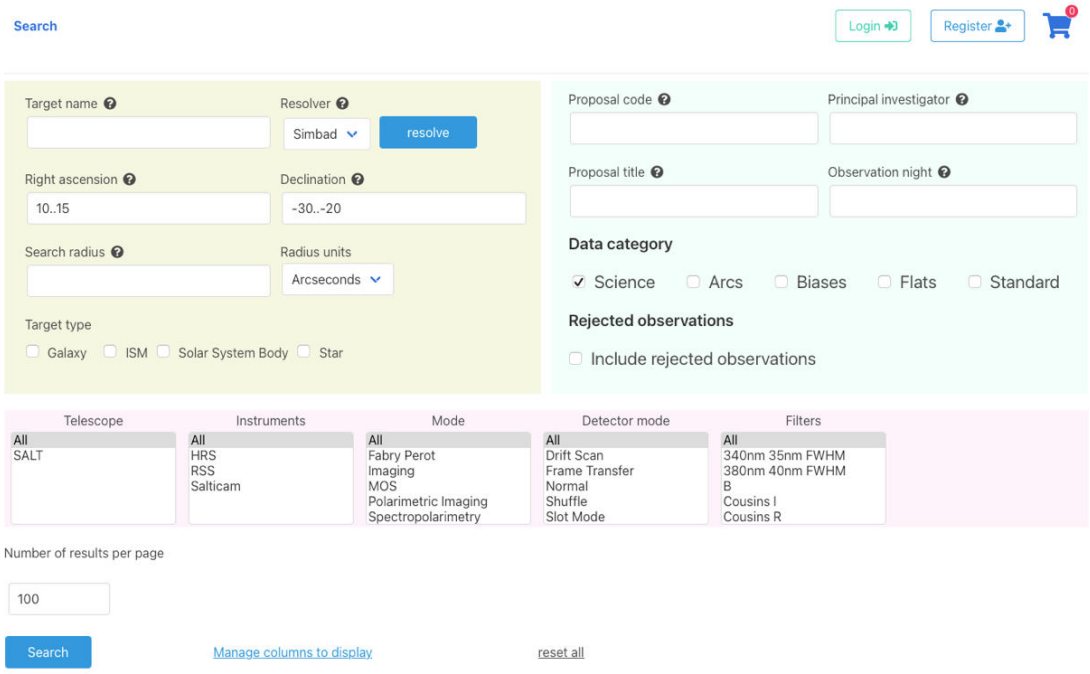


Moses Mogotsi.—

SALT data archive – reminder and user survey

SALT's public data is available on SALT's data archive at https://ssda.saao.ac.za/. This website allows you to query all of SALT's observations. Filters such as a range of target coordinates, the name of the Principal Investigator or the instrument used can help you to narrow down the search results. Both public and proprietary data are included, but in case of the latter only investigators on the associated proposals have access to the target coordinates. You can download data which is public or which you own.

Of course, having a browser-based archive is good but not the full story. SALT's data should also be accessible in other ways, so that it can easily be used alongside observations taken by other telescopes, using tools such as Topcat. But which tool(s) should preferably be supported? The SALT Users Group for Astronomical Resources (SUGAR) and SALT Astronomy Operations invite you to have your say and take part in a short survey at https://forms.gle/8JexFfeUvrkQLoCS6 by 1 October. We are looking forward to your input!



Screenshot of the data archive webpage

Christian Hettlage.--

MEET THE TEAM: Phelokazi Dube

Software Developer

Hello everyone,

My name is Phelokazi Dube, and I've recently joined the SALT Astro Operations team as a developer. I was born and raised in the Eastern Cape. I hold a Bachelor of Science degree from the University of Fort Hare, where one of my majors was Computer Science. I enjoyed it so much that I went on to do my Honours on it, which included a mini-project that really sparked my interest in building practical, useful systems.

After graduating, I decided I wanted to gain industry experience before continuing with my Master's degree, which I'm currently pursuing — still in Computer Science at Rhodes University. My research focuses on building a real-world web application using functional programming languages and frameworks, and exploring how some of their advantages can be adopted in other contexts.

Astronomy was something completely new to me until I joined SARAO in 2021 as part of the Software Development department. There, I worked on several projects, mainly using Python with a framework called Tango Controls, which is used to develop and manage control systems for large instruments like telescopes. My time at SARAO gave me the opportunity to work with different departments, learn how the telescopes operate, and understand how radio astronomical data can be processed and stored.

One of the most memorable experiences was helping to build a small teaching telescope as part of the graduate programme. The idea was to create a hands-on tool that could be used in the SKA African partner countries to introduce students to the basics of radio astronomy. It was an interactive way to learn about telescope design, assembly, and operation, with a focus on the control system. That experience was really insightful to me.

My previous experience was based on radio astronomy, and now that I'm here there's optical and infrared. I'm excited to see and know what that entails and I'm looking forward to learning more about this side of astronomy and contributing wherever I can..

Cheers,
Phelokazi

SALT SCIENCE PAPERS

April 2025 – July 2025

Below is the list of SALT publications since our last newsletter (for our full list of publications, please visit http://astronomers.salt.ac.za/data/publications/). We encourage SALT users to inform us of any papers making use of SALT data, and to double check the link above after publication.

- Loubser, S. I., Alabi, A. B., Hilton, M., et al. 07/2025: An independent estimate of H(z) at z = 0.5 from the stellar ages of brightest cluster galaxies, MNRAS 540, 3135 -- https://ui.adsabs.harvard.edu/abs/2025MNRAS.540.3135L
- Shara, M. M., Lanzetta, K. M., Masegian, A., et al. 07/2025: A 70 pc Diameter Nova Superremnant Surrounding the Recurrent Nova RS Ophiuchi, AJ 170, 56 -- https://ui.adsabs.harvard.edu/abs/2025AJ....170...56S
- Liu, M., Zhang, Y., Wang, Y., et al. 05/2025: Detection of an Orphan X-Ray Flare from a Blazar Candidate EP240709a with the Einstein Probe, ApJ 984, 5 -- https://ui.adsabs.harvard.edu/abs/2025ApJ...984....5L
- Tsantaki, M., Magrini, L., Danielski, C., et al. 05/2025: Ariel stellar characterisation: III. Fast rotators and new FGK stars in the Ariel mission candidate sample, A&A 697, A102 -- https://ui.adsabs.harvard.edu/abs/2025A&A...697A.102T
- Pandey, A., Martínez-Aldama, M. L., Czerny, B., et al. 04/2025: New Theoretical Fe II Templates for Bright Quasars, ApJS 277, 36 -- https://ui.adsabs.harvard.edu/abs/2025ApJS..277P