EUROPEAN ORGANISATION FOR ASTRONOMICAL RESEARCH IN THE SOUTHERN HEMISPHERE

SCIENTIFIC TECHNICAL COMMITTEE

99th Meeting
Meeting held via videoconference, October 25-27, 2021

DRAFT MINUTES
Draft Minutes of the 99th meeting of the Scientific Technical Committee (STC) held via videoconference, 25, 26 and 27 October 2021.

The STC convened with the following composition:

**Chair:** P. Callanan (Ireland)

**Members:**
- J. Cenarro Lagunas (Spain)
- V. Hill (France)
- T. Hovatta (Finland)
- P. Jáchym (Czech Republic)
- K. K. Knudsen (Day 2, 3) (Sweden)
- J. Liske (Germany)
- S. Kimeswenger (Austria)
- M. Marconi (Italy)
- R. McLure (United Kingdom of Great Britain and Northern Ireland)
- F. Pepe (Switzerland)
- L. M. Pérez (Chile)
- G. Pietrzyński (Poland)
- H. Sana (Belgium)
- S. Sousa (Portugal)
- M. Vestergaard (Day 1, 2) (Denmark)

**Observer:** M. Murphy (Australia)

**ESO Council President:** L. Tacconi

**Other:**
- S. Cristiani (Day 2) (INAF, Astronomical Observatory of Trieste)
- F. Eisenhauer (Day 2) (Max Planck Institute for Extraterrestrial Physics)
- F. Ferrini (Day 2) (Cherenkov Telescope Array Observatory)
- R. Zanin (Day 2) (Cherenkov Telescope Array Observatory)

**On behalf of the ESO Executive:**
- P. Andreani
- P. Ballester (Day 1, 2)
- X. Barcons
- G. Beccari (Day 1, 2)
- F. Biancat Marchet (Day 1)
- R. Brunner (Day 1)
- C. Burger (Day 1)
- M. Cirasuolo (Day 1, 2)
- F. Comerón
- C. De Breuck (Day 2)
- F. Kemper
- B. Koehler (Day 1)
- B. Leibundgut
- A. Mérand
- L. Pasquini (Day 1, 2)
- F. Patat (Day 2, 3)
- M. Péron
- S. Ramsay (Day 1, 2)
- M. Rejkuba (Day 2, 3)
- M. Romaniello (Day 2)
I. De Gregorio Monsalvo (Day 2)  A. Russell
F. Delplancke  M. Schoeller (Day 1, 2)
S. Egner (Day 1, 2)  M. Sterzik
E. Emsellem  R. Tamai (Day 1, 2)
J. C. González (Day 1)  L. Testi
N. Hubin (Day 1, 2)  J. Wolillez (Day 2)
R. Ivison  M. Zwaan
A. Kaufer

Minutes:  N. Alas Silva
25 OCTOBER 2021

1. **Opening of the Meeting and Adoption of the Agenda (STC-675)**
   
P. Callanan opened the meeting and thanked ESO for organising a three-day meeting.

R. Ivison reminded the STC of the need to elect a vice-Chair and informed the Committee about the meeting dates for 2022: 26 and 27 April and 25 and 26 October. Regarding a possible visit to Chile, he noted that this might occur in 2023.

The agenda was approved without comments.

2. **Approval of the Minutes of the 98th STC Meeting (STC-674)**
   
The minutes were approved without comments.

   
The DIRECTOR GENERAL was thanked for his report.

   P. Callanan noted that despite the many adverse conditions, considerable progress had been made as far as the La Silla Paranal Observatory (LPO) is concerned, adding that it was great to hear about the possibility of it returning to full operational capacity by the end of 2021. He further acknowledged the good news regarding ERIS, 4MOST and MOONS. On the Extremely Large Telescope (ELT), he observed the reported good progress with the mirrors and the instruments, noting a handle on the costs and a better understanding of the challenges ahead. Regarding the ALMA and VLT/VLTI joint proposals, he asked if more could be said on the possible coordination issues and concerns mentioned in the presentation.

   The DIRECTOR GENERAL asked F. Kemper to reply.

   F. Kemper explained that the main stumbling block is that the Very Large Telescope (VLT) side thinks joint proposals should be ranked A to be successful. In contrast, the ALMA side thinks it should be either grade A or grade B because they do not want to make it too difficult for people and they want to keep it attractive. The VLT side wants to avoid the double jeopardy situation for joint proposals, since this is the core driver, meaning they want the highest possible chance of successfully implementing the proposals, hence the need for rank A. She reported that she would elaborate on this topic during her talk.

   Regarding ELT and HARMONI, P. Callanan asked the DIRECTOR GENERAL to comment on the mentioned communication issues between ESO and the consortium and within the consortium itself.

   The DIRECTOR GENERAL stated that as per the recommendation of the communication review established by STFC with ESO’s support, ESO and the consortium are now trying to work as a single team. The programmatic issues and the ones pertaining to the workforce needed to deliver this challenging instrument are being worked on.

   R. Tamai added that this was discussed at length during the ELT Subcommittee (ESC), where ESO presented various actions to come out of the stalled situation. He pointed out the Science and Technology Facilities Council (STFC) had conducted a very interesting and helpful review of the communication of HARMONI, which ESO, together with the consortium, will follow up.
He further pointed out that the Red Flag raised by ESO highlighted clear points that both ESO and the consortium need to work on to better work together as one team. He added that other critical scientific aspects were also presented to the ESC.

P. Callanan questioned if there were lessons to be learned here, as far as other consortia and instruments projects are concerned.

R. Tamai observed that MAORY was also in a challenging situation two years ago, and a Red Flag was raised with defined clear objectives on how to lift it. MAORY has since gone through a successful Preliminary Design Review (PDR). ESO is happy with how the consortium is now working with them, and the situation improved significantly. He concluded by saying that identifying difficulties encountered and working on them together, as a team, to overcome them is a positive feature.

P. Callanan agreed that it sounded positive, adding that he hoped for a reasonable conclusion. He then commented that the STC is concerned with the cost overruns for HIRES and MOSAIC, potential issues with Guaranteed Time Observations (GTO) further down the line, and a potential cost overrun for MAORY as well. On HARMONI, he asked if there were also implications on its resourcing from a cost point of view going forward, in addition to the communication issues.

R. Tamai replied that regarding resources, ESO has heard that there might be some difficulties that have not yet been put on the table. In terms of people, he identified the tightness on both sides as a resource issue. To overcome this, there is an effort from the consortium side to gather expert and senior experienced people who will help with the design and manufacturing so that the project can move forward. He added that the resources point had been included in the Red Flag and that he hoped actions from ESO and STFC would improve the situation.

4. **ESO Budget 2022 and Forward Look 2023-2025 (Renate Brunner)**

R. Brunner was thanked for her report.

P. Callanan commented that the report was comprehensive, providing a valuable oversight of all the observatories’ activities.

Regarding the 2.0% indexation on Member States’ contributions, J. Liske asked if ESO was worried about the rise of the inflation rate.

R. Brunner explained that one main part of the indexation on Member States’ contributions is the indexation on ISM salaries which is calculated retroactively. The current indexation combines the inflation rates from July 2020 to July 2021. Next year, if the inflation rate increases, the indexation rate on Member States’ contributions will increase as well, and ESO will have to wait for the Member States’ decision.

J. Liske asked what the 5 MEUR per year in management savings that starts in 2023 will consist of exactly.

R. Brunner expressed that ESO always manages to find savings; she further explained that as part of the regular budget preparation process and financial planning, ESO would note that savings will be necessary and identify the areas where cuts can be made.

The DIRECTOR GENERAL reminded STC that management savings had been introduced to ensure ESO’s share of the ELT funding from its own budget, as promised in the ELT funding principles. These savings were 3 MEUR per year and have been 5 MEUR per year for the last
three years. He concluded by saying that the areas where cuts will happen in 2022 have been identified.

Concerning the wave of retirements of La Silla staff and the mentioned replacement by external service providers, P. Callanan asked what the nature of the retirements was and what responsibilities would be devolved to these external providers.

A. Kaufer explained that this was part of the La Silla 2020+ operations model, where senior people who carried out the work during the last ten years would not be replaced by new ESO hires. Instead, they had a two-year process to convert technical and operational support and maintenance of the facilities, including the telescopes. This process led to a call for tender. The company that won the contract is the one that was previously doing technical and operation support in Paranal. The La Silla contract has been running since 01 June 2021, and it is going quite well. He further added that ESO is testing how far they can go with such external technical support, noting that La Silla is a well-established site where the technologies are reasonably well understood and can be maintained by an external provider. However, ESO will take note of any lack of competencies.

P. Callanan asked if there were cost savings involved.

A. Kaufer replied that there are savings if senior staff are not being replaced. He further added that they had taken this opportunity to reevaluate the roles of some staff, particularly at the technician level, since there was an overlap between the external providers and the ESO staff; as a consequence, three ESO La Silla technicians are moving into the M1 segment coating operations, lowering La Silla costs. He observed that the overall costs seem to be below what they were before, although a cost analysis is yet to be done. He concluded by saying that the advantage of an external provider is the reduced long-term liability because a contract can be ended or re-scoped at any time, while if ESO hired new staff now, they might remain with ESO for the next 30 years.

On the mentioned switch from Observing Programmes Committee (OPC) panels to distributed peer review, V. Hill asked if a decision on this had been formally taken.

R. Ivison replied that the decision had been taken but would be subject to review by the STC. He added that the roadmap that is being followed leads to one call per year alongside a fast-reaction channel and perhaps also a high-risk channel, with dual anonymity in place for both.

P. Callanan pointed out that T. Hovatta had interesting comments about the ALMA experience, noting that there will be tweaking involved as far as the DPR is concerned.

R. Ivison noted that such concerns would be taken into consideration when the statistics become more reliable, which will be soon.

5. **ESO Engineering Standards (Sebastian Egner)**

S. Egner was thanked for his report.

P. Callanan noted the importance of the issue for the observatory, the stakeholders, consortia and industry alike.

On the statement that if the community and the consortia support ESO in standardisation, this will be a benefit, F. Pepe suggested that ESO change their approach and first show the benefits and then ask consortia and the community to adhere to it since if there is a benefit,
there is no reason not to use standardised components. He then asked what the future of the continuous-flow cryostats will be and if ESO has a plan to standardise cooling systems.

S. Egner explained that the ESO cryogenics standards include continuous flow and the closed-cycle coolers. He added that ESO is prototyping new developments for closed-cycle coolers to make them easier to maintain and exchange components when needed. He noted that what has not been standardised is the actual design of a continuous-flow cryostat, such as the one for MUSE.

F. Pepe took the view that since the situation is changing because some of the expertise is not available anymore on the continuous-flow cryostat, ESO should have a plan for this. He then asked if it made sense to standardise components when looking for cutting-edge performance or on components that are expected to evolve quickly in terms of performance in the next few years like, for example, wavefront sensors or Real Time Computing (RTC).

S. Egner explained that on RTC, ESO is not looking to standardise hardware for the real-time system hardware but for the architecture, such as the interfaces and protocols, which gives a bit of flexibility to the overall system. He noted that this was a lesson learned from the VLT and the real-time computer for the AOF (SPARTA): to insist to have the same platform everywhere is not always the best approach. He explained that the issue was that five/six years ago, there were simply no wavefront sensor cameras on the market. Instead, ESO decided to develop the cameras themselves, starting a contract with Teledyne e2v to develop a dedicated chip, a dedicated detector, electronics and readout boards. The cameras are now available. ESO needs to evaluate if they will use these wavefront sensor cameras or use a different system for the instruments for the next ten years.

F. Pepe considered that he might have misunderstood the term standard because he would call this a development. He understood the ESO definition of standard as selecting one common solution among many different possibilities, which is something he sees more as a Research and Development (R&D) concept of making at least one system available.

S. Egner agreed, pointing out the New General detector Controller (NGC) as another ESO standard product.

P. Callanan asked if there were any collaborations with other observatories as far as developing standards or if this was a purely an ESO-led initiative.

S. Egner replied that this was an ESO-led initiative.

6. **ELT-related business**

6a. **ELT project overview, incl. instrument updates (Roberto Tamai) (STC-676C-ELT)**

R. Tamai was thanked for his report.

P. Callanan noted that it was great to see the overall progress on the mirrors.

On the reported M5 mirror delamination problem with the chemical vapour deposition (CVD) coating, M. Vestergaard asked if the parts need to be re-coated and, if so, what is the timeline and potential costs.
R. Tamai replied that there are enough blanks even if one of them recently demonstrated some cracks under the CVD coating. He explained that there is a validated process in place to remove the CVD coating and start again the coating, which reduces the timeline. He further said that ESO is looking into options within the contract to procure additional spare segments and already do the CVD coating on them. The point is to anticipate the known risks that can manifest during the polishing. If spares are in the queue, ready for polishing, the timeline will be reduced.

M. Vestergaard concluded that ESO is trying to limit the timeline using the blanks so that the wait time is not long.

R. Tamai agreed, adding that this is ESO’s baseline path. He further said that ESO is looking into an alternative mitigation plan, not to achieve the final scientific requirement of the ELT but to anticipate part of the commissioning.

On the HARMONI Red Flag report, R. McLure asked if there was a trade-off between the two major points noted: the diffraction limit performance of the instrument and the maintenance issue.

R. Tamai replied that from experience, he knows what the impact of maintenance on an instrument is: reliability, access, replacement of items. He noted that sometimes maintenance does not affect the scientific performance of an instrument, especially if the instrument is designed from the beginning with maintenance and access in mind.

S. Ramsay emphasised that there are several issues around maintenance where decisions (one way or another) can affect scientific performance, including the diffraction limited science. One example is the adaptive optics of the instrument that is cooled to minus 15 degrees to reduce the K-band background, at the cost, however, of not being able to buy off the shelf components and an extensive programme of prototyping that HARMONI is currently doing, coupled with the fact that to maintain it, the instrument needs to be brought up to temperature. In the case of the diffraction limit, she mentioned that the HARMONI colleagues might say that to reach the diffraction limit, one may need to add another actuator, such as a second guide arm so that the rotation of the telescope can be measured. However, this is another system that might break down; on the other hand, it is just one among many since there are 10s if not 100s of motors already in HARMONI. She concluded by saying that the progress of the Red Flag has been structured such that these issues, which are system issues, can be aired and be adequately discussed.

R. McLure asked the best estimate for the delay that the situation to resolve the Red Flag introduces.

S. Ramsay replied that the process might take six months to one year. She added that whether this translates directly into project delay or if things can be arranged to allow progress in other directions is yet to be discussed. She emphasised that ESO would like the systems people in HARMONI, and from ESO, to have the free space to look at the instrument and make sure that the result from the Red Flag is a solid baseline.

R. Tamai stated that the timeline would likely have been much longer without the Red Flag report.
6b. **HIRES and MOSAIC way forward (Michele Cirasuolo) (STC-669 rev.)**

6c. **Proposal for the design and construction of MOSAIC (Michele Cirasuolo) (STC-678)**

M. Cirasuolo was thanked for his reports.

The 6d. discussion point was deferred to discussion point 6f.

6e. **Report from the ELT Subpanel (Vanessa Hill) (Full Report ESC Meeting 18-19 October 2021)**

V. Hill was thanked for her report.

Regarding the ongoing discussion with Council on option one and option two, S. Sousa expressed the view that the science production that could be done with 60 nights of GTO, with the current designs of HIRES and MOSAIC will not be the same science production done with a similar number of nights and descoped instruments. However, he was unsure if this was discussed with the instrument consortia and their science teams.

M. Cirasuolo replied that, in the interest of the science, the consortia aim to have the best instrument, agreeing that a better instrument will do the same science better and faster and achieve even more science than a descoped instrument. He concluded by acknowledging that they are faced with a complicated, multifaceted puzzle: trying to maximise the amount of money, the GTO, the science performance, and the knowledge that a better instrument will serve the consortia and the community better.

S. Sousa added that a descope might demotivate the consortia because the science return of the same 60 nights will be different, which the STC should consider.

P. Callanan asked for comments regarding MAORY’s second deformable mirror (DM).

V. Hill replied that the ESC was convinced that the second DM significantly improves the actual performance and how much of the sky and how many nights in the year one can use with a given performance. However, they noted that because of the over-costs already present for the current solution with one DM, the second DM should be considered as an open option for an upgrade rather than forcing it into the current instrument, meaning that the instrument should be designed for a second DM such as this option remains open for the future.

P. Callanan commented that options without the second DM are being considered as far as the current over-costs are concerned. He added that more on this issue would be presented at the next STC meeting.

On MOSAIC and HIRES, P. Callanan informed that the STC had a solid recommendation from the ESC concerning how to proceed: option one is not viable, and option two, with its gate Funding Review, is the way to go.

M. Vestergaard voiced that option two is the only sensible one to take right now. Adding that enforcing the limit of 60 GTO nights will require that many people work very fast, right now, to think about what can happen in three years, which is impossible.
P. Callanan noted no dissenting voices to M. Vestergaard’s comment, adding that the GTO issue and its impact will be considered again at the gate review. He then asked M. Cirasuolo if more could be said about current GTO limits.

M. Cirasuolo replied that there is pressure on GTO from both first- and second-generation instruments. He continued by saying that option two allows Council to have time to decide on the final number of GTO nights, which can be 60 or more, noting that option two provides a margin for thinking and a much more solid understanding of the actual situation.

P. Callanan considered that it would also allow for a clearer picture of MAORY and what will be in the mix there.

Regarding M4 and the reference body (RB) issues, J. Cenarro asked if ESO has a plan B or a way out in case the situation should not converge to the initial specifications and further asked if there has been an evaluation on the impact of this issue of the overall performance of the telescope.

R. Tamai explained that ESO is moving along two paths: one where they are still trying to achieve the requested performance of the RB and another one investigating the impact, if any, of using what is available as it is today. He added that they are reusing the stroke of the pads of the actuators behind the mirror because of the uncertainties of the flatness of the reference part; they need to see if the error budget introduced for the full stroke of the activators is enough or not.

J. Cenarro added that if the issue continues and there is a need to decide, the STC should comment on it.

M. Cirasuolo noted a final clarification following the discussion of the ESC on the (ELT) Pre-Focal Station for Nasmyth B (PFS-B): PFS-B has been included in the schedule and is far from the critical path.

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7. **LSP-related business**

7a. **LPO Operations (Andreas Kaufer)**

A. Kaufer was thanked for his report.

On the mirror recoating, P. Callanan asked if it was done based on a particular timescale or if it was done based on a drop of the reflectivity by a certain percentage.

A. Kaufer explained that the requirement states that the reflectivity should not drop more than 10%. ESO has to recoat every eight-meter mirror every two years under normal operations. He added that there was not much contamination in terms of dust during a safe state since the telescope was closed for about six months. There is a bit of a backlog on the eight-meter mirrors, but ESO will try to recoat all during the next twelve months: the recoating of the first was done now, the next is planned for March 2022. After this is done, they will go back to the two-year cycle.

P. Callanan noted that for Unit Telescope (UT) 1, the presentation mentioned coating in 2016 and 2021.
A. Kaufer informed that UT1 was in the queue for longer because of quota refurbishment. However, the delay was not only due to the pandemic but started in the fall of 2019 with the social unrest in Chile.

P. Callanan observed that the degradation seems to only be of a few per cent even with the delay.

A. Kaufer explained that the graph in slide 11 shows that the coating is within the requirements: the lower blue curve shows what has to be achieved while the upper red curve shows what could be achieved in a super good vacuum.

Regarding CONCERTO, P. Callanan noted he was not sure he understood the plot shown in slide 12 while acknowledging that it is interesting to see new technology deployed on APEX.

7b. **Science with GRAVITY+ (Frank Eisenhauer)**

F. Eisenhauer was thanked for his report.

F. Eisenhauer took the opportunity to express how Europe stands out in interferometry and high angular resolution astronomy, and generally in instrumentation.

Regarding slide 14 of the presentation on the direct detection of GAIA exoplanets, M. Vestergaard asked about the issues that prevented GRAVITY from detecting it earlier.

F. Eisenhauer pointed out that GRAVITY is not a planet-search machine because its field of view is very small; it is typically 50 milliarcseconds, so it cannot efficiently search for planets around a star like SPHERE. He added that what is essential for them is to have prior information on where to look and not do blind searches; they will wait for the next Gaia data release to have the acceleration and the candidates.

7c. **Proposal for the design and construction of GRAVITY+ (Antoine Mérand) (STC-679)**

A. Mérand was thanked for his report.

On slide five of the presentation, F. Pepe asked if the 150 nights was per UT, or in total UT time?

A. Mérand replied affirmatively, explaining that since GRAVITY+ uses four telescopes, it means 150 divided by four.

On the tentative timeline, F. Pepe asked if it was an optimistic schedule and if it had any contingencies.

F. Eisenhauer replied that there are no contingencies and that it is a realistic schedule, noting that the manufacturing has been pre-launched, the Adaptive Optics (AO) is in good control and that the laser will depend on the possibility to implement it in Paranal and how it is phased with the coding of the main workhorse. He concluded by saying that there are no technical showstoppers, and in comparison to GRAVITY, there are fewer uncertainties.

A. Mérand added that the Laser Guide Star (LGS) is also known territory since it replicates the technology used on ELT, and in terms of design and placement on the telescope, it will mirror what was done on UT4.
On the resources point and the mentioned delays for FORS+, CUBES and BlueMUSE, whose phase A has been postponed to 2023, which is a year later than what the STC initially advised, R. McLure asked if ESO is in a position to provide any support to the BlueMUSE consortium through the delay.

L. Pasquini replied that ESO would be able to cover and support the team, adding that some of the work will start already in late 2022. He explained that the real problem would be if GRAVITY+ requires more than the 38 (Full Time Equivalent) FTE in total, representing about 1/3 of the Paranal Instrumentation Programme (PIP) resources per year; however, he further observed that ESO is about one year from the Provisional Acceptance Europe (PAE) of 4MOST and MOONS, meaning that there will be fewer projects to run by the end of 2023.

Since GRAVITY+ will be deployed in several phases, V. Hill asked if the GTO will also follow these phases.

A. Mérand replied that he did not know.

F. Eisenhauer replied that the draft agreement is currently with the Contracts and Procurement team at ESO, adding that the phasing is mentioned: with an achieved milestone, part of the GTO can be used.

L. Pasquini added that the proposal is to start with some nights as soon as the implementation is done.

7e.  Science with CUBES (Stefano Cristiani)

S. Cristiani was thanked for his report.

S. Kimeswenger observed that the CUBES team were using Sky Model and asked how sensitive the simulation was, mainly the knowledge of the Huggins band of the ozone and if it would harm, for example, the coverage at 305 nanometres.

S. Cristiani said the bands are relatively broad, meaning the resolution of CUBES should not be a significant problem.

S. Kimeswenger replied that they are not and explained that they are a template in Sky Model.

S. Cristiani informed that the team used observations of bright objects at high signal-to-noise for the simulations of the science cases, noting that they were not only relying on Sky Model.

On the example of deuterium abundances measurements for Quasi Stellar Objects (QSOs), P. Callanan asked if there was a sense of how significant the population increase with CUBES will be.

S. Cristiani replied that potentially the increase should be an order of magnitude. However, he added that it is difficult to give a precise number since it will be a case-by-case issue.

On the deuterium question, M. Murphy asked if the team had looked at the existing measurements and degraded the spectra to resolving power of 20,000 and analysed them to see if they got the same answers as with UVES.

S. Cristiani replied that the measurements could be done because a 20,000 resolution is high enough. Still, he pointed out that it should not be done with CUBES alone: complementary UVES information at high resolution should also be used.
7f. **Proposal for the design and construction of CUBES (Bruno Leibundgut) (STC-680)**

B. Leibundgut was thanked for his report.

Regarding costs, F. Pepe asked if the mentioned costs were only capital and not FTEs.

B. Leibundgut replied that they were only capital costs.

J. Liske asked if the STC were given the Top Level Requirements (TLRs) for any of the proposals, noting that the STC should be given the TLRs to understand better what they are being asked to approve.

A. Mérand commented that for GRAVITY+, the TLRs are copied into document STC-679 but not explicitly as TLRs.

J. Liske reminded that CUBES and VLT being complementary to the ELT only happens because the current coatings on the main five ELT mirrors are out of spec and do not meet the TLRs regarding transmission and reflectivity of the mirrors. Therefore, ESO has a project running with the Fraunhofer Institute to find better coatings for the ELT mirrors within the TechDev programme. He then asked what would happen to CUBES if, in the future, there were better coatings recipes for the ELT. He observed that although HIRES, in its current specification, does not go below 4000 Å, a UV module could be added to take it to the 3000-4000 Å range, noting that the reason why the module does not already exist is the ELT coating issue. He further reminded that in STC’s 94th meeting, the STC report that had recommended CUBES Phase-A had also asked for a comparison of CUBES and its capabilities with other possibilities (such as an upgrade of UVES) and upcoming UV facilities, adding that this comparison was never presented.

B. Leibundgut remarked that ELT could not be an argument against CUBES.

J. Liske replied that this was not an argument against CUBES or the consortium but a comment on what ESO should do.

S. Cristiani noted that CUBES first light will be in 2027. On the sensitivity, he explained that the low-resolution mode, which matches the resolution of XSHOOTER, ensures they are background limited for faint high-redshift sources. He further observed that the CUBES gratings, which work in the first order, make it difficult for any other cross-dispersed spectrograph to reach comparable sensitivities.

About the 1.8 MEUR cost gap, M. Vestergaard asked if the consortium has a clear view of where the money might come from and also if there is a contingency plan in place if the funding fails.

S. Cristiani replied that the six partners that make up the consortium had discussed this. They are sure they will raise the money. He also noted that the costs gap is a relatively small contribution: divided by the six partners, it is around 300 kEUR over five years.

M. Vestergaard asked if that budget line included FTEs.

S. Cristiani replied that it did not, adding that the final draft of the memorandum of understanding has been prepared and that the partners have agreed on the financial commitment. He said that he does not believe the cost gap is a risk.
L. Pasquini recalled that the comparison with a UVES upgrade and XSHOOTER was part of the CUBES Phase-A study. He informed that there is also a cost gap of 1 MEUR for GRAVITY+, noting that ESO is confident that the consortium will solve it.

7g. **Paranal instrumentation update (Luca Pasquini) (Cou-1957)**

L. Pasquini was thanked for his report.

P. Callanan commented on the good news regarding CRIRES+ and the IRLOS upgrade. On the ERIS PAE critical non-compliance, he pointed out that having to remove an anti-vibration spring to improve vibrations must have been a first.

About the vibrations, L. Pasquini replied that it should not have been the case by design, but it was what happened.

On slide 11 of the presentation, M. Vestergaard asked what Tau_0 was.

L. Pasquini replied that Tau_0 is the coherence time.

N. Hubin added that at Paranal, the coherence time is, on average, three milliseconds.

L. Pasquini noted that a coherence time below three milliseconds is considered bad.

M. Vestergaard asked what were the Tau_0 units on the plot.

N. Hubin replied seconds.

P. Callanan noted that it was positive to see that MAVIS had secured the additional funds to cover part of the extra cost of the spectrograph.

L. Pasquini pointed out that the additional funds were secured quickly after the kick-off, which was a good sign.

7i. **Eupraxia visiting instrument telescope proposal (Bruno Leibundgut) (STC-681)**

B. Leibundgut was thanked for his report.

P. Callanan expressed his disappointment because implementing this technology would have been great. However, he noted that it had got great potential for the future.

J. Liske, regarding the FLAMES option, asked if the field lens was left in, couldn’t the issue of the reduced transmission be fixed by doing a longer integration. Being that this is a technology demonstrator that has been demonstrated on the Anglo-Australian Telescope (AAT), he further asked what would be the point of doing it on an eight-meter telescope?

B. Leibundgut replied that indeed the technology had been demonstrated. However, he pointed out that the four-meter telescope is not enough for the science case because the flux from the eight-meter telescope is needed to reach the targeted faint galaxies. If the science case could be done behind the FLAMES field lens, this is something that needs to be assessed.

J. Liske observed that this is an H-band instrument and asked about the warmness issue.
B. Leibundgut replied that the proposal was clear about the PRAXIS instrument on the AAT suffering from thermal background at the same wavelength.

7j. **Update on Special Call 107, Joint Proposals, and next steps (Ferdinando Patat)**

F. Patat was thanked for his report.

V. Hill asked how the consequences of the proposed changes will be followed up and how the STC will be involved in it.

F. Patat explained that different things are being planned. He reported that data is being collected on the dual-anonymous process, which was the easiest thing to implement in the system and has been in place for one semester. The first report will note how the gender and country balance changes. They expect it to be in line with ALMA and the *Hubble Space Telescope (HST)*. On the DPR, reviewers will receive N different comments for the same proposal. For each comment, the Principal Investigator (PI) will grade the quality of the comments. He pointed out that one of the drivers of the DPR is that many users say that the comments are of poor quality, which is related to the fact that panels have too many proposals on their hands. DPR will decrease the number of proposals drastically. What they want to measure is if the feedback level improves in quality. He further explained that next, they would need to measure if the science is better by using a DPR selection or a classical panel selection; they will maybe have half of the proposals reviewed via DPR and half via a classical panel, and after a few years make a comparison as to whether those selected by a panel and those selected by DPR produced “better science”, whatever that may mean.

S. Kimeswenger asked if the annual schedule does not eat up half of the gain one gets from DPR.

F. Patat replied that the experience from other observatories shows that the number of proposals is reduced by about the square root of two. If half of the proposals are sent to DPR and half to a panel that has the same size as it has now, the load will be reduced. He noted that if it is shown that DPR works, it will evolve with time such that only large programmes and surveys will be discussed in person, meaning a single reviewer’s load would be of the order of 10 proposals, which is a factor of 10 times smaller than the current load.

P. Callanan commented that it sounded like a utopia.

F. Patat agreed.

7k. **Report from the LSP sub-panel (Hugues Sana) (Full report LSP meeting 20-21 October 2021)**

H. Sana was thanked for his report.

L. Pasquini asked to clarify if the recommendation regarding CRIRES+ and the pipeline was to place more resources to ensure the consortium has enough human resources and perhaps move to an agreement that the analysis software is then made public.

H. Sana replied that there had not been a formal decision on this. Still, the framework of the discussion was that the current status of the radial velocity accuracy was not good enough. It was understood that it would only be possible to reach the TLR accuracy of 3 (three) m/s by applying better post-processing methods. He mentioned that it was explained to the panel that this has not been achieved yet because of a lack of resources, but that this work would be a responsibility of the consortium and the software developed to achieve that accuracy would...
belong to the consortium and not necessary to ESO. He stated that the panel’s opinion was that this was not a good model because most of the community would not benefit from the 3 (three) m/s TLR. He concluded by saying that to recommend supporting or not the allocation of resources for this work, they would first need to know how many FTEs would be necessary to do this.

P. Pasquini mentioned that, to the best of his knowledge, one or two postdocs were working on that. He then clarified that his question was to know if the STC had a strong opinion on this issue.

H. Sana said that, in his opinion, if there is an instrument TLR, that should be available for the entire community.

L. Pasquini then explained regarding ERIS that there is a model.

H. Sana clarified that he meant to say that there was no model explaining the vibrations.

L. Pasquini agreed.

H. Sana said that the document's text is more precise than the slides.

F. Pepe mentioned that he did not understand why there would be a risk that the community would not have access to the 3 (three) m/s TLR and asked how the 3 (three) m/s is achieved.

L. Pasquini replied that it is done using an absorption cell. Since this is considered a full post-processing analysis work, it was not included in the deliverable when the agreement was done with the consortium.

F. Pepe commented that this sounded strange.

H. Sana asked how ESO would validate the TRLs and the stability of the spectrograph if it does not have access to that software.

L. Pasquini replied that they would have to rely on the analysis done by the consortium. Regarding stability, he explained that the cell is there because one does not rely on the instrument's stability.

F. Pepe asked if the data extraction, calibration and reduction package is part of the deliverable.

L. Pasquini replied that the pipeline would give everything except the cell data analysis. He added that Point Spread Function (PSF) fitting had not been implemented yet because there are not many lines to provide the PSF, which is why the precision is currently 15 m/s.

F. Pepe asked if the mention of the new data reduction frame refers to the data flow.

H. Sana replied affirmatively.

F. Pepe mentioned that the title in the slide was “data reduction”.

H. Sana agreed that it was supposed to be data flow.

F. Pepe asked about the proposed Exoplanet event.

H. Sana commented that this had not happened yet, but it is on the long-term planning.
F. Pepe asked if this was an action to ESO.

H. Sana replied affirmatively.

B. Leidbungut argued that the idea was to see how the ESO instrumentation contributes to this field and whether there are any gaps.

F. Pepe asked why the focus on the particular subtopic of giant planet formation and evolution.

B. Leidbungut explained that this came up specifically from the La Silla Paranal Subcommittee (LSP) a couple of years ago and one reason why this has not been done yet was that there had been discussion among the programme scientists on what topics would be interesting in addition to exoplanets and exoplanet formation and also to include all ESO facilities and not only VLT/VLTI.

V. Hill added that this issue came about also concerning the SPHERE+ science case positioning.

F. Pepe argued that he would have titled it differently in that case.

V. Hill stressed the concern about the significant need in FTEs to ESO regarding GRAVITY+ and asked if any mitigation has been planned and what happens if the risk materialises.

L. Pasquini replied that the FTEs are being inserted in the risk registry of the programme and that there are several possibilities. One is to convert resources in money, i.e. to pay for additional people; another is to affect the other ongoing projects; a third is to get an answer at the organisation level, where another programme takes missing resources. He commented that this was discussed with the consortium, and no de-scoping would make sense.

M. Vestergaard had a question on the dual-anonymous review: namely, how to distribute the proposals between reviewers. She commented that if it is done in the same way as in ALMA, she has some concerns.

F. Patat asked if she meant DPR and not dual-anonymous.

M. Vestergaard replied affirmatively.

F. Patat replied that the final specifications are still not completely defined. Still, one thing that will undoubtedly be different from the ALMA process is that the reviews will be completely independent, whereas, in ALMA, there is a time interval in which the DPR reviewers will be able to see what the others have said.

M. Vestergaard commented that she sees pros and cons to both approaches. A con is that some reviewers might misunderstand how the review should be done, and they give a 10 to a proposal to which they wanted to give a one; another could be that some reviewers might not have read the proposals correctly. She then added that her main concern had to do with the evaluation of sets of proposals with different average levels, which means that a good proposal in a very high standard set could be ranked lower than a weaker proposal in a weaker set.

F. Patat explained, regarding the first con raised, that the tool used by ESO tells the user if a grade is excellent or bad, so it will be very difficult to miss that. Regarding the last point, he argued that this is cured because most of the reviewers will not review the same set of proposals, and there will be several hundred reviewers participating in the process. He
mentioned that there could be a case where someone is a complete outlier, maybe because they do not read the proposal, which he noted also happens in panels, where someone might conform to the mainstream. He also argued that this would partially be cured because of the larger number of reviewers, allowing more easily to detect the outliers and reject them. Finally, he concluded that there will always be a level of subjectivity that will not be possible to be removed unless a machine replaces the reviewers.

M. Vestergaard asked to clarify that if each reviewer gets a different set of proposals, the ranking can be a little bit random because they are all measured against different things.

F. Patat explained that the assignment matrix would be sparse and semi-random. He mentioned that he understood the point that one reviewer could be very unlucky and get a set of the worst proposals available, but the assumption is that most of the reviewers will not.

V. Hill asked about the status of the R&D part of the SPHERE+ upgrade.

N. Hubin mentioned that this has a lower priority than BlueMUSE and what is being done now is to rely on the resources from the SPHERE+ consortium, which is committed to providing a management plan to see how much effort they can gather to develop SAXO+, which should happen in the coming months. On top of that, he mentioned that since one of the highest risks of SAXO+ is the RTC development, the consortium was asked to consolidate the TLR of the RTC because the amount of effort required will depend on the solution chosen. Based on this, ESO will be able to assess how many FTEs are needed. On a side note, he mentioned that the increase of GRAVITY+ and other projects in terms of FTE puts pressure on the technology development programme.

8. Other business

8a. Scientific Prioritisation report (Fernando Comerón) (STC-682)

F. Comerón was thanked for his report.

P. Callanan thanked Fernando Comerón for the presentation and the ad-hoc meeting with the STC, where STC expressed their concerns with the prioritisation report.

F. Pepe mentioned that he had already expressed his doubts in that previous meeting, and he confirmed those doubts, appreciating at the same time the work that had been done for this document. He stressed the inconsistency between the fact that the document is named “science priorities” and the repeated mention that these are not priorities, making this more of a review document and not a priorities document. He exemplified two aspects that are not addressed by this document: how ESO allocates its limited resources to different approved projects and how the STC will advise the ESO Council to choose among not yet approved different projects.

F. Comerón explained that these are priorities in the sense that what is listed in the document has gone through the processes of approval, discussion and recommendation, which means that the document consolidates and lists the result of that assignment of priorities in which the STC has been involved.

F. Pepe argued that part of the STC has been involved but mentioned that the document’s purpose has been evolving in the last couple of years, which was not a linear process. He added that STC asked three years ago what the process to make the decisions was, but that had not been addressed in the document.
J. Liske clarified that what this document is doing is summarising things that have gone through STC previously and are important to the organisation. However, he stated that he completely shares the concerns of F. Pepe and that STC should take the document for what it is now, which is a summary of the state of affairs and of what the community wants. However, ESO should start immediately thinking again about how the prioritisation process is set up, how the document might be used by ESO management, and its relation with the Council strategy document.

F. Comerón mentioned that his impression is that the process should be moving to set up a ranking, more than a list of priorities. However, he clarified that this did not appear in the terms of reference for the group that worked on the current document.

F. Pepe stressed that “priority” is not synonymous with “important” and that setting priorities means setting a ranking. He added that if there is a list of things classified as important and ESO doesn’t have the resources to accomplish them, this document does not address how to choose which of the items in the list is to be done.

F. Comerón added that if the purpose is to establish a ranking, something with a broader scope than just a working group should be responsible for it.

F. Pepe agreed with it.

H. Sana argued that one only needs to prioritise things that are in conflict, meaning that as long as there are no conflicts, there are no issues. He added that priorities are needed when things go wrong or get delayed. He mentioned that he had difficulties understanding how the entire programme of ESO could be prioritised and coming up with a list that goes up to a thousand.

R. Ivison agreed with H. Sana. He mentioned that there were several misconceptions, and it was easy to understand why these happened. He observed that this was the second time this process had taken place, noting that the considerable effort for GRAVITY resulted from that first process identifying GRAVITY as the most important thing to do. He argued that the second process was less clean for various reasons like the messy start and several other already underway processes, like the VLT 2030 and ALMA 2030 exercises. He stated that the intention of this programme was never to override those parallel processes but to capture them and look for synergies between those concepts. He also said that this document could be seen as a list of priorities because, like other road maps, what is not mentioned should be taken as things that ESO will not do.

L. Pasquini added that LSP and STC are always involved when ESO arrives at a big conflict point. On the other hand, he mentioned that this exercise can only be done at a certain level and that there are processes already in place to deal with conflicts.

M. Vestergaard asked if it would make sense to rename the document.

F. Comerón replied that he did not think the document's content makes it a roadmap.

M. Vestergaard suggested adding more clarifying comments about the purpose of the document.

F. Pepe agreed that because it is not the task of STC to do management work, this should be clarified in the document.
8b. **CTA way forward (Xavier Barcons) (STC-677)**

The DIRECTOR GENERAL was thanked for his report.

F. Pepe asked what would happen if the STC did not recommend positively.

The DIRECTOR GENERAL replied that it would be a sign that ESO does not support the Cherenkov Telescope Array (CTA) project as it is today for the reasons stated in the presentation. ESO could always join later when a construction proposal is on the table when an operations plan is available. However, it would create a big hit, which not voting initially in favour of the cost book had already created. He further explained that ESO did not feel comfortable approving the cost book, not because of scientific reasons but programmatic aspects.

F. Pepe asked if the operations would remain cost-neutral for ESO.

The DIRECTOR GENERAL replied affirmatively.

On the risk that ESO has to operate the Cherenkov Telescope Array South (CTA-S) at standards not appropriate for an observatory, F. Pepe observed that if operations are very complex and ESO has to hire more staff, ESO will not be able to invoice these extra costs to the Cherenkov Telescope Array Observatory (CTAO).

The DIRECTOR GENERAL agreed and acknowledged that this is why an operations plan is needed.

F. Pepe asked if this is clearly stated in the contract.

The DIRECTOR GENERAL replied that the contract is clear: ESO will operate CTA-S on a cost refund basis. He reminded that this will be the first ground-based gamma-ray observatory and that MAGIC, HESS, and VERITAS are experiments and run as such. CTA is meant to be operated as a facility observatory for the community. He stated that ESO’s reputation is at stake, and if ESO is to operate an observatory, it will do it according to its own standards.

8c. **Science performance of CTA Alpha configuration (Roberta Zanin) (STC-677)**

R. Zanin was thanked for her report.

H. Sana asked to clarify if ESO’s share of observing time is 10% of GTO or of the total time.

R. Zanin replied that it was 10% of the total time.

H. Sana then asked if the Chilean time was coming from the ESO time.

R. Zanin replied that it was on top of that.

P. Callanan asked what drove the decision of putting all four big telescopes on Cherenkov Telescope Array North (CTA-N) instead of dividing them by CTA-N and CTA-S.

R. Zanin mentioned that the important thing is to have at least three Large-Sized Telescopes (LSTs) to get the required angular resolution and sensitivity and that the CTA team decided to have four for redundancy purposes. Therefore, it doesn't make much sense in scientific terms to split into groups of two. Considering this, there was then a political decision to build the four LSTs in the northern site.
J. Liske asked to clarify what happens when going from the baseline to the alpha configuration.

R. Zanin replied that although there is a loss in on-axis sensitivity, in the off-axis sensitivity, there is none. In terms of angular resolution, she mentioned a loss of 10% around 1 Tev, and below 150 GeV, the loss is 20-30%. Despite this, she stressed that the science requirements are still fulfilled.

P. Callanan said that he presumed that those improvements are mapped more to the CTA-N with its large telescopes.

R. Zanin said that this was not so because the large telescopes do not play any role in the case of the off-axis sensitivity.

P. Callanan asked what the band in red below the requirement line in the off-axis sensitivity plot was.

R. Zanin replied that it was the systematic uncertainty in the simulation, driven by the fact that all the equipment is new in the simulation, and there are no atmospheric changes.

P. Callanan asked if a timescale on when the large telescopes could be placed on the site exists.

R. Zanin replied that there were already stakeholders looking for funds. She argued that it could be possible that these large telescopes would be funded in five years.

S. Kimeswenger asked why the spacing between the Small-Sized Telescope (SSTs) in the alpha configuration is much smaller.

R. Zanin replied that the space between telescopes, which is still under study for the SSTs, is a compromise between the large array footprint, which gives the on-axis sensitivity and the angular resolution. She added that this study would determine if the optimal separation would be about 210-290 meters on average. She also mentioned that they do not need a large footprint for small energy events, but with increasing energy, one wants the largest footprint possible.

The DIRECTOR GENERAL asked if by not having the LSTs in the southern configuration, what is lost is primarily extragalactic observations.

R. Zanin replied that the extragalactic sources at distances larger than redshift 1.5 are not detected.

P. Callanan asked if the arrays in the south would be focused on the galactic sources.

R. Zanin replied affirmatively.

P. Callanan asked how many sources would the array in the south be able to pick up.

R. Zanin replied that 100 sources are known with the current instruments in the galactic plane. The expectations are to detect a factor of five or seven of more planetary nebula and a factor of three more supernova remnants, which means 800 sources instead of 100. In terms of extragalactic sources, an increase of a factor of two is expected for non-flaring AGNs.

P. Callanan commented that it is a pity that the number of GRBs is reduced due to the lack of large telescopes.
R. Zanin argued that from that 40% reduction, 20% can still be seen by the northern array. She added that this is a conservative estimate because this study assumed a maximum slewing time of 90%, but on average, this number will be smaller and affect the GRB detection.

P. Callanan asked the reason for using the silicon photomultipliers for the smaller telescopes and the more traditional photomultiplier tubes (PMTs) for the larger telescopes.

R. Zanin explained that the dual mirror design has a smaller plate scale, which requires smaller cameras and thus the choice of the silicon PMT. She added that this has a massive benefit because it increases the duty cycle of the telescope since it makes it possible to observe with a bright moon, which is not possible with the standard ones.

P. Callanan asked if the silicon PMTs are not feasible for the large telescopes.

R. Zanin replied that there is a study to implement silicon PMTs in LSTs on the southern site, and the reason why it was not considered for the north site is because there were some technical challenges that had to be addressed and are being addressed at the moment. She explained that one of them is the high efficiency of the silicon detectors on the infrared, which increases the night sky background, which is a problem for small energies, where small events are more difficult to disentangle from this background. Another challenge is the more significant amount of data in the LSTs that have to be treated online, requiring some machine learning algorithms to reduce the data size.

P. Callanan commented that it would be nice to see possible future collaborations between CTA and ESO in addressing some of these technological challenges.

R. Zanin agreed that it would be qsuite possible.

8e. Questions regarding Fact Sheets DOO/DSC (STC-676A-DOO/STC-676B-DSC)

P. Callanan acknowledged that ESO had done exceptionally well in promoting itself in the current situation from a communication point of view by holding various workshops and seminars online.

In Period 108 (P108), P Callanan observed that the pressure factor was still relatively high.

F. Patat replied that it is extreme due to carry-over, noting that the available time for new programmes dropped.

J. Liske asked what the thinking about ESO conferences was and if they were going back to face-to-face in the future.

I. Gregorio-Monsalvo replied that ESO is evaluating the situation and thinking about moving to hybrid conferences, noting that hybrid mode will first be tested in smaller meetings to address capabilities and technical issues.

P. Callanan asked R. Ivison to comment on H. Sana’s previous question about the LSP meetings going more online and this being a template for future meetings.

R. Ivison replied that it was an interesting point. He noted that it was too early to tell if ESO will hold STC meetings online as a matter of course. He took the view that people miss the informal chance to chat that face-to-face meetings provide. He added that the STC travel to Chile is not a question of if, but when.
P. Callanan agreed that the face-to-face interactions aspect is essential, adding that the fact that the STC members have met beforehand provides a bedrock that can be used during virtual meetings; however, these connections need to be reinforced by face to face meetings.

V. Hill informed that the ESC did not comment on the future nature of its meetings. Her personal feeling is that for the STC, it is important that the meeting takes place face-to-face, at least sometimes. Because the ESC is smaller, a face-to-face meeting is not as needed as for the STC.

H. Sana explained that the LSP has members from Australia, Chile and the west coast of the United States of America. Having a one day face-to-face meeting is not as convenient as a virtual meeting. His personal opinion is that LSP and STC should not both be virtual.

J. Liske asked if the Einstein Telescope is being discussed at ESO?

The DIRECTOR GENERAL replied that ESO is keeping an eye on developments. He added that he personally supported the German initiative to establish a new centre in the preparatory phase.

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9. ALMA-related business

9a. EASC management and programmatic aspects (Leonardo Testi) incl. status of EU development projects

L. Testi was thanked for his report.

About the correlator plans, P. Callanan noted that an estimate of the costs seems to be known, adding that at the same time, there is a tension with the ALMA upgrades and the ALMA 2030 enhancements. In addition, he asked if a correlator with capabilities as they are budgeted right now will be able to deal without the ALMA 2030 enhancements.

L. Testi explained that in the original plan, the costs of the correlator was scoped at around 20 MEUR and that this was based on the correlator upgrade project. The current price estimate, for which ESO has not yet seen the entire technical and cost proposal that is in North American hands, is rumoured to be 40% higher, which is significant. He added that this is for a correlator that will be able to correlate twice the current bandwidth while all the rest of the signal system chain, for ALMA 2030, is scoped for three or four times the current bandwidth. He concluded by saying they are short on both sides: money and capabilities.

P. Callanan asked if there were any mitigation plans.

L. Testi replied that there had been preliminary discussions. On one side, they are investigating the readiness of different technologies, which may or may not be ready in time for ALMA 2030 but might be relevant on a longer time scale. On the other hand, they are also inquiring how much it would cost to expand to four times the current bandwidth capability, but at this stage, it is unclear if there is money within the development project to cover this.
9b. **ALMA science operations (Martin Zwaan) incl. evaluation of peer-distributed proposal review process**

M. Zwaan was thanked for his report.

9c. **ALMA Programme Science (Francisca Kemper) incl. status of development studies, status of ADP initiative and ALMA-wide development roadmap status**

F. Kemper was thanked for her report.

T. Hovatta argued that, regarding the correlator upgrade, it would make more sense to have the correlator update work with four times the IF bandwidth before the corresponding receiver update and asked the timeline for this.

F. Kemper agreed and mentioned that the correlator is on the top in the priorities list out of the roadmap, although the focus is currently not on it. She then added that she did not know when room would be made available in the budget for the four times the bandwidth upgrade.

L. Testi commented that what was mentioned by the North American side was that there is no plan for the upgrade execution. He added that the project’s blueprints could be made available, and any of the partners could buy the missing pieces. The North American partner plan is to produce the double band with correlator buy 2028 and the Band 6 receiver, according to the timeline shown in the presentation.

F. Kemper added that there seems to be some usefulness in using the broader bandwidth receivers with the narrower bandwidth correlators because, apparently, it will be possible to choose which channels to be correlated.

T. Hovatta asked if it was confirmed that it would only cost 20% more to go for the four IF bandwidth upgrades.

L. Testi replied that that is what ESO was told, although he was not sure if that figure (8 MEUR) included the potential software costs.

T. Hovatta asked if, since this was a North American development, the STC could do something to have them prioritise the correlator higher up.

F. Kemper replied that this would be discussed at the ALMA board meeting in two weeks.

L. Testi confirmed and added that if STC agrees there is a serious concern about this and thinks that ALMA should make a serious effort to make sure it has a broader bandwidth correlator, that should be stated. This will have a significant weight on ESO’s stance regarding the project.

K. Kraiberg Knudsen recalled an issue related to in-house expertise and knowledge and argued that it could play a role in how they choose to prioritise things.

L. Testi mentioned that the hardware, in this particular case, was not produced by the National Radio Astronomy Observatory (NRAO) but developed by the National Research Council (NRC) in Canada. He added that the decision to do the correlator upgrade was made at a later stage, and indeed there was a competence gap between the original correlator and the upgrade and the technology was getting a bit obsolete at the same time. He mentioned that he was worried that if a correlator upgrade for twice the bandwidth is deployed and we plan another upgrade in the 2030s to reach four times the bandwidth, one might end up again with a problem of obsolete technology.
9e. **ESO ALMA GTO policy (Rob Ivison) (Cou-1958)**

R. Ivison was thanked for his report.

P. Callanan commented that it was a great initiative.

P. Jáchym raised the concern that this could be disadvantageous for small communities with no access to the consortia.

R. Ivison assured P. Jáchym that ESO heard these concerns and fully understood them and argued that this should be seen as an opportunity and any R&D groups that come into the system now would be able to benefit from this.

V. Hill asked why the cap of GTO is not set, for example, to 5% if the 10% value is not expected to be reached.

R. Ivison argued that it would reflect a lack of ambition, where the goal is to enhance the ALMA development plan and ensure that ALMA has the best possible receivers, like in the case of VLT.

V. Hill argued that the pressure for observing time is two or three times higher in ALMA.

R. Ivison recognised that it was true, although it is difficult to predict how those numbers will evolve in ALMA’s case. He then mentioned that the cap in VLT and ELT is around 20%, so he considers a 10% cap for ALMA to be a reasonable number.

V. Hill asked to clarify why to set a cap value that will unlikely be reached and to explain how the computation is done to get to the cost of GTO.

R. Ivison replied that the second question should be addressed by Council, adding that it has to do with the amortisation of capital costs. Regarding the issue of the 10% cap, he argued that although in the immediate future, the GTO time will barely hit a handful of percentage, he expects the GTO usage to reach the cap value in the long term, adding that this would be on top of the money coming from ESO, and argued that it would benefit everyone with little impact on the community.

S. Kimeswenger argued that since the instruments developed with this GTO time will be available to all the ALMA partners, the European community, which is already the one with the largest over-subscription, is co-financing the development of new instruments, whereas the communities from the other partners do not contribute for this effort. He also raised the concern that ESO member countries with communities that do not participate in submillimeter instrument development but use submillimeter instruments for science would not take advantage of this.

R. Ivison reiterated that the concerns of the member states with small communities are being taken into account by ESO. Regarding the issue of other ALMA partners benefiting from the instruments developed with European GTO time, he argued that, although it might look naive, the benefits in terms of performance that can be achieved at the cost of a few percentages of observing time will be favourable for everyone and that in his view was a good deal.

P. Jáchym asked if this also concerns the development studies or just the projects.

R. Ivison replied that it was difficult to answer because the idea is not to set too many constraints. He stressed, however, that the projects that will go forward have to be approved not only by ESO’s Council but also by all of the ALMA partners.
K. Kraiberg Knudsen reminded this had been part of a long discussion where the instrumentation community needs different ways to prove that they have successfully acquired the resources to continue the instrument development. She also argued that the small number of submillimeter telescopes worldwide reflects the instrumentation community’s size.

F. Pepe commented that there is a broad agreement that the GTO concept has been very successful, at least in the case of VLT, and he does not see this as a problem for the countries with a small community because the cap is a small percentage. He agreed with this approach, especially if there would be a boost in the telescope’s performance, which would not be possible to achieve otherwise. He then asked if it would be utopic to ask the other ALMA partners to make a step in this direction and contribute to this technology development effort.

The DIRECTOR GENERAL replied that this discussion took place more than a year ago with the directors of the other ALMA executives while stressing that, even for other telescopes, this procedure of rewarding the community with GTO time for the development of instruments is something that ESO does and no one else does. This possibility is explicitly contemplated only for ESO in the ALMA tri-lateral agreement. He mentioned that, in ALMA, there are three big-budget lines: the on-site costs, which are balanced year per year between the partners, the off-site costs and the development programme which are not and, which in his view, would be something very difficult to change. He added that the other partners have different approaches for their development programmes, like looking for partnerships with third-party countries. These are allowed to apply for the observing time, but no guaranteed time is exchanged for those contributions.

F. Pepe asked if these additional partners would be counted in the budget.

The DIRECTOR GENERAL replied affirmatively but said that this does not mean that the other partners within the partnership will compensate it.

9f. Report from ESAC (Talvikki Hovatta) (Full Report ESAC Meeting 29 September & 1 October 2021)

T. Hovatta was thanked for her report.

On the new modes issue and the fact that they were not being used enough in Cycle 8, P. Callanan asked if there was a way to redeem this, a way to promote the presence of the modes to the community in general.

M. Zwaan noted that promoting is a good point and explained that ESO tried to do this with the polarisation mode, releasing science verification data. He clarified that proposals on the solar and pulsar modes had been received, but they had not made it through the final peer review selection.

P. Callanan asked if adding external referees for selected categories, as mentioned in the European Science Advisory Committee (for ALMA) (ESAC) report, could help assess these proposals.

M. Zwaan noted that adding external referees would be quite a different addition to the whole distributed peer review model. He would be more in favour of other methods to promote the new modes. He further added that it is important to evaluate what the community wants in terms of new modes and that the ALMA Science Advisory Committee (ASAC) needs to agree on the new modes they will work on for new Cycles.

P. Callanan thanked everybody for their time and attention and closed the meeting.