

## AugerPrime Radio detector operation readiness review

Brief report of the review committee (Petr Travnicek, Mauro Gajardo, Nicolas Gonzalez, Frank Schroeder, Ricardo Sato)

The Committee congratulates the RD team for completing the deployment of the detector and for its successful operation. We note that the material presented by the radio team was carefully prepared and answered most of the questions arising from the charges of the reviewing committee. The committee members agree that the RD system is close to passing the Operation Readiness Review i.e. to be included in the operation of the observatory for science production. A few remaining issues, which require some additional effort and/or time, were fairly mentioned by the RD team and some others were raised either by the management, committee members or by the collaboration. These are mostly minor issues and the committee believes that they can easily be resolved by the coming November meeting or earlier.

The remaining questions/issues include:

### **Equipment availability and readiness**

Special tools and testing equipment:

- Ensure that the “test bench” for digitizer is delivered to Malargue (e.g. system using not commissioned UUBs or using available PC interfaces).
- Please continue and finalize the preparation of the LNA calibration device so that it can be given to staff in Malargue together with documentation.
- In case the local staff repair LNA, digitizer or other components or need to do some field testing, what equipment do you consider important/useful to have in Malargüe? (eg. spectrum analyzer, oscilloscope, etc.).

The most common failures and their mitigation plan:

- The dust accumulated in some LNA housings: is the housing tight enough against dust and water after the fix?
- Orientation of the antenna: please report after some subsequent period of operation if the problem is really solved by tightening the screws.
- Lightning events: is the rate of the failures associated with lightning consistent with previous experience before upgrade? Can you track the number with time? Is there a way to relate it with rates of similarly associated failures reported on UUBs?
- LNA amplifier chips: given the fact that 115+ destroyed chips were already needed to be exchanged (which successfully demonstrates the LNA repair procedure); is the number of spares (1000) really large enough? With the more regular operation ongoing, can we distinguish better between lost amplifier chips due to transport + installation procedure and during normal operation?
- LNA other components: please update the numbers for failures of chip and other LNA components once finishing repair of all ~175 damaged LNAs (page 50 of your presentation)
- Please keep the list of all failures and their potential sources updated, have eyes open to other types of failures not discussed so far (other components).

Long-term plan for component repairs or replacement:

- Please include your new findings into an updated long-term plan for component repairs and replacements.

Future procurements of spare parts, tools, and consumables. Spares availability:

- Please provide a list of repairable components for all sub-systems including digitizers and mechanics. These numbers would be compared to spares so we know if we have a projected deficit or not. Please mention/list the most critical component(s) in the electronics or elsewhere in the system that you foresee will not be available on the market after 5/10 years and compare to the number of spares of these components.
- What exactly do you plan for future procurements (if any)?

### **Data Management**

Reliability and consistency of the data:

- Please report on the progress in solving the dead-time issue. Which of the three options do you finally select? How much can we reduce the issue in terms of lost events?

#### Monitoring of RD:

- Demonstrate progress in the integration of RD in SD monitoring and provide a timeline for final implementation. Meanwhile, make sure that the alternative MoRd system is fully accessible by RD and SD experts as well as by local staff.
- Update on the plan to integrate RD in SD shift.

#### Technical Documentation

- The technical documentation provided in Dropbox seems to be rather complete. Please ensure that it is transferred to EDMS and remain open to further checks of completeness of the documentation by the RD team, review committee, management and observatory staff.
- Create a landing page: The documentation of the various aspects of the RD seems to be in the various places where it belongs (EMDS, Wiki pages, Monitoring, Gitlab repositories, ...). As distributed over several places, this might still be hard to navigate and find all information in a few years from now, in particular, because there is no RD landing page (website and/or wiki page as it exists for other detectors of the observatory). Such a landing page should contain links to the different places of hardware, firmware, and software documentation, the monitoring, deployment and maintenance information, etc. There is no need to duplicate information, e.g., one could link to existing sub-pages of the AERA wiki when appropriate. The purpose is simply to make all information easily accessible.

#### Procedures

- Maintenance/installation procedures are defined by RD team together with the local experts and they are living documents always improving over the time. Can you show a current version of such procedures as an example (in Spanish or English)? Where and how are these documents available? These ever-evolving documents can be provided as a link on the landing page (see above), so that all collaborators can check them.
- Please remember to respect availability of all procedures and aspects: general operation, hardware and software troubleshooting and maintenance, process for handling major repairs as well as inclusion of safety considerations in all procedures (e.g. when and how grounding is required).

#### Training

- Complete the training of the Observatory staff.

#### Operations costs

##### Resources:

- Please continue and finalize together with the local staff the evaluation of the human resources and costs needed to operate and maintain the RD system, including materials and equipment.

##### Rates of failures and frequency of repairs and replacements:

- The calculation of the expected failure rate is difficult due to overlap between those originating from the installation process, commissioning, and operation. The calculation presented was fair and probably the only possible way at the moment. However, the committee found it difficult to distinguish between the mentioned cases. The projection onto the next 10 years should be re-thought using new data and discriminating unavoidable failures during regular operation from those that are a consequence of a sub-optimal deployment or maintenance. The committee is aware of the fact that the next lighting season starts only in November but still the updated numbers and plots would be useful to see.

#### EFM installations

- Please follow the proposal from the management about the additional questions related to operation of EFM installation. Is the documentation for the operation of the EFM available? What is the failure rate and the local personpower requirement to maintain and operate it? What are the costs for operating it? (battery replacement, component replacement, etc.). Is the local staff trained to maintain and operate the system? What is the minimum required uptime for the system? Statistics on uptimes and failure rates.

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