

Status Review of Installed Atmospheric Monitoring Devices

Mar 8, 2017

Committee members:

B. Fick, L. Nellen, L. Perrone, R. Smida (chair), M. Unger, V. Verzi

ATMOSPHERIC MONITORING STATUS REVIEW

Charges to the Review Committee

Review to be held in Malargüe, November 2016
(version 20160920)

Review Committee Members:

- 1) R. Smida (chair)
- 2) L. Nellen
- 3) L. Perrone
- 4) M. Unger (remote)
- 5) B. Fick
- 6) V. Verzi

Introduction:

The objective of the Atmospheric Monitoring Status Review is to determine if the different atmospheric monitoring devices and equipment are providing relevant information to the Auger science case and if they are prepared to run for ten more years of operation of the Observatory.

The review should include:

- CLF and XLF
- APF
- Lidars
- Raman Lidar
- Meteorological Stations
- FRAM
- Cloud Cameras
- BG-Cam
- BLS
- GDAS
- Aerosol Sampling

The Review Panel should consider, but not be limited to, the following issues:

1. Science: Are the scientific objectives of the system and its role in the overall science objectives of the Observatory well defined and understood? Is the data it provides been used adequately for analysis and/or for the benefits of other Auger tasks?

2. Performance: What are the performance metrics? Is the system performing as expected? What are performance expectations?

3. Costs: are the costs (direct and indirect, manpower) of the system understood?

4. Maintenance: is it well understood which groups/people are responsible and which groups/people are taking care of maintenance?

5. Data: Is the data flow and data processing and handling well understood and in accordance with the Auger criteria? Does the full collaboration have access to the data? Is long term storage and processing of the data foreseen? Is the data provided by the Atmospheric Monitoring systems used in regular Auger data processing? If not, are there plans to use them?

6. Redundancies: do any of the systems provide redundant data which is already covered by other instruments?

7. Is a continuation of the operation of the system recommended?

If the answer to 7 is positive, then:

8. 10-year availability: is the system prepared for other 10 years of operation? Are costs, manpower, spares, requirements well understood? Who is providing them? Is there a long term plan for component repairs or replacement? Are spares available or identified?

9. Technical Documentation: are technical documentation, drawings, schematics, available? Are instructions for operating and maintaining, and software code, available and organized? Is documentation uploaded to EDMS at CERN?

10. Responsibilities: Has an ORR been performed or is an ORR envisaged? Timeline?

11. Future Plans: describe future plans for the system, including possible extensions or upgrades.

Short report for the Project Manager @ the Nov meeting

Atmospheric Monitoring Status Review

The objective: Is a device providing relevant information to the Auger science case and is it prepared to run for ten more years of operation of the Observatory?

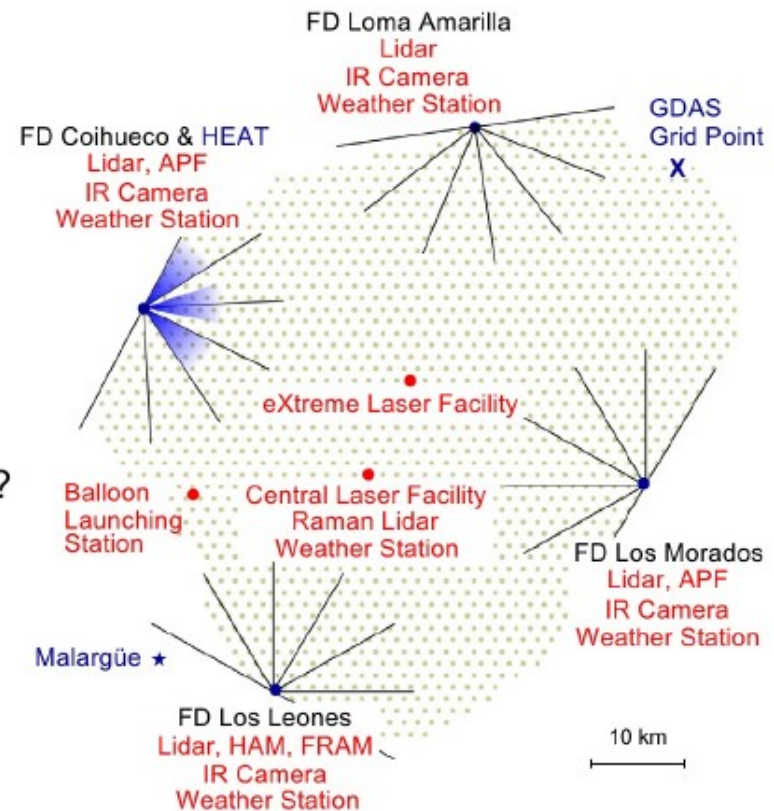
All installed atmospheric monitoring devices (even those with ORR) are under this review.

The review panel should consider, but not be limited to, the following issues:

- science provided,
 - performance,
 - costs (direct and indirect, manpower),
 - maintenance (responsible groups),
 - usage of data,
 - redundancies,
 - is a continuation of a device recommended?
- If yes, then:
- 10-year availability,
 - technical documentation,
 - responsibilities and
 - future plans.

Review Committee Members:

B. Fick, L. Nellen, L. Perrone, R. Smida (chair),
M. Unger and V. Verzi



Short report for the Project Manager @ the Nov meeting

This review has started on Tue, 15 Nov 2016.

- The committee has received documents in advance.
- Well prepared presentations have initiated fruitful discussion about different aspects of reviewed devices.

Thank you for it!

I. Allekotte:

We expect you to deliver a preliminary report with your (preliminary) findings shortly before the CB meeting on Friday 18th. I would appreciate a final report within the following two months (in any case before the March 2017 meeting).

Members of the committee will continue their work. First, we plan to send our preliminary findings to people responsible for atm. moni devices and evaluate their feedback. We will do their best to provide our recommendations in time.

**Our preliminary report was sent to Bianca, Lawrence and
auger_atmosphere email list on Jan 1, 2017.**

**Comments from the Atmospheric Monitoring Group were received
on Feb 13, 2017.**

From Radomir Smida★
Subject **Preliminary recommendations for the Atm Moni Status Review** 01/12/2017 06:22 AM
To Keilhauer, Bianca (IKP) <bianca.keilhauer@kit.edu>★,
lawrence Wiencke★, Auger Atmosphere★
Cc Brian Fick★, Lukas Nellen★, Lorenzo Perrone★, Unger, Michael (IKP)★,
Valerio Verzi★

Dear Bianca, Lawrence, all,

we would like to thank you for all provided documents and your cooperation during this Status Review!

We have prepared a PRELIMINARY recommendations about atmospheric monitoring devices and a file with them is attached. Could you let us know your comments/questions? The best would be before Jan 30th.

Best regards,
Radomir for the Status Review Committee

Emails by BK, MM, RM, LW, VR,...

**Comments of the Atmospheric Monitoring Group
to the preliminary report of the review committee
„Status Review of Installed Atmospheric Monitoring Devices“**

L. Wiencke, B. Keilhauer – Task Leaders – 13. February 2017

The atmospheric task is grateful for the committee to review the installations at Malargüe. We thank for the fruitful and supportive discussions and the provided draft report.

In the following, we will comment on your table of all devices on page 3 and the detailed comments and questions on pages 4 and 5. We will follow your given order.

Our recommendations

Aerosol sampling

- **We strongly encourage to have more cooperation with the atmospheric monitoring group and find a way how to use the results in the Auger analysis.**
- **Could the measured data be compared with results of other measurements (e.g. APF)?**
- **Are their results needed for the Auger science?**

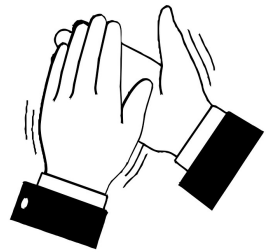
The Aerosol Sampling is fine even with the high manpower demands, since this activity is done in an "associated" group which has no other duties in the Auger Collaboration. The group an active member of the atmospheric task and presents regularly its work at the Collaboration meetings. So your suggestions for some studies will be followed quite likely.

*MM: Completely agree about the interest in continue improving the inter-comparisons with measurements from other monitors...
...plans for cooperation are increasing and will be possible when some adjustments in data of other monitors are ready.*

APF

- Who can take care of these two devices?
- The APF at LM needs to be repaired.

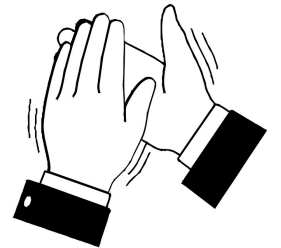
For the APF, the group of Mines volunteered to take over this responsibility.



BG cameras

- **Are data available?**
- **Could be an access to the database implemented in the Offline?**

The Olomouc group is already working on it.



The BG cams are fine. The responsible group will check if the data can be made available of the collaboration in additional databases.

BLS

- Does it make sense to keep the container? How much do we pay for it?

The BLS is fine. Currently, the Auger Project Manager prefers to keep the container at place. It will be discussed regularly if the container should be removed.

CLF/XLF

- **A spare laser will be needed soon. Funds for it are needed.**

LW: We first need to get a spare laser.

- **Could be an automatic analysis developed?**

- **We suggest to analyze also inclined shots.**

*LW: I agree that we need to start working on analysis of inclined tracks.
Need volunteers to look at these.*

The CLF / XLF are fine. Some improvements in the analysis are ongoing and the high manpower is perhaps reduced after all the discussions and work performed in the Aerosol Working Group.

Elastic lidars I.

The old elastic lidars are troublesome devices.

Current status: LL and LM not working, LA gets stuck, CO laser loses power

What is needed to make them reliable and useful for the collaboration:

Invest money and manpower to lasers, new mirrors, mechanics, housing, operational and analysis software, documentation and manuals.

What is **a clear manpower estimate** needed for it?

Our recommendation: **The collaboration should decide to either dedicate a bigger effort to them or abandon them.**

Is there **strong case for our science goals** to keep them running?

Currently used for:

- **the presence of clouds** (also the IR cloud cameras, could be also BG cameras)
- **the cloud height from lidars in the Xmax analysis** (also the CLF and XLF)

Elastic lidars II.

Our recommendations:

- 1/ Focus on the new lidar at LA.
- 2/ Keep the old one at LA running in parallel. (Parts from other sites can be used for this one.)
- 3/ Study any strong case for old lidars. (Is the hrz aerosol non-uniformity important enough?)
- 4/ When new lidar is understood and is running well, consider what to do about old lidar(s).

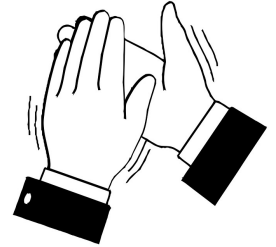
The Elastic Lidars need more discussions in the atmospheric task together with FD analysis experts. The treatment of the cloud cut could be improved. Running the old Elastic Lidars only for cloud information seems not to be an optimal solution. The Torino group is concentrating on setting up a running new hardware and software system for the LA lidar. It could be discussed to stop operating the old Elastic Lidars at the other stations, resulting in a reduced demand on the FD shifters. After having the new LA lidar running properly and having learnt from these data, we can decide if it is useful and feasible for us to put more effort into the old elastic lidars.

*RM: ...we need four α_0 measurements, one per site. Aerosols are not homogeneous. I am anyway working hard to get VAOD(h) profiles...
I am sorry to be slowed down by unnecessary software overheads and unpleasant hardware failures.*

FRAM

- Will be an access to the data implemented in the Offline?

The Prague group is already working on it.



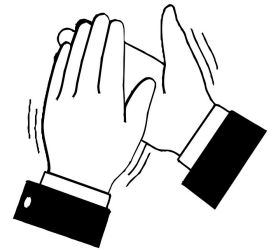
- How reliable are VAOD data?
- Could be used for checking the horizontal atmospheric homogeneity?
- Would it make sense to have one FRAM at each FD site for improved exposure for low energy showers?

The FRAM is fine.

GDAS

- It would be nice to have fully automatized data storing/analysis from satellite instruments.

GDAS is fine and the scripts are already in place for automatic data integration into the Auger databases.

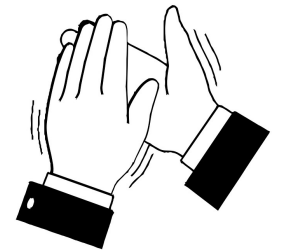


GOES

- It is very useful, but has not been updated for some time. Could some group keep the database updated?
- It would be nice to have fully automatized data storing/analysis from satellite instruments.

The GOES data are interesting for the collaboration and used in the FD reconstruction. It would be of great help that the scripts are put in place to extract the data more or less automatically from the satellite server. B. Fick tries to have a new student for this work.

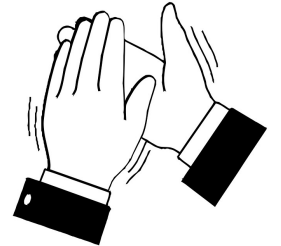
Brian has already a student.



IR (cloud) cameras

- It would be great to fill a gap in the data between Dec 2012 and Mar 2014, at least partly.

The Adelaide group is already working on it.



- Pixel-wise cloud information is used in the HECO module sequence in the Offline. Unfortunately, this module sequence is not used in all analysis. Could all analysis groups switch to this module sequence and use pixel-wise cloud information?

The IR cloud cameras are fine. Perhaps the experts of the cloud camera should discuss further with the Offline experts to make most use of these data for the FD reconstruction.

Raman lidar

- **We suggest to consider an independent laser for the Raman lidar, which would mean no need for a moving mirror.**

LW: The question of a separate laser needs to be reviewed carefully by the Mines and L'Aquila groups first before reaching a decision. ...the technical details are not trivial.

VR: This should be done in cooperation...

Review Committee: purchase a new laser, it will be primarily a spare one for the CLF, but could be used for the Raman in the meantime.

- **What is a longer-time strategy for this system and data?**
- **How long it will take to get final data for reference nights?**
- **Is it possible to automatize the Raman lidar operation and closing FD shutters (e.g. veto like for elastic lidars).**

The Raman Lidar is fine and currently used for the work in the Aerosol Working Group. Perhaps we should think about a long-term strategy for this data.

Weather stations

- It would be nice to have fully automatized data system.

The Weather Stations are fine. The scripts are already running automatically, but some more quality checks need to be implemented.

Summary

Items to be considered in the Review

1. Science: see table on the next page

2. Performance: see table on the next page

3. Costs: Partly covered are elastic lidars, C/XLF and Raman lidar.
Other devices are covered by responsible groups.

4. Maintenance: We are missing a group responsible for APF.
Higher requirements on the Observatory are only for elastic lidars.

5. Data: see table on the next page

6. Redundancies: Yes, they exist. However, they are not big and they provide important cross checks as we have learned over years.

7. Is a continuation of the operation of the system recommended?:
Yes for all, but BLS and elastic lidars.
Elastic lidars: the collaboration should decide to either dedicate a bigger effort to them or abandon them.

.....

8. 10-year availability: Critical issues have been identified for APF, C/XLF, elastic lidar(s) and Raman lidar.
Automatized analysis would be beneficial and we strongly encourage it.

9. Technical documentation: The documentation will be collected and stored on a webpage before moving it to EDMS at CERN.

10. Responsibilities: ORR for any device has been discussed.

11. Future plans: See reports collected for each device.

Device	Responsible group	Data taking manpower	Data analysis manpower	Maintenance required by a group & Observatory?	Is operation, data taking, reparation covered?	Are data regularly used?	Keep it?
Aerosol sampling	IFIR Rosario (AR)	Low	High	Low	Yes	No	Yes (?)
APF	CSM (US) !	Autom.	?	Low	Yes (?)	Yes, occasionally	Yes
BG cameras	Olomouc (CZ)	Autom.	?	Low	Yes	By shifters, for extended FD operation	Yes
BLS	Not operated	X	X	X	X	X	No
CLF, XLF	CSM (US)	Low	High	Low	Partly	Yes	Yes
Elastic lidars - old	Torino (IT)	High	High	High	Partly	Only cloud fraction and height	No (?)
Elastic lidar - new	Torino (IT)	High	High	High	Partly	Not yet	Yes (?)
FRAM	Prague (CZ)	Low	Not too high	Low (now)	Yes	Only for StS	Yes
GDAS	KIT (DE)	Satellite	Low	None	Yes	Yes	Yes
GOES	MTU (US)	Satellite	Not automatic, yet	None	Yes	DB not updated	Yes
IR (cloud) cameras	Adelaide (AU)	Autom.	Not too high	Low	Yes	Yes	Yes
Raman lidar	L'Aquila (IT)	Low	?	Low	Partly	Yes	Yes
Weather stations	KIT (DE)	Autom.	Low	Low	Yes	Yes	Yes

The members of the committee would like to continue their work until all comments and questions are addressed in satisfying way.