## First aerosol concentration measurements at the Auger North site

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Instituto de Física Rosario (IFIR) – Argentina Colorado School of Mines (CSM) - USA Instrument used for the measurements:

#### **Portable Laser Aerosolspectrometer and Dust Monitor Model Grimm 1.109**

#### **Dual technique:**



\* It supplies *particle or mass concentration* (particle/liter, µg/m<sup>3</sup>), in fixed time intervals, also, *size distribution* of aerosols;

\* It *collects particles in a filter for later analysis* of concentration, shape, size and elemental composition by different techniques: gravimetry,SEM/EDX, PIXE, etc. <u>Measuring principle:</u> the air enters into the Grimm instrument through the inlet and is led into the measuring cell. A laser diode emits light at 655 nm, that is scattered by the aerosols present in the air sample. The scattering light pulse of every single particle is being counted and the intensity of its scattering light signal classified to a certain particle size, in the range  $0.22 - 32 \mu m$ . The sampling volume of the Grimm 1.109 is 1.2 liter/minute.



### **Measurements**

- Period: 17<sup>th</sup> June 30<sup>th</sup> July, 2010. End of Spring Summer in Northern Hemisphere.
- Location: DLF building, Lamar, Colorado. Auger North Site. 1206 m a.s.l.
- Altitude of the sample inlet above ground: 1.98 m.
- Concentrations measured every 5 minutes.
- First aerosol concentration measurements and collection of aerosols at Auger North.

#### This experiment provides:

- knowledge of aerosols concentrations at Auger North site (to be compared later with Auger South), at different atmospheric situations given by temperature, winds, rainfalls, etc., in order to infer the origin and behaviour of the aerosols at the site.

- samples of aerosols collected in filters, that can be analyzed in shape, size and elemental composition, in order to understand their influence in the attenuation of the fluorescence UV light generated by cosmic ray showers (and detected by the FD). For Auger South, this can be compared with the Andersen-Graseby 240 measurements;

- useful information to compare with the data from other Auger aerosol monitors and to complement them;

- information that can be used to infer the lidar constants.

### **Installation of the Grimm 1.109**

It was installed inside the DLF building in Lamar, with a 70 cm long hose traversing the wall and a radial-symmetric sampling head in its end, that permits the entrance of aerosols.



Grimm 1.109 inside the DLF building

DLF building with pipe, hose (inside pipe) and sampling head (pointed with the finger), on the external side of the wall.





# Analysis of concentration data (for particles bigger than 0.22 μm)



Mean values of concentration for each hour (each point is a 1 hour average) for the different days of measurements. Alternation between days with lower and higher concentration levels. It is not observed a general trend of concentration change during this period (June 17<sup>th</sup>–July 30<sup>th</sup>).



Day and night, as given by sunrise and sunset for each day in http://www.usno.navy.mil/USNO/

Concentration mean values of day and concentration mean values of night, with RMS, for the different days of measurements. We observe for the same days a similar general behaviour with respect to the hourly mean values (previous slide) but the peaks are lower and smoother.

![](_page_10_Figure_0.jpeg)

Mean and RMS values of concentration for each hour, from all days (June 17<sup>th</sup>–July 30<sup>th</sup>). Low mean values for Lamar. Constant decay of mean values during night. Sudden increase (from about sunrise) during the early morning. Slow (and fluctuating) decay during most of the day. Sudden increase at sunset and early night. RMS bigger during day.

## **Conclusions and future work**

- We performed the first aerosol concentration measurements in Lamar, obtaining low concentration levels, in general, lower than 15 μg/m<sup>3</sup>, during the end of spring – summer period: June 17<sup>th</sup> – July 30<sup>th</sup>, 2010.
- Most of the time, aerosol concentration levels are really low: lower than 5 µg/m<sup>3</sup>. Good news for cosmic rays fluorescence detection.
- Not observed a general trend of variation in concentrations during this period (mostly stable in temperature conditions).
- Not observed a clear difference in behaviour between day and night values when the mean concentrations are taken over the whole day and the whole night, along the measurement period (MV day and MV night can be either higher or lower than each other for different days).

- But it can be observed a characteristic behaviour of mean concentrations as a function of hours (for all data set). This fact could be related with the daily evolution of the aerosols boundary layer.
- The RMS of mean values of aerosols as a function of hours, is bigger for the day data than for the night ones. Could it be an influence of sunny or cloudy conditions during day hours (in the influence on the behaviour of boundary layer or in the growth of aerosols size, for example)?
- Necessity of analysis of concentrations taking into account weather conditions (temperature, winds, rainfalls, etc.).
- Grimm 1.109 will measure concentrations at Auger South, to compare with previous work done with Andersen-Graseby 240 there and to compare with Auger North measurements with Grimm 1.109.

- It is also planned to install again Grimm 1.109 in Lamar during winter period (to contrast with summer period). It is necessary to take into account a longer period (with changing seasons and, consequently, temperature conditions), in order to find a general trend of concentration behaviour along the year.
- Measurements can be compared with data from other aerosols monitors at Auger North (like DLF/AMT and Raman lidar).
- The analysis will be continued by analyzing concentrations at different aerosol sizes, to conclude which aerosol size range is more frequent in the Auger North site.
- This will be complemented with the analysis of the filters placed on the Grimm 1.109 instrument, that collected aerosols during the measurement period in Lamar. The analysis will be performed with different techniques, like SEM/EDX and PIXE, in order to obtain size, shape and elemental composition of the collected particles.

## Conference on non-cosmic ray science with cosmic ray observatories

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