

## **Present status and modernisation of the Dourbes Cosmic Ray Observatory for improved space weather research and forecasting**

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The NM64 neutron monitor, like the one in operation at the RMI Geophysical Centre in Dourbes (50.1°N, 4.6°E), has proved to be an important measurement tool for space weather research and development of forecasting and prediction services. However, modern research poses higher, more challenging demands on the quality of measurements – higher accuracy and precision, better resolution, and real-time dissemination of data and products. Such demands become even more challenging when utilising an instrument that has been conceived and built more than half a century ago. Currently, the neutron monitor in Dourbes consists of 9 detector tubes and aging electronics and computer peripherals. In order to comply with the abovementioned modern-age requirements, in addition to the permanent maintenance, the Dourbes neutron monitor needs substantial refurbishment and upgrades.

Recently, several modules of the electronics have been replaced, including the data logging system, the power supply units and cable infrastructure. In addition to the hardware upgrades, computer software has been developed in-house to improve data acquisition, processing, and archiving, including data quality assessment and cleaning in real time. The construction of a second neutron monitor, equivalent to the one currently in use, is in progress. The planned addition of 9 new detector tubes marks a significant upgrade towards the building a modern and more reliable cosmic ray observatory of international standard. The second monitor is being built in several stages. In the first stage, a section of 3 detector tubes will be constructed and tested in the coming months. Initially, we will exploit the producer-free concept, i.e. without the producer, made out of lead (Pb) and used for neutron multiplication. This will allow the verification of several theoretical and computer simulations, performed by a nuclear transport code, in order to investigate the neutron monitor's yield functions. In the following stages, the second neutron monitor will be completed with 2 additional sections each consisting of 3 tubes. The addition of a lead producer will be decided after data comparison and differentiation between both monitors during quiet and active periods.

An additional expansion of the Dourbes observatory is envisaged with the construction of a muon telescope. The project is still at an early design stage. The first version of the design is expected soon together with a budget estimate.