

Measurements of cosmic-ray muon flux with a mobile detector at the Belgrade muon station

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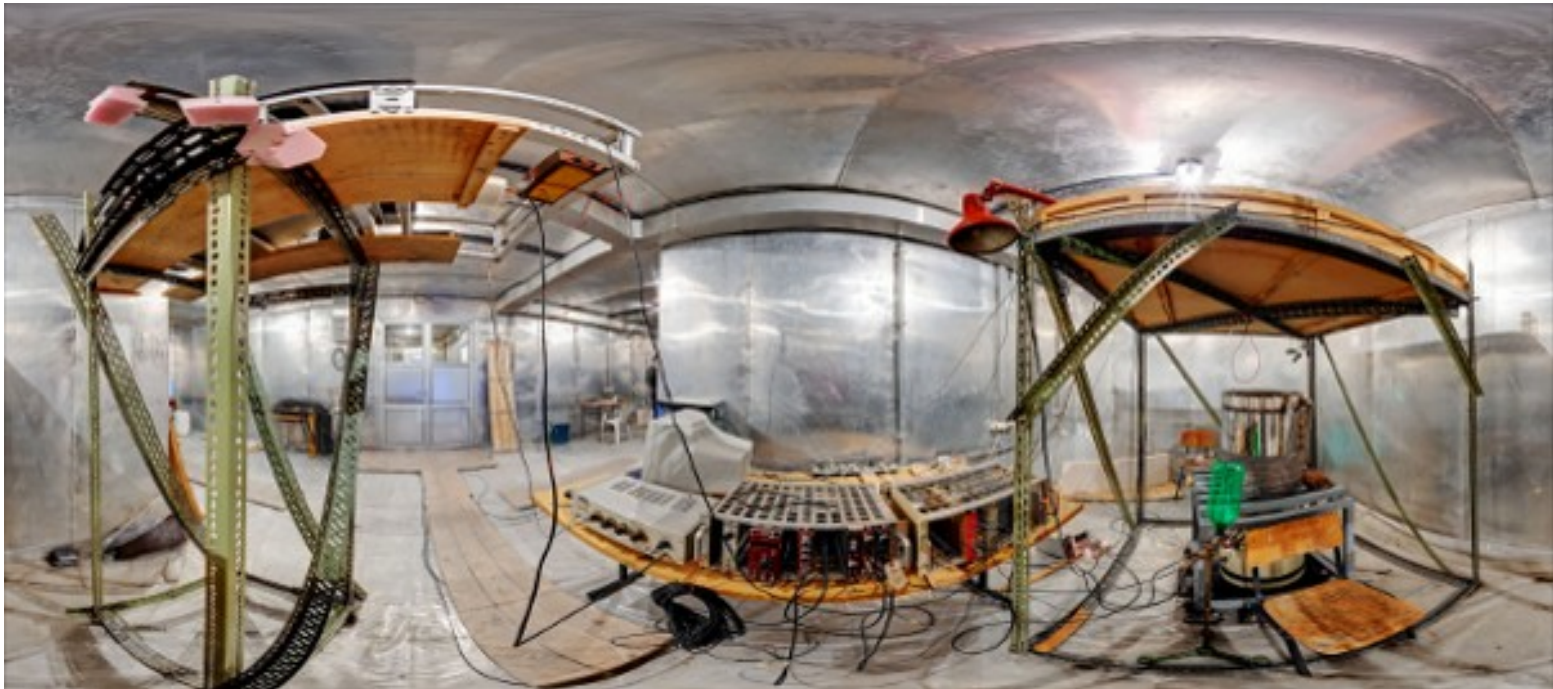
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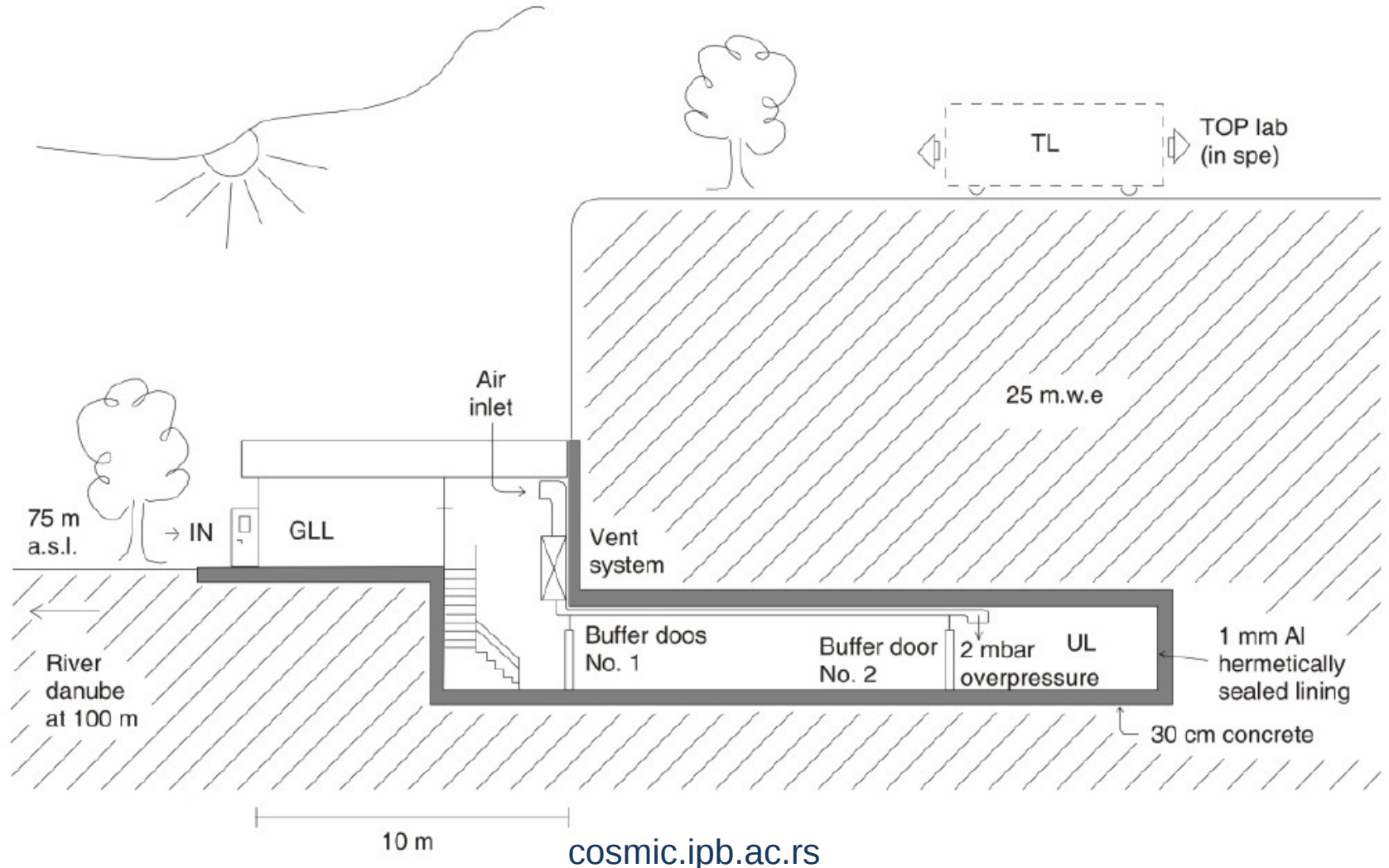
Low-background underground laboratory

- Dedicated facility for measurements of the cosmic-ray muon intensity and gamma spectroscopy measurements
- At the intersection of the two research subjects, the study of muon-induced background in gamma spectroscopy is of particular interest



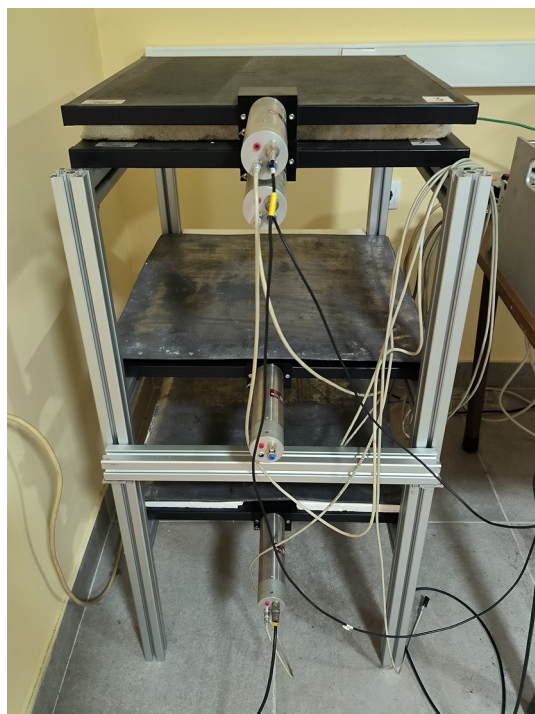
cosmic.ipb.ac.rs

Low-background underground laboratory



Measurements of the cosmic-ray muon intensity

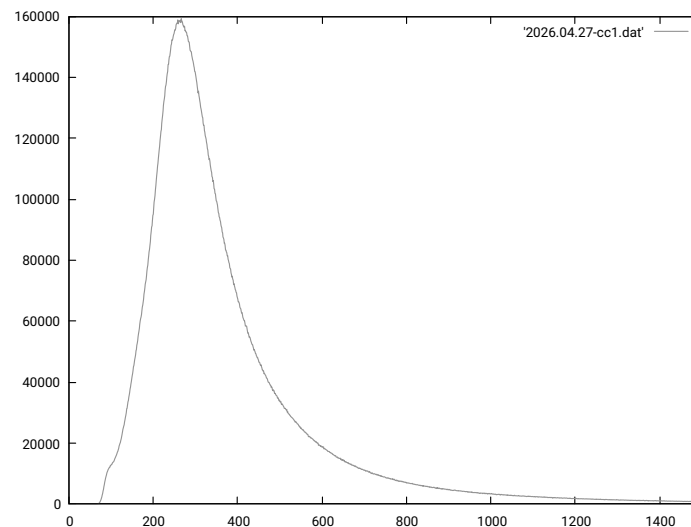
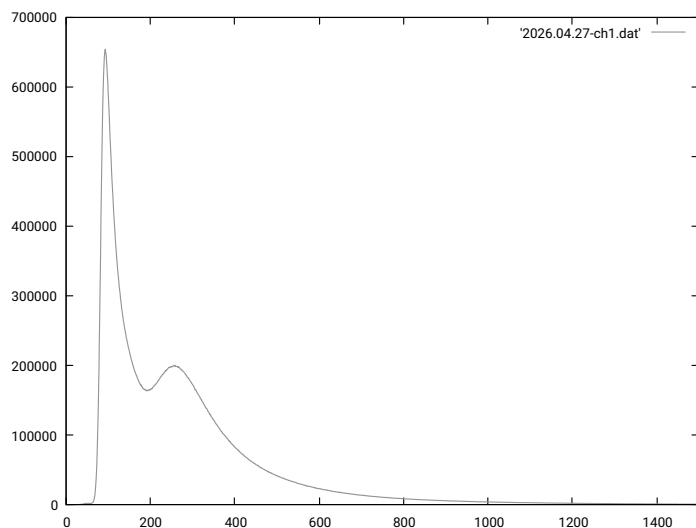
- Measurements have been continuously performed since 2002, simultaneously at the ground and the underground level
- The new experimental set-up consists of four 50cm x 50cm x 2cm plastic scintillators, which can be arranged flexibly



- Data acquisition via 4-channel 100 MHz ADC
- Every event is recorded with the time of occurrence and its amplitude
- Offline analyses of coincidence events between different channels

Measurements of the cosmic-ray muon intensity

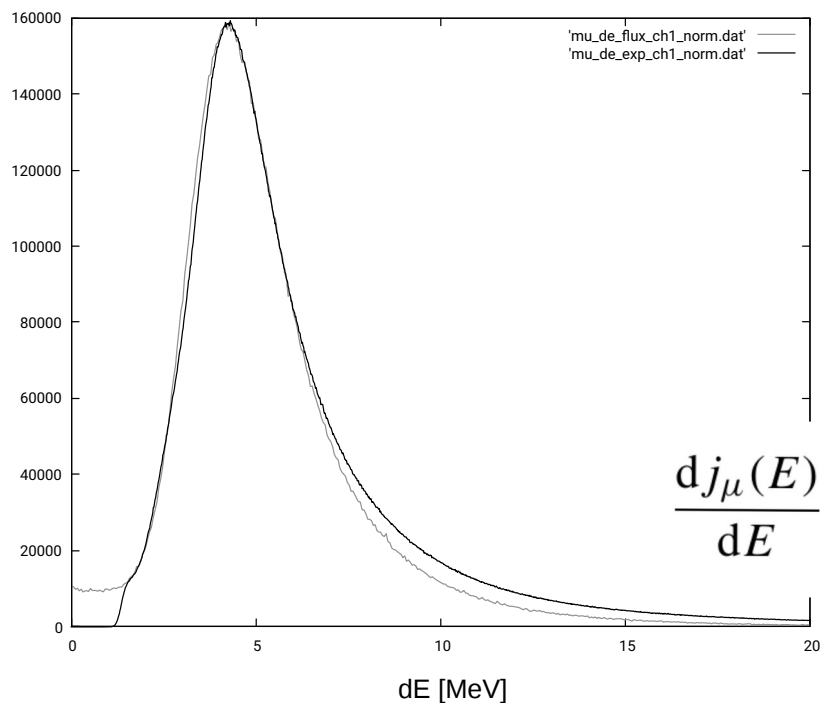
- Single detector and coincidence spectra
- Prompt coincidence events selected within a 50 ns time window



- Coincidence spectra are considered as solely due to energy losses by charged particles in the scintillator

Measurements of the cosmic-ray muon intensity

- Interpretation of the experimental spectra and their features has been done using Geant4 and CORSIKA



- Muon directional intensity

$$I(\theta) = I(0) \cos^n \theta$$

- Energy spectrum

$$\frac{dj_\mu(E)}{dE} = 0.14E^{-2.7} \left(\frac{1}{1 + 1.1 \frac{E \cos \theta}{115 \text{ GeV}}} + \frac{0.054}{1 + 1.1 \frac{E \cos \theta}{850 \text{ GeV}}} \right)$$



Results

- Precise values of the muon flux at ground level and at the depth of 25 m.w.e. were measured with large plastic scintillators
- Number of muon events was corrected for events below the instrumental cuts and for those muons that trigger the first but not the second detector (11.5%)
- Preliminary, muon flux obtained is $170 \pm 2 \text{ cm}^{-2}\text{s}^{-1}$, which is consistent with our previous work
- A. Dragić et al., Nucl. Instrum. Methods Phys. Res. A 591, 470 (2008)
D. Joković et al., Eur. Phys. J. Plus 138 (2023) 1006.