Dear Reviewers, Dear Editor

On behalf of all the authors, thank you for your helpful comments and suggestions that have improved the quality of this article. We have modified the article in the spirit of these comments. (The original idea was not only to address muographers, but also geologists and geophysicists, and therefore details of the measurement technique and mathematical background were not included in the first version.)

Answers to Reviewer 1

Comment 1.
Structure and Readability. The paper follows an unconventional and confusing structure, introducing the results before thoroughly discussing the methodology. This approach makes it difficult for the reader to understand the basis of the conclusions. My recommendation is to reorganize the paper to follow a logical progression: Introduction, Methodology (including measurement techniques, data acquisition, and validation), Results, Discussion and Conclusion
Answer
The structure of the article follows the suggestion of Scientific Reports. The article is based on the guidelines published by the journal. Unless the Editor clearly suggests otherwise, we wish to stick to these guidelines.

Comment 2.
2. Lack of Explicit Methodology. The methodology section is insufficient, as it primarily references previous work by the same research group instead of clearly describing the procedures used in this study. The authors should explicitly detail the following aspects: the muon detectors' specifications, the steps taken to filter, calibrate/analyze the data, and finally, the methods used to verify the accuracy of the results.

Answer
As this suggestion is highly relevant, various elements have been added to the text, marked in the revised version (orange). We tried to include all relevant details which are useful, particularly for geoscientists. This includes information on detector geometry, position resolution and calibration methods. Data quality and accuracy verification is an integral part of the data analysis, most prominently the consistent tracking (detection) efficiency monitoring.

These additions can be found in the **Methods** chapter, largely under **Detectors**, **Density distribution estimation** and **Uncertainty and limitation** sub-chapters.

Comment 3.
Absence Discussion of Simulations. The manuscript states that simulations were used to verify the measurements but does not provide details on the simulation framework, input parameters, or assumptions. The authors should clarify the simulation type (e.g., Monte Carlo methods, GEANT4, or another simulation framework to propagate muons through the geophysical object), input parameters, and boundary conditions. Discuss whether the simulations were used to model the expected muon flux or validate the density reconstruction.
Answer
Based on your useful and relevant suggestion, we have modified the simulation section in the **Discussion chapter** accordingly. We have emphasized that in our case the simulation was aimed at testing and validating the 3D tomography procedure. (The word “simulation” in the present study is used indeed in the context of validation possibility, not in terms of high energy physics)

We have simulated only the largest potential source of error in the whole data processing: tomographic reconstruction, focusing on bias, artifacts, detectability (performed in a real environment and with random errors generated by the error distribution of real measurements). The relevant parameters of this simulation are given in the manuscript.

Comment 4.
Limited Explanation of Bayesian Discrete Tomography. The paper mentions that Bayesian discrete tomography was used for density reconstruction but does not summarize the mathematical approach, referring readers to other publications. The authors should briefly explain the Bayesian approach, the criteria for selecting prior distributions and regularization parameters, and a better discussion of uncertainties and resolution limitations.
Answer
During the draft proposal, we considered keeping this explanation to a minimum, however, the proposal is clearly acceptable, and the requested additions have been made.
In the new version both Bayesian tomography and its parameterization (regularization parametrization) are covered in the sub-chapter "Estimation of density distribution". The uncertainties and limitations of the method are described in the last subsection at the end of the article. A brief section about the spatial distribution of estimated standard deviation of our results has been added at the end of the Results section (Fig. 12 a-c) with a short evaluation.

Comment 5.
Scientific Contribution and Novelty. The study successfully applies muography in a fractured carbonate region, revealing a near-vertical NE-SW fracture system and identifying a large cavity. While the results are valuable, the novelty compared to previous muography studies is not well articulated. The author should clearly state how this study advances the field beyond existing literature by comparing findings with other muographic studies.

Answer

Such detailed subsurface imaging of a large geological object measured with high angular resolution muon telescopes has never been done before. As a result, a 3D density distribution reconstruction with a spatial resolution of 1-2 m could be performed, which allows the identification of possible fracture (fault) zones and cavities (also exploring their geometry) can greatly support geological modelling.
We believe that our results are suitable to demonstrate the performance of three dimensional subsurface muography, which is currently close to the limit of feasibility.
The summary at the end of the **Results** section has been added as suggested.