

and measuring UHECRs. Its results will be useful information for the planned POEMMA mission [5]. Rapidly evolving progress on the development of the Terzina telescope and its SiPM camera, including the full simulation chain, the amplification stage, and the ASIC, is reported. A preliminary estimation of the trigger rate at a given threshold and readout pad size has been assessed for different mission lifetimes. The radiation dose accumulated by the SiPM and electronics mainly caused by electrons, secondary gammas, and protons has been estimated as well as the SiPM power consumption. An indication of Terzina aperture has been provided.

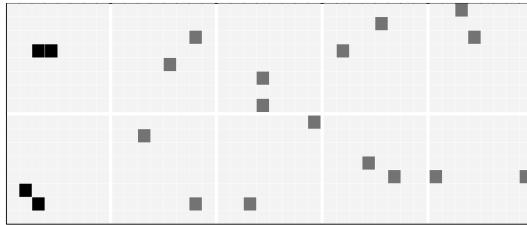


Figure 16: Camera composed of 10 arrays of SiPMs. Each array is readout by one ASIC with  $8 \times 8$  channels. On the left, pixels in black forming a clusters can be seen, while the other fired pixels represent examples of background.

## Acknowledgements

NUSES is a joint project of the Gran Sasso Science Institute and Thales Alenia Space Italia, funded by the Italian Government (CIPE n. 20/2019), by the Italian Minister of Economic Development and the Abruzzo Region (MISE n. F/130087/00/X38), by the Italian Space Agency (ASI n. 15/2022) and by the Swiss National Foundation (SNF grant n. 178918).

## References

- [1] I. De Miti for the NUSES Collaboration, J. Phys.: Conf. Ser. 2429 (2023) 012007.
- [2] A. Di Giovanni and M. di Santo for the NUSES Collaboration, POS 414 (2022) 354, URL: <https://pos.sissa.it/414/354>.
- [3] A. L. Cummings, R. Aloisio and J. F. Krizmanic, “Modeling of the Tau and Muon Neutrino-induced Optical Cherenkov Signals from Upward-moving Extensive Air Showers,” Phys. Rev. D **103** (2021) no.4, 043017 [[arXiv:2011.09869](https://arxiv.org/abs/2011.09869)].
- [4] A. L. Cummings, R. Aloisio, J. Eser and J. F. Krizmanic, “Modeling the Optical Cherenkov Signals by Cosmic Ray Extensive Air Showers Directly Observed from Sub-Orbital and Orbital Altitudes,” Phys. Rev. D **104** (2021) 063029.
- [5] A. V. Olinto *et al.* [The POEMMA Collaboration], “The POEMMA (Probe of Extreme Multi-Messenger Astrophysics) observatory,” JCAP **06** (2021), 007, [[arXiv:2012.07945](https://arxiv.org/abs/2012.07945)].
- [6] J. Krizmanic, *et al.* "POEMMA: Probe of extreme multi-messenger astrophysics." EPJ Web of Conferences. Vol. **210**. EDP Sciences, 2019.
- [7] A. Gola *et al.* "NUV-Sensitive Silicon Photomultiplier Technologies Developed at Fondazione Bruno Kessler", Sensor **19** (2019) 308.
- [8] <https://www.spenvis.oma.be/>.
- [9] S. Agostinelli *et al.*, "GEANT4: A simulation toolkit", Nucl. Instrum. Meth. A506 (2003) 250–303.
- [10] <http://geant4.web.cern.ch/geant4>.
- [11] <https://pypi.org/project/easchersim/1.1/>, Austin Cummings BSD 3-Clause License.
- [12] J. Bellido *et al.*(Auger Collab.), Proceedings of Science(ICRC2017), 506 (2017).
- [13] M. G. Aartsen *et al.*, Phys. Rev. D **100** (2019) 082002.
- [14] M. Takahiko *et al.* "Suppression of the optical crosstalk in a multichannel silicon photomultiplier array" Opt. Express 29 (2021) 16914–16926.
- [15] W. Hofmann, *et al.* "Balloon-borne infrared telescope for absolute surface photometry of the night sky," Appl. Opt. **16** (1977) 3125–3130.
- [16] S. Mianowski *et al.* "Proton Irradiation of SiPM arrays for POLAR-2", Research Square (2022).

## The NUSES Collaboration

R. Aloisio<sup>1,2</sup>, C. Altomare<sup>3</sup>, F. C. T. Barbato<sup>1,2</sup>, R. Battiston<sup>4,5</sup>, M. Bertaina<sup>6,7</sup>, E. Bissaldi<sup>3,8</sup>, D. Boncioli<sup>2,9</sup>, L. Burmistrov<sup>10</sup>, I. Cagnoli<sup>1,2</sup>, M. Casolino<sup>13</sup>, N. D'Ambrosio<sup>2</sup>, I. De Miti<sup>1,2</sup>, G. De Robertis<sup>3</sup>, C. De Santis<sup>11</sup>, A. Di Giovanni<sup>1,2</sup>, A. Di Salvo<sup>7</sup>, M. Di Santo<sup>1,2</sup>, L. Di Venere<sup>3</sup>, M. Fernandez Alonso<sup>1,2</sup>, G. Fontanella<sup>1,2</sup>, P. Fusco<sup>3,8</sup>, S. Garbolino<sup>7</sup>, F. Gargano<sup>3</sup>, R. Aaron Giampaolo<sup>1,7</sup>, M. Giliberti<sup>3,8</sup>, F. Guarino<sup>11,12</sup>, M. Heller<sup>10</sup>, R. Iuppa<sup>4,5</sup>, A. Lega<sup>4,5</sup>, F. Licciulli<sup>3</sup>, F. Loparco<sup>3,8</sup>, L. Lorusso<sup>3,8</sup>, M. Mariotti<sup>13,14</sup>, M. N. Mazziotta<sup>3</sup>, M. Mese<sup>11,12</sup>, H. Miyamoto<sup>1,7</sup>, T. Montaruli<sup>10</sup>, A. Nagai<sup>10</sup>, R. Nicolaidis<sup>4,5</sup>, F. Nozzoli<sup>4,5</sup>, D. Orlandi<sup>2</sup>, G. Osteria<sup>11</sup>, P. A. Palmieri<sup>6,7</sup>, B. Panico<sup>11,12</sup>, G. Panzarini<sup>3,8</sup>, A. Parenti<sup>1,2</sup>, L. Perrone<sup>15,16</sup>, P. Picozza<sup>17</sup>, R. Pillera<sup>3,8</sup>, R. Rando<sup>13,14</sup>, M. Rinaldi<sup>18</sup>, A. Rivetti<sup>7</sup>, V. Rizi<sup>2,9</sup>, F. Salamida<sup>2,9</sup>, E. Santero Mormile<sup>6</sup>, V. Scherini<sup>15,16</sup>, V. Scotti<sup>11,12</sup>, D. Serini<sup>3</sup>, I. Siddique<sup>1,2</sup>, L. Silveri<sup>1,2</sup>, A. Smirnov<sup>1,2</sup>, R. Sparvoli<sup>18</sup>, S. Tedesco<sup>7,19</sup>, C. Trimarelli<sup>10</sup>, L. Wu<sup>1,2</sup>, P. Zucco<sup>4,5</sup>, S. C. Zugravil<sup>7,19</sup>.

<sup>1</sup>Gran Sasso Science Institute (GSSI), Via Iacobucci 2, I-67100 L’Aquila, Italy

<sup>2</sup>Istituto Nazionale di Fisica Nucleare (INFN) - Laboratori Nazionali del Gran Sasso, I-67100 Assergi, L’Aquila, Italy

<sup>3</sup>Istituto Nazionale di Fisica Nucleare, Sezione di Bari, via Orabona 4, I-70126 Bari, Italy

<sup>4</sup>Dipartimento di Fisica, Università di Trento, via Sommarive 14 I-38123 Trento, Italy

<sup>5</sup>Istituto Nazionale di Fisica Nucleare (INFN) - TIFPA, via Sommarive 14 I-38123 Trento, Italy

<sup>6</sup>Dipartimento di Fisica, Università di Torino, Via P. Giuria, 1 I-10125 Torino, Italy

<sup>7</sup>Istituto Nazionale di Fisica Nucleare (INFN) - Sezione di