

## Verification Protocols for the Lightning Protection of a Large Scale Scientific Instrument in Harsh Environments: A Case Study

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**Abstract :** This paper is devoted to the study of the most suitable protocols to verify the lightning protection and ground resistance quality in a large-scale scientific facility located in a harsh environment. We illustrate this work by reviewing a case study: the largest telescopes of the Northern Hemisphere Cherenkov Telescope Array, CTA-N. This array hosts sensitive and high-speed optoelectronics instrumentation and sits on a clear, free from obstacle terrain at around 2400 m above sea level. The site offers a top-quality sky but also features challenging conditions for a lightning protection system: the terrain is volcanic and has resistivities well above 1 kOhm-m. In addition, the environment often exhibits humidities well below 5%. On the other hand, the high complexity of a Cherenkov telescope structure does not allow a straightforward application of lightning protection standards. CTA-N has been conceived as an array of fourteen Cherenkov Telescopes of two different sizes, which will be constructed in La Palma Island, Spain. Cherenkov Telescopes can provide valuable information on different astrophysical sources from the gamma rays reaching the Earth's atmosphere. The largest telescopes of CTA are called LST's, and the construction of the first one was finished in October 2018. The LST has a shape which resembles a large parabolic antenna, with a 23-meter reflective surface supported by a tubular structure made of carbon fibers and steel tubes. The reflective surface has 400 square meters and is made of an array of segmented mirrors that can be controlled individually by a subsystem of actuators. This surface collects and focuses the Cherenkov photons into the camera, where 1855 photo-sensors convert the light in electrical signals that can be processed by dedicated electronics. We describe here how the risk assessment of direct strike impacts was made and how down conductors and ground system were both tested. The verification protocols which should be applied for the commissioning and operation phases are then explained. We stress our attention on the ground resistance quality assessment.

**Keywords :** grounding, large scale scientific instrument, lightning risk assessment, lightning standards and safety

**Conference Title :** ICLE 2019 : International Conference on Lightning and Electrostatics

**Conference Location :** Tokyo, Japan

**Conference Dates :** December 04-05, 2019