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The DIAPHANE telescopes: architecture and recent upgrades

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The DIAPHANE project is a pluri-disciplinary collaboration between particle and geo-physicists to perform the tomography of large geological structure mainly devoted to the study of active volcanoes. The detector used for this tomography, hereafter referred to as "telescope", uses a standard, robust, cost-effective and well-known technology based on solid plastic scintillator readout by photomultiplier(s). We present the global architecture of the telescopes, prefectly adapted to the volcanic harsh environment and in particular the electronics system, built on the concept of autonomous, triggerless, smart e-Sensors.

First radiographies have been performed on the Mont-Terri undergound laboratory (St-Ursanne, Switzerland) and on active volcanoes: La Soufrière of Guadeloupe in the Lesser Antilles, France and mount Etna, Italy. The first generation of those telescopes uses Hamamatsu H8804-200mod photomultipliers.

In this article we present upgrades of those telescopes, based on the use of Silicon PhotoMultipliers to increase the m.i.p. detection efficiency and of embedded sub-nanosecond resolution TDC. Those upgrades are completely compatible with the existing set of telescopes and allows to compare different detection technology in the same framework.