

Radio-Morphing: a fast, efficient and accurate tool to compute the radio signals from air-showers

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The preparation of next generation large-scale radio detectors such as GRAND requires to run massive air-shower simulations to evaluate the radio signal at each antenna position. Radio-Morphing was developed for this purpose. It is a semi-analytical tool that enables a fast computation of the radio signal emitted by any air-shower at any location, from the simulation data of one single reference shower at given positions. Radio-Morphing was demonstrated to generate the electric field time traces with amplitudes in good agreement (<30% difference for two thirds of signals) with microscopic simulations, while reducing the computation time by several orders of magnitude. However, several features still needed to be addressed for the tool to be fully efficient and accurate. We present here major improvements on the Radio-Morphing method that have been implemented recently. The upgraded version is based on revised and refined scaling laws, derived from physical principles. It also includes a new spatial interpolation technique, thanks to which an excellent signal timing accuracy can be reached. We will present the methodology, performances and possible applications of this universal tool.

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