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Experimental study of hard-X ray emission from laboratory sparks

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We present the characterization of hard-X rays produced by meter-long laboratory sparks carried out at the high-voltage laboratory of RSE, Milano, Italy. Sparks are known to emit X-rays when positive and negative streamers connect, before breakdown. Numerical simulations suggest that X-rays are produced by Bremsstrahlung in air by electrons accelerated to the runaway regime in the high electric field at the streamers tip.
Positive meter-long discharges are produced by a Marx generator loaded by a meter-long air gap formed by a spherical anode and a conical-shaped cathode. Maximum voltage at breakdown is about 1 MV. We investigate the production of X-rays by means of an array of scintillation detectors deployed around the cathode. Each detector is a 2” NaI(Tl) scintillating crystal coupled to a photomultiplier tube (PMT). Each detector is battery-powered and enclosed in a metallic housing for EM shielding. Analog signal output is trasmitted to a shielded control room by means of optical fibre tranceivers, and then collected by a fast digitizer. We present the experimental setup and first results concerning detection efficiency, energy spectra, and geometrical distribution of the emission.