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The observation of X-ray bursts along and perpendicular to the streamer path.

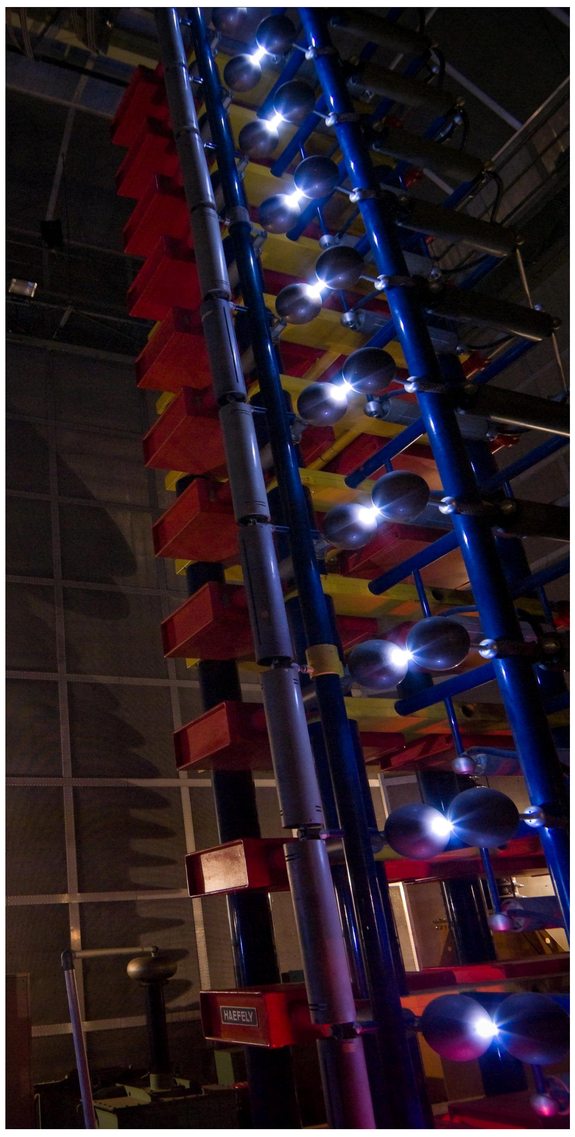
P. Kochkin, C.V. Nguyen, A.P.J. van Deursen

Electrical Engineering Department, Eindhoven University of Technology,

Den Dolech 2, 5612 AZ Eindhoven, The Netherlands, p.kochkin@tue.nl

Building on Transient Plasmas (BTP)
10757 Understanding Lightning: From Terrestrial Gamma-Ray Flashes to Lightning Protection

Experimental setup.



A 17 kJ Marx generator with a 1.2/52μs pulse shape when unloaded was used to generate surges of positive and negative polarity.

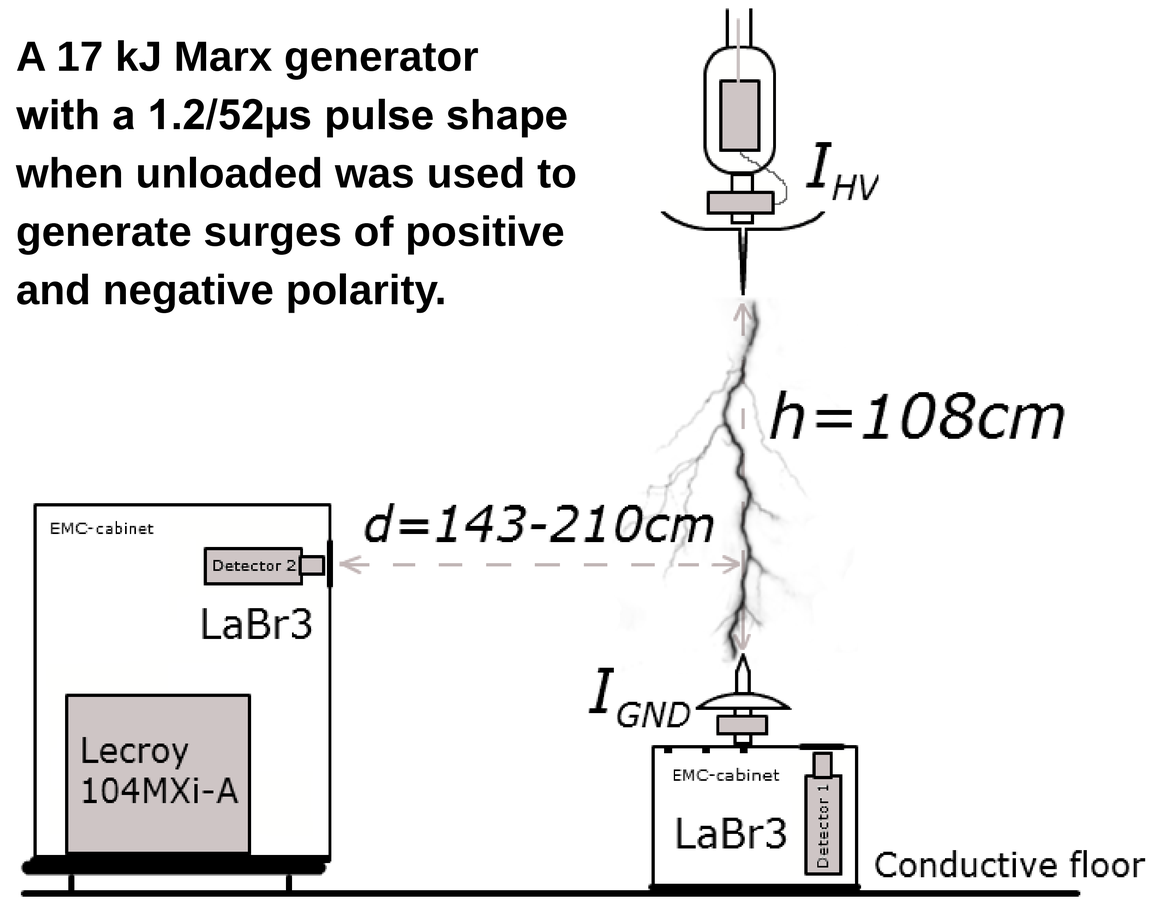
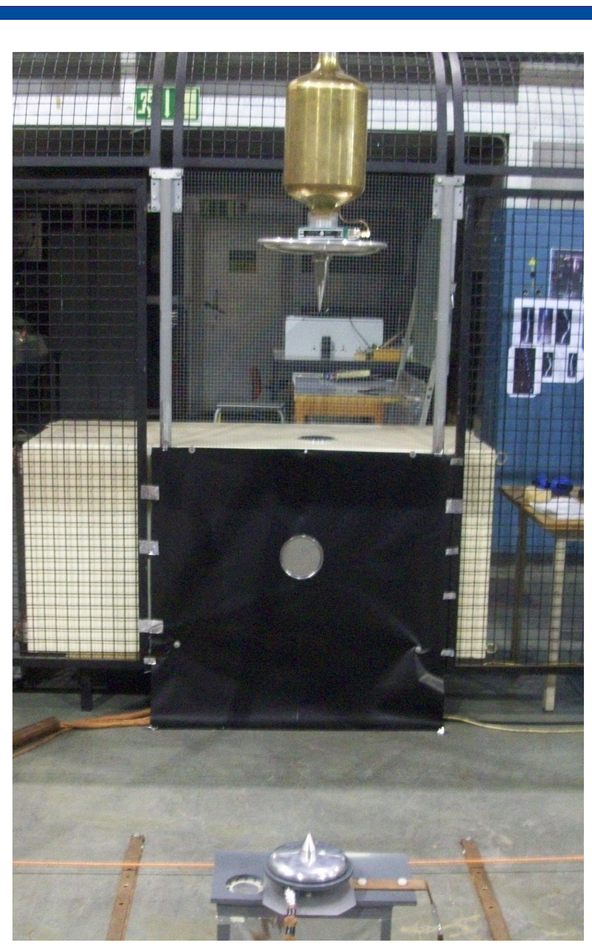
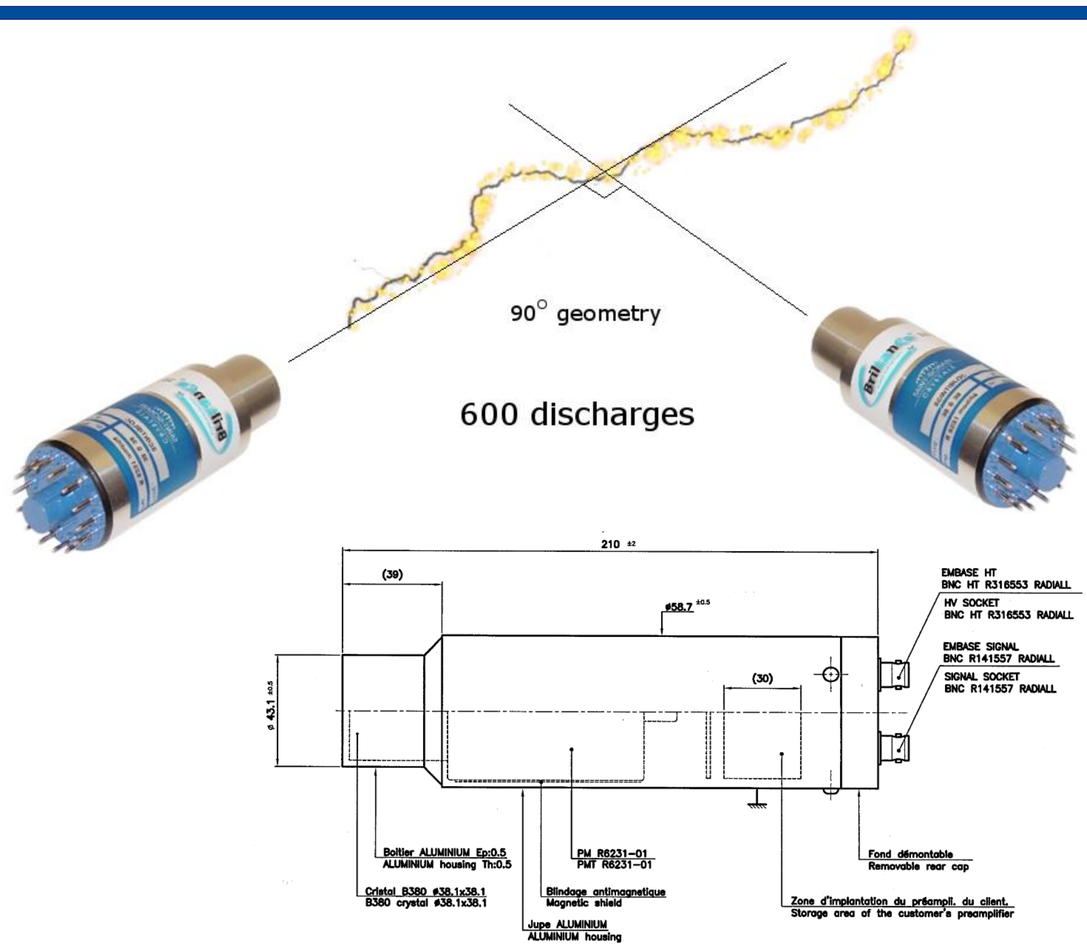


Figure 1: Schematic view of experimental setup to measure x-ray from laboratory sparks.

• Full gap breakdown at approximately 1MV surge voltage within one to two microseconds after the maximum.





Experimental data.

600 discharges of positive and negative polarity.

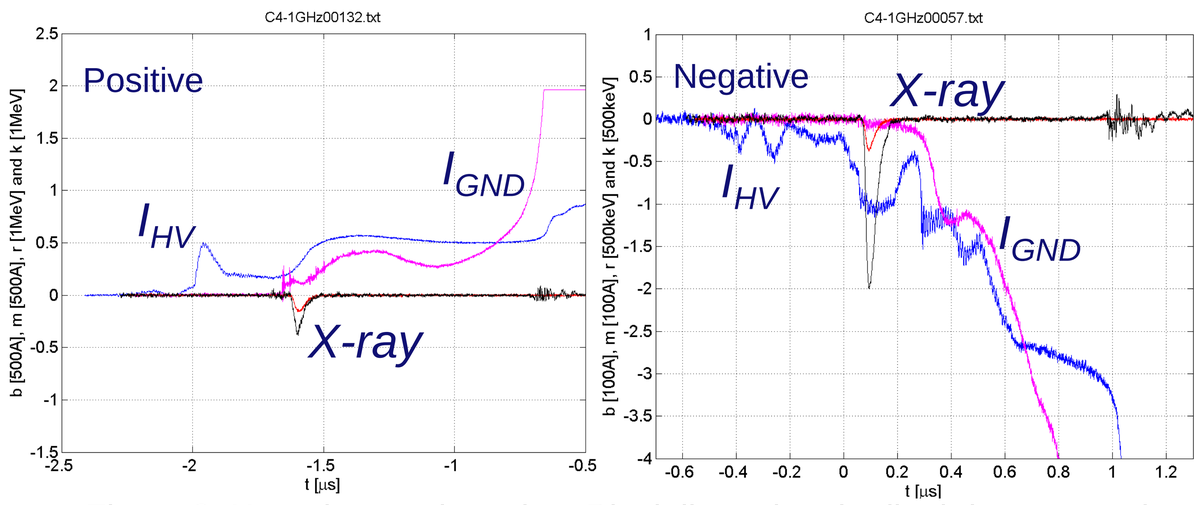


Figure 2: X-ray bursts detection. Black line – longitudinal detector, red line – perpendicular.

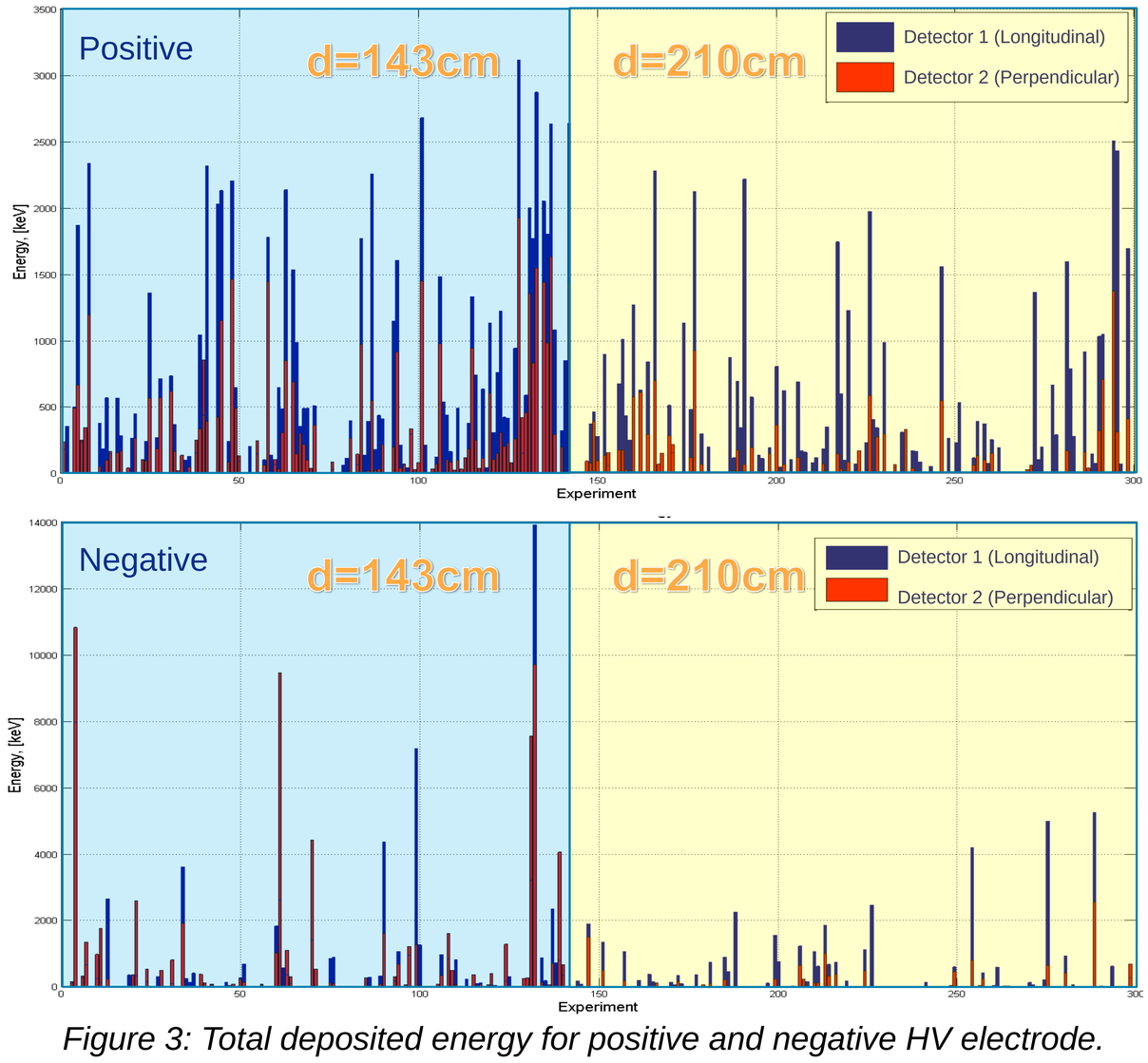
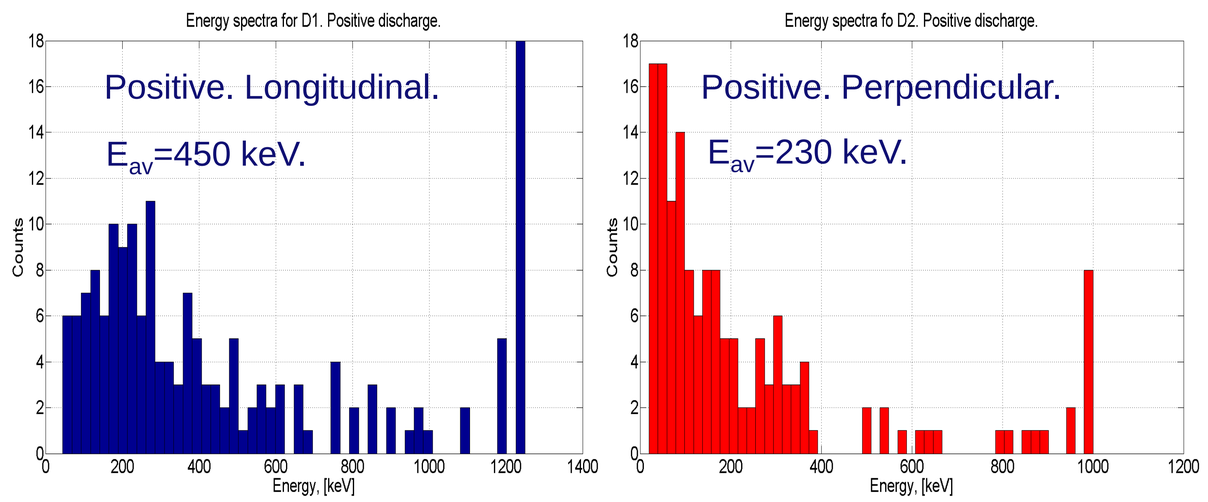


Figure 3: Total deposited energy for positive and negative HV electrode.

Summary.

- Longitudinal detector recorded more events than Perpendicular.
- Average deposited energy was higher for Longitudinal detector.
- Timing of X-ray bursts correspond perfectly to negative streamers occurrence time.
  - For the negative discharges, x-ray radiation was recorded immediately before the cathode current jump, during the negative streamers originated in high-voltage electrode.
  - For the positive discharge time interval of x-ray is wider than for the negative. Most often the x-ray bursts for positive discharges observed during the early growth of cathode current (presumably the negative streamer phase).

Energy spectra.



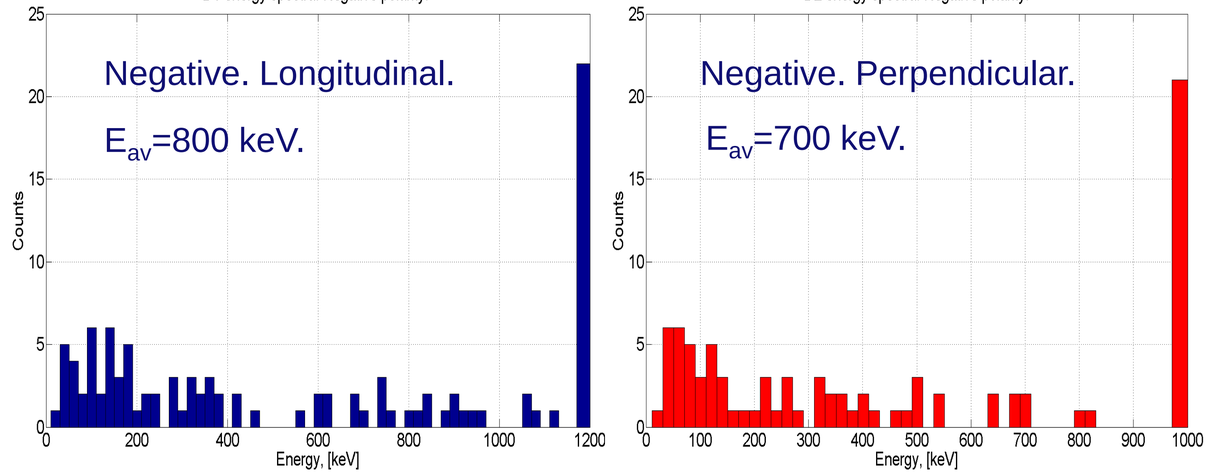
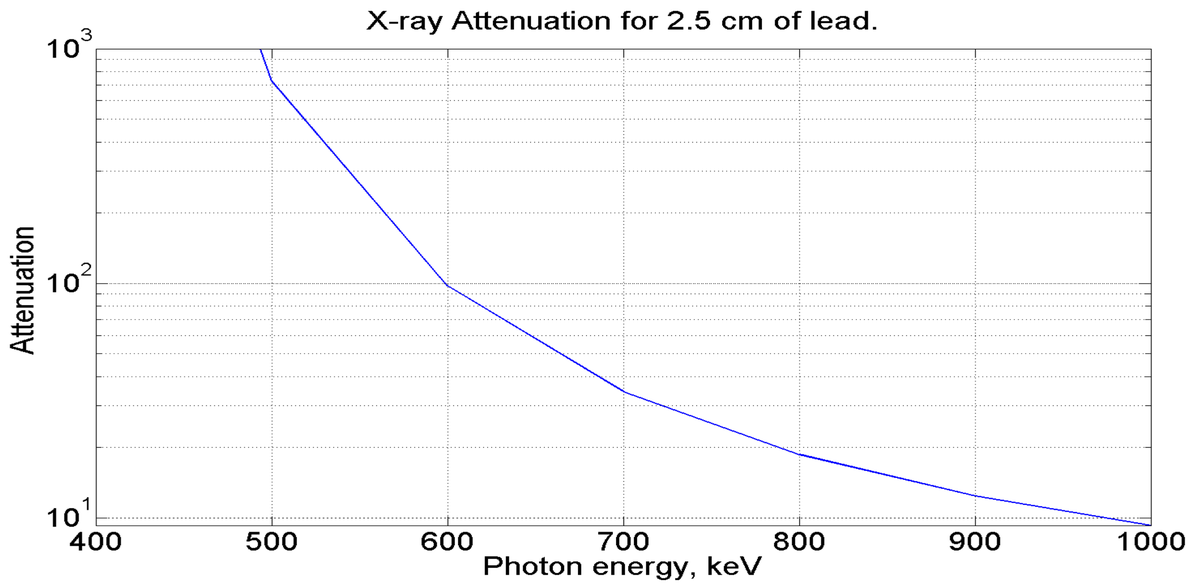


Figure 4: X-rays energy spectra. E_{av} means average energy per one X-ray burst (fig. 2) and may consist of several photons.

Attenuation and background.

- Background emission in the laboratory do not exceed 50 counts per second when measured with $LaBr_3$ (Ce^+) detectors.
- During 100 discharges of both polarity with 2.5 cm of lead shield around detector we did not register any photons.



STW: Building on Transient Plasmas (BTP)

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