

### 3-D PROPERTIES OF PULSED CORONA STREAMERS

van Veldhuizen E.M.<sup>a</sup>, Nijdam S.<sup>a</sup>, Luque A.<sup>b</sup>, Brau F.<sup>b</sup>, and Ebert U.<sup>a,b</sup>

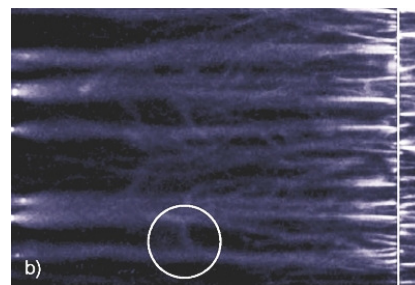
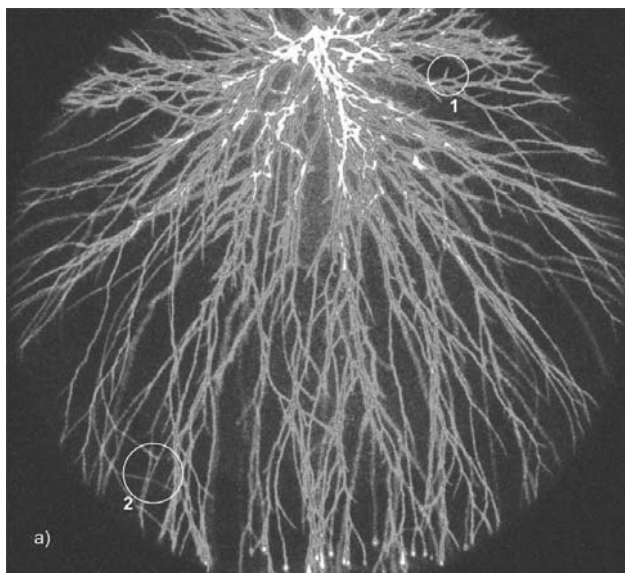
a) Dept. Applied Physics, Technische Universiteit Eindhoven, PO Box 513,  
5600 MB Eindhoven, The Netherlands

b) Centrum Wiskunde & Informatica, PO Box 94079, 1090 GB Amsterdam, The Netherlands

**Abstract.** Properties of pulsed corona streamers are measured and simulated in three dimensions (3D). Stereophotography is used to measure branching angles and to investigate whether apparent streamer reconnections are real. 3D simulations of two parallel streamers show electrostatic repulsion, but they also can merge due to photoionization. Other aspects of streamer interactions become evident through theoretical investigations of a periodic array of streamers.

#### 1. INTRODUCTION

Pulsed corona discharges can form very complex patterns<sup>1-2</sup>. Figure 1a shows a photo of a discharge in quite pure nitrogen where the electrodes are a needle above and a plate below, i.e., the electrode geometry is cylindrically symmetric. Therefore the figure shows a two-dimensional projection of a three-dimensional event. From the needle a number of streamers emerge that branch repeatedly until more than 100 streamers have formed in the middle between the electrodes. Streamers branch after a characteristic length and with a characteristic distribution of angles, they probably repel each other, but there are also events where they seem to reconnect. Figure 1b shows streamers emerging from a wire on the right and propagating to a plane on the left. The figure shows reconnections as well. Photos of streamers emerging from a row of pins<sup>3</sup> inserted into a planar electrode resemble those of wire plane configurations<sup>5-6</sup>.



**FIGURE 1a).** ICCD image of a point-plane corona in a 16 cm gap at 400 mbar in nitrogen with about 0.2 % oxygen<sup>14</sup>. The streamers are thinner than in air, form very short branches, e.g. in circle 1, and possibly reconnect, see circle 2.

**FIGURE 1b).** Streamers in a 5 cm wire-plane discharge in air also show reconnections<sup>6</sup>. Further only a small fraction of the streamers that initiate at the wire reach the cathode.

<sup>a</sup> Electronic address: [e.m.v.veldhuizen@tue.nl](mailto:e.m.v.veldhuizen@tue.nl)