Figure 5

Voltage Waveform Tailoring operation (with valleys-type waveform, N = 4) of the COST-jet: Normalized spatio-temporal plots of the electron impact excitation rate from the ground state into the He I 3S1-state obtained experimentally (first row) and from PIC/MCC simulations (second row) for different fundamental (f0) frequencies (indicated above the columns). The positions of the sheath edges are shown as solid white lines in (e)-(f) and they are calculated using the Brinkmann criterion [67]. For case (a), where the criterion cannot be fully applied due the lack of quasi-neutrality (see discussion in [68]), the sheath positions are marked as dashed solid lines. The panels also show regions of interest (ROI) around the excitation maxima, indicated by dotted rectangles. Within these ROIs the simulation data are averaged to obtained the EEPFs shown in figure 7. The third and fourth rows show the time averaged helium metastable density profiles obtained experimentally and computationally, respectively. The powered electrode is located at x = 0, while the grounded electrode is at x = 1 mm. The peak-to-peak value of the driving voltage is Vpp = 500 V. The He flow is 1000 sccm with an N2 admixture of 0.1 %.

Experimental data are marked as Experiment

Simulated data is marked as Simulation

x [t/TRf] , y[mm]

(Figure5a-5c): Experimental Exc. Rate for N2-admixtures of 1 sccm and different applied frequency of 6MHz, 12MHz and 18MHz respectively with N=4

(Figure5d-5f): Simulated Exc. Rate for N2-admixtures of 1 sccm and different applied frequency of 6MHz, 12MHz and 18MHz respectively with N=4, additionally the simulated plasma sheaths are added as white lines

x[mm], He\*[1010 cm-3]

(Figure5g-5i): Experimental helium metastable density for N2-admixtures of 1 sccm and different applied frequency of 6MHz, 12MHz and 18MHz respectively with N=4, with error bars added

(Figure5j-5l): Simulated helium metastable density for N2-admixtures of 1 sccm and different applied frequency of 6MHz, 12MHz and 18MHz respectively with N=4