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Correlations between density distributions, optical spectra and ion species in a hydrogen plasma

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An experimental study of plasma density distributions in a 2.45 GHz hydrogen plasma source operated at 100 Hz is presented. Ultrafast photography, time integrated visible spectra, time resolved Balmer-alpha emission, time resolved Fulcher Band emission, ion species mass spectra and time resolved ion species currents have been implemented as diagnostics tools for a broad range of plasma conditions. Preliminary results of density distributions and optical emissions correlated with H⁺, H₂⁺ and H₃⁺ ion currents by using a Wien Filter system with optical observation capability are presented. The magnetic field distribution and strength is reported as the most critical factor for transitions between different plasma patterns and ion populations. The breakdown study of typical plasma distributions for visible, Balmer-alpha and Fulcher Band is also presented showing the atomic and molecular distribution evolution where some unexpected structures are observed. The use of visible light emissions as a valuable diagnostic tool for tuning ion sources plasmas is proposed on the base of obtained results.