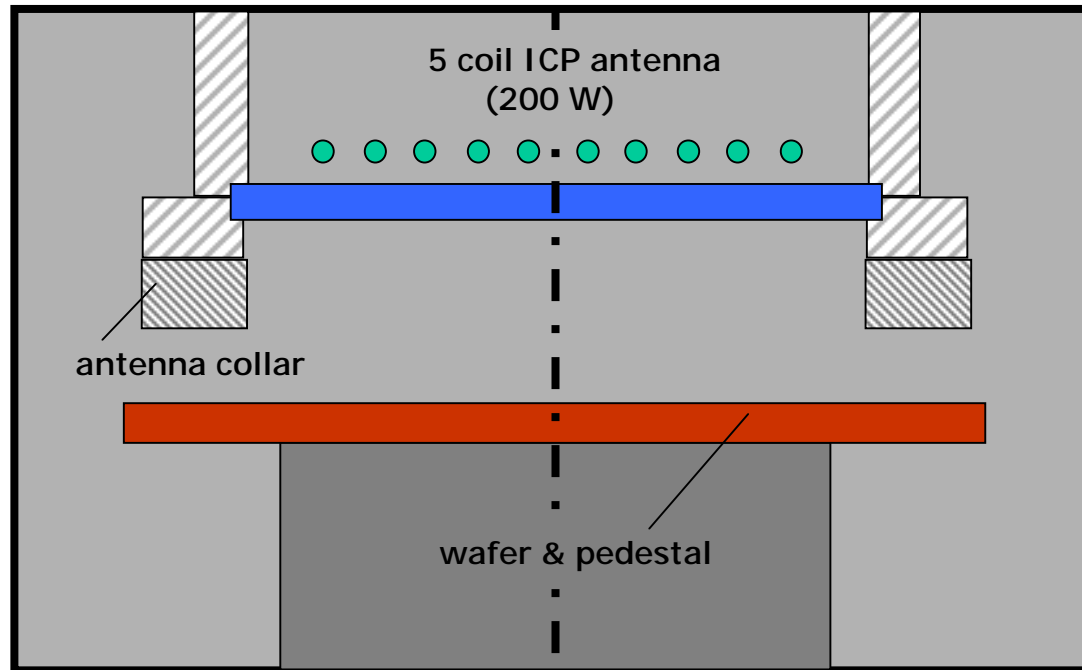


PLASMA SIMULATIONS
OF AN
ICP C_4F_8 DISCHARGE



Research & Software, L.L.C.

COMPUTATIONAL GEOMETRY: Standard GEC ICP Reference Cell

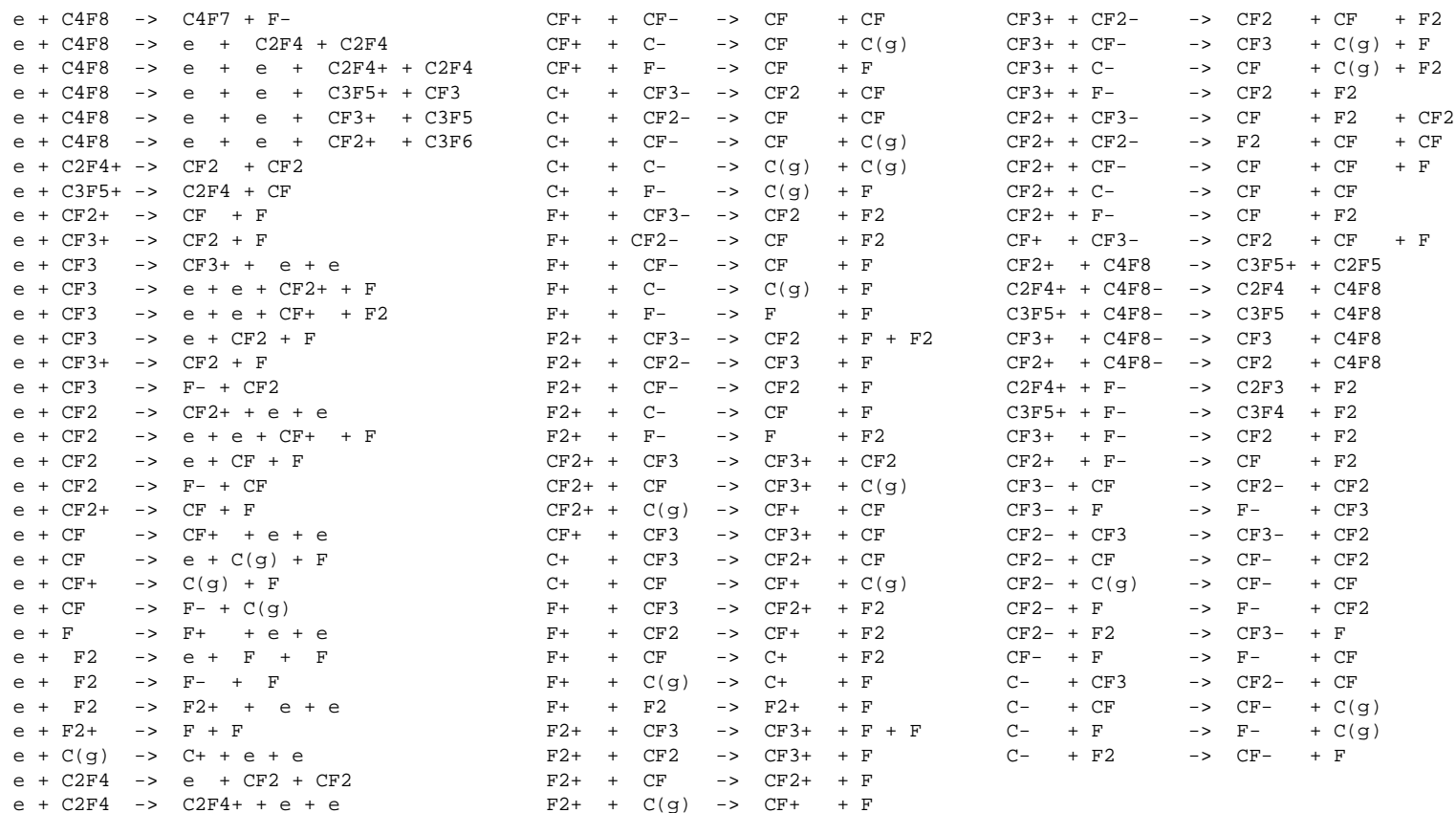


Inlet Flow:
10 sccm C4F8

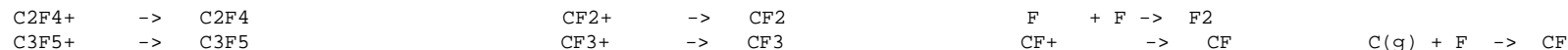
Boundary Conditions
 $T_{\text{wafer}} = 250 \text{ C}$
 $T_{\text{collar}} = 200 \text{ C}$
 $T_{\text{walls}} = 30 \text{ C}$
 $P = 5 - 20 \text{ mTorr}$

FULL C4F8 CHEMISTRY SET: A Comprehensive Chemistry Model is Used to Characterize the Equilibrium Electrons

Plasma Reactions



Surface Reactions



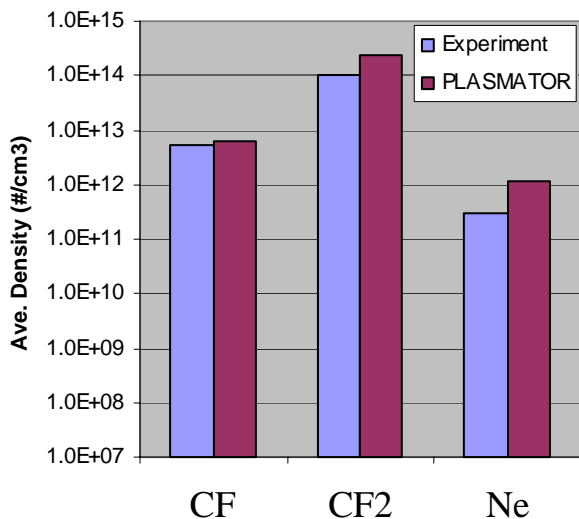
PLASMATOR RESULTS

OXIDE ETCHING

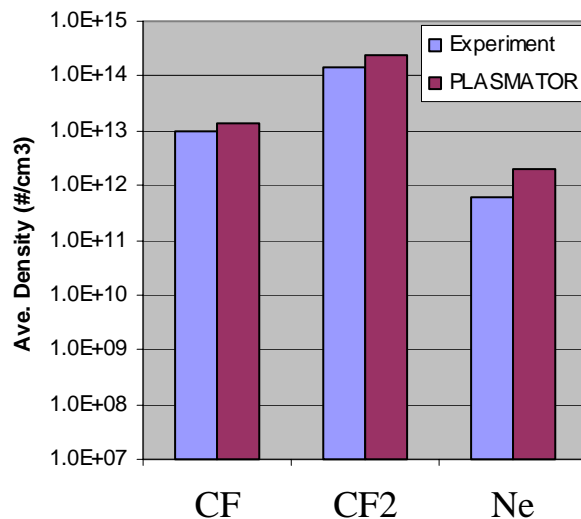
COMPARISON TO EXPERIMENTS:

PLASMATOR Results - Power and Pressure Variation

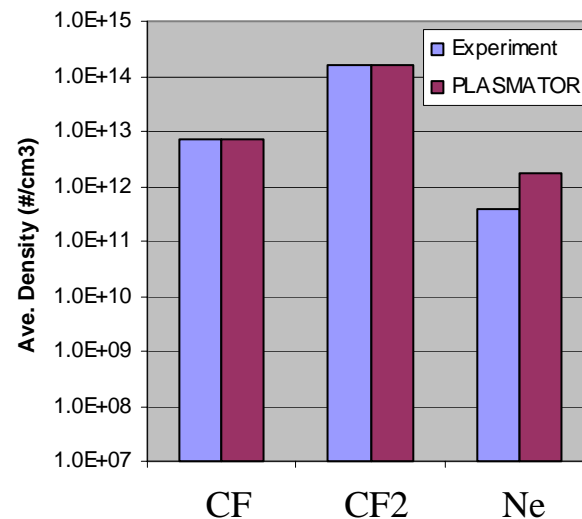
200 W, 15 mTorr



350 W, 15 mTorr



350 W, 25 mTorr



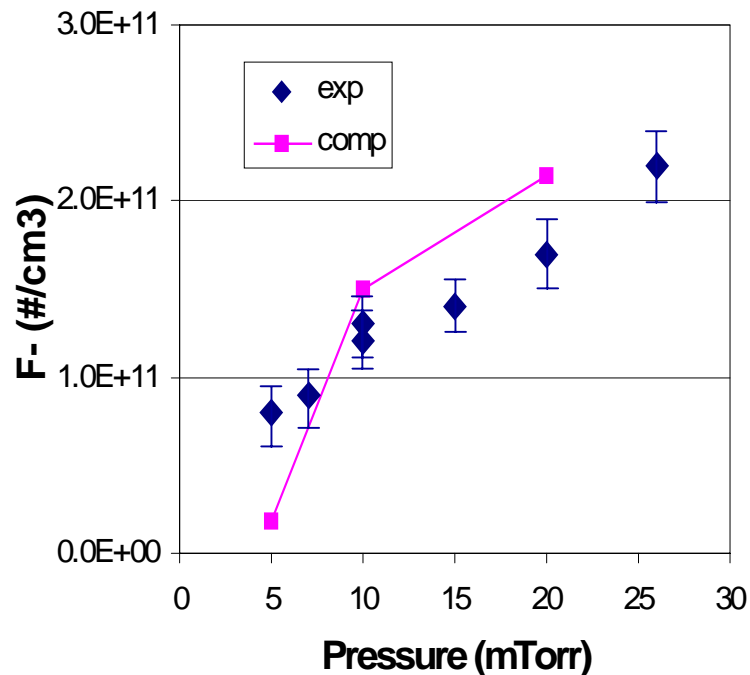
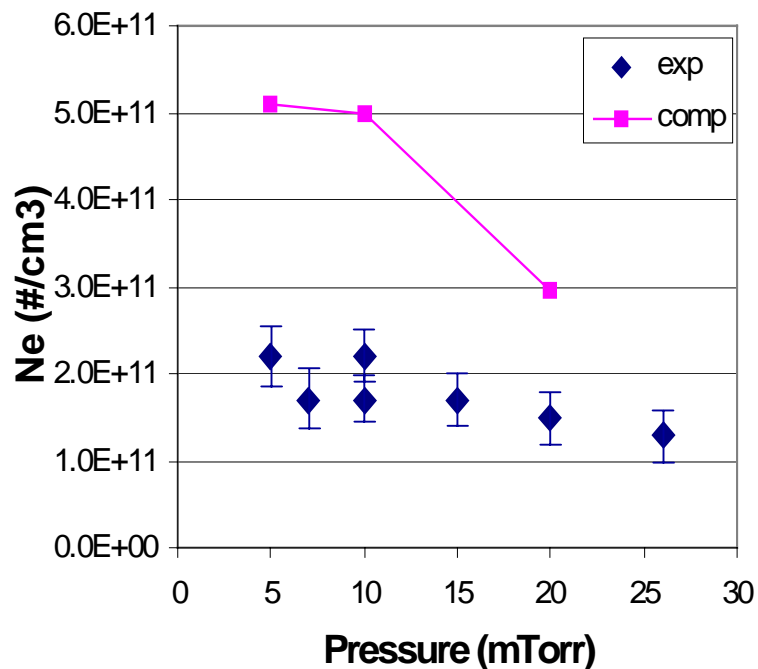
Reactor Conditions:

10 sccm C4F8

* Measurements courtesy of Karla Waters & Harold Anderson at the University of New Mexico

COMPARISON TO EXPERIMENTS:

PLASMATOR Results - Pressure Variation Effects on Electron and F⁻ Density



Reactor Conditions:

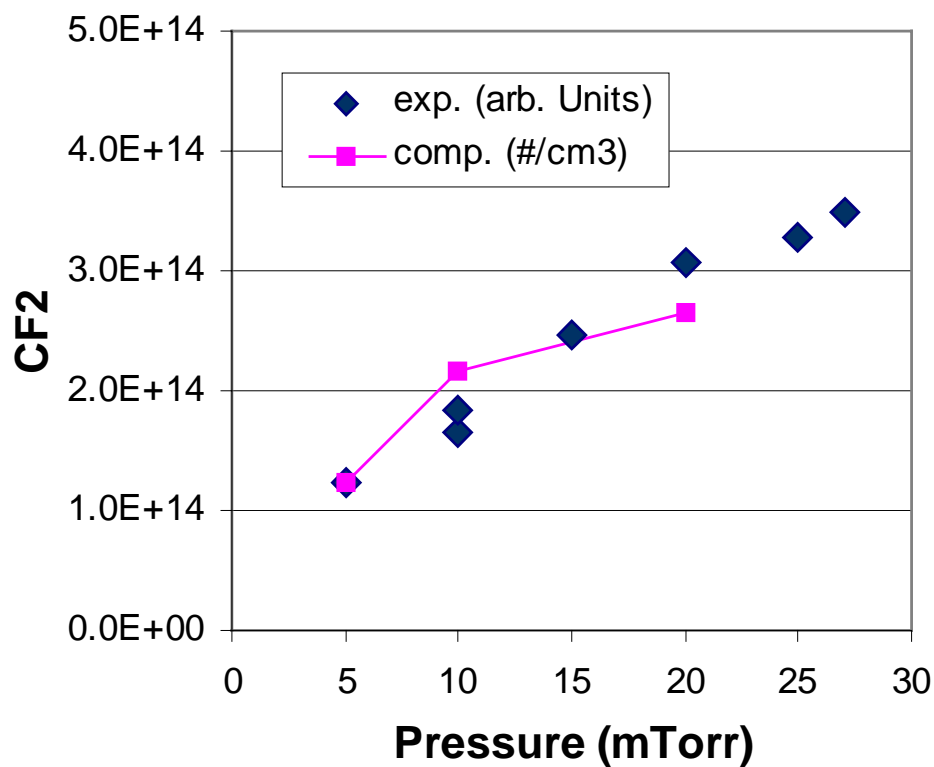
10 sccm C₄F₈

200 W ICP

* Measurements by Greg Hebner, Sandia National Labs

COMPARISON TO EXPERIMENTS:

PLASMATOR Results - Effect of Pressure Variation on CF₂ Density



Reactor Conditions:

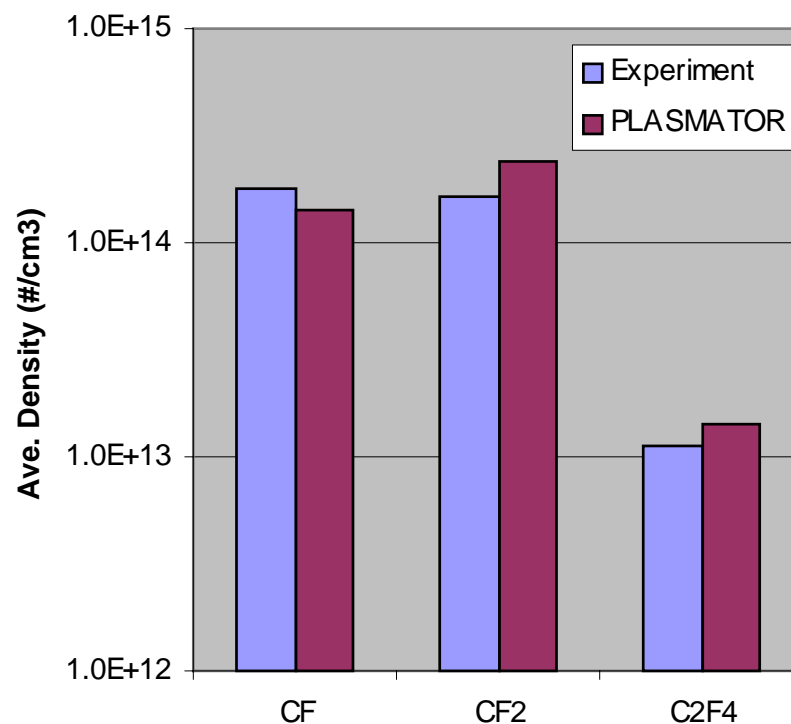
10 sccm C₄F₈

200 W ICP

* Measurements by Greg Hebner, Sandia National Labs

COMPARISON TO EXPERIMENTS:

PLASMATOR Results - Absolute CF, CF₂, and C₂F₄ Density



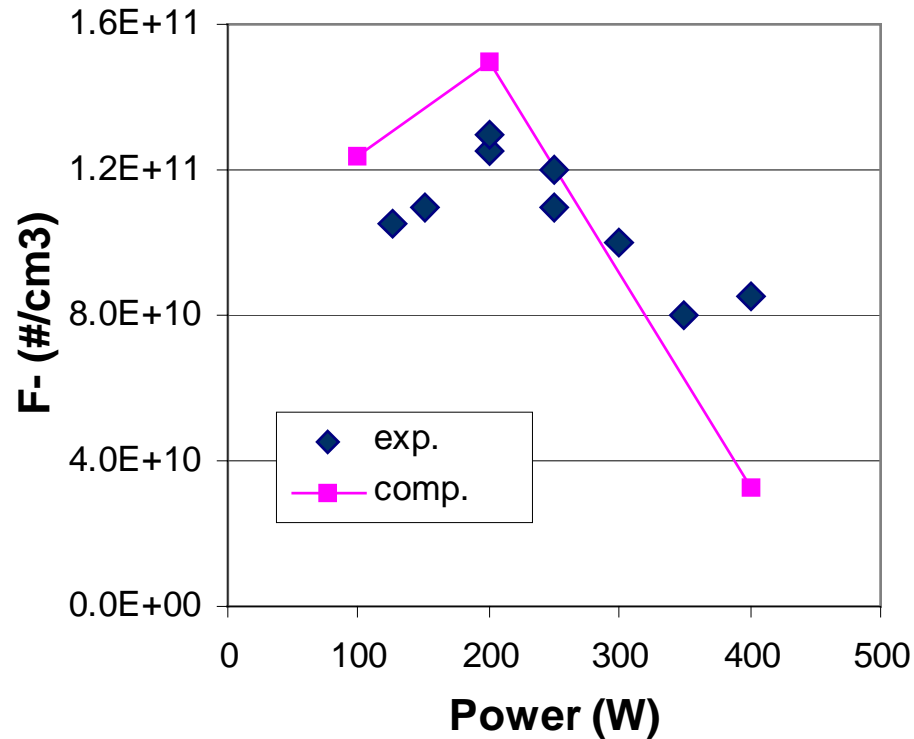
Reactor Conditions:

10 sccm C₄F₈
350 W ICP
15 mTorr

* Measurements courtesy of Harold Anderson at the University of New Mexico

COMPARISON TO EXPERIMENTS:

PLASMATOR Results - Effect of Power Variation on F^- Density



Reactor Conditions:

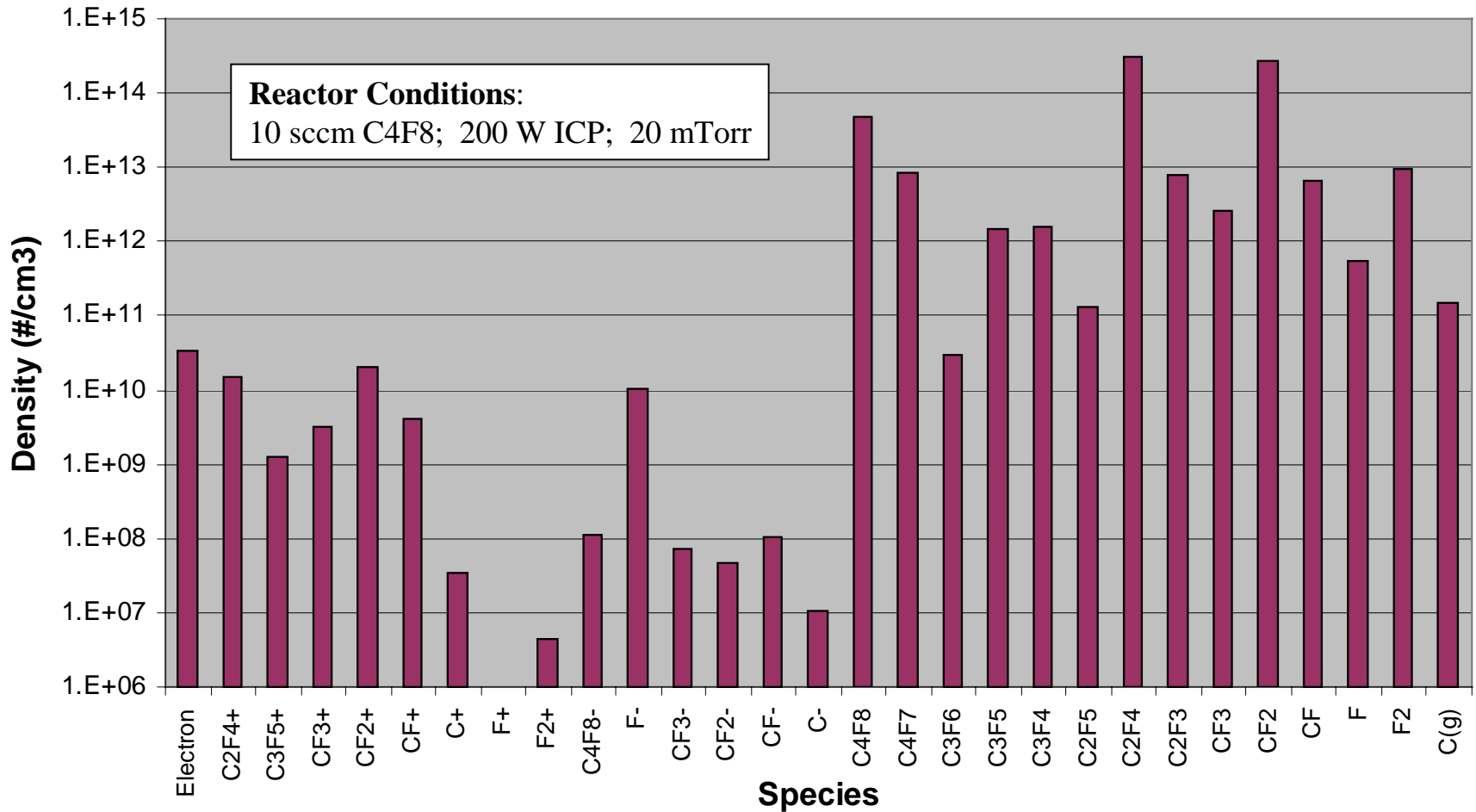
10 sccm C4F8

10 mTorr

* Measurements by Greg Hebner, Sandia National Labs

PLASMA COMPOSITION:

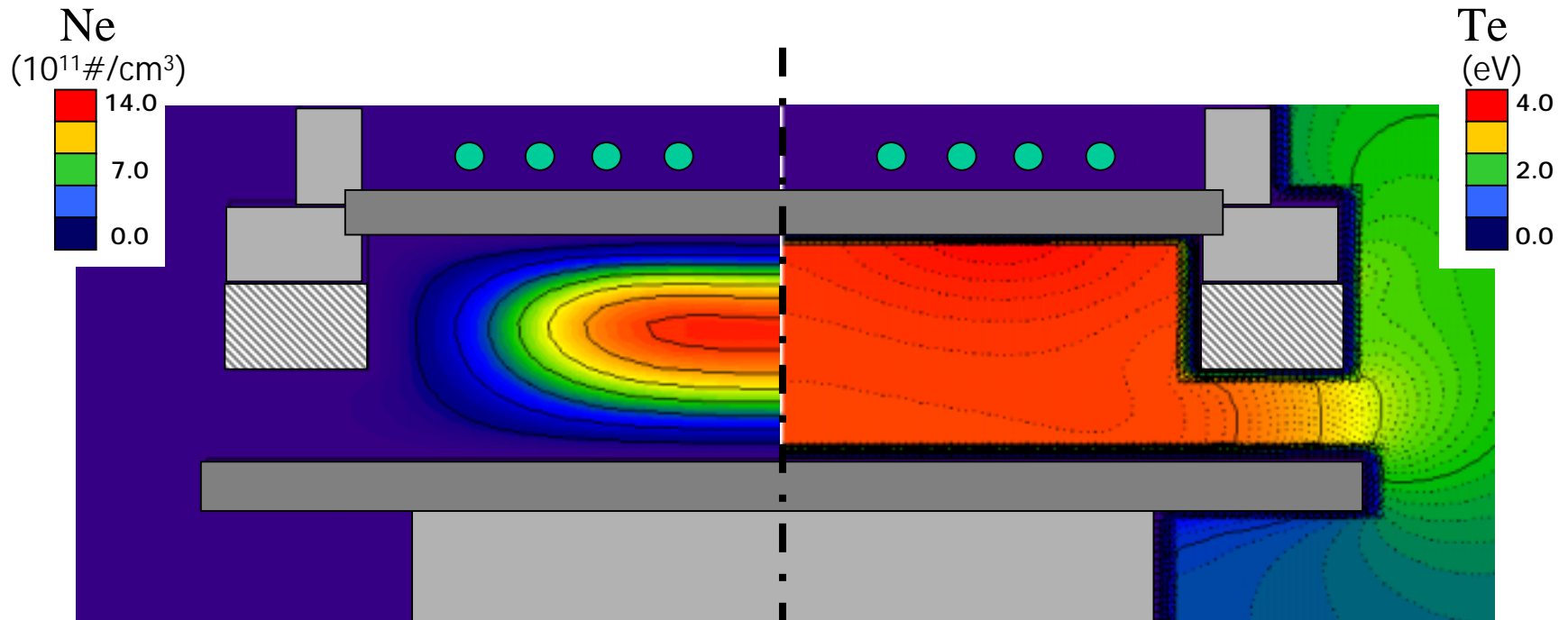
PLASMATOR Results - Average Densities



A comprehensive chemistry set allows the dominant species to be determined.

PLASMA COMPOSITION:

PLASMATOR Results - Electron Density and Temperature

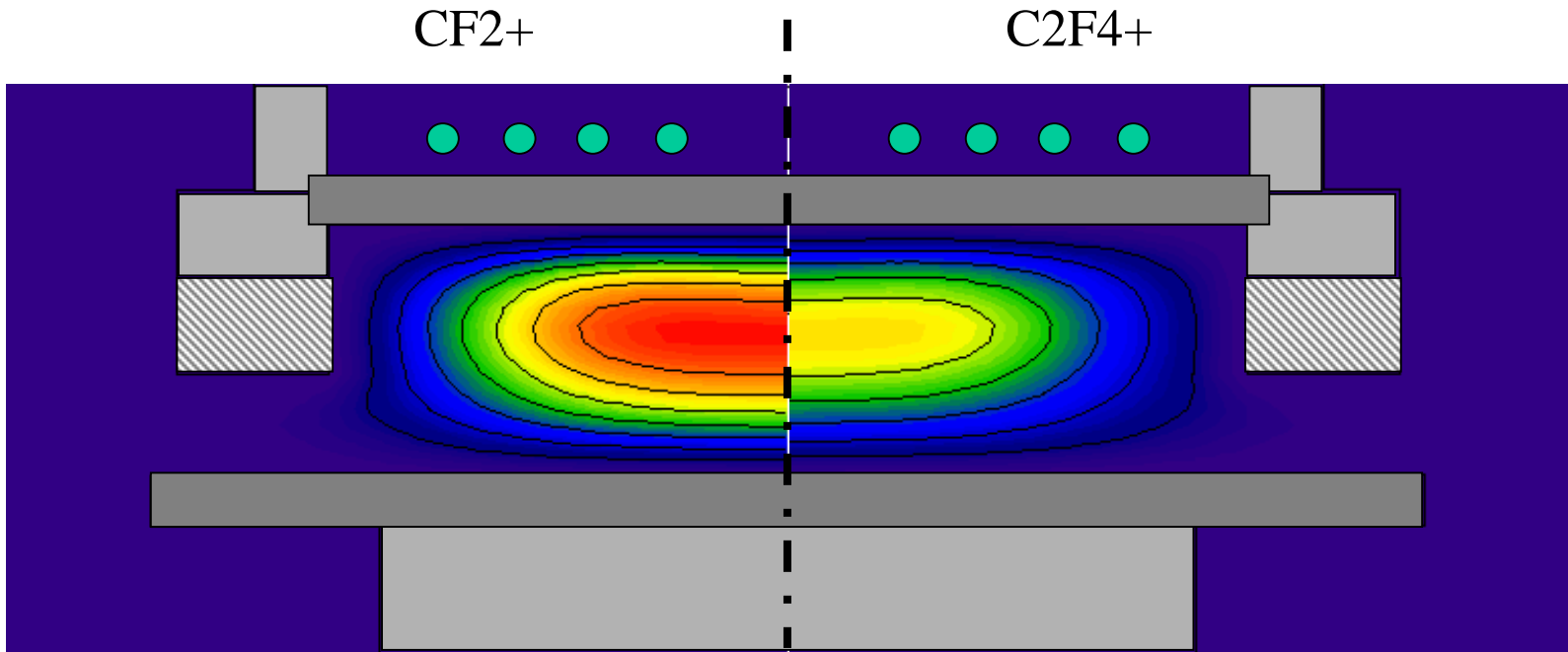


Flow Parameters:

10 sccm C₄F₈
20 mTorr
200 W ICP

PLASMA COMPOSITION:

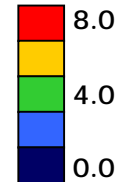
PLASMATOR Results - Principal Ions: CF_2^+ and C_2F_4^+ Density



Flow Parameters:

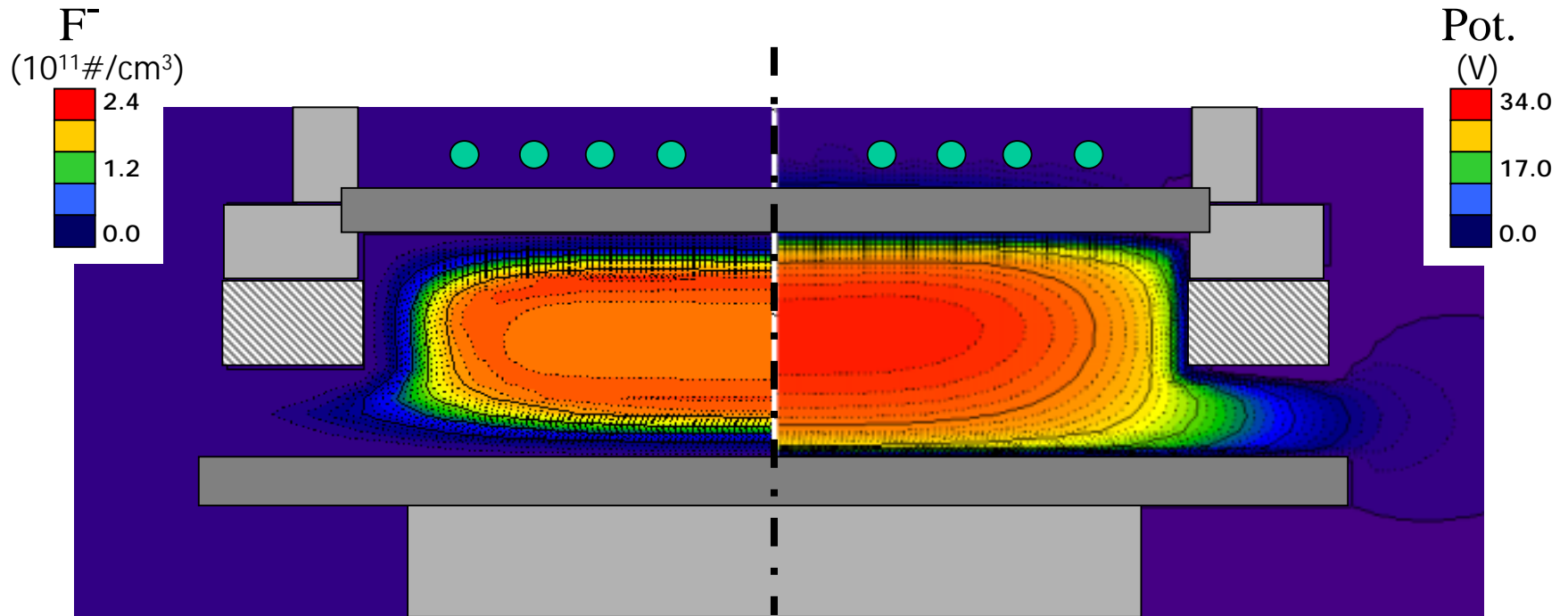
10 sccm C_4F_8
20 mTorr
200 W ICP

($10^{11}\#/\text{cm}^3$)



PLASMA COMPOSITION:

PLASMATOR Results - Negative Ion Density and Plasma Potential



Flow Parameters:

10 sccm C₄F₈
20 mTorr
200 W ICP