

# Asymmetric Edge Biasing for Scrape-off Layer Control in NSTX

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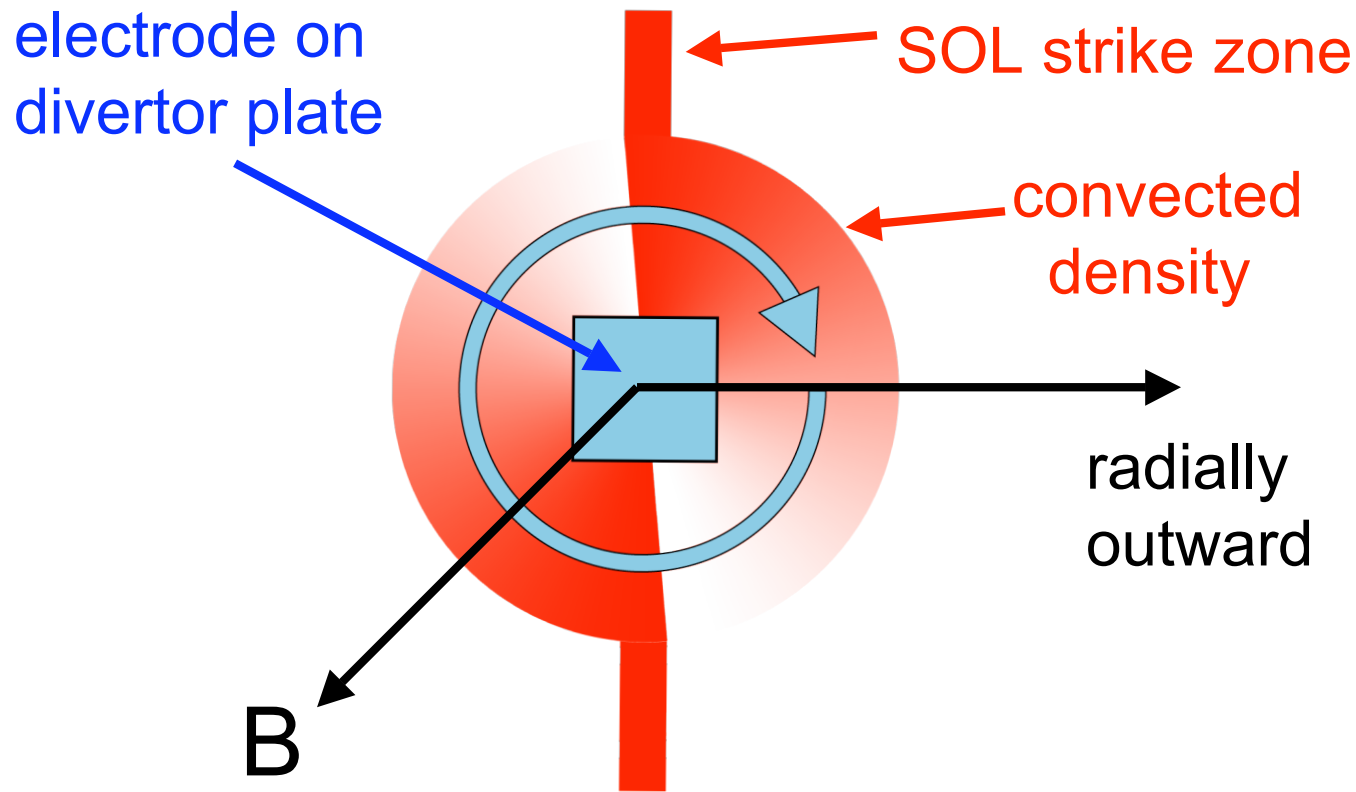
*and the NSTX Research Team*

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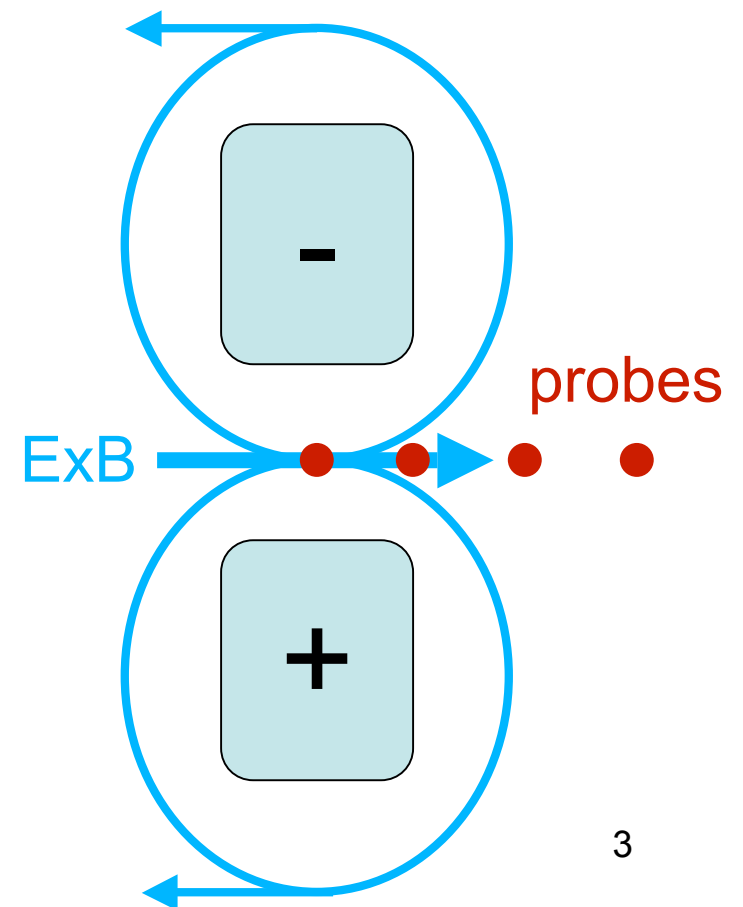
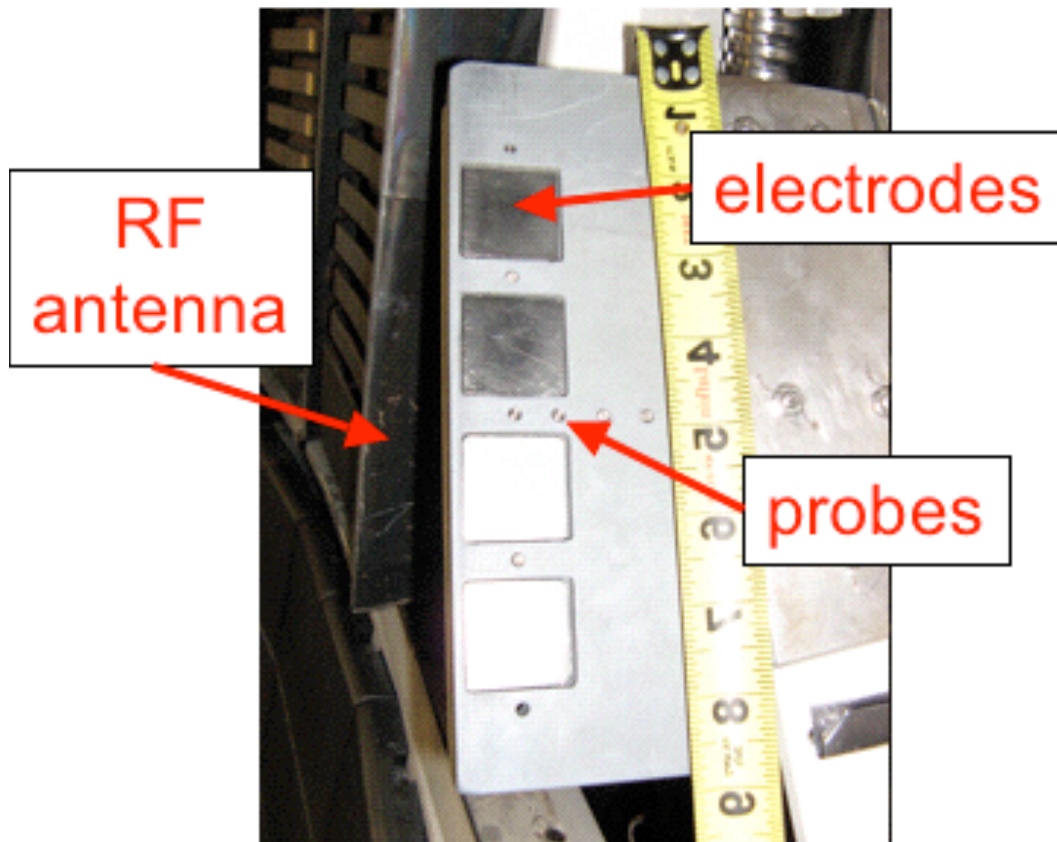
# Convective Cell Generation

- Goal is to broaden heat / particle SOL width at divertor plate by creating local convective cells [Cohen/Rytuvov '97]



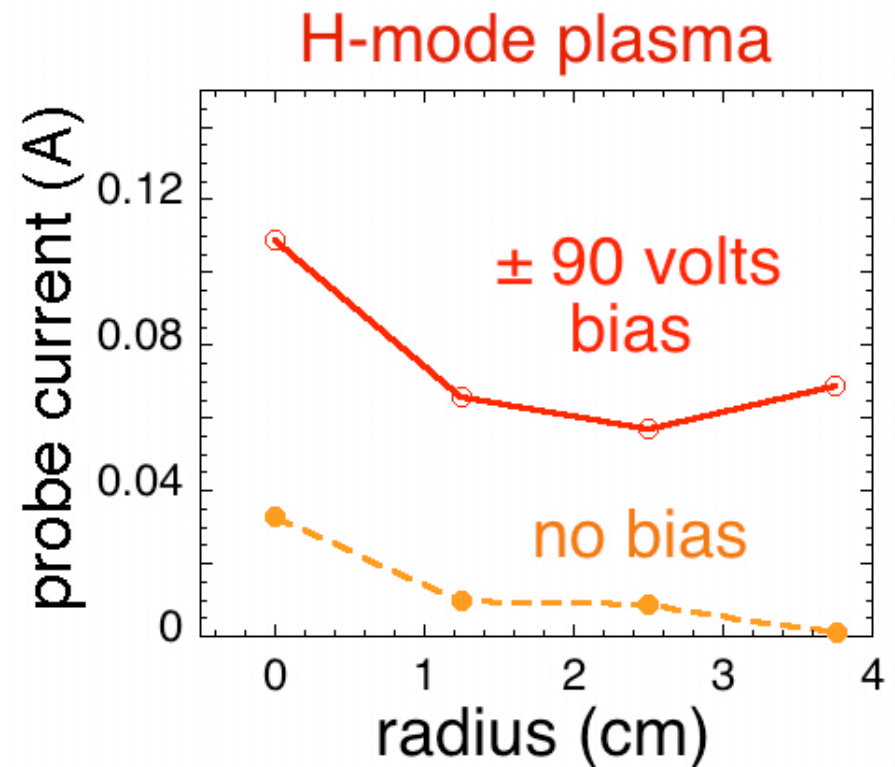
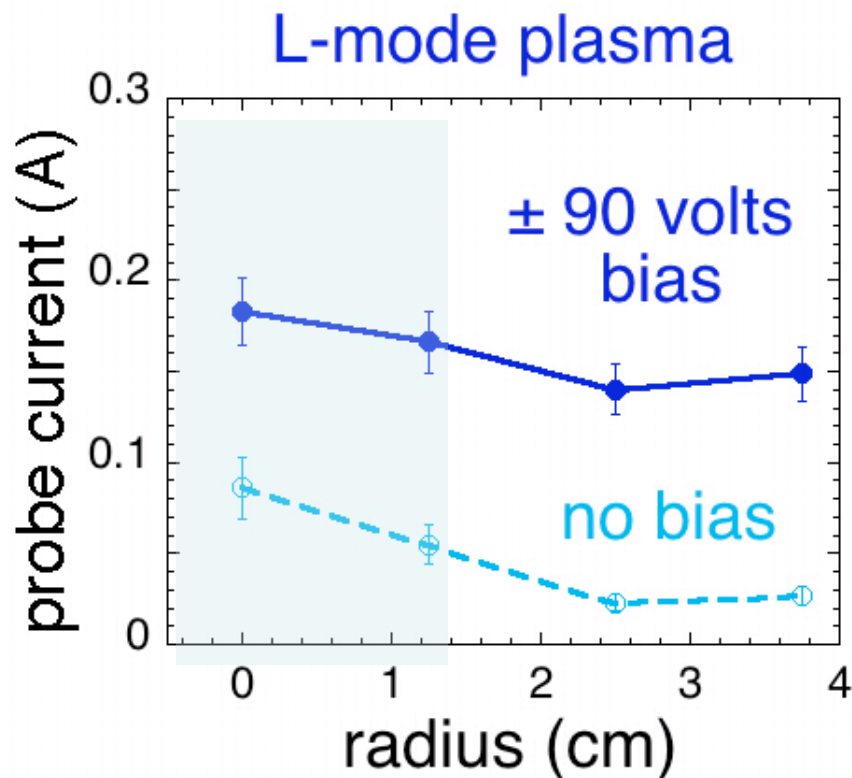
# NSTX Electrodes and Probes

- Electrodes and probes located below outer midplane
- Electrodes biased up to  $\pm 100$  V with respect to vessel



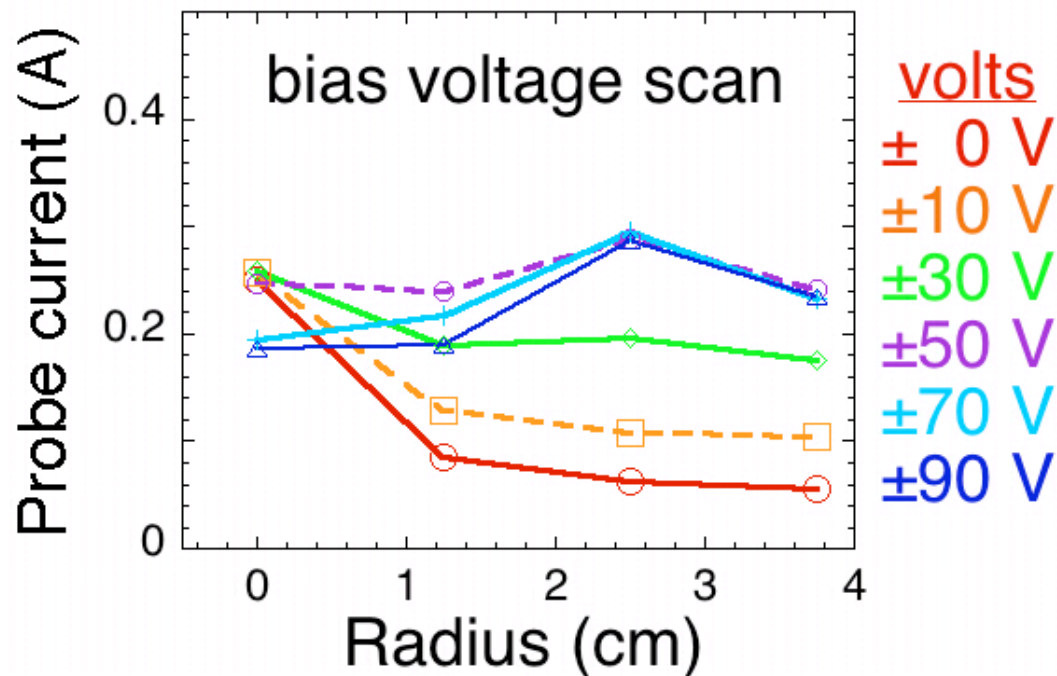
# Density Profile Effects of Biasing

- Radial profiles of  $I_{e,sat}$  averaged over many on/off cycles
- Typically  $n \sim 10^{11} \text{ cm}^{-3}$  and  $T_e \sim 5\text{-}10 \text{ eV}$  (at  $r=0 \text{ cm}$ )



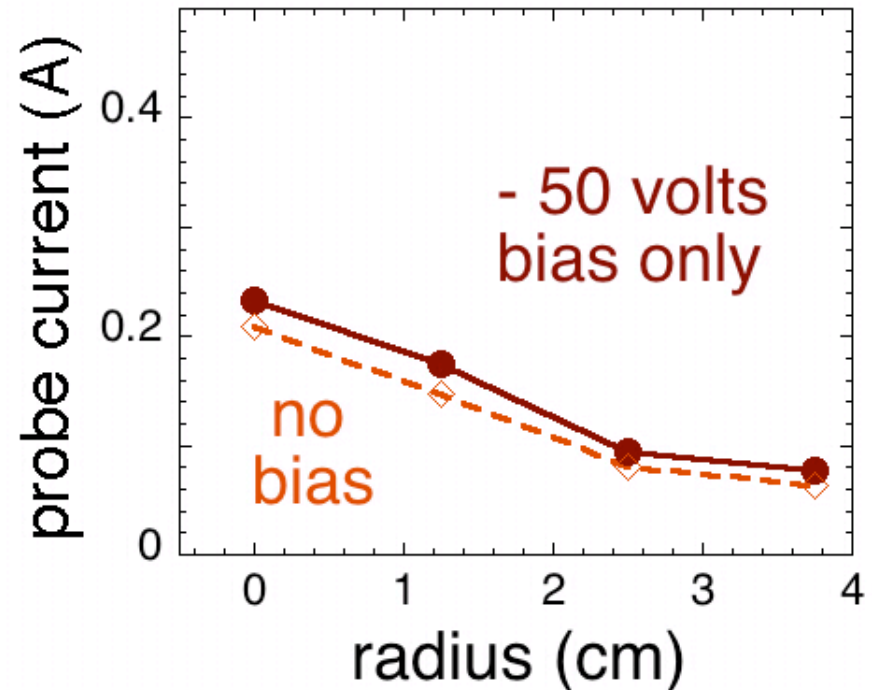
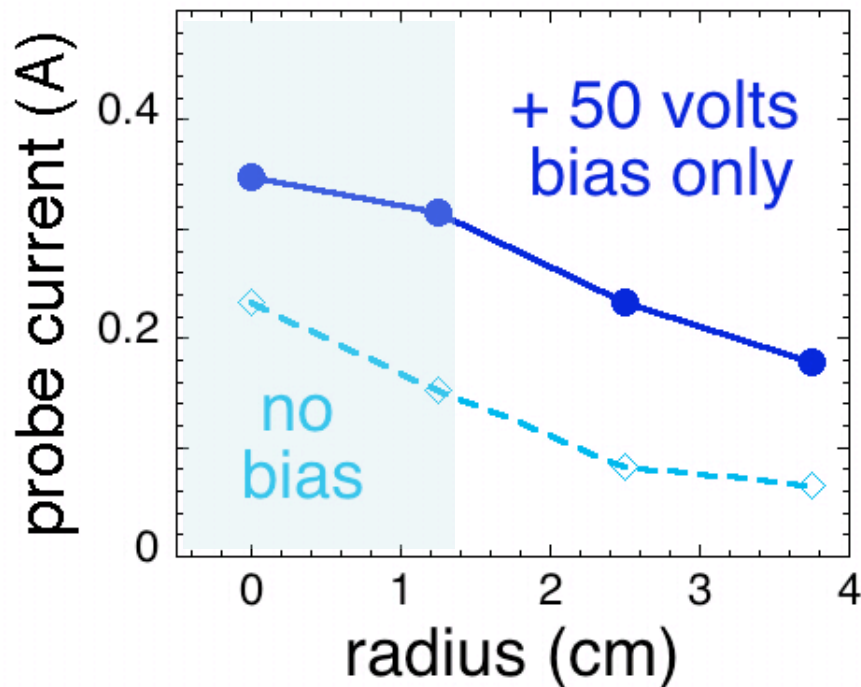
# Electrode Bias Voltage Scan

- Effects on density profile vary with biasing voltage
- Need only  $V \sim 30$  volts for most of effect to occur



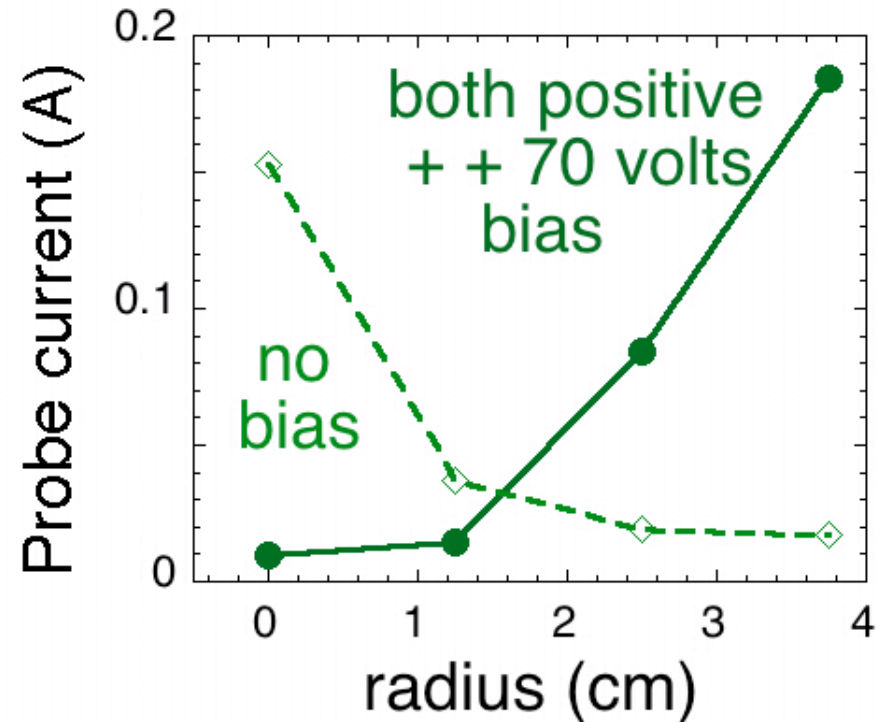
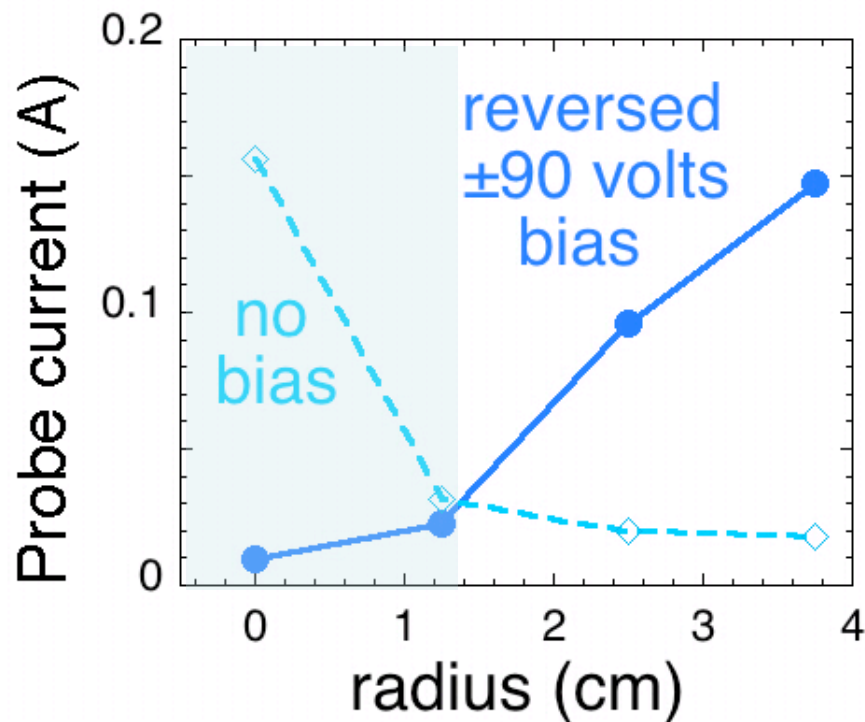
# Single Electrode Response

- Density responds more to positive than negative electrode, ~ as predicted by Ruytov/Cohen from sheath theory
- But positive biasing requires a large power  $\sim 0.5 \text{ MW/m}^2$



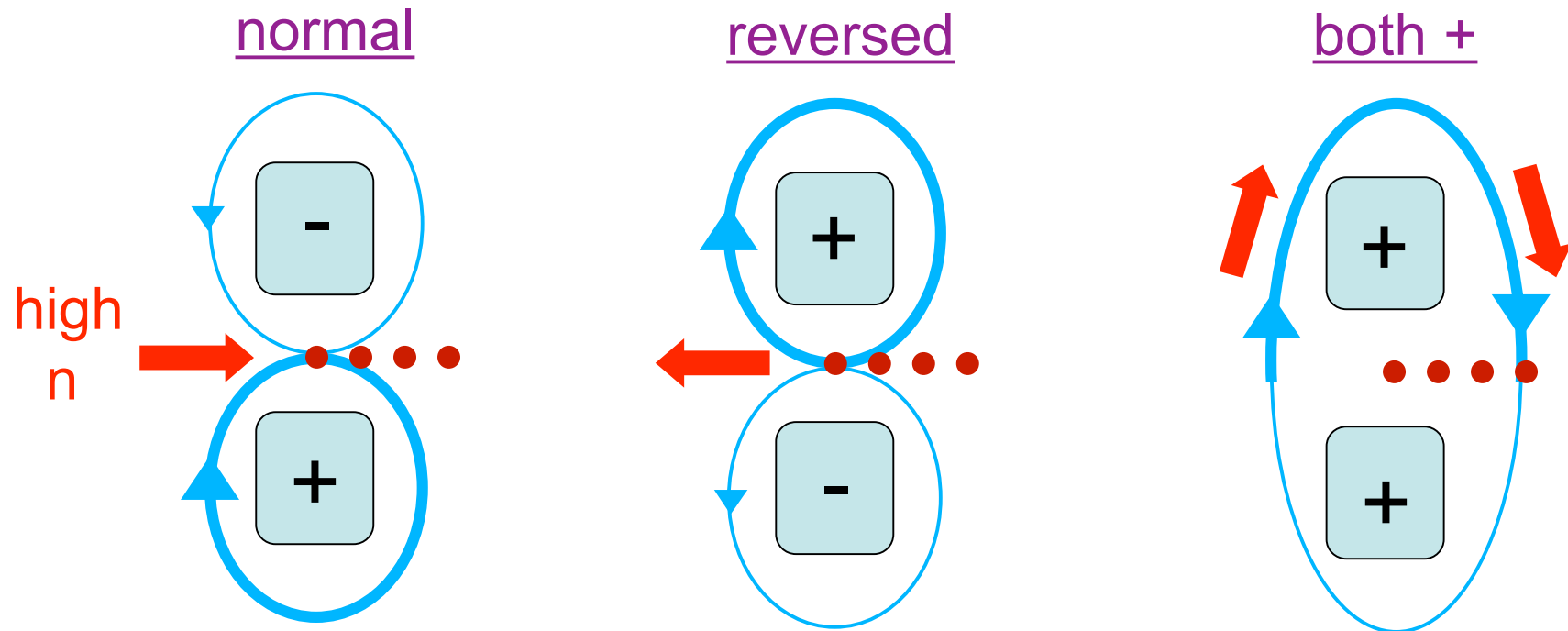
# Reversed Polarity Electrodes

- Density profile reversed with opposite E polarity
- Similar effect when both electrodes are positive



# Qualitative Interpretation

- Profiles changes ~ consistent with expected ExB flows





# Conclusions

- Biased electrodes can control local SOL at outer midplane
- Results qualitatively consistent with convective cell model

*For quantitative understanding, need to know range of*

*electric field penetration both  $\parallel$  and  $\perp$  to  $B$*

*(no simple models)*

# Plans

- Electrodes in tiles between liquid lithium divertor segments
  - measure effects  $\parallel$  and  $\perp$  B with camera + probes
  - learn to minimize power needed for SOL control

