

XP-744 SOL Electrode Biasing

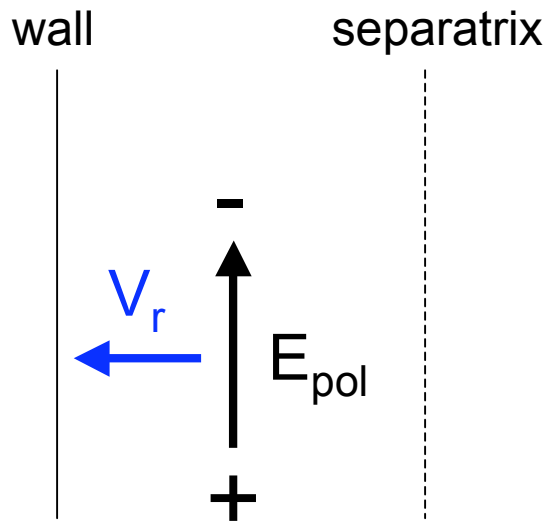
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NSTX Meeting 6/11/07

- Preliminary results from XP-744 (~ 2 hrs on 6/8/07)
- Possible improvements

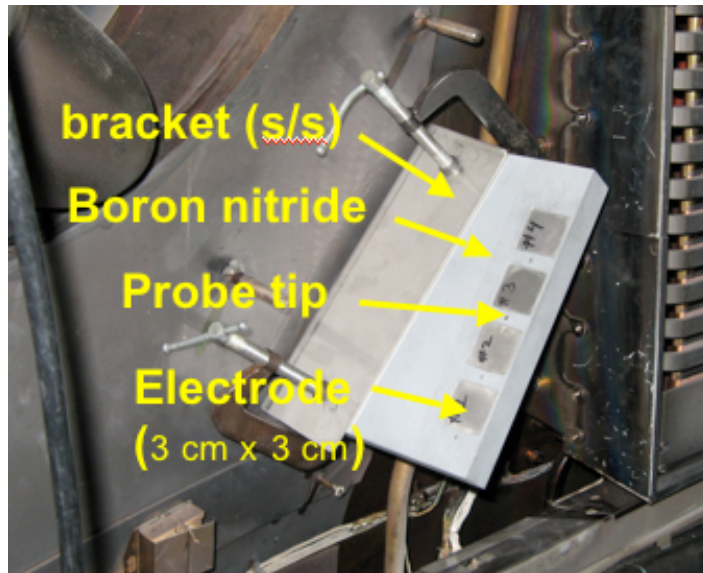
SOL Control by Edge Biasing

- Create localized poloidal electric fields in SOL to make local radial $V_r = E_{pol} \times B$ drift to drive plasma outward
- If V_r is larger than the outward turbulent transport speed, local SOL width will be increased (particles and heat)



- $V_r(\text{cm/sec}) = 10^8 E_{pol}(\text{V/cm})/B(\text{G})$
 - turbulent 'blob' speed $\leq 1 \text{ km/sec}$
- \Rightarrow need only $V_r \sim 5 \text{ V/cm}$ to broaden SOL in NSTX (because of low B)

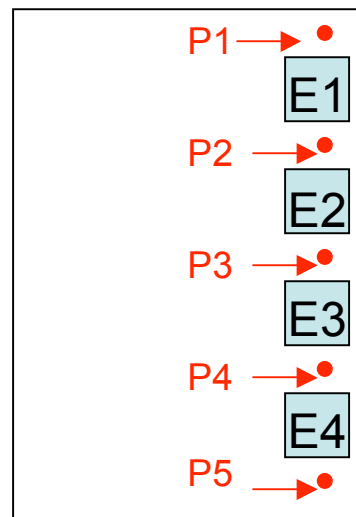
BEaP (Biased Electrodes and Probes)



Present capabilities:

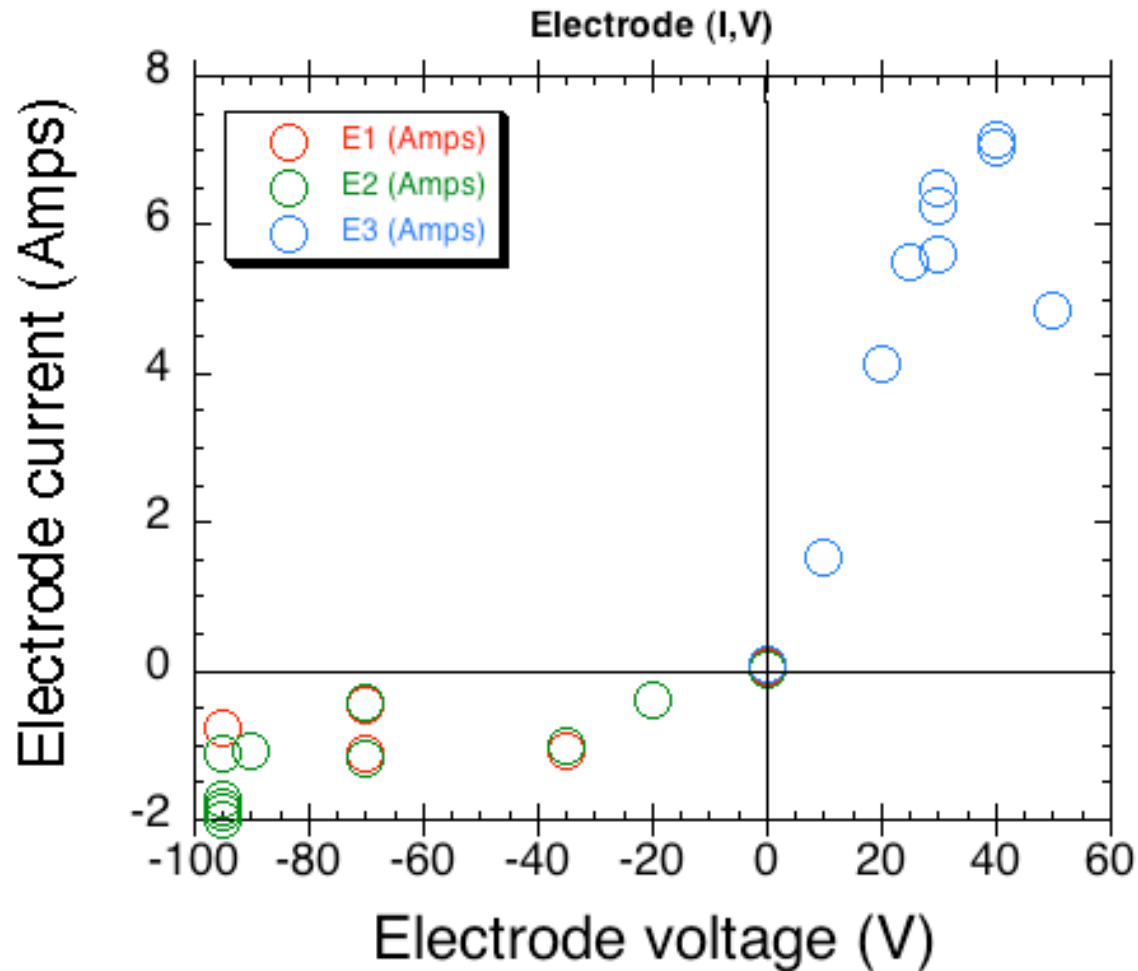
- ± 100 V, 10 A on any two electrodes
- 5 Langmuir probes
- change outer gap to control density at electrodes

outer wall



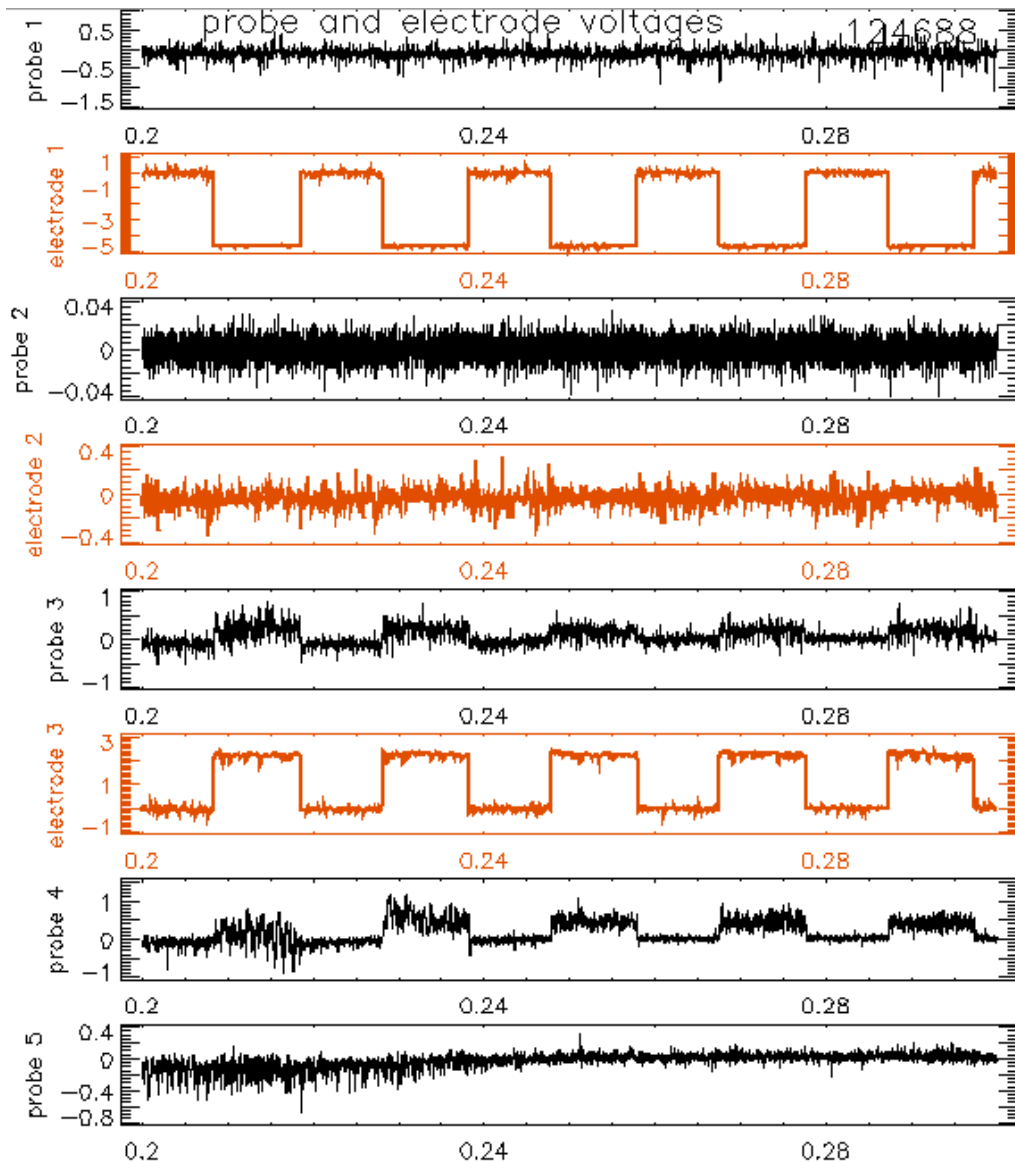
separatrix

Electrode Current vs. Voltage



- Electrode current
 $I_e/I_i \sim 7$ at ± 40 volts
 - Probe current
 $I_e/I_i \sim 20$ at ± 50 volts
- => different (I,V) for electrodes and probes ?

Probe Floating Potential Response

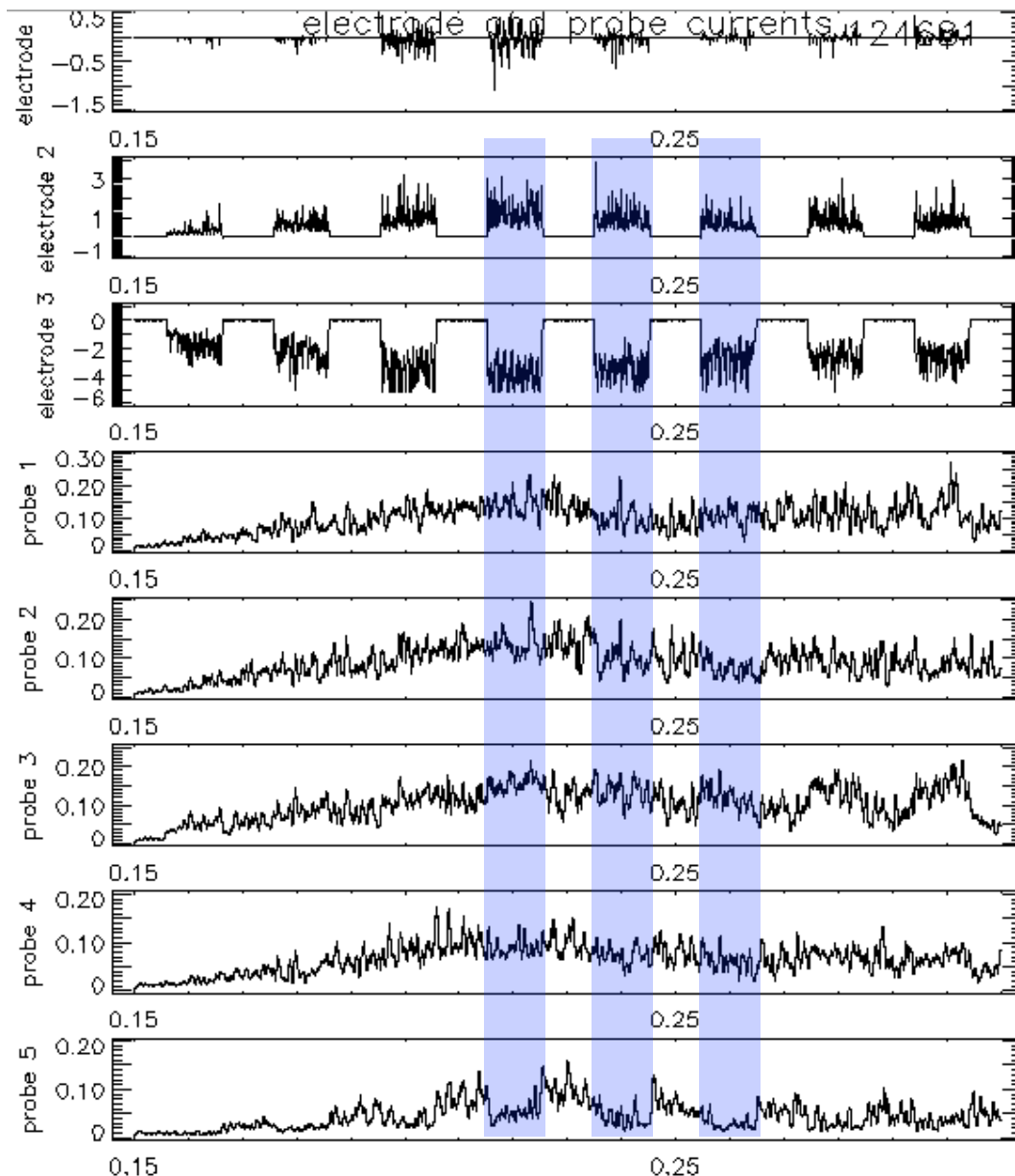


- floating potential of probes near + bias electrode go up ~20% of voltage on electrode

- floating potential of probes near - bias electrode has much smaller change (~ 0)

=> positive electrode affects local E_{pol} ?

Probe Ion Current Response



- some effect of + bias on $I_{i,sat}$ and $I_{e,sat}$ in probe 5
- would expect maximum ExB effecton probe 4 !

=> effect at probe 5 from inward ExB ?

Possible Improvements

- Understand present results with theoretical models
- Increase positive bias supply from ~10 A to ~30 A
- Move electrodes closer to the edge of RF limiter
- Add radial array of probes to measure local SOL
- Add GPI of electrode structure to see local 'blobs'
- Try AC biasing ≤ 100 kHz (as in TEXT and W7-AS)
- Try biased structures within divertor plates