Test of LLD Electrodes for SOL Control

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Goals:

- evaluate whether electrode bias affects local SOL at divertor plate
- evaluate whether electrode bias affects ELMs or global plasma

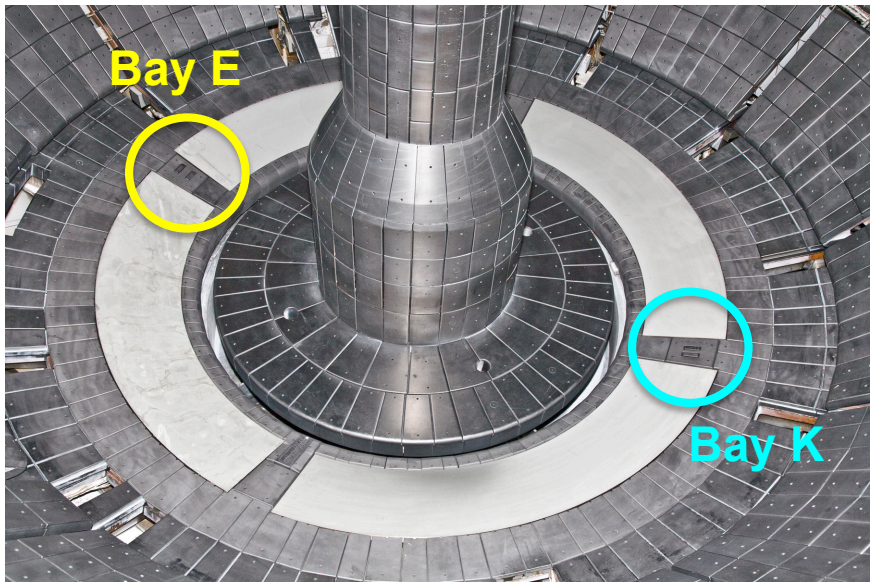
Data from 2010 run:

- XP#1051 (1/2 day) of electrode biasing in standard H-mode
- piggyback for > 100 shots (many with OSP near electrodes)

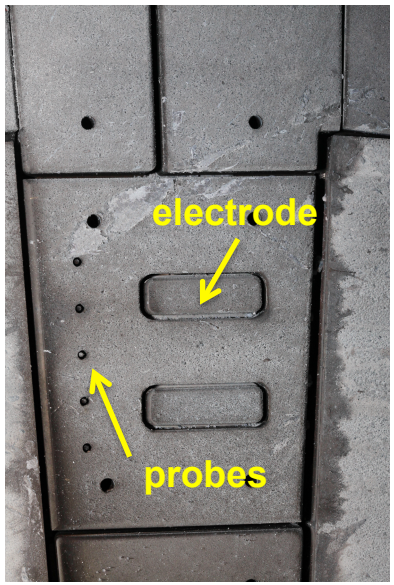
Electrodes and Probes in LLD Diagnostic Tiles

- All electrodes, probes, and power supplies worked well with no failures
- No shorts or damage to electrodes or probes visible (maybe flakes in gaps)

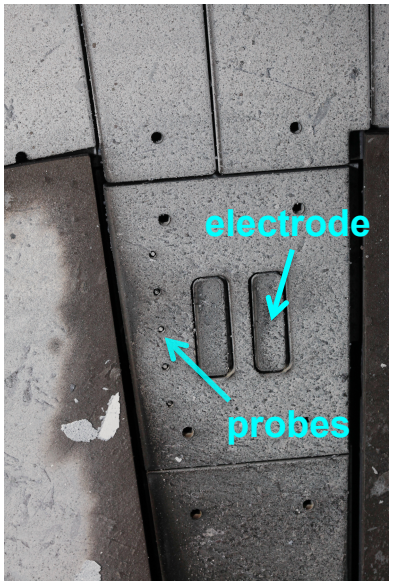
LLD (before run)



Bay E (after run)



Bay K (after run)



Summary of Results Found So Far

- Density and floating potential on LLD probes nearby electrodes can be significantly affected by electrode biasing, most clearly when both nearby electrodes are (+) biased and OSP is near electrodes

- LLD camera viewing Li I light shows ~ 1 cm 'deflection' nearby (+) biased electrode, but no deflection was seen in D_α, Li II, or C II light

- Electrode surfaces emit bright light after ~ 0.1 sec of strong (+) biasing (probably due to surface heating of electrode)

However, in other cases no such effects were seen with biasing !

So far no effect on ELMs or global plasma is seen due to biasing

Effect on Local Ion Saturation Current

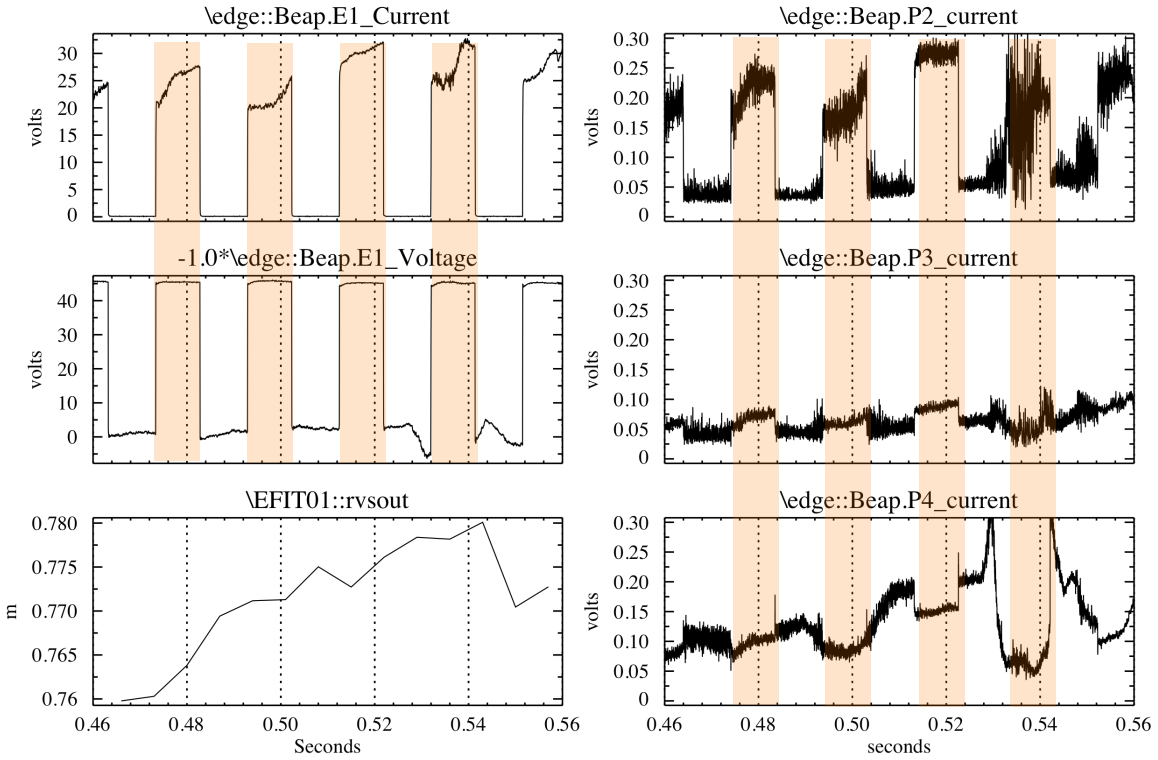
- Ion saturation current on a nearby probe increased by factor of ~ x5 when both adjacent radial electrodes were biased at +50 V near OSP, when electrode current was ≥ 20 Amps in each electrode

Shots:
142014

Electrode current (A)

Electrode voltage (V)

OSP (m) (electrode 0.76-0.82 m)



I_{sat} @ 50 V probe #2 (77.2 cm)

I_{sat} @ 50 V probe #3 (78.8 cm)

I_{sat} @ 50 V probe #4 (80.4 cm)

Effect on Local Floating Potential

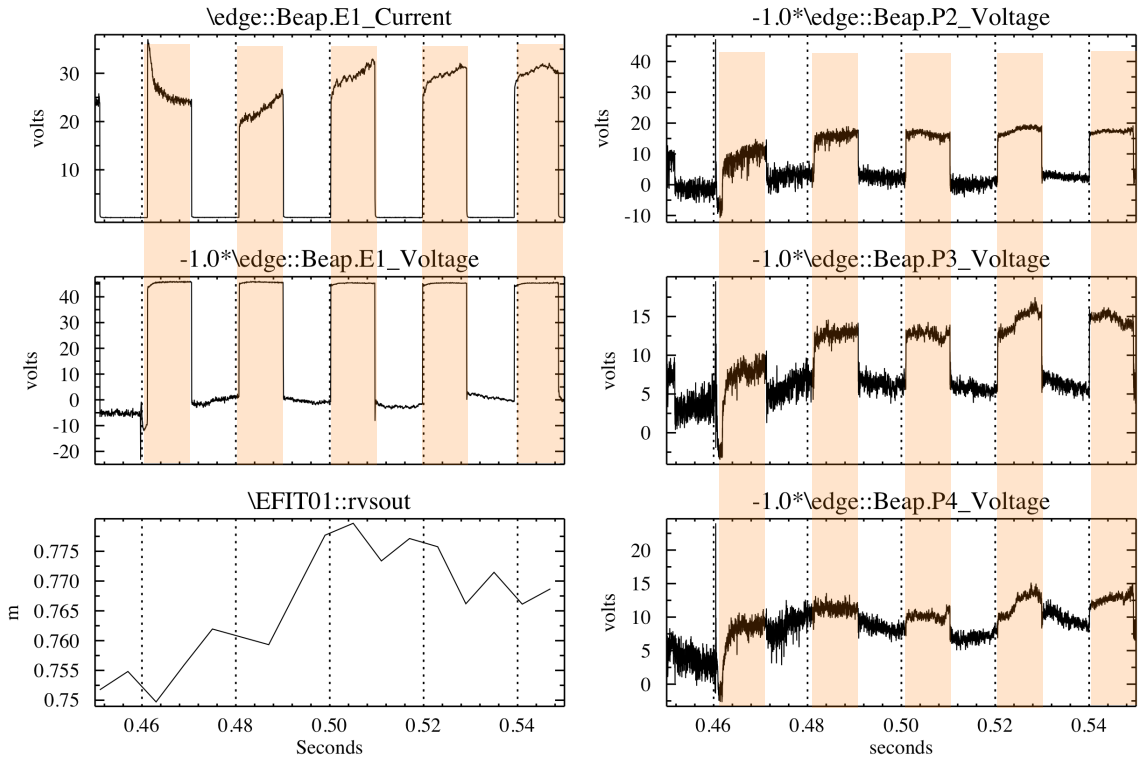
- Floating potentials on nearby probes increased by +10 volts when both adjacent radial electrodes were biased +50 V near OSP, when electrode current was ≥ 20 Amps in each electrode

Shots:
142020

Electrode current (A)

Electrode voltage (V)

OSP (m) (electrode 76-82 cm)



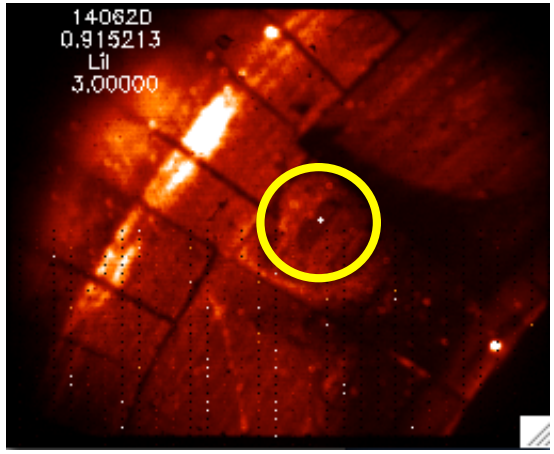
V_{float} probe #2 (77.2 cm)

V_{float} probe #3 (78.8 cm)

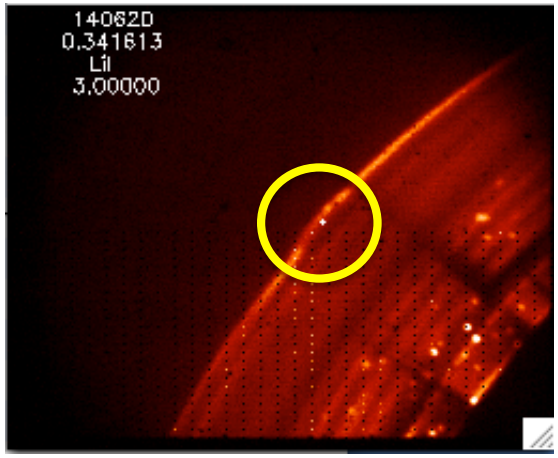
V_{float} probe #4 (80.4 cm)

Effect on Local Li I Light Emission

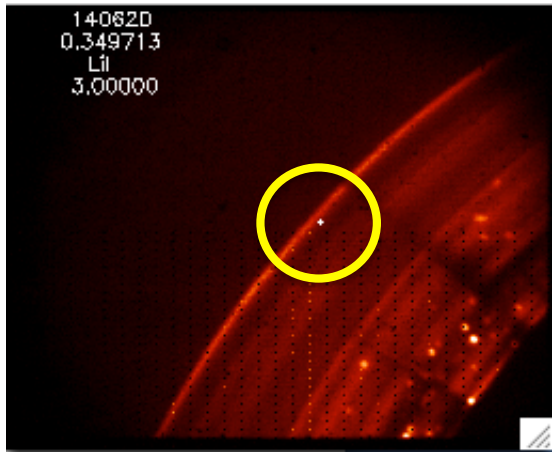
location of (+) electrode



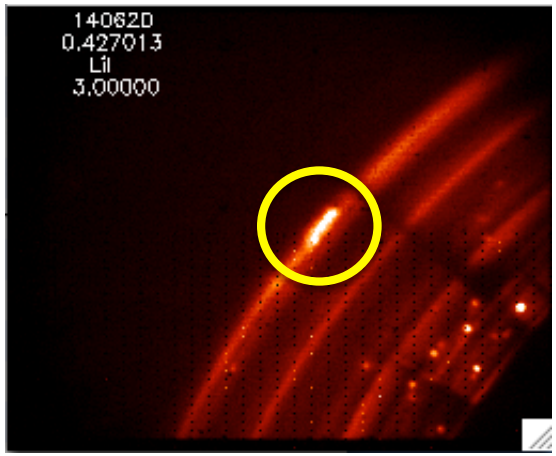
deflection with electrode ‘on’



no deflection with electrode ‘off’



light emission from electrode



Questions for Data Analysis

- How does electrode bias affect local SOL at divertor plate ?
- How far does electrode potential go along/across B field ?
- Where does electrode current go (or come from) ?

Larger questions:

- Can large-area biased electrodes be used to control SOL width ?
- Can large-area biased electrodes be used to control ELMs ?