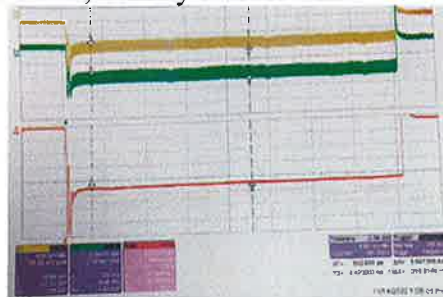
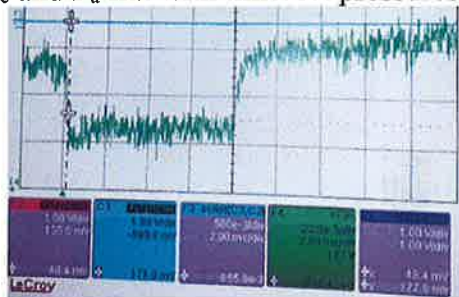


prepared 11/14/22 S.A. Cohen

Goals: Tests of RMF system with goal to get big bright flashes (BBF). No success

- a) SRS: max 1.5 Volts.
- b) Base vacuum: 5.9×10^{-7} T FEC; RGA says partial pressure $\text{H}_2\text{O} \sim 30 \times \text{N}_2$
- c) Ops at: $P_o = 0.28\text{-}1.1$ mT CC, 96% H_2 and/or (0.5 mT max) Ne.
- d) BB and MP ranges: $I = 100\text{-}400$ A
- e) Nozzle coil: 50-300 A
- f) L-2: $4 \times 8 + 8 \times 4$
- g) Helicon: 0.1-0.24; 70-500 W
- h) P_{RMF} at 75 kW; antenna I's balanced, $\pm 2\%$; P's not (30% diff), neither P_{fs} or P_{as} .
- i) RMF antenna Phase $\sim 90^\circ$ on Pearsons; discrepancy between different measurement techniques. From Pearsons in tanks, from directional couplers, from homodyne coils near antennas. Big difference – sometimes 110° vs 90° .
- j) P_a to 25 kW.
- k) 8-ms pulses, 1/s rep rate
- l) $V_{\text{cap bank}} = 16$ kV

1. Very sensitive to frequency. Frequency is near 1.805 MHz BUT a 500 Hz change can change the reflected power from 1% to 5%.
2. Still no BBF. Small dim flashes (**sdf**).
3. Tried increasing H₂ pressure by two means. a) closing FEC gate value; and b) increasing H₂ gas flow into SEC. Neither produced BBF. (to ~ 1.1 mT). When closing FEC gate valve, glowing column appeared, as usual, in FEC.
4. Interferometer says max n_e to 5e10/cc if r = 8 cm, to 1.4e11/cc if r = 3 cm. Most likely 8 cm since **sdf**s seem to fill vessel
5. n_e and P_a flat with time. At pressures above 1 mT, density a bit lower.



6. T/B & N/S not tuned to same resonant f_r . One above and one below f_r . Pearsons say $I_{peak} \sim 20 \times 1.45 \text{ V} \times 1.414 = 41 \text{ A (pk)} = 2.7 \text{ G}$ at SRS = 1.5, $P_f \sim 75 \text{ kW} \rightarrow$ estimate only 4.4 G at 200 kW. **Low – need more like 10 G. Why so low?**
8. Tank cables getting warm, quite warm.
9. Tried L-2 current variations: $I \sim 150$ to 400 A. **No BBF.**
10. Tried mirror ratio: 7-25. **No BBF but density rose x2 at 300 A I_{nozzle} .**
11. Tried Pressure variations: 0.2 to 1.05 mT H2, **no BBF.**
12. Tried Ne gas: 0.4-0.9 mT, **no BBF.** n_e not higher

13. The helicon cup potential, V_c , was ~ -1.1 kV rms. When the RMF power was applied, V_c would/could rise to about -0.7 kV.
14. Estimate of power: Glassman supply $- 16$ kV * 70 ma /duty factor = 140 kW compared to directional couplers saying 75 kW to plasma. About right, 50% of wall power becomes RF.

Problems/conclusions

1. **Still no BBF**
2. Plasma (helicon) sometimes disappears. No small dim flashes (sdf) then.
3. Ne, higher amu, did not improve n_e .
4. Higher Pressure, to 1 mT, did not improve n_e at power $< \sim 75$ kW.
5. Higher pressure in FEC did not improve n_e .
6. Higher helicon power did not significantly improve n_e .

Recommendations/questions

1. Try switching Quad-splitter's RG217 cables. Is the rotation direction right?
2. Balance antennas: power **and** current, via quad splitter
3. Add gas puff
4. Raise power above 90 kW. Non-linear field penetration threshold?
5. Bias Ta plate and cup + and - (also measure/print V_{cup})
6. Raise RMF power --- need to fix waveform, 200 kW amp tuning
7. Understand P_a imbalance
8. 8. Understand phase discrepancy
9. Get X-ray data to see if fast e created
10. Get spectrometer data to "see" Te.
11. Ground planes?