**11/29/2022 PFRC-2 Run Summary**

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RMFo @ **1.8032-1.8037 MHz**, air-gapped, two-turn antennas, ground plane between antennas and Lexan vessel. RMF power system: SRI -> AR100LM -> 8KD -> 200kW -> quad splitter -> RG-217 transmission -> tanks -> antennas. BB and Magnapower for L-2 coils. Magnapower for nozzle coil. BN-covered HTS-FCs.

**Goal:** RMF: measure tD for Argon and Ar/H2 mixutes vs B and Power

**Setup:**

1. SRS: to 1.8 Volts (94 kW).
2. Faraday ground planes grounded

c) Base vacuum: 6.6 e-7 T FEC; RGA H2O peak 10x H2 peak

c) Ops at: Po ~ 0.96->0.22 mT CC Ar and 0-> 0.5 mT CC H2

d) BB and MP I=200, 300, 400 A

e) Nozzle coil: 50 A

f) L-2: 4 x 8 + 8 x 4

g) Helicon: 0.1 V, ~70 W

h) Antenna I’s balanced, 20%; P’s Pfs & Pas at ±6%. Phase 91°±3°

i) 4.5-ms pulses, 1/s rep rate.

j) Vcap bank = 16 kV

k) RMF amp filament V, I: 15.24 Volts, 206.3 A

**Results**:

1. Adding Ar gas (only) increases H2O and H2 x4
2. Making 70 W Ar helicon increases H2 a factor of 20X above just-Ar-gas and CO x14
3. The (time-averaged) helicon cup potential <Vc> is ~ -520 V
4. **BBF with Ar** even at relatively low, 24 kW, if B low, ~ 140 G (I ~ 200 A).
5. Pr/Pf ~ 1-2%
6. tD defined as when ne amplitude is 1/3 that of full density peak.
7. ne with Ar to 1.2e13/cc; two or more ne decay times, typically ~ 0.1, .3 and 1 ms
8. ne higher with B, but, at this power increase peters out at 400 A (280 G)

Chart, line chart

Description automatically generatedSRS 1.8-> 92 kW, nmax~1.2e13/cc

1. The density rise has 3 parts. A) slow t= 200 ms; B) fast t= 10 ms, and C) very slow t= 500 ms. A) and B) are smooth. C) is noisy. The method used here of measuring tfast, looking at scope traces of single shots**, is NOT good.**
2. In Pearsons, 3 w at least 30 dB below w with Ar; in probes more at least 40 dB lower
3. Vc in helicon falls (more negative) for low RMF powers, rises (less negative) for high.
4. RMF antenna real Phase ~ 90° on Pearsons.
5. With Ar: Pa ~ 12 kW at Pf ~31 kW (39%) and Pa ~ 20 kW at Pf ~ 56 kW (36%).

Chart, line chart

Description automatically generated Looks it 42%.

1. Tuning RMF. f = 1.8032 and 1.8037 MHz
2. Slow then fast ne rise. Slow ~200 ms; fast ~ 5 ms. ne noisy, ±30% @ 1-5 kHz
3. At higher B (IL-2 ~ 400 A), 4 kHz osc in Pa and in ne.
4. Spreadsheet parameters ~ consistent with experiment. Te = 100 eV, Emax,e (Hamiltonian) = 100 eV, Ti = 0.2 eV, amu = 40, rs ~ 5 cm, B(0,0) = 200 G, fRMF ~ 1.6 MHz, Pa = 20 kW, tE ~ 10 ms, if approx. Ar radiation losses included.)

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| **Recommendations/questions**   1. Raise power above 90 kW. Non-linear field penetration threshold? Harmonics? 2. Bias Ta plate and cup + and -. Measure I’s. 3. Get X-ray data vs t to see if/when fast/energetic e- created 4. Get spectrometer data to “see” Te. 5. Try He, less radiation than Ar. Small gyro-radius than hydrogen 6. Transition Ar -> H2 runs: increase H2 partial pressure. |