

01/03/2023 PFRC-2 Run Summary

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RMF₀ @ **1.800 MHz**, air-gapped, two-turn antennas, ground plane between antennas and Lexan vessel. RMF lower 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.

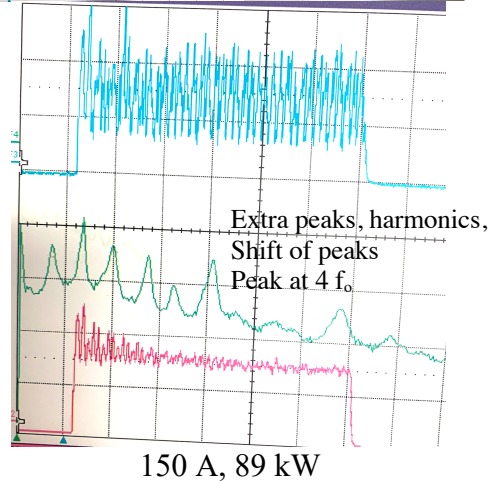
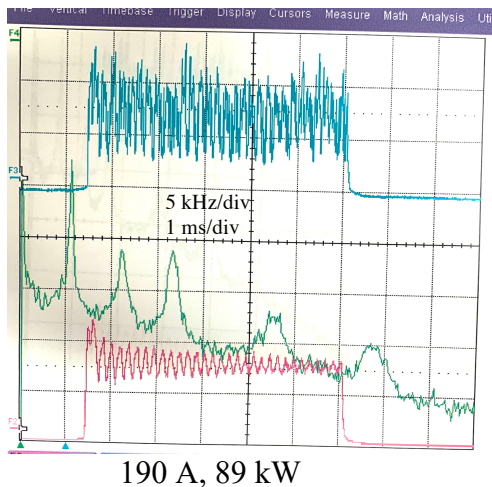
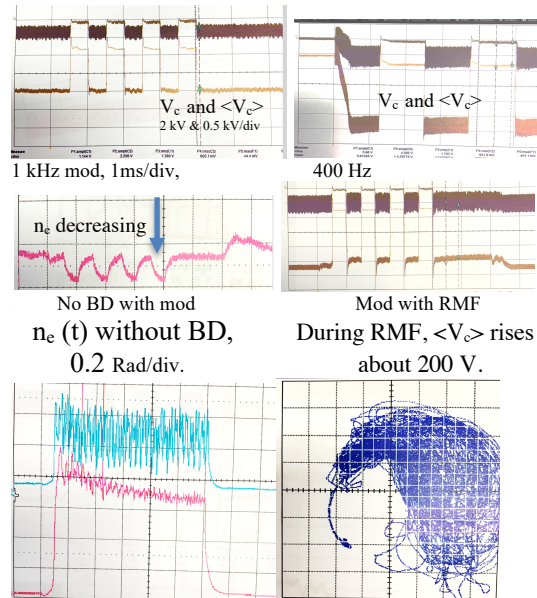
Goal: X-rays from RMF & helicon plasmas: aperture scan, helicon modulation

Setup:

- SRS_{RMF} to 1.80 Volts. f_{RMF} to 89 kW; $f = 1.8015 - 1.8018$ MHz
- 6-ms-duration RMF, 1/s, 105°
- SRS_{helicon}: 0.26 Volts. $P \sim 570$ W
- Base vacuum: 3.1×10^{-7} T FEC
- Ops at: $P_{\text{cc}} \sim 0.27\text{-}0.78$ H₂ and 0.21-0.27 mT Ar
- RGA says H₂ can exceed 99%
- Ratio of antenna currents (Pearson) TB/NS ~ 0.80

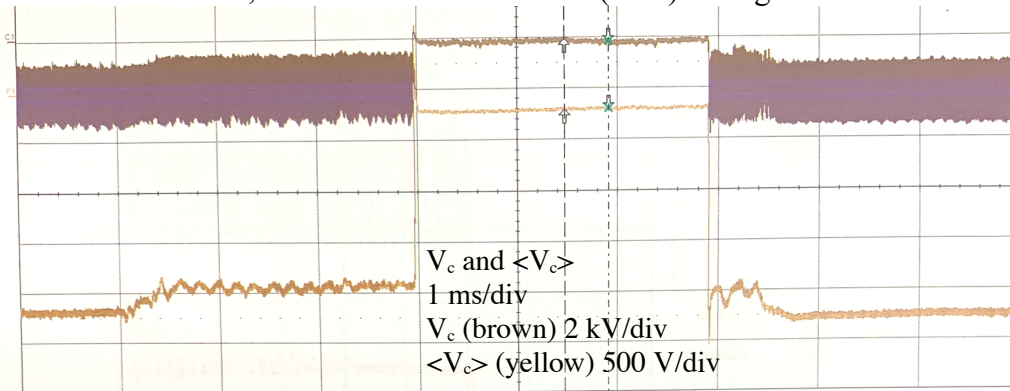
Results:

- $P_r/P_f \sim 1\%$ N/S and 2% T/B, changes with time. Need to change f .
- $\langle V_c \rangle$ from helicon -1.5 to -2.5 kV, depending on power. Top two figures are without RMF.
- During modulation, when helicon power goes to 0, the $\langle V_c \rangle$ quickly (0.05 ms) exceeds 0 reaching +44 to +900 Volts then falls back to -300 V (while the helicon is off.) It can stay at this level for > 1 ms.
- With RMF, - 500 V spikes at end of mod. 3rd figure.
- Oscillation frequency in n_e and P_a during RMF changed with conditions.



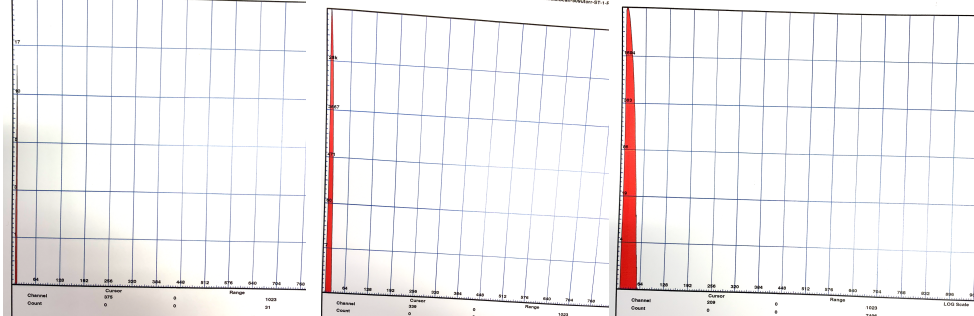
If Ar lowered to 0.17 mT, no BD (with $P_f = 89$ kW and H₂ fixed at 0.27 mT).

6. Modulated Helicon, 3-ms duration on then off (each) during RMF



7. Measure P1:amp(C1) P2:amp(C2) P3:ms(C1) P4:ms(C2) P5:ms(F1) P6:min(F1) P7:--- P8:---
8. SDDs during Helicon-off period 3.5-5.5 ms – note no high energy > 500 eV X-rays.

ST = 1%, $\tau_{\text{peak}} = 5.6 \mu\text{s}$, $t_{\text{accumulation}} \sim 1 \text{ sec}$, $\sim 9 \text{ eV/ch}$



Nozzle

Radial

Midpoint

Cts at peak. $\sim 14!!$

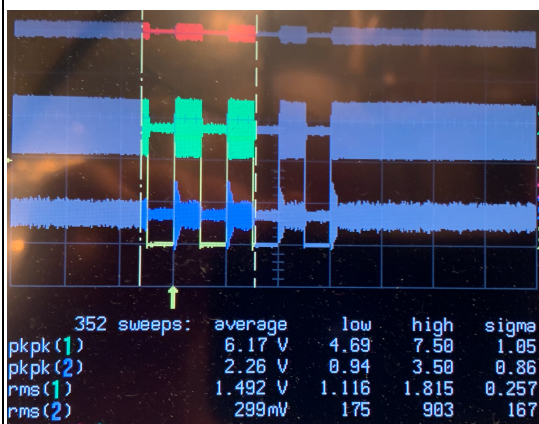
220k!!!

32k

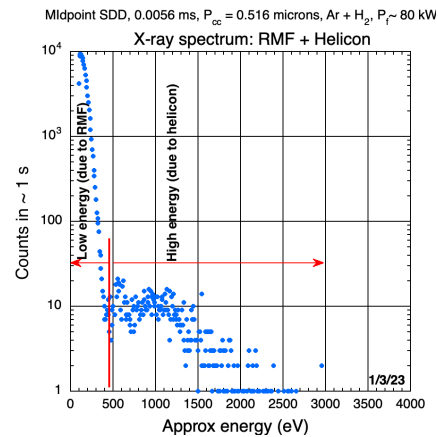
9. Aperture scan showed that low E signal, 150-450 eV, due to RMF plasma, not pick-up or pile-up BUT PPU is important at high CR, esp aperture 4.

10. Mod data showed that high E signal, 0.5-5 keV, due to helicon.

11. Set up of mod. Helicon output, 1 kHz



Signals from helicon system: V_f , V_r



X-ray spectrum Helicon + RMF

Recommendations/questions

1. τ_{peak} scan, ST scan, to check for PPU.
2. Radial SDD scan