

MHD Equilibrium and Stability of Zero-net Current Structures

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May 23, 2012

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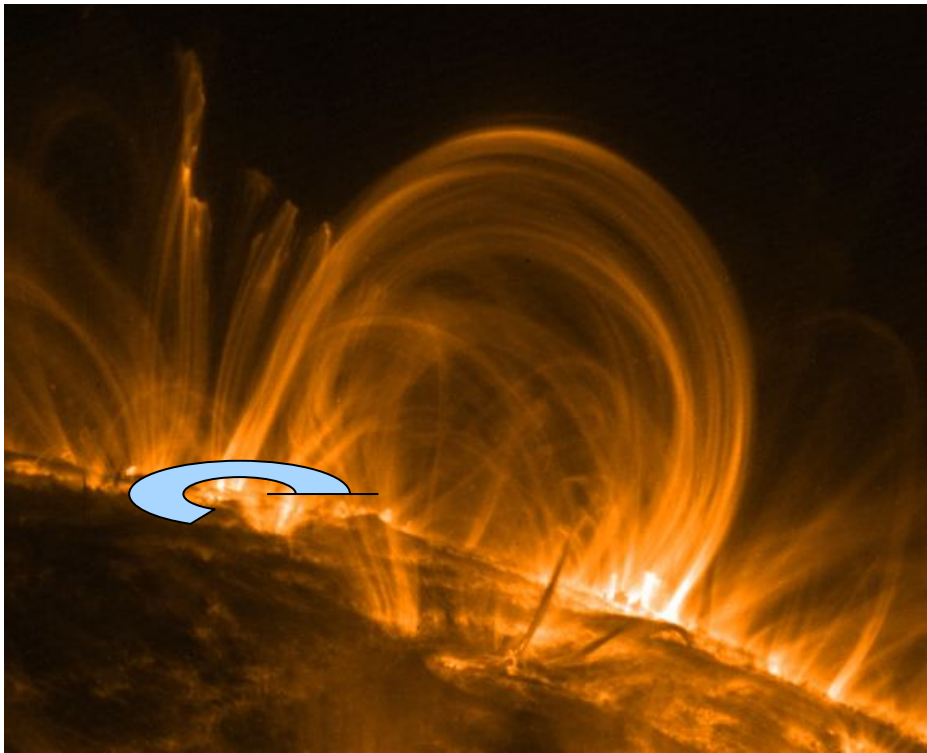


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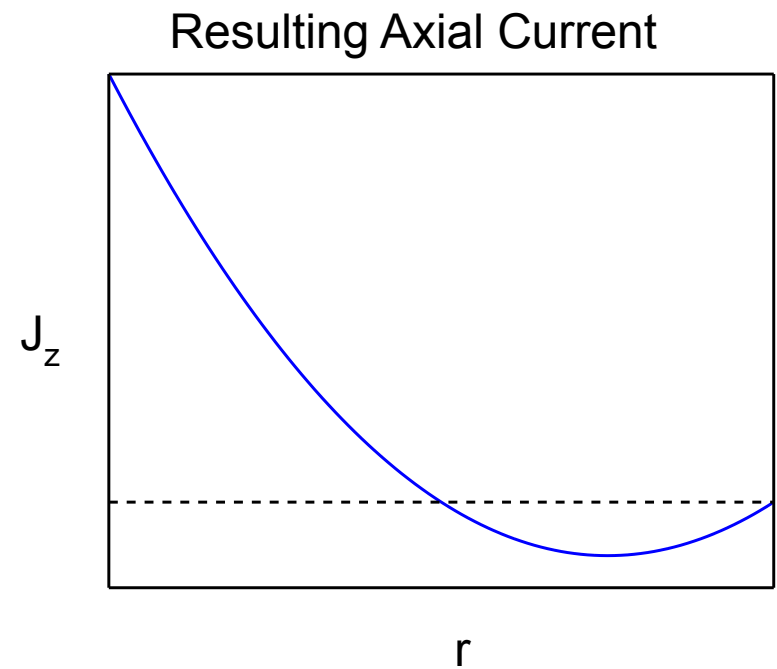


Astrophysical Motivation – Solar Flares

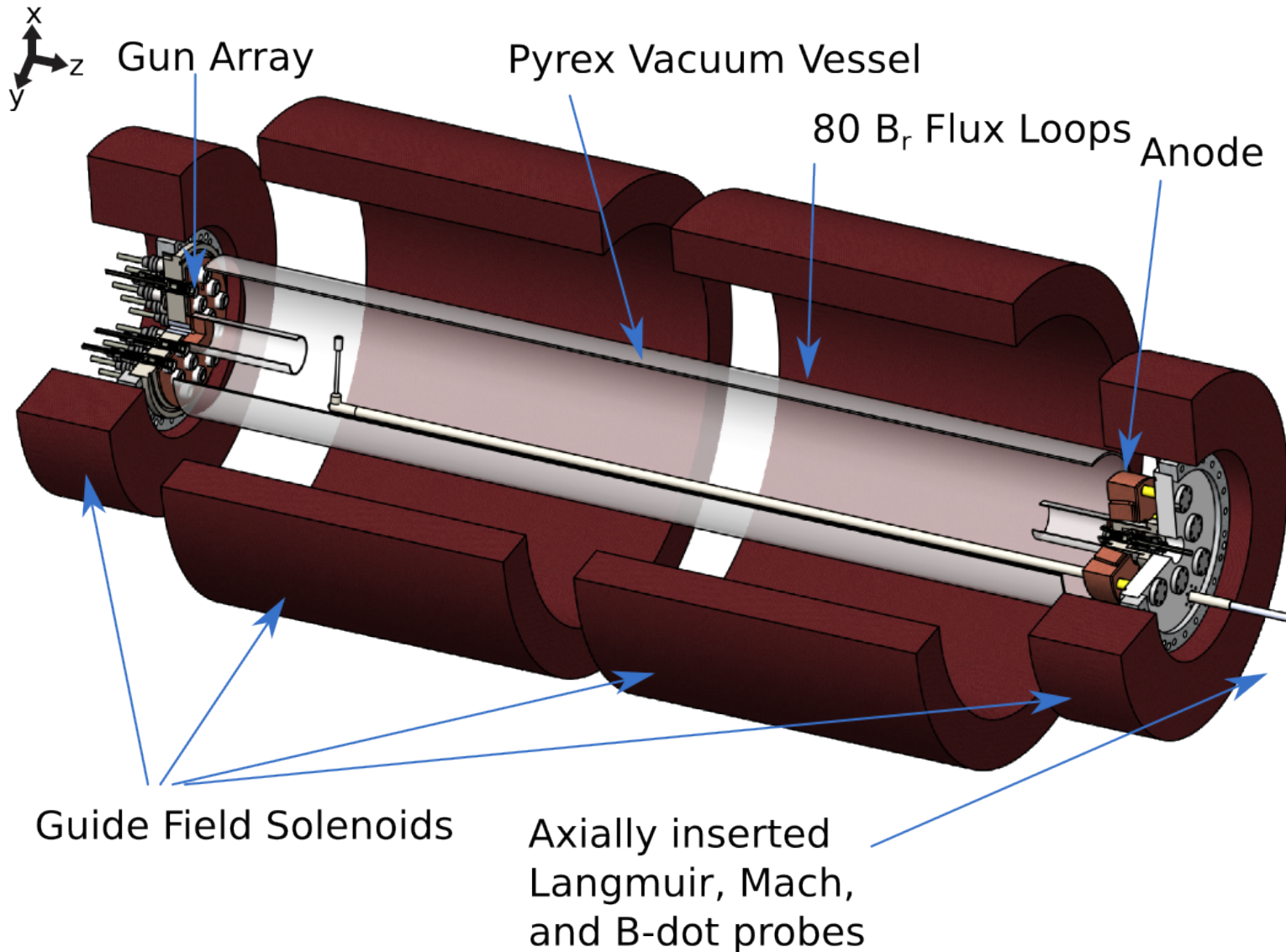
Coronal Loop, Anchored in Turbulent Photosphere



Gold & Hoyle, 1960
Mikic et. al. 1990



Rotating Wall Machine is a Line-tied Screw Pinch



$$B_z = 300 - 1000 \text{ G}$$

$$I_g = 0 - 1 \text{ kA}$$

$$n_e \approx 2 \times 10^{20} \text{ m}^{-3}$$

$$T_e \approx 3 - 5 \text{ eV}$$

$$S \approx 70 - 300$$

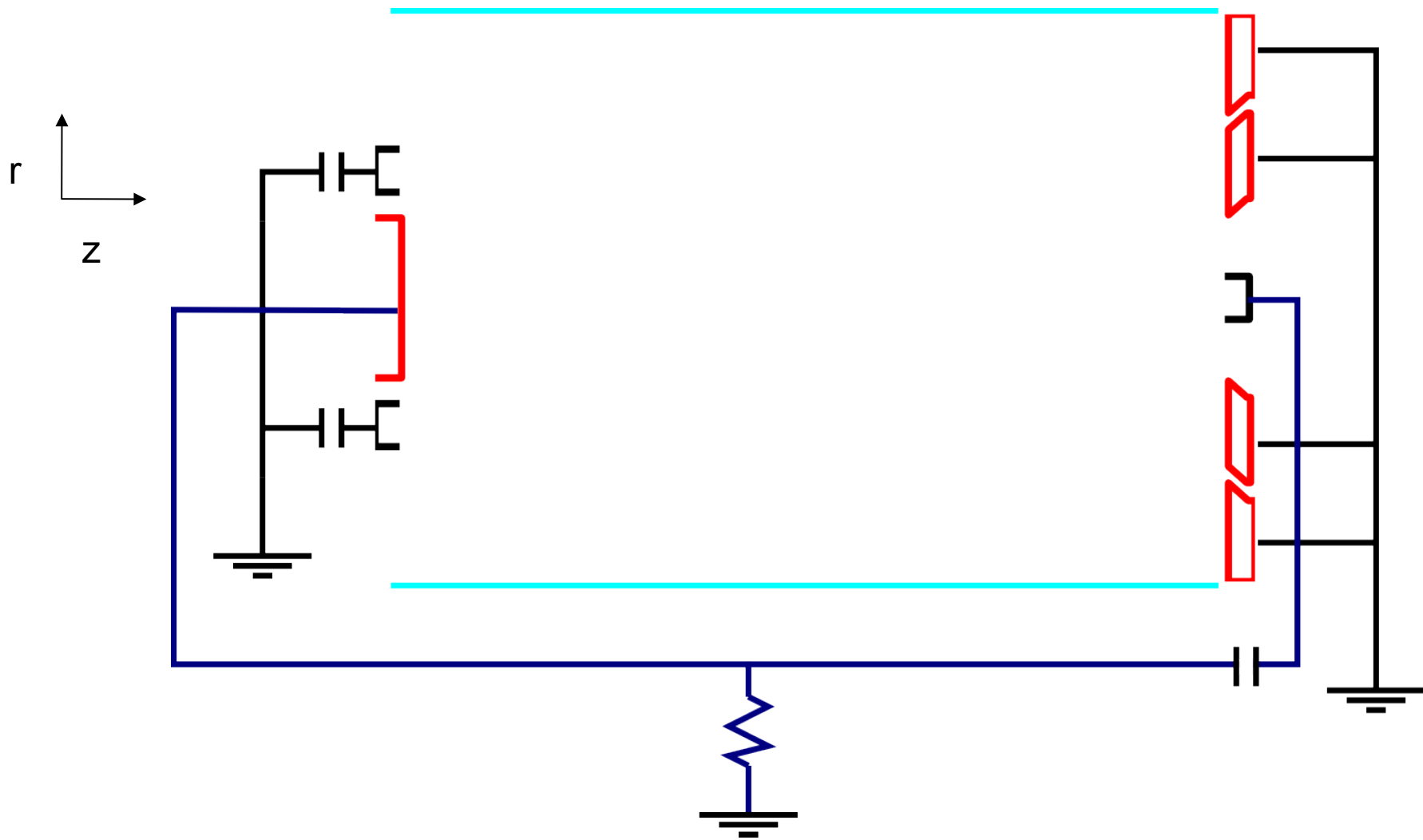
$$\delta_{SP} \approx 1 - 4 \text{ cm}$$

$$\delta_i \approx 1.3 \text{ cm}$$

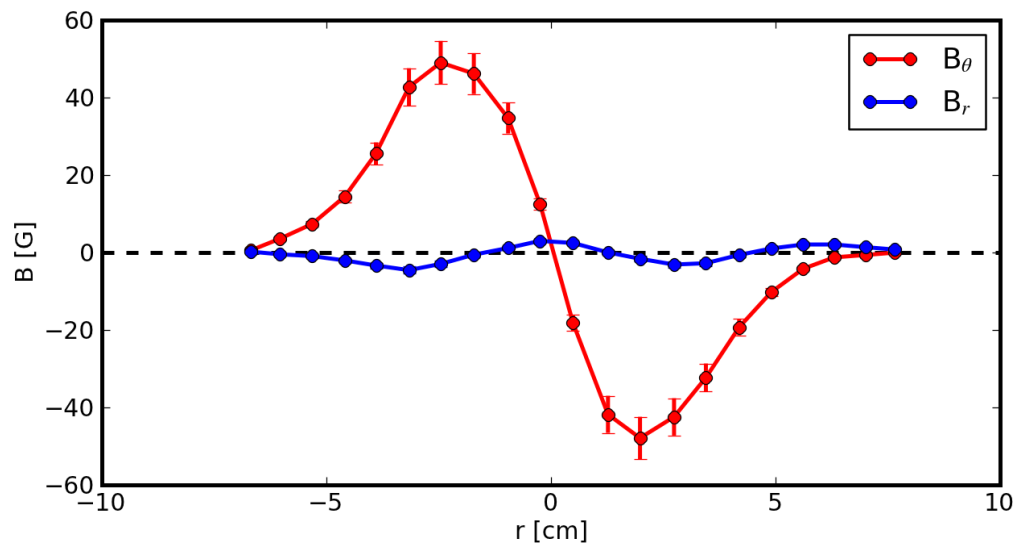
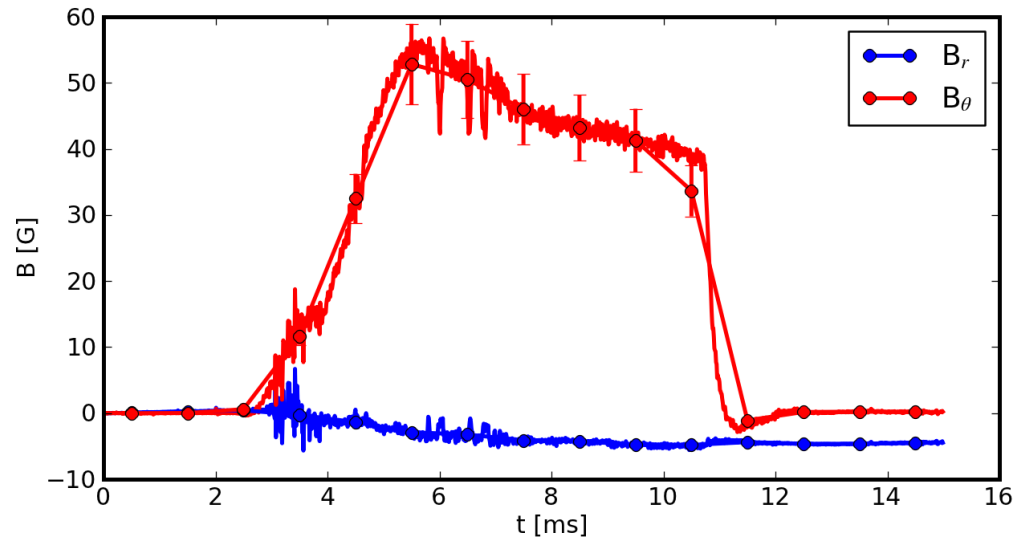
$$\tau_{SP} \approx 100 \mu\text{s}$$



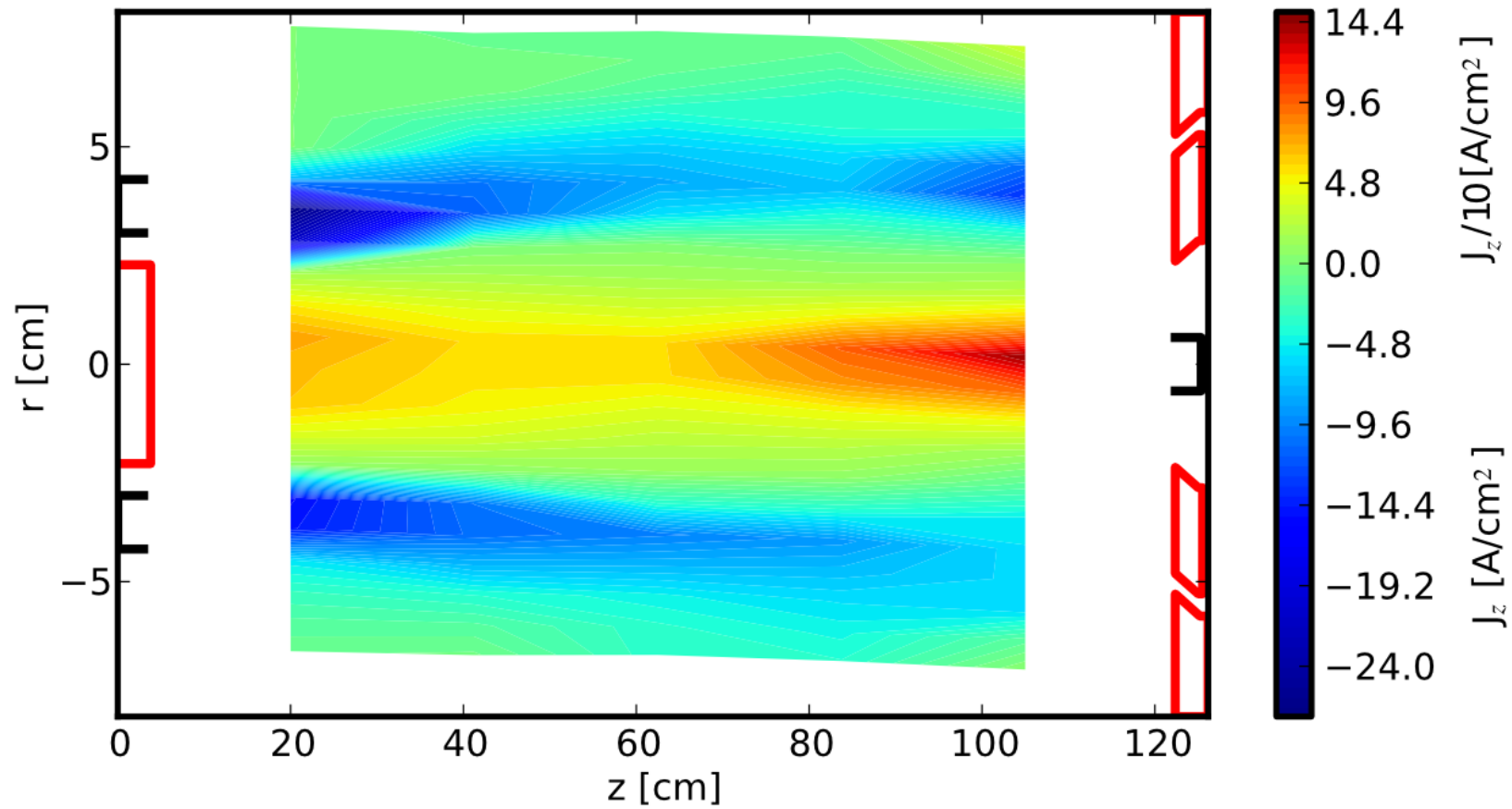
Electronics for Driving Coaxial Current



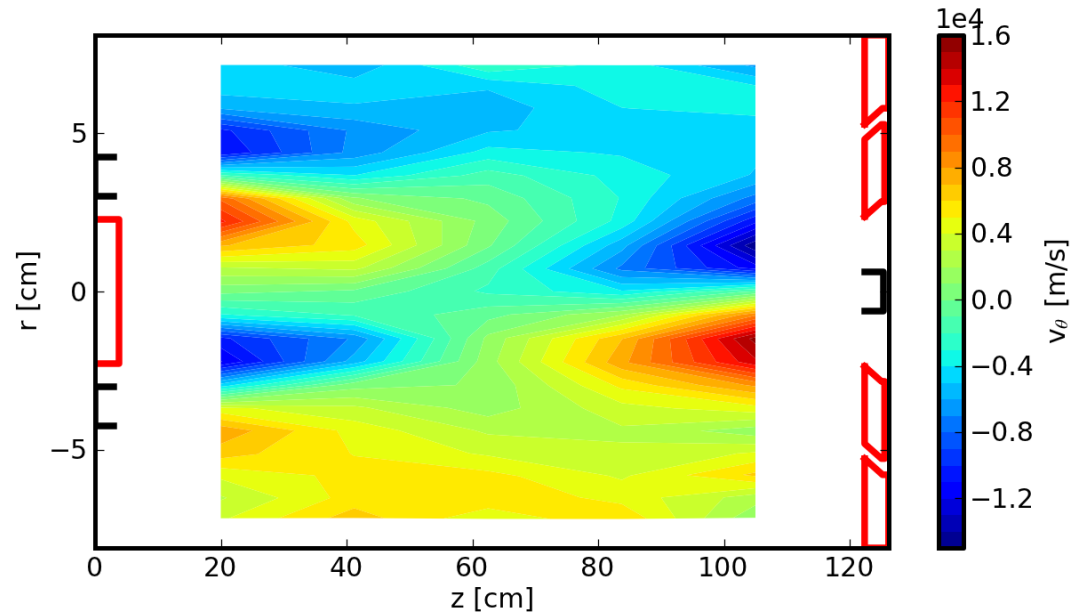
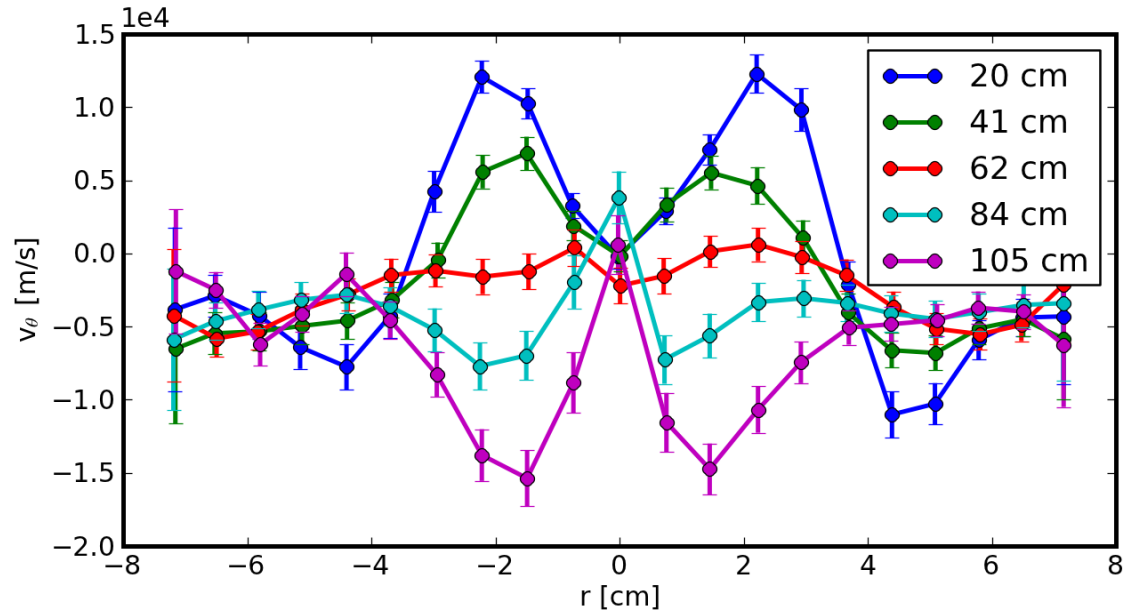
Use internal probe to map 2D magnetic equilibrium



J_z shows coaxial structure, radial diffusion

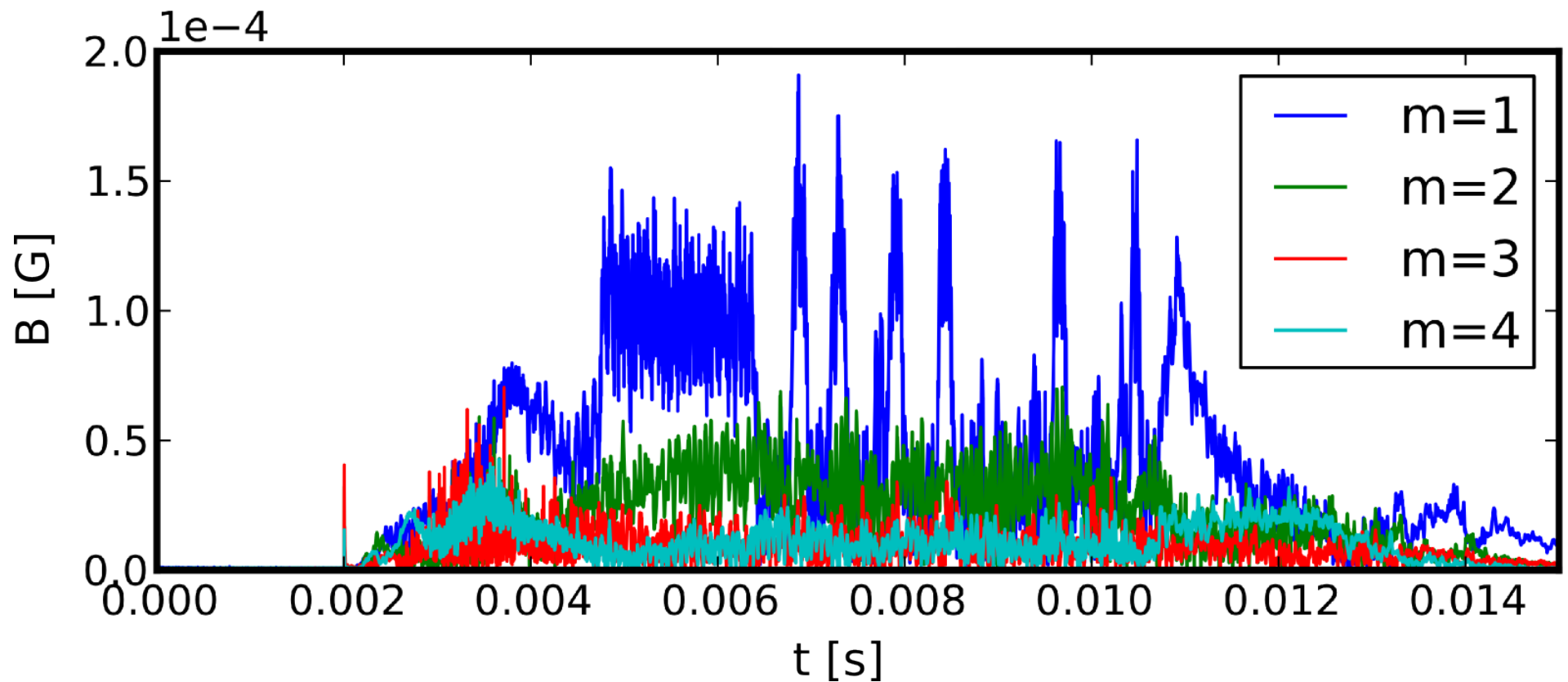


ExB Rotation is Balanced



External Magnetic Array shows impulsive $m=1$ events

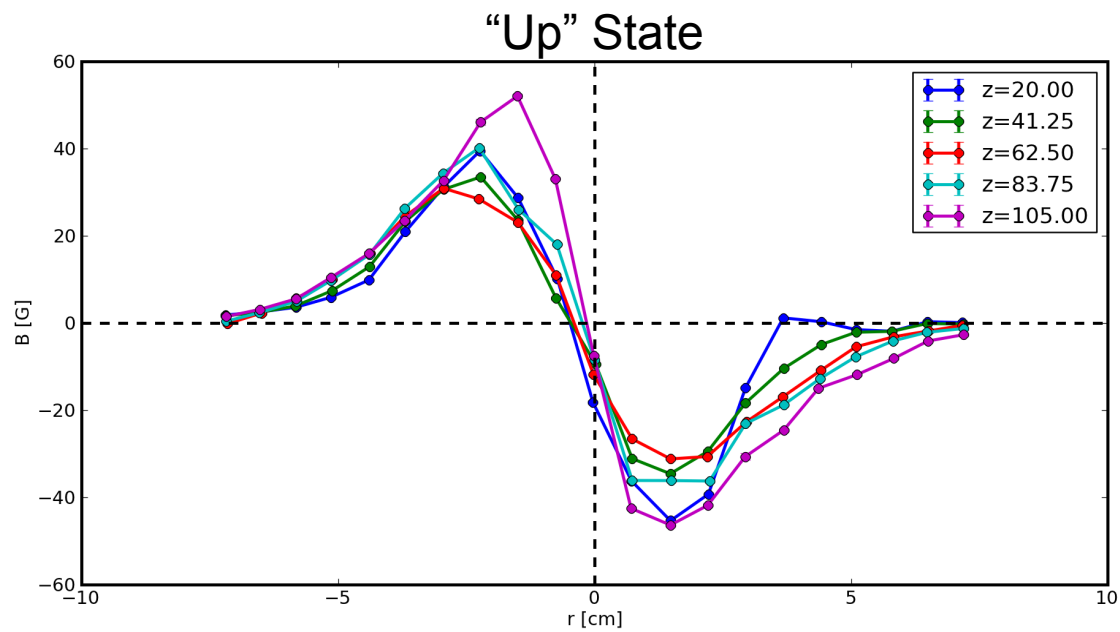
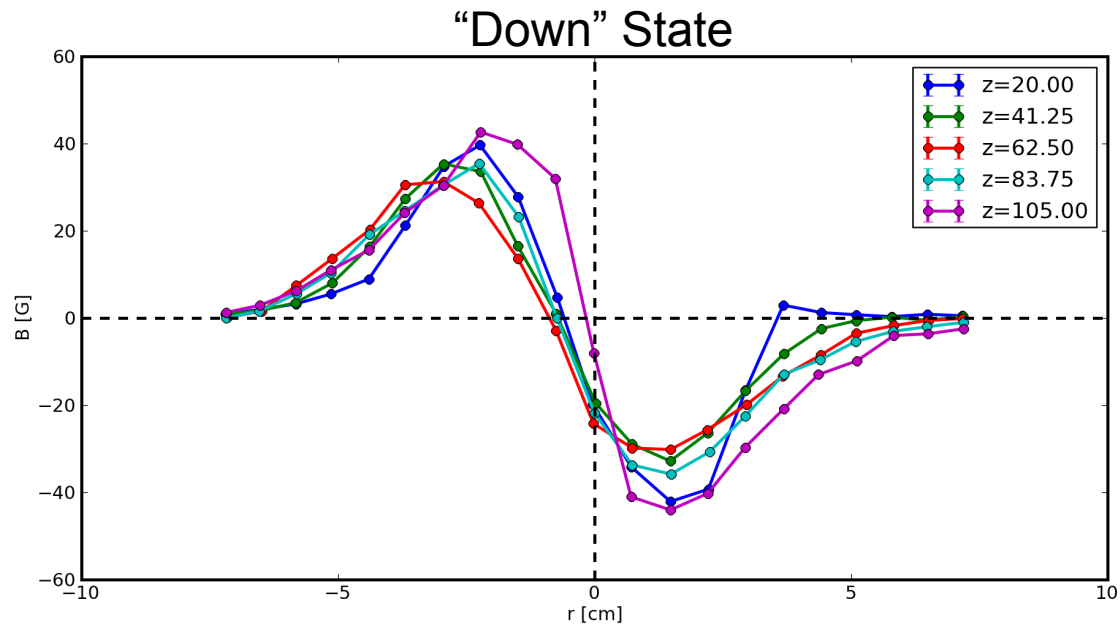
B_r m number decomposition



Impulsive Events Change Magnetic Eigenfunction

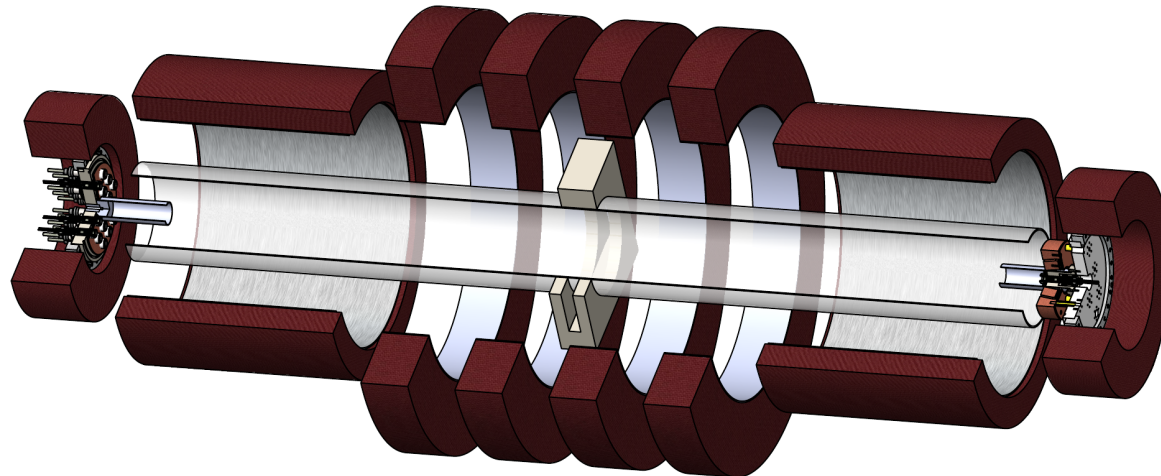


Internal Equilibrium Shifts



Summer 2012 Upgrades

- Construction is underway to lengthen the machine and to install a 200KW ECH system
- A box port at center of vessel will allow greater diagnostic access
- Several reconnection and flow-driven instability experiments are planned for the upcoming years



Conclusions

- A unique experimental geometry related to astrophysical structures
- Equilibrium characterized by 1D screw pinch equations, not force free
- Impulsive, Sawtooth like events have been observed and are being diagnosed
- Machine currently being upgraded to support more detailed diagnostics and additional experiments

