**Introduction & Motivation**

- Sawteeth oscillations are tied to a 1/MHD mode, but other important aspects and not clearly understood.
- How do sawteeth properties depend on total and vacuum transform?
- Due to the unique nature of CTH, the vacuum and total transform can be varied.
- The size of the inversion radius and characteristics such as the rise and crash timescales are investigated as functions of the total and vacuum rotational transforms.

**Compact Toroidal Hybrid (CTH)**

- J-FT field periods terminated with auxiliary toroidal field coils.
- Operational as conventional torus with ECRH plasma generation.
- Toroidal plasma current driven with ohmic current elongation and 3D closed nested flux surfaces in toroidal plasmas.
- Temperature is determined by comparing the ratio of experimental values from 186 diagnostics including: Rogowski coils, cube coils, saddle coils, and SXR signals are used to compute the equilibrium model.

**Theory of Two-Color SXR $T_e$**

- Each filter has a different photon cut-off energy (bold lines) limiting the lower energy range of the bremsstrahlung radiation.
- The filters are 0.5 um C and 1.0um or 3.0 um Al. A 0.5um Al (1.0 um, 3.0 um) and C (0.5 um) filters were assumed as the dominate impurity for both filters.
- $\Lambda$ = 5.75 m $\tau_{eff}$ = 20 kW SXR $\phi_0$ = 0.2 m Discharge duration = 0.1 s

**Reconstructions using V3FIT**

- V3FIT is used to reconstruct a fully 3D plasma equilibrium.
- V3FIT finds the best fit between data signals calculated from the given equilibrium model and experimental values.
- CTH uses VMEC as the equilibrium solver for V3FIT.
- VMEC is an ideal MHD equilibrium solver. It can calculate the 3D closed nested flux surfaces in toroidal plasmas.
- Experimental values from 186 diagnostics including: Rogowski, cube coils, saddle coils, and SXR signals are used to compute the equilibrium model.

**References**