

Abstract Submitted  
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**Non-axisymmetric equilibrium reconstruction on the Compact Toroidal Hybrid Experiment using external magnetic and soft x-ray inversion radius measurements**<sup>1</sup> X. MA, M. CIANCIOSA, J.D. HANSON, G.J. HARTWELL, S.F. KNOWLTON, D.A. MAURER, D.A. ENNIS, J.L. HERFINDAL, Auburn University — Non-axisymmetric free-boundary equilibrium reconstructions of stellarator plasmas are performed for discharges in which the magnetic configuration is strongly modified by the driven plasma current. Studies were performed on the Compact Toroidal Hybrid device using the V3FIT reconstruction code [1] incorporating a set of 50 magnetic diagnostics external to the plasma, combined with information from soft X-ray (SXR) arrays. With the assumption of closed magnetic flux surfaces, the reconstructions using external magnetic measurements allow accurate estimates of the net toroidal flux within the last closed flux surface, the edge safety factor, and the outer boundary of these highly non-axisymmetric plasmas. The inversion radius for sawtoothed plasmas is used to identify the location of the  $q = 1$  surface, and thus infer the current profile near the magnetic axis. With external magnetic diagnostics alone, we find the reconstruction to be insufficiently constrained.

[1] J. D. Hanson et al., Nucl. Fusion **49**, 075031 (2009)

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