

**Point-source helicity injection for ST plasma startup in PEGASUS**<sup>1</sup> A.J. REDD, D.J. BATTAGLIA, M.W. BONGARD, R.J. FONCK, D.J. SCHLOSSBERG, University of Wisconsin, Madison — Plasma current guns are used as point-source DC helicity injectors for forming non-solenoidal tokamak plasmas in the PEGASUS Toroidal Experiment. Discharges driven by this injection scheme have achieved  $I_p \geq 100$  kA using  $I_{inj} \leq 4$  kA. They form at the outboard midplane, transition to a tokamak-like equilibrium, and continue to grow inward as  $I_p$  increases due to helicity injection and outer- PF induction. The maximum  $I_p$  is determined by helicity balance (injection rate *vs* resistive dissipation) and a Taylor relaxation limit, in which  $I_p \propto \sqrt{I_{TF} I_{inj} / w}$ , where  $w$  is the radial thickness of the gun-driven edge. Preliminary experiments tentatively confirm these scalings with  $I_{TF}$ ,  $I_{inj}$ , and  $w$ , increasing confidence in this simple relaxation model. Adding solenoidal inductive drive during helicity injection can push  $I_p$  up to, but not beyond, the predicted relaxation limit, demonstrating that this is a hard performance limit. Present experiments are focused on increasing the injection voltage (*i.e.*, helicity injection rate) and reducing  $w$ . Near-term goals are to further test scalings predicted by the simple relaxation model and to study in detail the observed bursty  $n=1$  activity correlated with rapid increases in  $I_p$ .

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- Prefer Oral Session  
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