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A Cusp Gun Gyro-TWA with Helical Waveguide Interaction Region CRAIG ROBERTSON, DAVID ROWLANDS, COLIN WHYTE, ALAN YOUNG, WENLONG HE, ADRIAN CROSS, ALAN PHELPS, KEVIN RONALD, The University of Strathclyde — The latest results of experimental and numerical investigations of an X-band gyro-TWA with a cusp gun and a helically corrugated interaction region are presented. A helically corrugated waveguide radically alters the dispersion relation of the interacting mode such that it matches the electron beam dispersion over a broad frequency range at close to zero axial wavenumber. Gyro-amplifiers require relativistic electron beams with low velocity spread and with a high fraction of the electron energy associated with the cyclotron motion. For harmonic operation and mode control an axis-encircling beam is desirable. A cusp gun was used to produce an axis-encircling beam by passing an annular beam through a magnetic cusp, introducing an azimuthal rotation. The passage of an electron beam through a non-adiabatic magnetic field reversal converted part of the electron beam's axial velocity into axis-encircling transverse velocity. Experiments were carried out using a field emission cathode and proved highly successful with a 120keV, 37A azimuthally rotating annular beam being formed. Microwave radiation in the frequency range of 8.4Hz to 10.4GHz was produced, with an output power 1.1MW at a frequency of 9.4GHz, corresponding to a saturated gain of 35dB and a measured efficiency of 25%.

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