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Global instability mode in a baffled Von Karman flow PAWEL BAJ, NICHOLAS WORTH, JAMES DAWSON, Norwegian University of Science and Technology — A low-frequency spectral peak is identified in velocity spectra measured close to the stagnation point of a baffled turbulent Von Karman swirling flow. This observation is consistent across a range of studied experimental datasets (3D3C Scanning-PIV and 2D3C Stereo-PIV measurements) acquired in two different facilities. An attempt is made to recognise the underlying velocity structure through an application of conditional averaging and Proper Orthogonal Decomposition. The structure that emerges takes a form of a spheroidal zone located near the tank's centre of accelerated, unidirectional flow perpendicular to the axial direction. This structure is then observed to precess around the tank's axis with the frequency of the spectral peak. The dynamics of the recognised feature is then studied via POD-Galerkin projection of the Navier-Stokes equations. This ultimately allows us to track origins of the structure down to the linear term of the projected equations, which is characterised by a pair of unstable eigenvalues. The structure can be, therefore, classified as a global instability mode. A simple sensitivity analysis shows that the characteristic frequency can be controlled via the mean shear in the radial plane.

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