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A reinterpretation of the distribution of vortical structure in wall turbulence[1] BEVERLEY MCKEON, IAN JACOBI, California Institute of Technology, ATI SHARMA, Imperial College London — The critical layer framework for turbulent pipe flow proposed by McKeon & Sharma (*J. Fluid Mech, 2010, see also the DFD-2010 presentation on 'Structure from the critical layer framework in turbulent flow' by Sharma & McKeon*) provides a model by which the distribution of hairpin-like vortices in wall turbulence can be reinterpreted. The model is used to demonstrate that the shear associated with the wall-normal variation of the mean velocity profile suppresses so-called retrograde vortices. Analysis of PIV images in the streamwise/wall-normal plane of a relatively low Reynolds number, zero pressure gradient turbulent boundary layer shows that the use of a Gallilean invariant decomposition of the velocity field prior to the calculation of swirl, i.e. subtraction of a constant convection velocity from the field, leads to a distorted count of the apparent number of retrograde spanwise vortices. By comparison, the result of a Reynolds decomposition suggests an essentially even distribution between prograde vortices (identified by many researchers as the heads of hairpin vortices) and retrograde ones, (i.e. vortices with the opposite sense of rotation) in agreement with the critical layer model.

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