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Experimental demonstration of scaling law for transition in subcritical channel flows[1] JIMMY PHILIP, ALEXANDER SVIZHER, JACOB COHEN, Faculty of Aerospace Engineering, Technion, Israel — Scaling law for the threshold amplitude of perturbations to trigger nonlinearity in subcritical plane Poiseuille flow as function of the Reynolds number is demonstrated experimentally. The process is composed of a linear stage followed by a non linear one. The disturbances are introduced through an almost streamwise independent slot drilled at the bottom wall of a horizontal air channel flow. For low injection rates, long counter-rotating pair of vortices is observed undergoing transient growth, where as, above a critical injection rate of the disturbance, the pair of vortices undergo secondary instability leading to the nonlinear phenomenon of the initiation of hairpin vortices. The normalized critical injection rate (v_0) scales with the Reynolds number (Re) as $v_0 \sim Re^{-3/2}$, as predicted by Chapman [J. Fluid Mech. **451**, 34 (2002)], using asymptotic theory. However, unlike in the theory which requires an impractical channel length of $O(R)$ for the growth of an infinitesimal small amplitude of vertical velocity (v_0) to $O(1)$ vertical vorticity, in the experiments a much shorter channel is used to obtain the same results by increasing the initial disturbance amplitude instead.

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