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Comparison between Prandtl, Navier-Stokes and Euler solutions for 2D flows in the presence of solid boundaries MARIE FARGE, LMD-CNRS-IPSL, Ecole Normale Superieure, Paris, France, ROMAIN NGUYEN VAN YEN, MATTHIAS WAIDMANN, Fachbereich Mathematik, Freie Universitaet, Berlin, Germany, KAI SCHNEIDER, M2P2-CNRS and Faculte des Sciences, Aix-Marseille Universite, France, RUPERT KLEIN, Fachbereich Mathematik, Freie Universitaet, Berlin, Germany — In 1904 Prandtl introduced the notion of boundary layer (BL), assuming all viscous energy dissipation takes place only in the BL (as long as it remains in contact with the body) whose thickness is inversely proportional to the Reynolds number, Re. He derived the BL equation and succeeded to asymptotically match its solution with that of an inviscid fluid flow governed by Euler's equation outside the BL. In the poster we address the following question: does energy dissipate when the BL detaches from the solid body? We consider a jet, modeled as a vorticity dipole, impinging onto a wall, that we study by Direct Numerical Simulation to see how solutions behave in the vanishing viscosity limit (equivalent to the limit of large Re). Starting from the same initial flow and the same geometry, we compare the solutions obtained for Euler's equation, Prandtl's equation, and Navier-Stokes equation, using different numerical methods. We observe that in the vanishing viscosity limit energy dissipation does not tend to zero, in a BL whose thickness scales as $Re^{-1/2}$ (as predicted by Prandtl's 1904 theory), but produces vortices at the wall which entrain the BL and roll it up to form a dissipative structure, whose thickness scales as Re^{-1} (Kato, 1984), which detaches from the wall.

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