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Three dimensional breakdown of an impulsively forced laminar separation bubble THEODOROS MICHELIS, MARIOS KOTSONIS, Delft University of Technology — The spatio-temporal behaviour of a short laminar separation bubble is investigated experimentally. The bubble develops on a flat plate driven by an adverse pressure gradient wall at Reynolds number based on displacement thickness at separation of $Re_{\delta_s^*} = 975$. The boundary layer is impulsively forced by means of AC dielectric barrier discharge plasma actuator located upstream of the separation point. The full four-dimensional flow development is captured by time resolved tomographic PIV measurements using the multi-pass light amplification technique. Immediately after forcing, a convectively unstable wave packet emerges due to selective amplification of modes which interacts with the reattachment process. The interaction becomes non-linear at the reattachment region, where Λ structures typical of laminar separation bubbles are captured before the occurrence of breakdown. The structures and breakdown are characterised in terms of temporal evolution, spanwise coherence and energy budget. The diminishing of Λ structures triggers a sharp reduction in size of the separation bubble by interfering with the natural shedding process. As a result, the bubble significantly elongates without shedding undergoing bursting before recovering to its unperturbed state.

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