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# Bleeding technique to control flow separation in hypersonic intakes

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## Abstract

Flow separation in hypersonic scramjet intakes due to shock wave-boundary layer interaction(SWBLI) degrades total pressure recovery, promotes intake unstart and affects combustion efficiency directly. This study numerically investigates boundary layer bleeding as a passive flow control method on a 2D double compression ramp inlet-isolator geometry at Mach 5, 6 and 7 using density based solver rhocentralFoam in OpenFOAM 2212. Three bleed slots placed at the isolator entrance with widths (2.809 mm, 3.5 mm, and 4.2135 mm) were evaluated against a no-bleed baseline. At the design Mach 5, the 2.809mm bleed slot improved total pressure recovery by 25.3% and 3.5 mm bleed slot improved it by 25.1% with visible suppression and shifting of recirculation bubble downstream. At off-design Mach 6 and 7 , bleed effectiveness decreases showing Mach specific character of passive fixed-geometry bleed.

**Keywords:** Hypersonic Intake, SWBLI, Total pressure recovery, Oblique shock waves