Online Resource 2 (ESM_2.pdf)

Supplementary mesh-resolution robustness checks for

“Three-Dimensional Flame-Head Bifurcation and Compression-Hydrodynamic Coupling in LES of Premixed Hydrogen-Air Propagation in a Half-Open Channel”.

Flow, Turbulence and Combustion

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This supplementary file contains Fig. S12-S15 and Table S5. The added materials document the mesh-resolution study for the baseline φ = 1.0 case within the common stable interval t ≤ 0.620 ms.

- Fig. S12: center-plane T = 1200 K contour overlays in a local flame-head window
- Fig. S13: centerline overpressure profiles at matched late common-window times
- Fig. S14: mesh-resolution comparison of D_b and Δp_{ahead} trends
- Fig. S15: spanwise T = 1200 K contour overlays at t = 0.620 ms
- Table S5: tabulated mesh-comparison values at 0.520, 0.580, and 0.620 ms

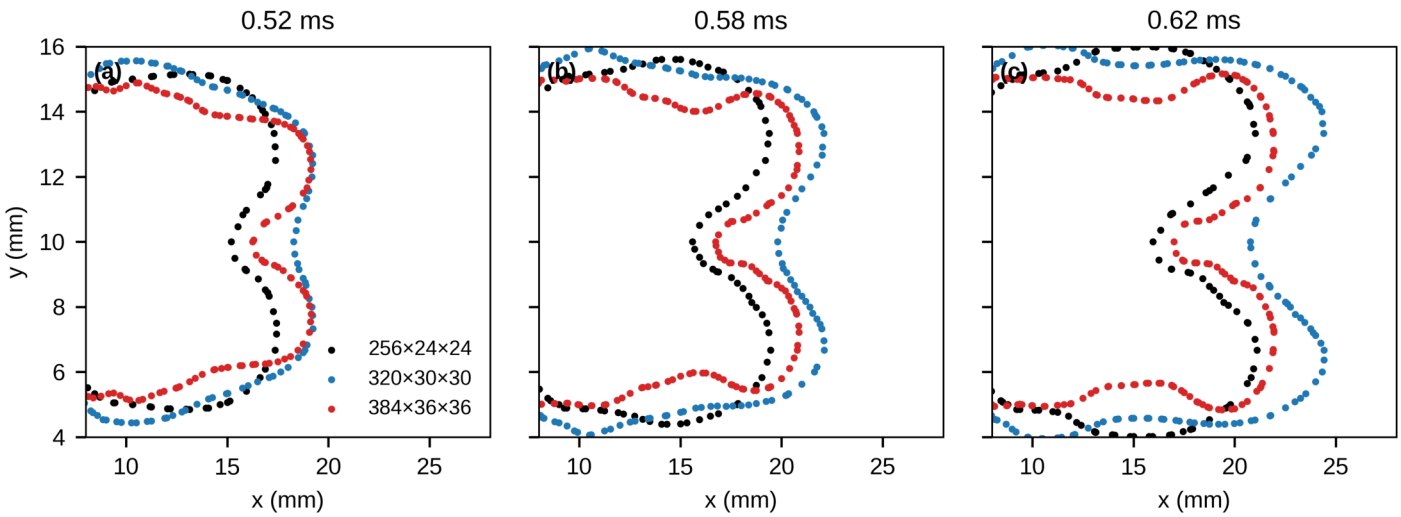

Fig. S12. Center-plane T = 1200 K contour overlays in a local flame-head window for the coarse, baseline, and fine meshes at t = 0.520, 0.580, and 0.620 ms. The same local window is used in all panels. The late common-window bifurcation topology can be compared directly across the three meshes.

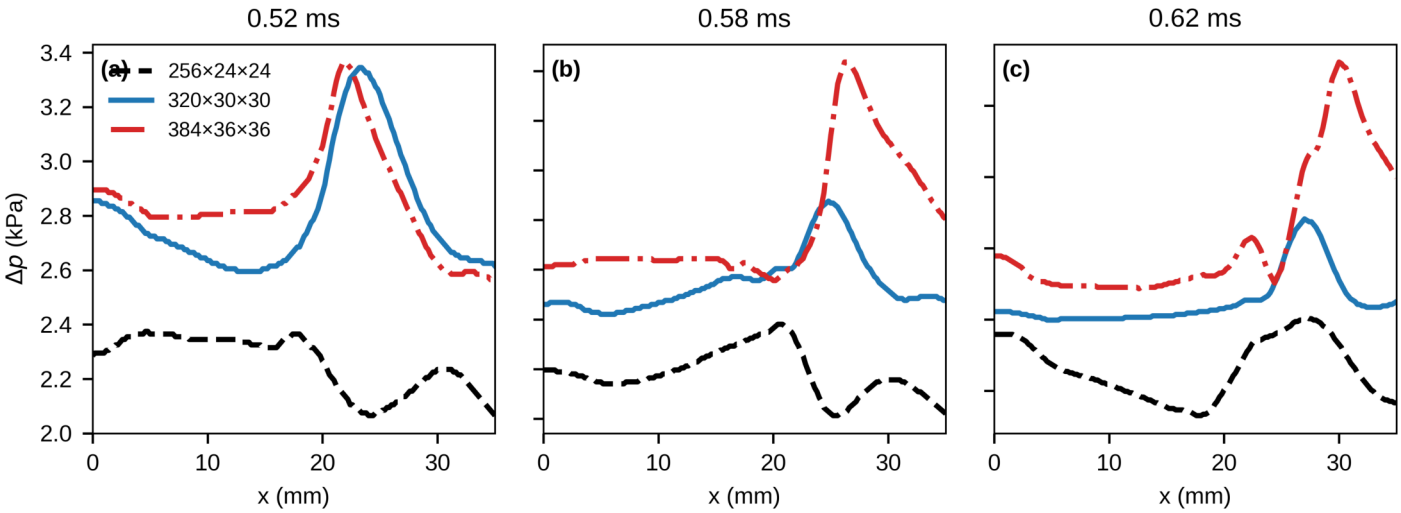

Fig. S13. Centerline overpressure profiles in the baseline φ = 1.0 case at t = 0.520, 0.580, and 0.620 ms. The three meshes preserve the same qualitative buildup of the ahead-of-flame compression layer, although the profile amplitude remains mesh-sensitive.

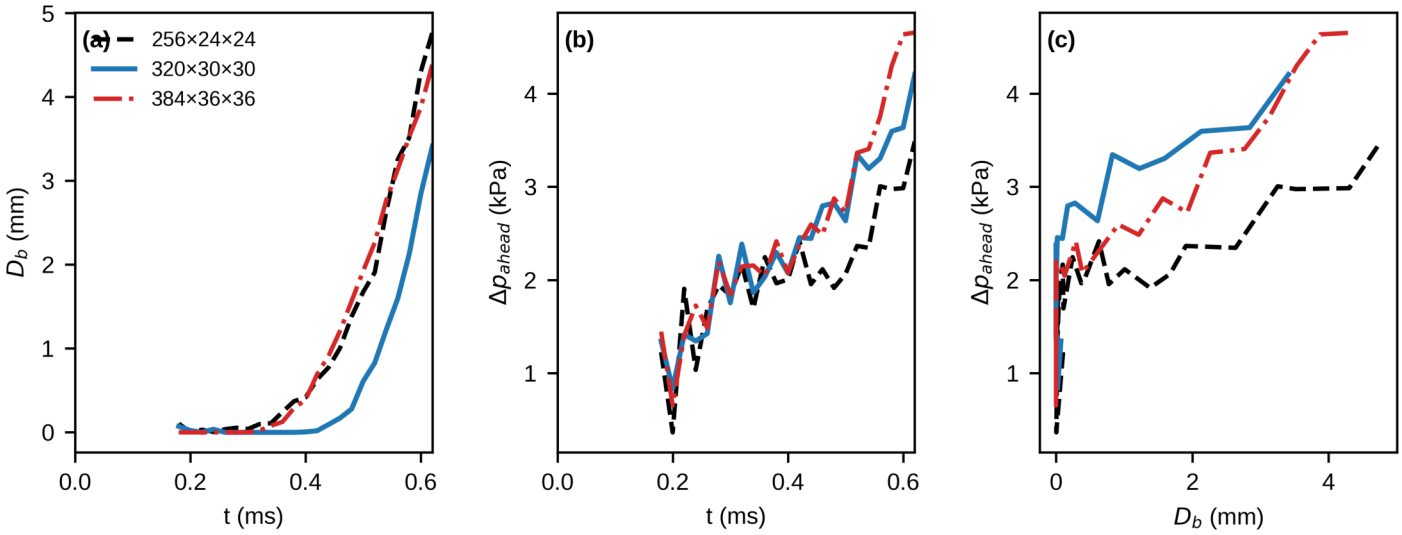

Fig. S14. Mesh-resolution comparison of the precursor metrics within the common stable interval (t ≤ 0.620 ms): (a) D_b(t), (b) Δp_ahead(t), and (c) trajectories in the (D_b, Δp_ahead) plane.

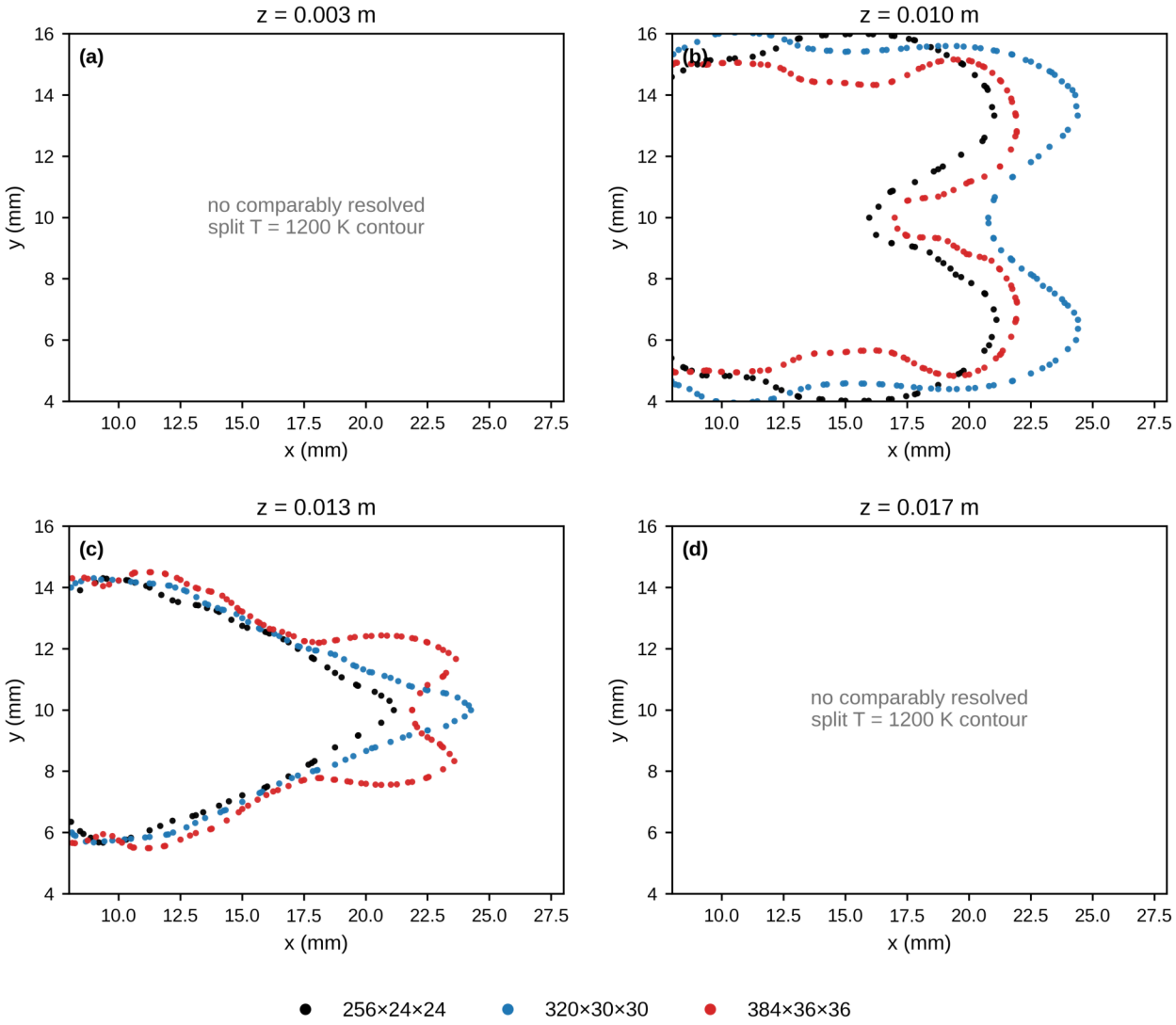

Fig. S15. T = 1200 K contour overlays at t = 0.620 ms on four spanwise planes, z = 0.003, 0.010, 0.013, and 0.017 m, for the coarse, baseline, and fine meshes. The center plane and the near-center off-plane section (z = 0.013 m) both show a split-front topology, whereas the farther off-center sections do not yet exhibit a comparably resolved split T = 1200 K contour at the present time and threshold. This supports a finite spanwise extent of the bifurcated flame head rather than a center-plane-only artifact.

Table S5. Mesh-resolution comparison for the baseline φ = 1.0 case within the common stable interval.

Mesh	D_b at 0.520 ms (mm)	D_b at 0.580 ms (mm)	D_b at 0.620 ms (mm)	Δp_ahead at 0.520 ms (kPa)	Δp_ahead at 0.580 ms (kPa)	Δp_ahead at 0.620 ms (kPa)	t(Δp_ahead ≥ 3 kPa) (ms)
256×24×24	1.9060	3.5160	4.7670	2.3650	2.9750	3.4850	0.560
320×30×30	0.8280	2.1300	3.4110	3.3450	3.5950	4.2050	0.520
384×36×36	2.2620	3.5280	4.3880	3.3650	4.2950	4.6550	0.520

Values are reported at matched late common-window times (0.520, 0.580, and 0.620 ms).
All metric columns are sampled at the same matched times for coarse, baseline, and fine meshes.
Absolute D_b values remain mesh-sensitive at matched times; the table is used to support topology/trend robustness rather than strict quantitative convergence.