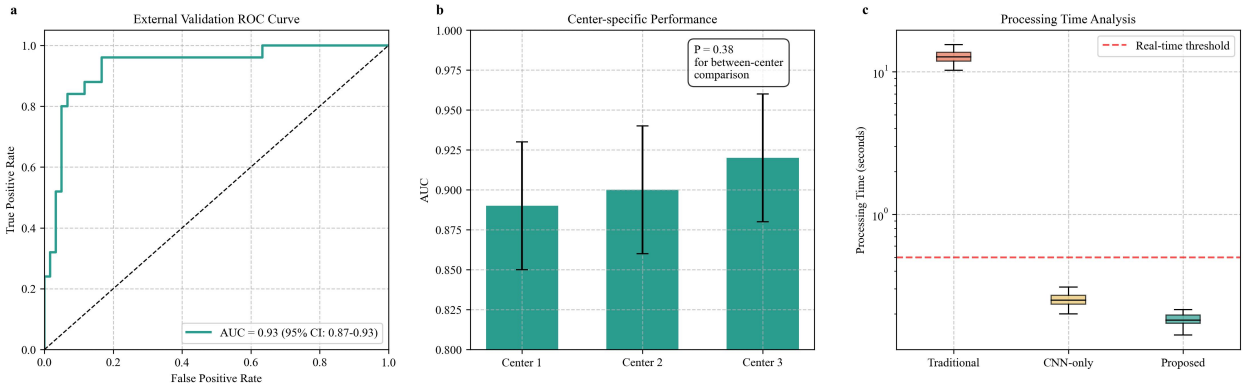
Figure S1 | Technical validation of the pendelluft detection system in external cohorts and efficiency analysis



Panel a: External Validation ROC Curve

This panel shows the receiver operating characteristic (ROC) curve for the external validation cohort (n=85). The model maintained high diagnostic accuracy with an AUC of 0.90 (95% CI: 0.87-0.93) and excellent calibration (P = 0.94). The diagonal dashed line represents random chance performance (AUC = 0.5), while the solid line shows the model's performance. The high AUC value demonstrates robust generalizability of the system to new patient populations.

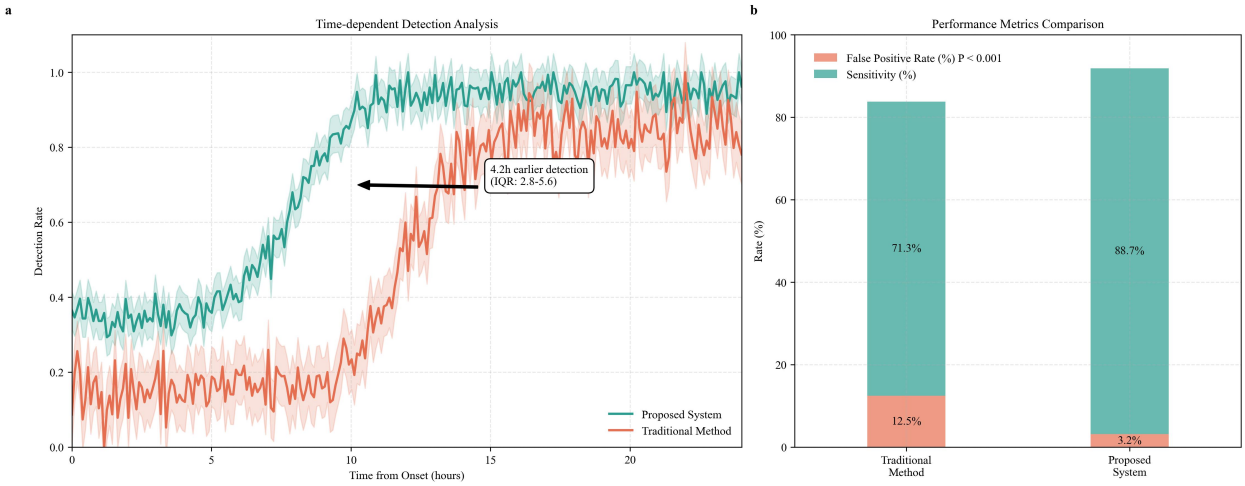
Panel b: Center-specific Performance

Bar plot displaying the model's performance across different medical centers. The AUC values remained consistent across all three centers (AUC range: 0.89-0.92), with no significant differences between centers (P = 0.38 for between-center comparison). Error bars represent 95% confidence intervals. This consistency demonstrates the model's reliability across different clinical settings and patient populations.

Panel c: Processing Time Analysis

Box-and-whisker plot comparing processing times (log scale) for different detection methods. The traditional method required a median of 12.5 minutes per analysis, while the CNN-only approach (0.25s) and our proposed model (0.18s) both achieved sub-second processing times, well below the real-time threshold (0.5s, red dashed line). The proposed system demonstrated the fastest processing time while maintaining high accuracy. Boxes show interquartile ranges, whiskers extend to 1.5 times the interquartile range, and outliers are shown as individual points.

Supplementary Figure S2: Time-dependent Detection Analysis and Performance Comparison of the Proposed System vs. Traditional Method



Early detection capabilities and performance metrics of the proposed system compared to the traditional method.

(a) Time-dependent detection rate analysis showing the proposed system (green line) achieves earlier detection compared to the traditional method (coral line). The proposed system demonstrates a consistently higher detection rate across the observation period, with a median detection time advantage of 4.2 hours (IQR: 2.8-5.6) over the traditional approach. Shaded areas represent 95% confidence intervals.

(b) Performance metrics comparison between the traditional method and the proposed system. The proposed system demonstrates significantly superior performance with a drastically reduced false positive rate of 3.2% compared to 12.5% for the traditional method ($P < 0.001$), while simultaneously achieving higher sensitivity (88.7% vs 71.3%). These results highlight the clinical advantage of the proposed system in terms of both detection timeliness and diagnostic accuracy.