Boom Supersonic Contribution to the 3rd AIAA Sonic Boom Prediction Workshop: Ground Signatures

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Outline

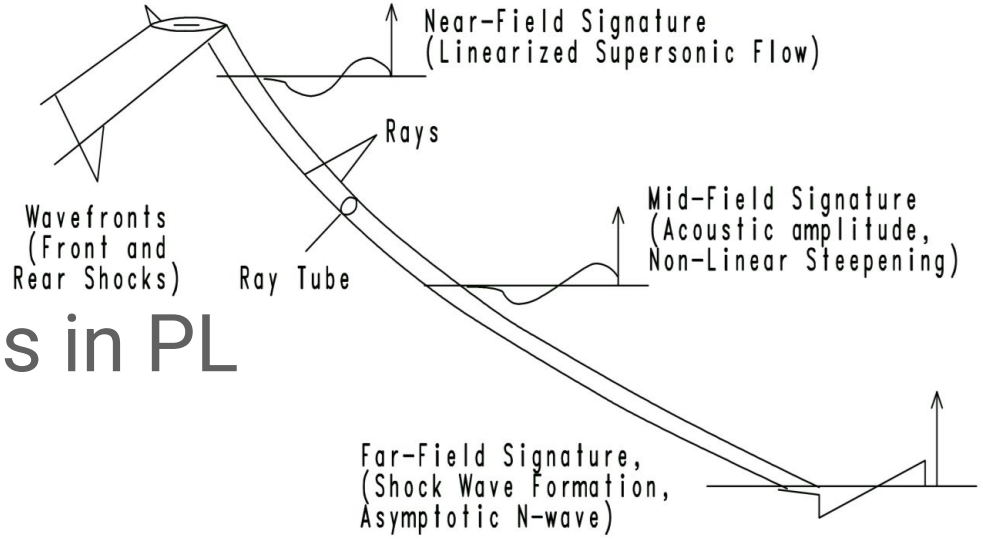
- Cases Analyzed
- Propagation Prediction Code – PCBoom 6.7
- Results
  - Ground Signatures
  - Cutoff
  - Loudness
- Conclusions

Cases Analyzed

- Case 1: C25P with provided measured atmosphere
  - Full Signature Sweep
  - Cutoff Analysis
- Case 2: C609 with provided measured atmosphere
  - Full Signature Sweep
  - Cutoff Analysis
- Case 2: C609 with standard atmosphere
  - Cutoff Analysis

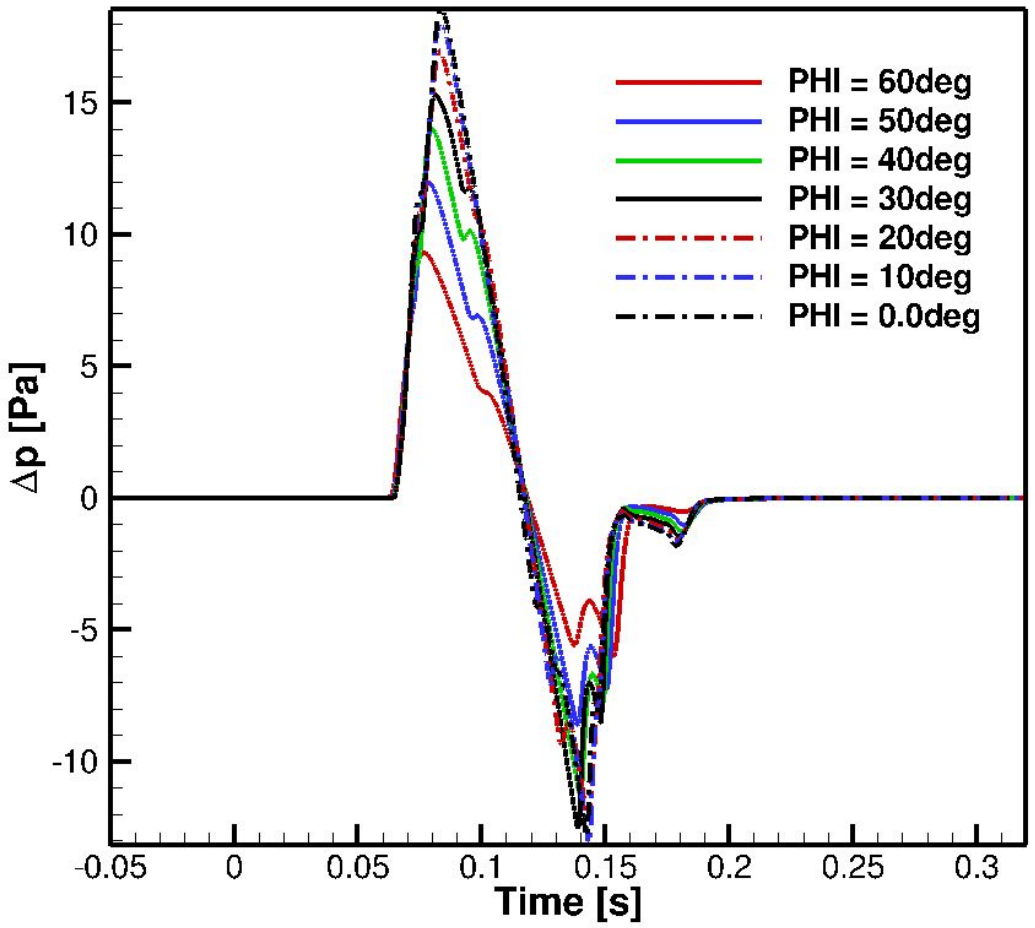
Propagation Code: PCBoom 6.7.1

- Utilized PCBoom 6.7.1 running on MacOS
- Basic propagation algorithm: Schulten Flat Earth with Burger's Molecular Relaxation
  - Ray tracing through a 3-D stratified atmosphere over a flat earth
  - Input signature format: Original Thomas form – dP/P vs. axial distance
- Sampling Frequency: 102.4 kHz
- Propagation time step: 0.05 seconds
- MacOS version only calculates Loudness in PL
  - ASEL, BSEL, or CSEL not available

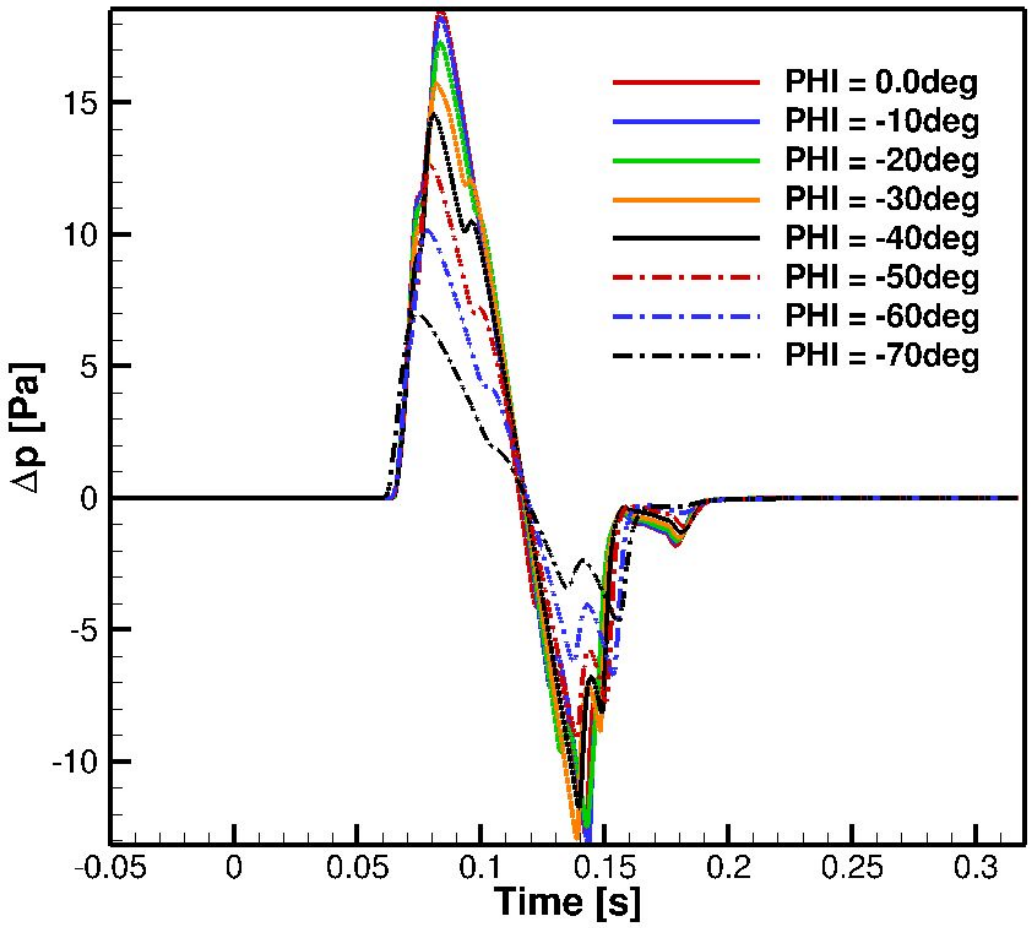


Case 1: Ground Signatures

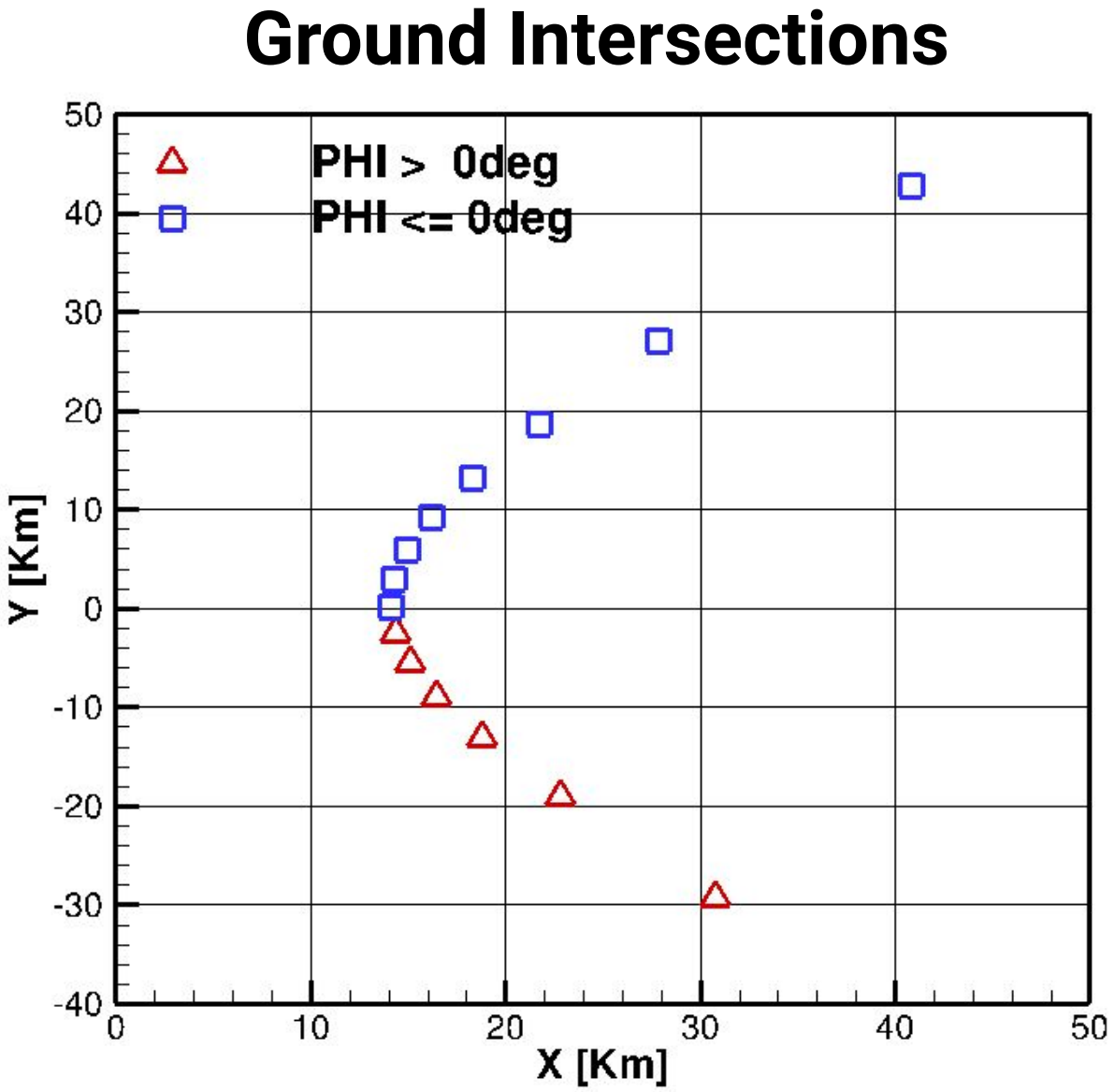
PHI > 0



PHI < 0



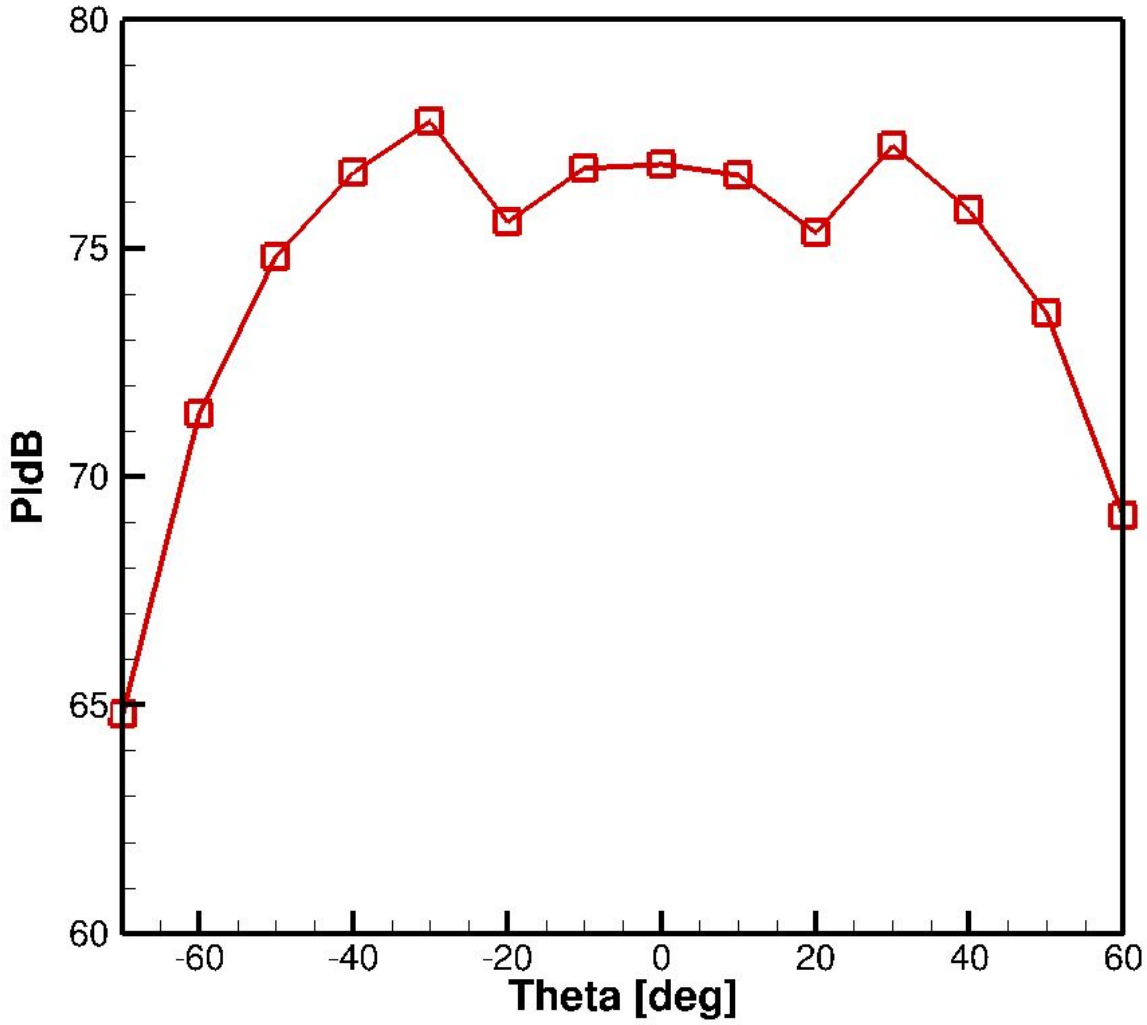
Case 1: Cutoff Analysis



Case 1: Cutoff Analysis

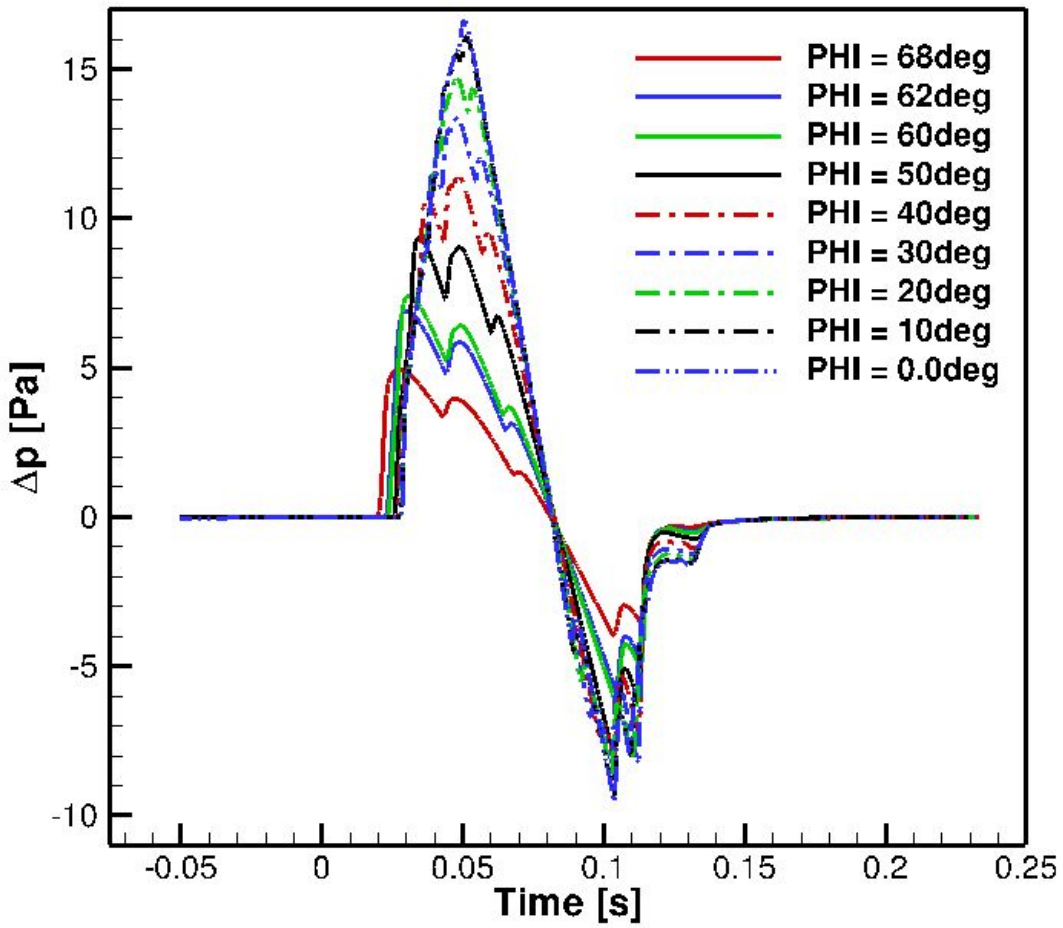
	PHI [deg]	(X,Y) [Km]	Time [min]
+Cutoff	**68.50**	**(53.2,-55.1)**	**4.0**
-Cutoff	**-77.8**	**(80.1,74.7)**	**5.7**

Case 1: Loudness

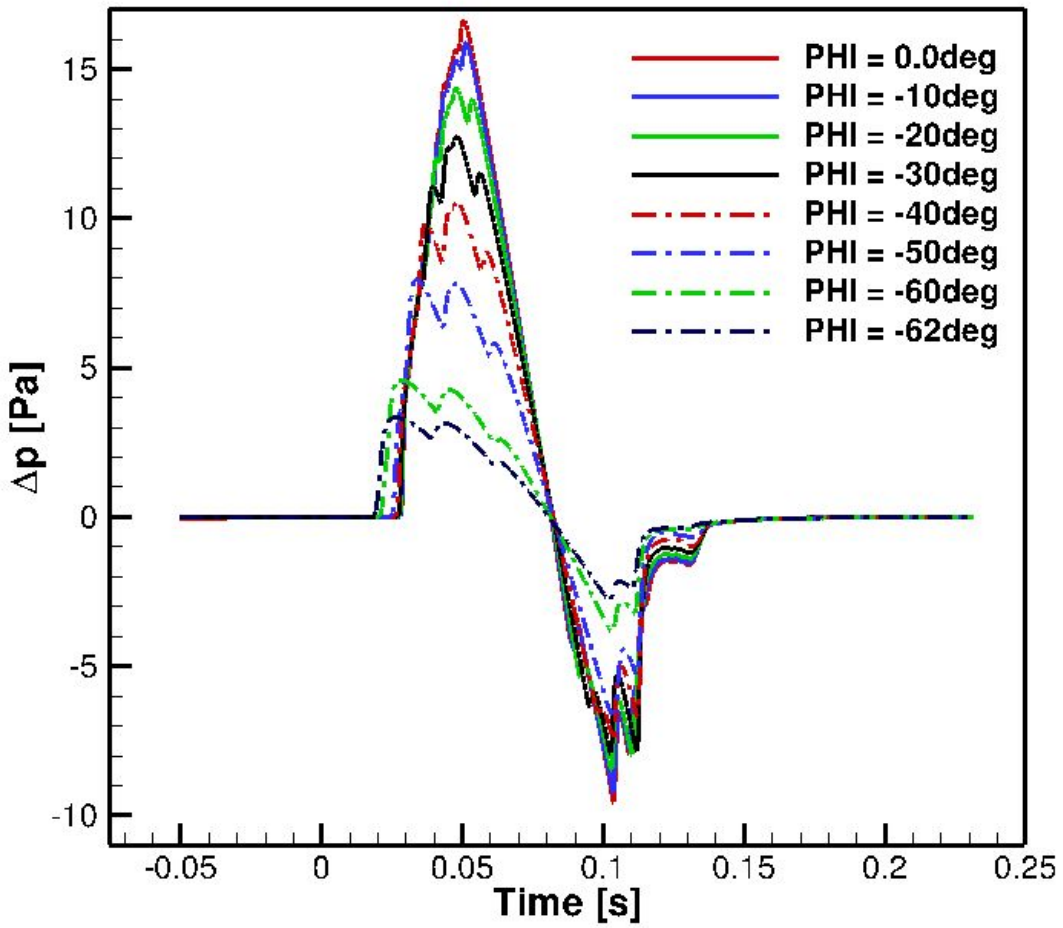


Case 2 - Measured atm: Ground Signatures

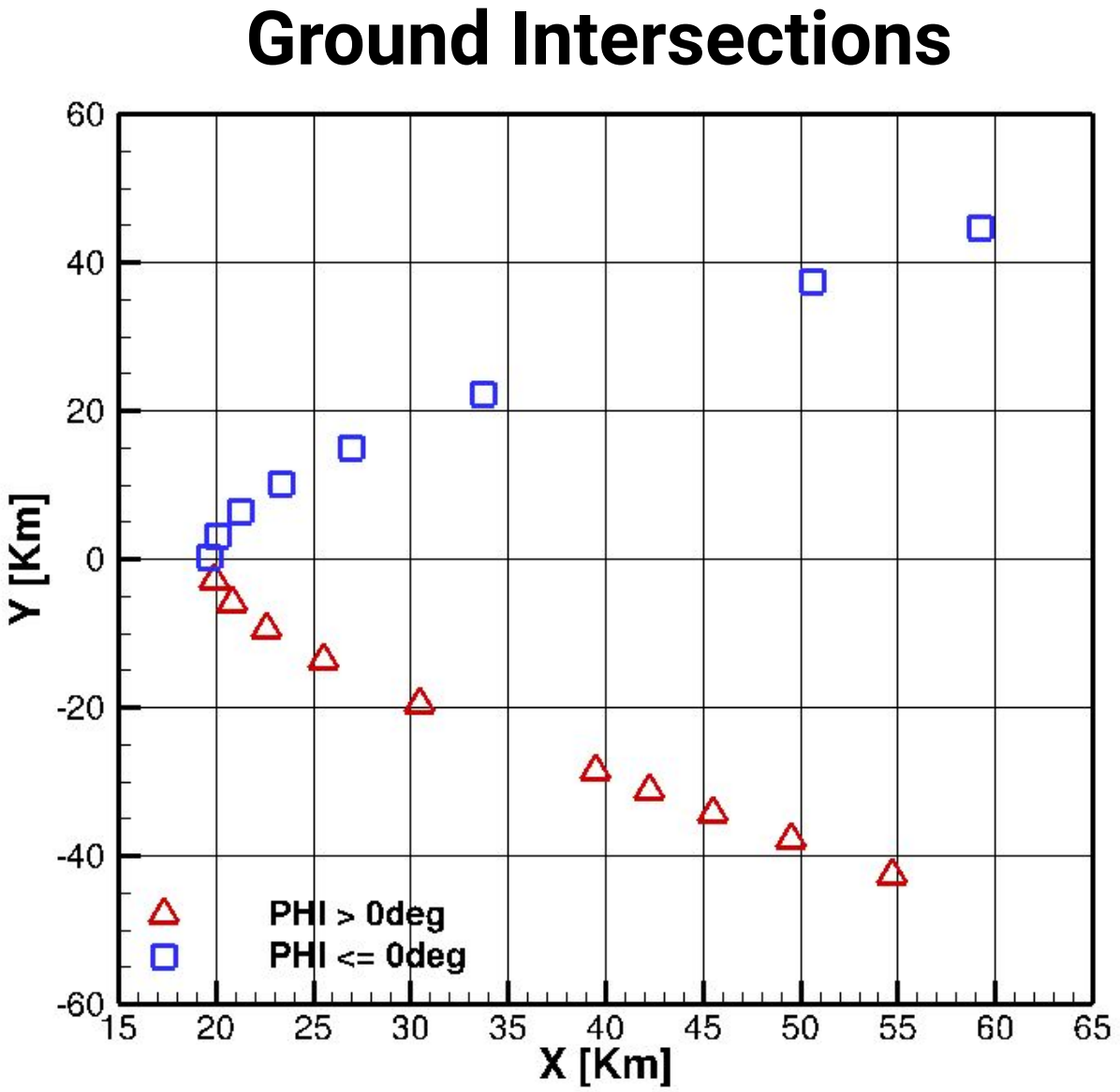
PHI > 0



PHI < 0



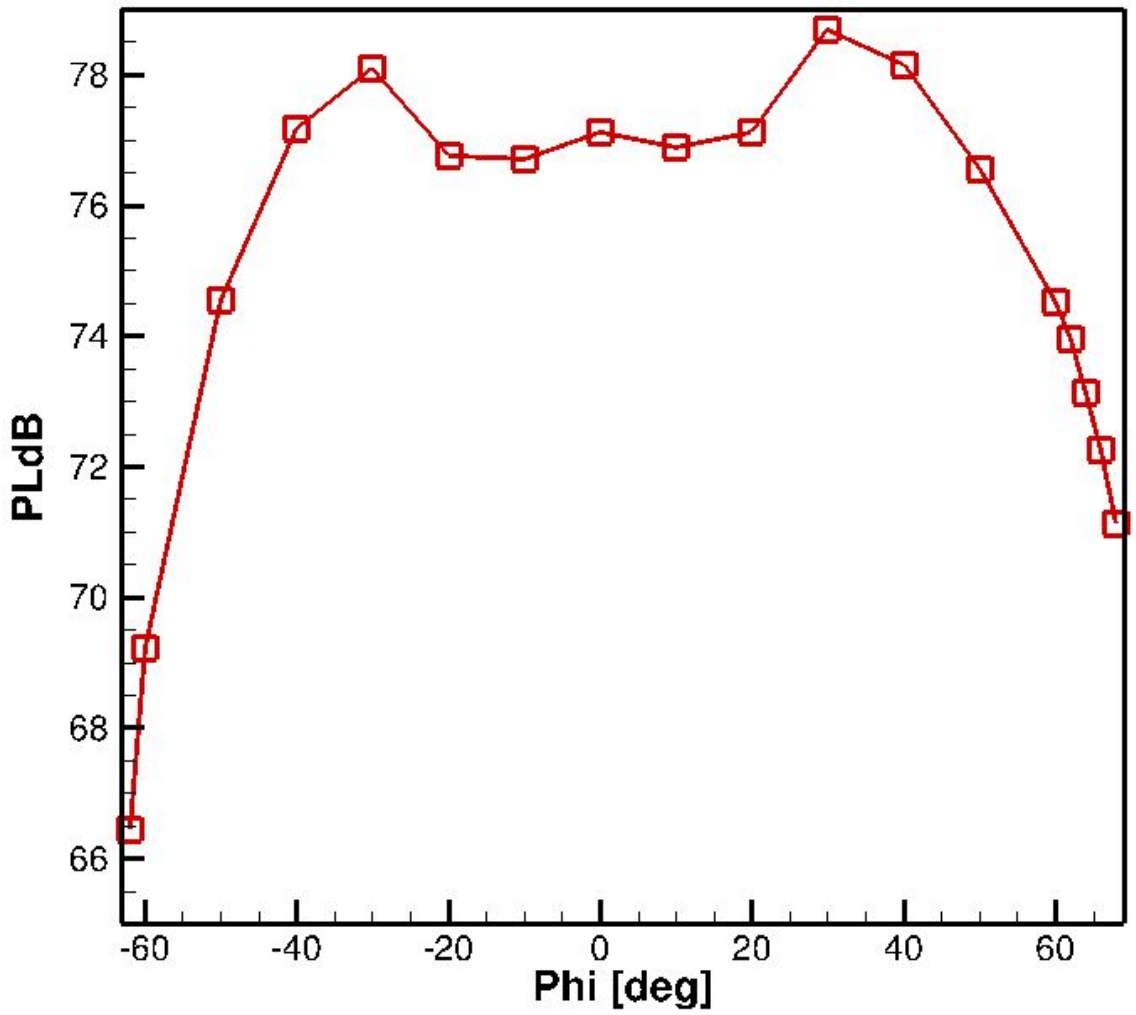
Case 2 - Measured atm: Cutoff Analysis



Case 2 - Measured atm: Cutoff Analysis

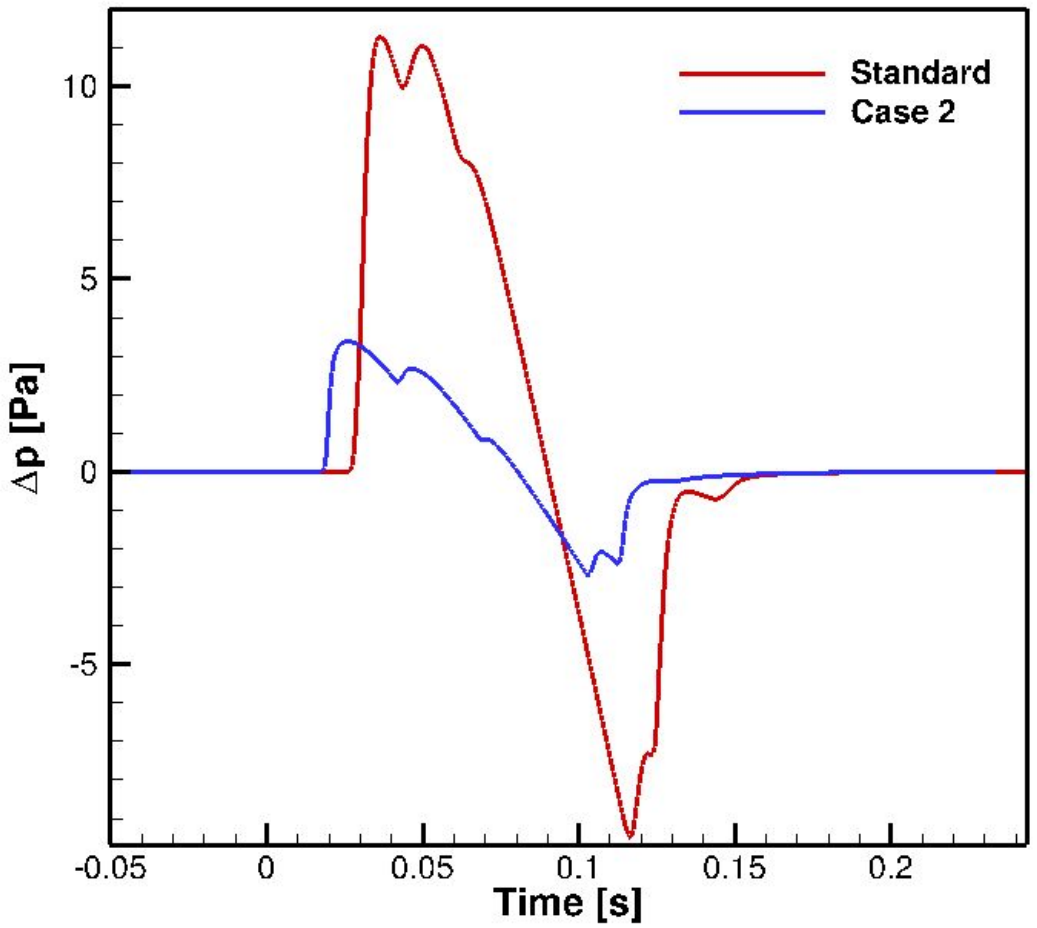
	PHI [deg]	(X,Y) [Km]	Time [min]
+Cutoff	**69.97**	**(62.7,-49.7)**	**4.12**
-Cutoff	**-63.59**	**(76.1,58.2)**	**4.84**

Case 2 - Measured atm: Loudness

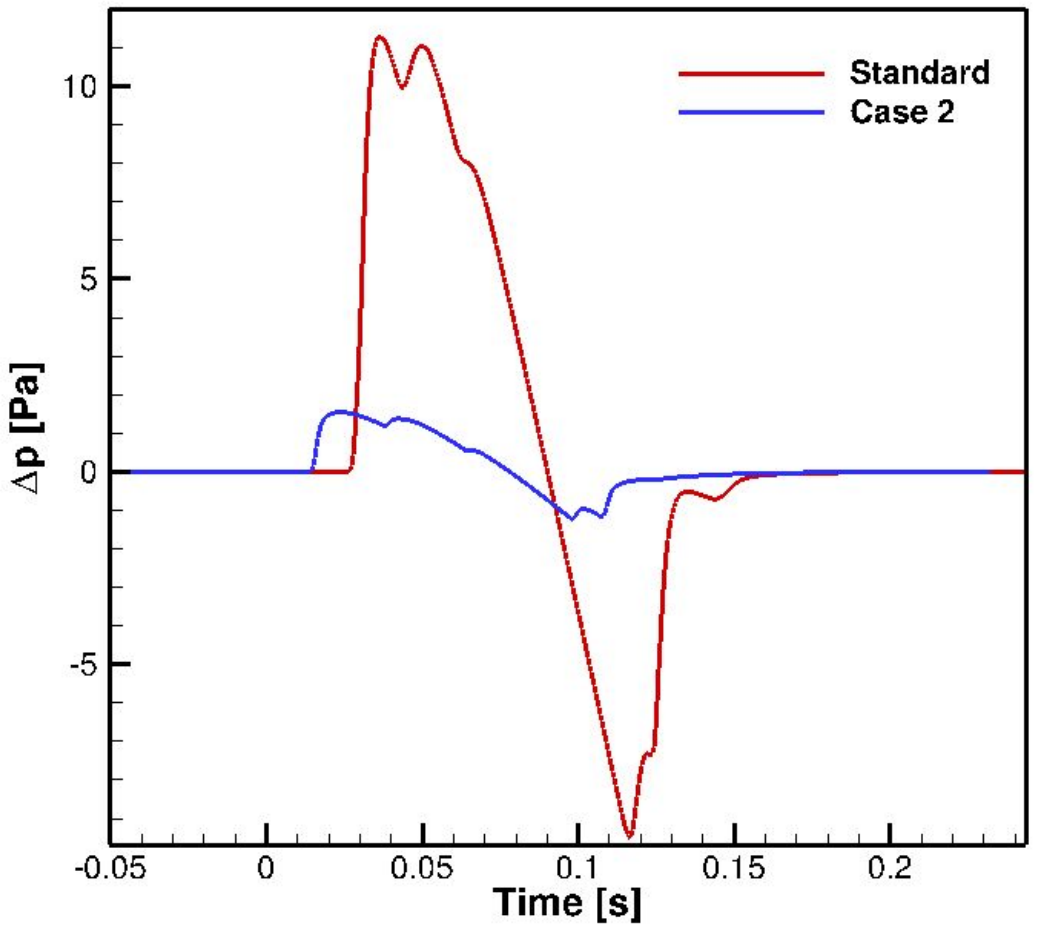


Case 2: Atmospheric effects

+Cutoff



-Cutoff



Case 2: Atmospheric effects

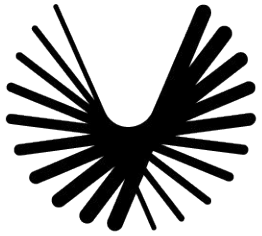
	Standard	Case 2
+Cutoff (deg)	**44.34**	**69.97**
(X,Y) Km	**(37.4,-25.6)**	**(62.7,-49.7)**
Time [min]	**2.56**	**4.12**
PLdB @ +Cutoff	**73.58**	**67.08**

Case 2: Atmospheric effects

	Standard	Case 2
-Cutoff (deg)	**-44.34**	**-63.59**
(X,Y) Km	**(37.4,25.6)**	**(76.1,58.2)**
Time [min]	**2.56**	**4.84**
PLdB @ +Cutoff	**73.58**	**58.36**

Conclusions

- Applied PCBoom to our cases
  - PHI angle convention modified after committee inquiry
- Asymmetric ground intersections and cutoff locations and time for non-standard atmosphere
- C609: standard atmosphere louder at cutoff than windy atmosphere



BOOM