Fuze Modeling Grand Challenge:
Computational Comparisons

Janet Wolfson, Ph.D., P.E.,
Jonathon Hong,
Jacob Dodson, Ph.D., P.E.
Fuzes Branch, AFRL (AFRL/RWMF)
850-883-0573 (DSN 875-0573)
janet.wolfson.1@us.af.mil

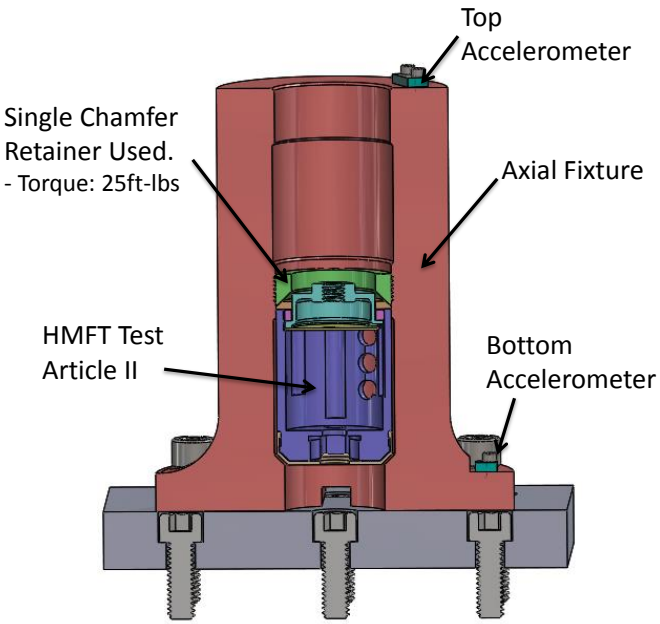
Caveat's to the Methodology

- Baseline study to understand current capability to do a pure prediction
- Manufacturing and test induced hardware defects that have not been characterized
- Traditional M&S processes to improve simulations are not being funded in this effort. Including detailed analysis of the effects on:
  - Materials
  - Methods
  - Experimental uncertainties
  - Known-unknowns/ unknown-unknowns

Goal of program is to look at ***trends*** of the predictions to ***understand fundamental challenges*** in models, data, or experimental practices

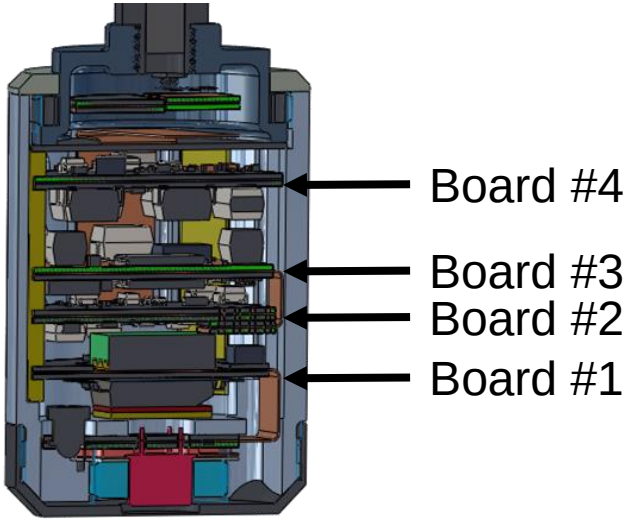
Experimental Setup

MTS-66 Drop Tower



Test Fixture

Test Article III
Circuit Boards with
Accelerometers

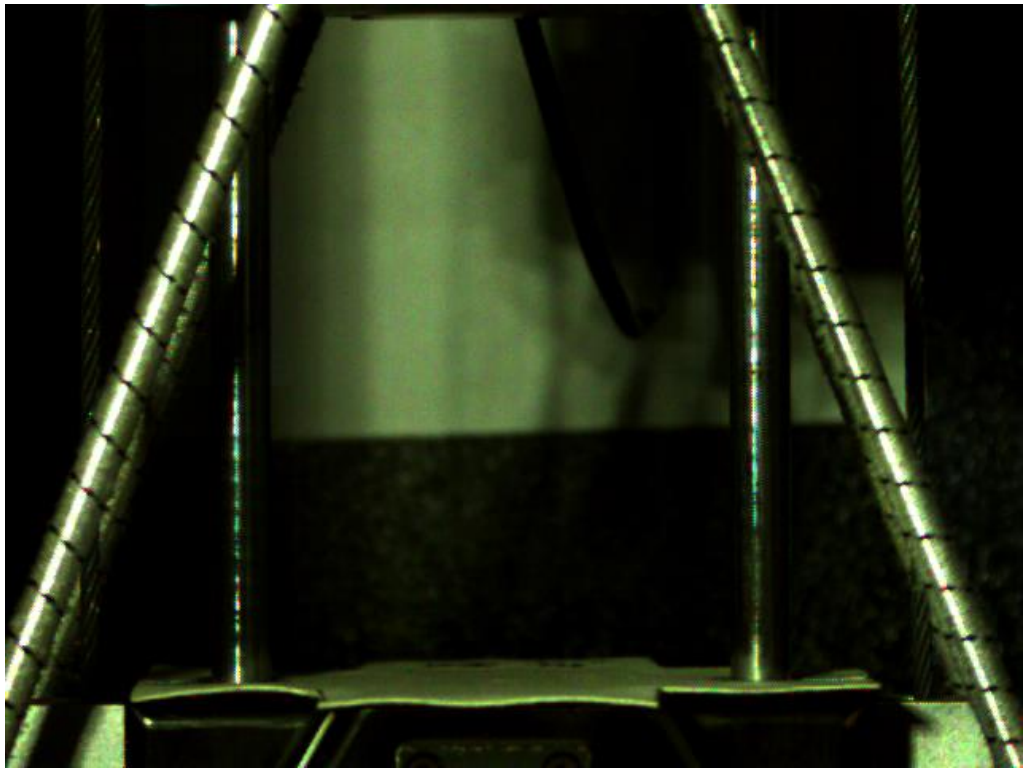


Test Article

MTS Drop Tower Video

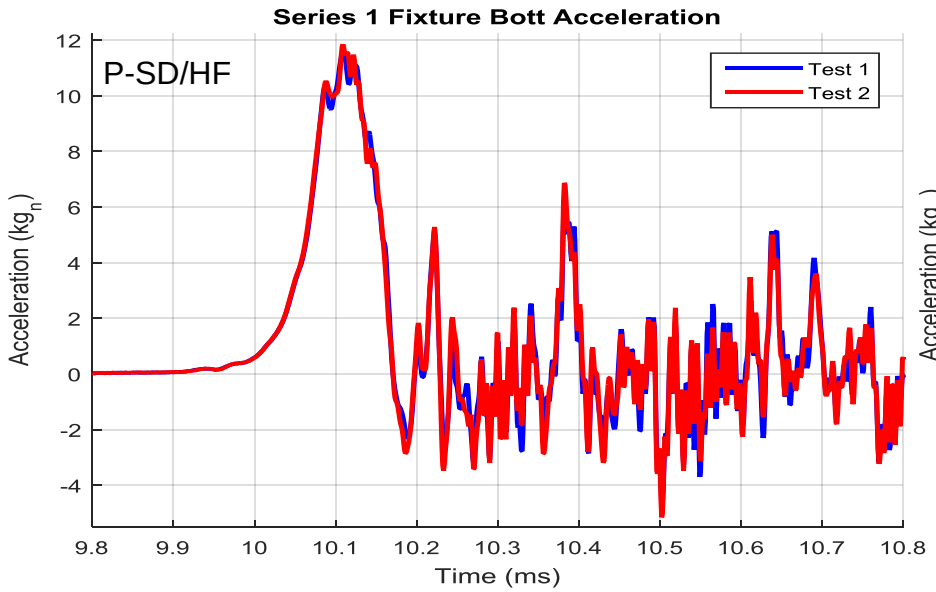
Drop Tower Video, Real Time

Drop Tower Video, High Speed Video

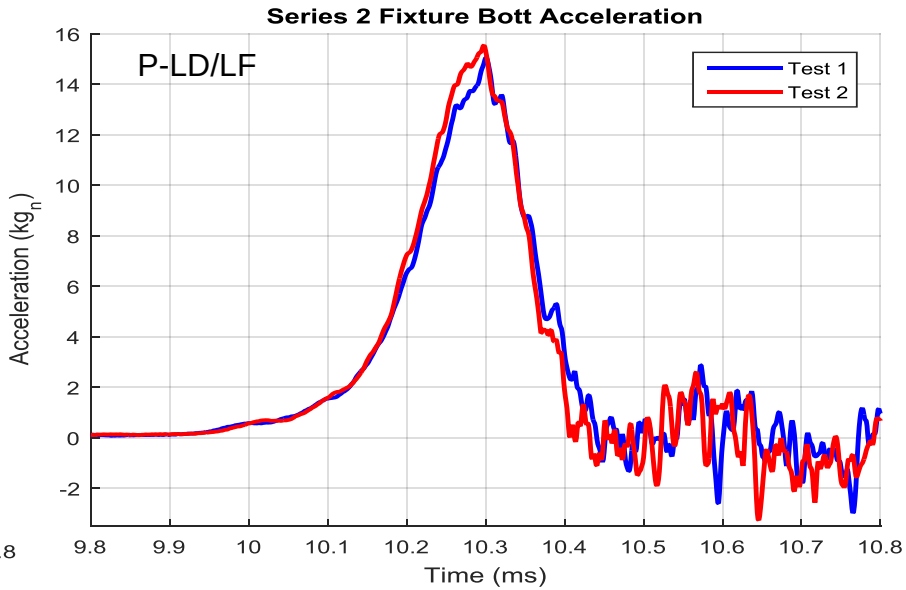


Initial Conditions

Serial Number	Drop Height	Mitigator	Duration Description	Frequency Description	Unit Condition
104	20”	1/16” F1 Felt	Short	High	Pristine
104	72”	1/2” F1 Felt	Long	Low	Pristine

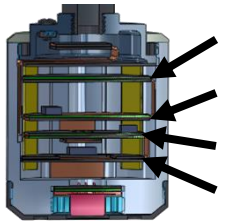


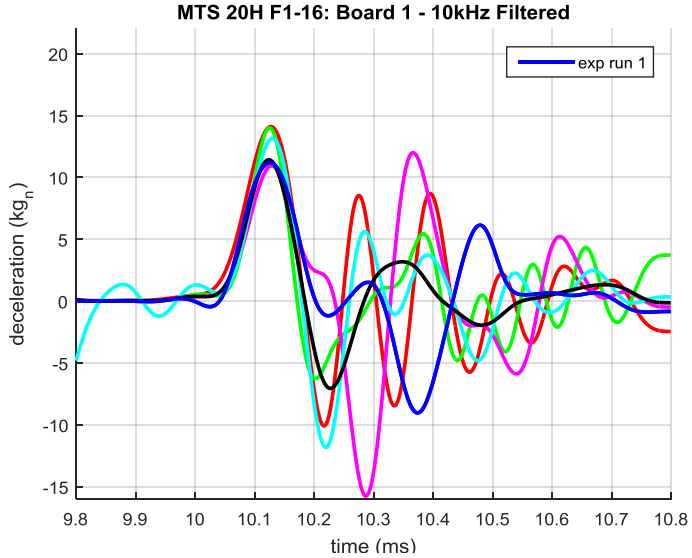
Peak - 11.6 k*g*, Duration – ~0.15 msec

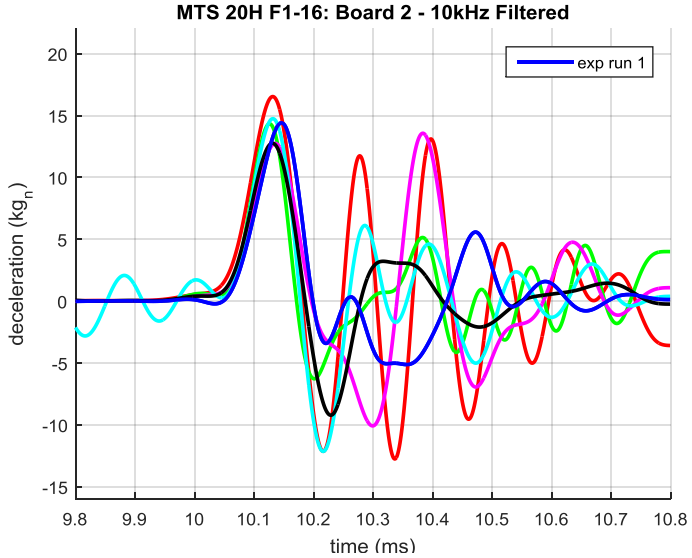


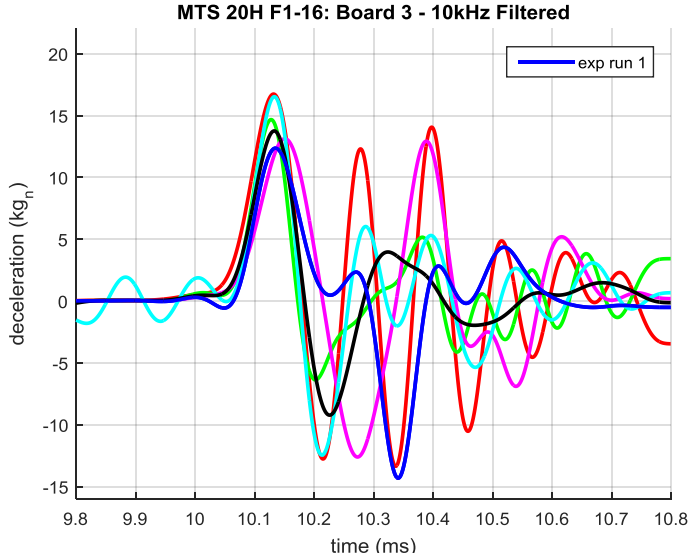
Peak - 15.1 k*g*, Duration – 0.32 msec

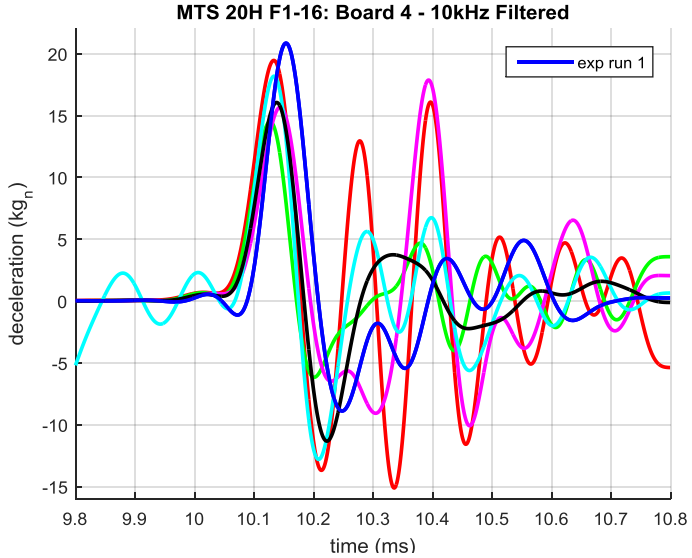
10 kHz Filtered Time History – SD/HF



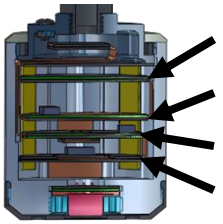


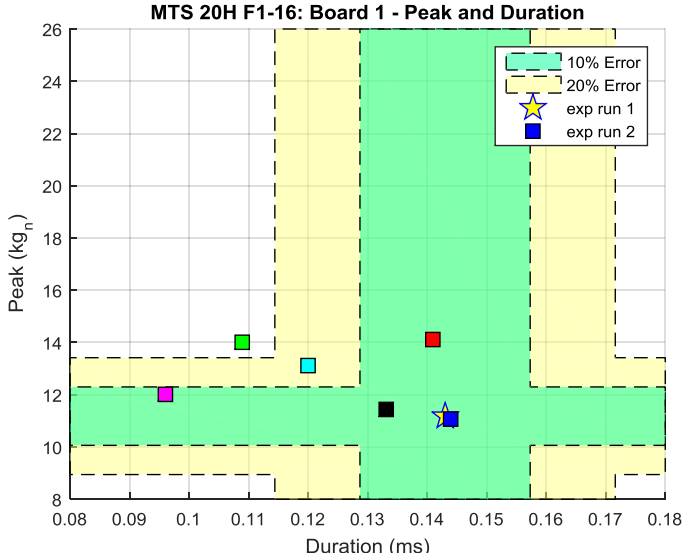


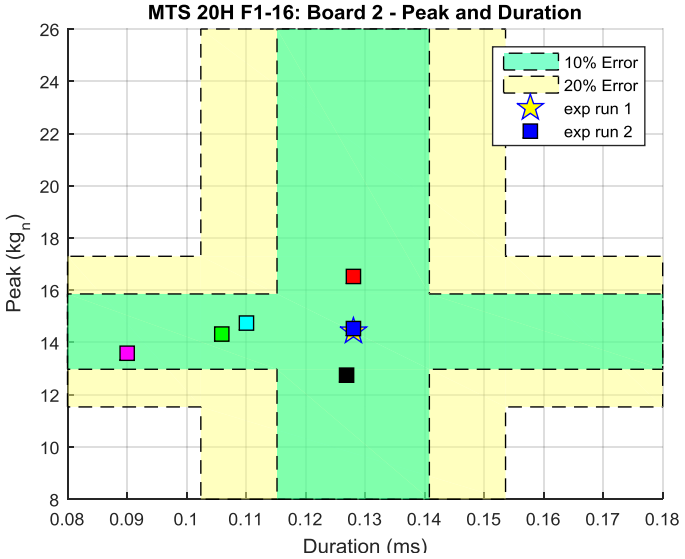


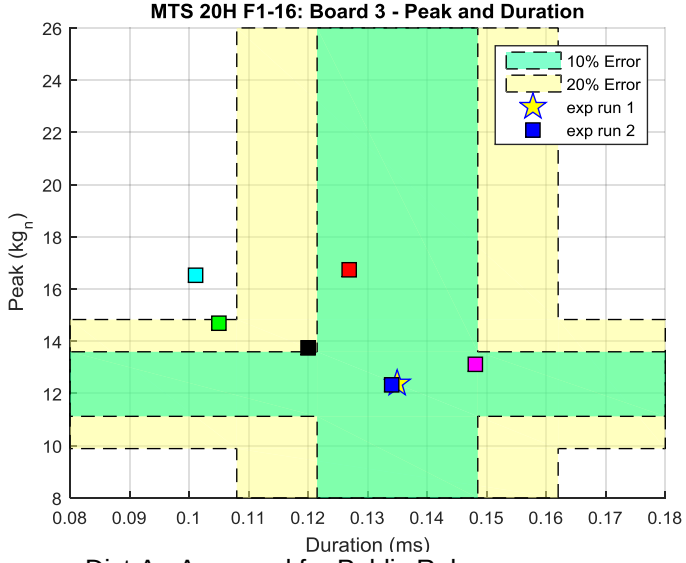


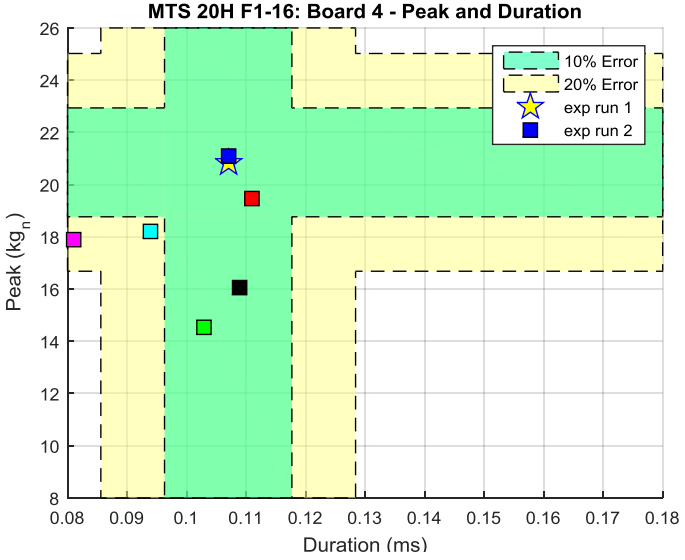
Peak and Duration SD/HF



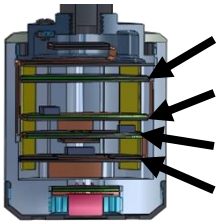


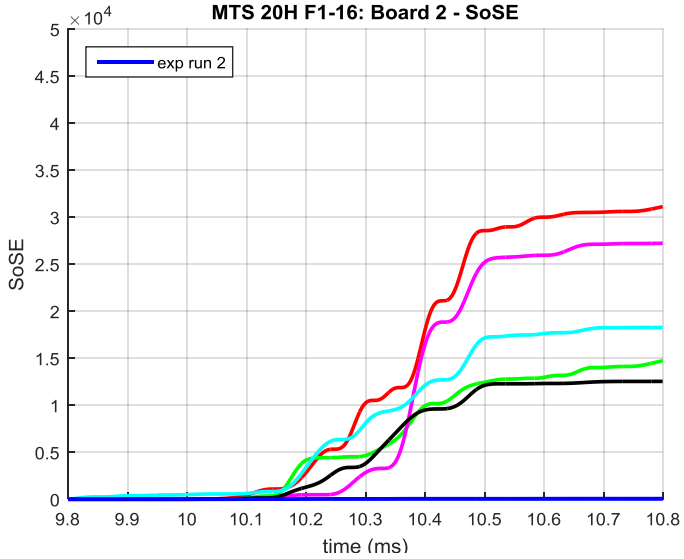


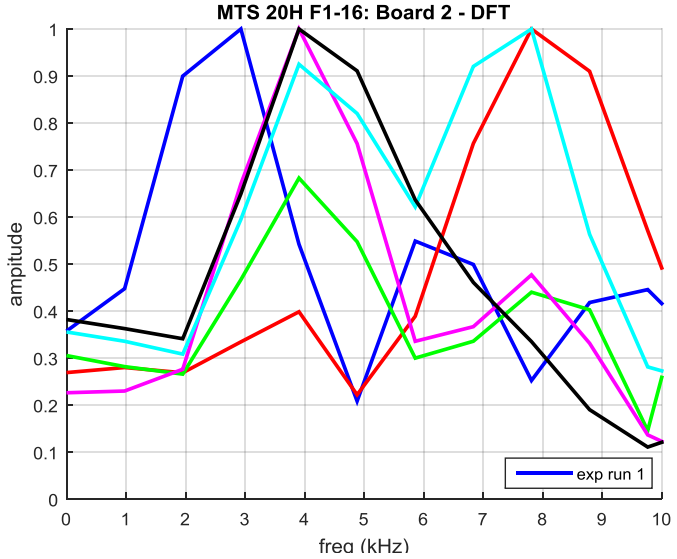


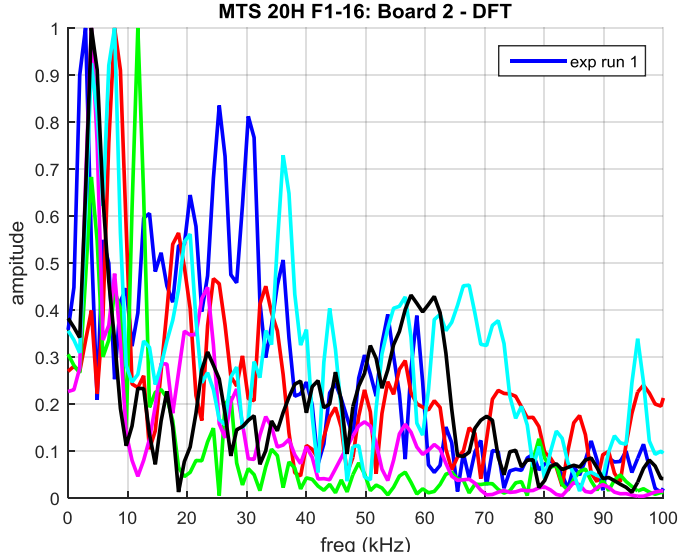


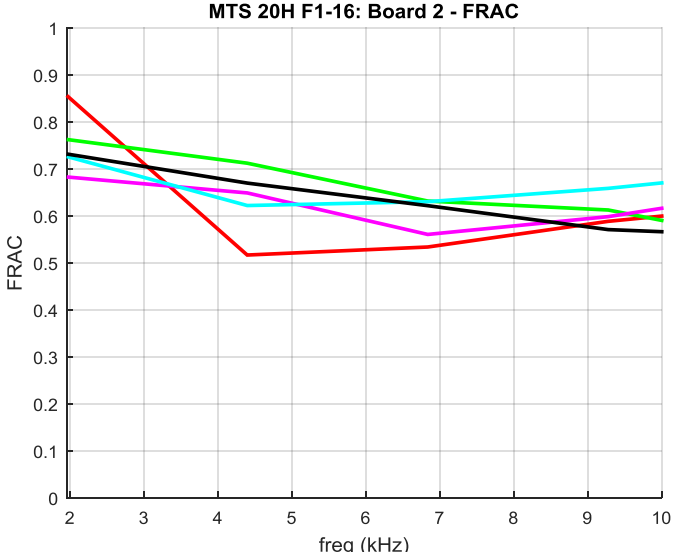
Other Metrics
Short Duration/High Frequency



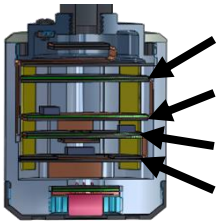


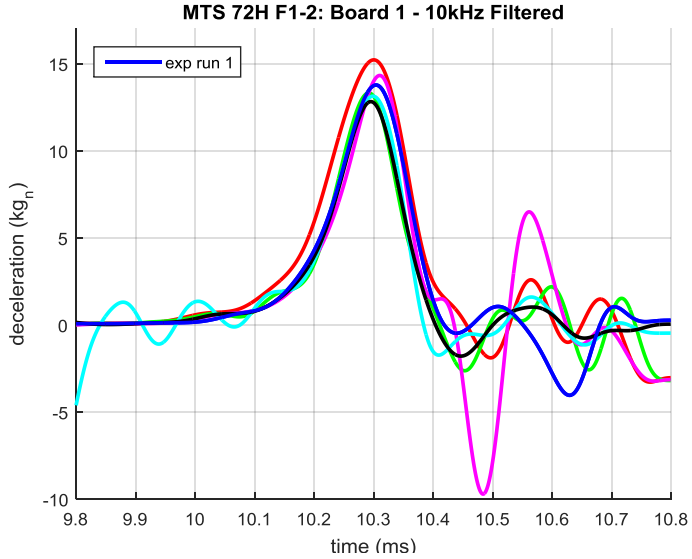


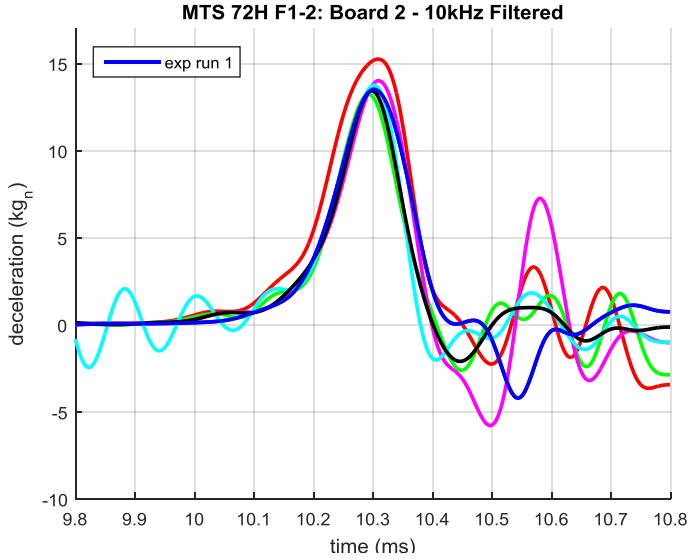


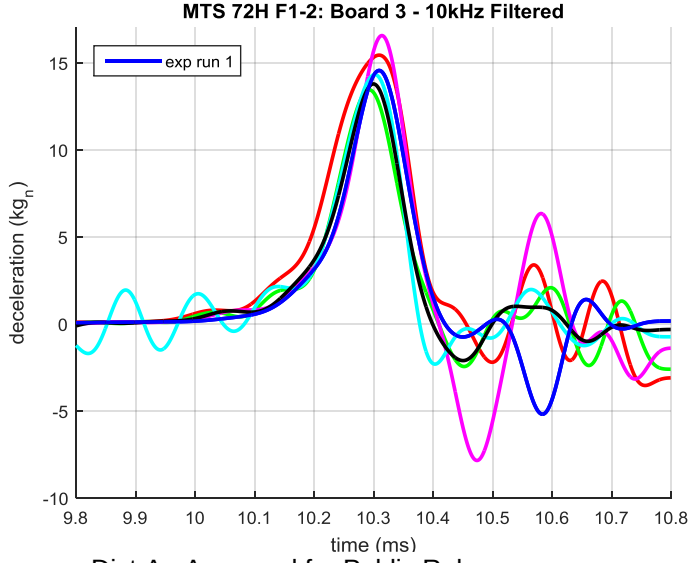


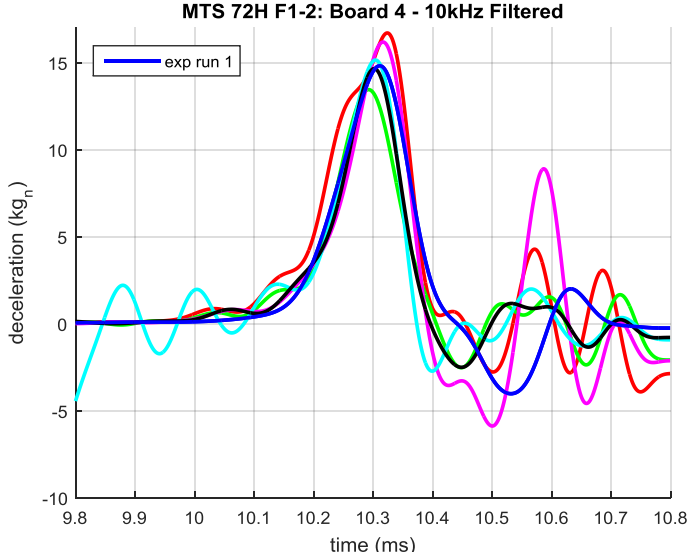
10 kHz Filtered Time History – LD/LF



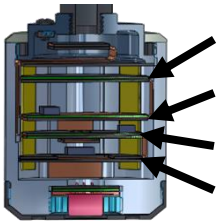


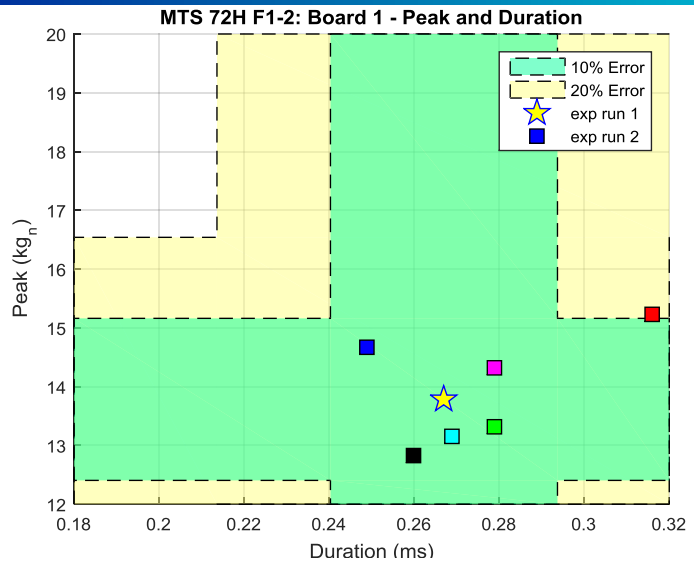


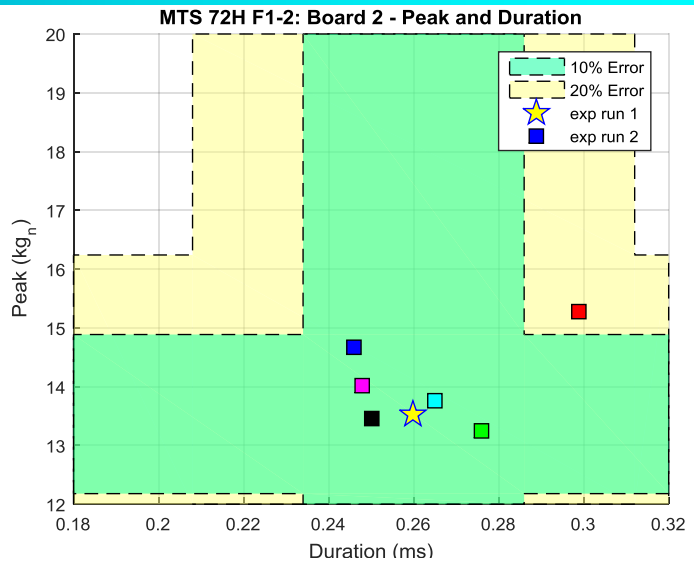


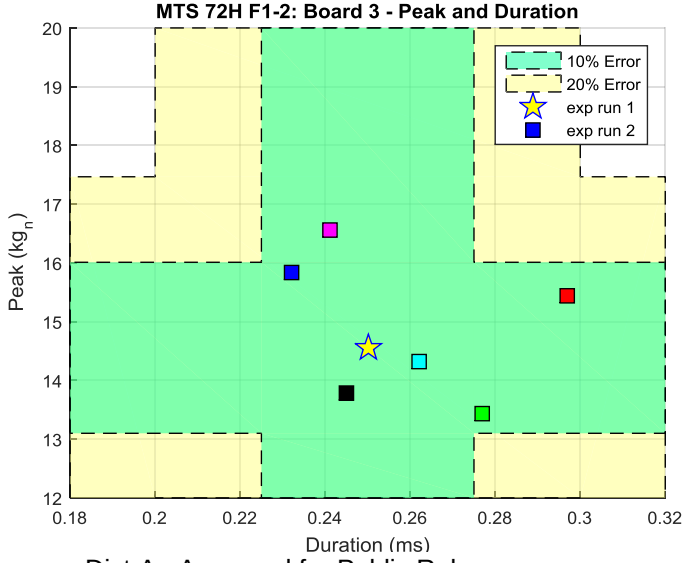


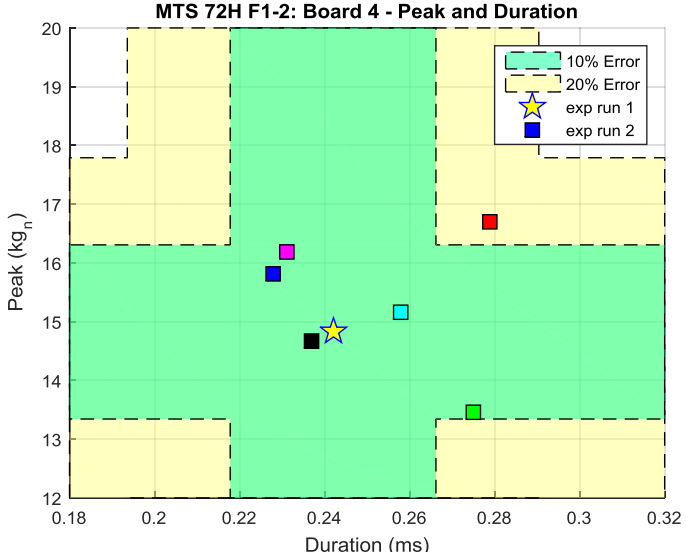
Peak and Duration LD/LF



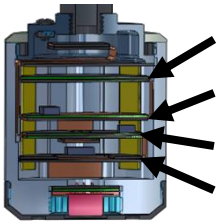


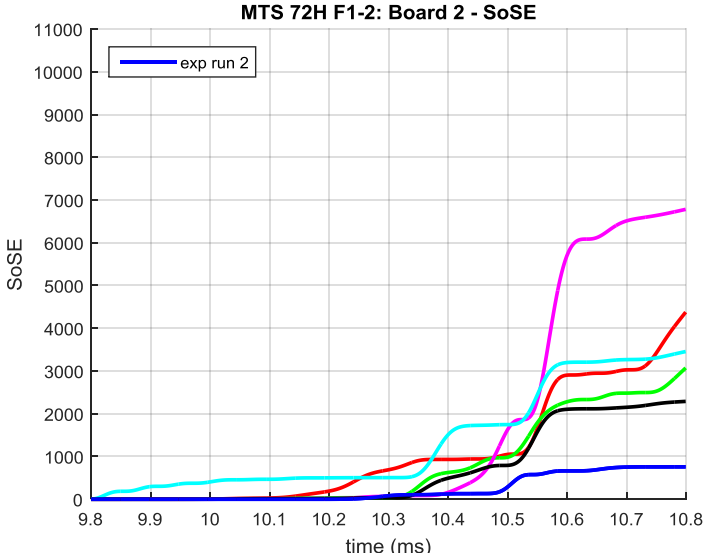


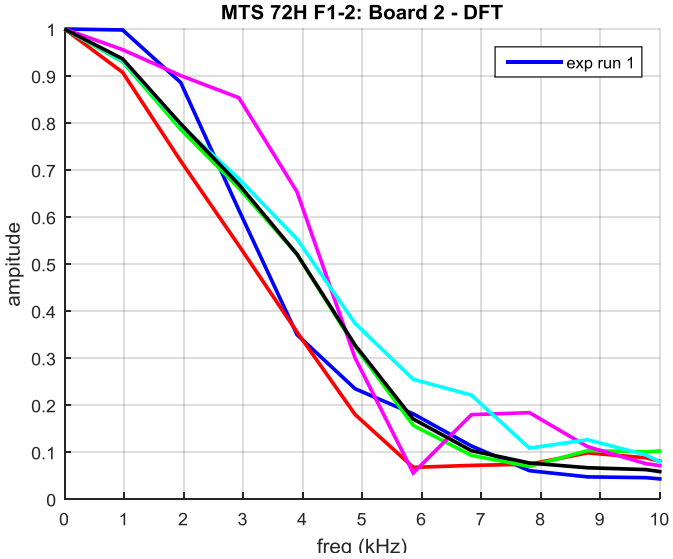


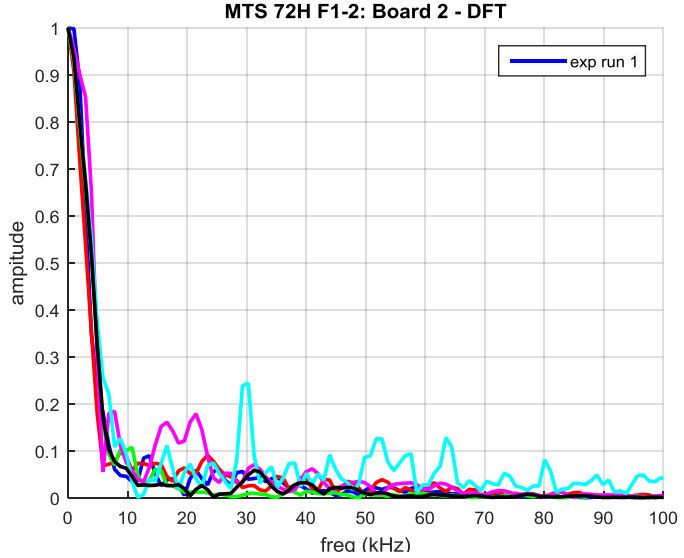


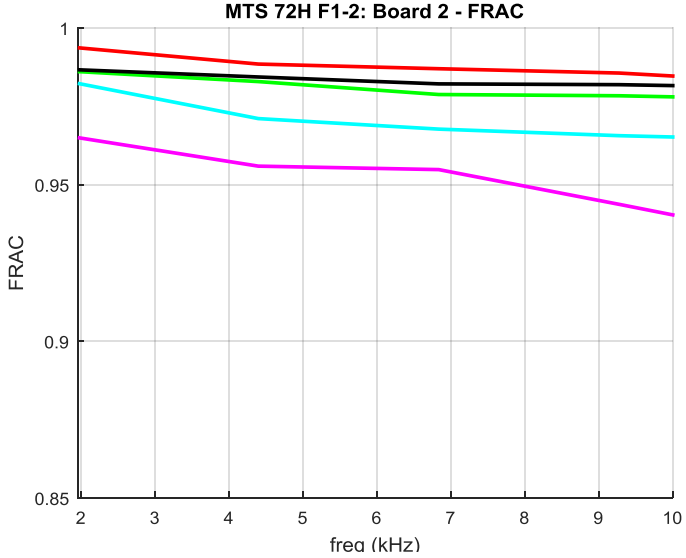
Other Metrics
LD/LF



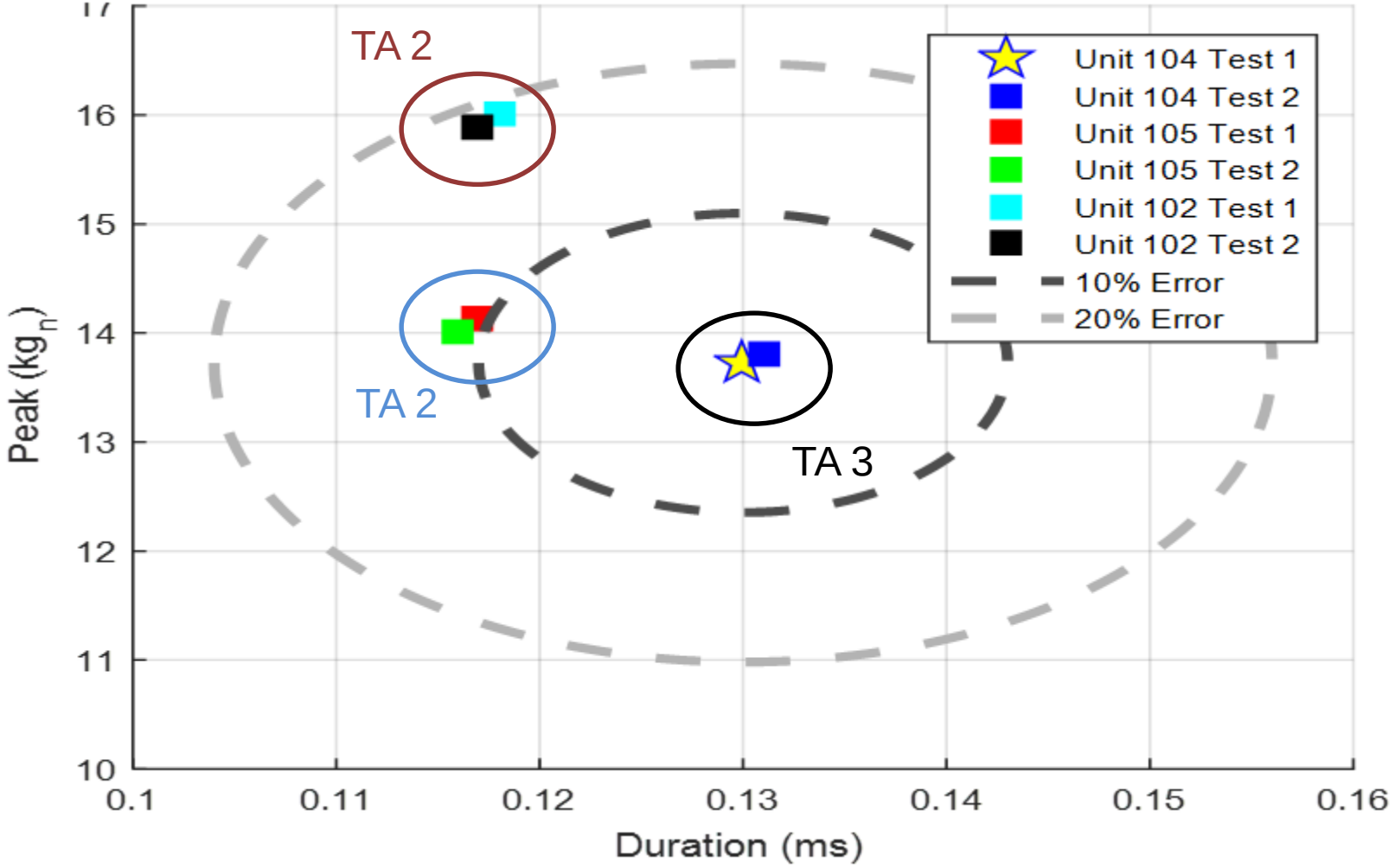






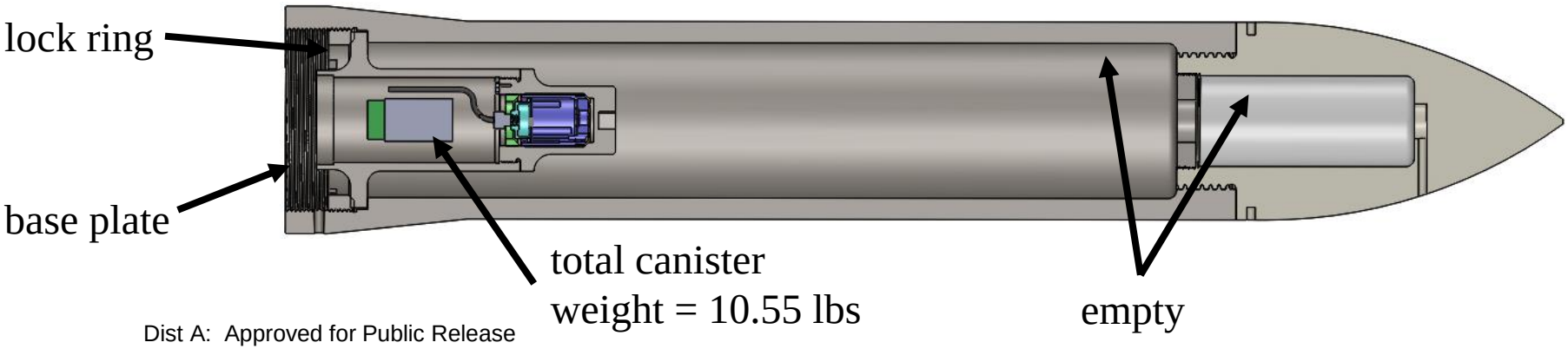


Item to Item Variation

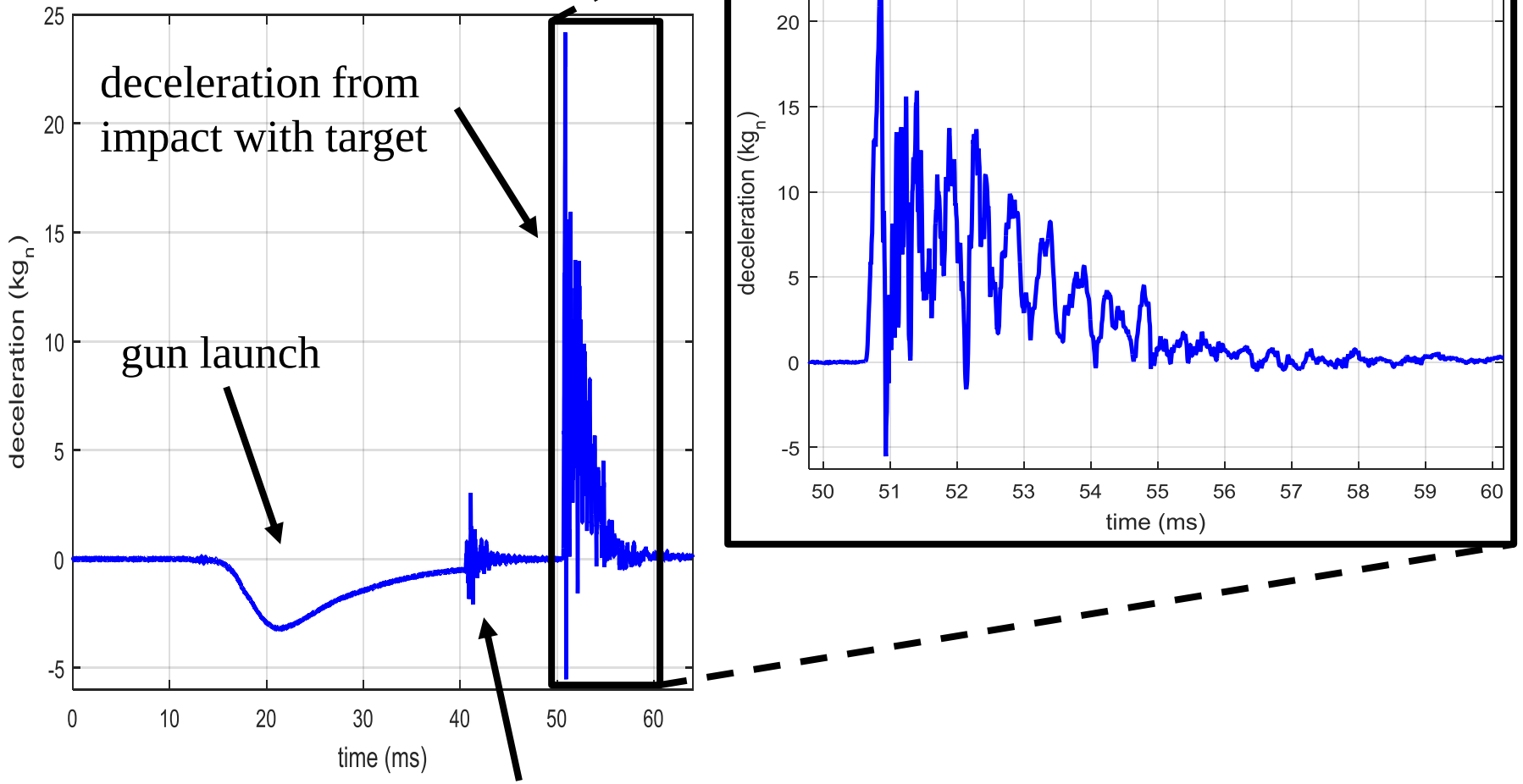


Next Steps

- Performers utilized the same techniques of applying an input load to the fuze component for the penetration test
- Last experiment will include modeling the entire penetration event and predict the response



Cannon Test



End of Program Output

- Best Practices Document is being developed for modeling and experimentation
- Training Class at Shock and Vibration Exchange has been developed based on these outputs
- Data will be shared via DTIC and DoD Fuze IPT to all interested parties

Conclusions

- Very successful with this last prediction
  - Performers believe this is due to experience with these types of predictions
- Initial cannon testing prediction is almost complete
- Final prediction will be an end-to-end penetration prediction
- Project will complete next year
- Best Practices document and presentation will be developed and shared with the DoD and industry