Methodology for Dynamic Characterization of Fragmenting Warheads

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• BOTTOM LINE UP FRONT

1 - PROPOSED METHOD TO ASSESS FRAGMENTATION
    FOR DYNAMIC EVENT
2 – QUESTIONING EXISTING METHODOLOGY FOR
    FRAGMENTATION LETHALITY

• Background/Issues

• Approach

• Test Set-up

• Results/discussion

• Conclusions

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CURRENT METHOD TO ASSESS FRAGMENTATION

- Static ARENA test
  - Statistical representation of the fragmentation
  - Fragmentation File (Z-data file)

- Lethality models use Z-data and dynamic impact conditions
  - Impact velocity, orientation, etc
  - Predict number of impacts on personnel
  - Determine probability of incapacitation, P_I

- Currently no method to correlate to "Dynamic" testing
  - just a probability of achieving a level of Incapacitation
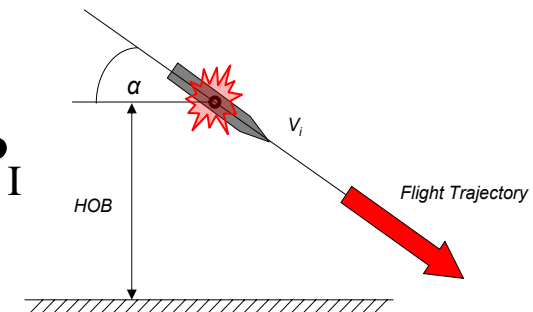
Z-data file established

P_I for impact condition computed

Performed dynamic event

  mannequins assessed for lethality

  all personnel fell within bands (P_I +/-)

ISSUE - no statistical correlation to fragment spray

- Goal:
  - Demonstrate method to collect fragmentation data in a dynamic event to produce higher statistical confidence in results

- Evaluation Concept:
  - Use warhead with well established Z-data file
  - Collect fragment spray via metallic witness panels located in an arena arrangement
  - Compare perforations in the panels from the detonated warheads to those predicted using the static arena file
    - Static event – no projectile velocity, *serves as a baseline*
    - Dynamic event - incoming velocity will be applied

- 105mm HEP round
    - inventory since 1970s
    - new Z-data file recently produced
- Metallic Witness panels

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Statically detonated from Platform

One side of Panel Arrangement

Test Setup:

Collect fragmentation with metallic panel array in "arena"

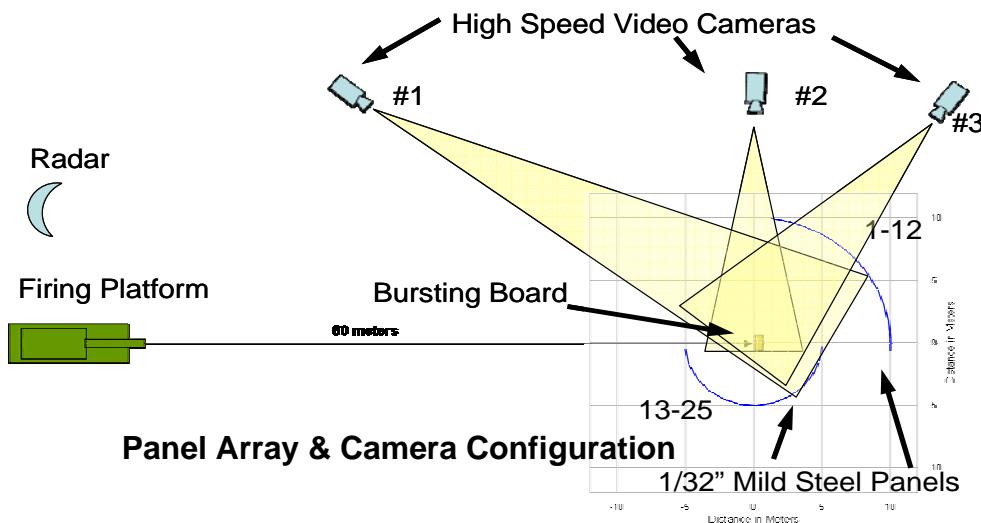Dynamic – fire 105mm HEP projectile through wood to detonate

Static – statically detonate HEP projectile

Measurements:

Panel array surveyed prior to test

Photograph panels, use image software to record position of impacts

Dynamic – use radar and video to determine impact velocity and location of warhead when it burst

High Speed Video Cameras

#1   #2   #3

Radar

Firing Platform

60 meters

Bursting Board

1-12

13-25

1/32" Mild Steel Panels

Panel Array & Camera Configuration

Distance in Meters

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| Test Number	Detonation Condition	Velocity Muzzle/Striking (m/s)	Test Objective	Result
1	Dynamic	LOST	Verify fuze function on the selected target material.	Proper fuze function
2	Dynamic	759 / 746	Verify fuze function on the selected target material	Proper fuze function
3	Dynamic	763 / 751	Collect dynamic distribution of fragments from the witness panels	Distribution Collected
4	Dynamic	758 / 744	Collect dynamic distribution of fragments from the witness panels	Distribution Collected
5	Dynamic	758 / 747	Collect dynamic distribution of fragments from the witness panels	Distribution Collected
7	Dynamic	754 / 744	Collect dynamic distribution of fragments from the witness panels	Distribution Collected
8	Dynamic	762 / 749	Collect dynamic distribution of fragments from the witness panels	Distribution Collected
9	Static	N/A	Collect static distribution of fragments from the witness panels	Distribution Collected
11	Static	N/A	Collect static distribution of fragments from the witness panels	Distribution Collected

All Evaluated a 90º Attack Angle and 0º Azimuth

Test Number	Detonation Condition	Velocity Muzzle/Striking (m/s)	Test Objective	Result
2	Dynamic	774 / 761	Collect dynamic distribution of fragments from the witness panels	Distribution Collected
3	Dynamic	761 / 749	Collect dynamic distribution of fragments from the witness panels	Distribution Collected
4	Dynamic	759 / 746	Collect dynamic distribution of fragments from the witness panels	Distribution Collected
5	Static	N/A	Collect static distribution of fragments from the witness panels	Distribution Collected
6	Static	N/A	Collect static distribution of fragments from the witness panels	Distribution Collected

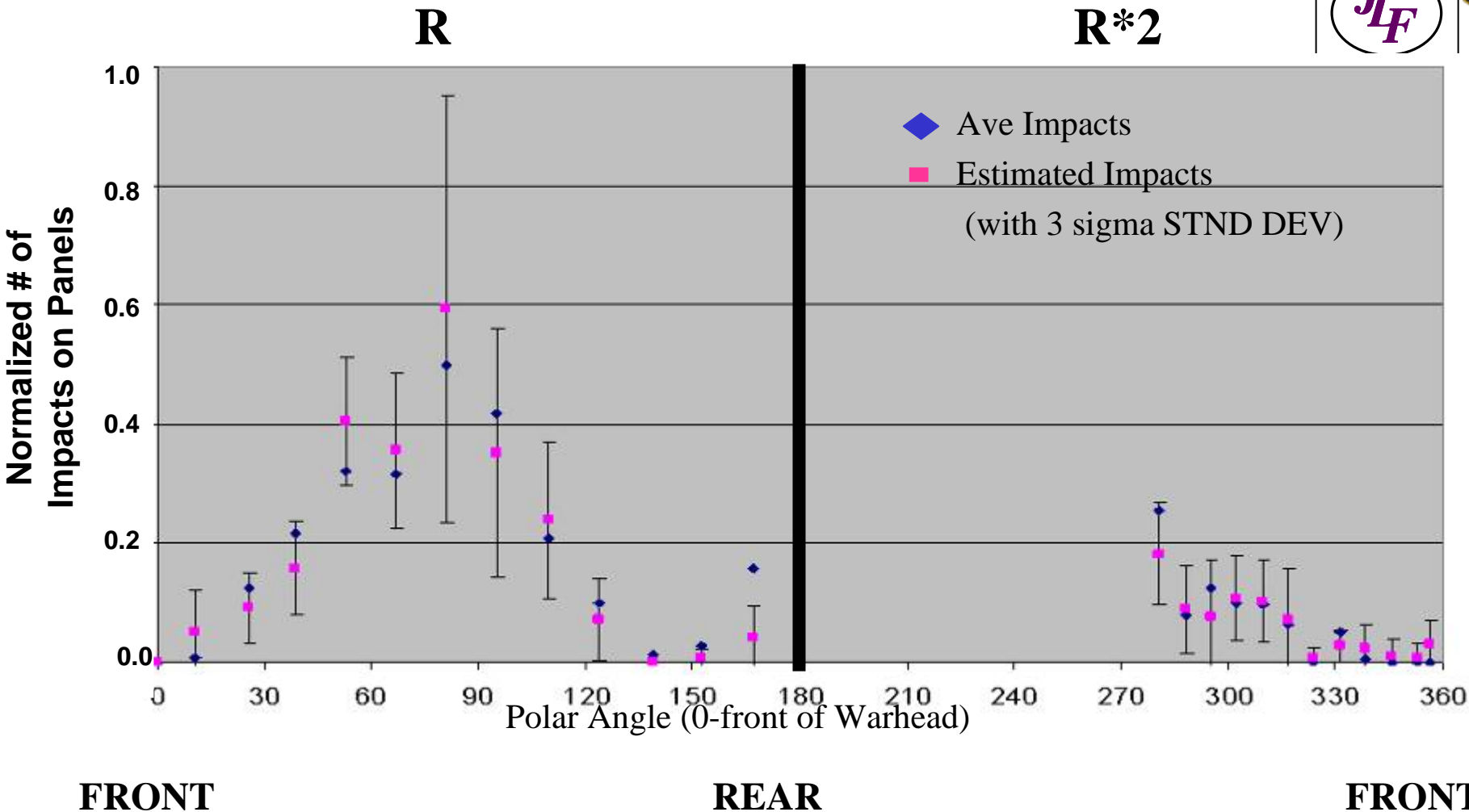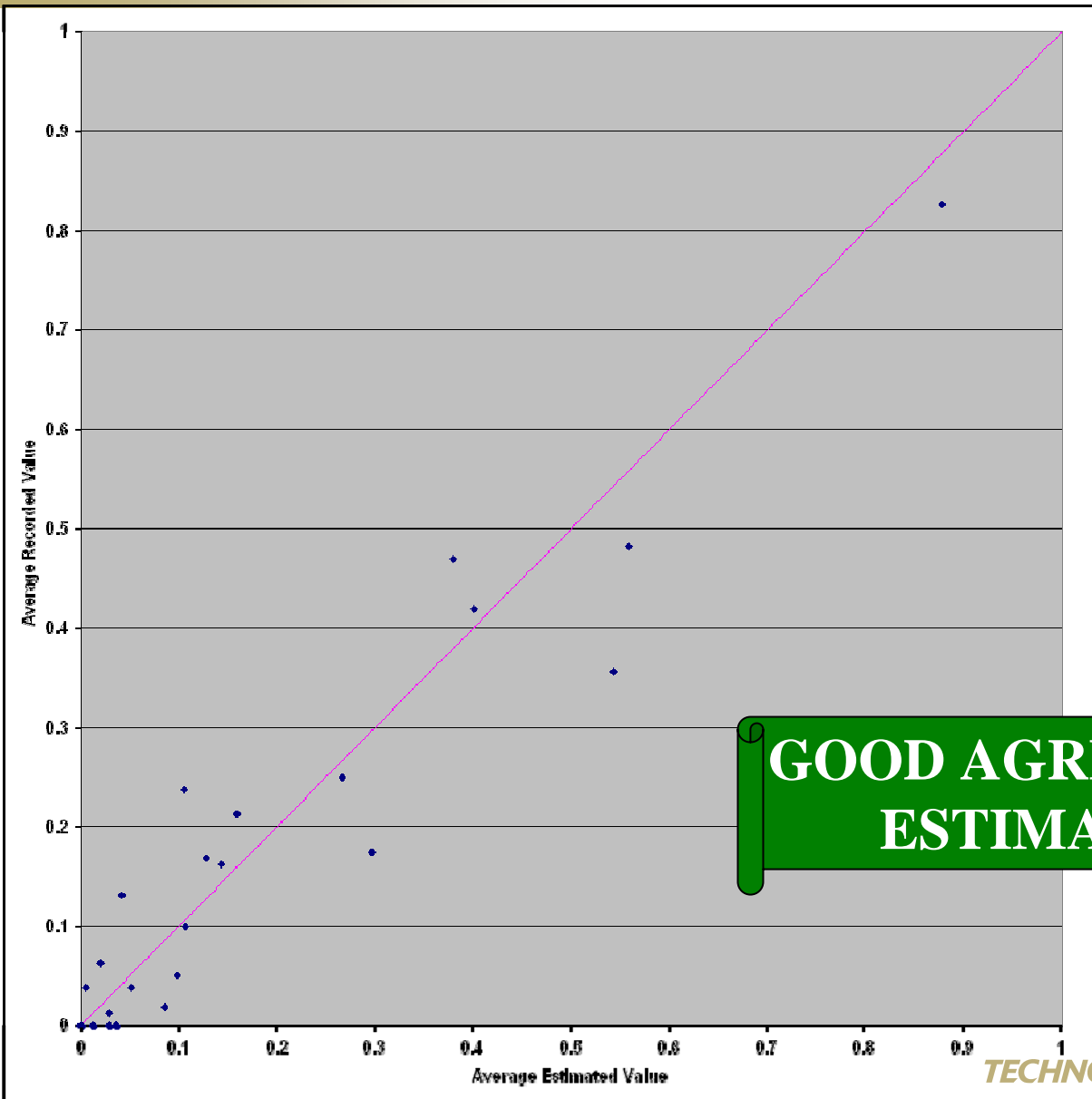## All Evaluated a 90° Attack Angle and 0° Azimuth

Dynamic shot

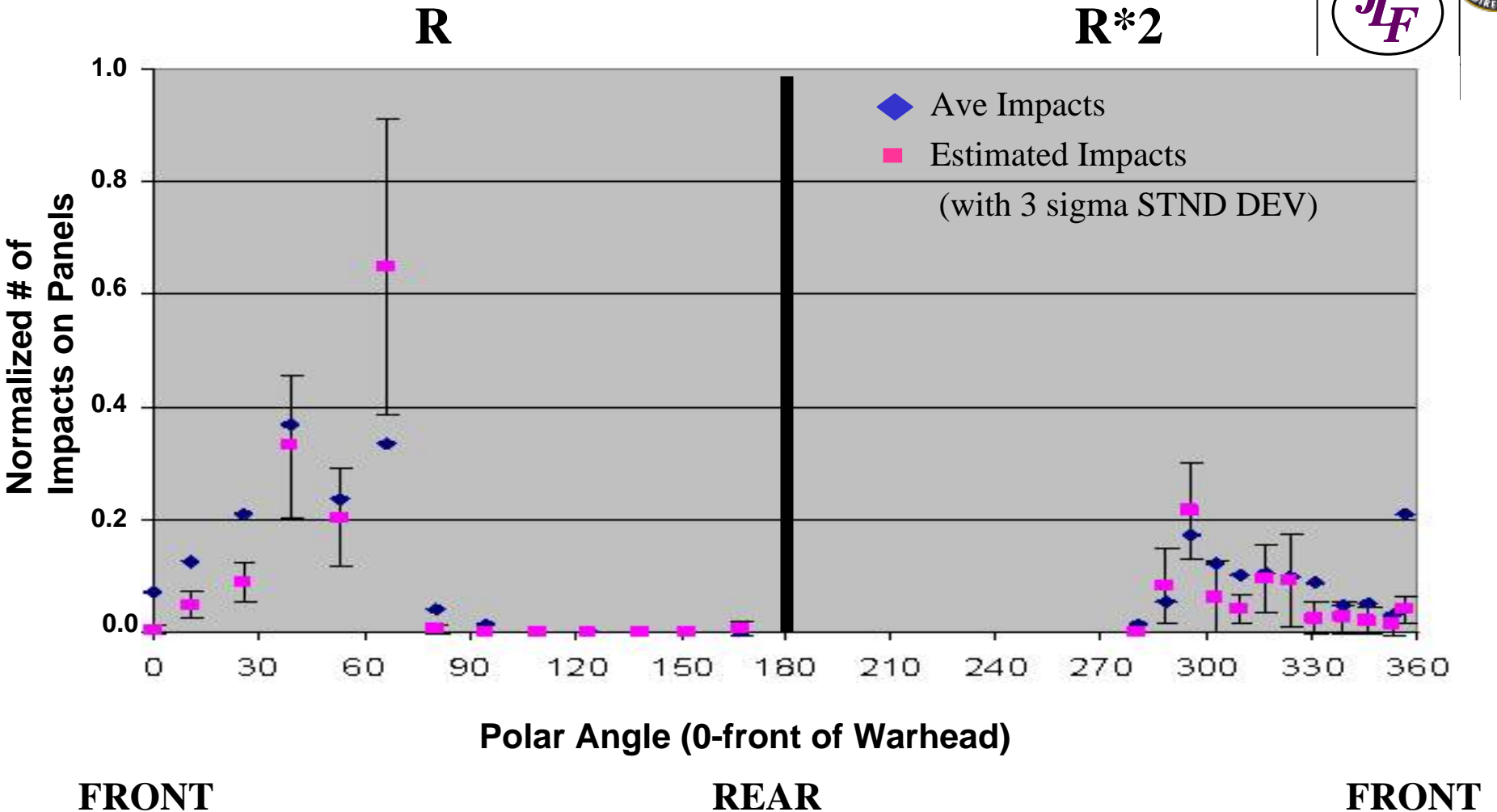**Panel Array**

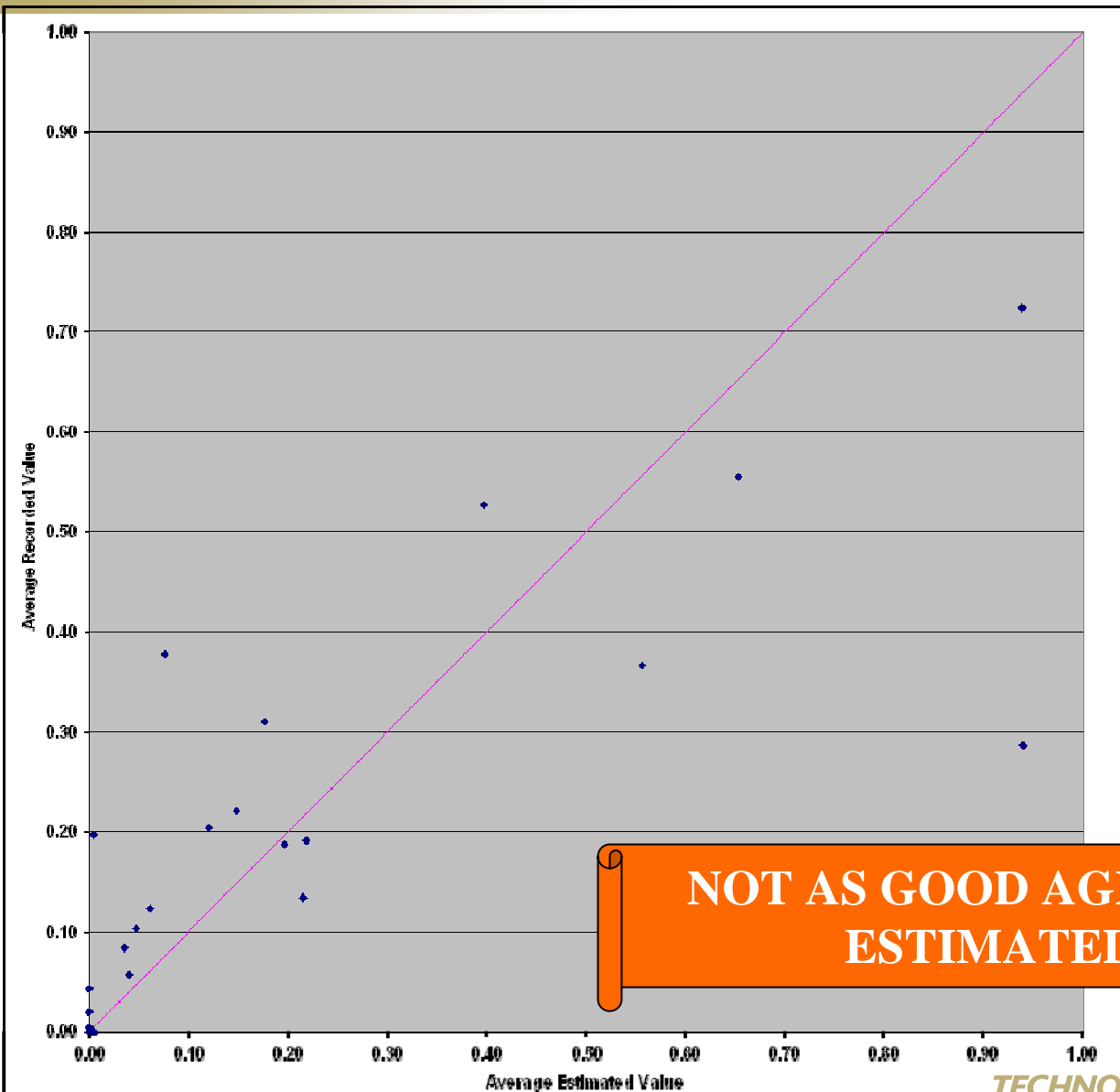POLAR ANGLES DEFINED

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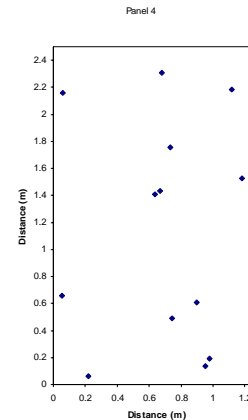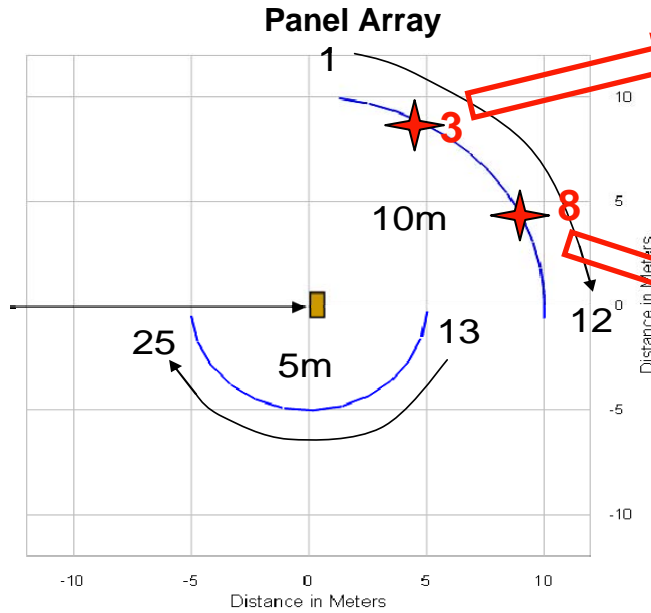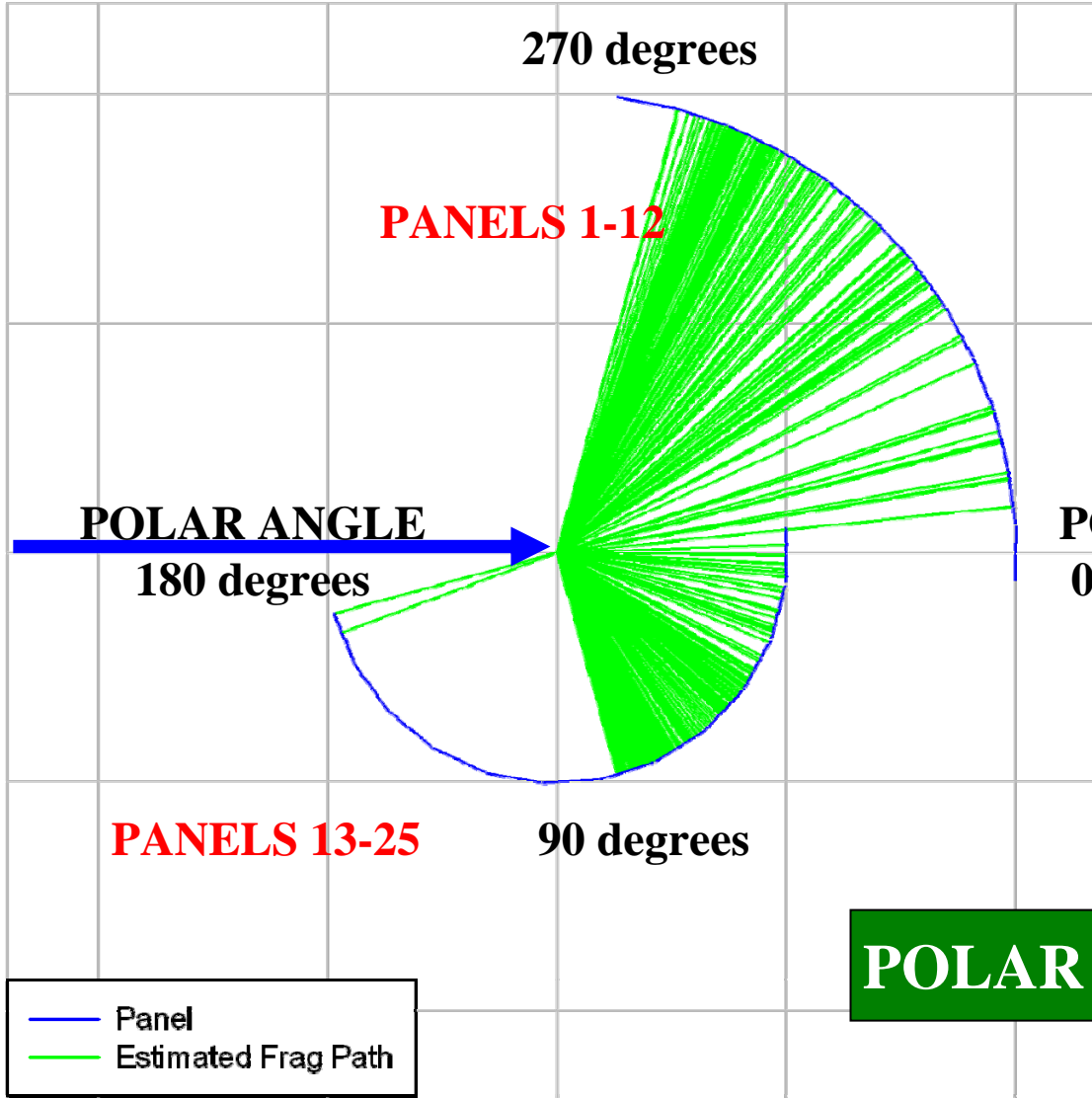
Good Correlation Between the Mean Static Estimate and The Mean Recorded Value.

GOOD AGREEMENT BETWEEN ESTIMATED & ACTUAL

Overestimate of fragments in the beam spray.

Underestimate of fragments in the nose and tail regions.

NOT AS GOOD AGREEMENT BETWEEN ESTIMATED AND ACTUAL

Static evaluation - good agreement

Dynamic estimates show less fragments in the front

Implications of differences in results

 Interaction of warhead expansion with wood during the dynamic detonation

 Parasitic debris from warhead is hitting panels in front for dynamic event

 Accuracy of fragment velocities of Z-data file more of an effect on dynamic event

  - May need a new format for Z-data (3-dimensional)

 Need to evaluate other warheads under same controlled conditions to prove theory

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Method collects data over a much larger range than previously gathered for dynamic events

This wider area results in a much greater confidence in verifying performance of fragmenting warhead

Review Current Z-data (arena) methodology

SUGGESTIONS:

1) Add metallic witness panels on "Live-Fire" evaluations
2) Include an intermediate evaluation with metallic witness panels prior to "Live-Fire" evaluations
3) Review fragmentation Evaluation methodolgy

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DEMONSTRATED SIMPLE METHOD
THAT VERIFIES THE
OVERALL SPREAD OF FRAGMENTS
IN DYNAMIC EVENT

OBSERVED ISSUES WITH CURRENT
Z-DATA FILE METHODLOGY

QUESTIONS ????

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