image SYSTEMS
MOTION ANALYSIS

FRAGMENTATION ANALYSIS
TRACKEYE ARENA

Fragmentation Analysis

When it comes to fragmentation test, it is impossible to use a classic 3D configuration for measuring the spatial repartition of fragments due to the high number of pieces which can mask each other.

TrackEye Arena offers an alternative solution where one or several screens with possibly different thicknesses or materials are positioned at a certain distance from an exploding device and monitored by a high speed camera.

When the mortar detonates, shrapnels and particles will scatter and pierce the panels producing bright spots on the image with the shape of the fragment.

The TrackEye software offers then a combination of dedicated statistics modules to characterize the flying particles impacting the screens for a qualitative understanding of the fragmentation test. The 3D location, angular dispersion, time of first appearance, and shape of each of the panel holes is detected automatically by the TrackEye Arena algorithms. All results are presented in various diagrams including a 3D reconstruction of the fragmentation test even when using one camera only.

The TrackEye ARENA solution is a world standard for fragmentation tests and is being widely used by defence research laboratories and proving grounds throughout the world.

CONCEPT OF TRACKEYE ARENA

1. An explosive device is placed on a detonation plateform to ensure the fragments will hit the ARENA panels before reaching the ground.

2. Those panels are surveyed using reference markers in a common 3D coordinate system with origin on the mortar. They can be placed at different distances, have different thickness and material properties. Generally Static 3D photogrammetry toolkit is used to easily survey the position of each panel.

3. High-speed cameras are placed behind shields with reinforced screens to protect them from fragments (require lens calibration) while recording the fragmentation event. Each camera is observing one or a set of calibrated panels. The exposure must be short and the lens aperture low to ensure sharp detection. An image of the setup must be captured in low light mode to see reference markers on the panels and get the orientation of the camera.

4. After the exploding device is triggered, shrapnel and fragments are scattered and will penetrate the calibrated panels. The recorded images are loaded into the TrackEye software.

5. TrackEye Arena automatically detects the bright spot on the images created by each fragment perforating the monitored panels. The hitting time, mean velocity, angular position (azimuth and elevation) and 3D position of each fragment is calculated along with some statistics on the shape of the hole.

6. After the test, the Static 3D system can capture a high-resolution photograph of the impacted screen against contrasted background and confirm the number of fragments detected.
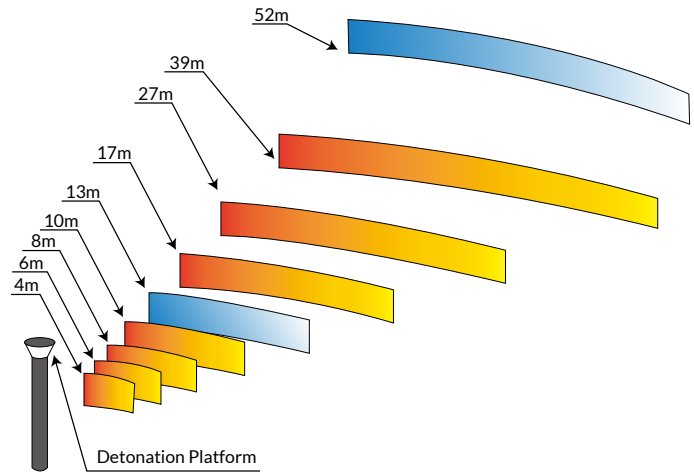
FRAGMENTS CAPTURING PANEL ARRAY
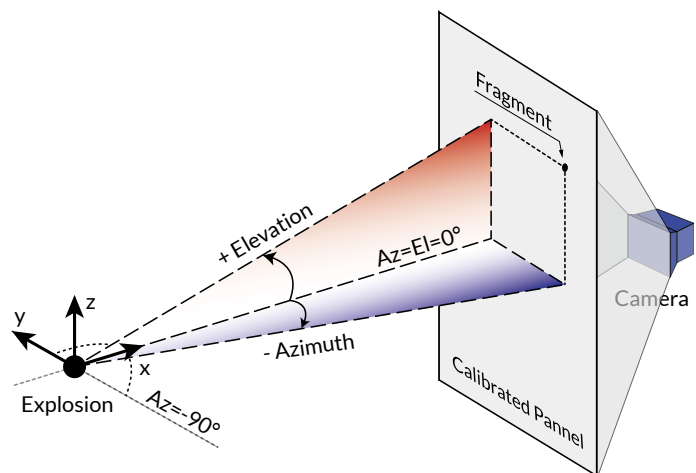
ADVANCED CALIBRATION AND SURVEY

Smart Lens Calibration Board:
Precise focal length & Lens distortion calibration for ultra-wide and fish-eye lenses

- Robust material and protection
- Multiple sizes covering A1-A7 format
- High accuracy and excellent flatness 0.1mm
- Pattern Auto Recognition

Static 3D Toolkit:
Photogrammetry solution for large scale 3D survey

SYSTEM COMPONENTS

◆ High-Speed Imaging System
  ◇ High-Speed Cameras
  ◇ Long Range Lenses
  ◇ Switch & Workstation
◆ Trigger System
  ◇ BNC / RS-485 Signal
  ◇ Optical Signal
◆ Photogrammetry Toolkit
  ◇ Calibrated DSLR
  ◇ Lens Calibration Board
  ◇ Range Finder
◆ Fragment Capturing Panels
◆ TrackEye Arena Software

DATA OUTPUTS

● Time of impact
● Area of impact
● Azimuth & Elevation angles of hit
● Panel hit (in multi-screen scenario)
● Average speed to screen for fragments
● Max, min, mean of these averages for fragments
● Fragments speed vs. angle
● Number of fragments vs. angle
● Statistics on shape of fragments

ARENA ADVANTAGES

TrackEye Arena [A] versus traditional laser sensor [L] solution

[A] Ultra-high Resolution achieving better than 1mm accuracy
[L] Minimum 5mm laser gate array

[A] Higher time resolution for ultra-fast fragments
[L] Maximum 4,000 m/s detection

[A] 3D visualization to show detected fragments ejected and hit panels at different distances and angles
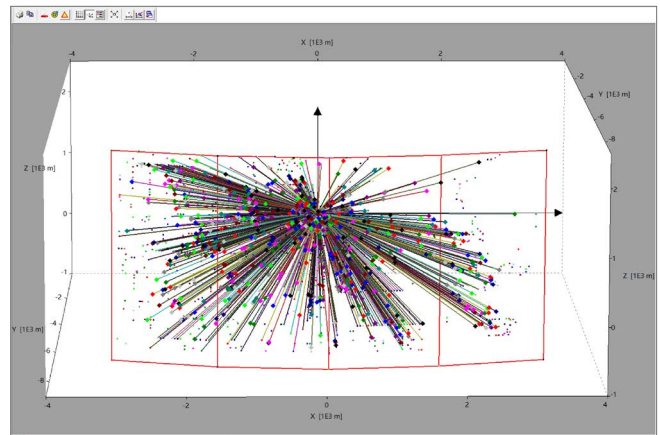[L] Low accuracy 2D diagram and 3D data only

STEP 1:
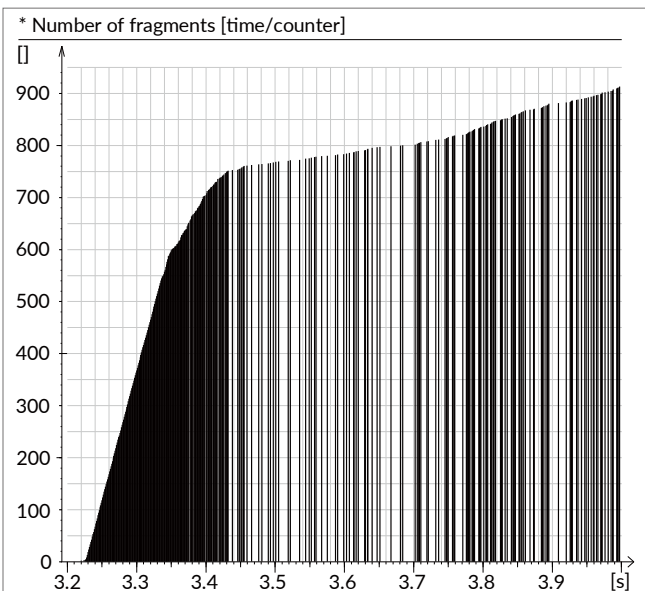Automated detection of hits on the panels
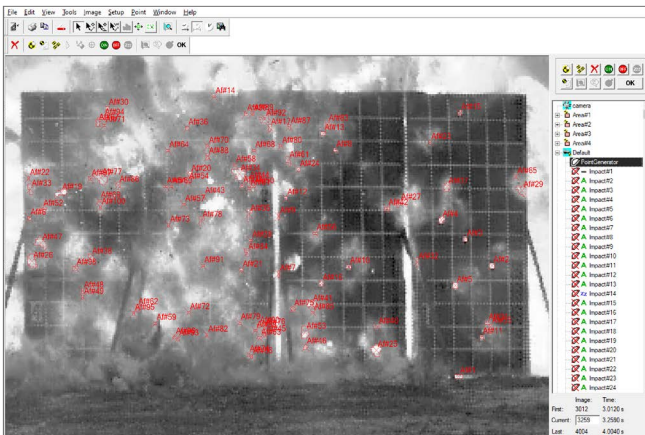
STEP 2:
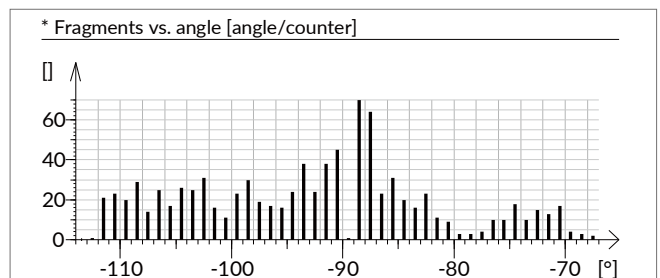3D visualization and video report for hit positions

STEP 3-1:
Export statistics and diagrams

STEP 3-2:
Export statistics and diagrams

image
SYSTEMS
MOTION ANALYSIS
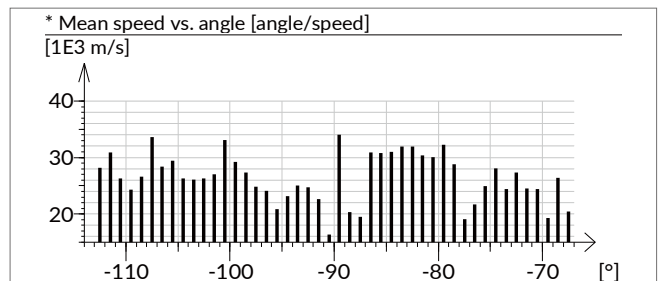
Trusted by over 50 test ranges in 140 countries...

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Agency for Defense Development

roketsan

RAFAEL
SMART AND TO THE POINT

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