

DEPARTEMENT: STRUCTURES & EFFECTS OF EXPLOSIONS
GEORGIOS KECHAGIADAKIS

12 September 2025



DEFENCE

■ STEE



Contents

1

The Department STEE

2

Blast waves in complex urban configurations

3

Damage of structures under blast loading

4

Combined fragment impact and blast loading

5

Final Words



DEFENCE



STRUCTURES & EFFECTS OF EXPLOSIONS

STE.E

Protection Engineering

Research Axes

PYROSHOCK



LUC MASSET
SENIOR RESEARCHER

BLAST WAVES IN COMPLEX URBAN CONFIGURATIONS



BACHIR BELKASSEM
SENIOR RESEARCHER



JASPER DEVRIENDT
ASSISTANT



DAVID LECOMPTE
HEAD OF STEE

DAMAGE OF STRUCTURES UNDER BLAST LOADING



MOHAMED BENRHOUMA
RESEARCHER

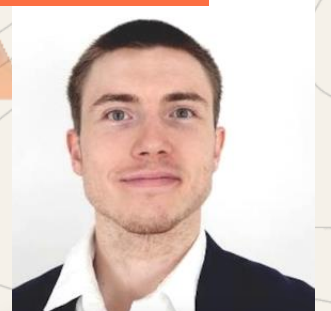


WALID KRAIEM
RESEARCHER

COMBINED FRAGMENT IMPACT & BLAST LOADING



GEORGE KECHAGIADAKIS
SENIOR RESEARCHER



TOM GERLACHE
RESEARCHER



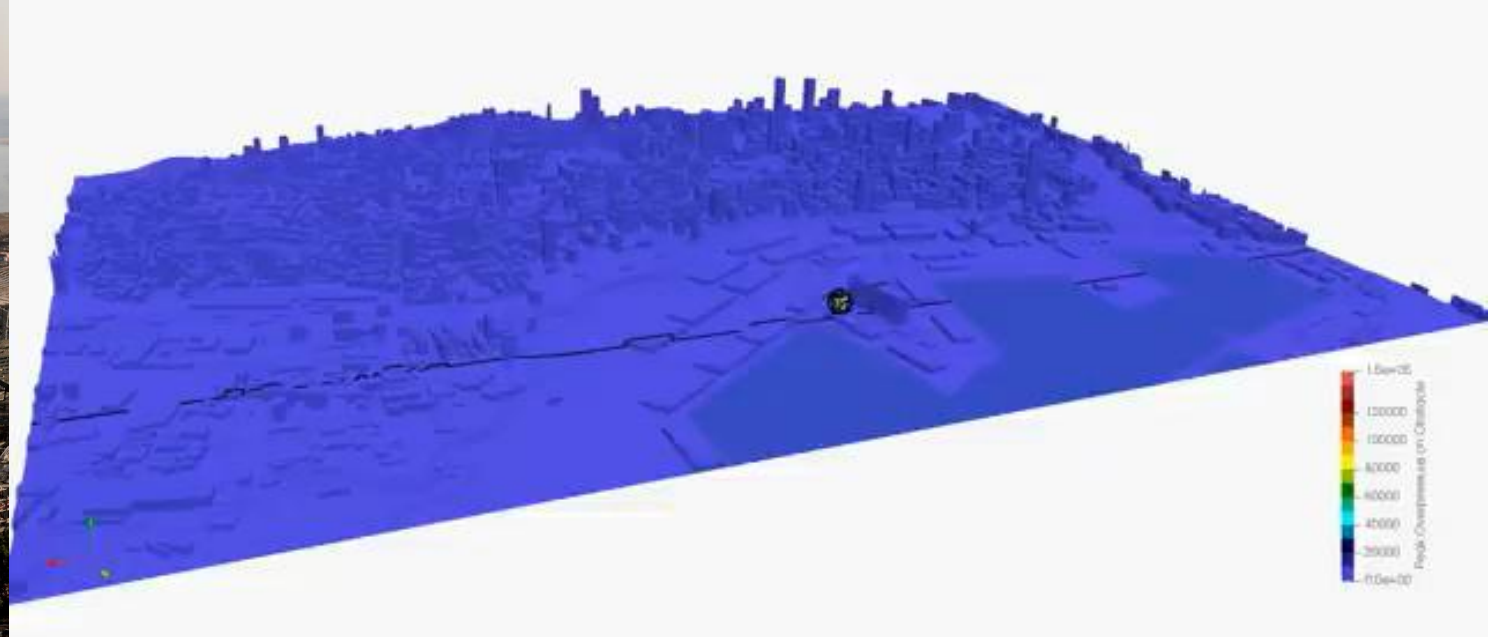
MAXIME TORRESE
RESEARCHER



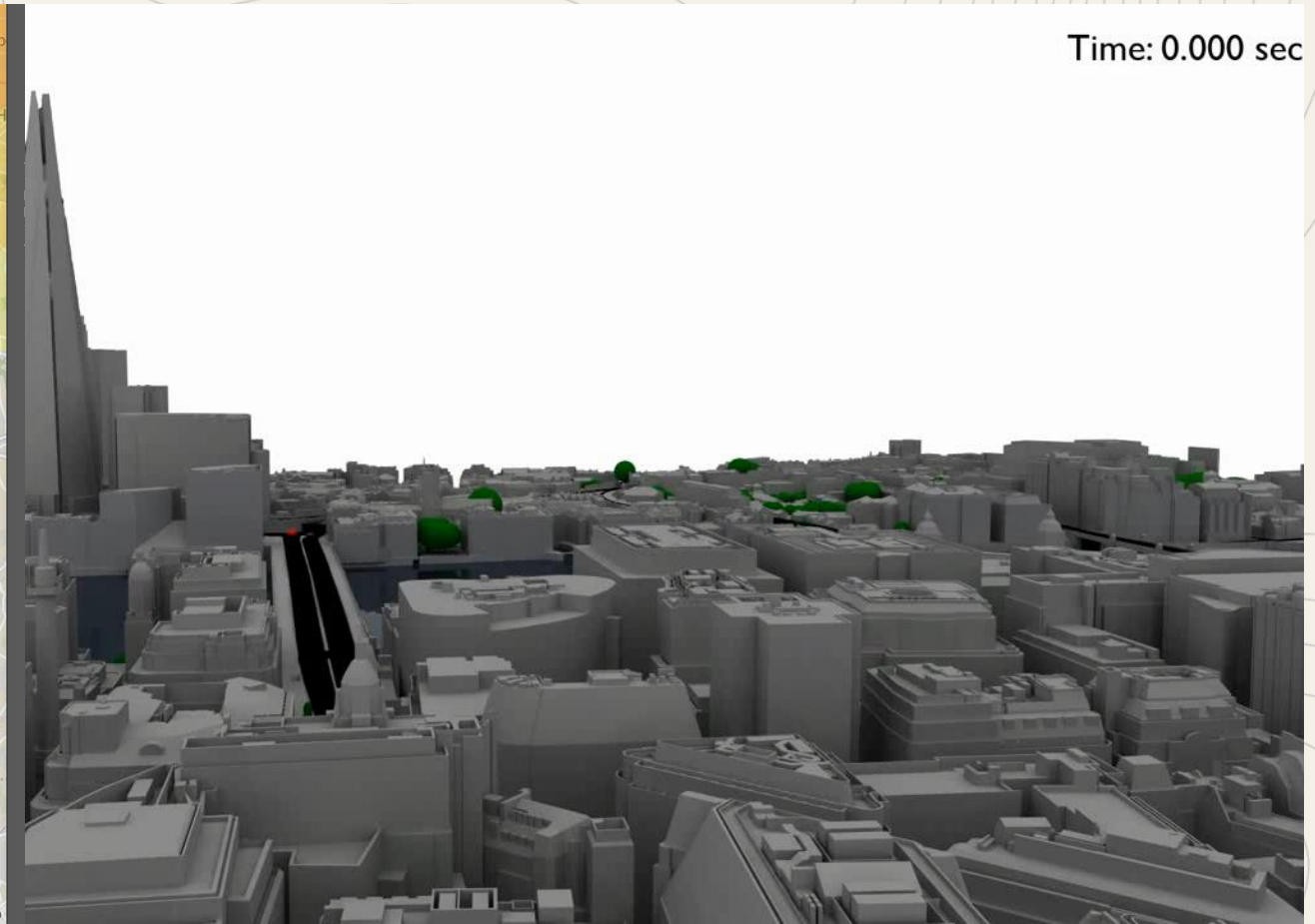
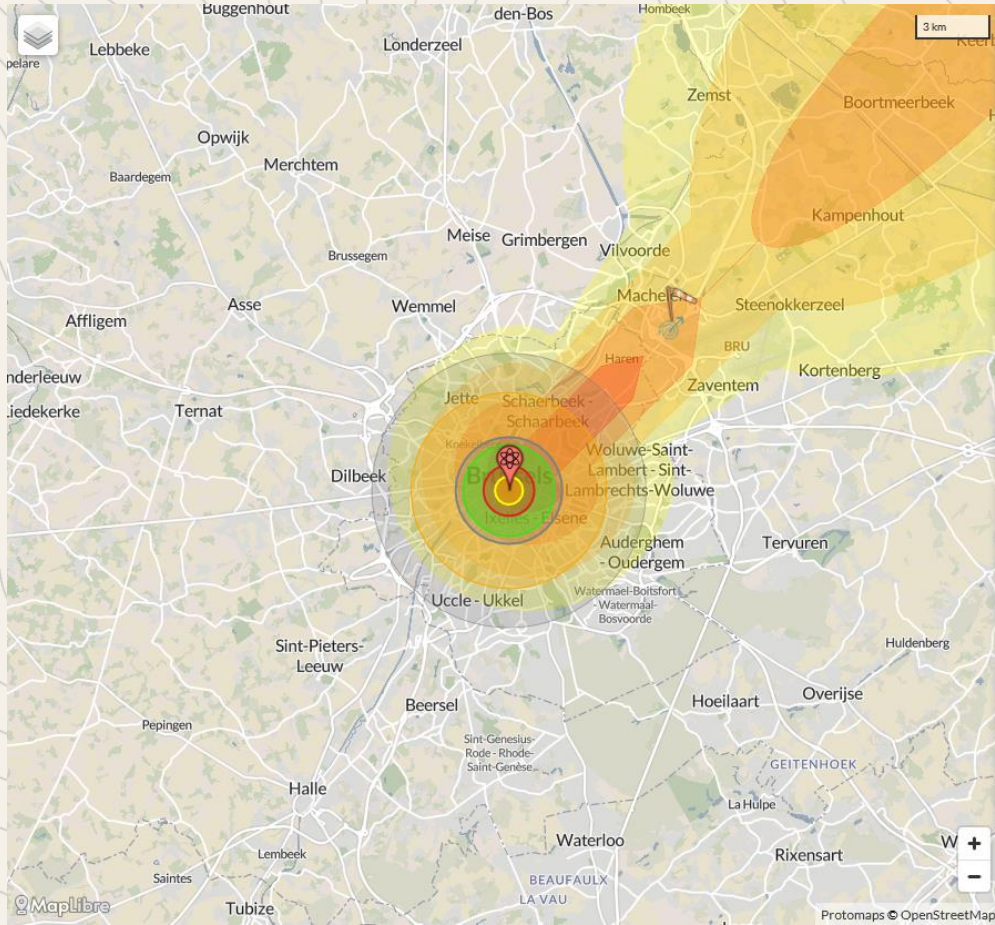
ABDELRAHMAN MYSARH
RESEARCHER

Blast waves in complex urban configurations

Beirut 2020



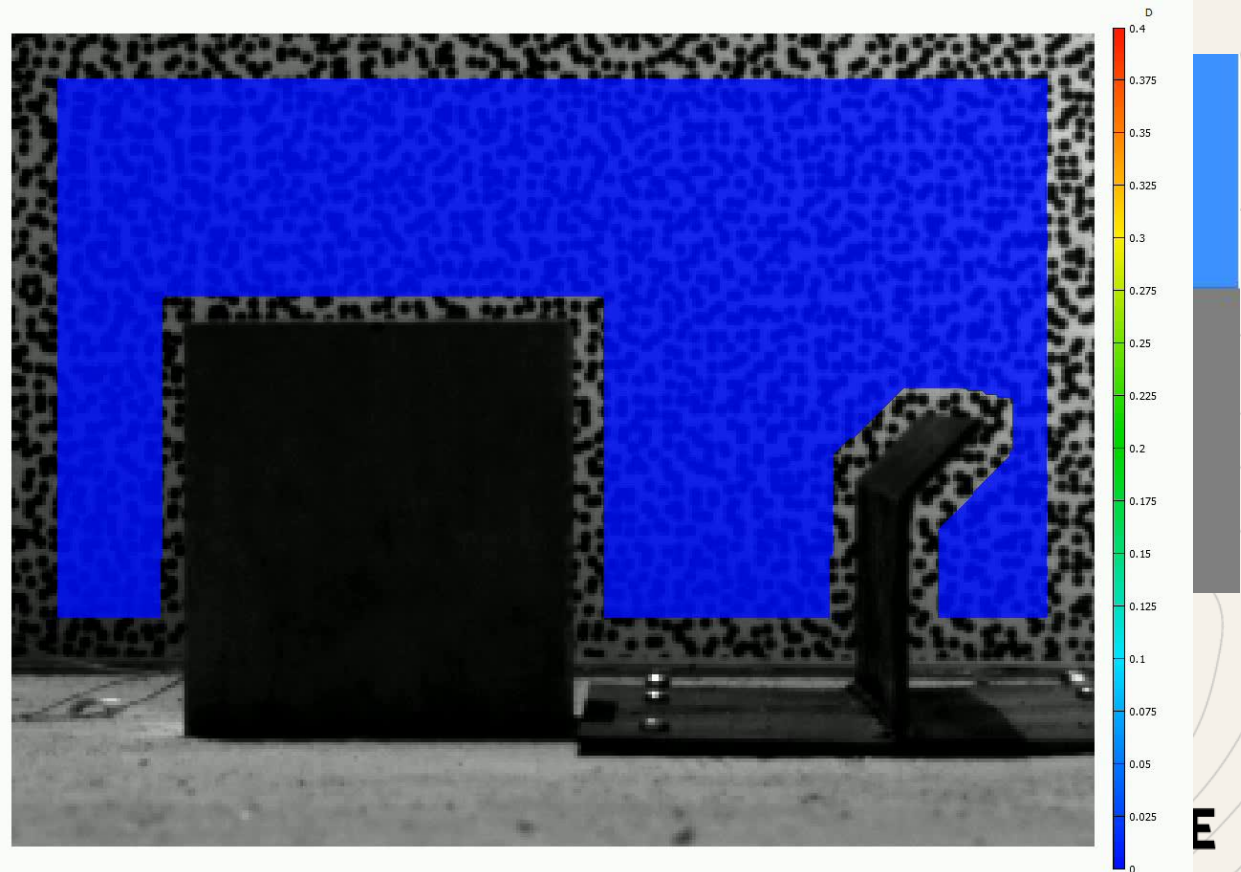
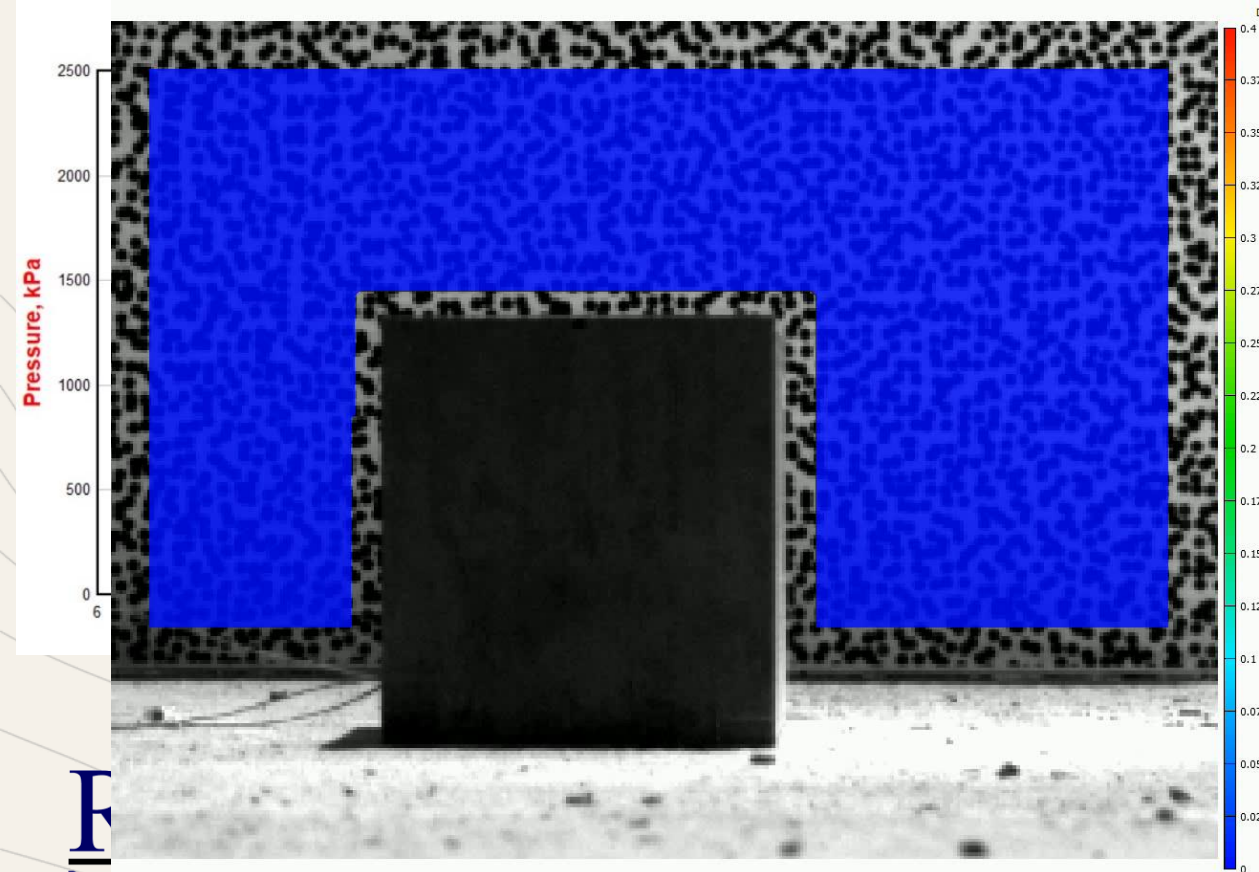
Blast waves in complex urban configurations



Blast waves in complex urban configurations

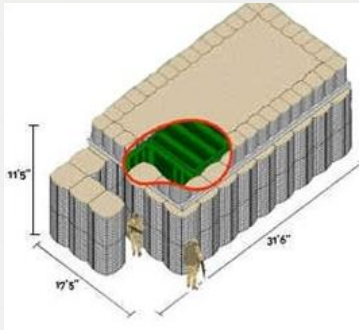
SIMPLIFIED TOOLS

ADVANCED TOOLS

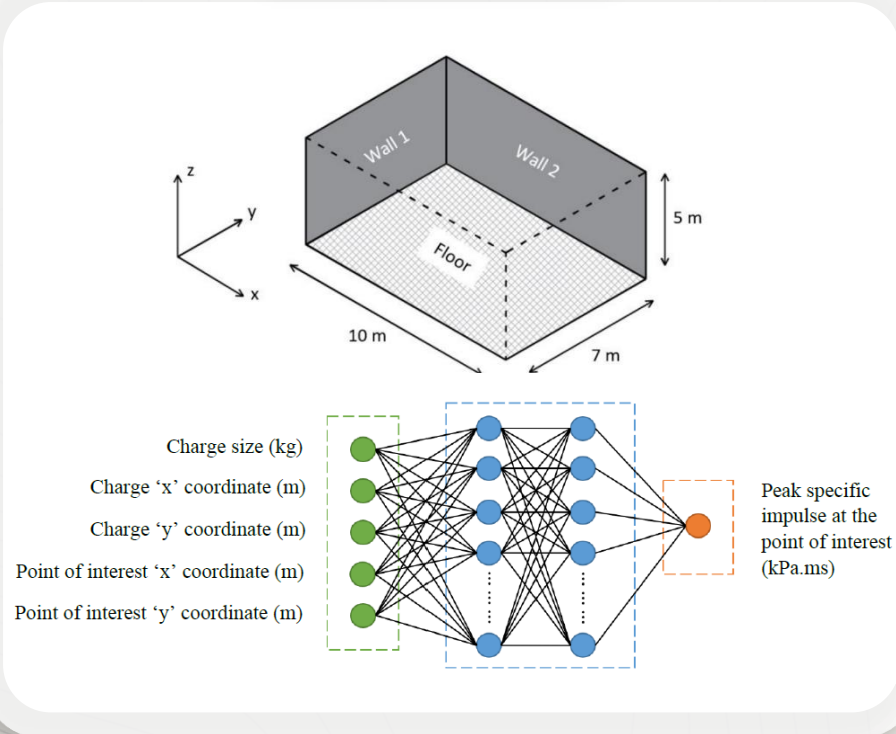
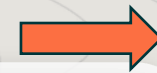
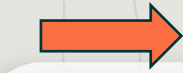


Blast waves in complex urban configurations

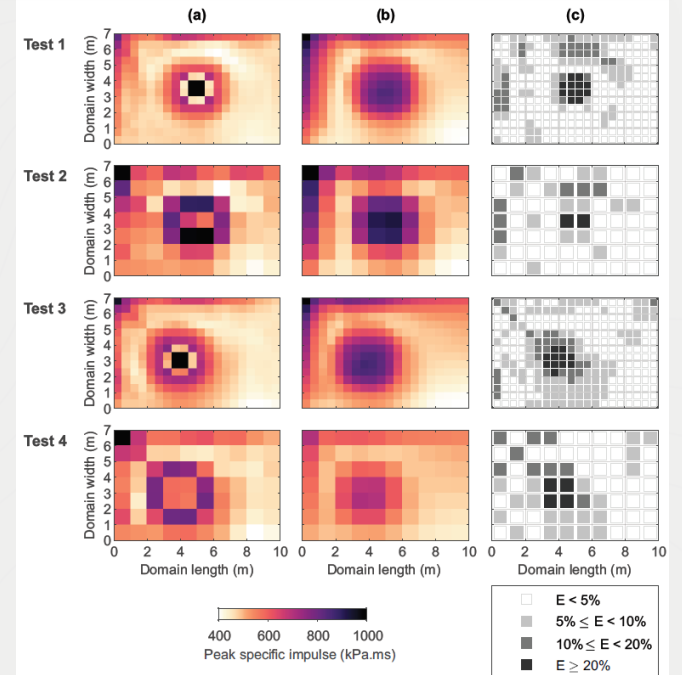
BLAST IN COMPLEX CONFIGURATIONS



MACHINE LEARNING

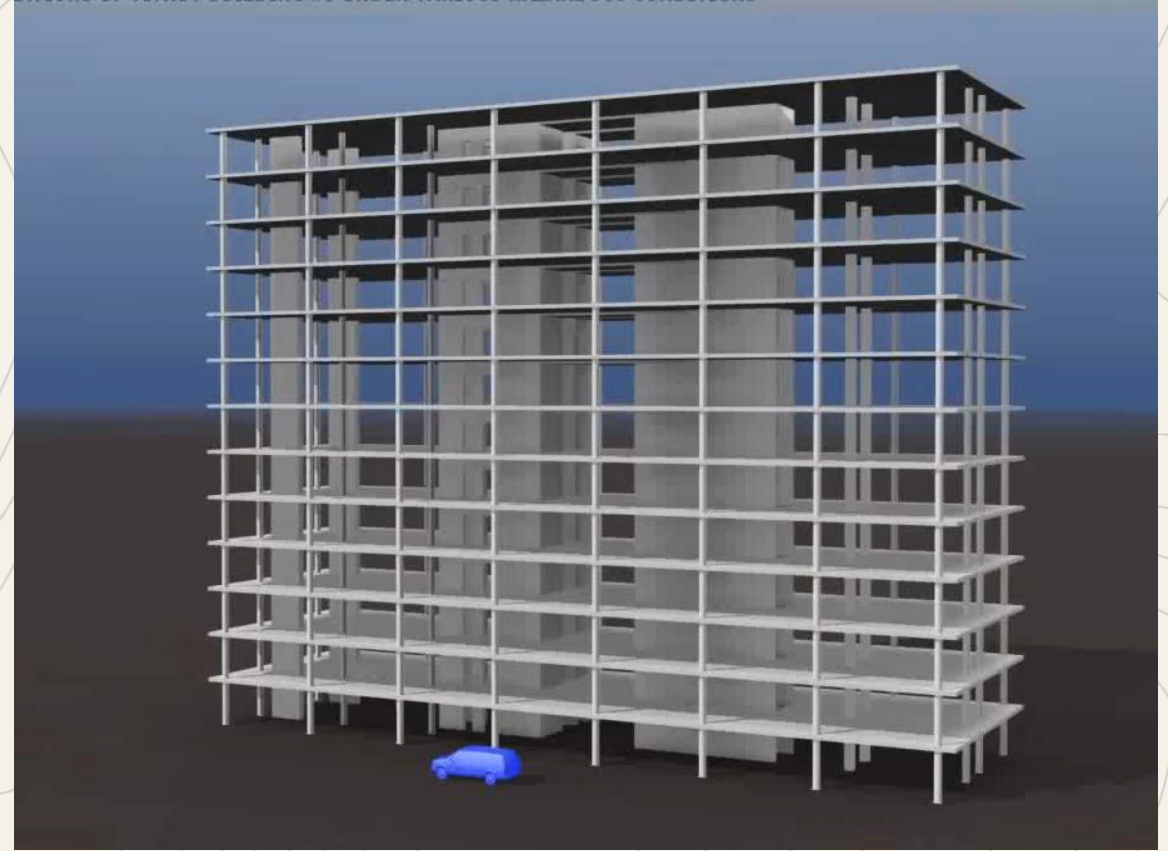


AI - GENERATED PRESSURE AND IMPULSE



Damage of Structures under Blast loading

Oklahoma 1995



Damage of Structures under Blast loading

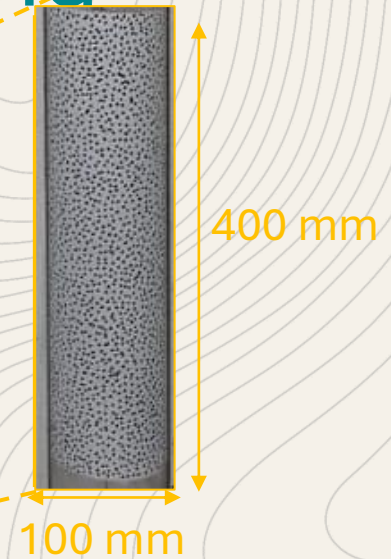
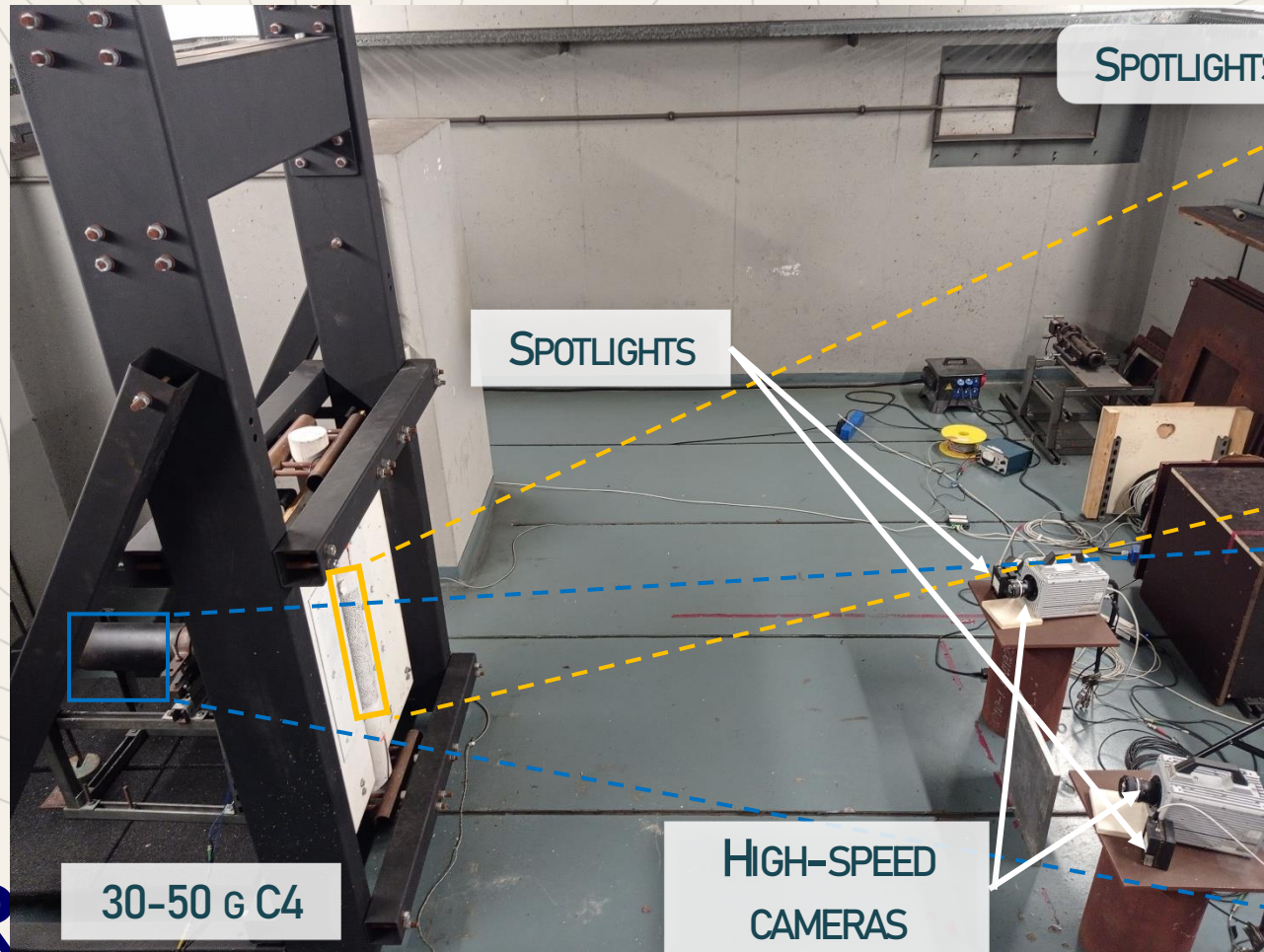
APPLYING THE BLAST LOADS:

FREE FIELD AIR BLAST

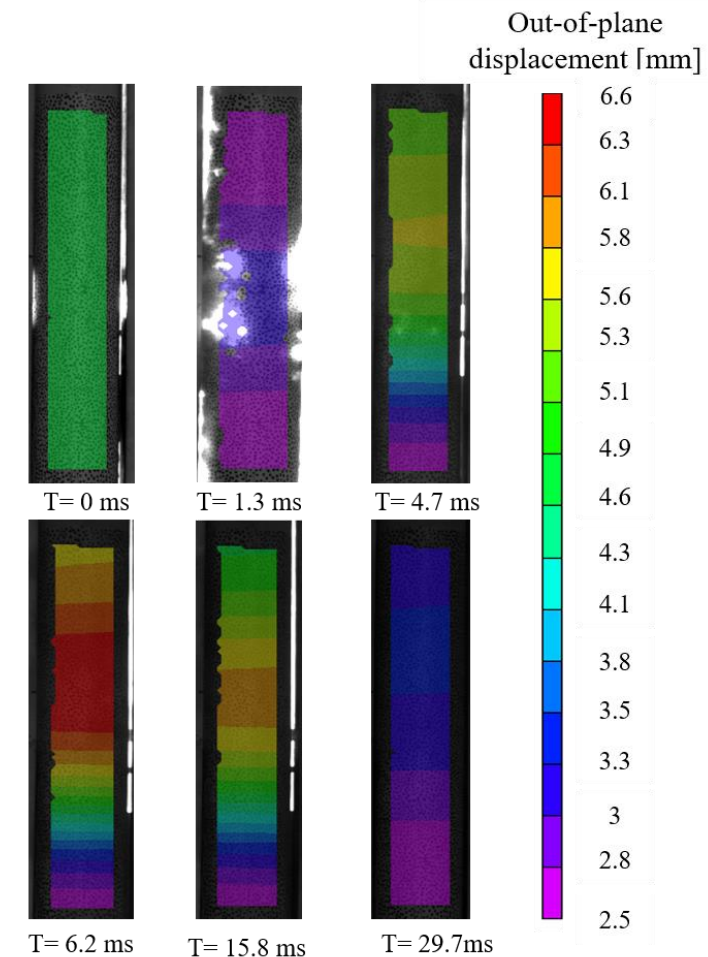
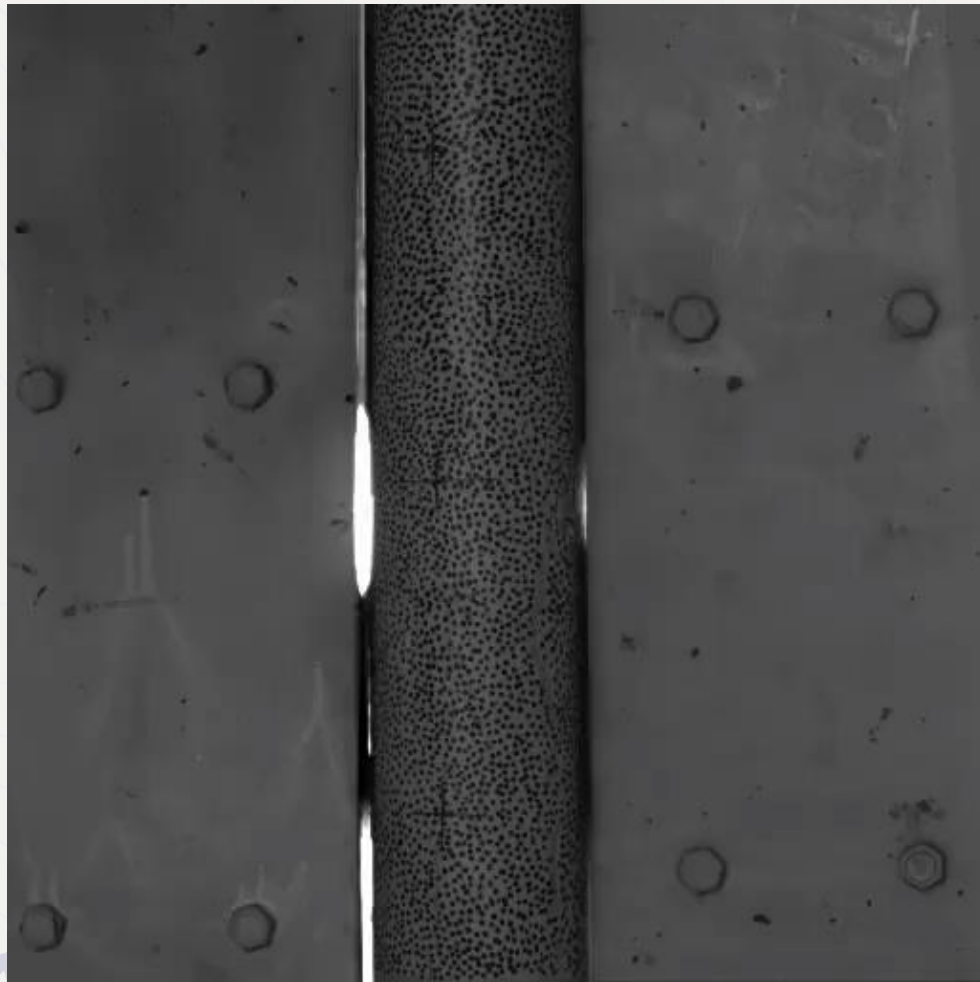
- EXPENSIVE
- COMPLICATED
- SAFETY CONCERNS
- FIREBALL IS OBSTRUCTING THE VIEW



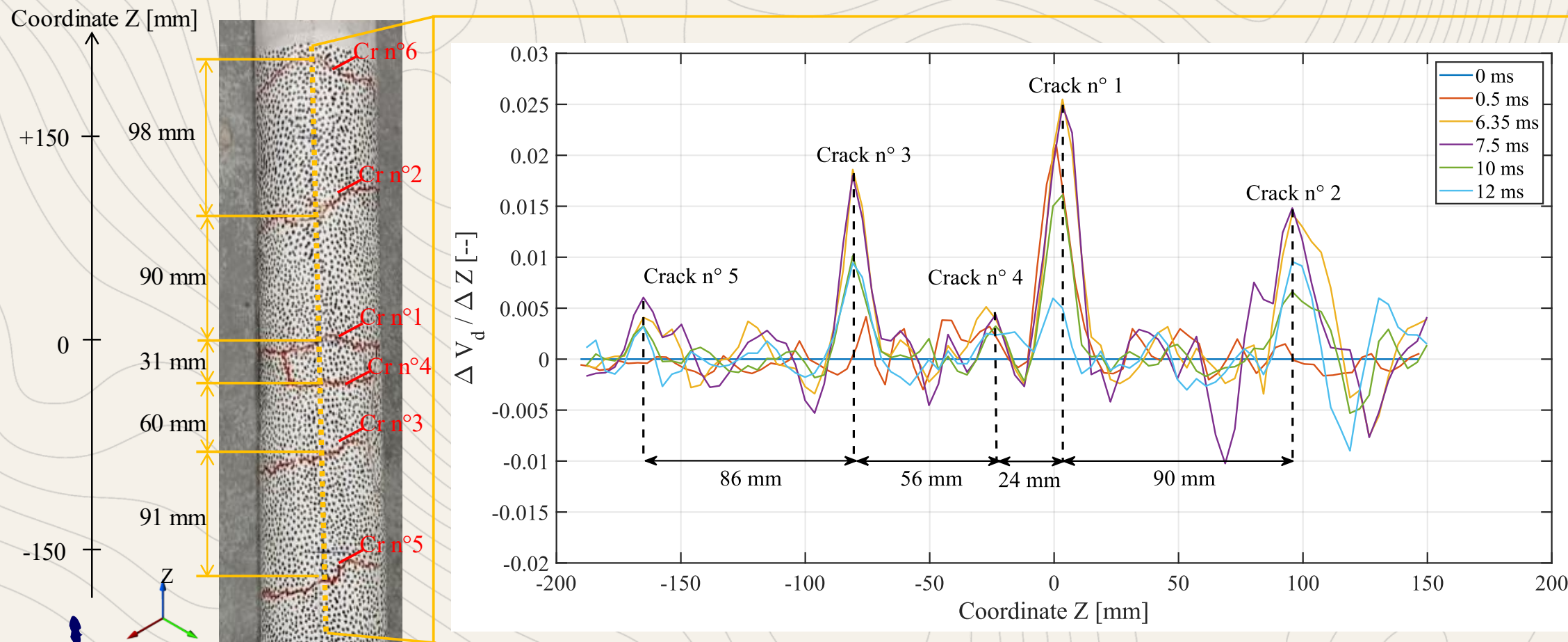
Damage of Structures under Blast loading



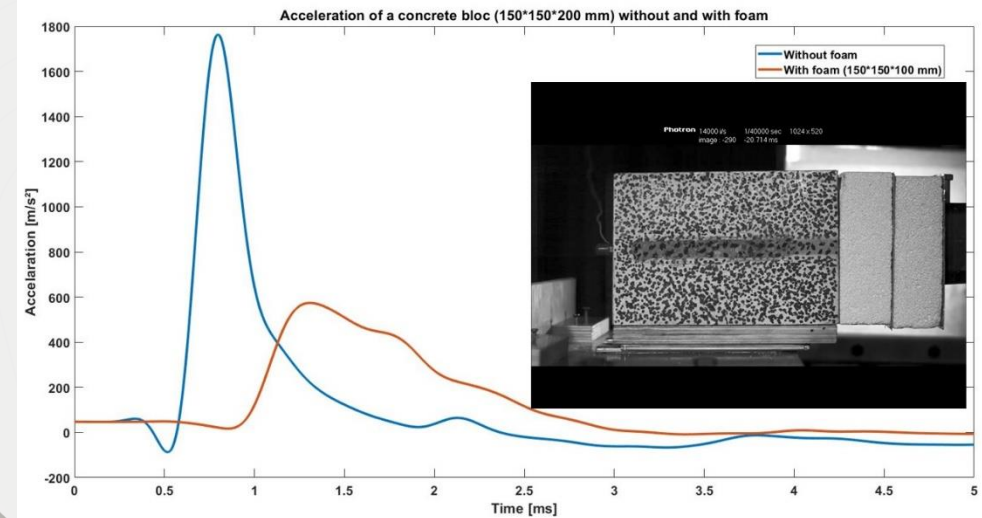
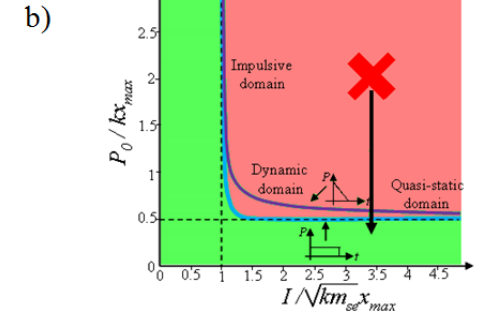
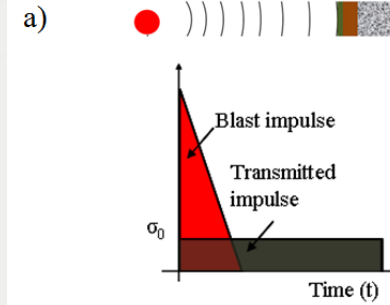
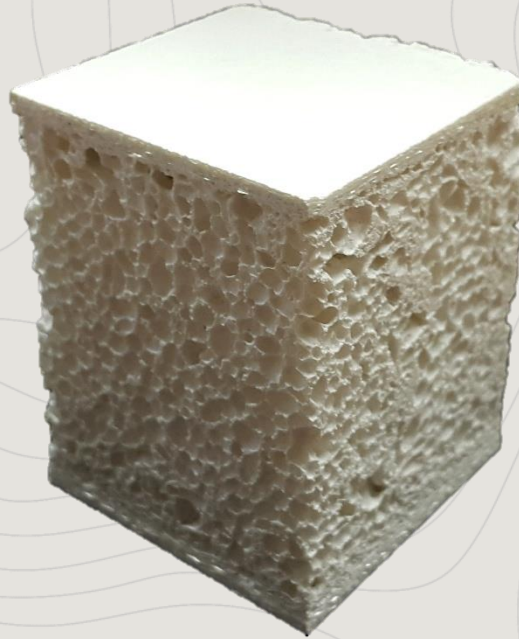
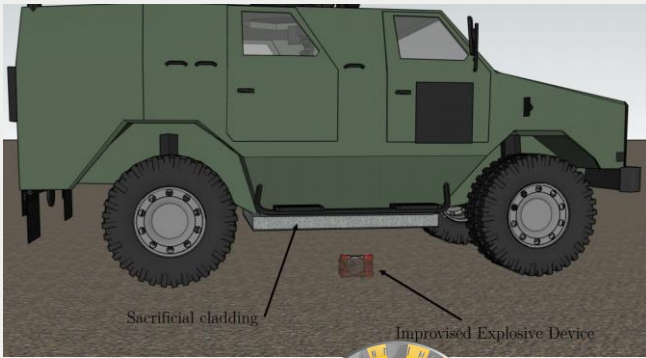
Damage of Structures under Blast loading



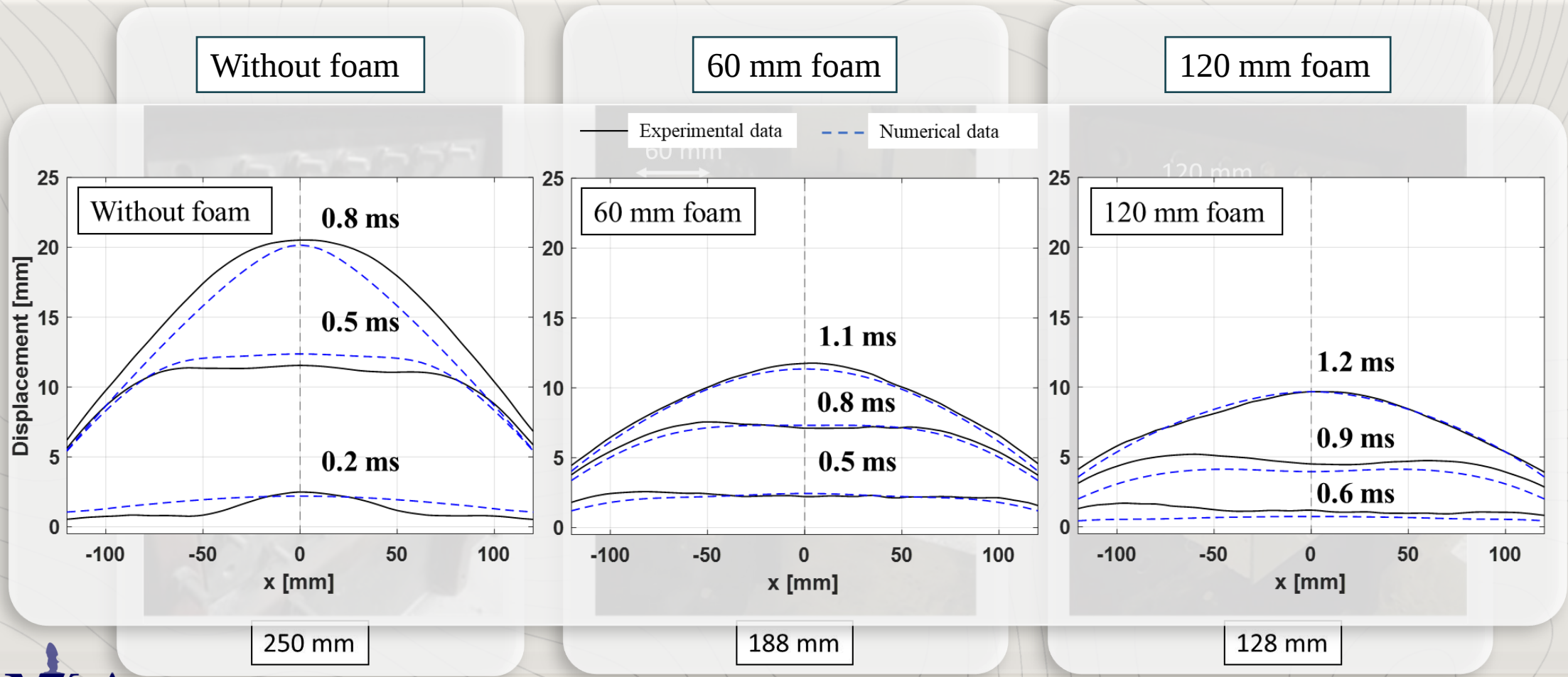
Damage of Structures under Blast loading



Damage of Structures under Blast loading



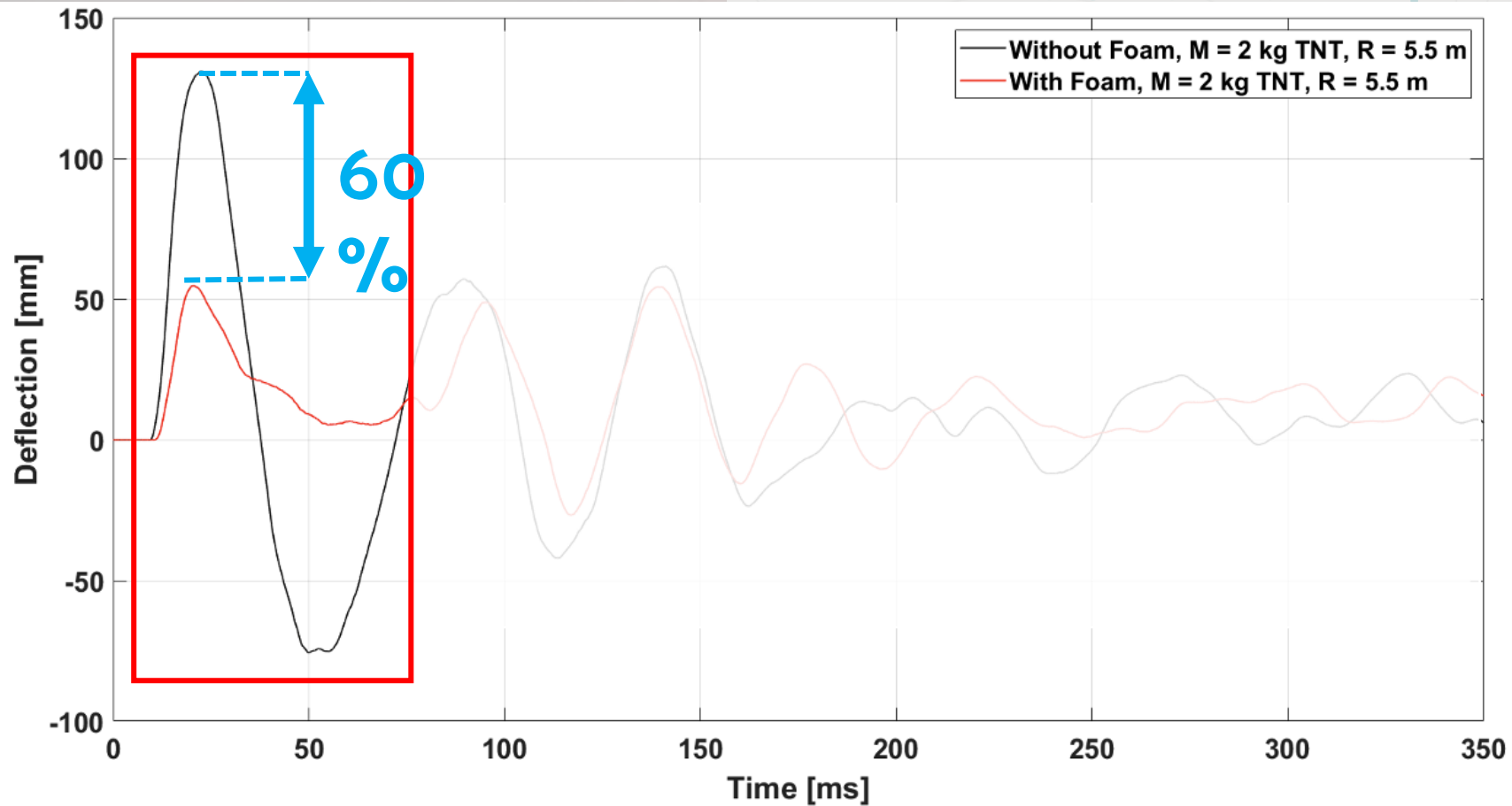
Damage of Structures under Blast loading



Damage of Structures under Blast loading



Under Blast loading



REFERENCE

Combined fragment impact and blast loading



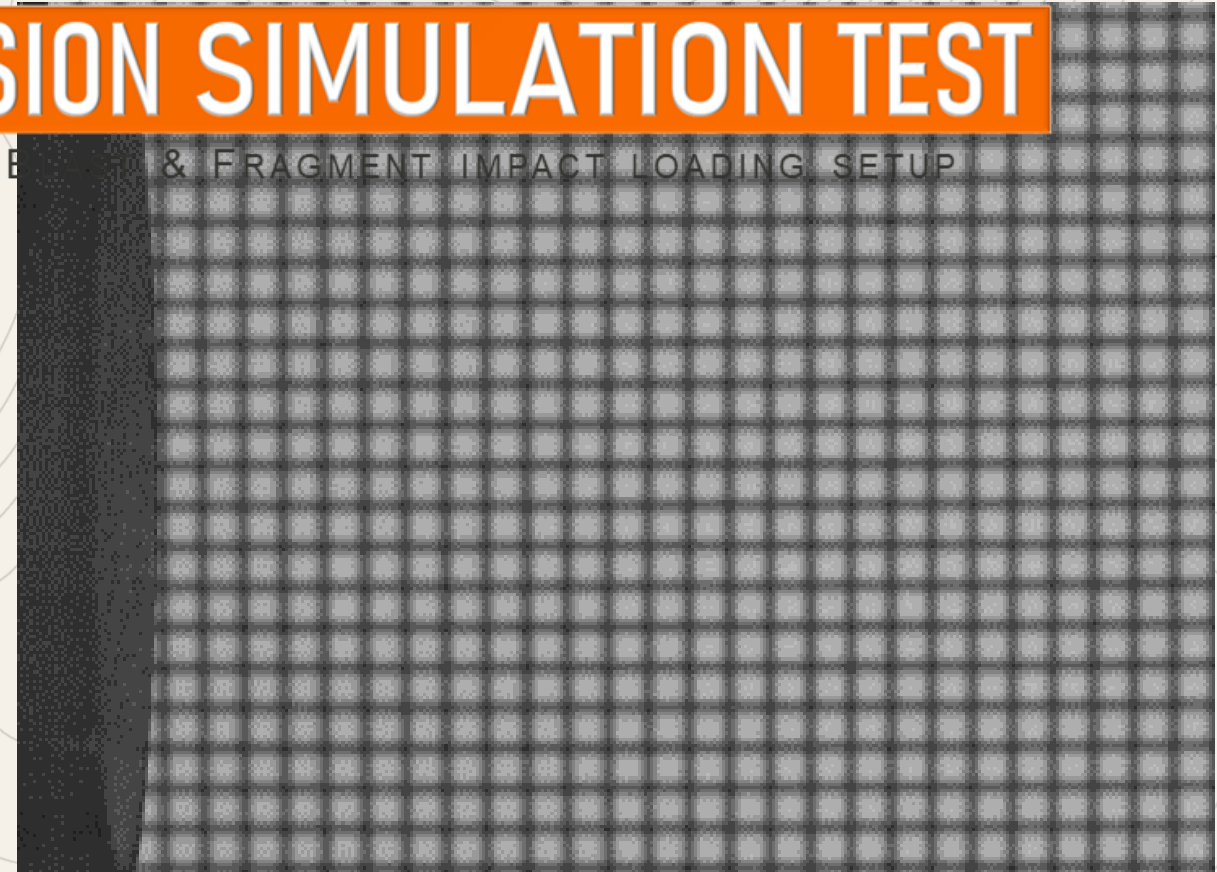
CONSISTENT EXPLOSION SIMULATION TEST

A HIGHLY CONTROLLED COMBINED B & FRAGMENT IMPACT LOADING SETUP

1-3 Simultaneous Fragments with **Accurately** defined Impact Points within **5mm**

Planar Blast Wave with **controlled** Overpressure

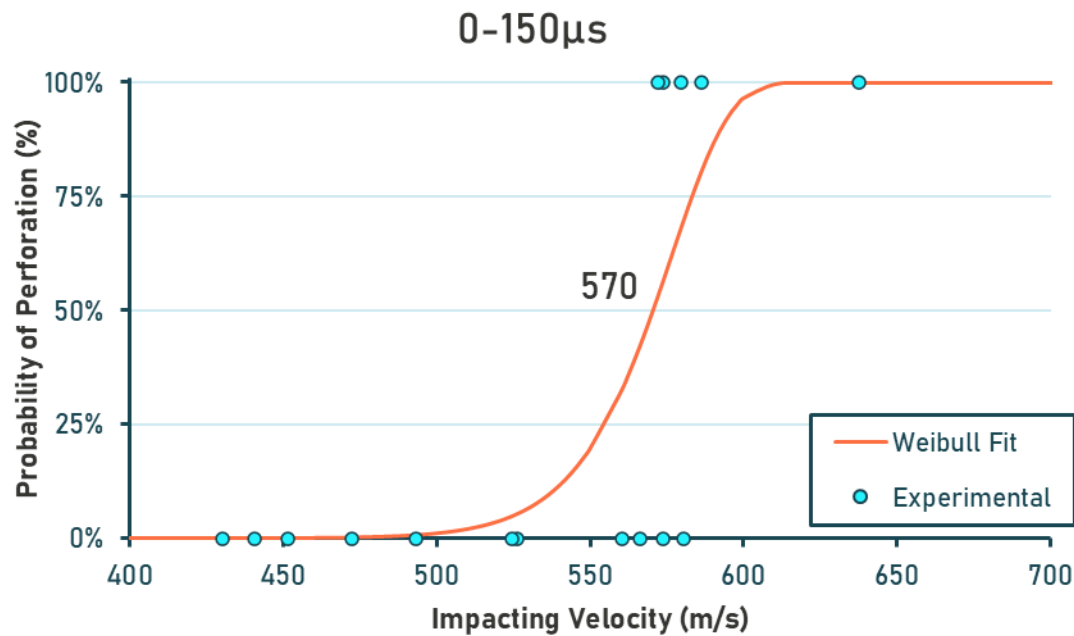
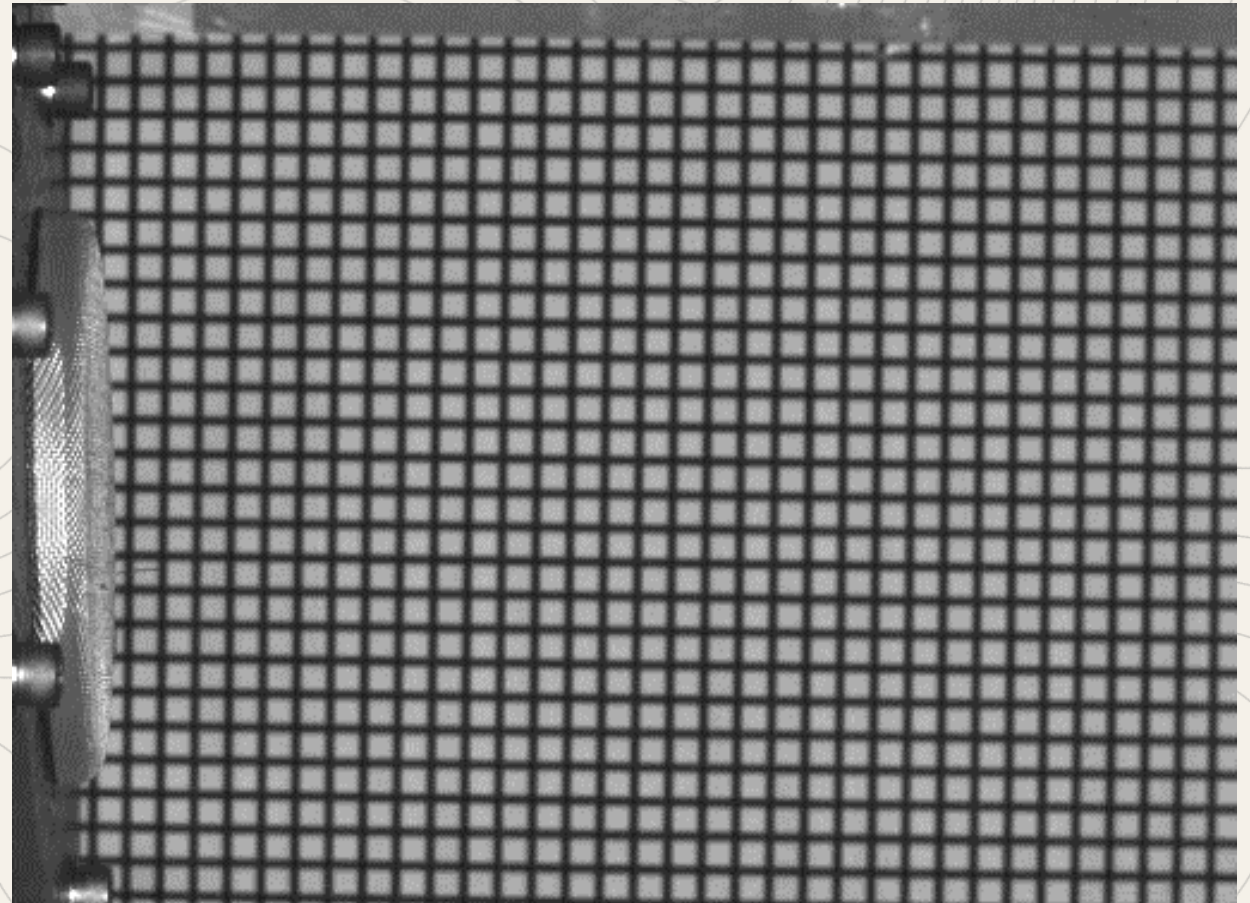
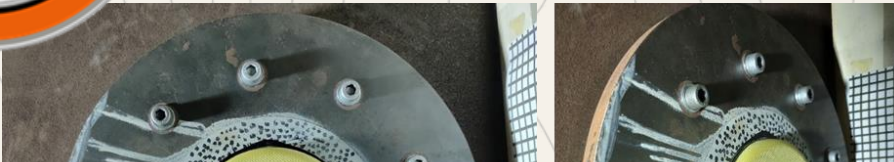
Control over the **Time Interval** between the loads in the **μ s** scale : STAND-OFF DISTANCE





ONSISTENT EXPLOSION SIMULATION TEST

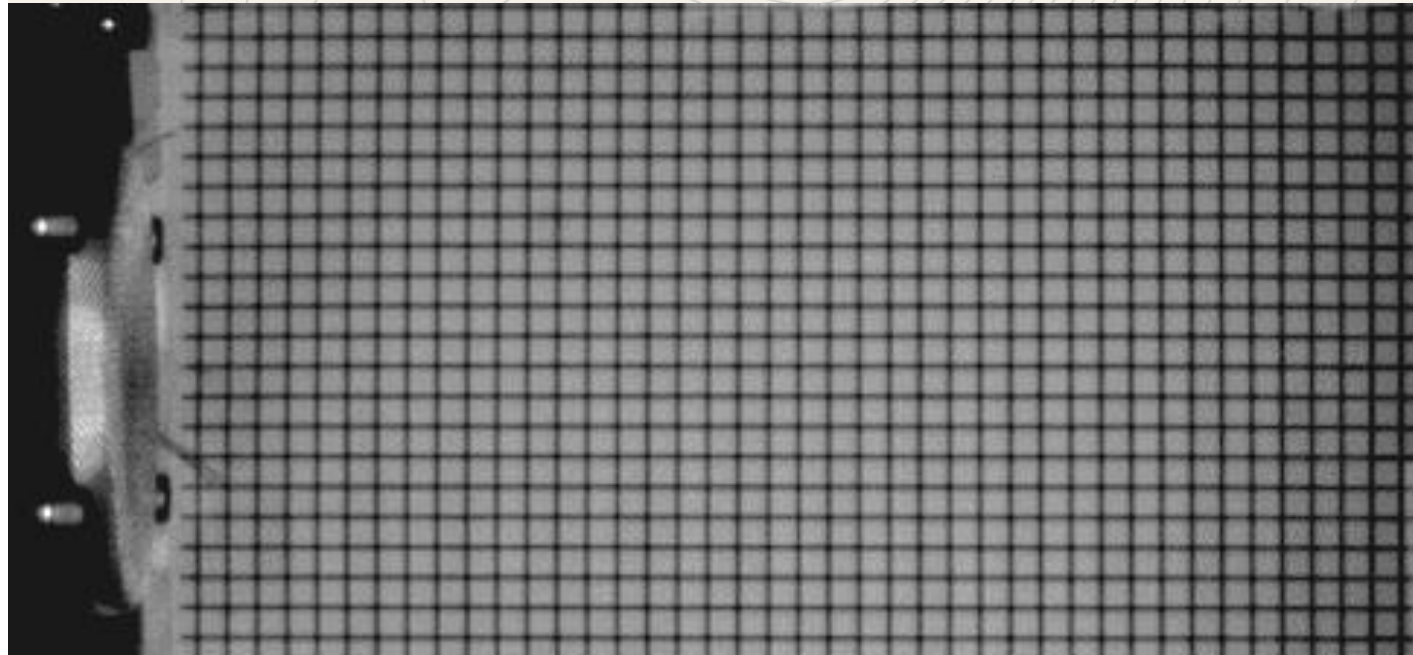
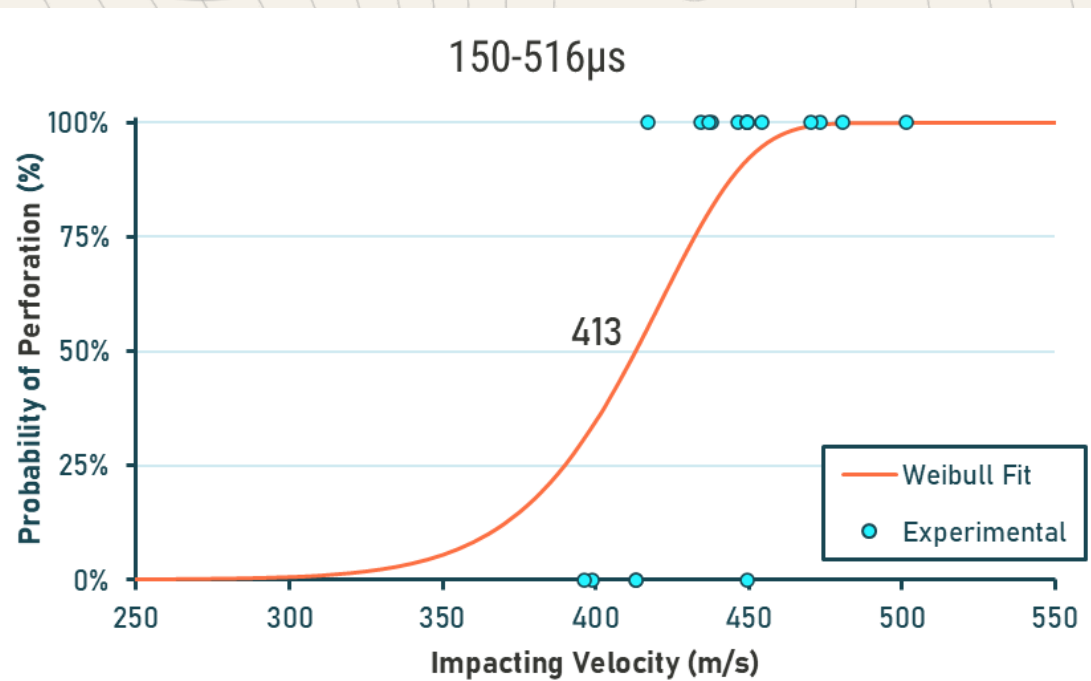
A HIGHLY CONTROLLED COMBINED BLAST & FRAGMENT IMPACT LOADING SETUP





ONSISTENT EXPLOSION SIMULATION TEST

A HIGHLY CONTROLLED COMBINED BLAST & FRAGMENT IMPACT LOADING SETUP



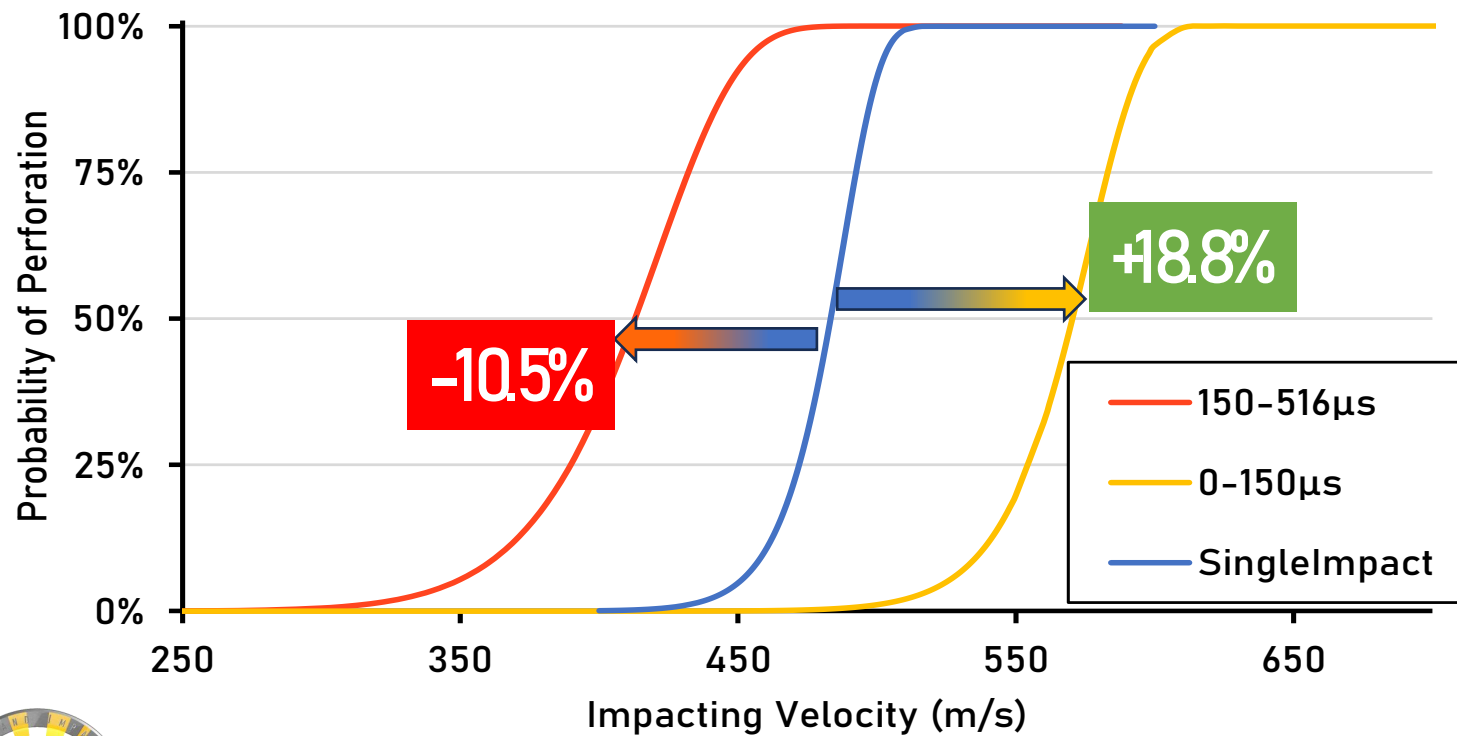
$$\Delta t = 333\mu\text{s} \quad V_i = 417\text{m/s}$$
$$V_R = 102\text{m/s}$$



ONSISTENT EXPLOSION SIMULATION TEST

A HIGHLY CONTROLLED COMBINED BLAST & FRAGMENT IMPACT LOADING SETUP

Comparison of V50 in three Combined Loading cases

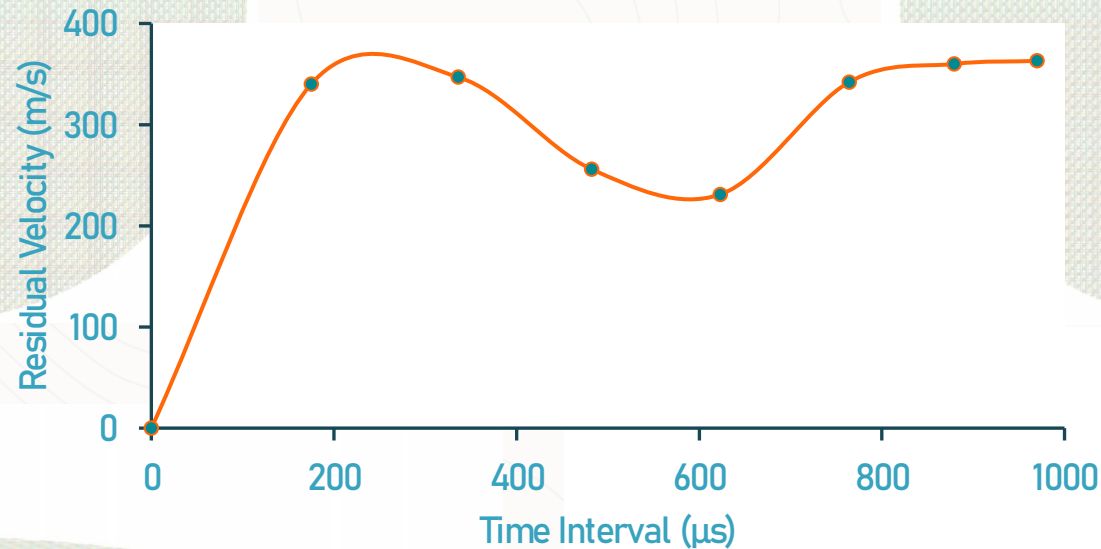


ONSISTENT EXPLOSION SIMULATION TEST

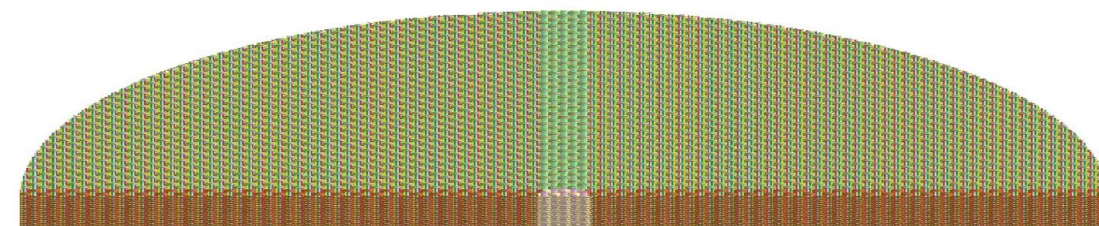
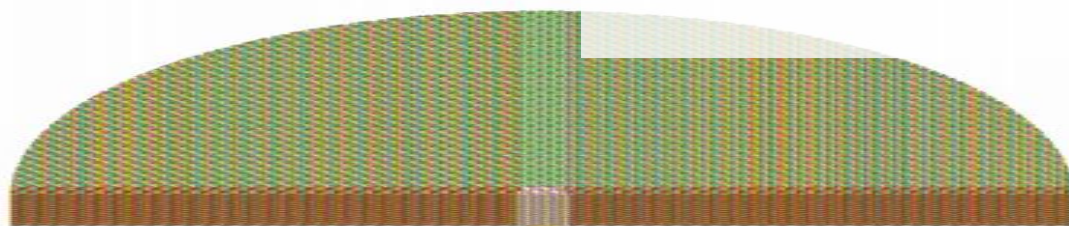
D COMBINED BLAST & FRAG PrePost 1484874

@Vimpact: 480m/s

$\Delta t = 0\mu s$
 $V_i = 480m/s$



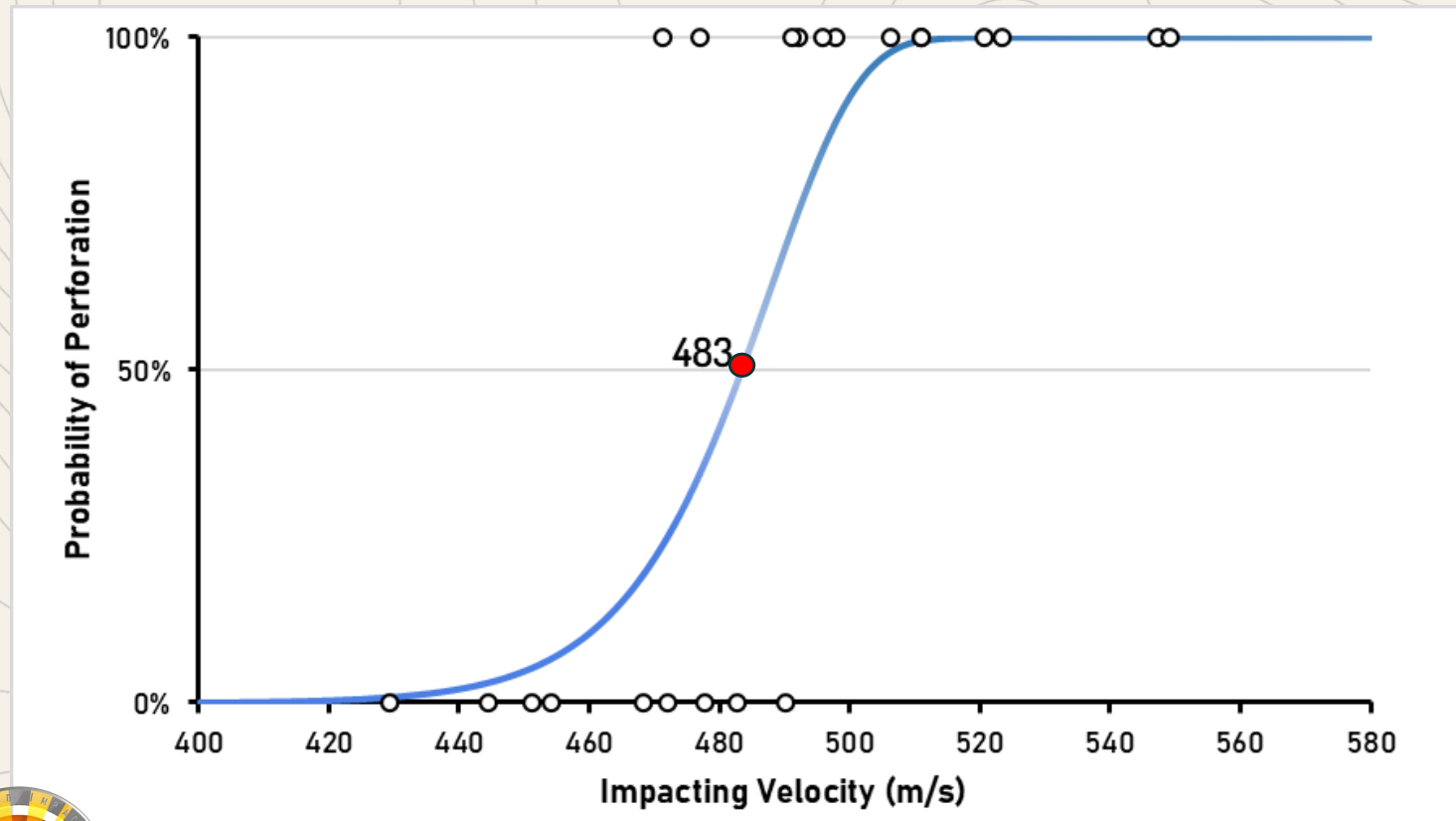
LS-DYNA keyword deck by LS-PrePost
 Time: 0





ONSISTENT EXPLOSION SIMULATION TEST

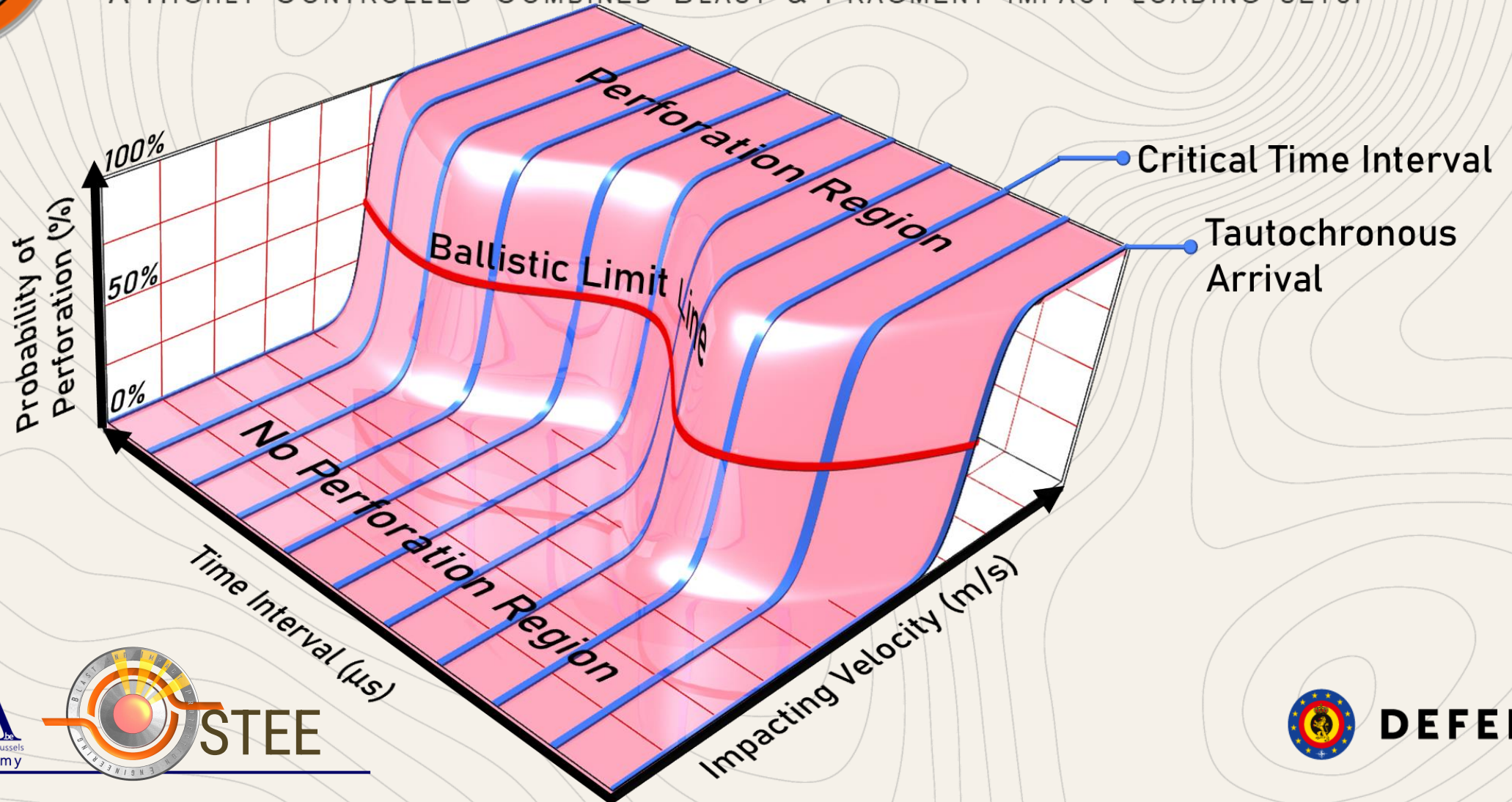
A HIGHLY CONTROLLED COMBINED BLAST & FRAGMENT IMPACT LOADING SETUP





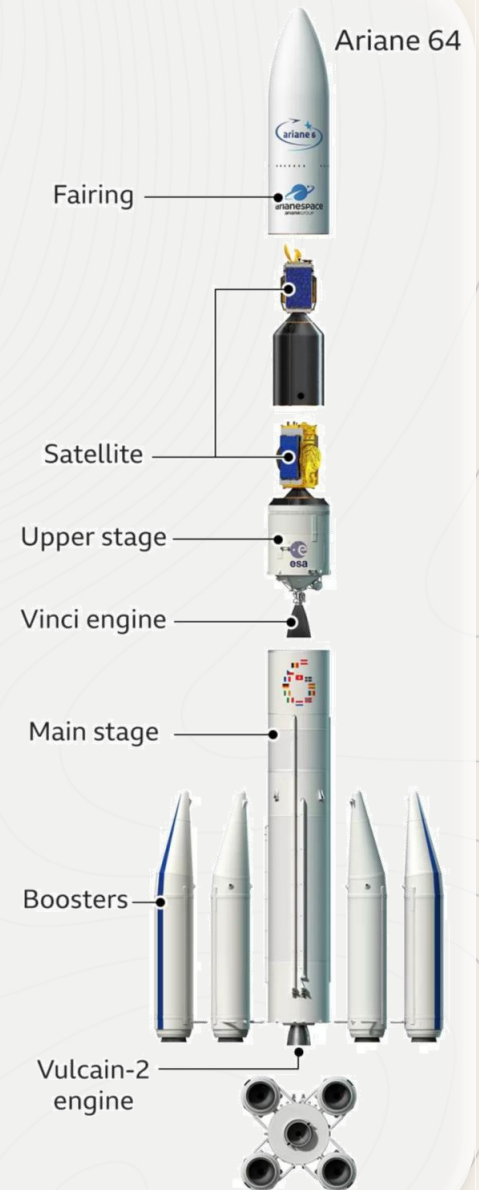
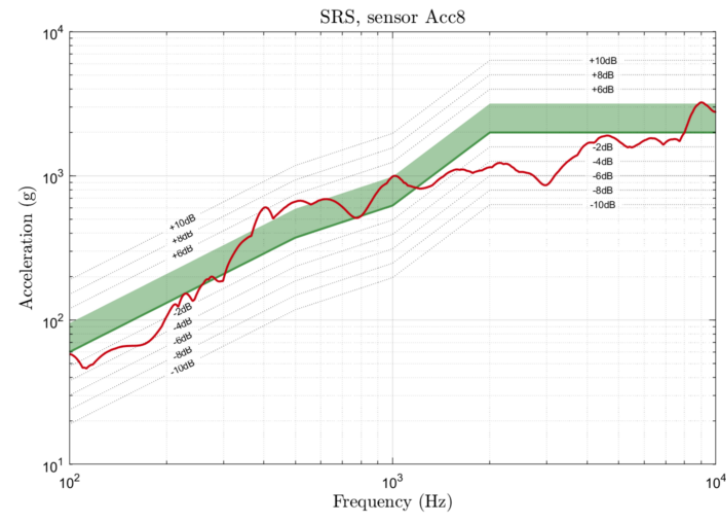
ONSISTENT EXPLOSION SIMULATION TEST

A HIGHLY CONTROLLED COMBINED BLAST & FRAGMENT IMPACT LOADING SETUP



PYROTECHNICAL SHOCK

ISO 17025





Questions?

