

Effectiveness of Air Burst Munitions

TNO | Knowledge for business



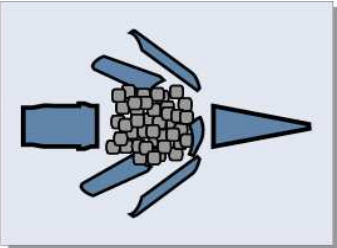
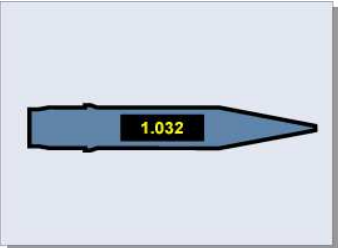
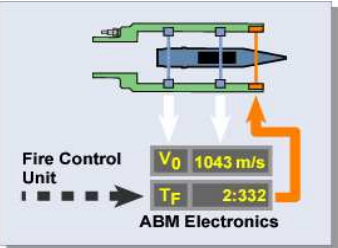
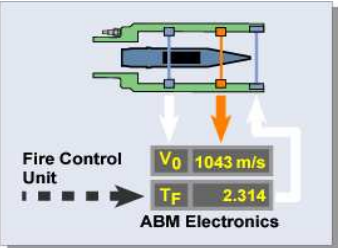
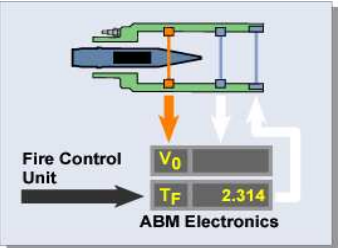
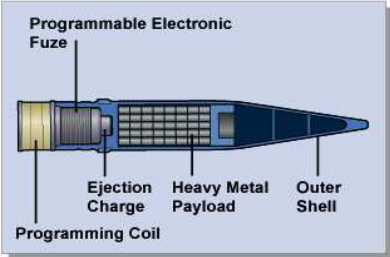
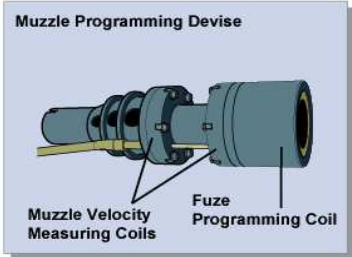
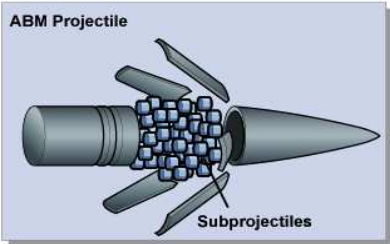
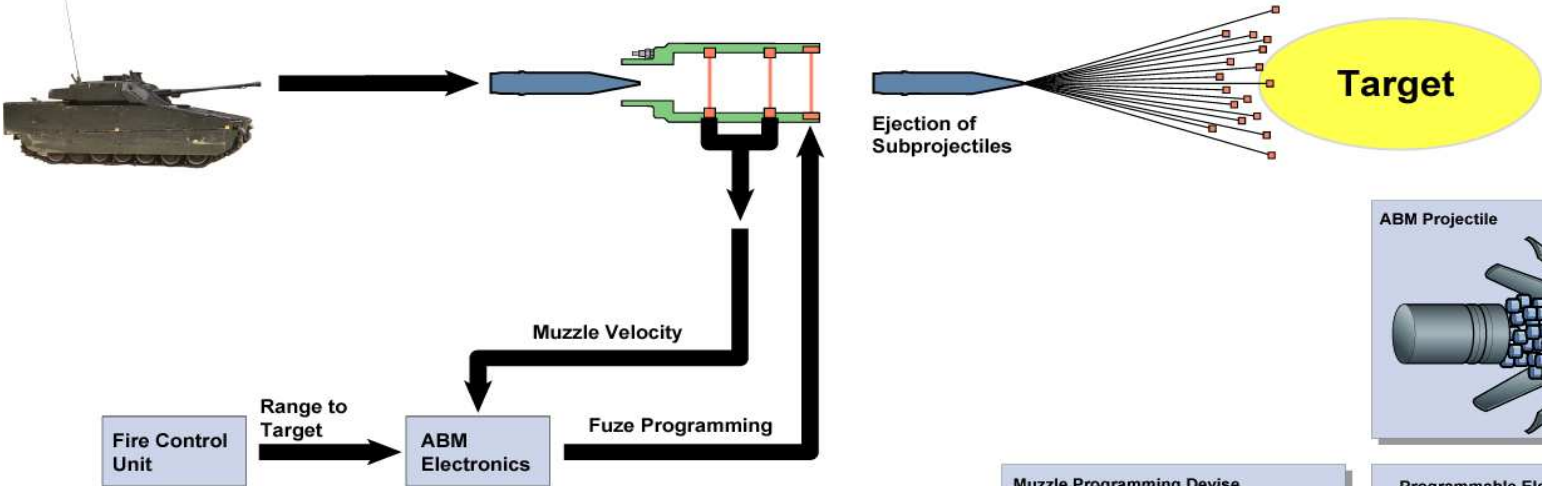
**J.J.M. Paulissen
E. van Meerten (RWMS)
Th.L.A. Verhagen**

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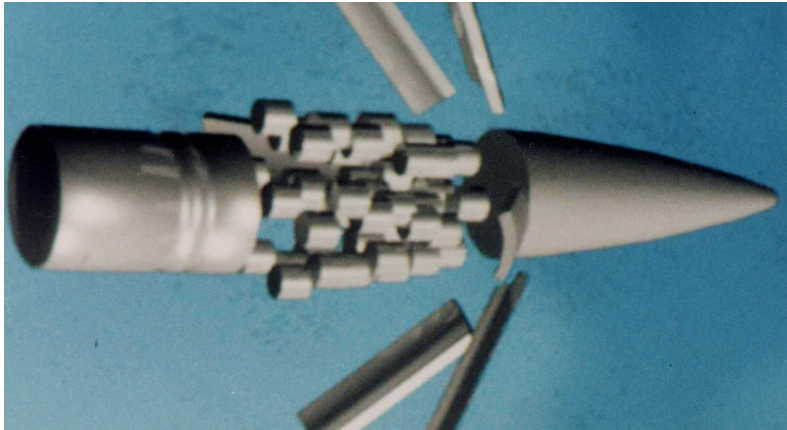
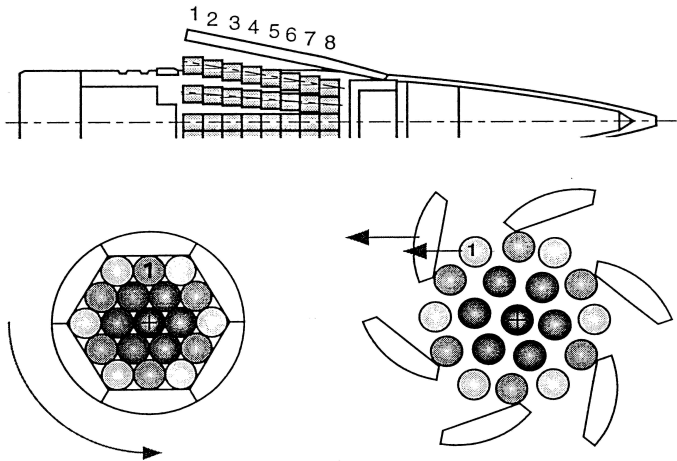
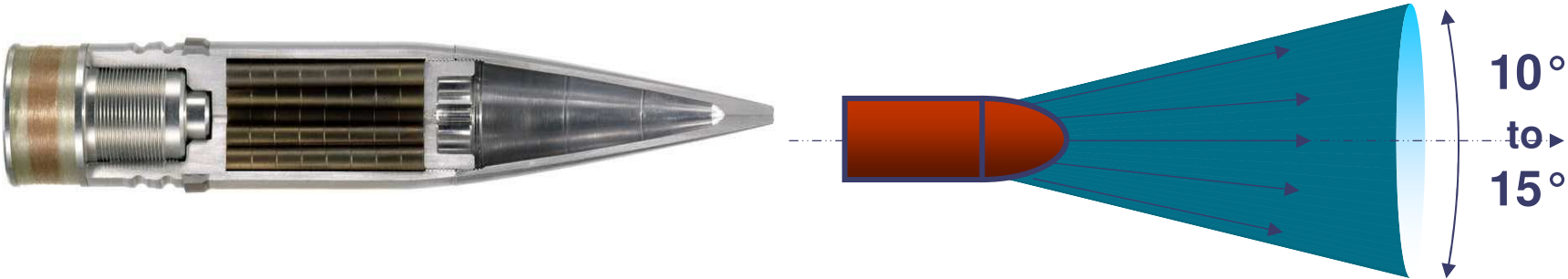
- ABM (KETF) modeling
- ABM (KETF) effects
- Firing doctrine for CV9035



Functioning of KETF

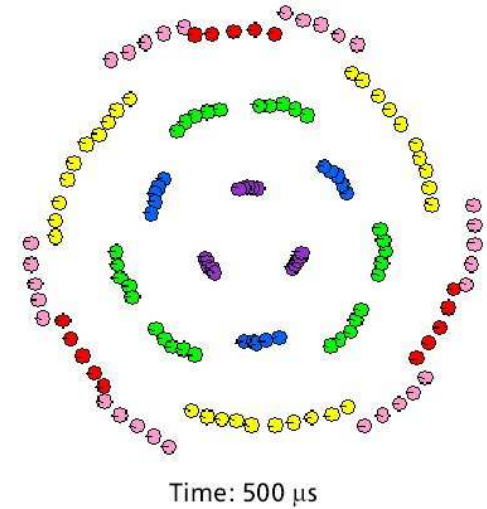
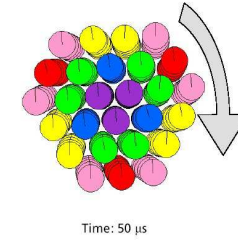
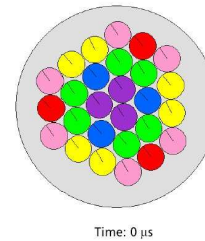
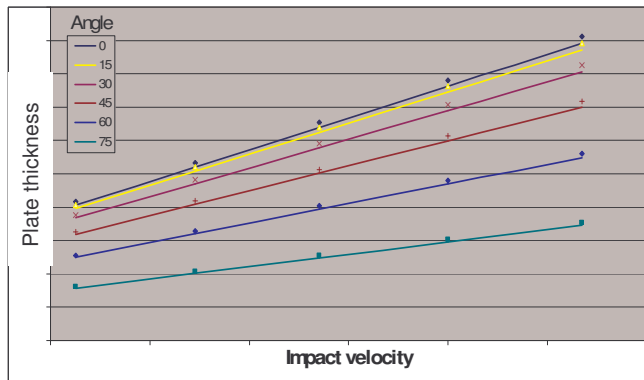


Characteristics of ABM (KETF)

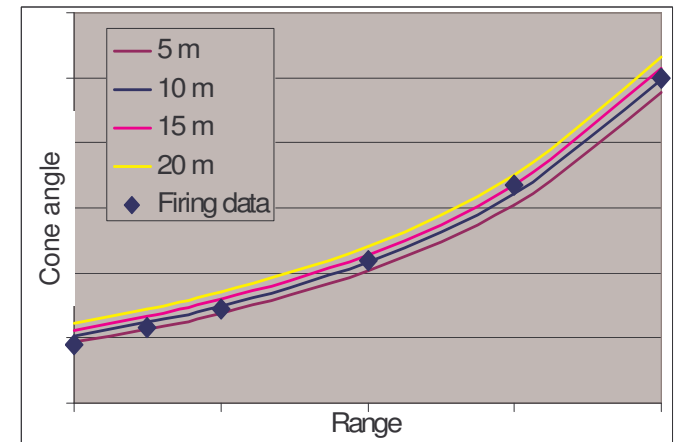
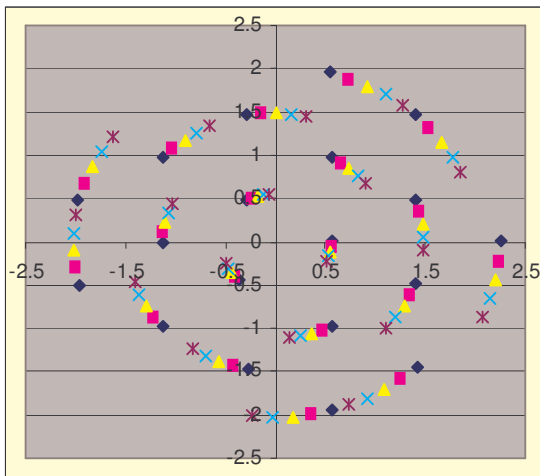


Modeling of ABM (KETF)

- Sub-projectile ejection and trajectories
- Sub-projectile penetration



35 mm AHEAD



Effects of ABM (1/2)

- Burst of 3 rounds against F-104G Starfighter

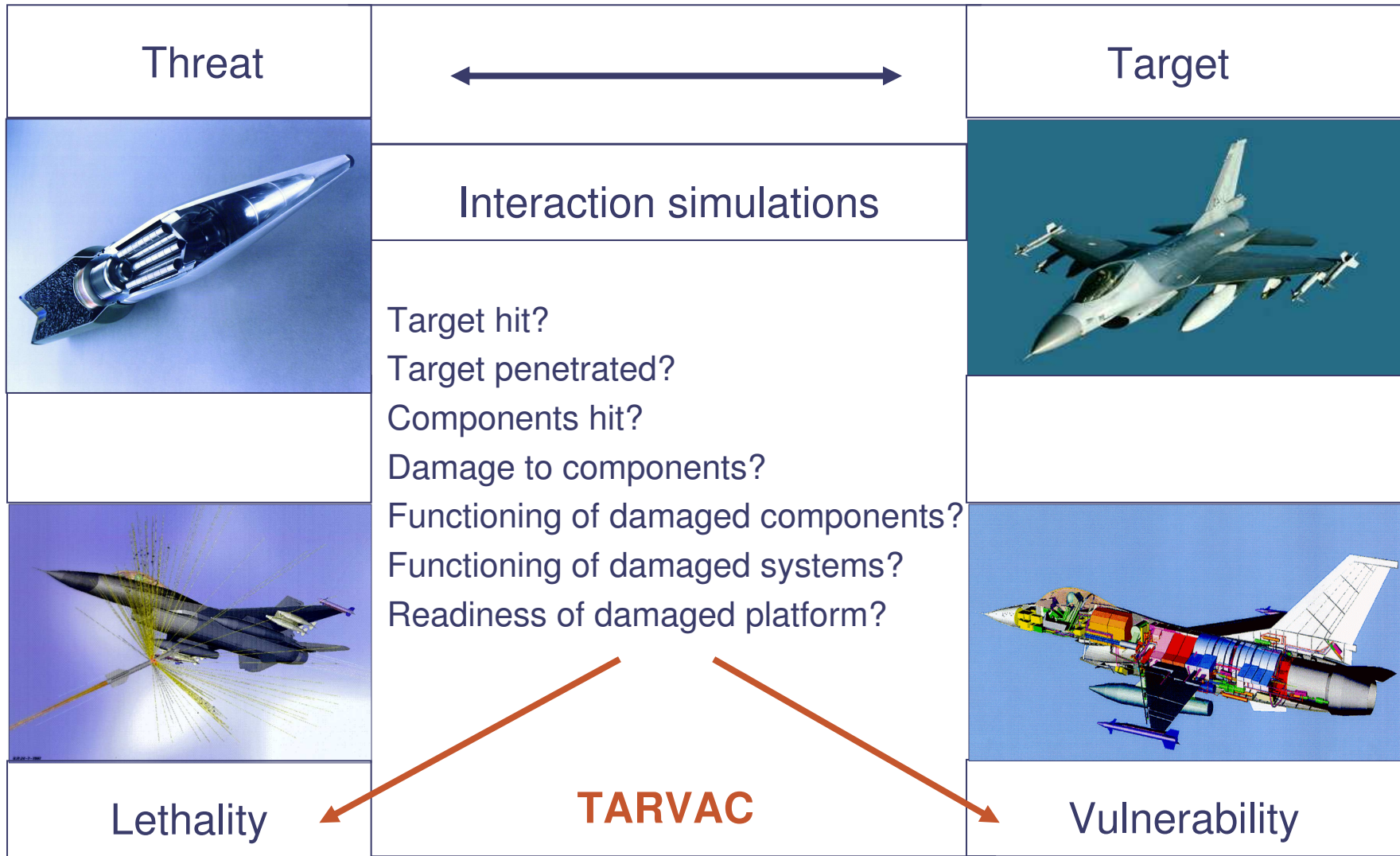


Effects of ABM (2/2)

- Burst of 3 rounds against F-104G Starfighter

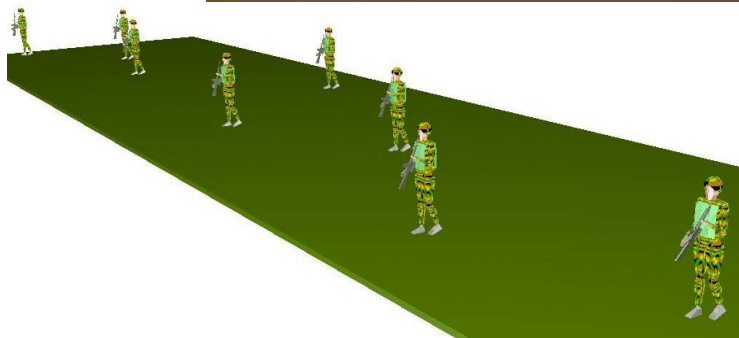
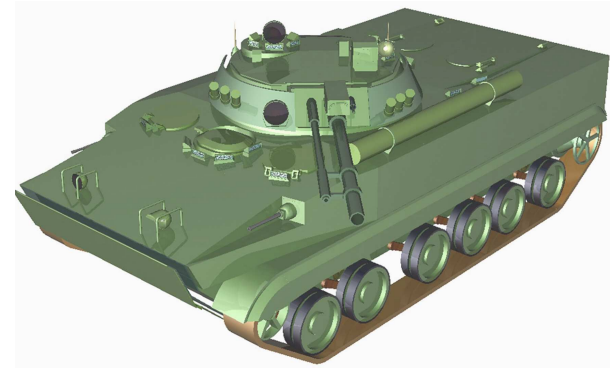


Input to TNO V/L modelling



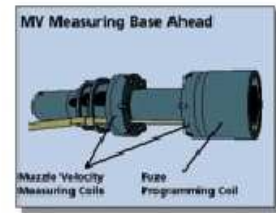
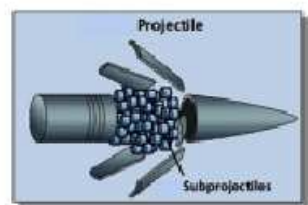
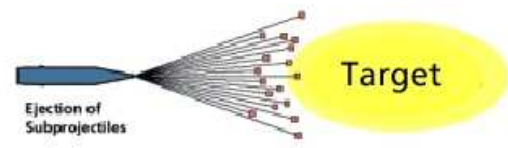
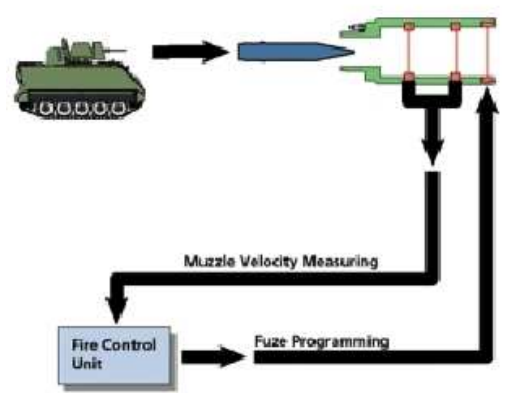
RNLA IFV Firepower

- Ammunition selection & modeling
- Caliber selection: 30 or 35 mm
- Ammunition optimization: firing trials with ABM sub-projectiles against optical sights, helmets, fragment resistance vests
- Firing doctrine development

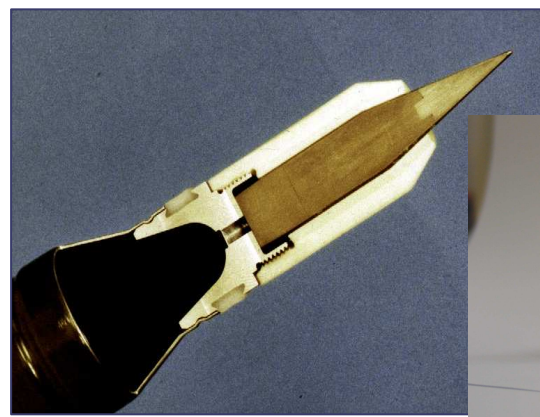
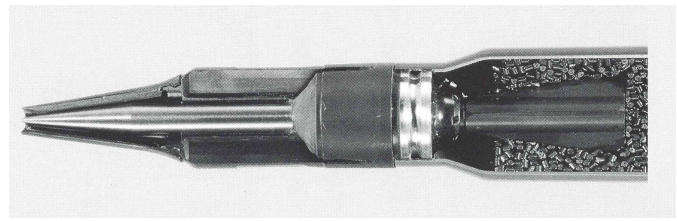


Ammunition selection

Air Burst Munition HETF/KETF



APFSDS



FAPDS/PELE

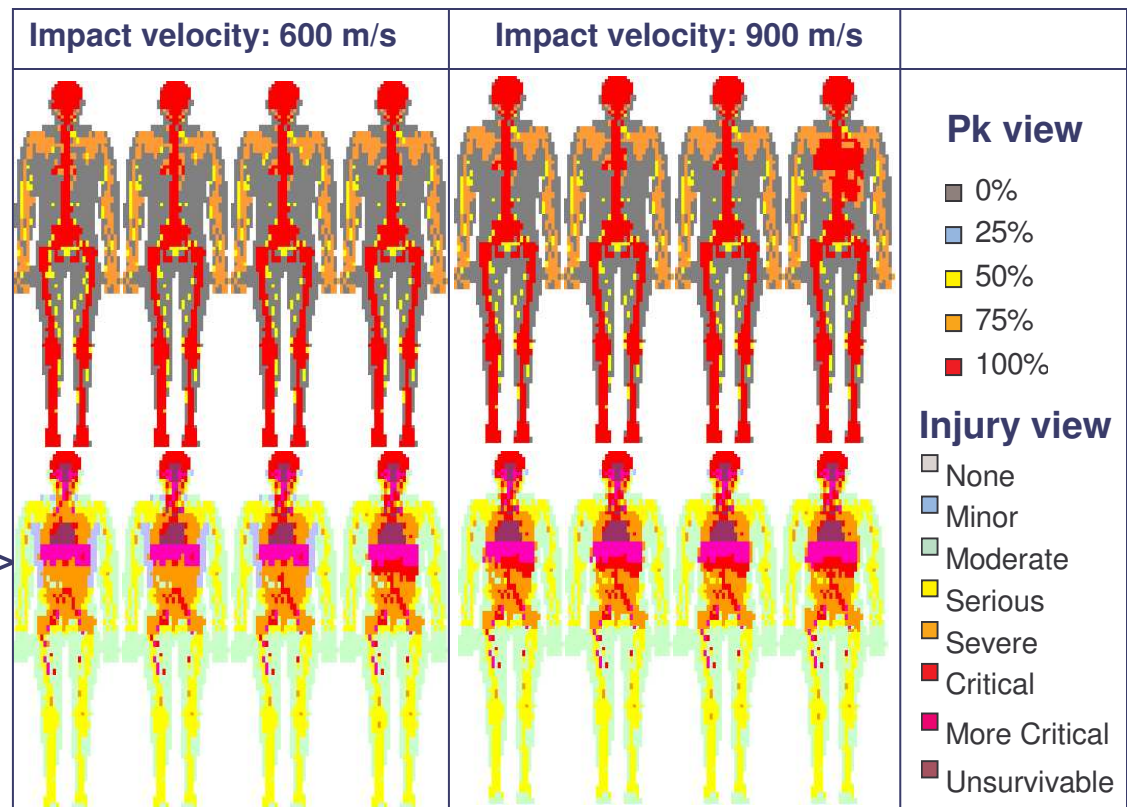


ABM (KETF) optimization

- Standing soldier, including helmet and vest, 30. sec assault
- Ballistic protection based on experimental data
- Using ComputerMan (US-ARL)

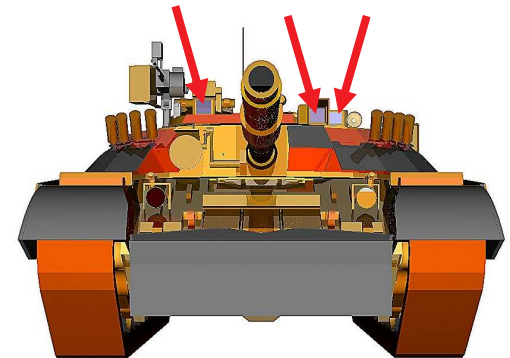
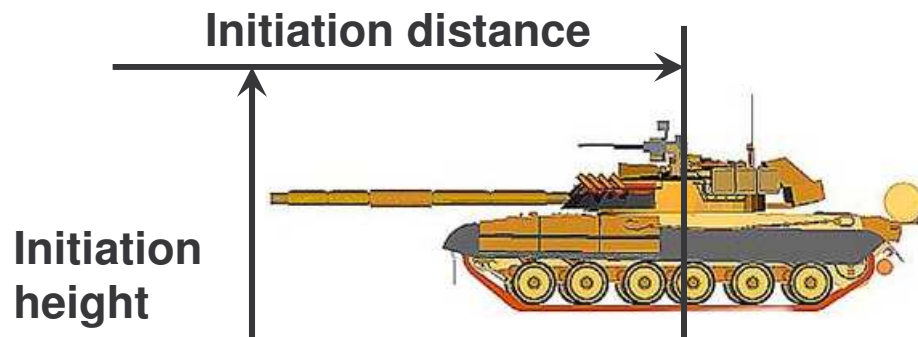
Increasing sub-projectile mass ->

- Fixed total payload mass: heavier sub-projectiles results in smaller density of fragment cloud
- Result: 35 mm KETF prototype is redesigned -> sub-projectile mass: 1.24 gram

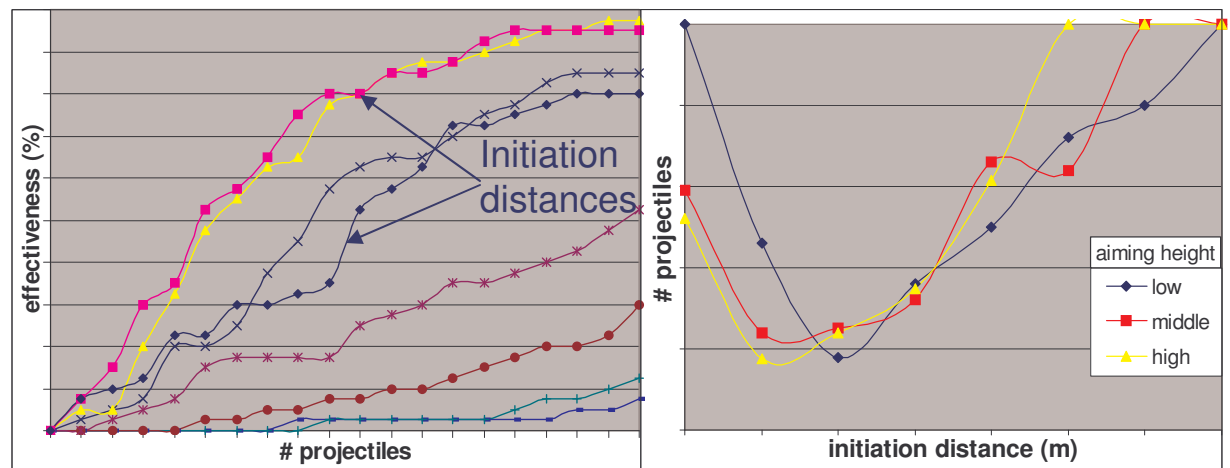


Firing doctrine (35 mm KETF against T-80U)

- Neutralise T-80U by killing all optical sights

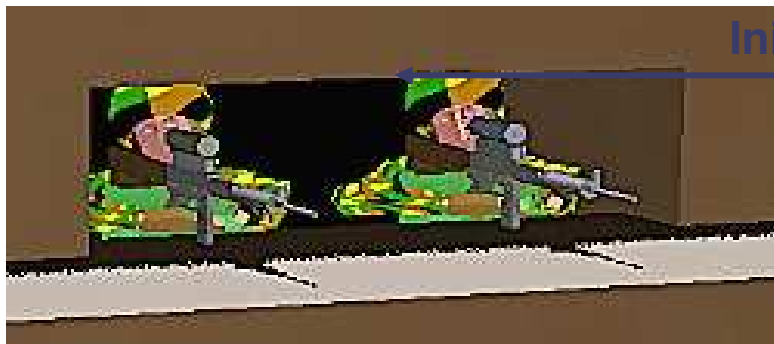


- Selection of initiation distance and height is essential for effectiveness KETF



Firing doctrine (35 mm KETF against Foxhole)

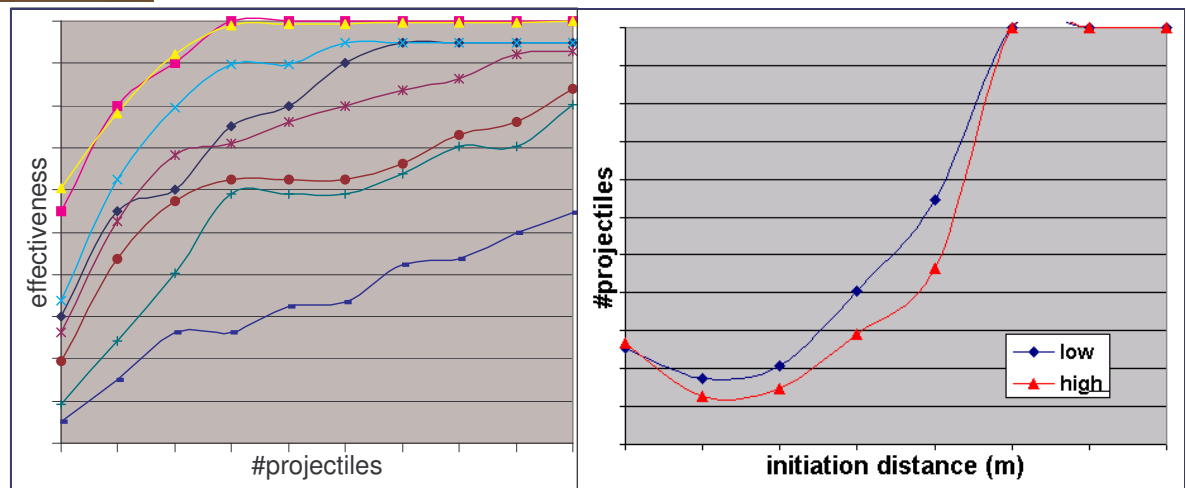
- Kill two men covered Foxhole



Initiation distance

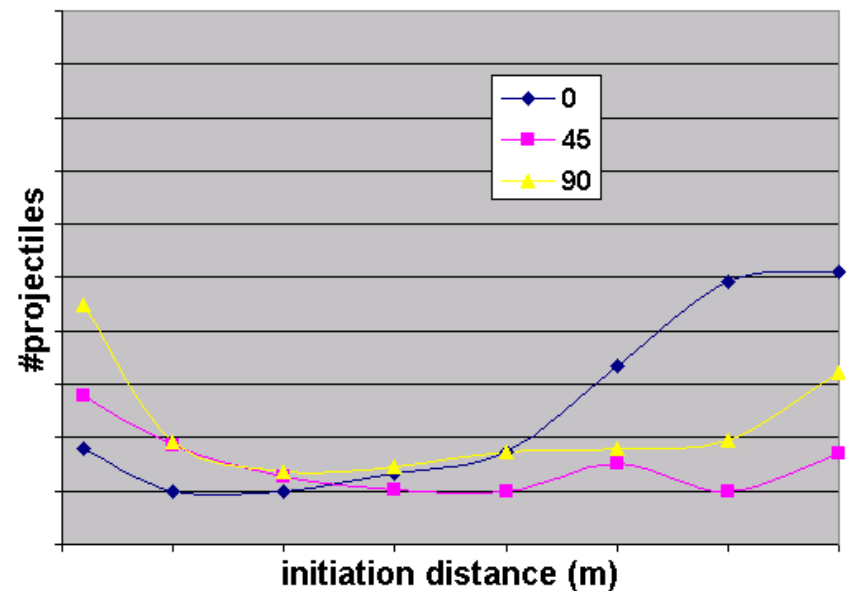
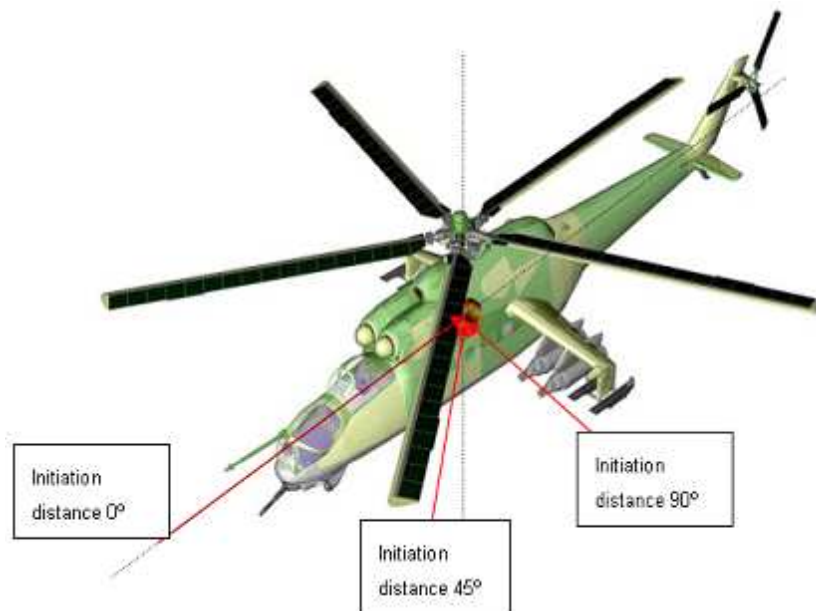
Initiation height

- Selection of initiation distance and height is essential for effectiveness KETF



Firing doctrine (35 mm KETF against Mi-24 Hind)

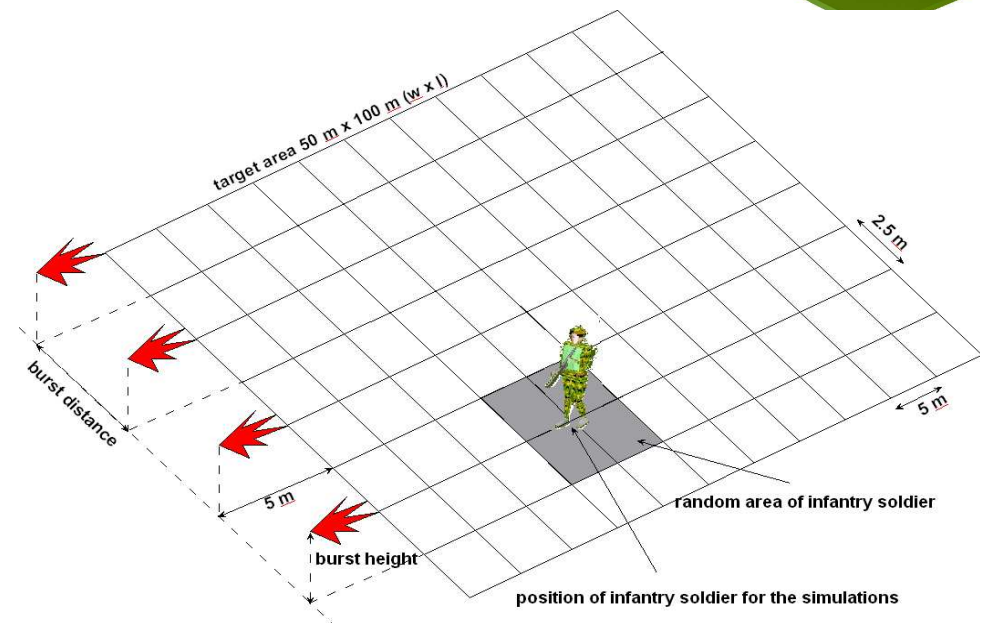
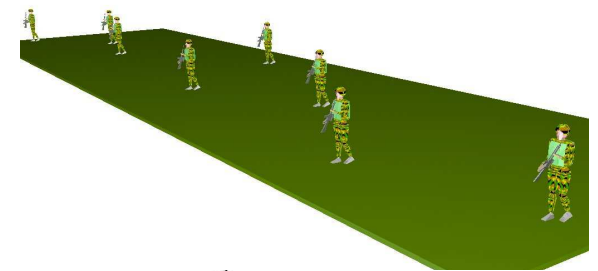
- Kill helicopter for three azimuth angles, 2000 m range
- K-kill, without manned control within 30 sec



- For KETF the selection of initiation distance is essential for KETF effectiveness
- KETF is very effective against helicopter

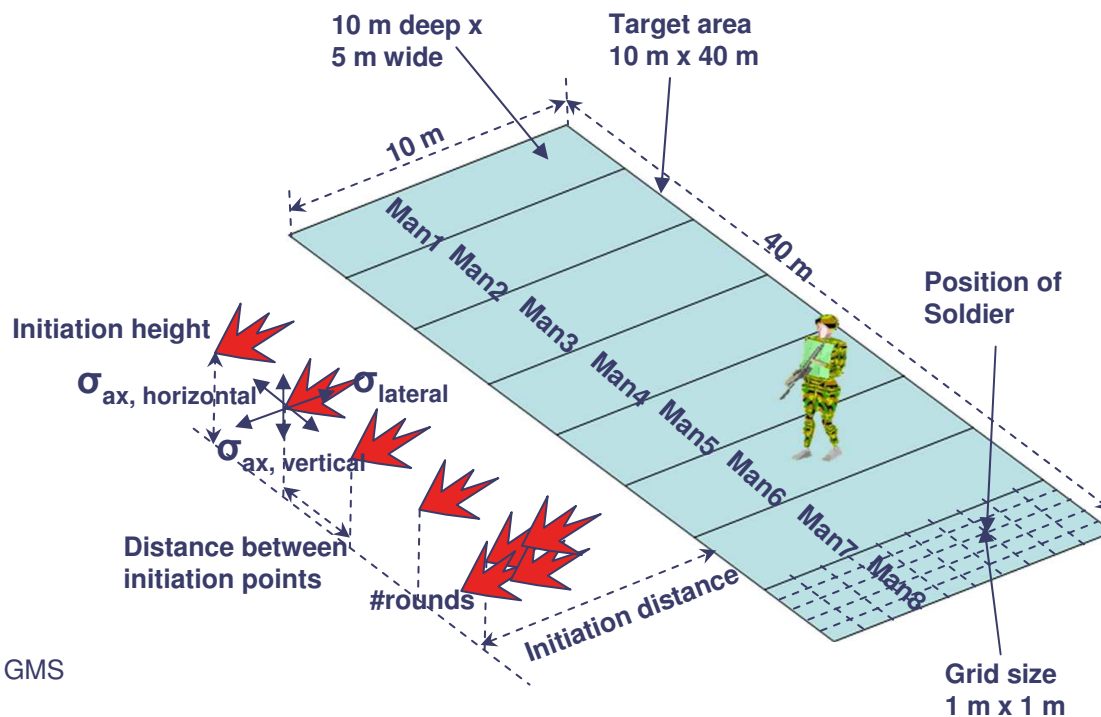
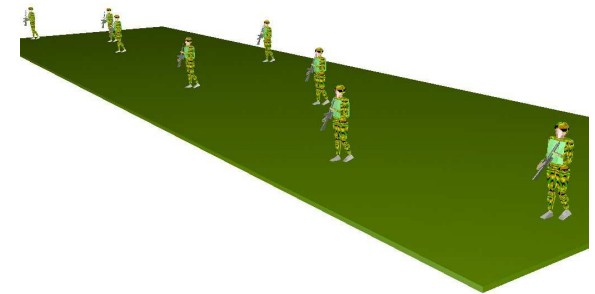
Firing doctrine (dismounted soldiers in open field)

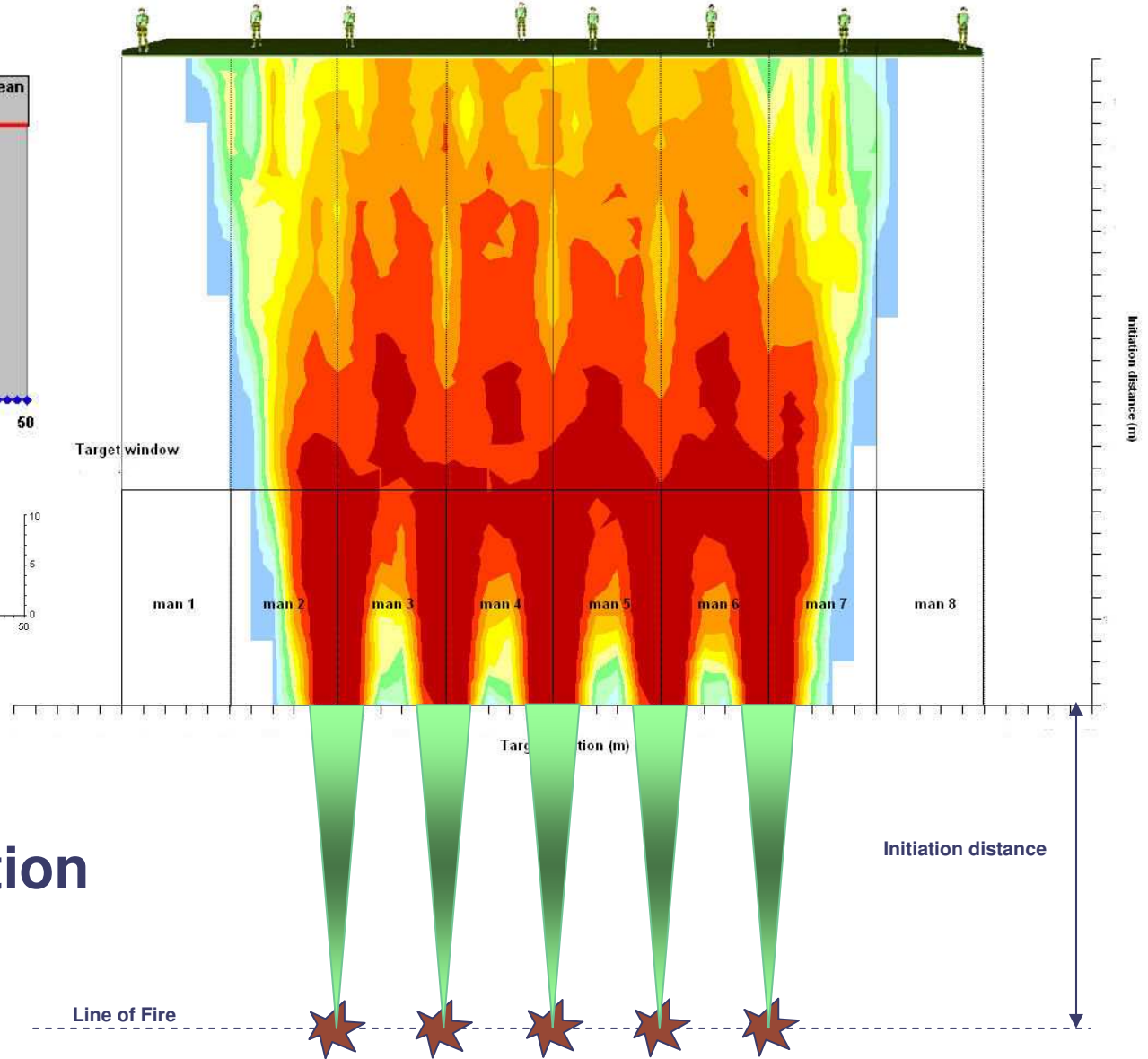
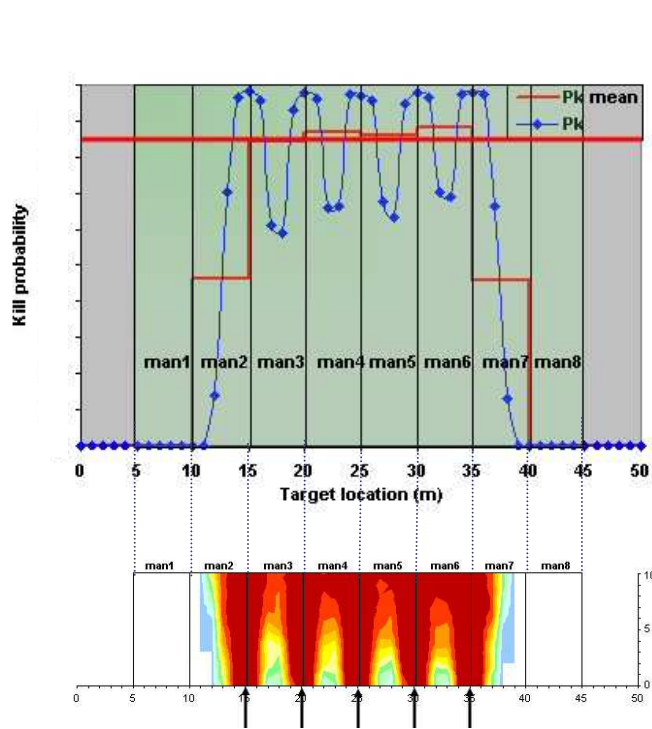
- Soldiers next to each other (line formation):
8 men covering an area of 10 x 40 m
- Soldiers in column formation:
5 men covering an area of 50 x 10 m
- Doctrine determined by combined variation of:
 - Initiation distance
 - Initiation height
 - Number of rounds
 - Distance between initiation points
 - System dispersions



Firing doctrine (dismounted soldiers in open field)

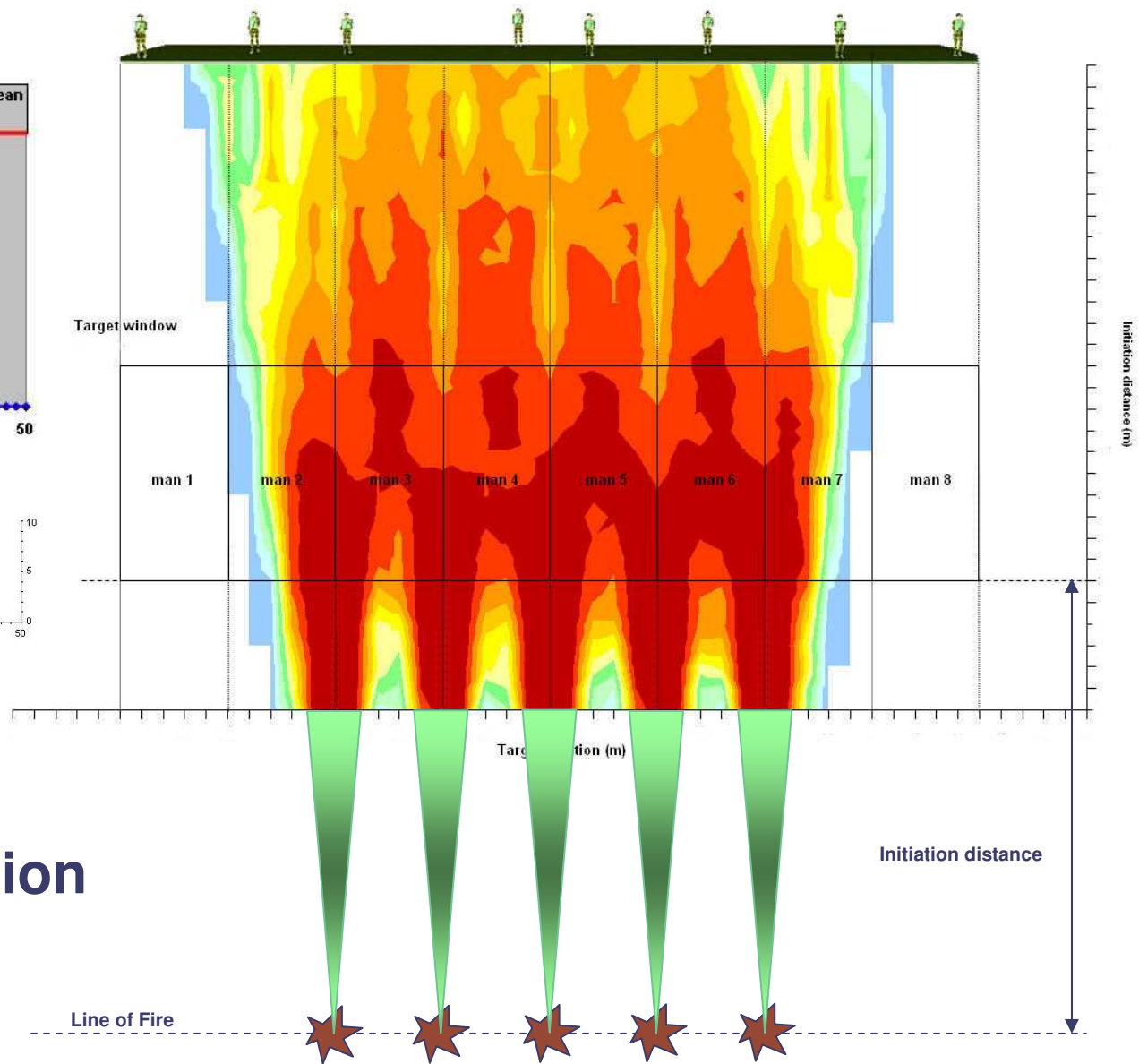
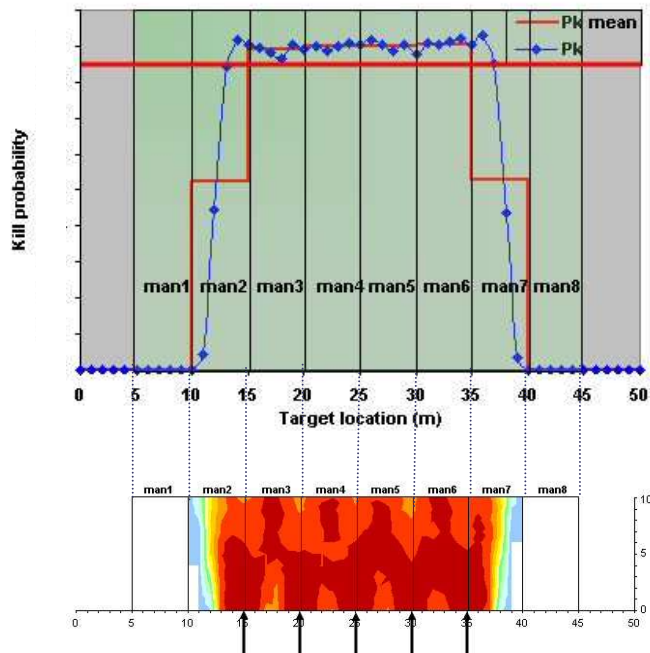
- Initiation distance
- Initiation height (offset to aimpoint)
- Distance between initiation points
- Number of rounds in initiation point
- Total system dispersion is taken into account
- Tools: Fragment trajectory + ComputerMan





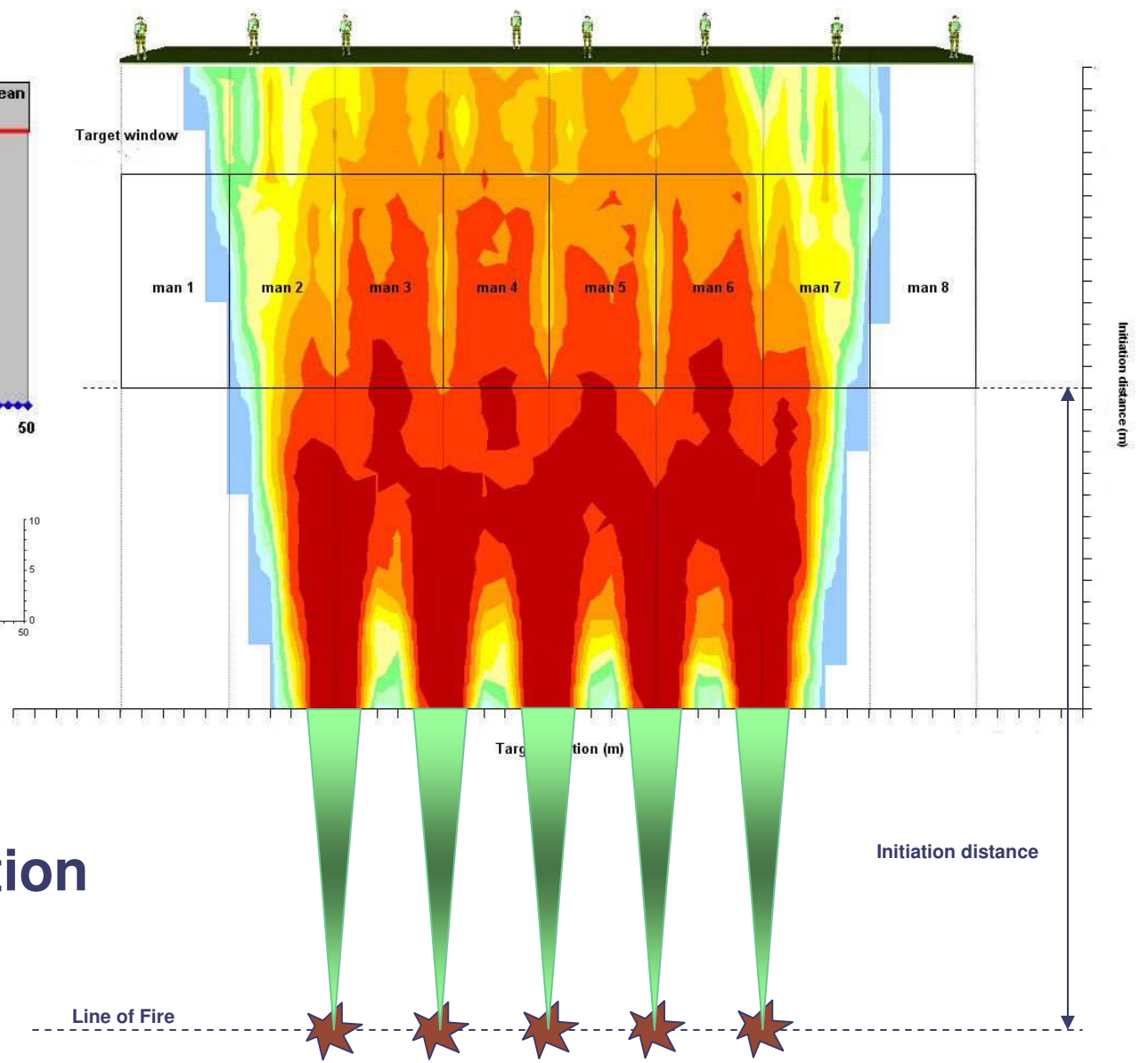
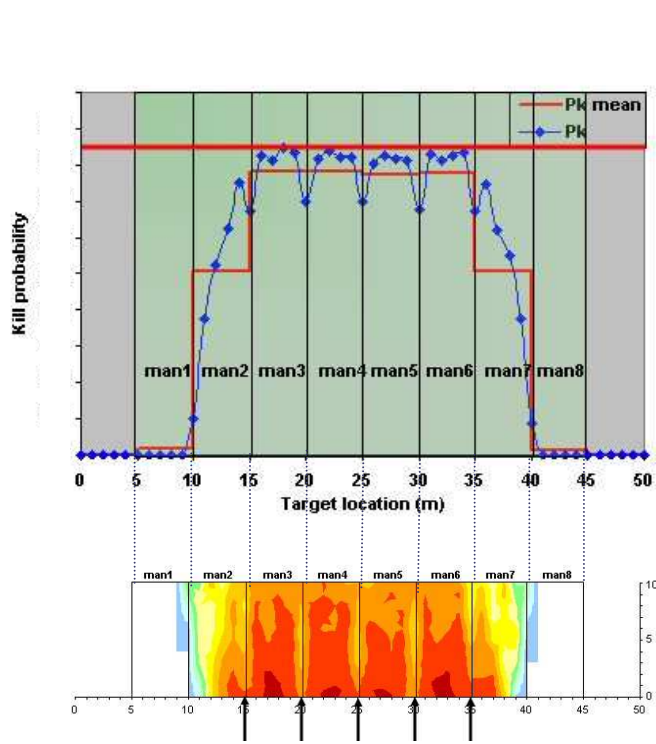
KETF initiation distance optimization

Too short



KETF initiation distance optimization

On target



KETF initiation distance optimization

Too long



CV9035 with 35 mm KETF

- The 35 mm KETF was selected for the RNLA IFV (CV9035) to fulfil the Firepower requirements
- Simulations proved essential in development of CV9035 Firing doctrine. Simulations based on an optimal balance between:
 - The number of fired projectiles
 - Initiation distance
 - Initiation height
 - Distance between initiation points
 - Time setting of the fuze
- Co-operation between operator, industry (RWMS) and TNO for projectile optimization
- Co-operation between operator and TNO for firing doctrine



TNO Weapon effectiveness simulation models

- **Medium caliber ammunition:**
 - Air Burst Munition: terminal ballistics & lethality models available
 - Frangible projectiles: terminal ballistics & lethality models available
 - PELE projectiles: terminal ballistics & lethality models under development

