

# Shock Desensitization Effect in the STANAG 4363 Confined Component Water Gap Test

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\*Participating guest from DGA/CEG (Gramat)

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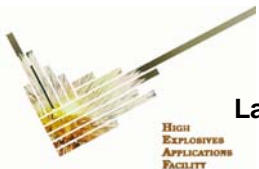


# Overview (ECWGT)

## Introduction

- Configurations
- Models
- Shock wave in water (time arrival, peak pressure)
- Go/No Go results
- Confinement influence on the Go results (Lagrangian pressure)

## Conclusion



# Explosive Component Water Gap Test (ECWGT)



## • Experiments

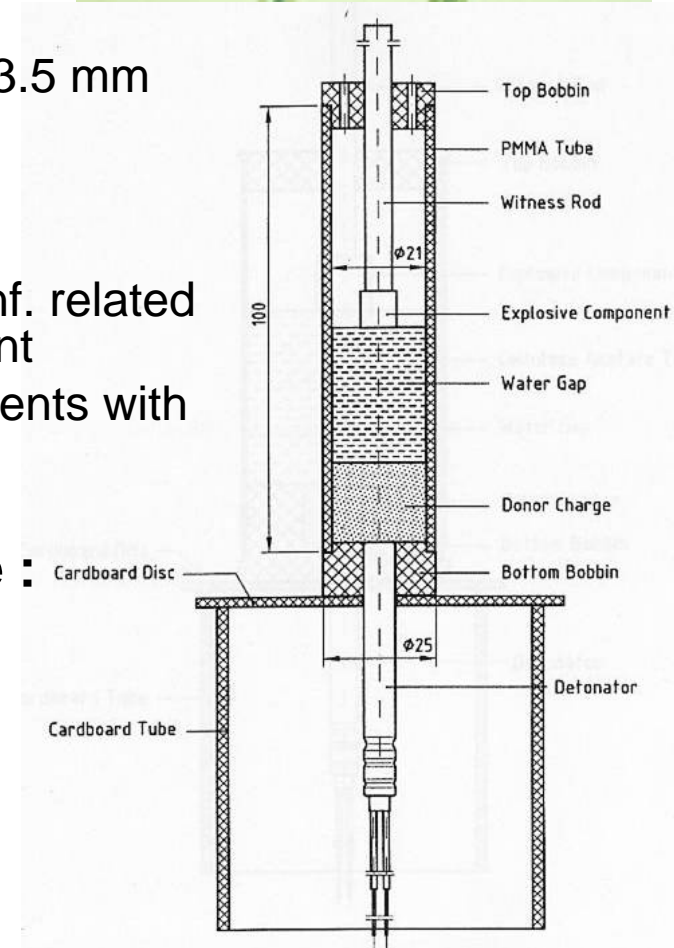
- Defined by Stanag 4363 ed.3 final draft
- performed by Wiweb and TNO
- $\varnothing$  3 mm PETN pellet with steel conf. 1mm, 2mm, 3.5 mm thick

## • Goal :

- Trying to understand better the influence of the conf. related to the desensitization with 3.5 mm thick confinement
- Update the Stanag 4363 ed.3 for confined components with explosive fills having a diameter less than 5 mm

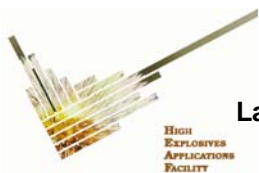
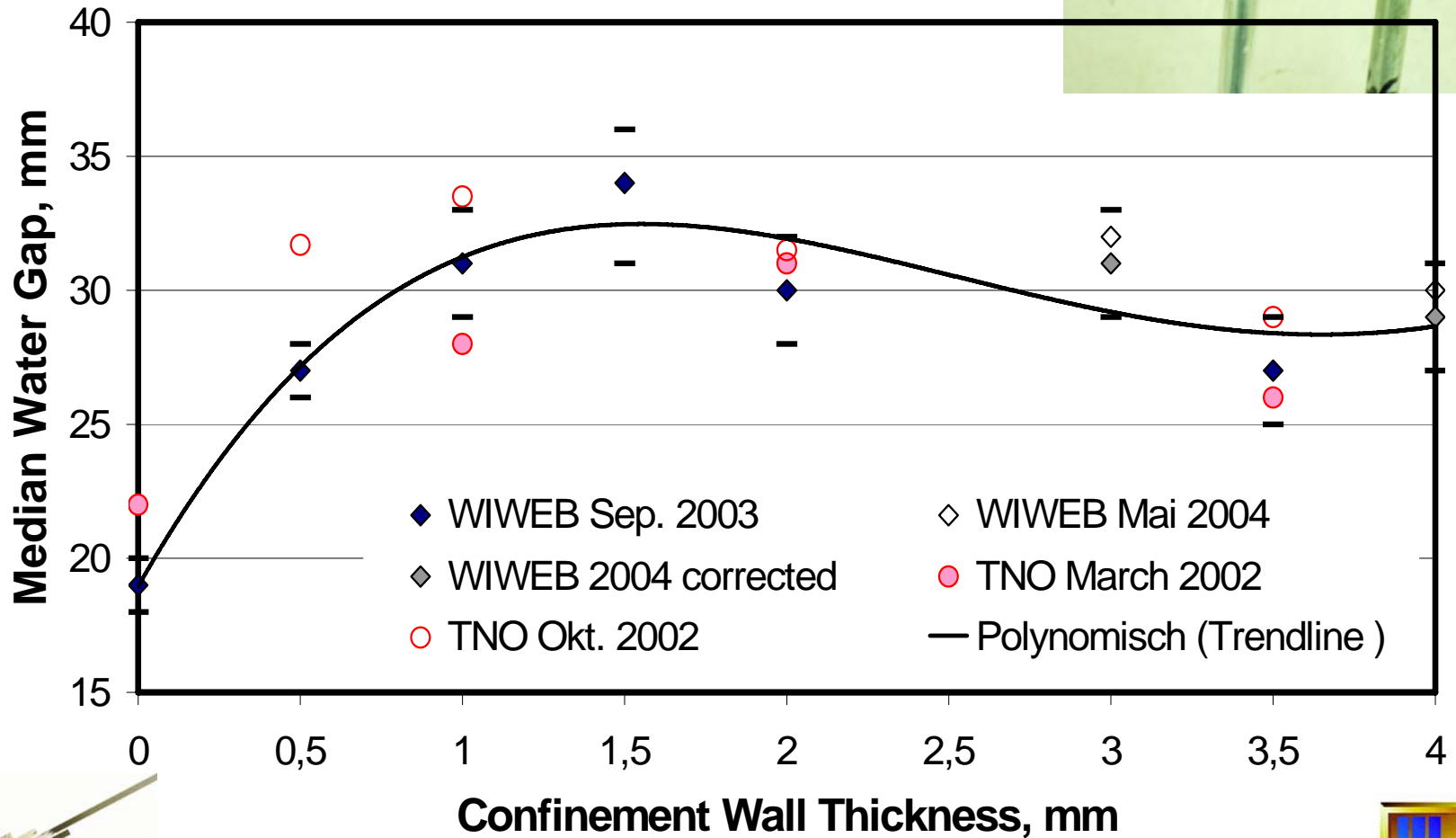
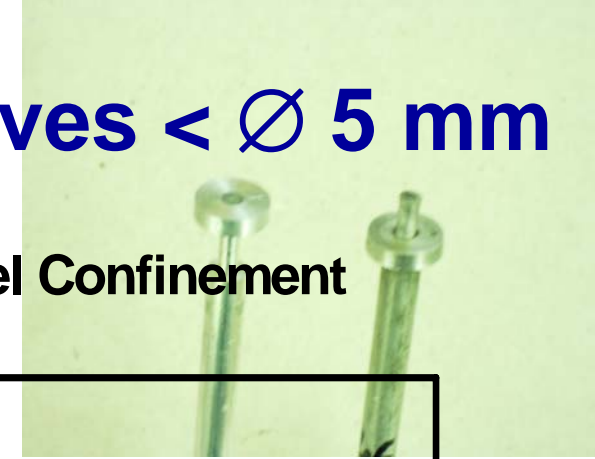
## • This work, Ls-Dyna runs 2D axi and 3D wedge :

- Models, including Ignition and Growth
- aluminum or steel annular confinement
- target double height
- half donor charge height and initiation type
- PMMA confinement thicknesses (water column)
- constitutive laws on go/no go threshold
- glue between Pellet and witness rod



# Special Effect for Small Explosives <math>\lt; \varnothing 5 \text{ mm}</math>

## 3 mm PETN Pellets with Annular Steel Confinement

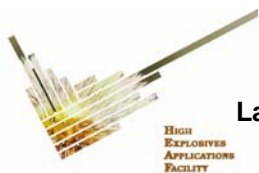
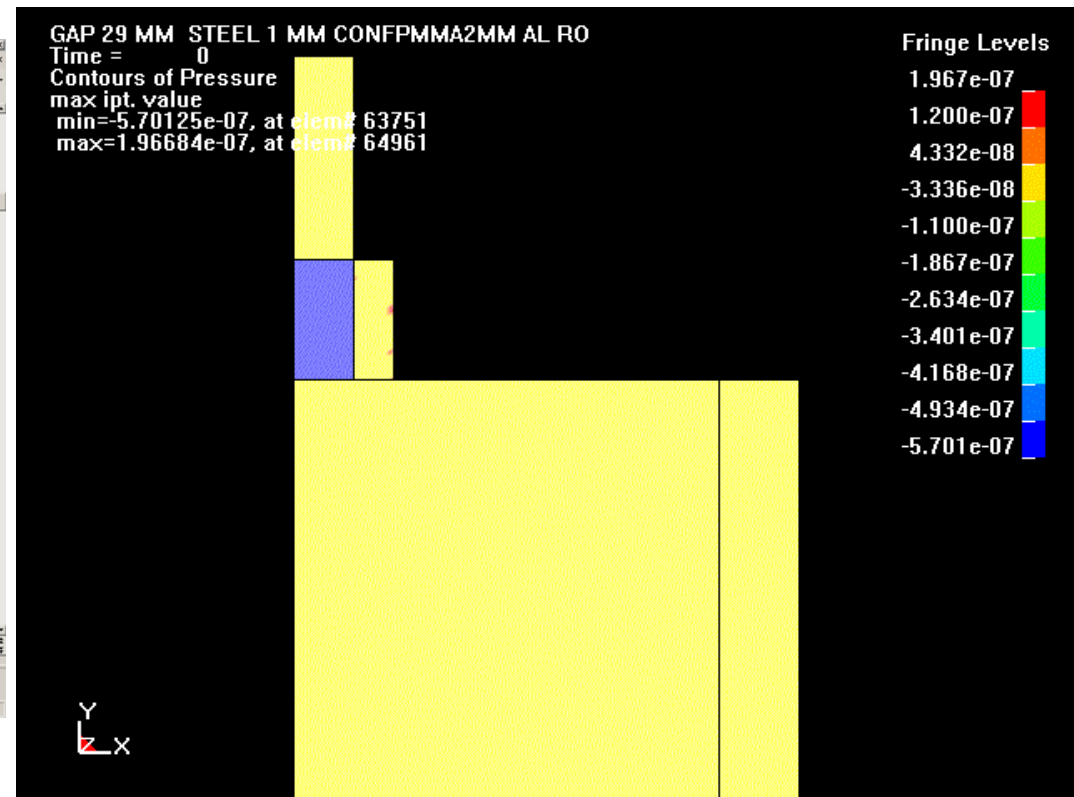
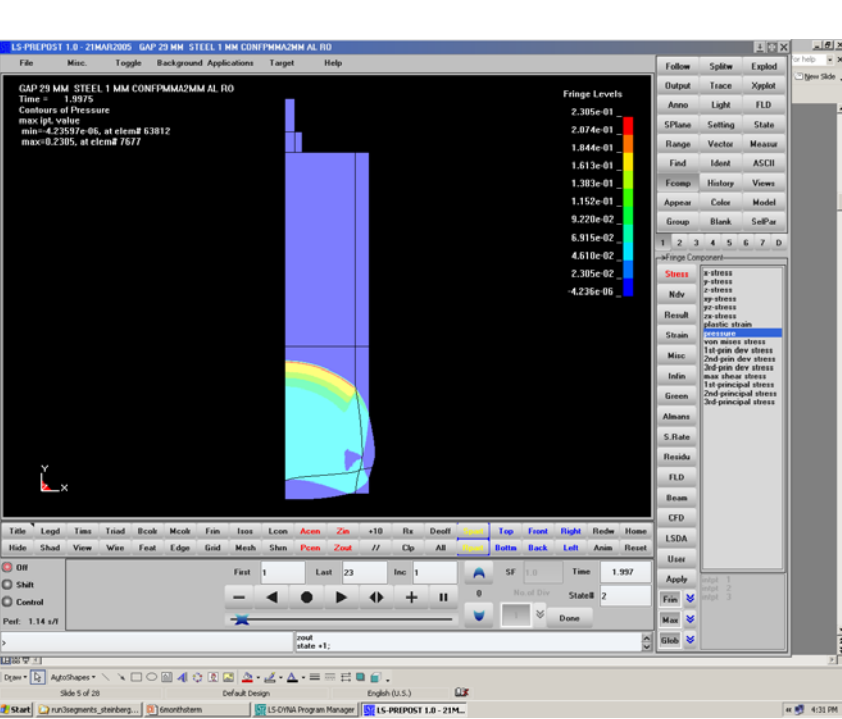


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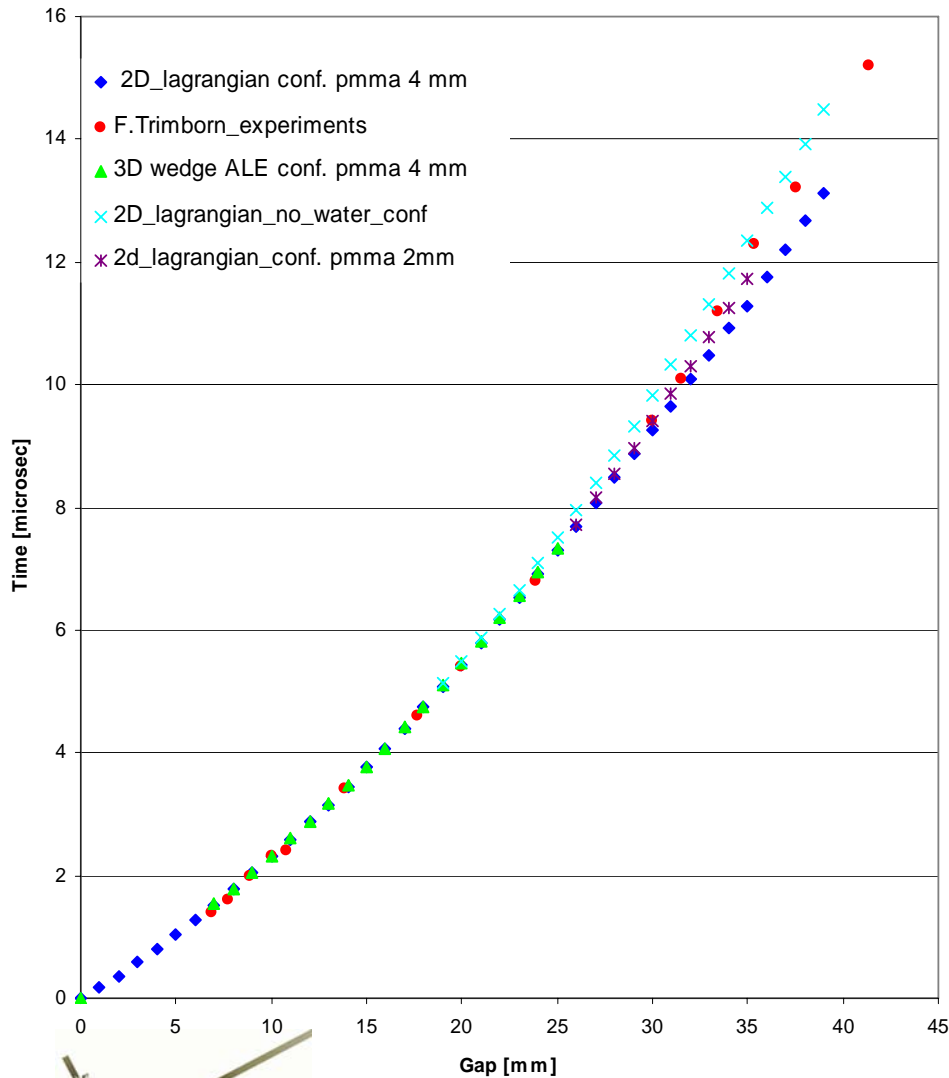
# Configurations - Models (ECWGT)



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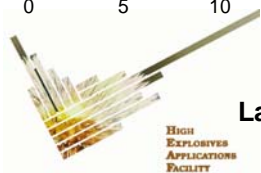
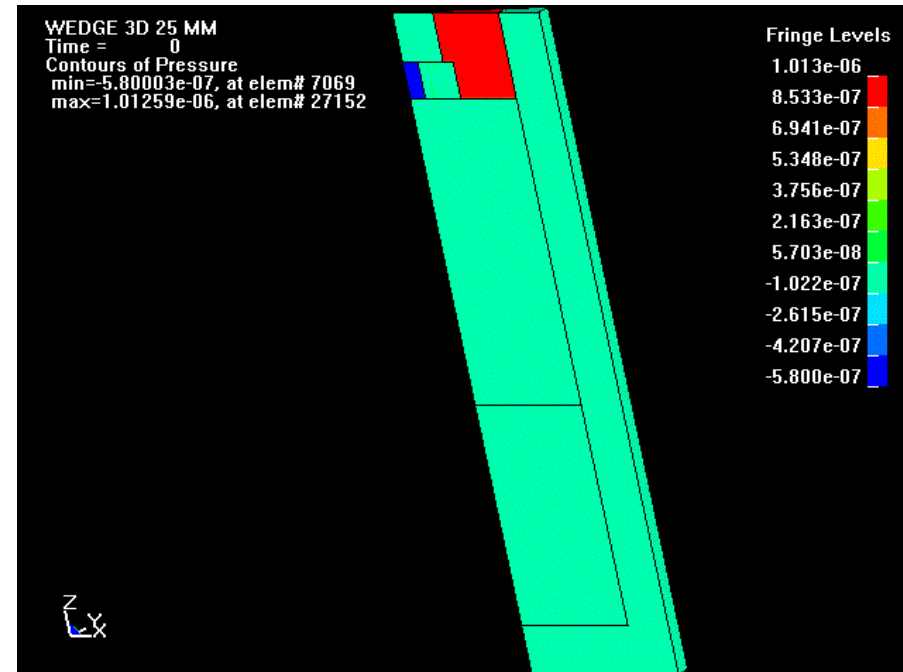


# Water shock wave (ECWGT)



## Time arrival versus distance in water :

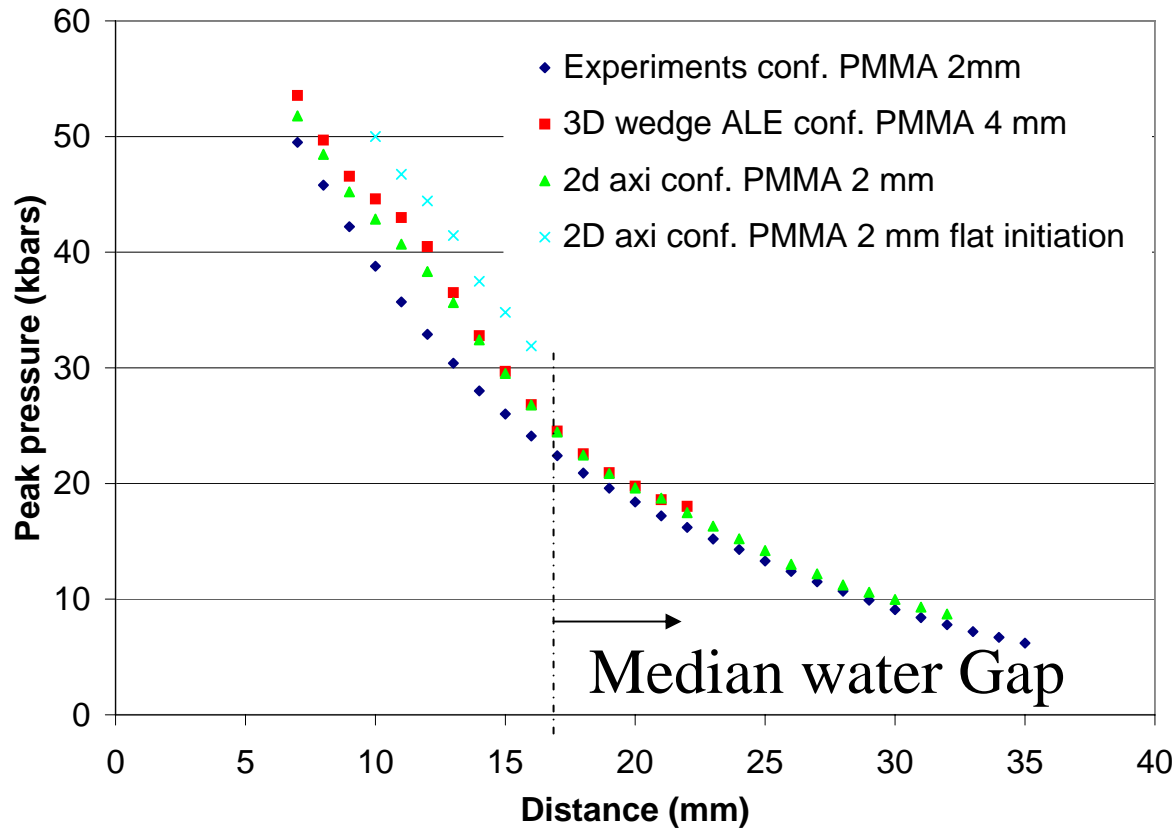
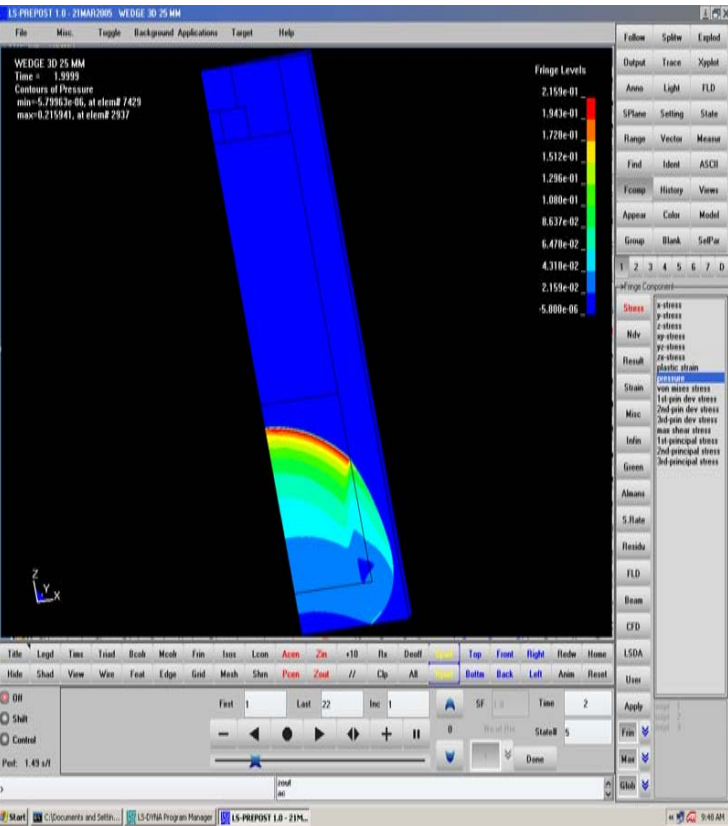
- Comparison experiments – calculations
- Effect of the PMMA confinement



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# Water shock wave (ECWGT)



## Peak pressure versus distance in water :

- Comparison experiments – calculations
- Effect of PMMA confinement



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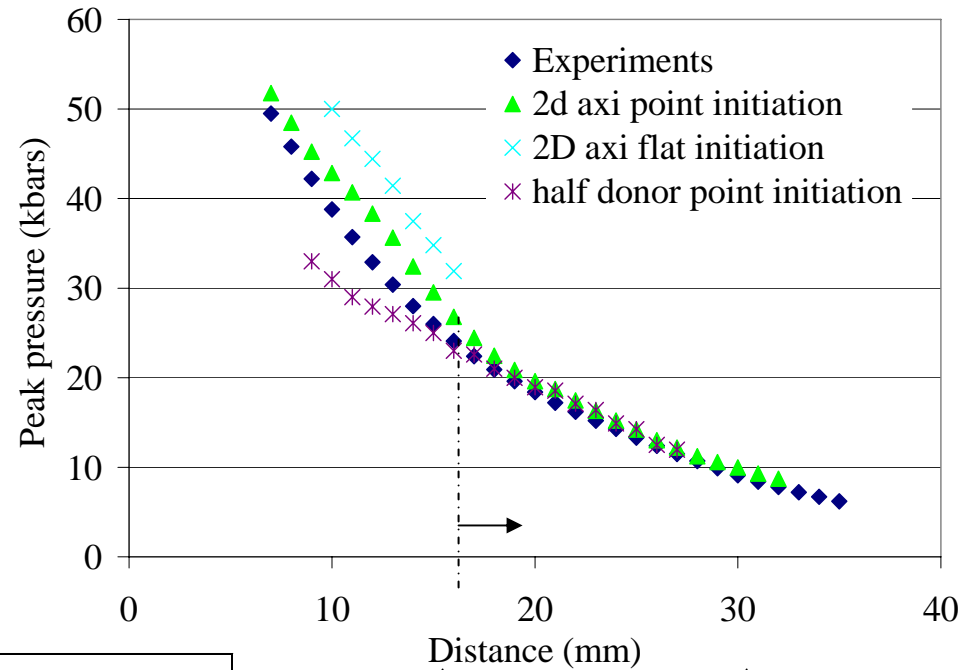
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# Go/NoGo results

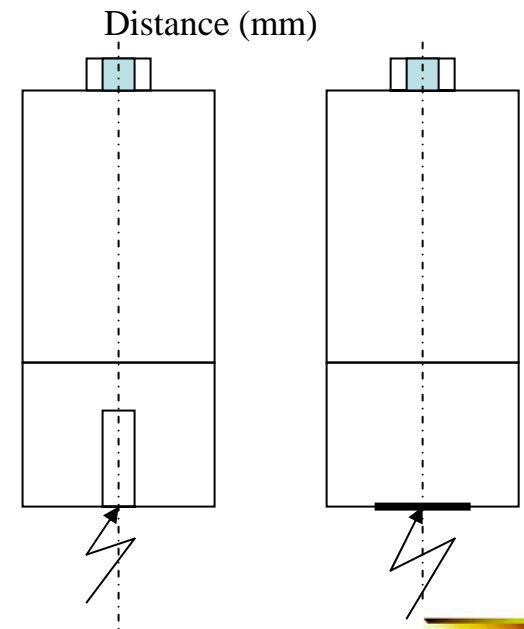
Influence of the donor pellet :

- cavity pellet
- plain pellet
- half donor



Steel confinement (target)

Initiation / Donor charge	Go, water gap	No Go, water gap
Point / Ø 21 mm h 20.3 mm	-	16.7 mm
Point / Ø 21 mm h 20.3 mm	-	20.7 mm
Flat / Ø 21 mm h 18 mm	15 mm	17 mm
Point / Ø 21 mm h 18 mm (simulation reference)	15 mm	17 mm
Donor charge	Go, water gap	No Go, water gap
Half height donor	26 mm	28 mm
Standard height donor	27 mm	29 mm

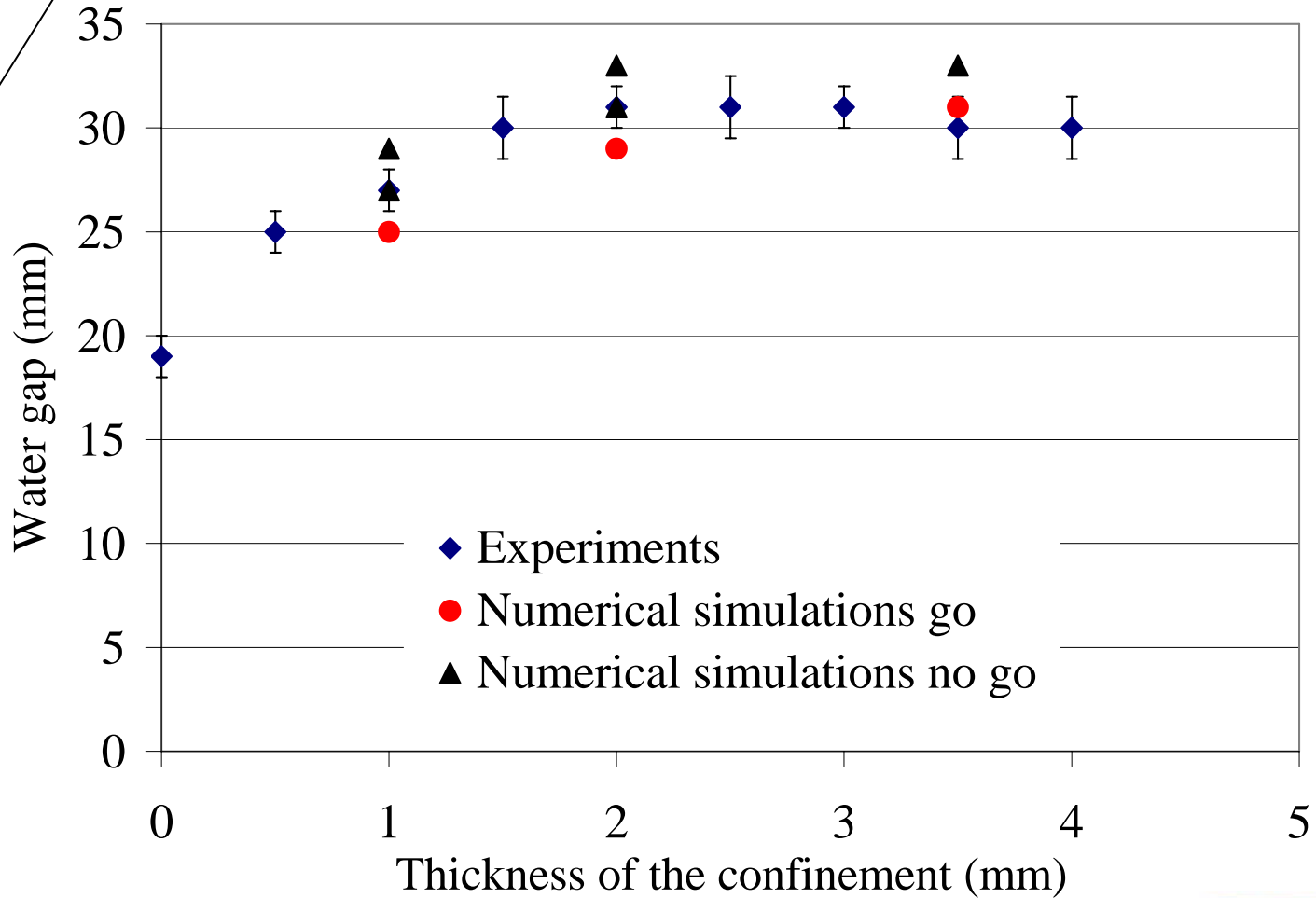
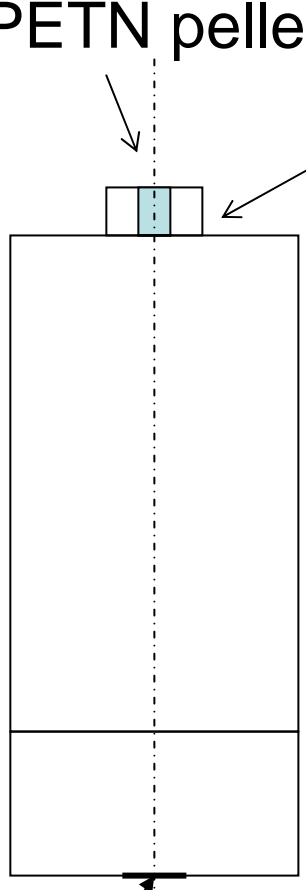




# Go/No Go results

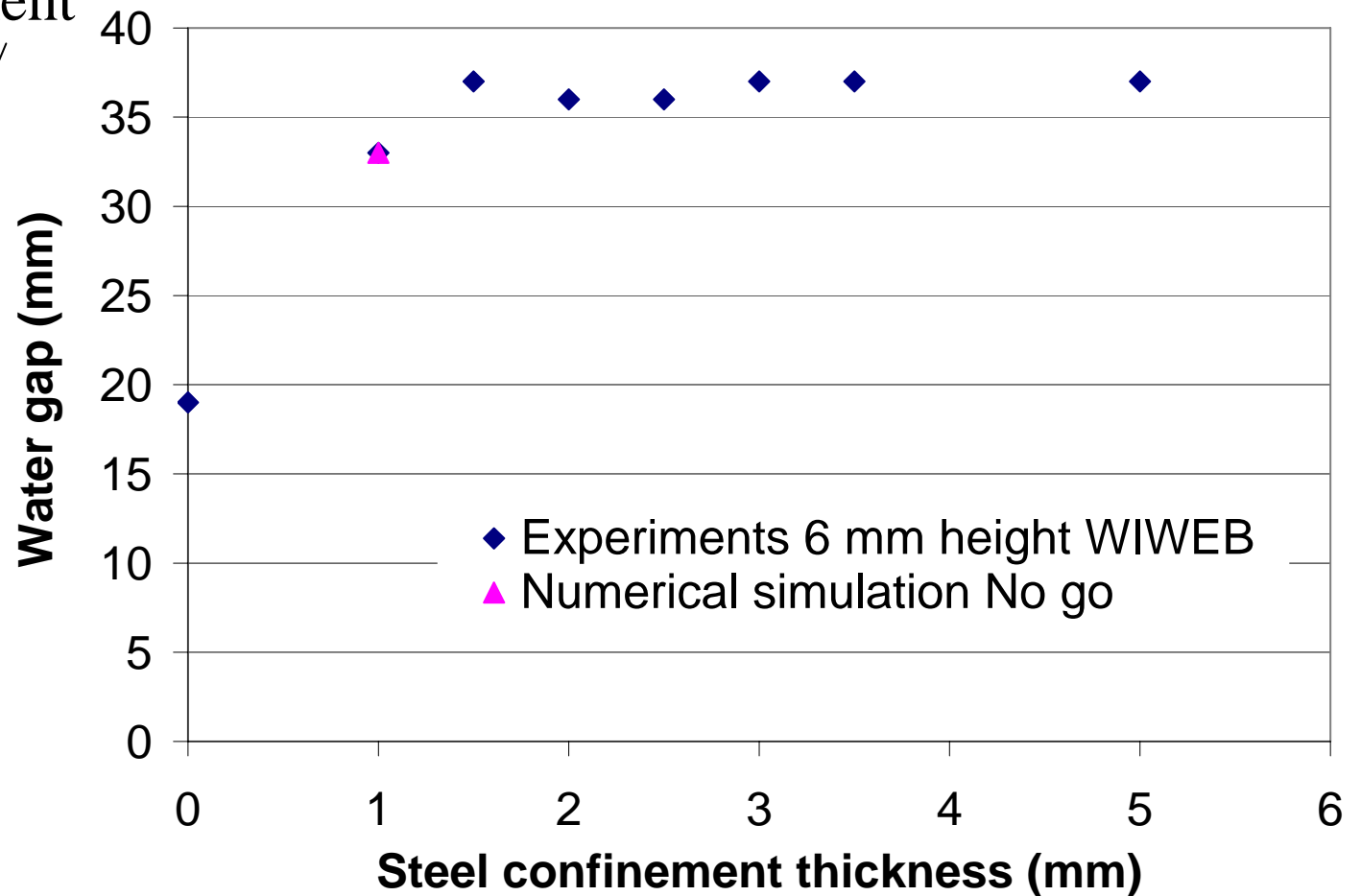
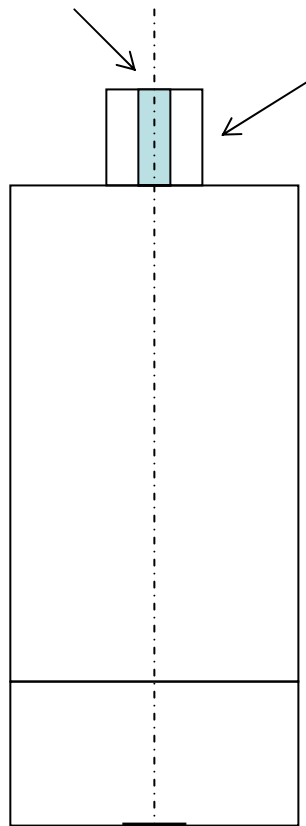
Ø 3 h 3 mm  
PETN pellet

Aluminum confinement



# Go/No Go results

- Steel confinement
- $\varnothing$  3 h 6 mm PETN Pellet



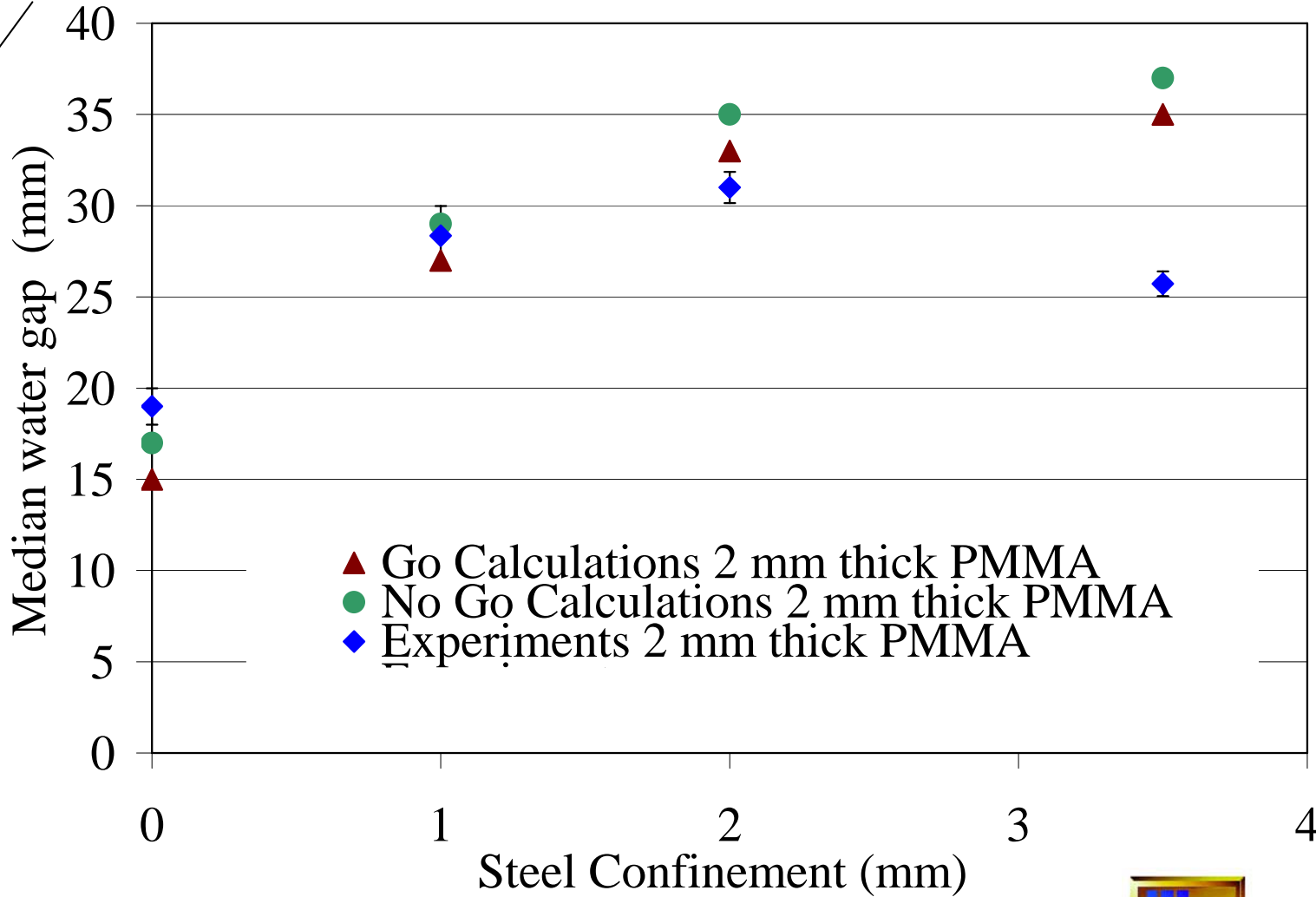
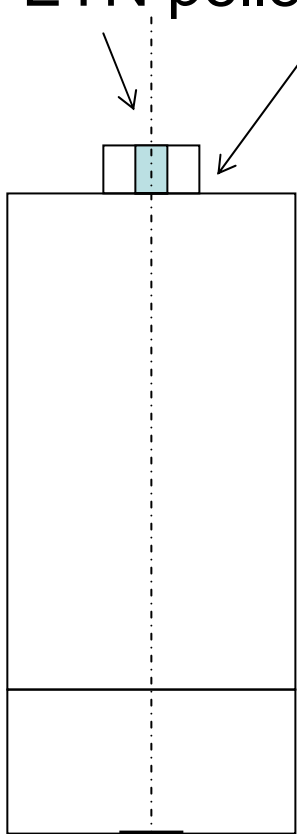
Receptor charge, $\varnothing$ 3 mm	Go, water gap	No Go, water gap
6 mm height	-	33 mm
3 mm height (reference)	27 mm	29 mm



# Go/No Go results

Ø 3 h 3 mm  
PETN pellet

Steel confinement

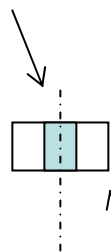


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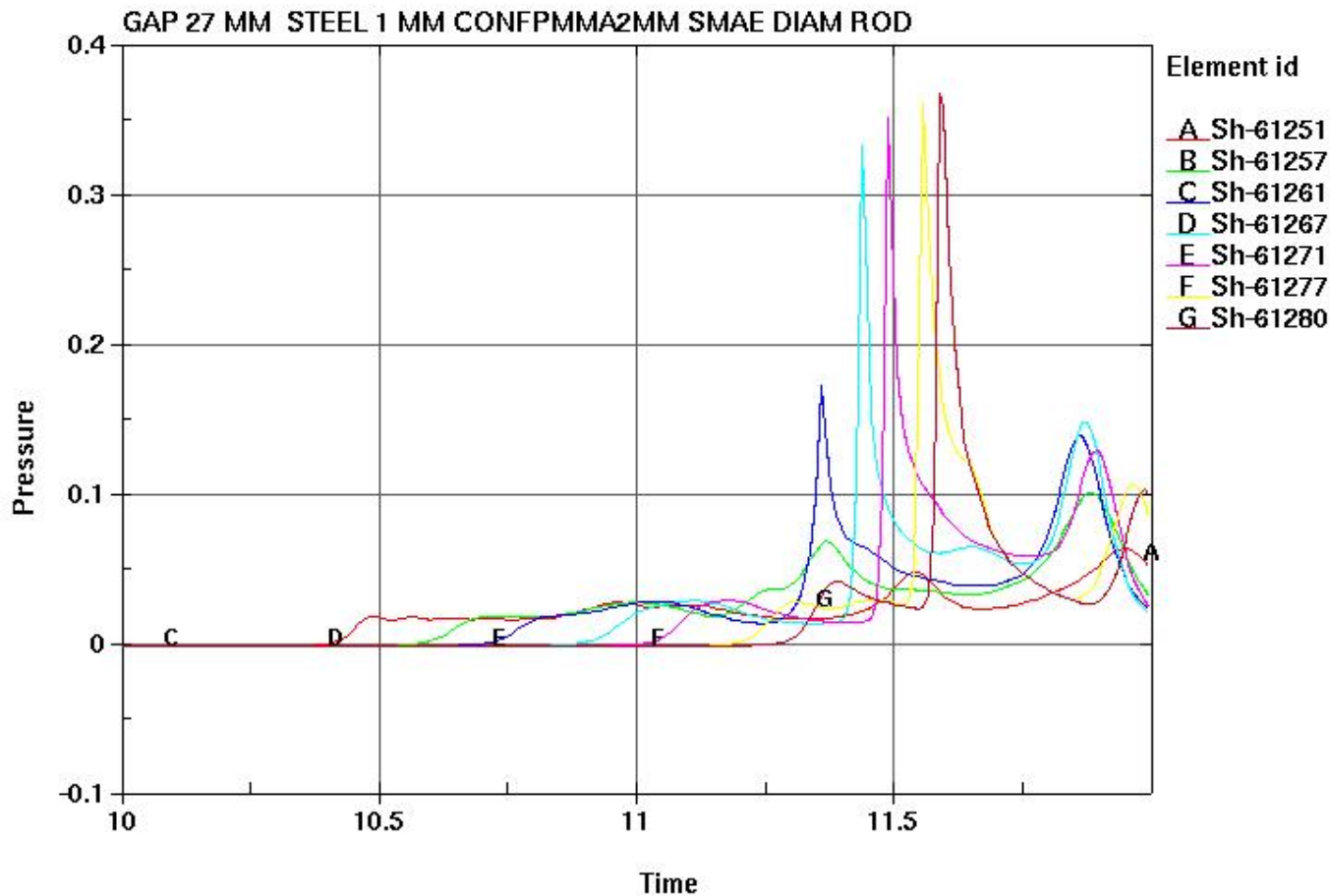


# Confinement Influence on Go Results (ECWGT)

Ø 3 h 3 mm  
PETN pellet

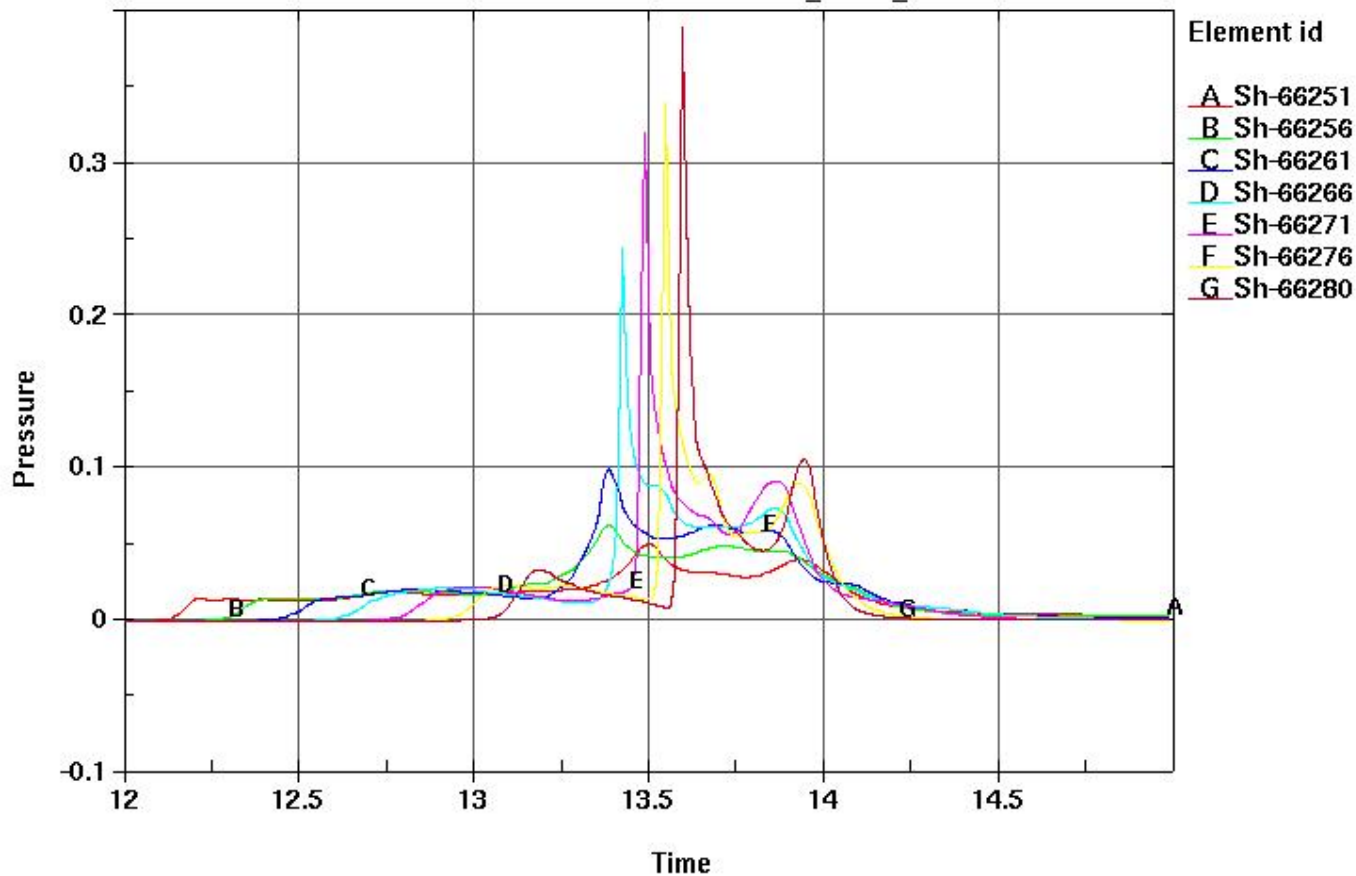


1 mm Steel  
confinement

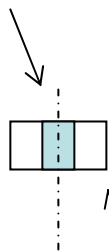


# Confinement Influence on Go Results (ECWGT)

GAP 31 MM STEEL 2 MM CONFPMMA2MM AL ROD\_DIAM\_3MM J COOK



Ø 3 h 3 mm  
PETN pellet




2 mm Steel  
confinement



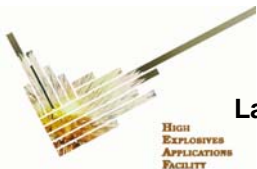
# Conclusion

The numerical simulation allow us to study the following effects :

- Ignition and Growth of the PETN Pellet
- Influence of the donor charge, and point or planar initiation
- Influence of the aluminum, steel confinement thicknesses
- Influence of the height of the pellet
- Influence of PMMA confinement (water column)
- Influence of constitutive laws on go/no go threshold
- Influence of glue between Pellet and witness rod



Experimental results are related for 2 mm and 3.5 mm confinement with desensitization due to the second lateral re-shock from the steel confinement



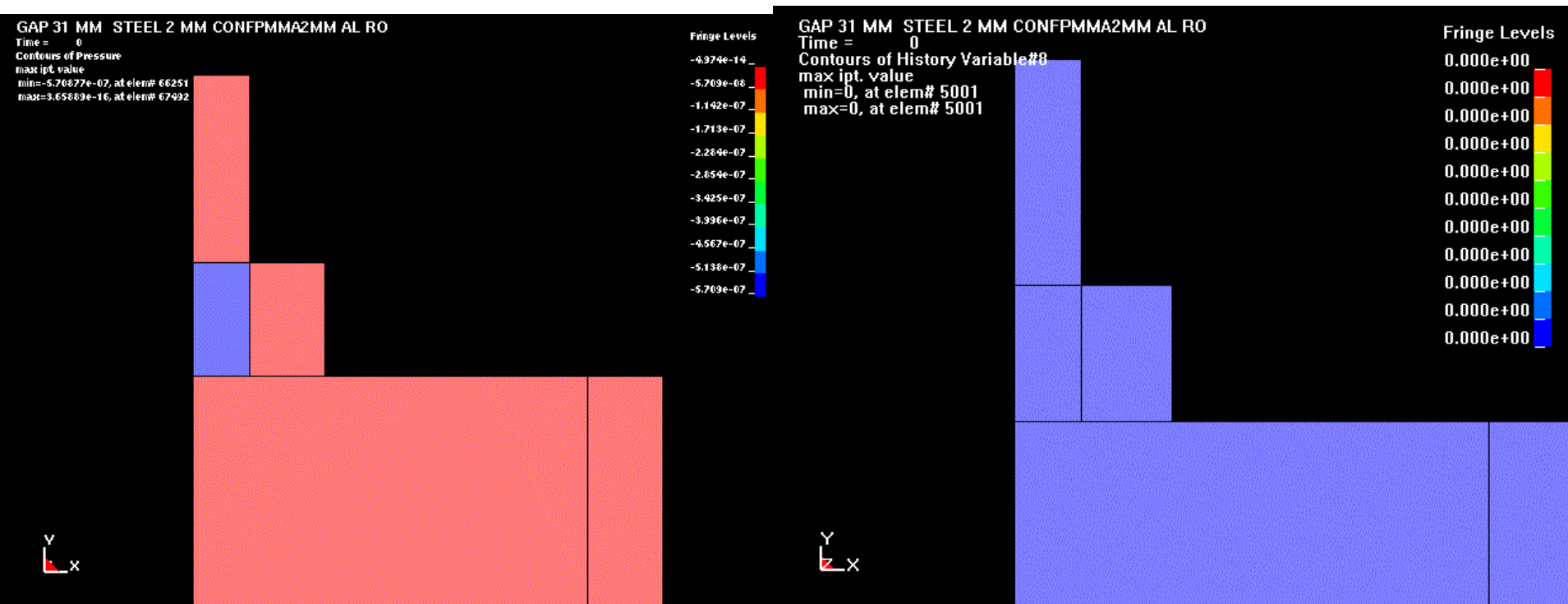
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# Confinement Influence on Go Results (ECWGT)

Gap 31 mm steel 2 mm pressure – Burn fraction

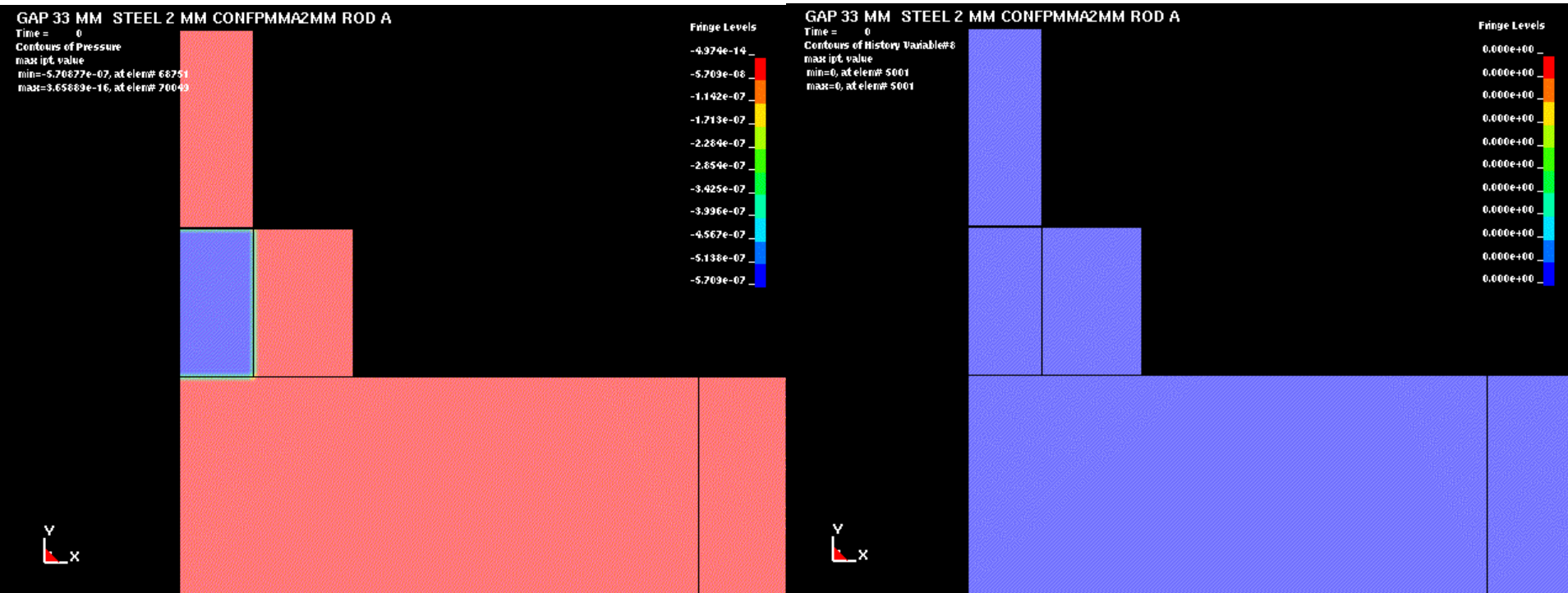


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Gap 33 mm steel 2 mm pressure – Burn fraction



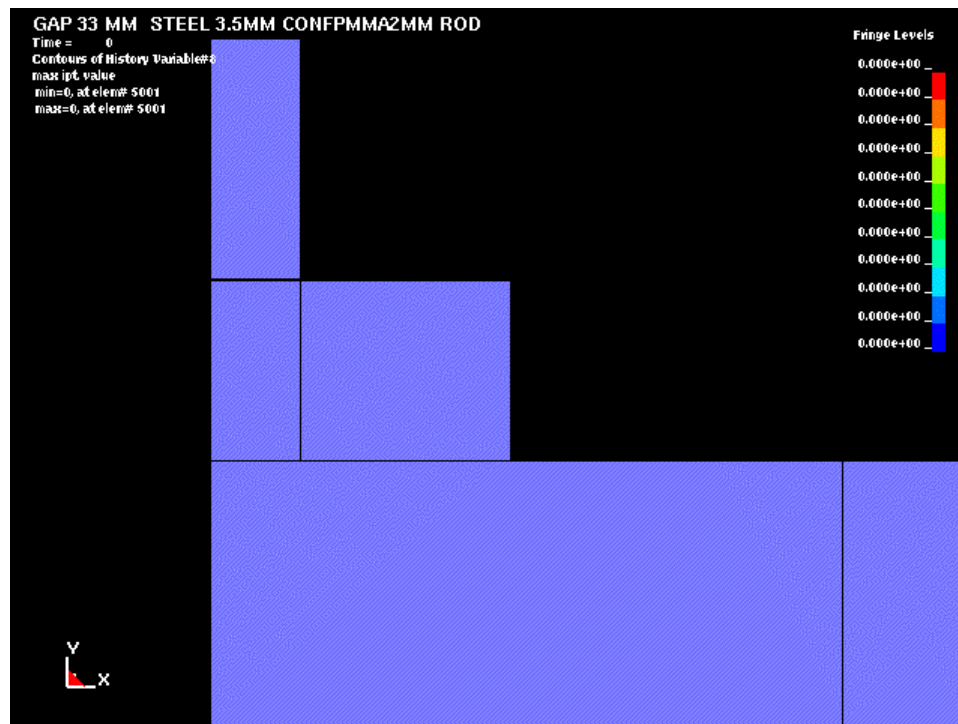
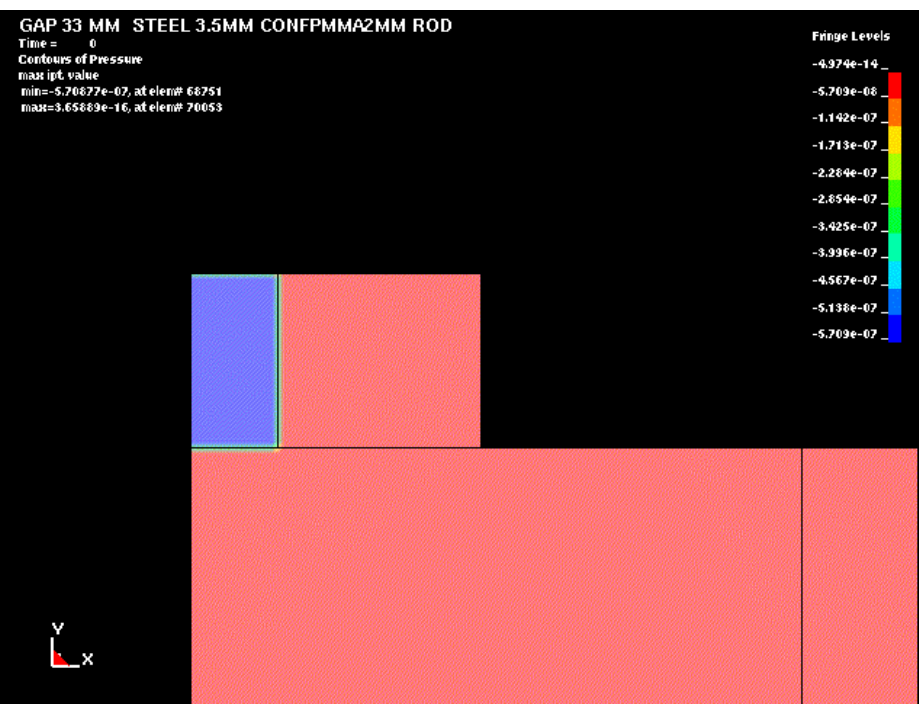
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# Confinement Influence on Go Results (ECWGT)

Gap 33 mm steel 3.5 mm pressure – Burn fraction

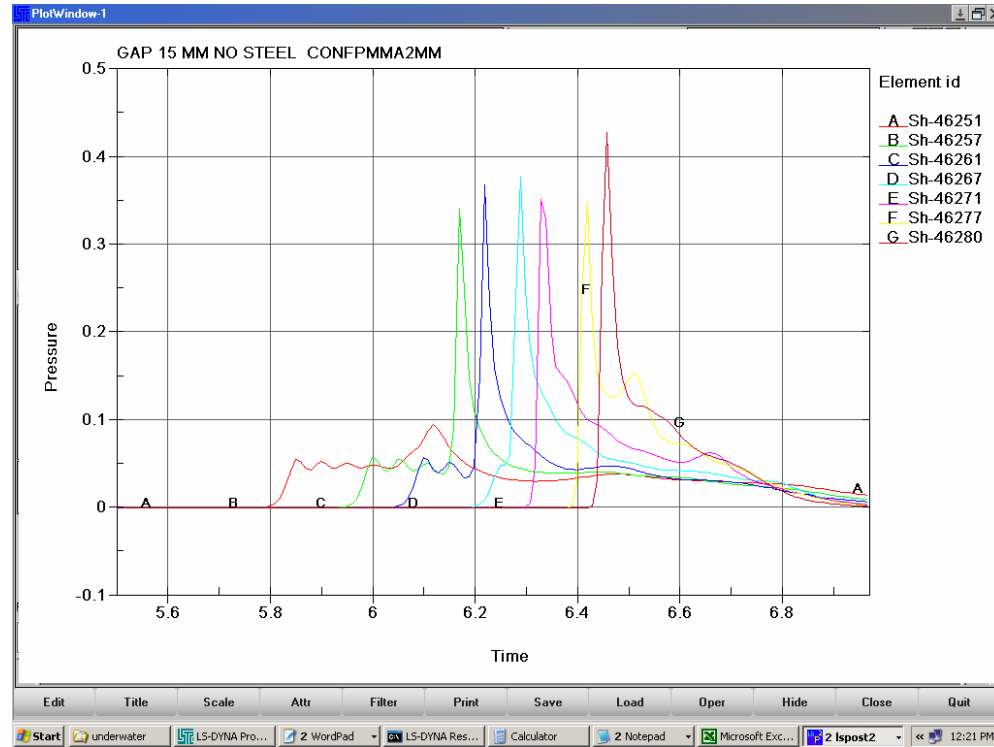
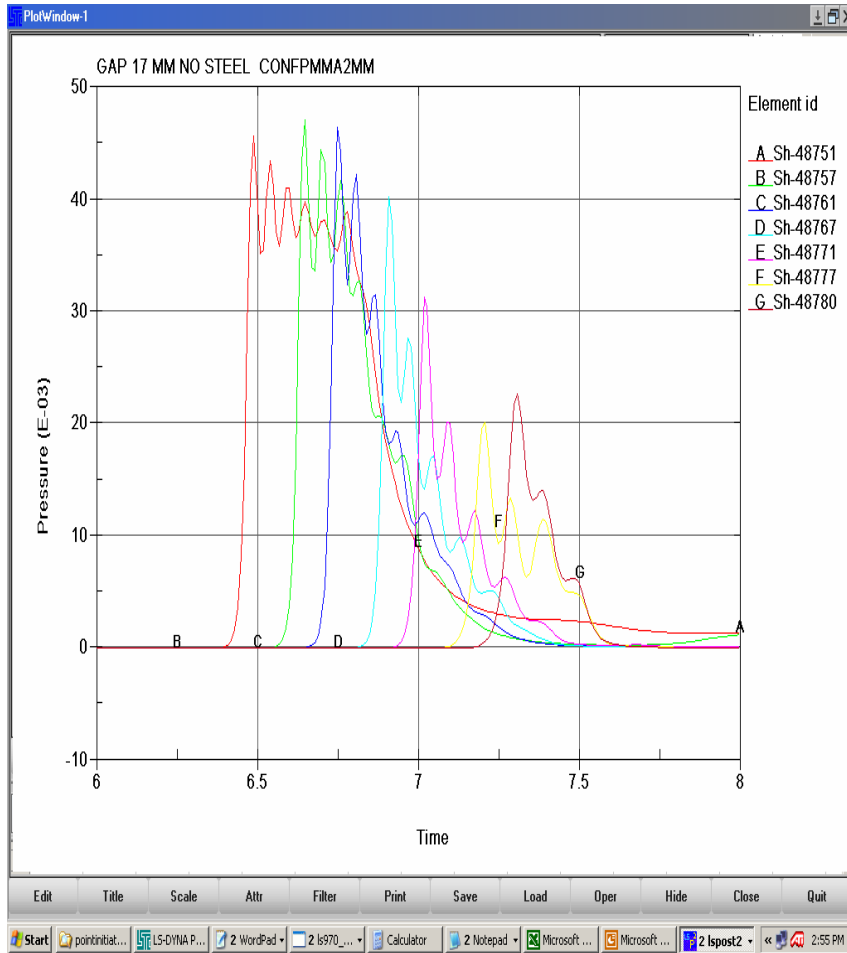


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# Confinement Influence on Go Results (ECWGT)



Flat initiation

