

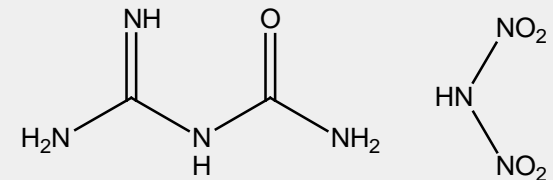
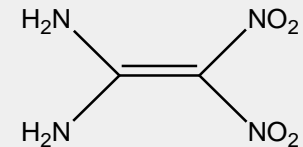
# PARAMETERS WITH IMPACT ON SENSITIVITY OF FOX CRYSTALS AND FORMULATIONS

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# Outline

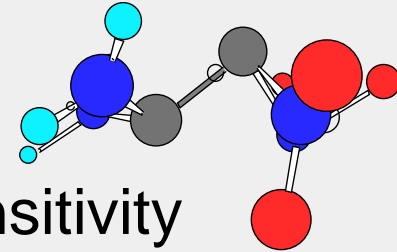
- Introduction
  - FOX-7
  - FOX-12
- Results
  - 4 case-studdies
- Conclusions
- Acknowledgements



# Introduction

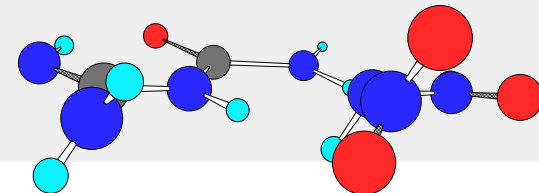
## FOX-7

- The relationship between particle size and sensitivity
- The impact on press density of solvent used in the flegmatization process
- The impact of sample capsule on DSC behavior



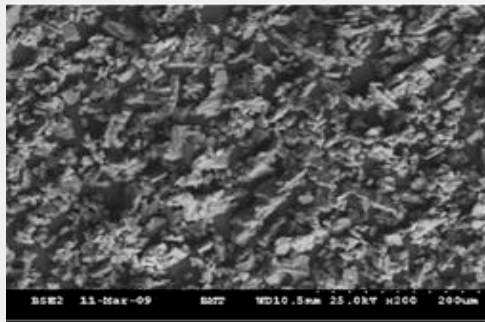
## FOX-12 (GUDN)

- Impact on sensitivity of fragmented FOX-12/TNT melt cast formulations

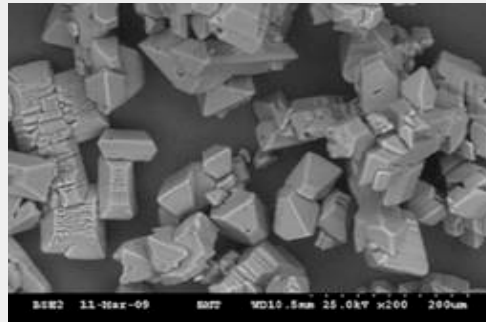


# Results - Particle size vs sensitivity

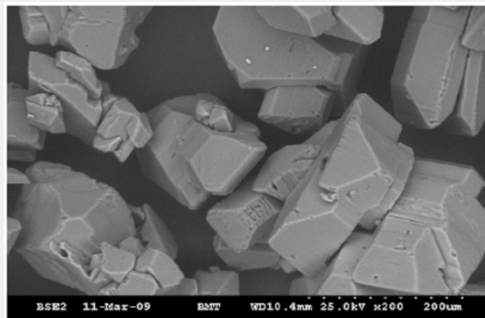
## FOX-7 Particles



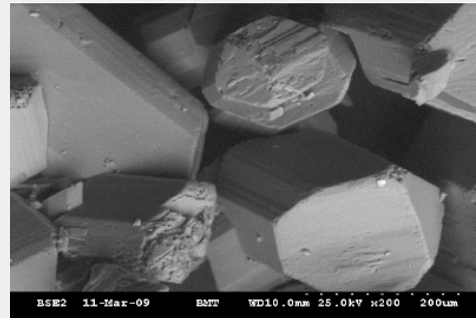
FOX-7 Class 1 (NSF110)



FOX-7 Class 2 (NSF 120)



FOX-7 Class 3 (NSF 130)



FOX-7 Class 4 (NSF 140)

FOX-7 type	Particle size [μm]	Bulk density [g/cm <sup>3</sup> ]
Class I	20-40	< 0.60
Class II	50-100	0.70
Class III	100-200	0.85
Class IV	250-350	> 0.95

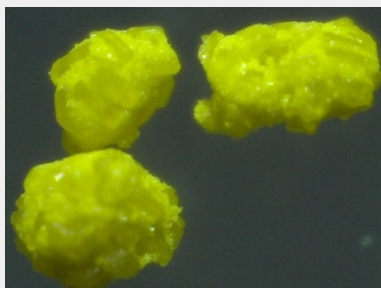
# Results - Particle size vs. sensitivity

<b>Median particle size [<math>\mu\text{m}</math>]</b>	<b>Drop hammer [J]</b>
>300	29.4
100-300	24.5
50-100	19.6
<50	14.7

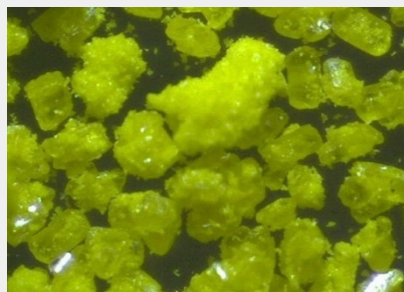
<b>Median particle size [<math>\mu\text{m}</math>]</b>	<b>SSGT [mm]</b>	<b>Pressure [kbar]</b>
250-350	2.8	140.4
20-40	14.0	117.4

# Results - Solvent impact on press density

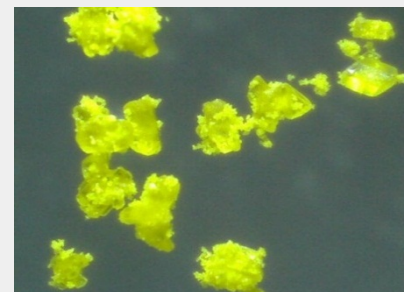
Solvent	Water solubility [% w/w]	Azeotropic ratio [% w/w]	Viscosity [cP]	Pressed Density [kg/dm <sup>3</sup> ]		
				30 bar	40 bar	50 bar
A	10	90	0.46	1.80	1.81	1.82
B	25	90	0.41	1.78	1.79	1.80
C	100	-	0.33	1.74	1.77	1.79



Solvent A

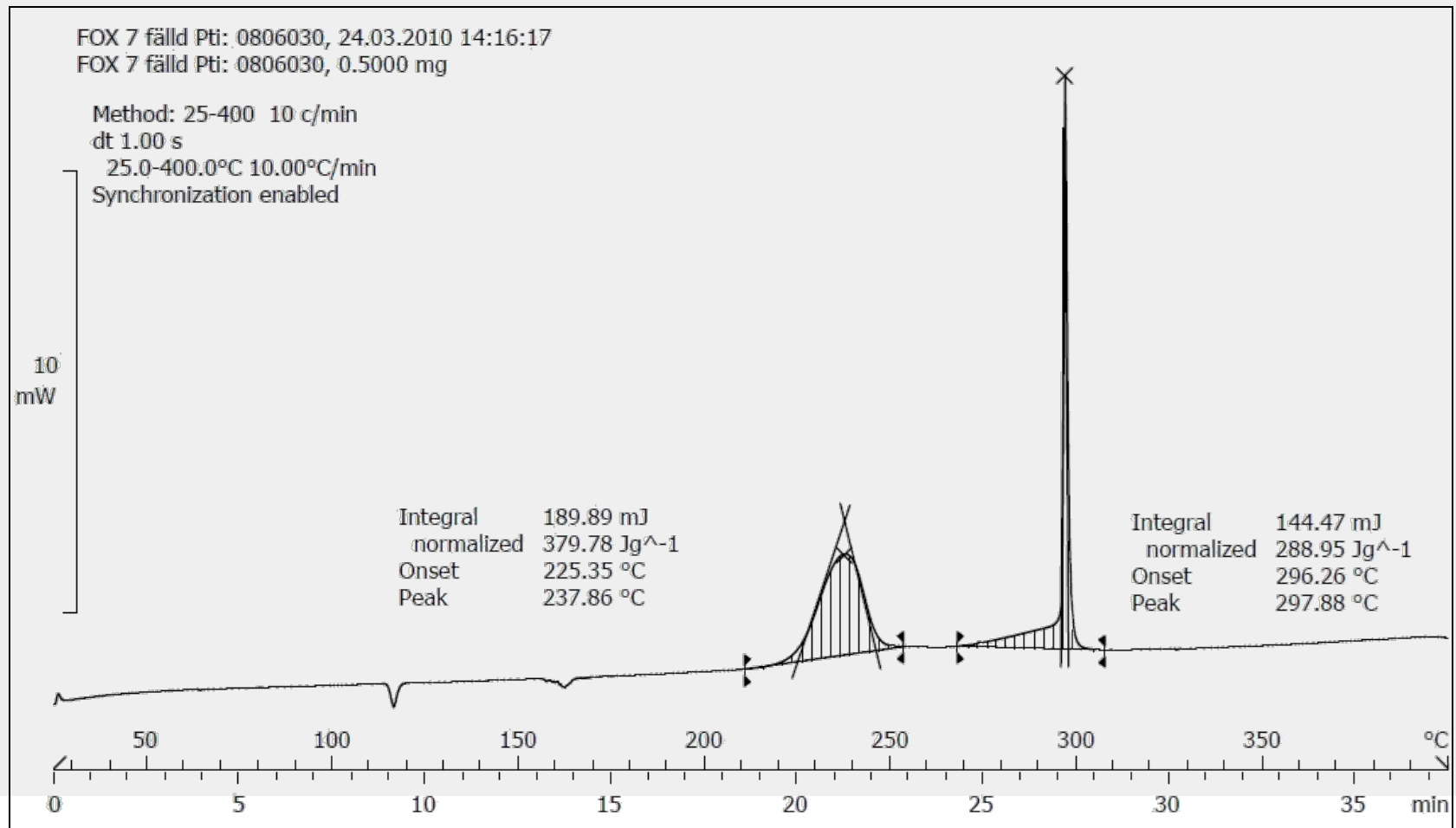


Solvent B

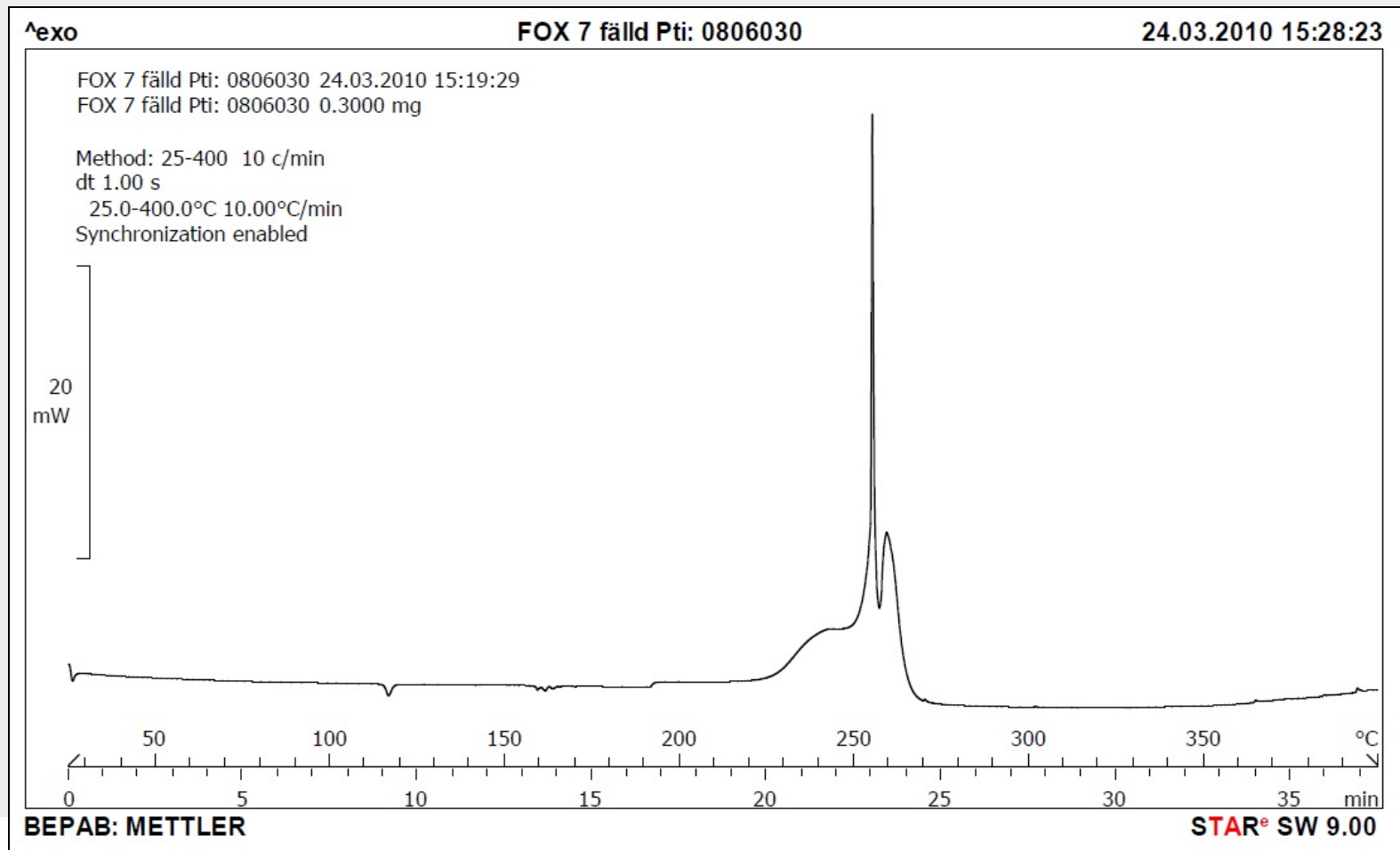


Solvent C

# Results - Impact of sample capsule on DSC behavior

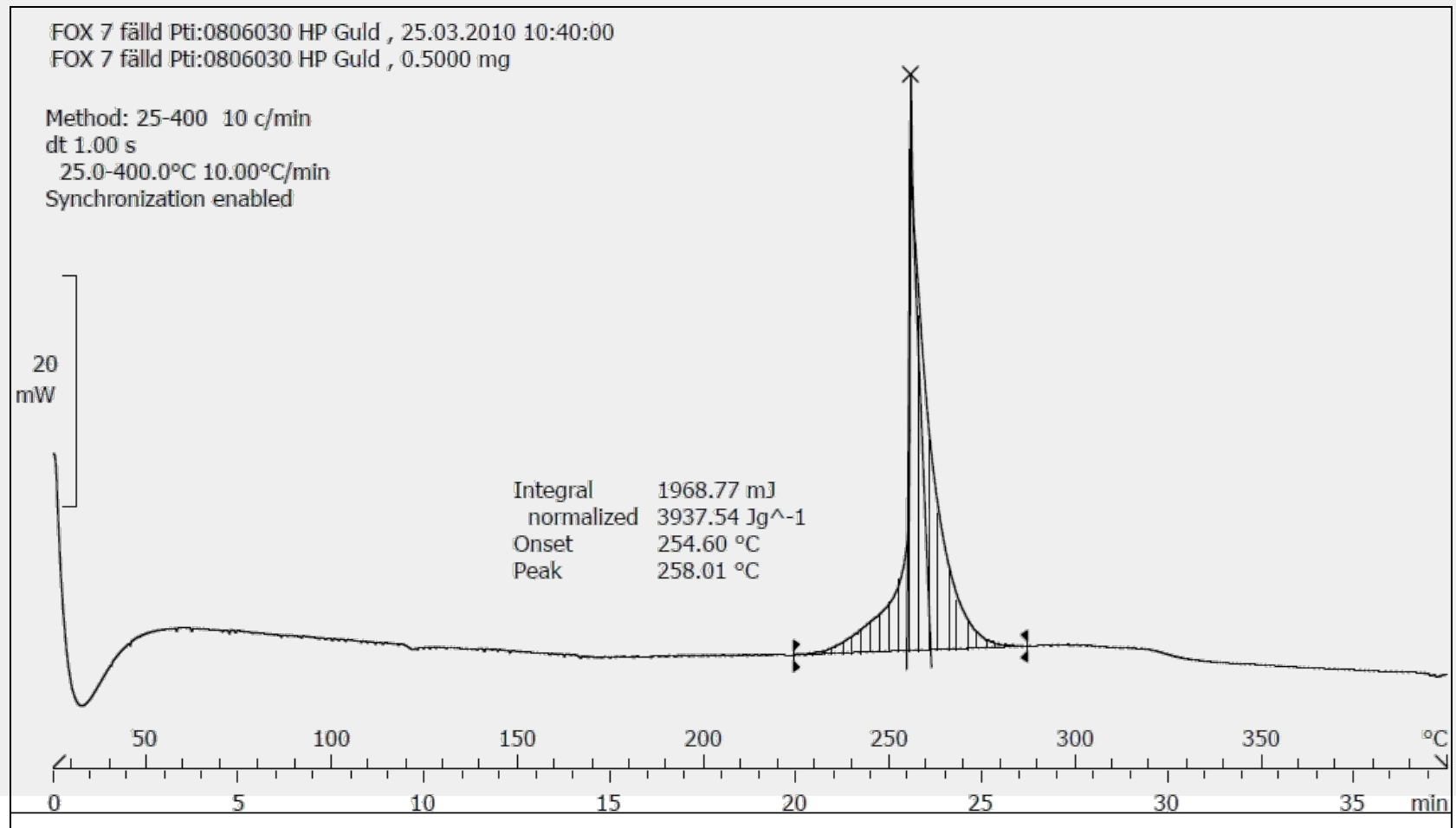


# Results - Impact of sample capsule on DSC behavior

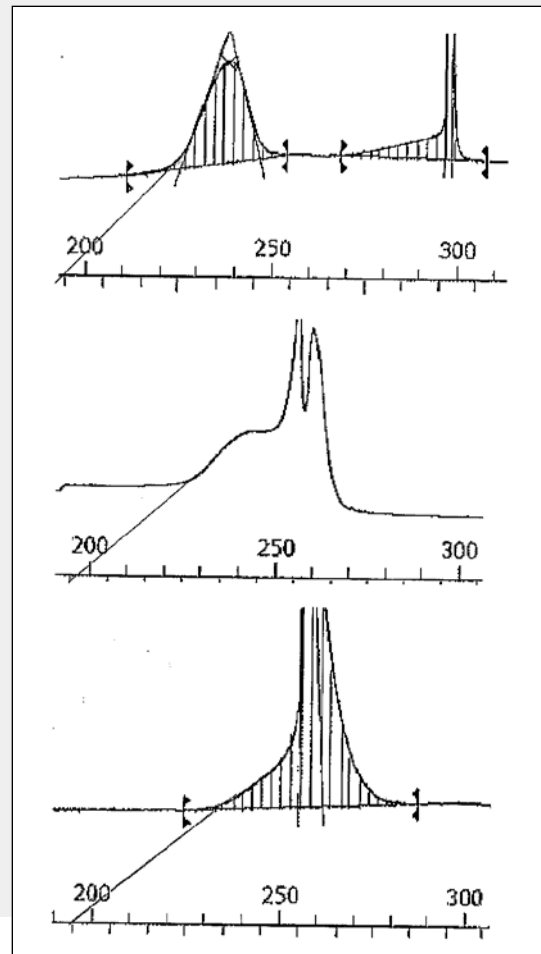




# Results - Impact of sample capsule on DSC behavior



# Results - Impact of sample capsule on DSC behavior



# Results – Sensitivity of fragmented FOX-12/TNT

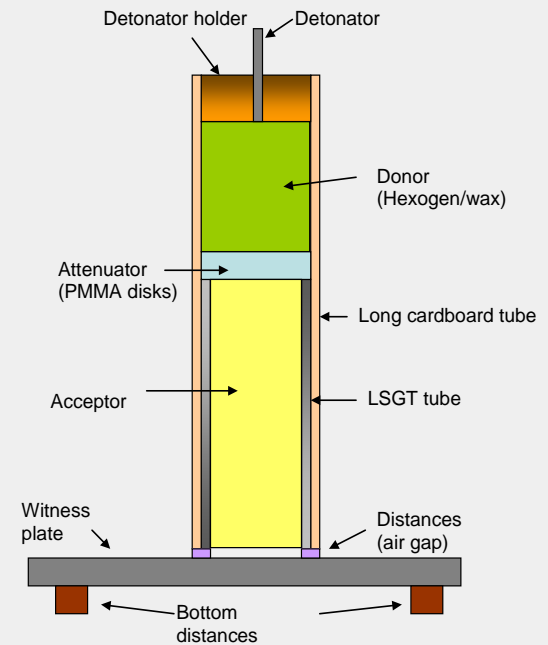
## GUNTOL

- 50/50 of FOX-12/TNT
- IM material
- Micro cavities
- Hot Spots
- Increased sensitivity
- Solid melt-cast or fragmented?



# Results – Sensitivity of fragmented FOX-12/TNT

## NOL Large Scale Gap Test



# Results – Sensitivity of fragmented FOX-12/TNT

LSGT Crushed Material					LSGT Cast Material				
FOI cards / mm / US-cards	Result (+/-)				FOI cards / mm / US-cards	Results (+/-)			
12 / 18 / 72	+	+							
13 / 19.5 / 78	+	-			13 / 19.5 / 78	+			
14 / 21 / 84	+	+	-		14 / 21 / 84	+	+		
15 / 22.5 / 90	+	-			15 / 22.5 / 90	+	+	-	-
16 / 24 / 96	-				16 / 24 / 96	-	-		



The sensitivity of GUNTOL:

- 78-90 US cards crushed material
- 84-90 US cards cast material

# Results – Sensitivity of fragmented FOX-12/TNT

<b>Explosive composition</b>	<b>Number of US-cards in the NOL LSGT</b>
GUNTOL 50:50	78-96
TNT cast	133
TNT pressed	175
RDX	323
TATB	78
Composition B (cast)	201
Composition B (pressed)	238
C-4	192
PBXN-110 (Bofors)	158

# Conclusions

- FOX-7
  - Larger particles are less sensitive than smaller ones
  - Type of solvent has direct impact both on coating efficiency and pressed density
  - The DSC behavior depends on the type of sample pan used
    - Open pans → two exothermal peaks,
    - Semi-open pans → one double peak
    - Sealed high pressure pans → one single peak
  - For risk analysis sealed high pressure pans should be used
- FOX-12
  - GUNTOL is just as insensitive when crushed as it is when intact
  - Further studies of this subject will be carried out

# Acknowledgements

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