



# *40mm Infantry Grenade Fuzes*

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***«The Fuzing Evolution – Smaller, Smarter and Safer»***  
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# Company Presentation

- A global leader in the field of ammunition fuzes and S&A devices
- Full range of products
- Key competencies in
  - Fuzing technologies
  - Micro-technologies
  - Ammunition electronics



- Increasing intensive military action in urban terrain and a move to asymmetric combat situations triggered demand for other types of guns and ammunition for those situations
- German Army required a 40mm IG HV fuze with SD mode
- Selection of US M549 design as basis
- Improvement of the M549 PD fuze into DM431A1 PDSD fuze
- September 2002: First serial production contract
- Following the successful completion of the development phase the DM431A1 fuze was already presented at the Fuze Conference in 2003

- The DM431A1 fuze is in serial production since 2003
- Both DM441 and DM451 fuze are now entering the international markets
- DM431A1 Customer: Diehl BGT Defence – End users: GER, NOR, ITA, IRE, LV, NL, PL
- DM441 Customer: Hellenic Defence – End users: GRE, FRA, QATAR
- DM451 Customer: Diehl BGT Defence – End user: GER

# Program Background, Application



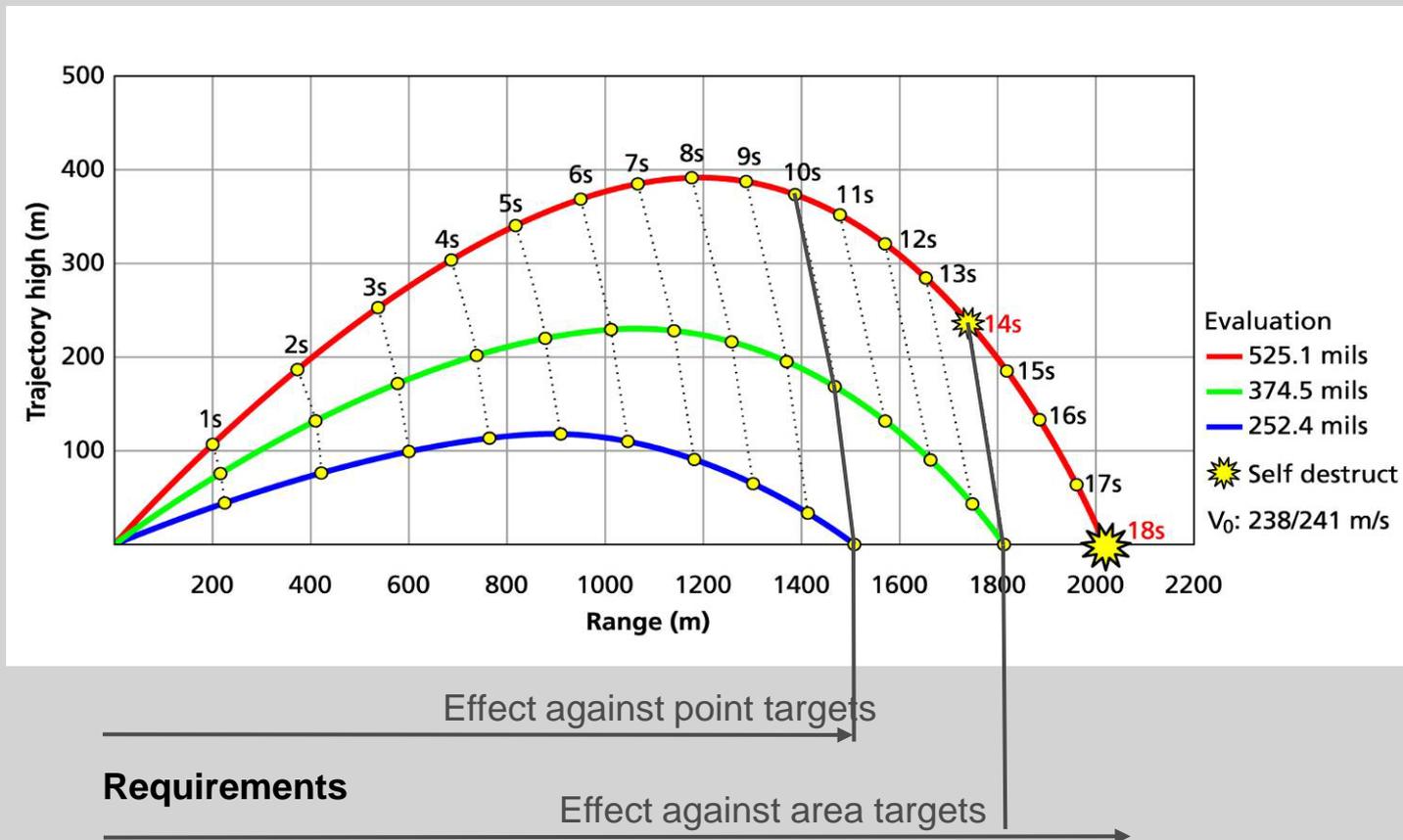
- AGL 40mm from Heckler & Koch

- H&K AGL mounted on German Vehicle FENNEK



# Program Background, Application

- Maximum range with integrated SD mode is 1.800m
- The German Army requirement is between 100m and 1.500m combat distance



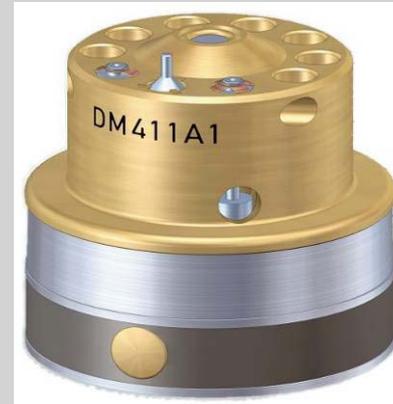
# Requirements for DM431A1

- STANAG 4157; STANAG 4187
- MIL-STD-331B; MIL-STD-1316B; MIL-STD-810E
- Overall functional Reliability  $\geq 97\%$
- Functioning Temperature: -46 C to +63 C
- Storage Temperature: -54 C to +71 C

# Overview of JUNGHANS 40mm Products

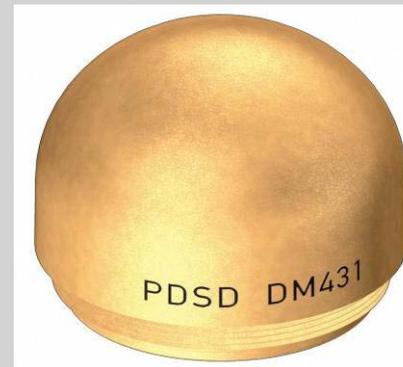
- 40mm Low Velocity

- DM411A1
- DM361



- 40mm High Velocity

- DM431A1
- DM441
- DM451 (IM)



# Overview of Cartridges and Fuzes

- Low Velocity: DM411A1 and DM361
  - JUNGHANS has produced many thousands LV-fuzes

## Technical Information:

- Muzzle safety distance ( $v_0=78\text{m/s}$ ): 8m
- Arming distance: 15m
- Arming set back: 2.000g
- Arming rotation: 2.300rpm
- Functioning temperature:  $-35^\circ\text{C}$  to  $+50^\circ\text{C}$
- SD time (in the temperature range):  $>8\text{s}$
- Weight:  $\sim 50,5\text{g}$



# Overview of Cartridges and Fuzes

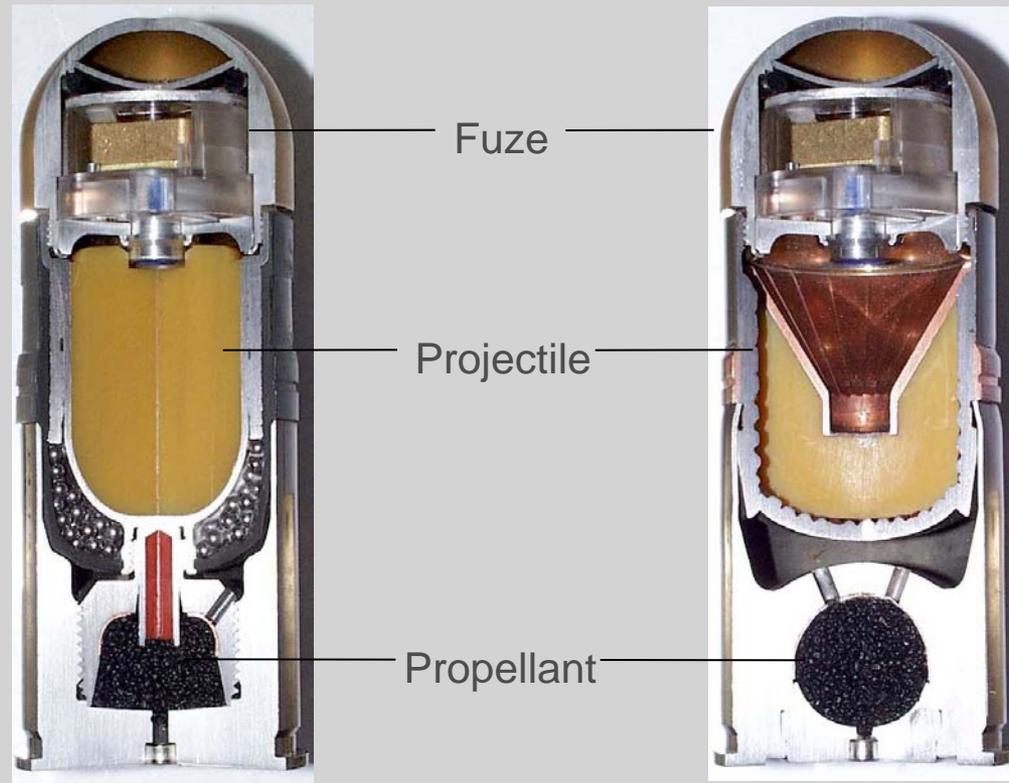
- High Velocity Cartridges in Service

Fuze DM431A1  
DM111 HE-PFF (Diehl)

High Explosive Pre-Formed Fragments

Fuze DM441 / DM451  
DM42 HEDP (e.g. Diehl)

High Explosive Dual Purpose



# DM431A1 IG HV fuze family

- DM431A1 IG HV and Variations

## Background:

- Mechanical point detonating fuzes equipped with a pyrotechnic self-destruct mechanism

## Technical Information:

- Muzzle Safety Distance  $\geq 18\text{m}$
- Arming Distance  $\leq 40\text{m}$
- Arming set back: 22.500g
- Arming rotation: 6.500rpm
- Functioning Temperature: -46 C to +63 C
- Storage Temperature: -54 C to +71 C
- SD time (in the temperature range):  $>14\text{s}$

# DM431A1 IG HV fuze family

- DM431A1 IG HV
  - PDSD fuze on HE-PFF (high explosive pre-formed fragments) round
  - To date, JUNGHANS has produced some 1 million DM431A1 fuzes
  - Reliability rate **99,7%** based on the results of the lot acceptance firings, in summary more than 7.400 rounds



# DM431A1 IG HV fuze family

- DM441 IG HV
  - Used for HEDP ammunition on the DM32 round
  - For use against soft targets and light armored vehicles
  - Penetration performance of more than 70mm armor steel
  - More than hundred thousand fuzes DM441 have been produced



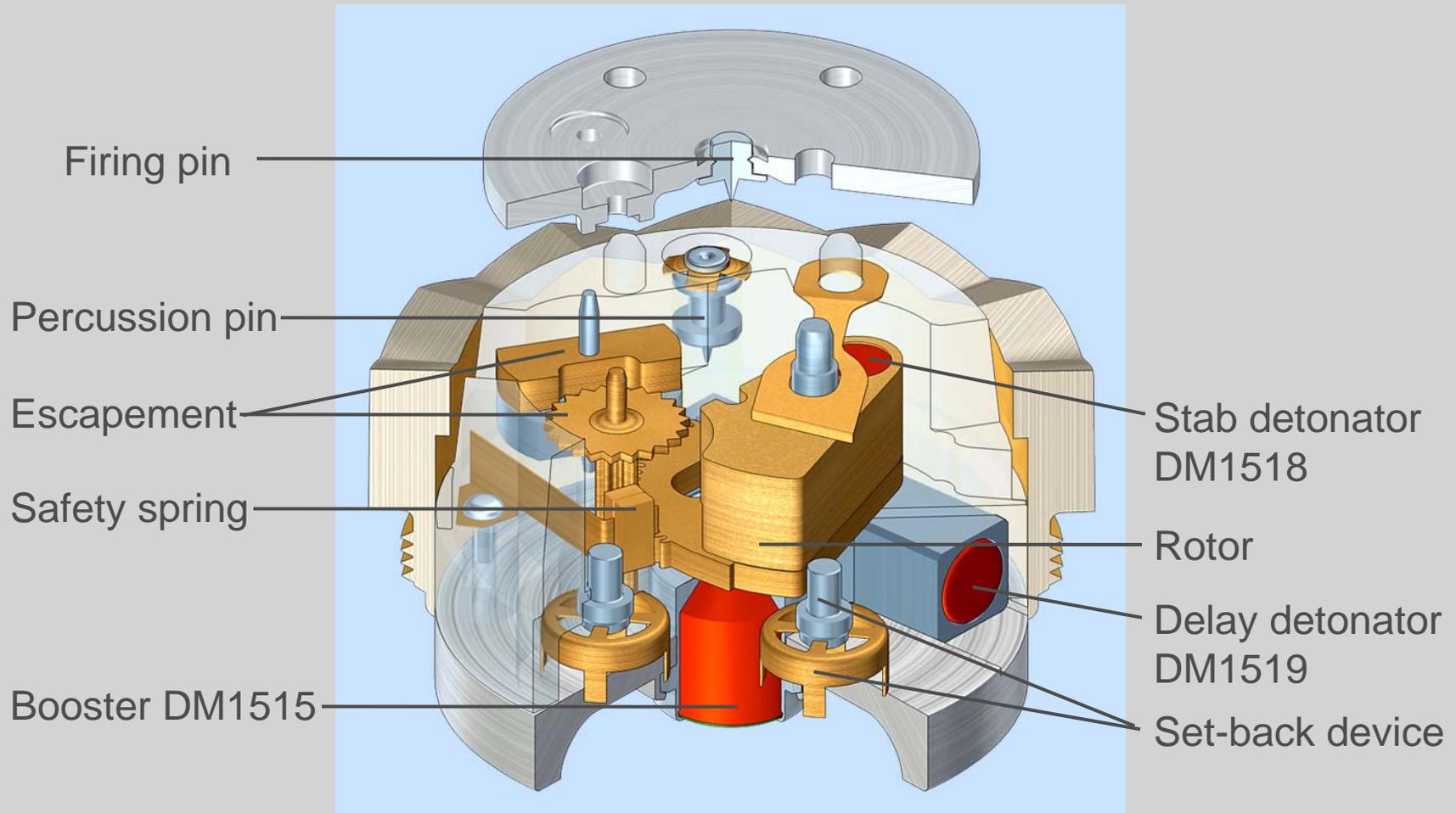
# DM431A1 IG HV fuze family

- DM451 IG HV
  - Latest addition to JUNGHANS 40mm fuzes
  - Used for insensitive HEDP ammunition on the DM42 round
  - Pilot lot acceptance in approval by GER
  - Serial production in progress
  - With insensitive spit back booster DM1603 (IM) and black ogive
  - For use against soft targets and light armored vehicles
  - High penetration performance of more than 70mm armor steel, high effectivity and robustness



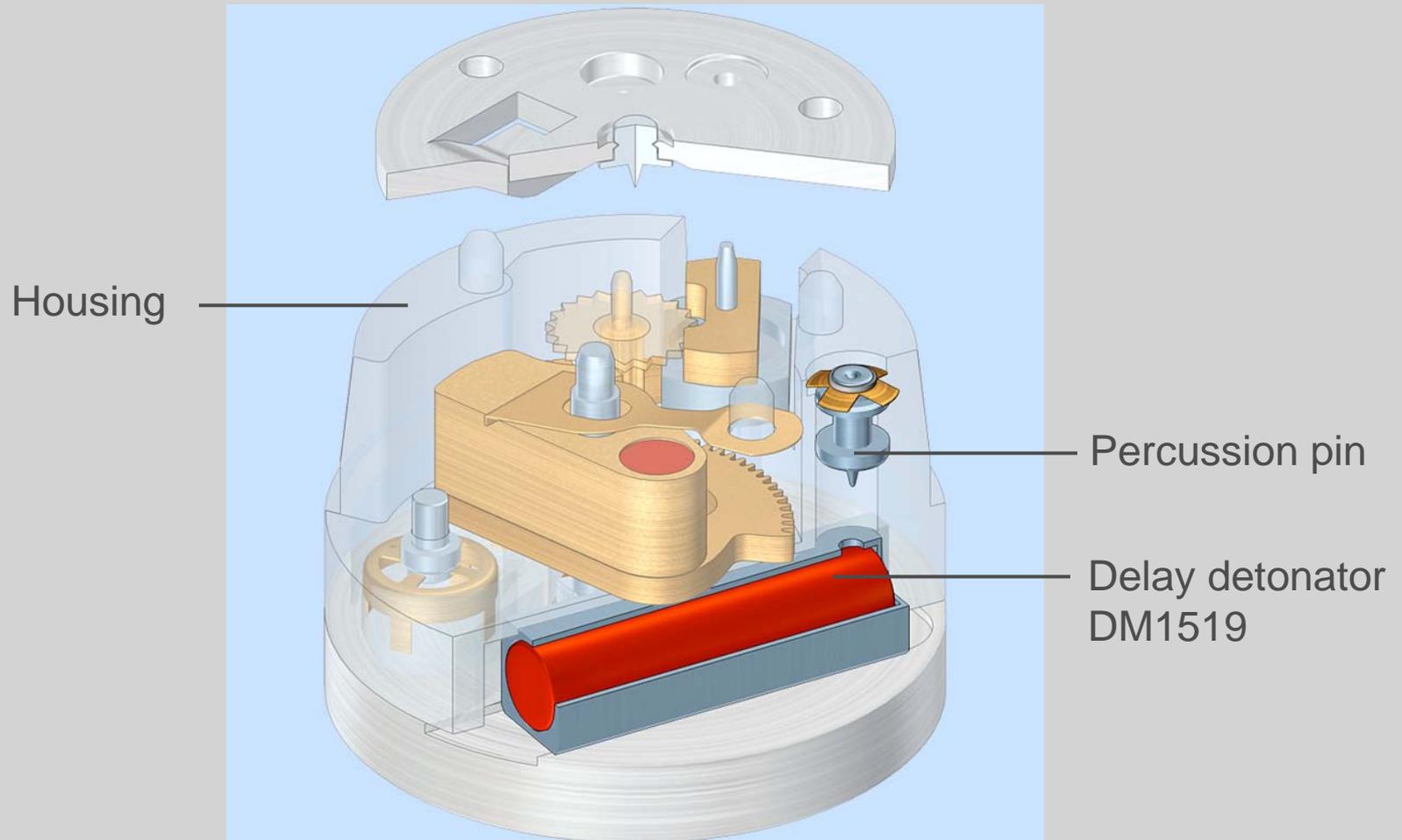
# DM431A1 – Fuze Design

- Fuze Description in safe position



# DM431A1 – Fuze Design

- Fuze description - integration of the SD mode



# Fuze Functioning Modes

- Fuze Functioning Modes are:
  - Impact mode (PD-mode)
  - Pyrotechnical self-destruct function
  
- Evaluation of Fuze Functioning Modes within Lot Acceptance Firings:
  - Muzzle safety: target plate at 18m
  - PD function: target plate at 40m
  - Impact sensitivity: target plate with 70°NATO angle at 100m
  - Impact sensitivity: firing on soft ground at 300m
  - SD firing with AGL (according to German standards)
  
- Lot acceptance firings are conducted according to high German standards

## STANAG 4187 Compliance

- The fuze has two independent safety features.
  1. acceleration-dependent safety elements: two setback springs
  2. rotation-dependent safety element: safety spring
- A mechanical delay mechanism guarantees the muzzle safety distance
- No manual manipulation possible due to closed fuze housing
- No stored energy for rotor movement prior to launch
- No duds due to self-destruct mode

## Why SD-mode ?

- Very high reliability rate (calculated with the results of the lot acceptance firings) of **99,7%** with all firings conducted on the specified ground / targets
- SD mode prevents (hazardous) duds in case of not specified target impact conditions:
  - High grass or bush
  - Snow
  - Water
  - Angle  $>70^\circ$  NATO or ricochet

# Trial Results

- DM431A1 – Firing against 3mm steel plate at 70°NATO



# Trial Results

- DM431A1 – Firing against 2mm plate at arming distance 40m



- DM451 HEDP – Pilot lot acceptance trials in GER
- Disciplines performed for this acceptance:
  - Dispersion pattern
  - Weapon function
  - Penetration performance: Firing against 70mm armor steel plate (in addition towards HE-PFF round)
  - Muzzle safety: target plate at 18m
  - PD function: target plate at 40m
  - Impact sensitivity: target plate with 70°NATO angle at 100m
  - Impact sensitivity: firing on soft ground at 300m
  - SD firing with AGL (according to German standards)
- Strongly convincing performance of the DM42 round with the DM451 fuze from JUNGHANS

# Trial Results

- DM451 HEDP – Firing against 70mm armor steel plate



- Complete Penetration of the ammunition



# Conclusion

- JUNGHANS is offering very safe and reliable IG fuzes which fully meet the latest safety requirements of major international customers and different IG solutions for asymmetric combat situations
- JUNGHANS demonstrates an unmatched live firing reliability today on the IG market
- JUNGHANS, thanks to its background and technology in fuzing solutions is also considering new solutions for the future in the domain of IG fuzes
- JUNGHANS focusses on **Safety, Quality** and **Reliability** to provide customers with flexible solutions for improved operational efficiency



JUNGHANS *Microtec* GmbH

**Thank you for your kind attention!**

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