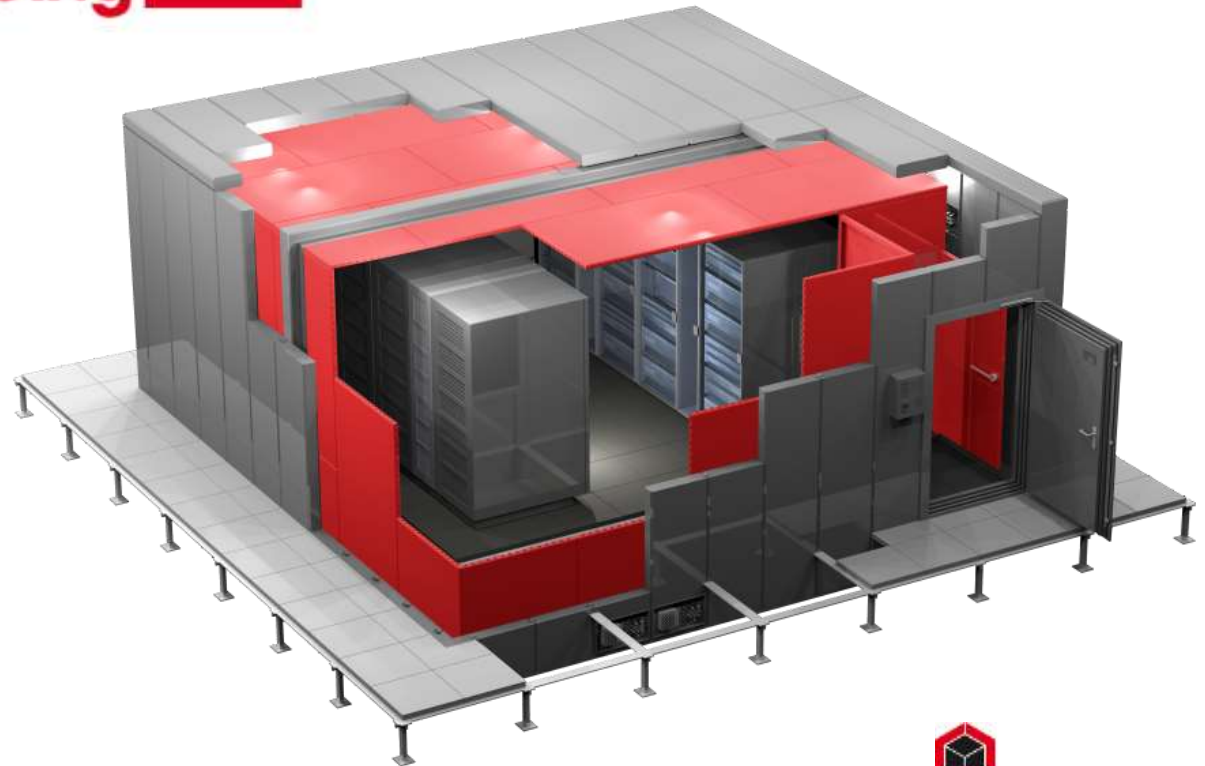


# Risks of Electro Magnetic Pulse and interference on Datacenters



# DCS

Data Center **Shielding**



# Physical risks as a threat for Datacenters



# Terms und Definitionen

## TEMPEST

TEMPEST is a National Security Agency codename referring to **spying on information systems through leaking emanations**, including unintentional radio or electrical signals, sounds, and vibrations. TEMPEST covers both methods to spy upon others and **also how to shield equipment** against such spying. The protection efforts are also known as **emission security (EMSEC)**, which is a subset of **communications security (COMSEC)**

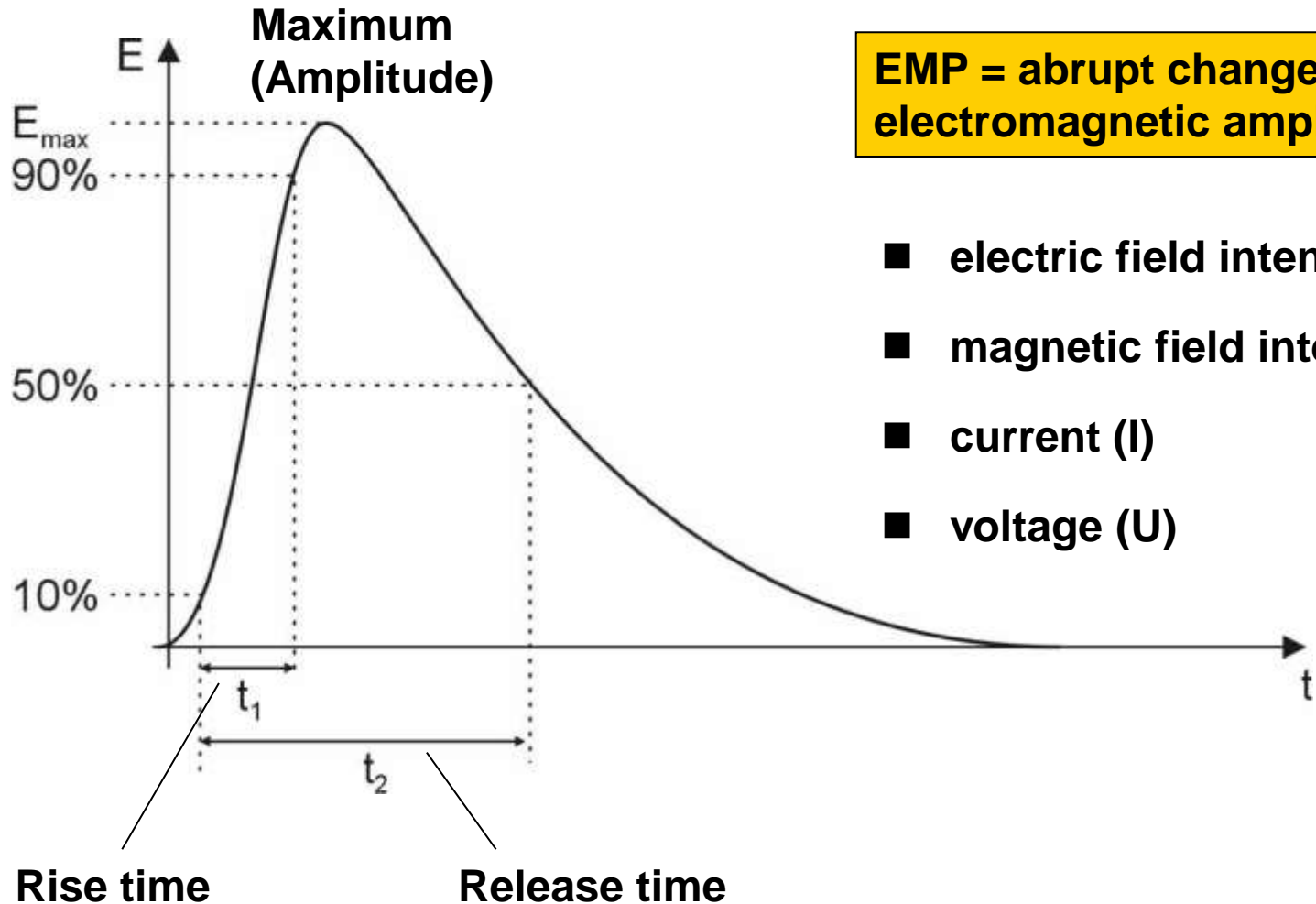
## VAN-ECK-PHREAKING

Van-Eck-Phreaking is a **technique for electronic espionage**, receiving information from **unintentional electromagnetic emissions** of devices.

## COMPROMISING RADIATION

Compromising radiations are defined as **unintentional information-containing signals** which, if intercepted and analyzed, may disclose the information transmitted, received, handled, or otherwise processed by any information-processing equipment

# What is an Electro Magnetic Pulse (EMP)?



**EMP = abrupt change of an electromagnetic amplitude**

- electric field intensity
- magnetic field intensity
- current (I)
- voltage (U)

# Causes of Electro Magnetic Pulse EMP

## Example : Switching operation in an electric substation distributor



- Closing of switches
- Switched inductive
- Voltage pulse as a travelling wave on the line
- Normally no problems caused

# Causes of Electro Magnetic Pulse EMP

## Example : Lightning



- Rise time in  $\mu$ -seconds
- current amplitude approx. 20 kA
- Propagation of an electromagnetic wave **LEMP**
- high induced voltage



# Causes of Electro Magnetic Pulse EMP

## Example : Nuclear Weapons

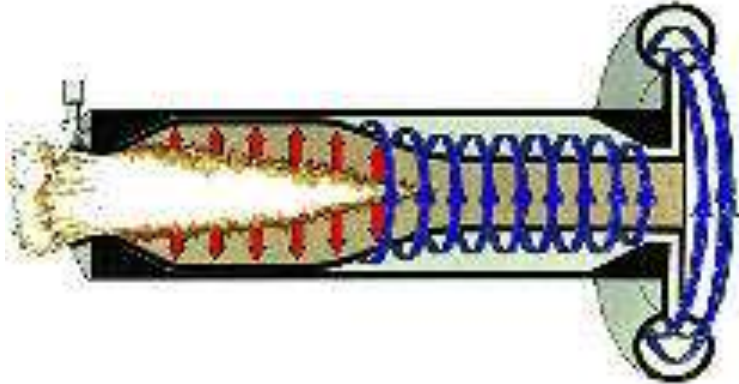


**NEMP-Generator with Strip-Line**

- abrupt discharge of  $\gamma$ -radiation ionizing the atmosphere → separation of charge
- propagation of an electromagnetic wave **NEMP**
- rise time approx. 4n-seconds
- military systems are shielded and “hardened” against NEMP
- civil systems do not have any NEMP-protection

# Causes of Electro Magnetic Pulse EMP

## HPM-Generator/Weapon



## Flux-Compression-HPM-Generator

- EMP-Generators produce synthetic electromagnetic Impulse
- impulse radiates electromagnetic wave
- rise time approx.  
< 4ns: **EMP**  
< 1ns: **UWB**
- modern microelectronics are sensible against radiated UWB-frequencies (100 MHz – 1 GHz)



# Causes of Electro Magnetic Pulse EMP

## HPM-Generator/Weapons – Latest design



**HPM-Generator on tripod**

(Quelle Diehl)

**Compact and effective HPM source**

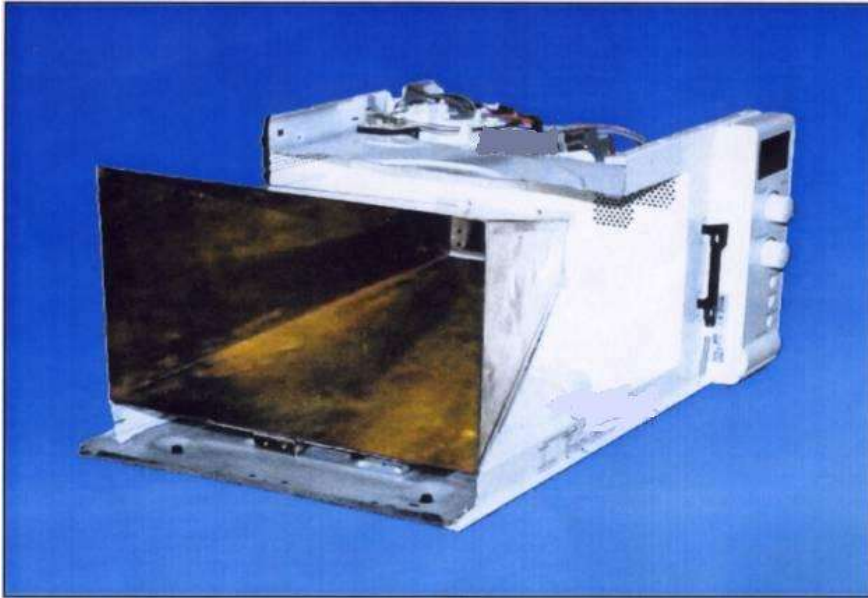
**Fitted into a suitcase**

**Very high power output 365 MW**

**Battery Operation time 20 min**

# Causes of Electro Magnetic Pulse EMP

## Do-it-yourself EMP-Weapon in an ex-microwave oven



- 800 Watt
- Standard components
- Cost: < 1.500 US\$

- **Construction manual for HPM-Weapons available on the internet**  
([www.amazing1.com](http://www.amazing1.com))
- **Components available in legal commerce**

# Consequences of EMP on IT-equipment



- **Reversible failure of computer systems**
- **Irreversible failure of computer systems**
- **Failure of control systems of infrastructure (AC, UPS etc.)**
- **Destruction of circuit boards**
- **Damages often only visible under an microscope**

# What does „Compromising Radiation“ mean ?



- **Compromising electromagnetic radiation emitted by machinery or devices (keyboards, printers, graphic cards etc.) used in IT- or communication equipment, can be received, decoded and recorded easily even across large distances.**
- **It is also possible to detect and transform data or other information processed and transmitted by a device into clear text.**
- **Compromising emitted electromagnetic radiation thus endangers the protection and security of data.**

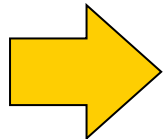
# Requirements on EMP-Protection

Estimated potential field intensity :

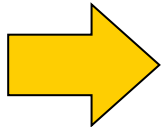
100 kV/m

Resistance of actual IT and systems in industrial environment :

10 V/m



Required attenuation factor > 10.000



Required shielding attenuation > 80 dB

Frequency range:

- from ca. 20 kHz - 4 GHz (all EMP)
- from ca. 20 MHz - 4 GHz (HPM-Weapons)

# Overview dB-values and attenuation factors

<b>dB-value</b>	<b>penetrating voltage / field intensity</b>	<b>penetrating power / power density</b>	<b>Attenuation factor</b>
<b>0 dB</b>	<b>100,0 %</b>	<b>100 %</b>	<b>0</b>
<b>10 dB</b>	<b>31,6 %</b>	<b>10 %</b>	<b>3,1</b>
<b>20 dB</b>	<b>10,0 %</b>	<b>1 %</b>	<b>10.0</b>
<b>30 dB</b>	<b>3,1 %</b>	<b>0,1 %</b>	<b>31,6</b>
<b>40 dB</b>	<b>1,0 %</b>	<b>0,01 %</b>	<b>100</b>
<b>50 dB</b>	<b>0,3 %</b>	<b>0,001 %</b>	<b>316</b>
<b>60 dB</b>	<b>0,1 %</b>	<b>0,0001 %</b>	<b>1.000</b>
<b>70 dB</b>	<b>0,0316 %</b>	<b>0,00001 %</b>	<b>3.160</b>
<b>80 dB</b>	<b>0,01 %</b>	<b>0,000001 %</b>	<b>10.000</b>
<b>90 dB</b>	<b>0,0316 %</b>	<b>0,0000001 %</b>	<b>31.600</b>
<b>100 dB</b>	<b>0,001 %</b>	<b>0,00000001 %</b>	<b>100.000</b>
<b>120 dB</b>	<b>0,0001 %</b>	<b>0,000000001 %</b>	<b>1.000.000</b>

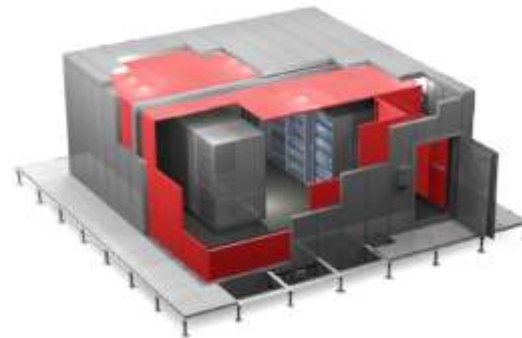
... but an interception-proof meeting room with an attenuation of 80 dB within a frequency range from 30 MHz to 10 GHz has a different planning requirement than a protected EEG-room for medical measurements with the same reference values





# Solutions for electromagnetic shielding against EMP-risks

- **Static and low-frequency electric fields (0 – 100 kHz)**
  - Protection with sheet metal or – metal foil creating a “Faraday” cage
- **Static and low-frequency magnetic fields (0 – 100 kHz)**
  - High-permeable, so-called “MU-metal” sheet metal shielding
- **High-frequency electro-magnetic fields (30 kHz – 40 GHz or higher)**
  - Electrically conductive fully closed metallic enclosures with sufficient thickness






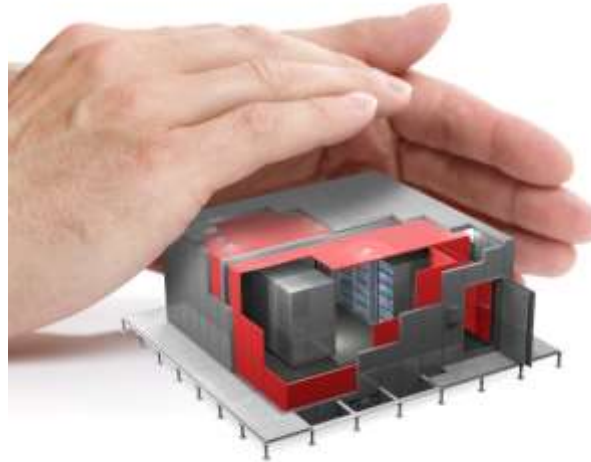
# Materials for electromagnetic shielding against EMP-risks

- **Copper (Cu)**, very expensive, to be welded or soldered, attenuation efficiency :
  - - Magnetic field : satisfactory
  - - Electric field : excellent
  - - Plane wave : excellent
- **Aluminium (Al)**, expensive, to be screwed or welded, attenuation efficiency :
  - - Magnetic field : good
  - - Electric field : excellent
  - - Plane wave : excellent
- **Steel (Fe)**, cheap, to be screwed or welded, attenuation efficiency :
  - - Magnetic field : excellent
  - - Electric field : excellent
  - - Plane wave : excellent
- **Shielding fleece (metalized)**, expensive, to be glued, attenuation efficiency :
  - -Magnetic field : satisfactory
  - -Electric field : good
  - -Plane wave : good

# DCS – Data Center Shielding

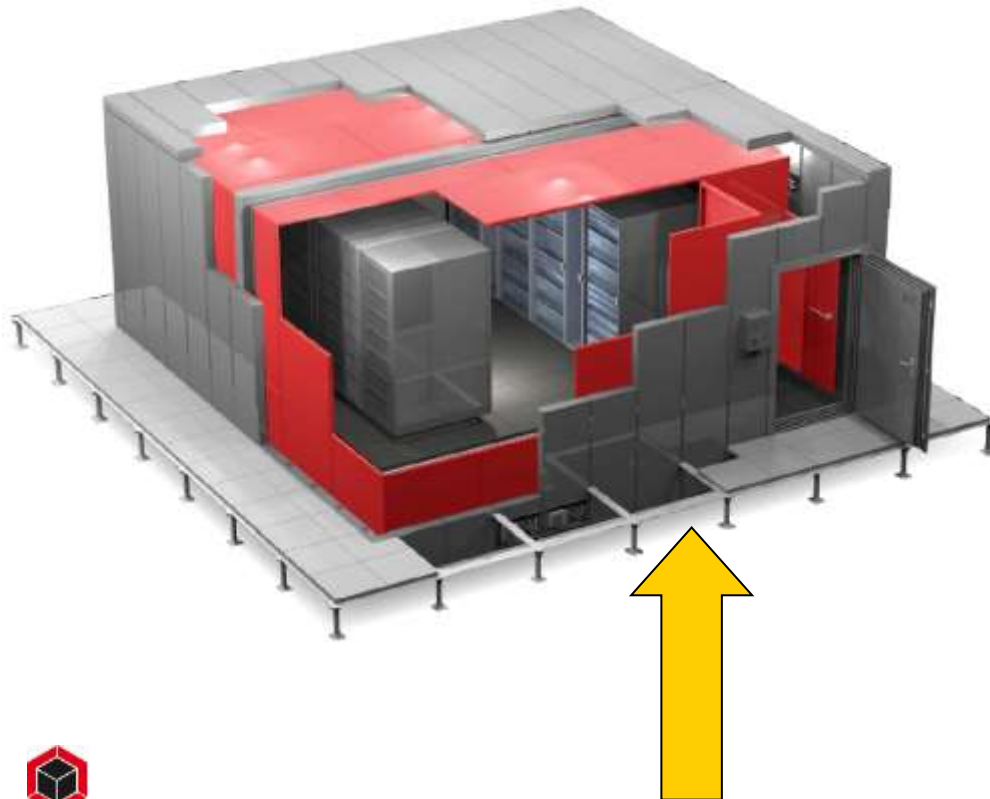
**Modular protection system against**


-  **Eavesdropping**
-  **EMP / HPM Attacks**
-  **Compromising Radiation**



**DCS - Data Center Shielding offers adequate and customized solutions for all types of security rooms and outdoor containers !!**

# Protection solution : DCS – Data Center Shielding

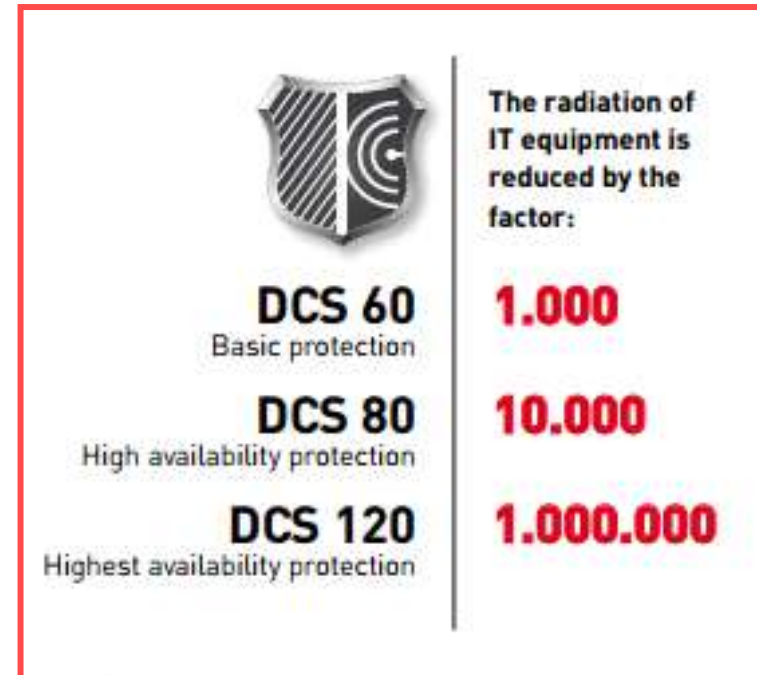


 **RZ-Products GranITe modular IT-room** (grey) with full EN-1047-2 certification (fire, impact), equipped with internal DCS - Data Center Shielding shell (red)

- modular industrially prefabricated panel system
- Expandable - Moveable (disassemble – reassemble)
- Usable in traditional construction datacenters and in modular rooms
- Electromagnetic shielding attenuation
  - > 120 dB from 100 kHz
  - > 80 dB from 10 kHz
- Turnkey-Solutions optional with:
  - EN-1047-2 certified IT-room solutions
  - Power-filters
- Note : normal modular IT-rooms offer max. 40 dB shielding in their standard version

# DCS - solution features

- ❁ Shielding attenuation of 60, 80 or 120 dB
- ❁ Compliant with shielding requirements of Tempest, NSA 65-2, IEEE 299, latest NATO-Standards
- ❁ Guaranteed shielding attenuation up to 40 GHz
- ❁ Prefabricated steel sheet panels
- ❁ Panel dimensions W x H: 1.500 x 3.000 mm
- ❁ System tested acc. to EN 50147-1, NSA 65-6, IEEE-STD 299 (MIL-STD 285)
- ❁ Individual shielding measurement and test certificate for each project



# Examples

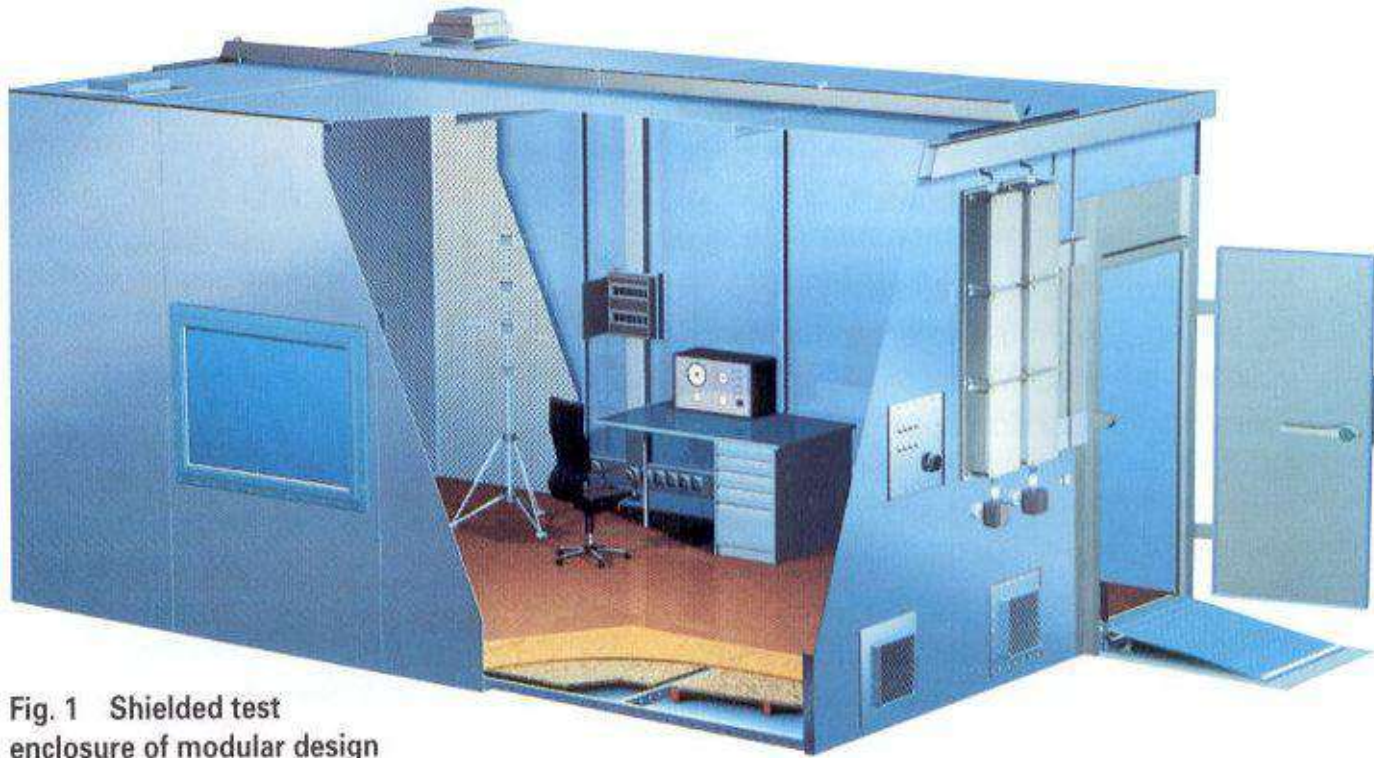
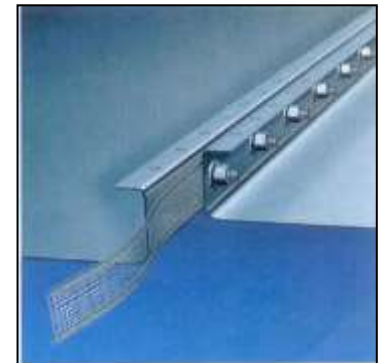


Fig. 1 Shielded test enclosure of modular design



Shielding panels with rail system for absorber lining



RF-tight connection of the panels by self-locking screws



# Examples



Installation inside normal building



Testing equipment



Shielded door system

**Installation and testing  
of modular system**

# Examples

## Non-modular „classic“ solutions

Surface coating with copper foil



Surface coating with metal fleece



# Examples



**Honeycomb Chimney**



**Wave chimney with Flange**



**Speed controlled Fan**

**Filters and ventilation elements for cabling, AC etc.**



**Filter elements outside IT-room**



**Filter box with network- and data cabling plus media converters**



**Pipe duct (Air/water/gas)**

# Your benefit

- ❶ Industrially produced quality instead of handcrafted stuff
- ❷ Fast and easy installation
- ❸ Integration into existing IT-security rooms, outdoor containers or buildings
- ❹ Future proof investments due to dis- and reassembly options (e.g. relocations)
- ❺ Increased intrusion protection in combination with the GanITe- and the QuartzITe security solutions



# Highlights

## **DCS – Data Center Shielding = Protection against:**

- ❶ **Compromising Radiation**
- ❷ **EMP**
- ❸ **Eavesdropping / interception**

## **DCS – Data Center Shielding is:**

- ❶ **Industrially Prefabricated**
- ❷ **Compliant with all standards**
- ❸ **Expandable**
- ❹ **Moveable**