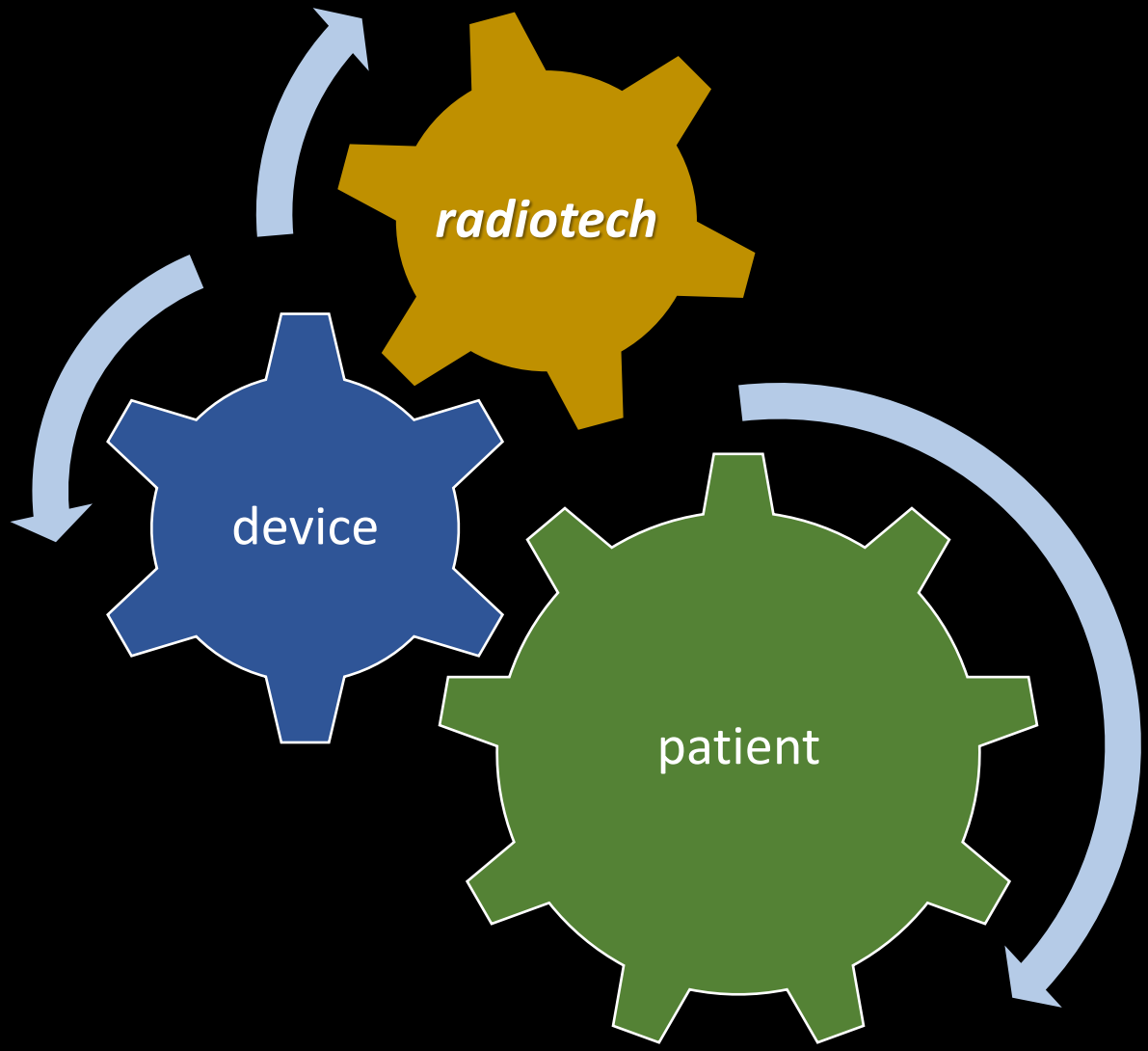
IMAN AFSHAR


SAFETY
SYNGO
PHYSICS
TECHNIQUE

- SAFETY


radiotech
device
patient

SAFETY

01

PATIENT SAFETY

- Hearing
- SAR
- Clothing
- Frist level
- Laser
- Screening of patient
- Accessories

02

MAGNET FIELD

- 5 Gauss Line
- ERDU
- RF Transmit mode
- GRADIENT
- RF

03

STOP BOTTOM

- TSB
- EPO
- MAGNET OFF

04

EMREGENCY

- Donot…
- Donat…

SAFETY

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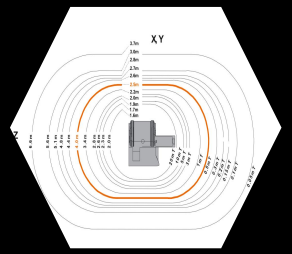
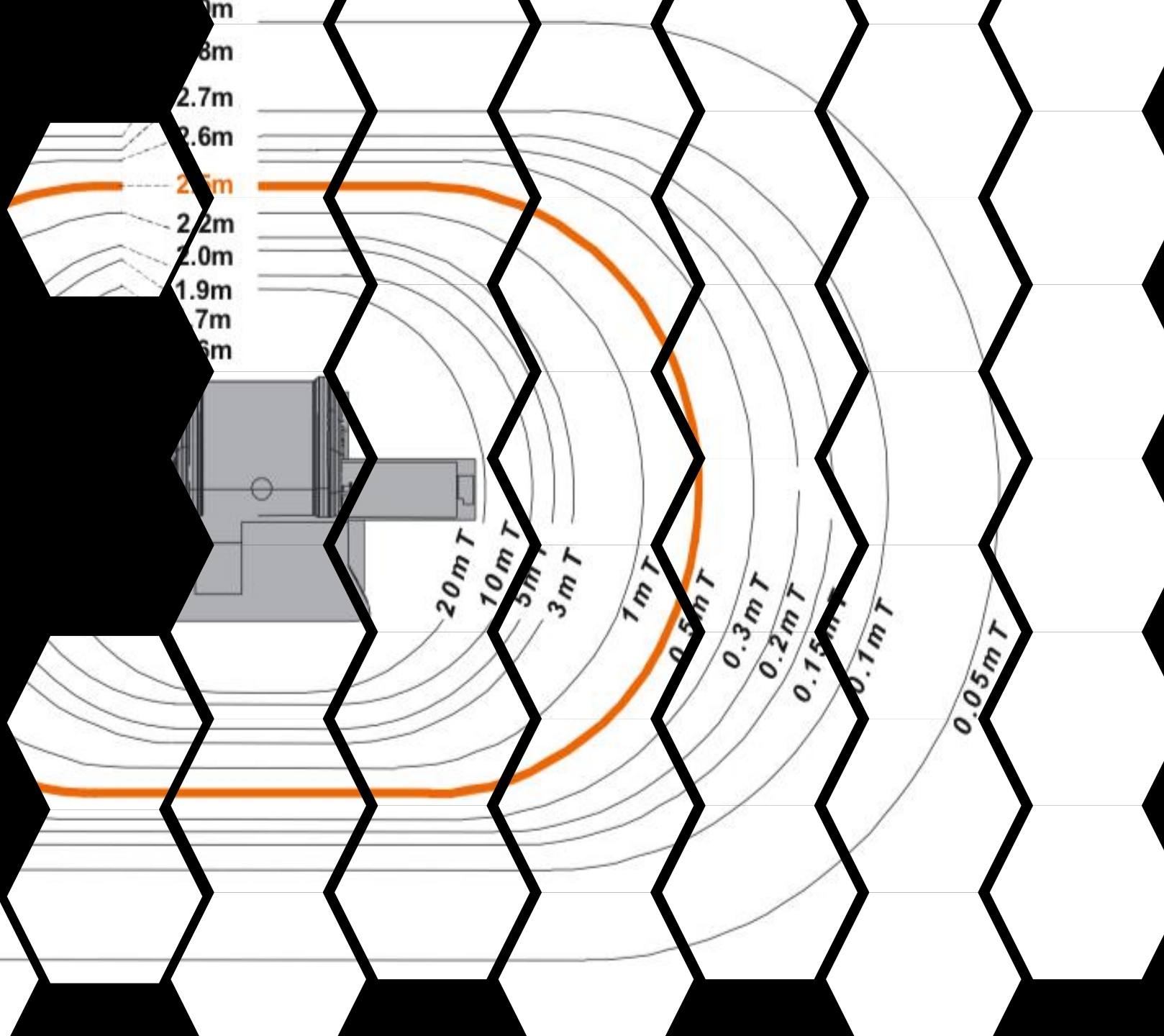
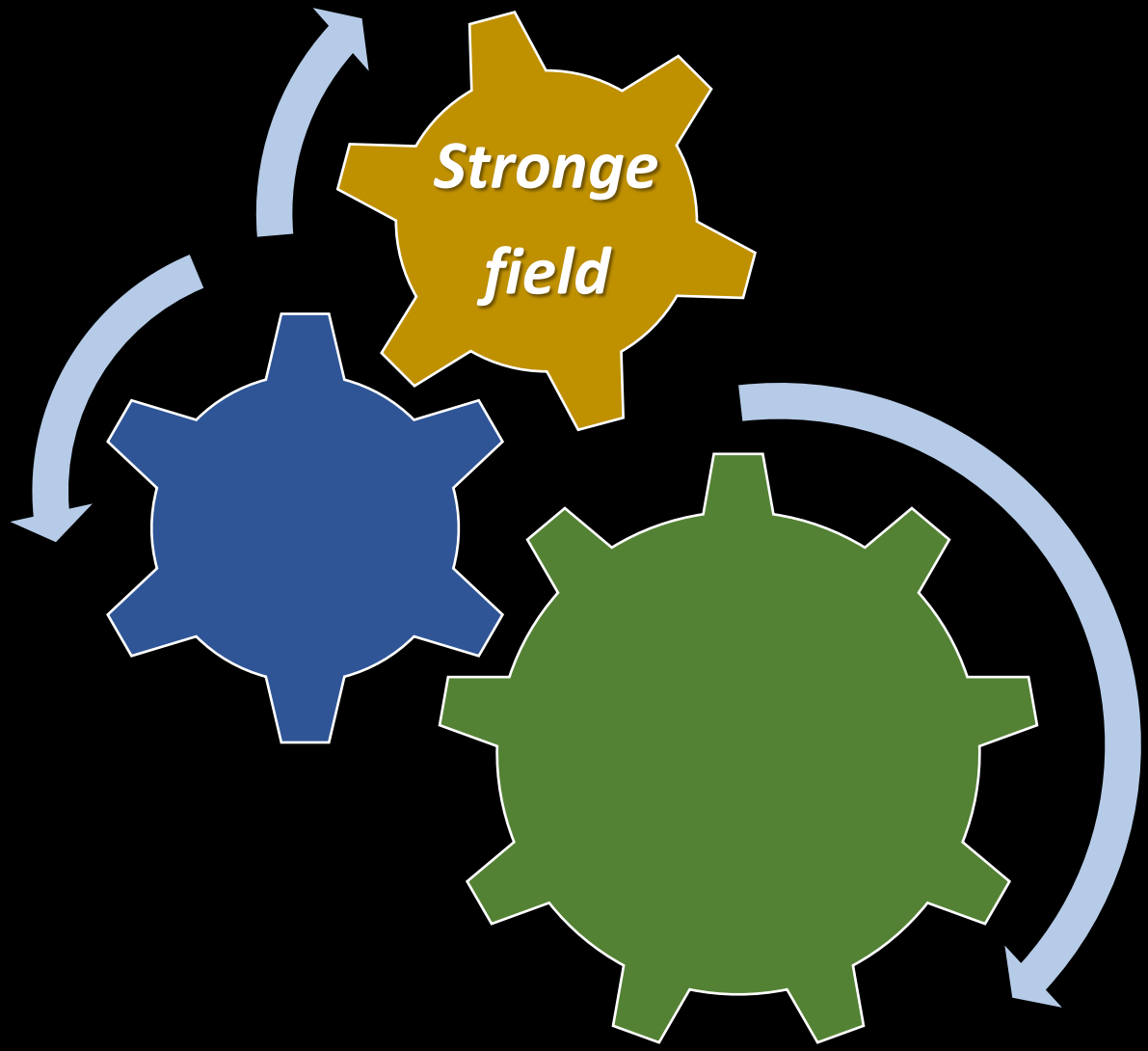
- Donot…
- Donot…
- Donot…

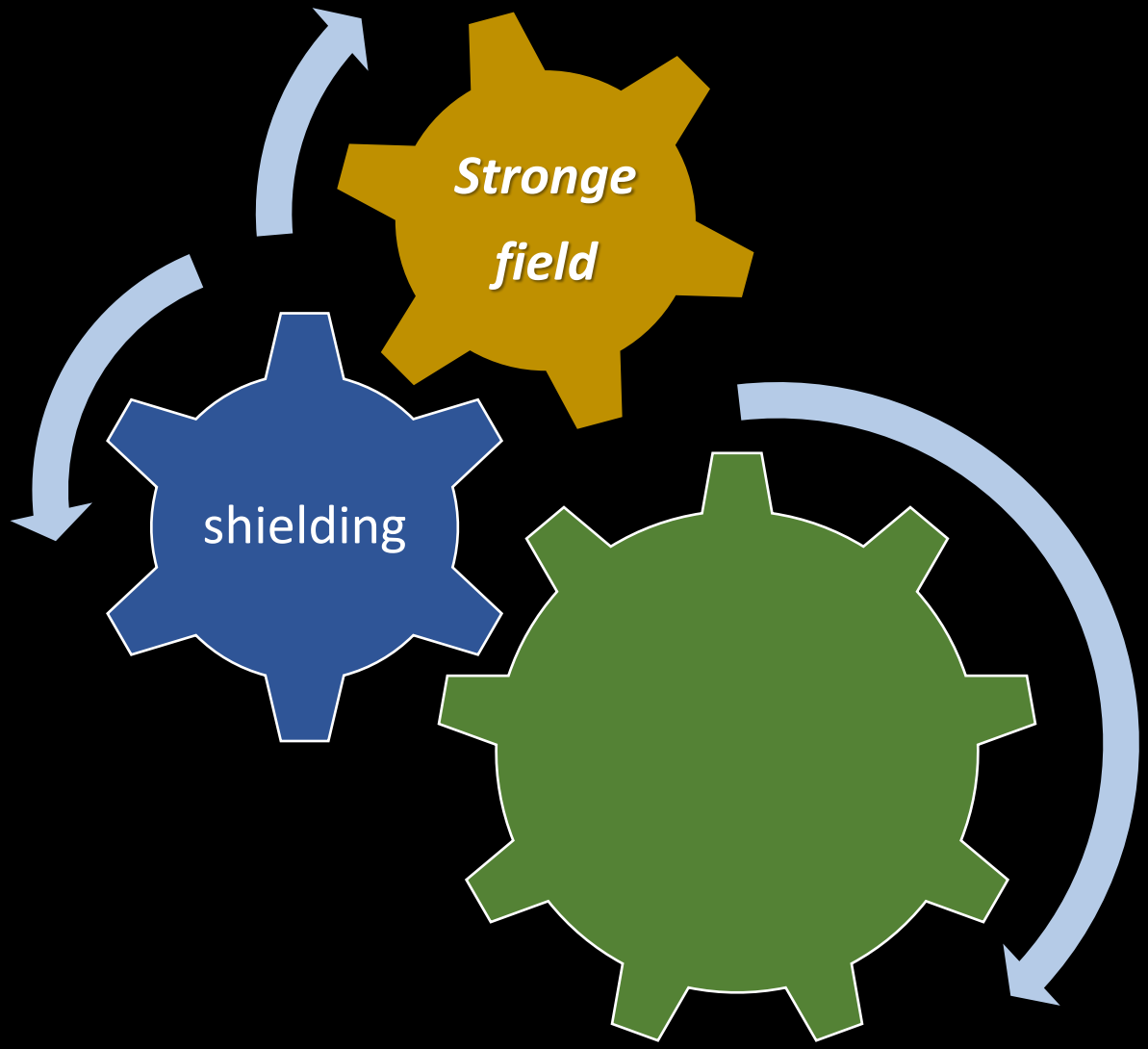
5gauss line

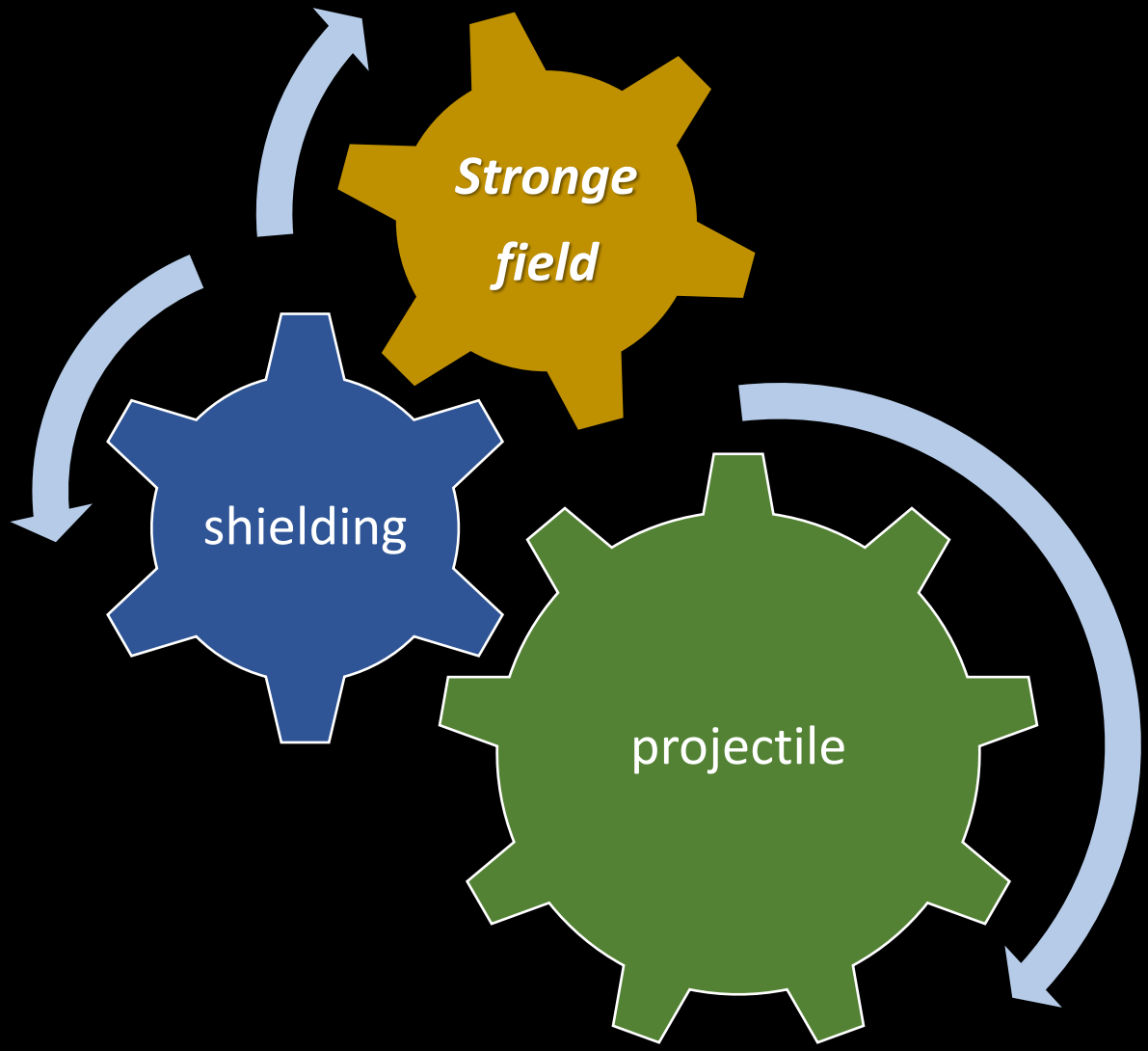
- *2.5m XY*
- *4m Z*

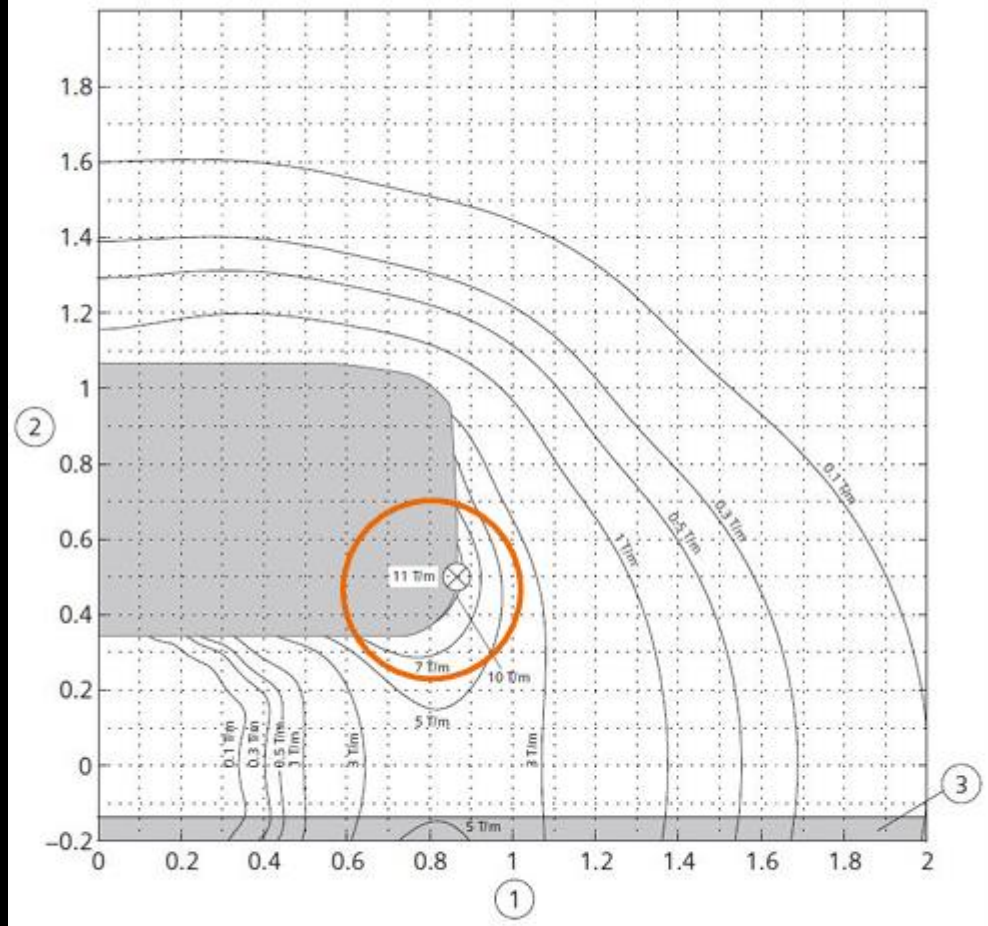





Stronge
field

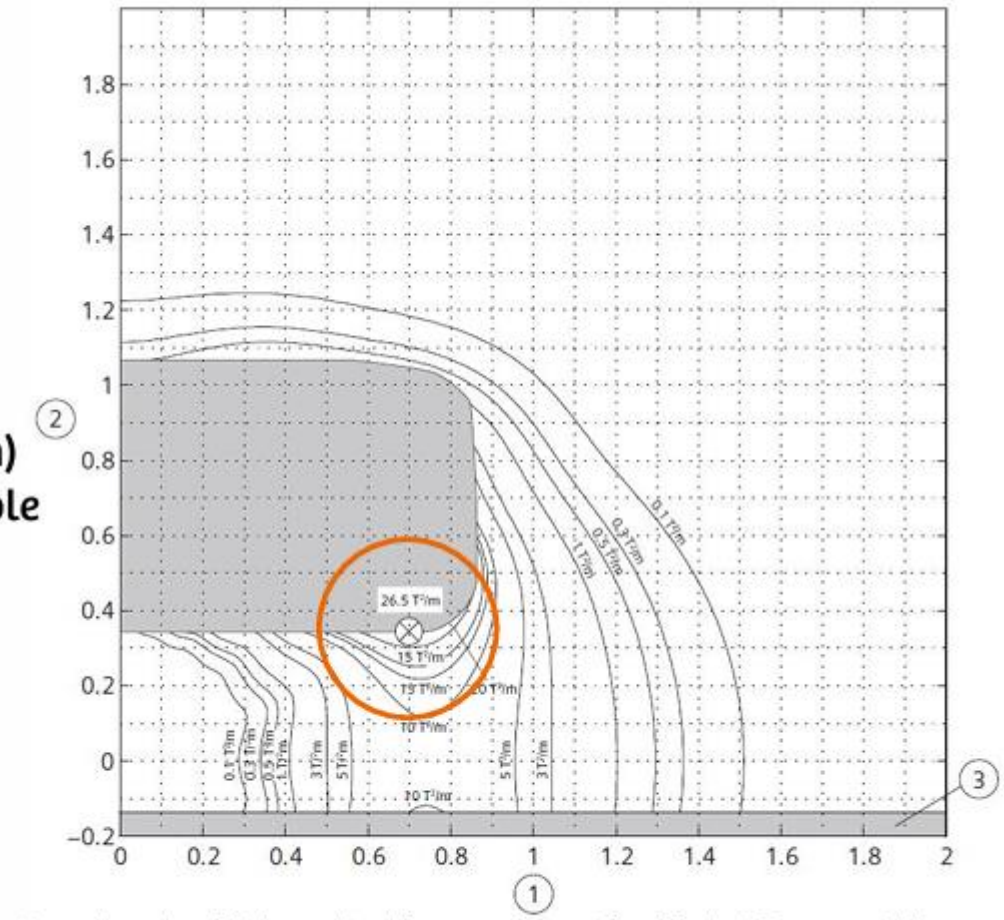

Stronge
field
shielding


Stronge field
shielding
projectile



Spatial gradient of the static magnetic field B_0

(1) Z Axis (m)
(2) Vertical (m)
(3) Patient table



Product of the static magnetic field B_0 and the spatial gradient of B_0





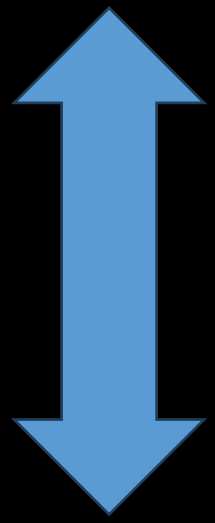




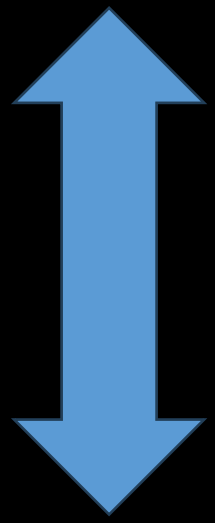



ERDU

ERDU

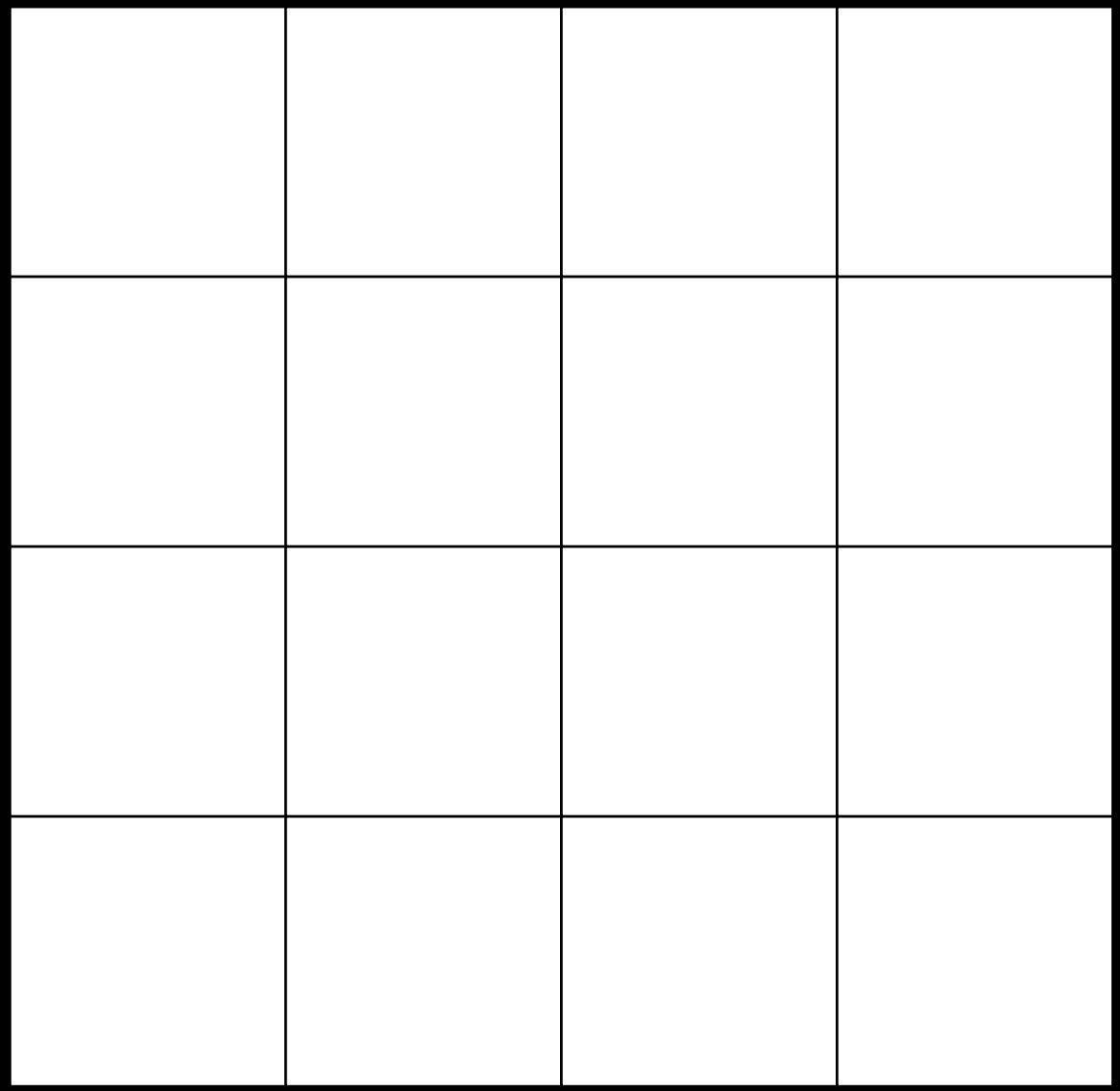


ERDU

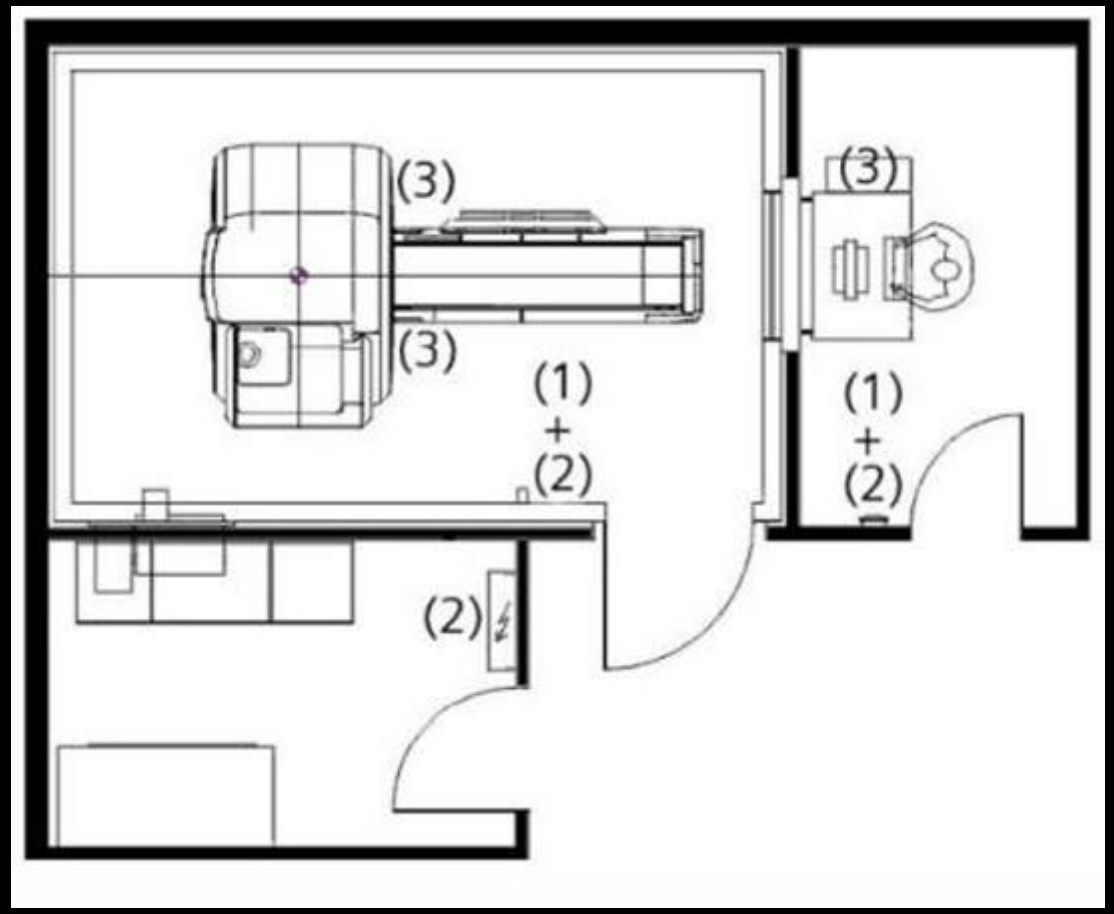


EMERGENCY RAMP DOWN UNIT

QUENCH



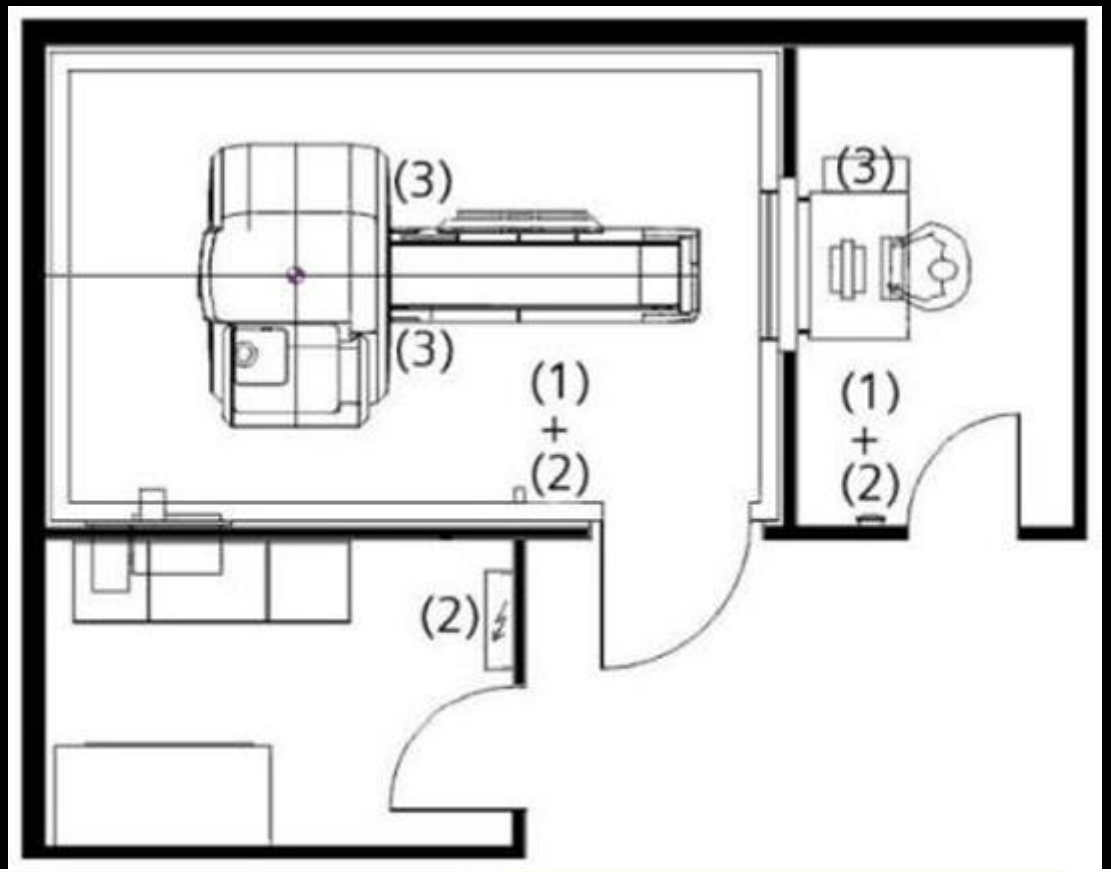
Only to be used …



(1) Magnet Stop switch

(2) Emergency Shutdown switch

(3) Table Stop button



(1) Magnet Stop switch

(2) Emergency Shutdown switch

(3) Table Stop button

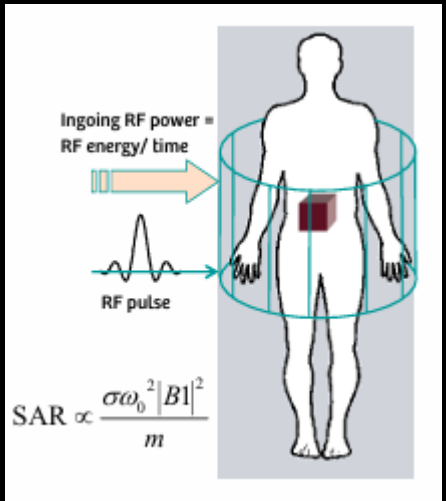
Magnet Stop switch

Emergency Shutdown

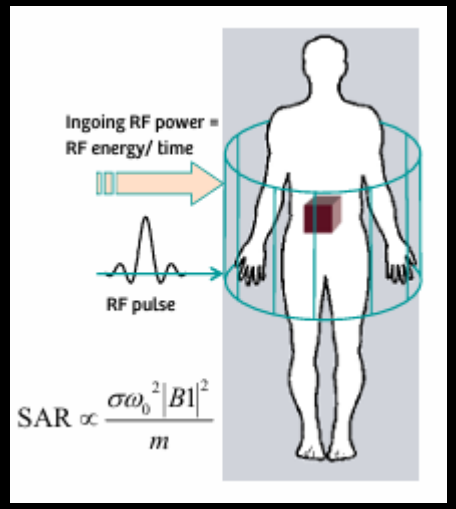
Table Stop on the patient table

Table Stop/Shutdown on the intercom

- ***SAR IS …***


Ingoing RF power =
RF energy/ time
RF pulse
$SAR \propto \frac{\sigma \omega_0^2 |B1|^2}{m}$

- ***SAR IS …***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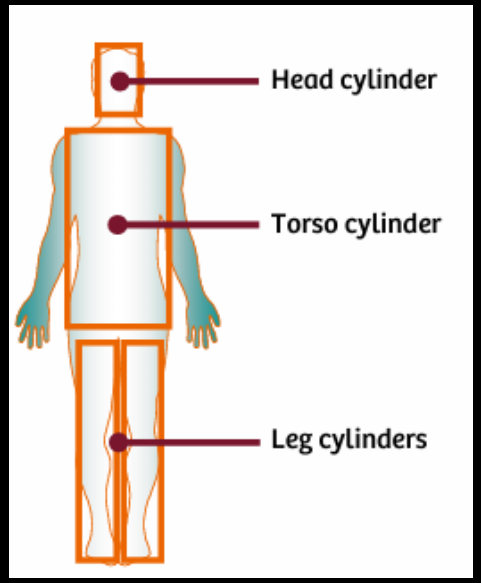
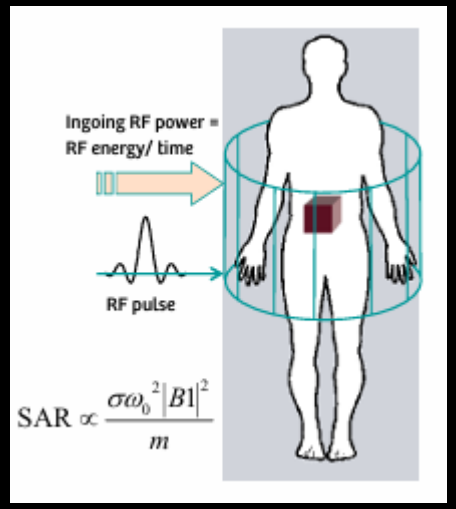

Head cylinder
Torso cylinder
Leg cylinders

- ***SAR IS …***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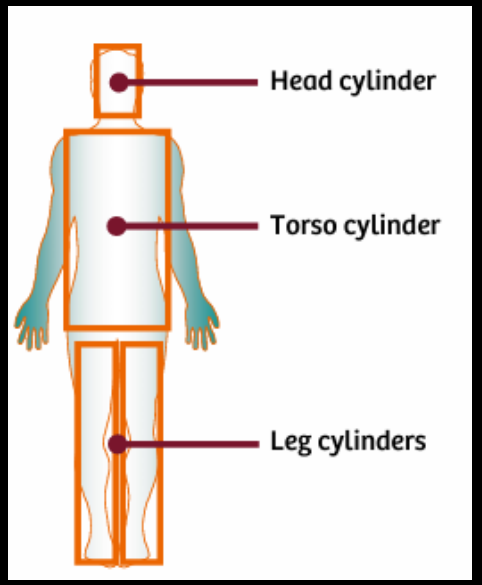
Head cylinder
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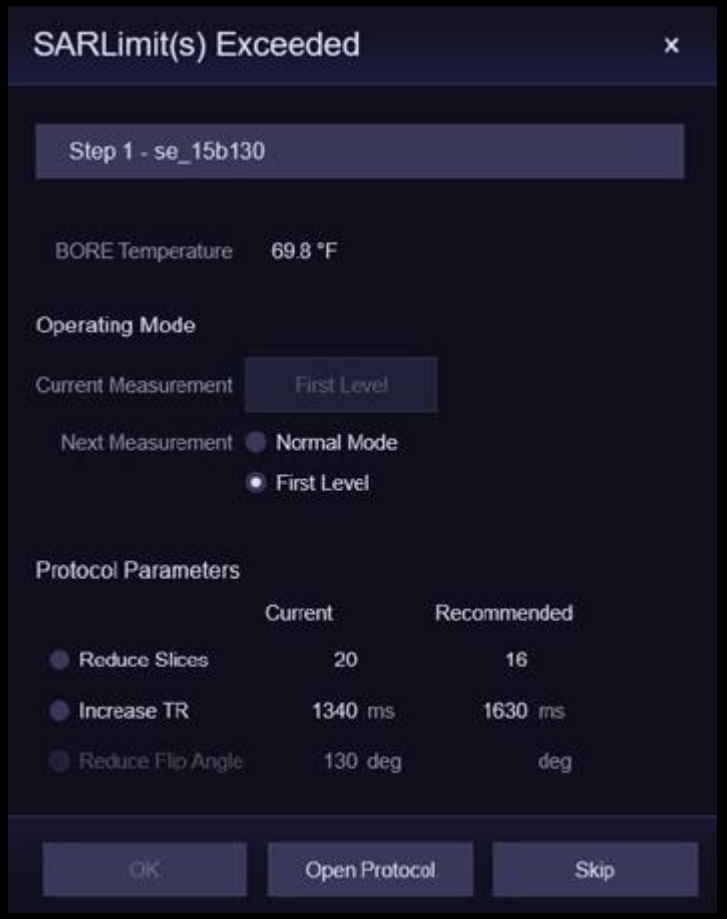
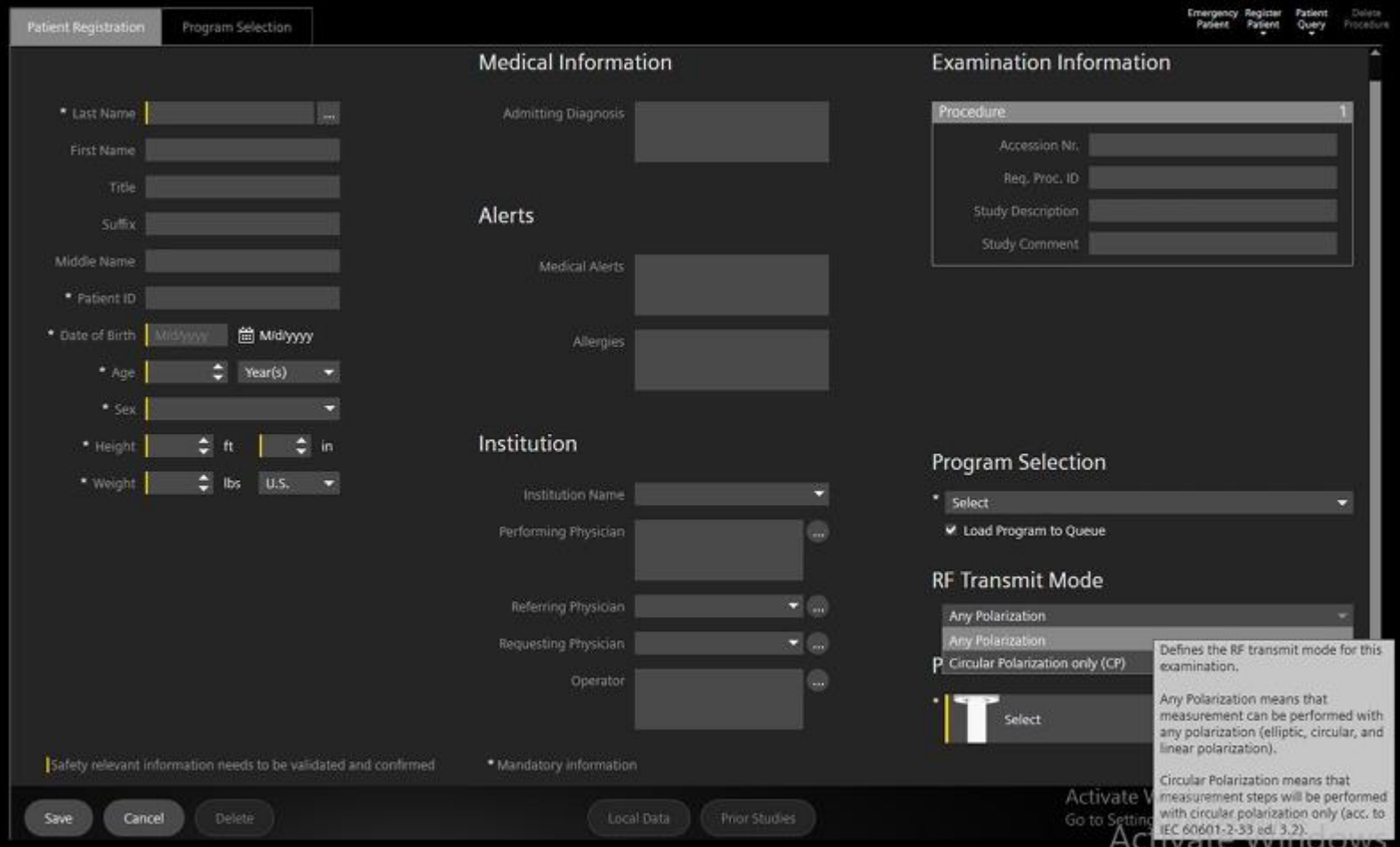
Leg cylinders


SARLimit(s) Exceeded
Step 1 - se_15b130
BORE Temperature 69.8 °F
Operating Mode
Current Measurement First Level
Next Measurement Normal Mode
First Level
Protocol Parameters
Current Recommended
Reduce Slices 20 16
Increase TR 1340 ms 1630 ms
Reduce Flip Angle 130 deg deg
OK
Open Protocol
Skip

- ***SAR IS …***


Patient Registration
Program Selection
Emergency Patient
Register Patient
Patient Query
Delete Procedure
Medical Information
Admitting Diagnosis
Examination Information
Procedure 1
Accession Nr.
Req. Proc. ID
Study Description
Study Comment
* Last Name
First Name
Title
Suffix
Middle Name
* Patient ID
* Date of Birth
M/d/yyyy
* Age
Year(s)
* Sex
* Height
ft
in
* Weight
lbs
U.S.
Alerts
Medical Alerts
Allergies
Institution
Institution Name
Performing Physician
Referring Physician
Requesting Physician
Operator
Program Selection
Select
Load Program to Queue
RF Transmit Mode
Any Polarization
Any Polarization
Circular Polarization only (CP)
Select
Defines the RF transmit mode for this examination.
Any Polarization means that measurement can be performed with any polarization (elliptic, circular, and linear polarization).
Circular Polarization means that measurement steps will be performed with circular polarization only (acc. to IEC 60601-2-33 ed. 3.2).
Safety relevant information needs to be validated and confirmed
* Mandatory information
Save
Cancel
Delete
Local Data
Prior Studies
Activate Windows

- ***SAR IS …***

HIGH/WEIGHT

- ***SAR IS …***

LOOKAHEAD MONITOR

HIGH/WEIGHT

- ***SAR IS …***

RUN TIME MONITOR

LOOKAHEAD MONITOR

HIGH/WEIGHT

- ***SAR IS …***

RUN TIME MONITOR

LOOKAHEAD MONITOR

HIGH/WEIGHT

TR/FA/#SLICE/ETL

- ***SAR IS …***

RUN TIME MONITOR

LOOKAHEAD MONITOR

HIGH/WEIGHT

FEET FRIST

TR/FA/#SLICE/ETL

- ***SAR IS …***

RUN TIME MONITOR	***LOOKAHEAD MONITOR***	***HIGH/WEIGHT***
FRIST LEVEL 	***FEET FRIST***	***TR/FA/#SLICE/ETL***

- ***SED IS …***

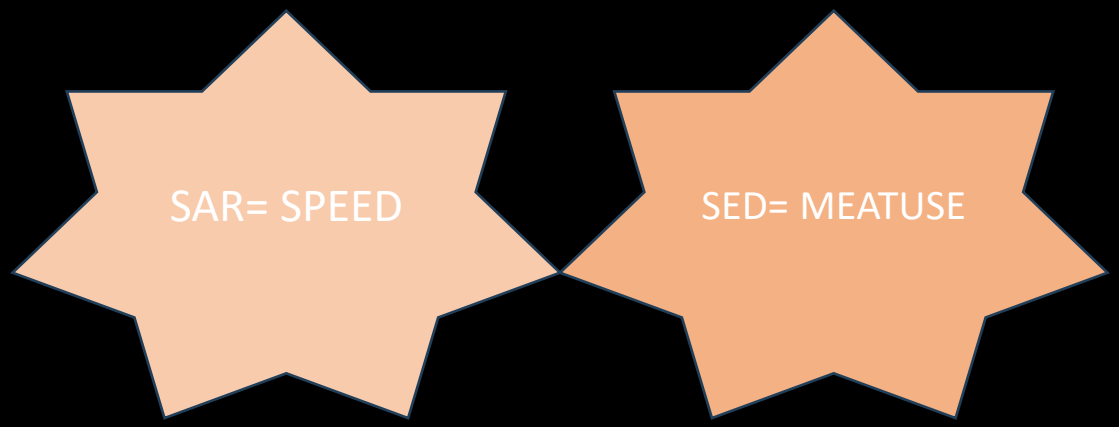
- ***SED IS …***

SAR*TIME

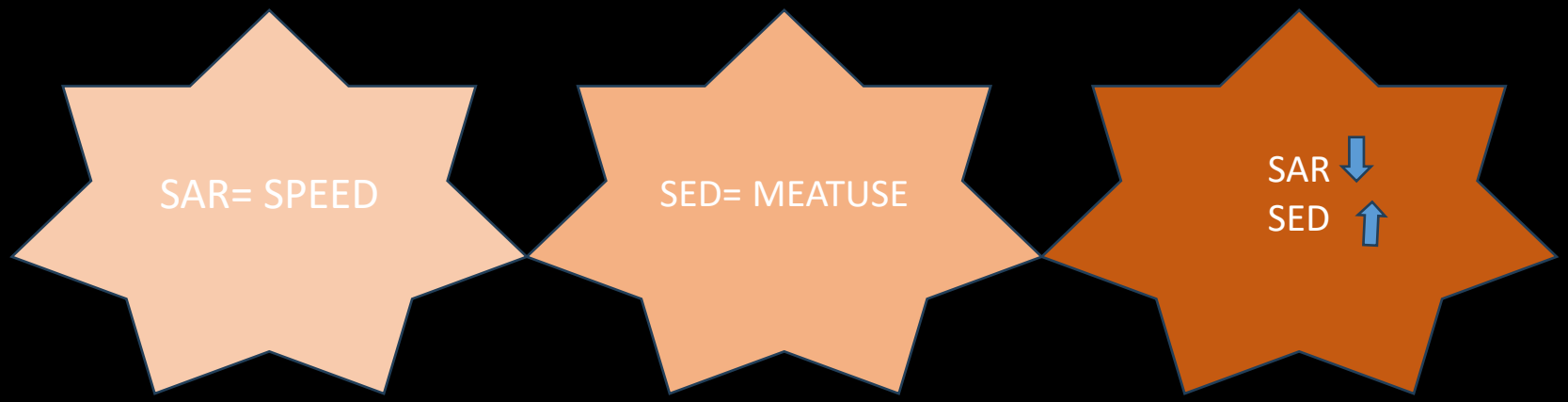
- ***SED IS …***

SAR*TIME

- ***SED IS …***



- ***SED IS …***



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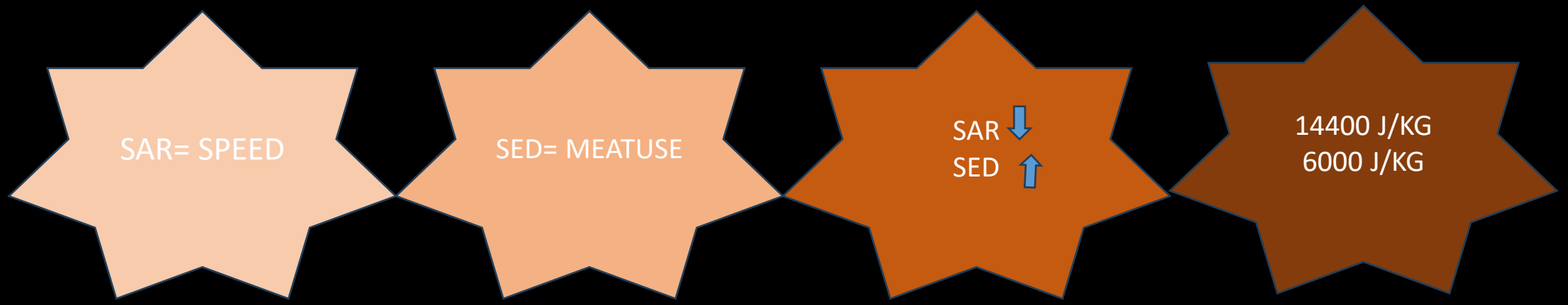
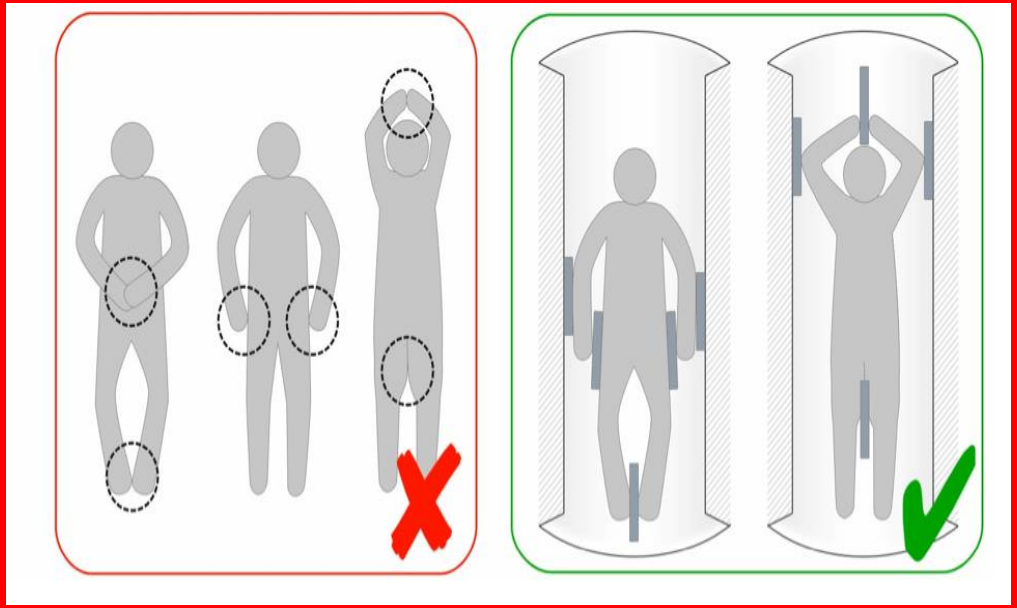


General MR safety measures

- **The subject must not be positioned as shown left.**
- **Use of paper/linen to cover all exposed skin.**
- **No synthetic blankets.**
- **No direct patient contact to magnet bore or cobles.**



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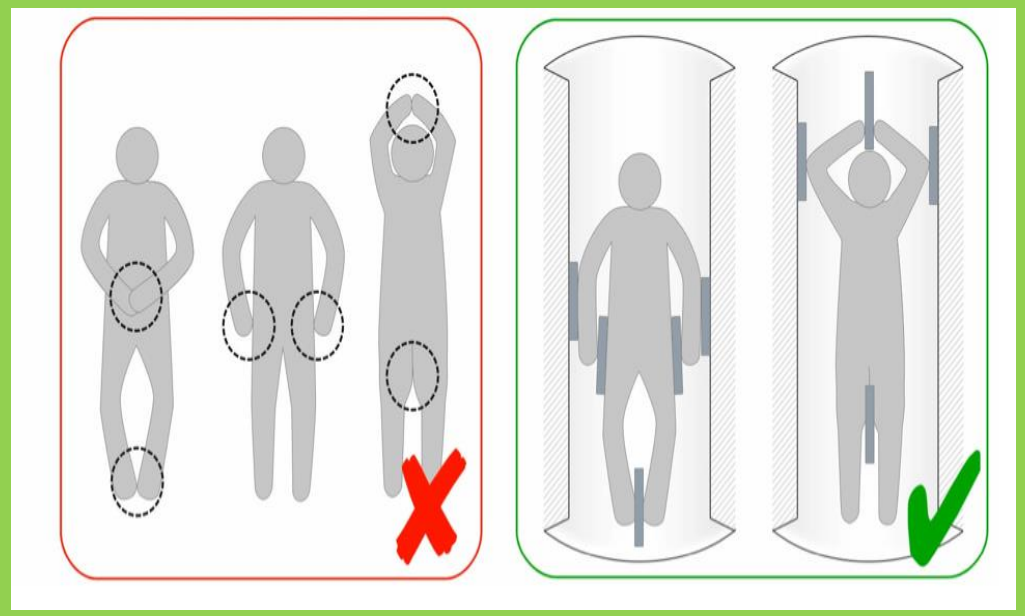


- *Terminology for accessories*

01

02

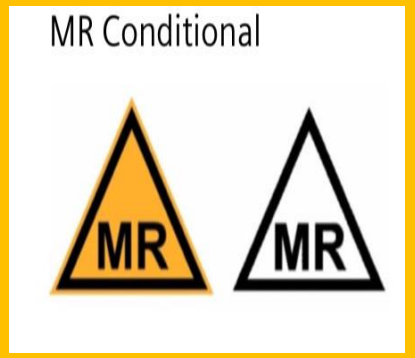
03

- ***Terminology for accessories***

02

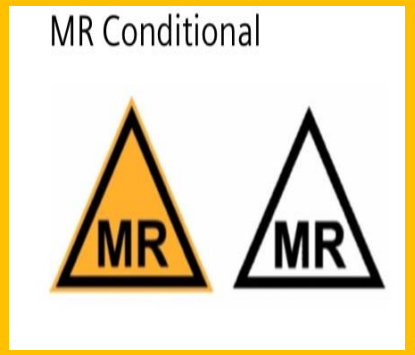
03

- ***Terminology for accessories***



03

- ***Terminology for accessories***




Implants susceptible to
electromagnetic effects


Implants susceptible to
electromagnetic effects


Open flames, no smok-
ing

Implants susceptible to electromagnetic effects

Metallic implants and other metallic objects inside the body

Open flames, no smok-ing

Implants susceptible to electromagnetic effects

Metallic implants and other metallic objects inside the body

Fire extinguishers with magnetizable metal housing

Open flames, no smoking

Implants susceptible to electromagnetic effects

Metal parts, e.g. tools

Metallic implants and other metallic objects inside the body

Fire extinguishers with magnetizable metal housing

Open flames, no smoking

Implants susceptible to electromagnetic effects

Metal parts, e.g. tools

Metallic implants and other metallic objects inside the body

Mechanical watches and electronic data carriers

Fire extinguishers with magnetizable metal housing

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Implants susceptible to electromagnetic effects

Metal parts, e.g. tools

Metallic implants and other metallic objects inside the body

Mechanical watches and electronic data carriers

Fire extinguishers with magnetizable metal housing

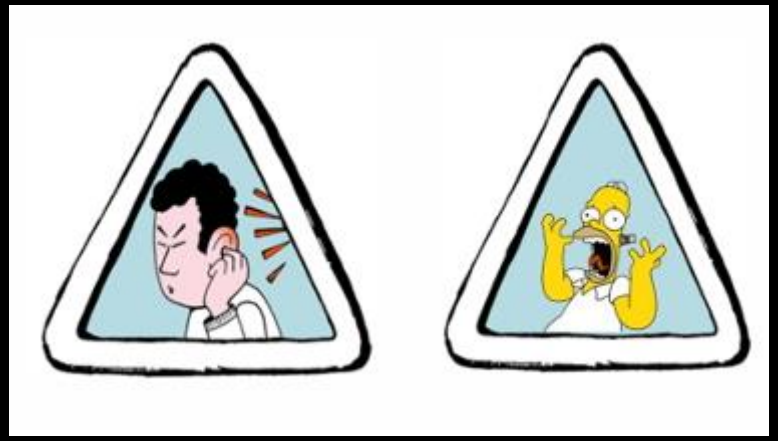
Electronic data carriers

Open flames, no smoking

- *LASER*


CAUTION
LASER RADIATION -
DO NOT STARE INTO BEAM
(LASER TYPE, WAVELENGTH,
PULSE DURATION, MAXIMUM OUTPUT)
CLASS 2 LASER PRODUCT

- *GRADIENT*



MRI ACCESS ZONES

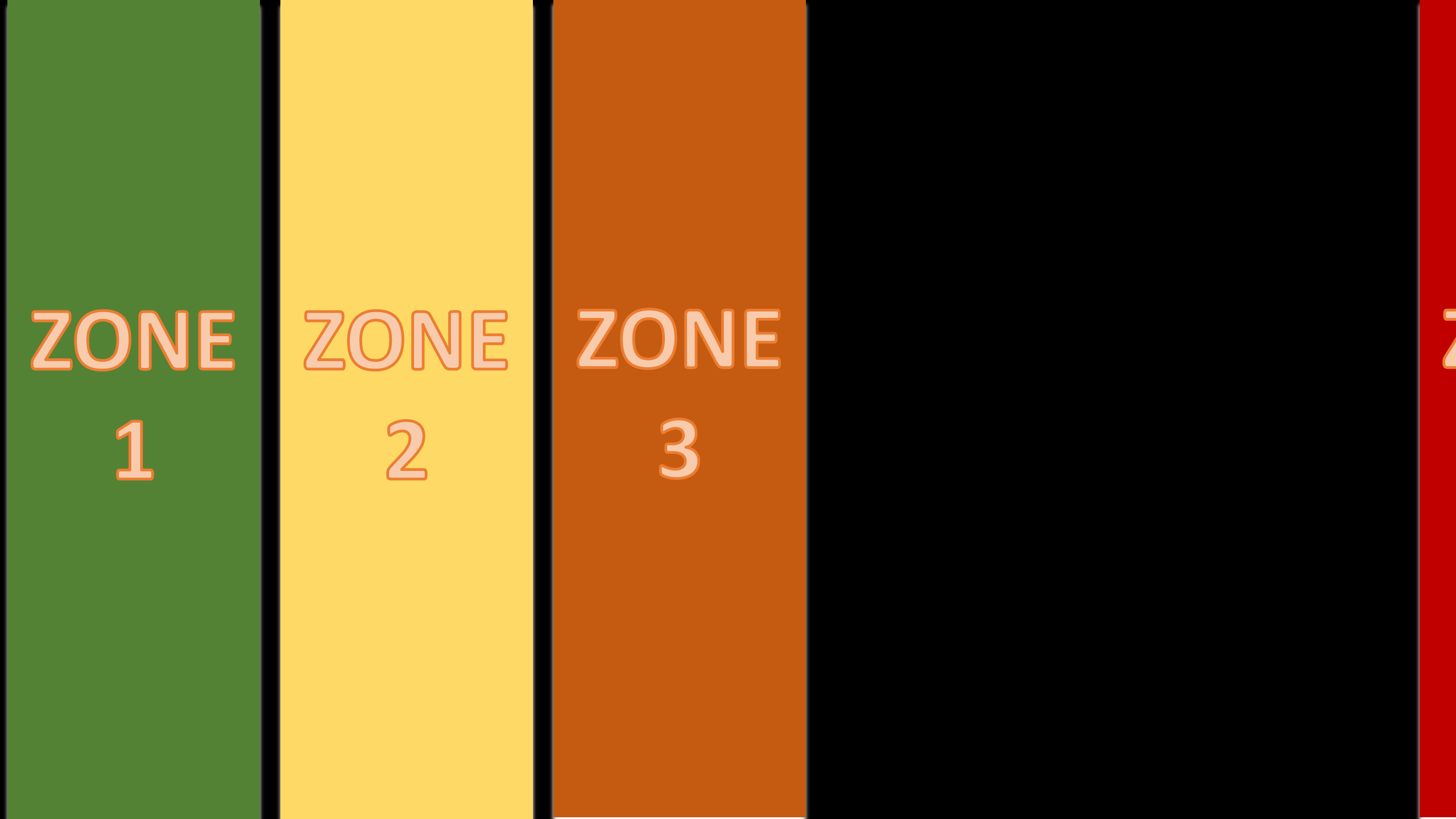
ZONE 1

ZONE 2

ZONE 3


ZONE 1
ZONE 2
ZONE 3


ZONE 1
ZONE 2
ZONE 3


ZONE 1
ZONE 2
ZONE 3

ZONE 1

ZONE 2

ZONE 3

ZONE 4

STAFF LEVELS

MRI ALWAYS ON

MRI ZONES

BIOLOGICAL EFFECT

CHECKING FOR FERROMAGNETIC MATERIAL

DONOT GUESS

ANNUAL SCREENING

PREGNANT EMPLOYEES

MRI SAFETY OFFICER

FOUR IMPORTANT FIELD IN MRI

CLAUSTROPHOBIA

CONTRAST MEDIA

1

Patient Screening: Conduct thorough screening to identify any implants or conditions that may pose risks.

1

Patient Screening: Conduct thorough screening to identify any implants or conditions that may pose risks.

2

Training: Ensure all staff receive comprehensive MRI safety training.

1

Patient Screening: Conduct thorough screening to identify any implants or conditions that may pose risks.

2

Training: Ensure all staff receive comprehensive MRI safety training.

3

Magnetic Field Awareness: Be mindful of the strong magnetic field to prevent accidents with ferromagnetic objects

۴

SAR Management: Monitor and manage Specific Absorption Rate (SAR) to minimize heating risks

۴

SAR Management: Monitor and manage Specific Absorption Rate (SAR) to minimize heating risks

۵

Emergency Preparedness: Have a clear protocol for emergencies like quenching or patient distress.

۴

SAR Management: Monitor and manage Specific Absorption Rate (SAR) to minimize heating risks

۵

Emergency Preparedness: Have a clear protocol for emergencies like quenching or patient distress.

۶

Patient Comfort: Use tools and communication to reduce patient anxiety and improve their experience.

Safety Information
Daily MR components functionality checklist

SIEMENS Healthineers

Before using the MR system, it's always important to observe the trained safety measures and check the functionality and/or cleanliness of the following parts and areas:

- ☐ Check that all warning symbols and signs are present inside and outside the examination room.
- ☐ Check the examination, control, and equipment room for liquid spills and puddles on the floor.
- ☐ Ensure that **no magnetizable materials or objects** are present in the examination room.
- ☐ Visually inspect the table appearance and cleanliness.
- ☐ Check the Intercom functionalities (e.g., LED, sound, patient communication).
- ☐ Verify that pressing the squeeze bulb triggers the patient alert.
- ☐ Test the Table Stop buttons to ensure they function properly and stop the table immediately (see page 6).
- ☐ Check that the patient video monitoring systems transmit images properly.
- ☐ Look for the System Check icon on the Home Screen. If it's red, review the **Message History - MR Scanner and Acquisition** and contact Siemens Healthineers Service or wait until the system is ready.

Safety Information
Pre-screening of patients and workers

Before any MR examination, **screen and inform the patient about the effects and risks** (e.g., stimulation, acoustic noise, heating effects, patient table movement). Additionally, educate the patient on how to collaborate. Document this information exchange in a Patient consent form, which must be signed before the examination.

Ensure that patients **always remove** ferromagnetic objects before entering the examination room.

Ferromagnetic objects are:

- Bras (with clasps, underwire)
- Belts
- Trousers with zippers or buttons
- Hair pins, barrettes, or hair clips
- Removable dental braces
- Nose and mouth masks with metal strips

Safety Information
Patient safety checklist

SIEMENS Healthineers

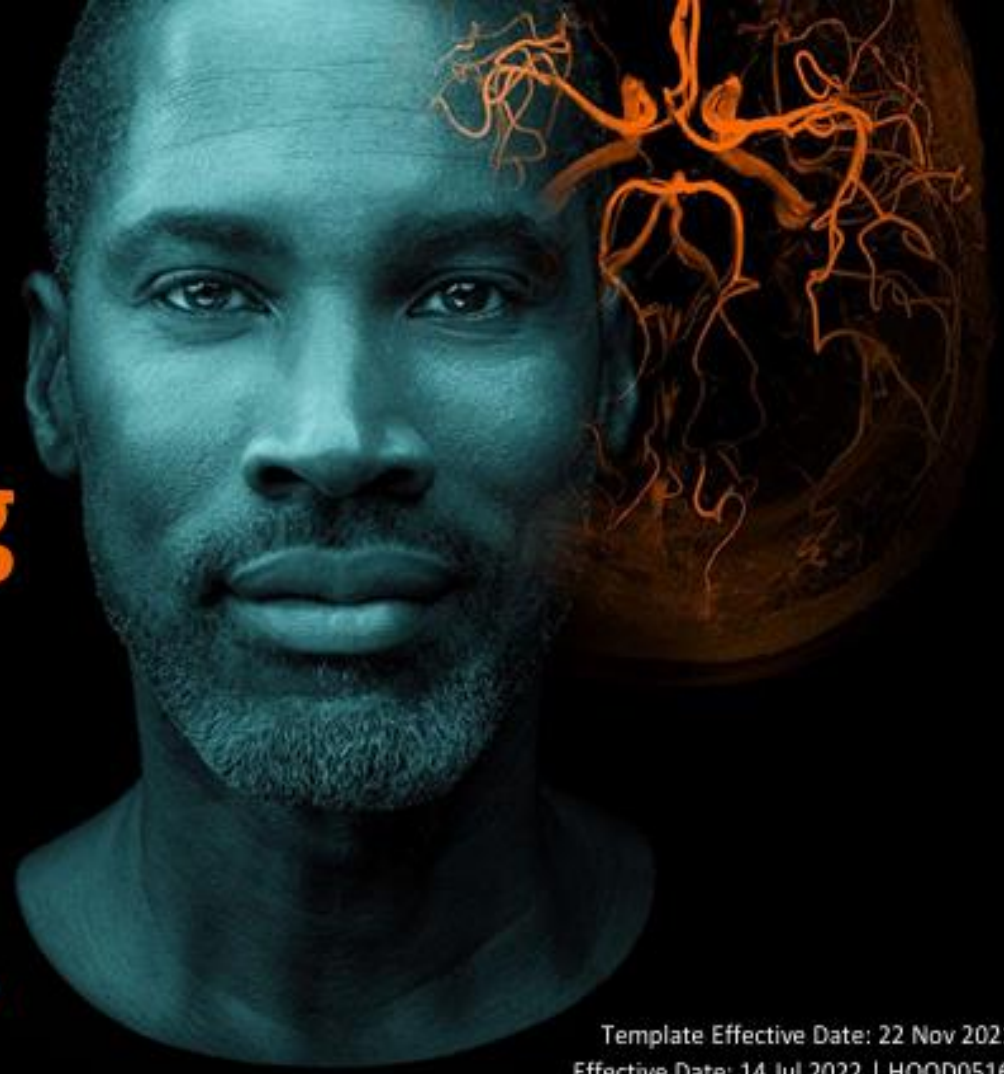
Always prioritize patient and staff safety while performing an examination.
Before starting scanning, please check the following:

- ☐ Does the patient have any implants, are they pregnant or are they wearing any (permanent) make-up?
- ☐ Is there a possibility of embedded metal splinters (e.g., due to military activities)?
- ☐ Is the patient wearing sufficient hearing protection?
- ☐ Is the patient correctly positioned to avoid skin-to-skin contact between body parts (e.g., touching hands, feet, etc.)?
- ☐ Is the patient correctly positioned to avoid contact between the body parts and the scanner bore?
- ☐ Does the patient need active and extra medical supervision during the exam?
  This is required for the following patient groups:
  - Patients not capable of communicating autonomously (infants, children, patients who are confused, sedated, or unconscious)
  - Decompensated cardiac patients, febrile patients, or all patients with potential of developing cardiac arrest, seizures, or claustrophobic reactions.

MR Coil Handling, Storage and Cleaning

Tips and Guidelines

Version 2022.04



Template Effective Date: 22 Nov 2021 | HILS 2223
Effective Date: 14 Jul 2022 | HOOD05162003286712

1

Damaged RF coils are the cause of many costly and time-consuming system issues.

1

Damaged RF coils are the cause of many costly and time-consuming system issues.

2

Coil connectors/Levers/Coil plug or coil link damage

1

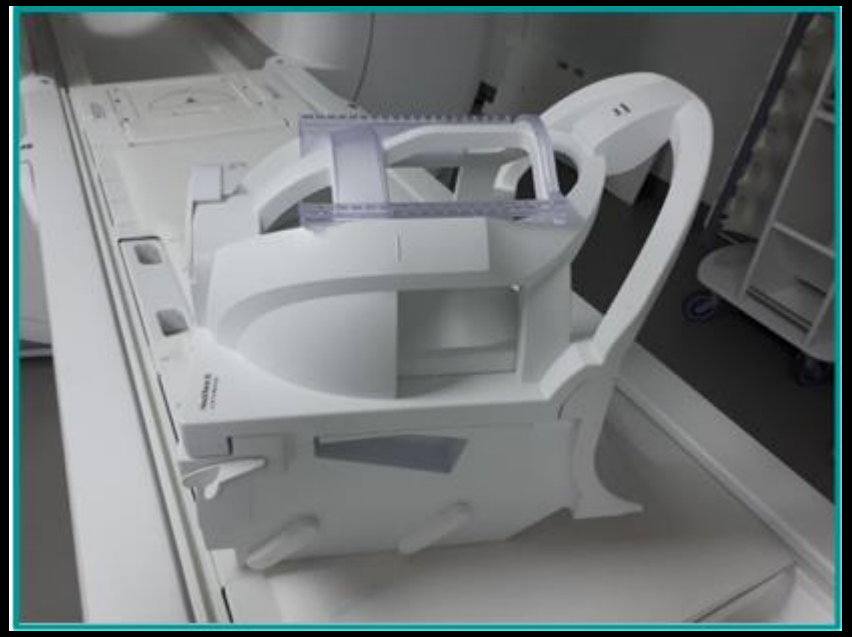
Damaged RF coils are the cause of many costly and time-consuming system issues.

2

Coil connectors/Levers/Coil plug or coil link damage

3

Check the coil connectors and links weekly



Cleaning Recommendations

Cleaning Recommendations

Cleaning Recommendations

- ✓ ***Clean at least every two months***
- ✓ ***Prior to cleaning, switch off the LCD monitor/video display and disconnect the main power plug. Wait until it has cooled down before cleaning***
- ✓ ***If additional cleaning is needed, spray window cleaner lightly on a cloth to clean the monitor. Never spray window cleaner directly on the monitor***
- ✓ ***Avoid scratching the surface of the LCD monitor/video display.***

Cleaning Recommendations

Cleaning Recommendations

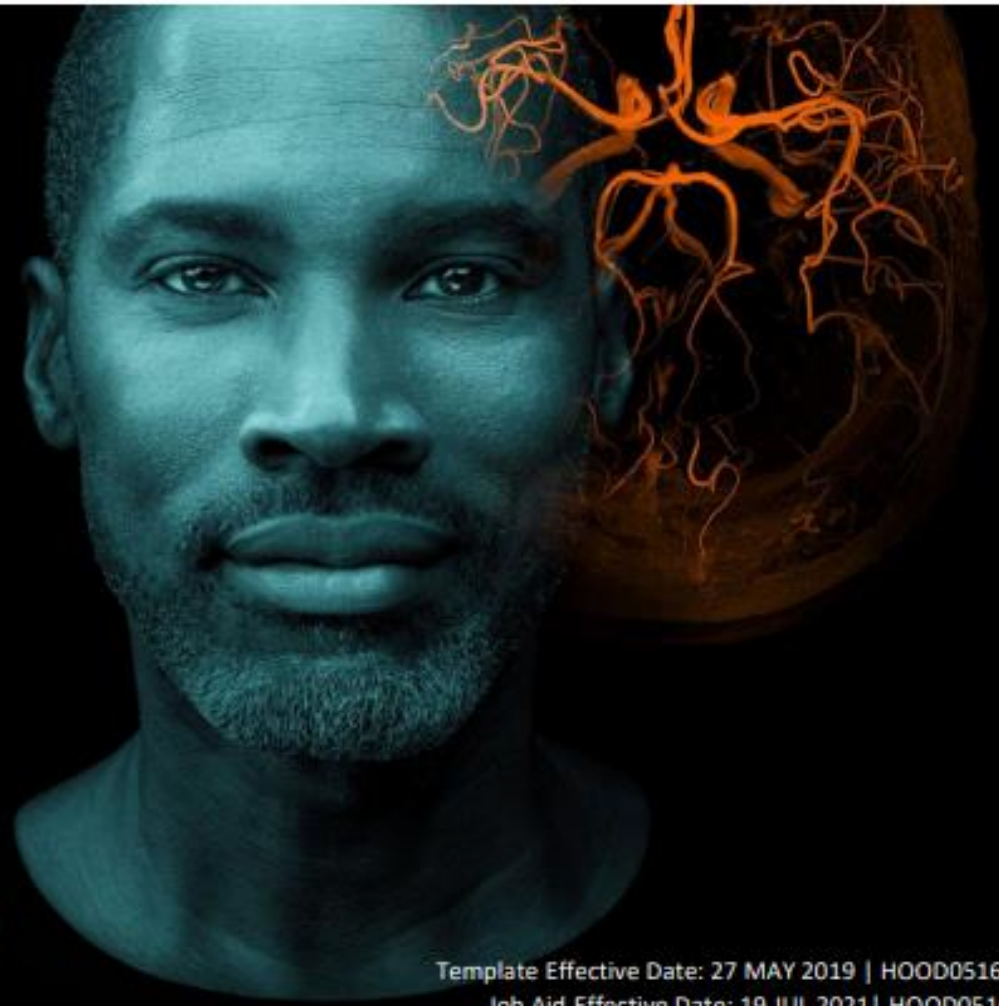
Approved Detergents	Not Approved Detergents
Aldehydes	Alcohol solution (70% isopropyl alcohol and 30% water) – Pads and accessories
Quaternary compounds	Benzine undiluted
Guanidine derivatives	Acetone
Peroxide compounds	Phenols
Pyridine derivatives	
Chloro derivatives	
Alcohol solution (70% isopropyl alcohol and 30% water) – COILS only	
Alcohol solution min. 60% ABV (only for coils and their accessories)	
Commercially available cleaning agents, detergent substances	
Alkylamine	
Organic acids	

Cleaning Recommendations

- ✓ ***Use commercially available cleaning and disinfectant solutions. Always refer to the lists of approved detergents provided in the operator manual for each system component and accessory.***
- ✓ ***Do not use hard or sharp objects (for example, knives or tweezers) to remove residue***
- ✓ ***Do not pour cleaning fluid directly onto surfaces or spray with fluids. Always use a damp cloth for cleaning. Carefully wipe the plugs and connectors with a cloth. Do not touch the contacts.***
- ✓ ***Do not immerse in cleaning or disinfectant liquid. Do not rinse with water***
- ✓ ***Wash the straps of the patent table at a temperature of 60°C with the approved detergents***

SIEMENS Healthineers

Artifacts Brief Overview



Template Effective Date: 27 MAY 2019 | HOOD05162003010284
Job Aid Effective Date: 19 JUL 2021| HOOD05162003208932

- ✓ ***In general, the image quality (IQ) depends on the image characteristics listed below. During Quality Assurance (QA), the user evaluates if the image matches the quality requirements regarding these characteristics.***

- ✓ ***Artifacts are changes of the signal intensity in an MR image that do not correspond to the real tissue signal. They result mainly from physiological as well as system-related effects. There are several types of artifacts, e.g., motion artifacts, which can affect the image for different reasons.***

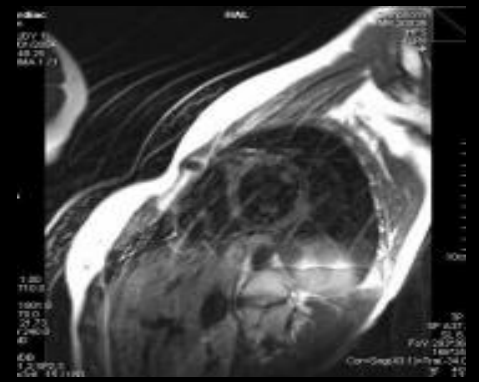
Characteristics	Short Description
Contrast	Differentiation between tissues with different compositions
Resolution	Image resolution is defined by the voxel size
Signal-to-Noise Ratio (SNR)	Ratio between the signal of the area of interest and the background noise
Artifact	Signal variations that can influence image appearance and interpretation

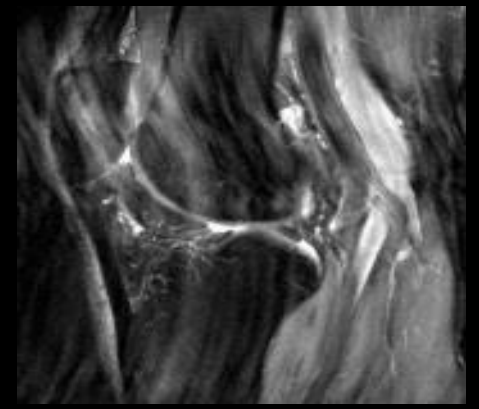
Motion Artifacts Artifacts due to Movement

- voluntary movements
- Involuntary movements

- ❑ *Phase Encoding Direction*
- ❑ *Ghosting artifact*
- ❑ *Pulstion artifact*

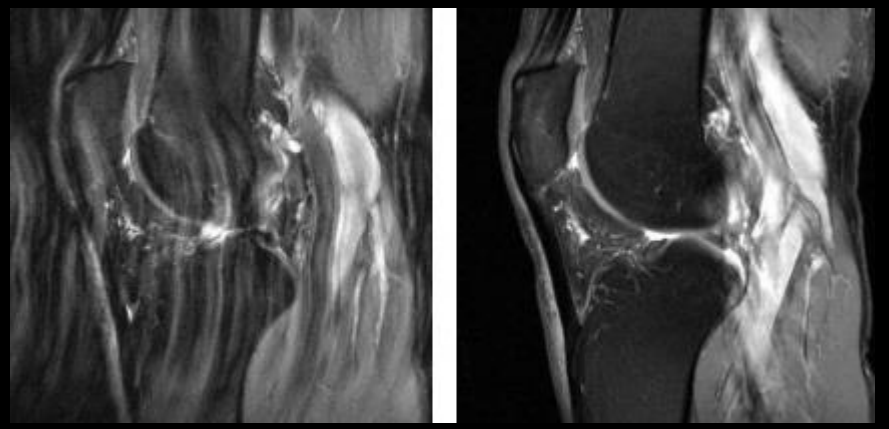
- ➢ *Advise the patient not to move during the examination.*
- ➢ *Increase the patient's comfort if possible*
- ➢ *repeat the scanning step.*
- ➢ *fast or motion-insensitive mode*
- ➢ *hyosine*





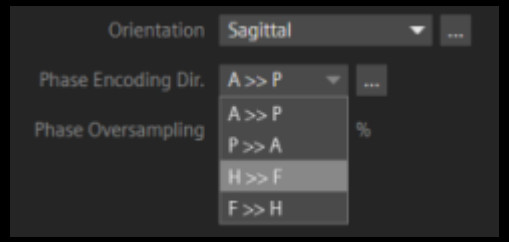
Flow Artifacts Artifacts due to Flow

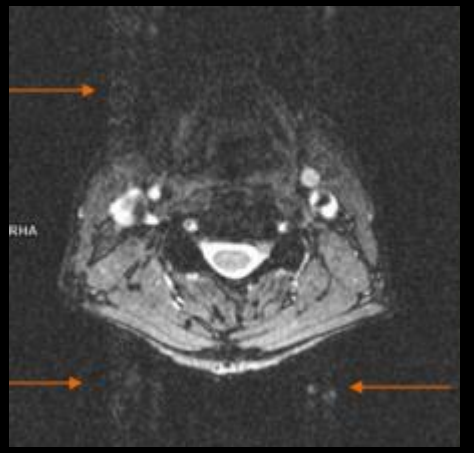
- periodic repetitive motions
- involuntary movements of fluids in the body



- ❑ *Phase Encoding Direction*
- ❑ *Pulstion artifact vessel & csf*

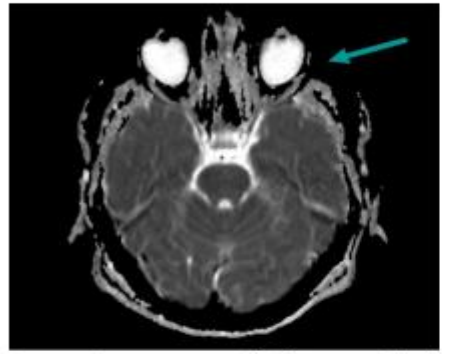
- ➢ *change the Phase Encoding Direction*
- ➢ *FC*
- ➢ *SATURATION BAND*
- ➢ *3D*
- ➢ *SE*
- ➢ *ECG*
- ➢ *GRAPPA*



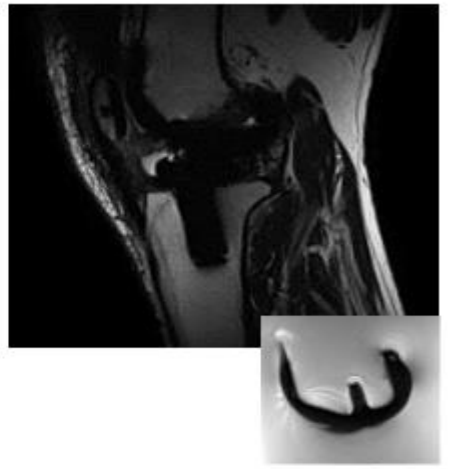


Susceptibility and Metal Implants Artifacts

- *due to magnetic sensibility relating to something*
- appear as localized image distortions or signal changes



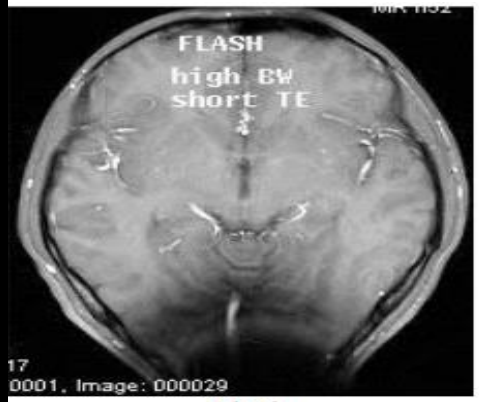
Generic susceptibility artifact



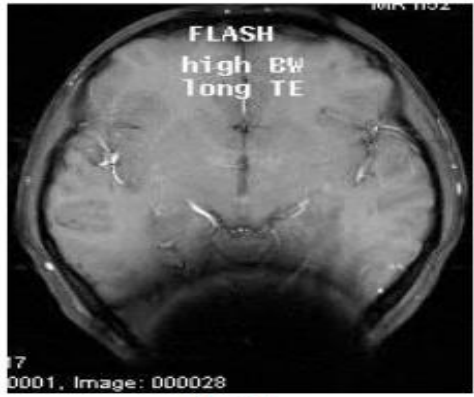
Metal implant artifact

- ❑ ***Generic susceptibility artifact***
- ❑ Metal artifacts

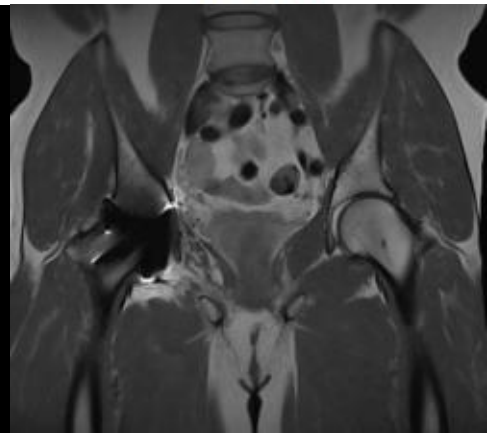
- ➢ higher bandwidth as well as lower TE are less affected.
- ➢ FSE VS GRE
- ➢ ETL // S.T // BASE RES // SEMAC // VAT



Flash
BW 150 HZ/Pixel
TE 4.6 ms



Flash
BW 150 HZ/Pixel
TE 11 ms



Aliasing Artifacts Artifact due to Overfolding

- **when the object to be scanned is bigger than the Field of View (FoV)**

❑ ***Phase Encoding Direction***

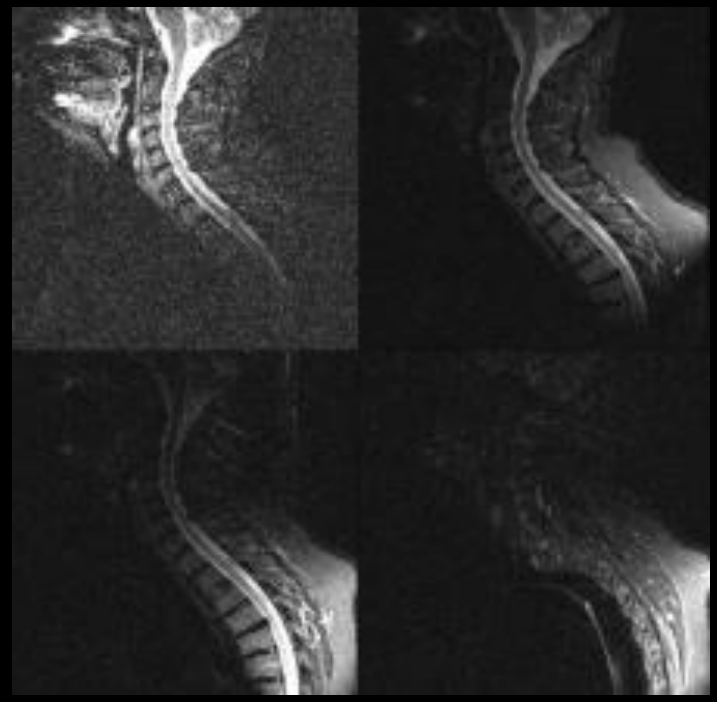
- ***oversampling in Phase Direction (2D images) or Slice Direction (3D images).***
- ***SATURATION BAND***
- ***PHASE ENCODING DIRECTION SWAP.***

Inhomogeneity Artifacts Artifacts due to Spatial Signal Inhomogeneity

Reasons for field inhomogeneity artifacts are:

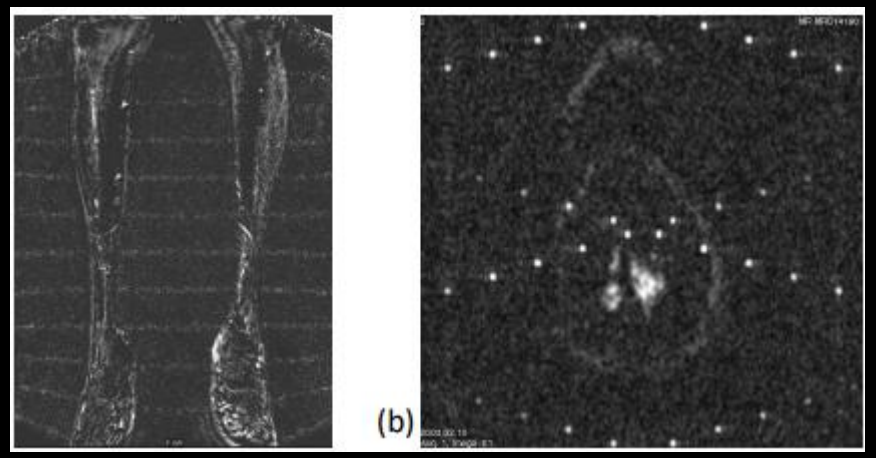
- **The radio-frequency (RF) field of the transmitting coil is not homogeneous. As a result, the RF pulses are of different strengths and the excitation is different.**
- **The radio-frequency (RF) field of the receiving coil is not homogeneous (different sensitivity). As a result, the signal is lower in less sensitive areas and stronger in areas with higher sensitivity.**
- **Inhomogeneity of the B0 magnetic field, e.g., due to shimming, eddy currents, local B0 inhomogeneities**

➢ *CALL TO SIEMENS*



Hardware Artifacts & ELECTROMAGNETIC ARTIFACT
Artifacts due to Coil Positioning, Broken or Wrong Coil

- *First, check that the coil is positioned correctly.*
- *A broken coil element can also lead to a signal loss and increase in noise.*
- *SHAPE & DISTANCE & SIZE*



ویرایش: سوم فروردین ۱۴۰۰

SIEMENS MRI Daily Check List (AMIRA)

بیمارستان: .... سوپروایزر: .... تاریخ: .... ساعت: ....

عملکرد Alarm Box اتاق کنترل (سبز بودن تمام چراغها)		مقدار Helium کنترل روزانه حجم هلیوم با ذکر عدد از قسمت cooling status الزامی است (نوسان در بازه ۰، ۹۰- قابل قبول است افت یا نوسان بیشتر از این حد گزارش شود)	گیج های کابینت Cooling			سیستم چیلر			تست Shimming با فانتوم		دمای اتاق ها سانتیگراد(22-18)		
Not Ok	Ok		فشار گاز کمپرسور (bar) (19-22)	کارکرد کمپرسور (ساعت) کمتر از ۳۰۰۰۰ (هر 30 هزار ساعت فیلتر عوض شود)	فشارگیج A (bar) 3< بالاتر از ۳	دمای آب ورودی چیلر به کابین (سانتیگراد) (8-13)	فشار آب ورودی چیلر به کابین (bar) (1.5 - 5)	دبی آب ورودی چیلر به کابین Lit/Min (110-120) 11-12 rpm	Not Ok	Ok	مگنت	تکنیک	کنترل

عملکرد کویل ها											تجهیزات ام آرای							توضیحات
Brain	Cervical	Shoulder	Knee	Body 1	Body 2	Small Flex	Large Flex	Small Loop	Large Loop	Breast	PMU (Physiologic Monitoring Unit)	فعال بودن Auto Send تصاویر به پکس و ارسال تصاویر روز قبل	کنترل فضای Database (بالای ۶۰ درصد پر نباشد)	خطاهای روزانه Event Log Tab دستگاه	عملکرد سرور سیستم پیام رسان هوشمند	بالس اکسیمتر (نحوه استقرار و شارژ مناسب)	اکسیژن دیواری	

نام قسمت ها		وضعیت	
عملکرد گیت ورودی اتاق مگنت		مناسب ☐	نامناسب ☐
عملکرد مانیتور ام آرای در اتاق کنترل		سالم ☐	ناسالم ☐
عملکرد گوشی بیمار در اتاق مگنت		سالم ☐	ناسالم ☐
وجود ویلچر و تخت مخصوص ام آرای		وجود دارد ☐	وجود ندارد ☐
عملکرد اینترکام (ارتباط کلامی با بیمار)		سالم ☐	ناسالم ☐
نظافت فضاها	پنجره ها و صندلی ها	مناسب ☐	نامناسب ☐
	کف پوش ها و سالنها	مناسب ☐	نامناسب ☐
	عدم وجود خون یا زائده فلزی در سوکت کوپلهای روی تخت	مناسب ☐	نامناسب ☐
	رختکن ها	مناسب ☐	نامناسب ☐
	ریکاوری ،تختها و تخت ام آرای	مناسب ☐	نامناسب ☐
	روشویی و تی شویی و کنترل طی ها طبق رنگ بندی	مناسب ☐	نامناسب ☐
	اتاقهای تکنیک ، مگنت ،کنترل	مناسب ☐	نامناسب ☐
تفکیک پسماندهای بیمارستانی		انجام شده ☐	انجام نشده ☐
وجود لوازم مصرفی پزشکی و اداری کافی(CD/DVD - لوازم حفاظت فردی- لوازم حفاظت از بیمار دروشیت،گان)		وجود دارد ☐	وجود ندارد ☐
وجود مواد ضد عفونی کننده در ریکاوری ، اتاق کنترل و مگنت		وجود دارد ☐	وجود ندارد ☐
Safety Box (کنترل تاریخ و حجم سطل		مناسب ☐	نامناسب ☐
تکمیل چک لیست ترالی کد و ملزومات متعلقه(اکسیژن -داروها - دفیبریلاتور -پالس - مانیتور - ساکشن)		انجام شد ☐	انجام نشده ☐

توضیحات / اقدامات :