



**scannexus**

# **CU Manual**

## TABLE OF CONTENTS

Table of Contents .....	1
1 Introduction .....	4
<b>GENERAL INFORMATION</b>	
2 General information.....	6
2.1 Emergency phone numbers .....	6
2.2 Contact numbers for MRI scanning facility - Oxfordlaan 55.....	6
2.3 Out of office hours .....	6
2.4 Reserving scanner time .....	7
2.5 Wiki .....	7
2.6 MRI logbook .....	7
3 CU training.....	8
4 Access to the Scannerlab .....	9
4.1 Burglar alarm system .....	9
<b>SAFETY</b>	
5 Safety instructions .....	12
5.1 Emergency buttons .....	13
5.2 Key system .....	14
5.3 Safety checks .....	14
6 Subjects .....	16
6.1 Physiological effects on subjects .....	16
6.2 Screening forms .....	16
6.3 Data handling.....	17
6.4 Incidental findings.....	17
<b>SCANNING</b>	
7 Scanning procedure general .....	19
7.1 Preparation .....	19
7.2 Positioning of subject .....	19
7.3 Table Operation .....	20
7.4 Patient Registration.....	24
7.5 Volume box and adjust volume box .....	25

7.6	Intercom.....	26
7.7	Magnet Bore fan & light .....	26
7.8	Export data .....	27
7.9	Saving protocol / Export to PDF .....	27
7.10	Finish Measurement .....	28
7.11	Local Dicom Data .....	28
7.12	Default Coils.....	28
7.13	Mock Scanner .....	29
8	Auto Align .....	30
8.1	First subject .....	30
8.2	Following subjects / Measurements .....	31
9	7T shim Procedures .....	32
9.1	Shim tool box .....	32
9.2	Shimming without shim tool box .....	35
10	Geometrical Distortion Correction.....	38
<b>PERIPHERAL EQUIPMENT</b>		
11	Equipment rack.....	40
11.1	Audio amplifier .....	40
11.2	Mixer.....	40
11.3	Speaker.....	41
11.4	Interface buttonbox and joystick.....	42
11.5	Switch boxes .....	43
12	Peripheral equipment MR room .....	43
12.1	Button response boxes .....	43
12.2	Sensimetric earplugs (+canal tips) .....	43
12.3	Music .....	44
13	Physiologic sensors .....	45
13.1	Charging station .....	45
13.2	Respiratory sensor .....	46
13.3	ECG sensor .....	46
13.4	Wireless pulse Sensor.....	47
13.5	Measured data.....	47
14	Stimulus PC.....	48
14.1	Presentation .....	48

14.2	E-prime .....	52
14.3	Projector control .....	56
14.4	3T Projector Settings.....	57
14.5	7T Projector settings .....	57
15	Eye tracker and goggles.....	59
15.1	Goggles and Eye tracker 7T (Visual coil) .....	59
15.2	Nano eye tracker 7T (NOVA coil).....	63
15.3	Eye tracker 3T.....	65
16	EEG 256 channels .....	67
<b>DEFAULT AND TROUBLE SHOOT</b>		
17	Default Settings 3T .....	69
17.1	Magnet Room .....	69
17.2	Stimulus equipment .....	69
17.3	console room.....	69
18	Troubleshooting 3T.....	70
18.1	Trigger / buttonbox / joystick .....	70
18.2	PC/projector screen.....	70
18.3	Auditory System .....	70
18.4	Scanner .....	70
18.5	Data.....	70
19	Default Settings 7T .....	71
19.1	Magnet Room .....	71
19.2	Stimulus equipment .....	71
19.3	Console room .....	71
20	Troubleshooting 7T.....	72
20.1	Table/laser light does not respond .....	72
20.2	Trigger / buttonbox / joystick .....	72
20.3	PC/projector screen.....	72
20.4	Auditory System .....	72
20.5	Scanner .....	72
20.6	Data.....	72
<b>APPENDIX</b>		
Appendix 1 explanation safety screening form .....		74

## 1 INTRODUCTION

Dear Certified Users,

This manual describes the basic usage of our scannerlab. You can find basic information about important phone numbers, safety, screening, preparing your measurement, peripheral equipment, etc.. If you need more information, please contact the Support Staff. Detailed information about equipment, special protocols can be found at our Wiki page. <http://137.120.141.83:8090/>

# GENERAL INFORMATION


## 2 GENERAL INFORMATION

### 2.1 EMERGENCY PHONE NUMBERS

For medical/fire emergencies: **1333**.

In case of a quench: **070-3332752** general service number of SIEMENS (24/7).

### 2.2 CONTACT NUMBERS FOR MRI SCANNING FACILITY - OXFORDLAAN 55

Room	Room #	UM phone	 scannexus
Reception	T0.007	85668	
3T Console	T0.009	85669	
7T Console	T0.027	85670	
9.4T Console	T0.026	85831	
RF Laboratory	T0.004	85667	

Person	UM Phone	Mobile	E-mail
Support Staff	85668	-	scanlabs@scannexus.nl
Christopher Wiggins	84802		c.wiggins@scannexus.nl
Esther Steijvers	85668		e.steijvers@scannexus.nl
Lotty Huijboom	85668		l.huijboom@scannexus.nl

Service	UM Phone	Full number
Servicedesk Facilitaire Dienst	82002	043-3882002
Security/Burglar Alarm	75566	043-3875566
UM Emergency	<b>1333</b>	043-3882452 / <b>112</b>
Siemens Hotline	070-3332752	070-3332752

#### INSIDE OFFICE HOURS:

**Contact the Support Staff** for any problems (speed dial button on the phone!)

#### OUTSIDE OFFICE HOURS:

Chris Wiggins, Esther Steijvers, Lotty Huijboom

### 2.3 OUT OF OFFICE HOURS

- Office hours (Mon – Fri from **9:00 -17:00**):
  - At least one CU has to be present during the entire time of scanning.
- Out of office hours (Mon – Fri before 9:00, after 17:00 and in weekends/collective holidays):
  - At least one CU and one person with at least Magnet Safety training have to present. At least one of them has to be BHV certified.

## 2.4 RESERVING SCANNER TIME

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- An online system, Calpendo, is used for this:  
<https://scannexus.calpendo.com/>
- [A video guide to Calpendo is available.](#)
- Once you complete Certified User qualification you can request a username on the system.
- **FPN users** have to contact [mriplanning-fpn@maastrichtuniversity.nl](mailto:mriplanning-fpn@maastrichtuniversity.nl) for reserving scanner time. Booking in Calpendo will be done by a dedicated person within FPN.

## 2.5 WIKI

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You can find extra information on the wiki about equipment, protocols, troubleshooting, etc.. The system also contains logbooks for each system.

<http://137.120.141.83:8090/>

## 2.6 MRI LOGBOOK

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- Each scanner has his own logbook on the wiki:
  - <http://137.120.141.83:8090/display/CU/Logbook+Prisma>
  - <http://137.120.141.83:8090/display/7TMRI/Logbook+7T>
  - <http://137.120.141.83:8090/display/94MRI/Logbook+9.4T>
- For entering incidents with the stimulus equipment or the scanner.
- If error occurs during scanning or with the stimulus equipment always check logbook for a general solution.



### 3 CU TRAINING

Contact the Scannexus Support Staff to register for the CU training.  
([scanlabs@scannexus.nl](mailto:scanlabs@scannexus.nl)).

The basic training contains at least 3 sessions of three hours each.

- Magnet Safety Training and a tour at the scannerlab.
- Rules and regulations and an introduction to the software.
- Practical session at the 3T scanner.

After these three sessions:

- CU for 3T:
  - Your first measurement is accompanied by a member of the Scannexus Support Staff.
- CU for 7T:
  - Continue with 7T upgrade training which will last about two-three hours.
  - Your first measurements will be accompanied by a member of the Scannexus Support Staff.

You will be asked to prepare yourself and read our guidelines before the start of the training. It is advised to get some basic MRI knowledge before starting the training. During the training the safety screening form will be explained. In the first session you have to fill in this form yourself. Documentation can be found at:  
<http://www.scannexus.nl/information/documentation>

The training is completed after successful supervised session(s). With completion of the training you have to confirm that you know how to operate the scanner and that you are aware of the risks and safety issues related to MRI and Scannexus specific procedures, by signing the Certified User Agreement. This will also be signed by a member of the Scannexus Support Staff. In appendix 2 of the Scannexus guidelines you can find the agreement and the accompanying checklist.

## 4 ACCESS TO THE SCANNERLAB

The facility is open 24 hours a day, 7 days a week. However, between 21:00 and 7:00, a burglar alarm is activated if nobody is in the building. There is no difference in alarm settings between weekdays, weekend days or collective holidays.

### 4.1 BURGLAR ALARM SYSTEM

To work during out of office hours, CU's will need to pick up a smart key from a member of the Scannexus Support Team:

- CUs should pick up the smart key at least 24 hours before their scan slots
- Smart keys must be returned within 48 hours of the finish of the scan slot (Tuesday 5pm in the case of weekend work).
- It is not permitted for one CU to pass the key on to another user. A Scannexus Support Team member must be involved in the transfer.
- The booking CU is responsible for obtaining and returning the smart key for their scan slot.



Entrance to the scannerlab building outside of normal hours is by the entrance facing Oxfordlaan. To open door, place your UM ID card on the card reader, and wait for the sound of the door unlocking to finish. **Pulling on the handle early can cause the door to not unlock.**



The burglar alarm control panel is just inside the entrance.

To use the smart key system:

- To de-activate the alarm:
  - When you enter the building you will hear a tone indicating the alarm is on.
  - Place the smart key near the display of the burglar alarm control panel until a beep is heard.
  - The delay time will stop and the tone will stop.
- To activate the alarm:
  - Please make sure no other users are in the building!
  - The setting is clearest if you open the cover, which hinges down.
  - Place the smart key near the display of the burglar alarm control panel until a beep is heard. It only needs a very short period of time.
  - Repeat this twice.
  - If the system has accepted this, the first indicator at the bottom (circled in the image below) will light up and a tone will be generated.
  - There is a time delay that allows you to exit the building.

On leaving the facility, the booking CU is responsible for checking whether other users are in the facility and activating the alarm if they are the last to leave.

# SAFETY



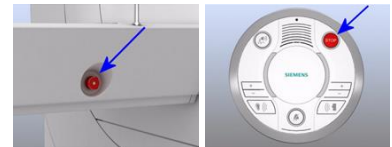
## 5.1 EMERGENCY BUTTONS

### 5.1.1 SQUEEZE BALL

- When squeeze ball is pressed by the subject → talk button on the intercom is used to turn off the alarm again. Pressed while scanning will not automatically stop the scanning procedure.

### 5.1.2 TABLE STOP BUTTON

- One button on each site at the scanner bed. Releasing by turning stop button counter clock wise.
- 3T: Look at scanner display for instructions.  
Stop button at the intercom device as well.



### 5.1.3 EMERGENCY ELECTRICAL SHUTDOWN

- Shuts down all electrical systems of the scanner (gradients, RF) but NOT the magnet, which will still remain at field.
- 3 buttons: one in the technical room, one in the magnet room, one in the control room.
- Should be used for any dangerous situation in the magnet room, especially when there is a fire in the magnet room.
- Additional handle at end of the table to pull the tabletop manually out of bore in case of electrical shutdown.



### 5.1.4 MAGNET DISCHARGE

- Demagnetizes the magnet via a process known as a quench.
- Should be used **only** if subject is in **immediate danger**!
- A large volume of helium gas is discharged during a quench.
- Very cold helium gas will rapidly escape through a vent tube to the roof top, so keep subject and yourself away from these vents.
- Slight risk that gas vents into the room, causing the oxygen level to drop and increasing pressure in room.
- Quenching is very expensive and might also be dangerous!



## 5.2 KEY SYSTEM

After the CU training the CU will be given access to the labs with their UM card.

- The key for the magnet room is available in the key cabinet.
  - This cabinet is located in the corridor towards the 7T and 9.4T rooms.
  - Accessible with your UM card.
  - It registers who possesses which key.
- The Keyholder is responsible for the safety.
  - The CU that picks up the key is the Keyholder!
  - The Keyholder is responsible for safety until the key is returned to the key cabinet.
  - Do not lock the door while scanning!
- Return the key after scanning.
  - Failing to lock the door after scanning keeps you responsible for safety.
  - Failing to return the key will result in loss of booking privileges.
  - Usage of the key cabinet is registered. This activity log is used as a checkup for usage and scan times. Any misuse will result in a loss of booking privileges for the Keyholder.

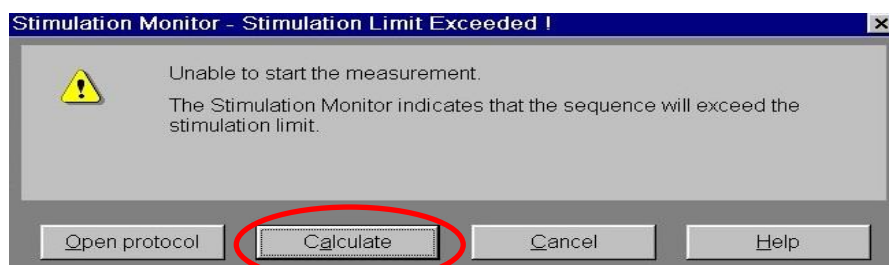
## 5.3 SAFETY CHECKS

The MR system safety checks are automatically performed according to IEC guidelines.

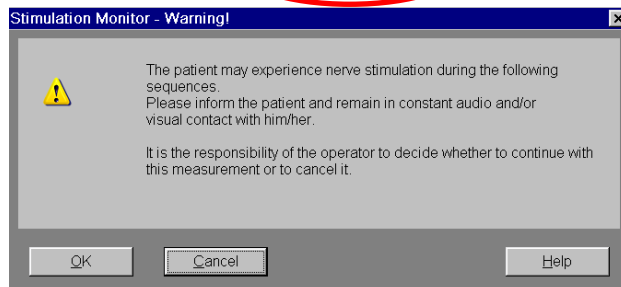
**Always be aware that the correct subject is registered (correct weight, gender, age)!**

### 5.3.1 PERIPHERAL NERVE STIMULATION

Warn subject about peripheral nerve stimulation. Let the subject know that it is not harmful, but that he/she has to squeeze the alarm ball if it becomes uncomfortable!



**You cannot proceed without altering your parameters. The system will make a suggestion.**



**You can proceed but inform the subject!**

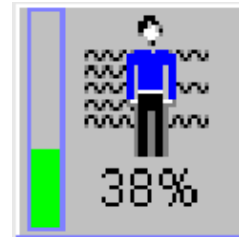


### 5.3.2 SAR LIMITS

The Specific Absorption Rate (SAR) describes the potential for heating of the subject's tissue due to the application of the RF energy.

The SAR is defined as the RF power absorbed per unit of mass of an object, and is measured in watts per kilogram (W/kg).

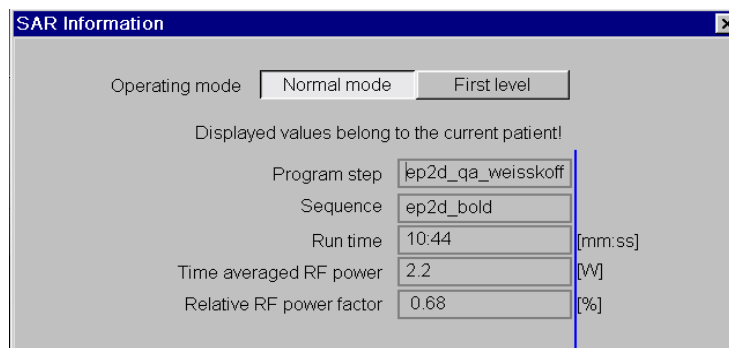
- Maximum temperature rise of 1°C is allowed.
  - At the end of the sequence you are at 38% of 1°C.
  - This varies per sequence.
  - Sum of sequences and delay time in between.



### 5.3.3 LEVEL 1 OPERATION MODE

You can proceed but only if the subject has no contraindications for thermoregulation!

- Peripheral nerve stimulation:
  - About 1% chance in standard operation mode of scanner.
  - About 50% chance in level 1 operation mode of scanner.
- SAR increases in level 1 operation mode of scanner, but is still within legal standards.

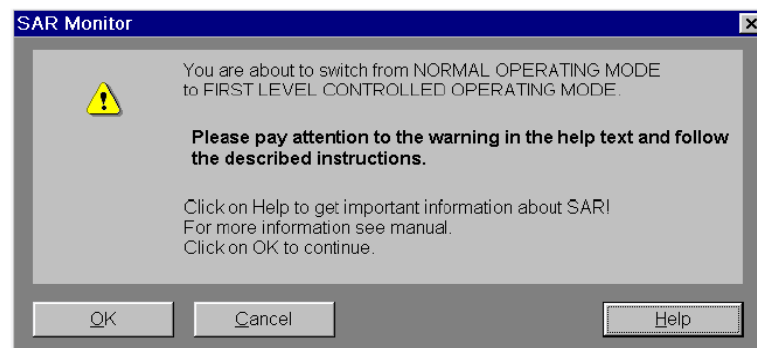


**SAR Information**


Operating mode:

Displayed values belong to the current patient!

Program step	ep2d_qa_weisskoff
Sequence	ep2d_bold
Run time	10:44 [mm:ss]
Time averaged RF power	2.2 [W]
Relative RF power factor	0.68 [%]

**SAR Monitor**

 You are about to switch from NORMAL OPERATING MODE to FIRST LEVEL CONTROLLED OPERATING MODE.

**Please pay attention to the warning in the help text and follow the described instructions.**

Click on Help to get important information about SAR!  
For more information see manual.  
Click on OK to continue.



## 6 SUBJECTS

### 6.1 PHYSIOLOGICAL EFFECTS ON SUBJECTS

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#### 6.1.1 STATIC FIELD

- Attractive Force
- Nausea / Vertigo / Metallic taste

#### 6.1.2 GRADIENT FIELD

- Peripheral nerve stimulation
- Sound pressure, use earplugs
- Avoid loops / Eddy Currents

#### 6.1.3 RF FIELD (SAR)

- Important to register correct weight and age of subject.

### 6.2 SCREENING FORMS

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#### 6.2.1 TEMPLATE SCREENING FORM

Advised to screen subjects beforehand:

- Service of Scannexus to use the template screening form to screen subjects beforehand. [www.scannexus.nl/documentation](http://www.scannexus.nl/documentation)
- Content can be adjusted by researcher
- If used: researcher is responsible for proper usage according to METC/ERCPN approval and storage of these forms.
- FPN researchers have to use the dedicated FPN screening forms.

The questions on this template screening form should give the researcher an idea if the subject has contra-indications for MR or for inclusion for your study. If you have questions regarding MR compatibility, an explanation form concerning the screening questions is also available at [www.scannexus.nl/documentation](http://www.scannexus.nl/documentation). Screening in advance prevents a subject to be canceled just before the actual scanning session.

#### 6.2.2 SAFETY SCREENING FORM SCANNEXUS

- **Mandatory!**
- Has to be completed and signed **EVERY TIME** by everybody who enters the magnet room (except CU and MST personnel, they sign this once).
- Printed out and signed by both the subject and CU.
- Printed version has to be handed in at the reception's mailbox.
- An explanation regarding the checklist is available in appendix 1 and [www.scannexus.nl/documentation](http://www.scannexus.nl/documentation).

### 6.3 DATA HANDLING

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- Subjects are not allowed to get the dicom images.
- CU can decide to hand out screenshots or reconstructions to the subjects, but never for clinical purposes.

### 6.4 INCIDENTAL FINDINGS

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Researchers can arrange their own incidental findings procedure or use the Scannexus incidental findings procedure (see appendix 3 of the Scannexus guidelines), to which the following applies:

- Subjects who don't want to know about incidental findings **WILL NOT** be scanned at Scannexus.

If the CU observes an anomaly in the brain and uses the Scannexus procedure:

- **DO NOT** inform the subject right away.
- If you are not a staff member of your faculty you must immediately inform the senior staff member who is your supervisor about the situation.
- Seek contact with the qualified medical expert, neuroradiologist, associated with the Maastricht Brain Imaging Center/Scannexus. Contact the Scannexus Support Staff for contact information of neuroradiologist.
- To provide the neuroradiologist with the relevant data, you also contact the Scannexus Support Staff.

# SCANNING

## 7 SCANNING PROCEDURE GENERAL

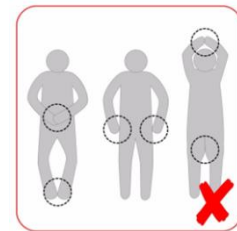
### 7.1 PREPARATION

Before the scanning procedure, make sure that subject signed the written consent form of the study and consent form concerning incidental findings (researcher's responsibility). FPN users need to use the forms within FPN.

- Subject needs to complete the safety screening form.
- Subject and CU need to remove all metal from body.
- Subject needs to remove:
  - hair clips / bobby pins and hair ties
  - shirts, sweaters, vests containing metal (e.g. zipper, buttons)
  - piercings and other jewelry
  - belts
  - contents of pockets
  - bra (with metal wire)
  - make-up (especially mascara)
  - glasses (MRI corrective glasses are available)
  - shoes
- Remind subject to go to the toilet before starting scanning.
- Inform subject about noise, peripheral nerve stimulation, heating, dizziness while entering the bore, not crossing arms and legs.
- Inform subject about the tasks.
- Instruct subject about usage of the alarm ball.
- Prepare experiment.

### 7.2 POSITIONING OF SUBJECT

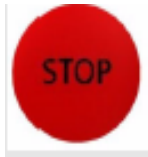
- Give subject earplugs.
- Give subject cushion for under the knees.
- Ask whether the subject wants a blanket.
- No loops of hands or legs.
- Brain studies: Position head of the subject in the coil using cushions besides the ears.
  - Hearing protection
  - Stability
- For other body parts:
  - Stabilize the body part in the coil by using cushions.
- Hand over the alarm ball to the subject.
- Test the alarm ball
- Position any stimulatory devices or sensors that you need, and check if they are placed correctly (avoid loops in cables).
- Adjust the mirror on the head coil if necessary.
- Use the laser light localizer (subject needs to close the eyes!)
- Move to isocenter. (see 6.3)



- Start your measurement and keep in contact with the subject.

### 7.3 TABLE OPERATION

All Siemens MR tables have approximately the same set of buttons. A list of the most used is shown below.



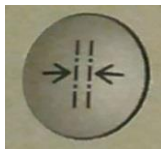
**Table Stop:** The tabletop stops immediately.



**Table Inward/Outward:** Moving the tabletop in or out the magnet bore.  
The tabletop moves when button is pushed in.



**Speed:** Moving the tabletop at increased speed.  
*Do not use when a subject is being examined. Only for phantoms!*



**Isocenter Position:** The tabletop moves in to the magnet bore until it reaches the defined isocenter.  
The tabletop moves automatically. Stop the movement by pressing another move button.



**Home Position:** The tabletop moves completely out of the magnet bore.  
The tabletop moves automatically. Stop the movement by pressing another move button.



**Laser Light Localizer:** When pressed a red laser cross is displayed to indicate the isocenter. Deactivate the light to set the position.  
*Always ask subject to close their eyes during operation!!*



**On/Off at 7T and 9.4T:** Switch the table ON/OFF. A corresponding LED is lighting when ON.  
When switching the table ON, it takes about 10s to get out of the sleep mode.

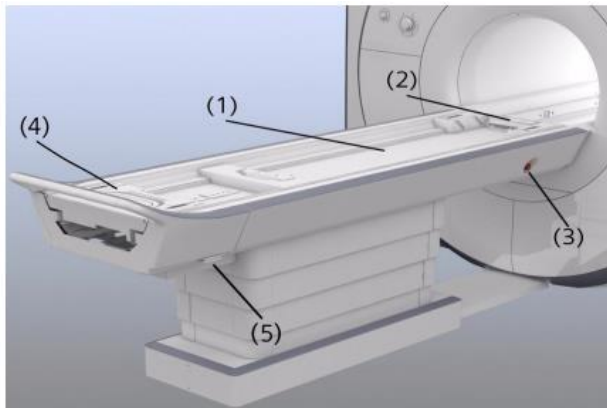
#### 7.3.1 MOVING TABLE OUT QUICKLY

- Small accidents, medical emergencies or inconvenience for the patient and quick removal of the table is needed. The fastest method for moving the tabletop out of the magnet bore is to press the '**Home Position**' button. Use this method whenever the power supply and/or motorized drive are intact.

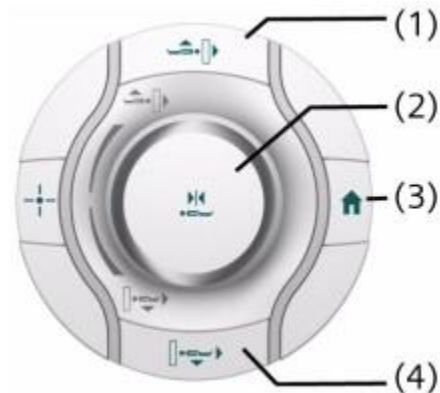
- In case of power failure and/or defective motorized drive, pull the tabletop manually out of the magnet bore. To disconnect the tabletop from the motor an additional emergency release, which is underneath the end of the table support, needs to be pulled outward.

### 7.3.2 3T PRISMA FIT

#### 3T SYSTEM OPERATION



- (1) Tabletop
- (2) Head end
- (3) **Table Stop** button
- (4) Handle to pull out the table top in case of emergency
- (5) Emergency release



- (1) **Table Up/Inward** button
- (2) Jog wheel, **Center Position** button
- (3) **Home Position** button
- (4) **Table Down/Outward** button

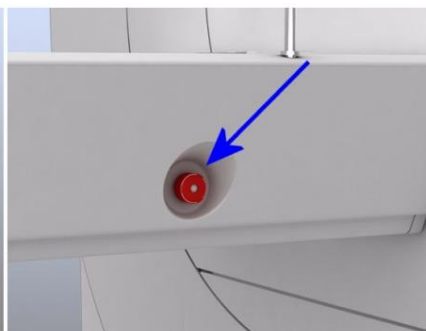
#### 3T TABLE EMERGENCY BUTTONS

The table stop buttons are located on the side of the table and on the intercom system.

The emergency release for manual table removal is located at the end of the table support



Intercom



Table



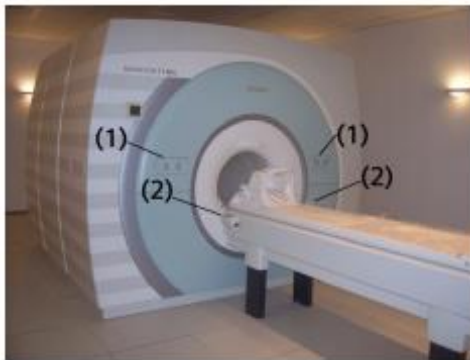
Manual table removal

### 7.3.3 7T

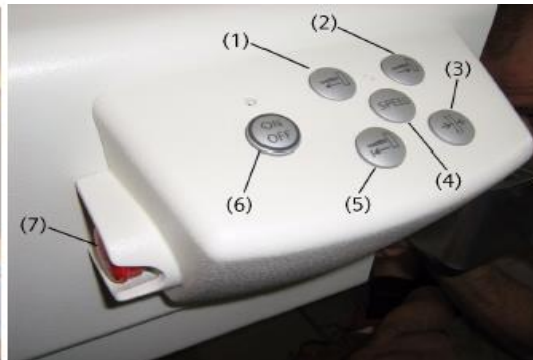
The table of the 7T system is different than the 3T system. There are three main differences:

- It has its own control panels because it is a separate system.
- In standard operating mode it varies the speed of the bed to reduce the dB/dt that the head of the subject experiences.
- To reduce the risk of RF noise being picked up during scanning, the bed should be turned off.

### 7T SYSTEM OPERATION



- (1) Control units (laser light) on both sides of the magnet bore.  
(2) Control units at the patient table.

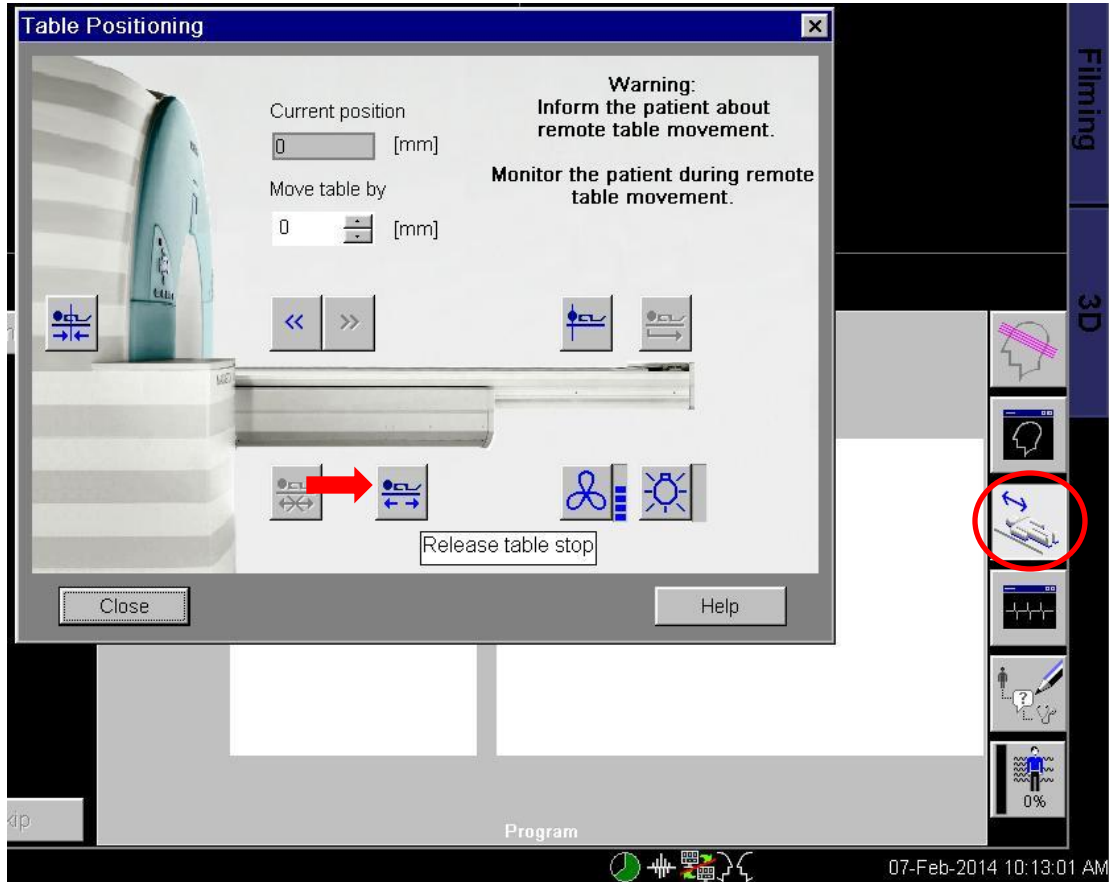


- (1) **Home Direction** button  
(2) **Isocenter Direction** button  
(3) **Isocenter Position** button  
(4) **Speed** button  
(5) **Home Position** button  
(6) **On/Off** button  
(7) **Table stop** button

#### Points of interest:

- When switching on the table it can take up to 20 seconds for the electronics to be fully operational.
- After a shutdown, the table needs to know its position. Laser light button is not responding. See display at scanner. If display shows ----, move table little bit towards bore. Then move to home position. Display will show table position again. Positioning with laser light is possible.
- If the bed is not responding check the buttons on the table control panel. They tend to get stuck. Then the buttons will not respond at all. You can just wiggle the button loose again.
- If the bed is still not responding check the emergency stop buttons and emergency release at the end of the table. Someone might have used them but not put them back properly.
- Turning on the SPEED feature (which turns on the GREEN LED above this button) disables the special speed regulation of the bed. **Do not use this when positioning or removing subjects.**

- Sometimes the system detects a "bed stop" event. Clicking on the "release table stop"- button might resolve it.



- If the table is still not responding the only solution found is to reboot the scanner.

#### 7T TABLE EMERGENCY BUTTONS

The table stop buttons are located on the side of the table, **NOT** on the intercom system.

The emergency release for manual table removal is located at the end of the table support.

#### 7.3.4 9.4T

You can find information on system handling of 9.4T at the dedicated Wiki page.

<http://137.120.141.83:8090/display/94MRI/9.4T+MRI+Home>



## 7.4 PATIENT REGISTRATION

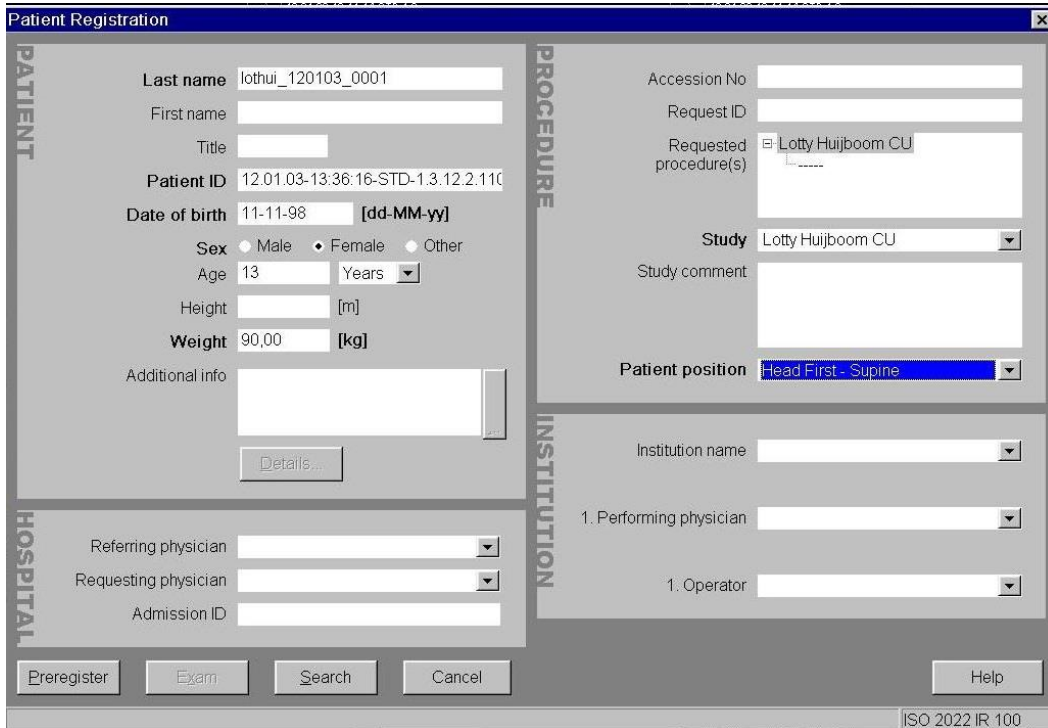
Fields that are in **bold** need to be filled in order to proceed. These are: Last name, Patient ID, Date of Birth, Sex, Weight, Height (only Prisma), Study and Patient Position.

The field 'Last name' needs to be used as follows:

- First 3 letters of CU's first name + first 3 letters of CU's last name.
- Date (YYMMDD).
- Numerical code (which links with your subject, if you need it).
- Optional → Measurement information.
- The fields are separated with an underscore.

Patient ID is filled in automatically.

Finally press Exam to register your patient and confirm the next window.



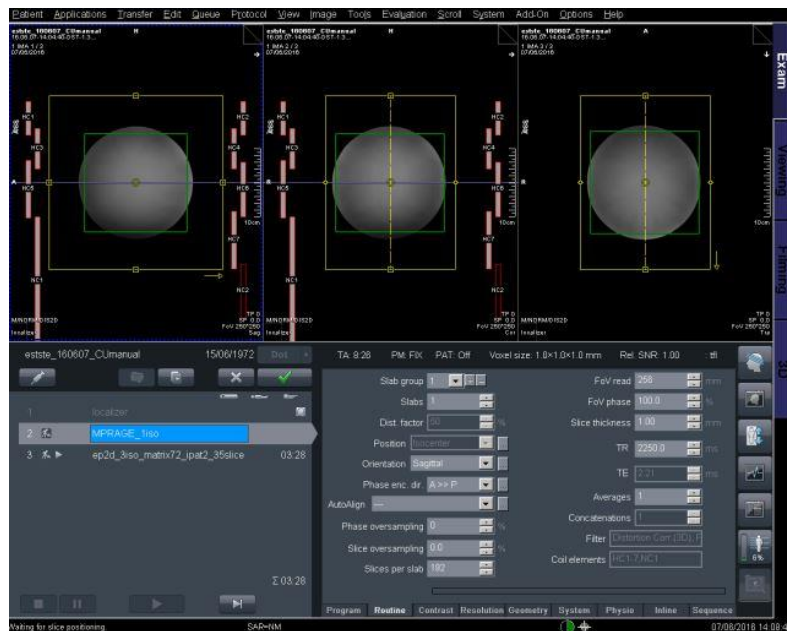
\*Only the bold fields need to be specified for the registration of the patient.

### 7.4.1 3T PRISMA FIT

The Prisma fit is a little different. It will show a second screen with the following **bold** fields: Program (select in all protocols), Body Part examined.

## 7.5 VOLUME BOX AND ADJUST VOLUME BOX

- Start your measurement with a localizer.
- Plan your next protocols by placing the volume (or slice) box.
- Optimize your shim values by placing your adjust volume box in the region of interest.

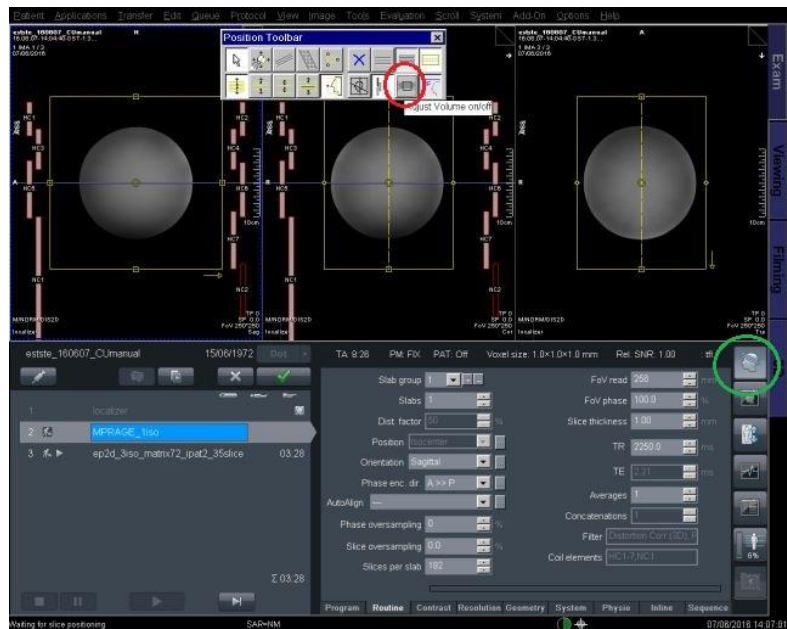


The yellow box presents your volume/slice box.

- Position the box over the area of interest
- Do not change the size of the yellow box. If you do, you might change settings like slice thickness or gap.

The green box presents your adjust volume.

- Position the box over the body part you are interested in.
- Change size.
- Do not include a lot of air.



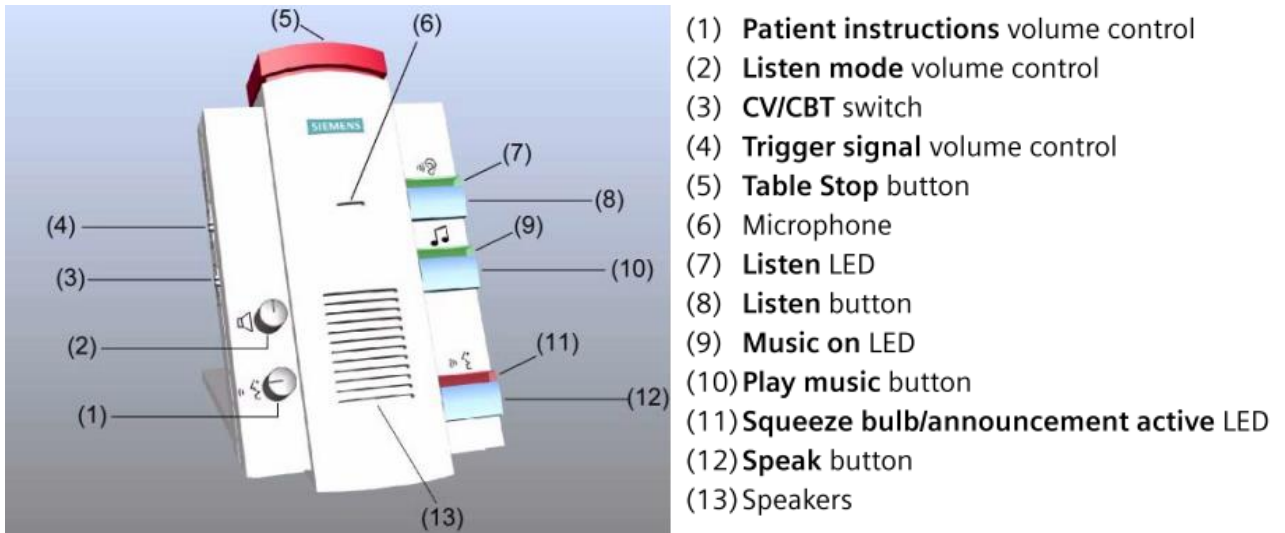
If you do not see the green box:

- Select position toolbar (green circle)
- Select adjust volume on/off (red circle)
- Green box is visible and can be planned.

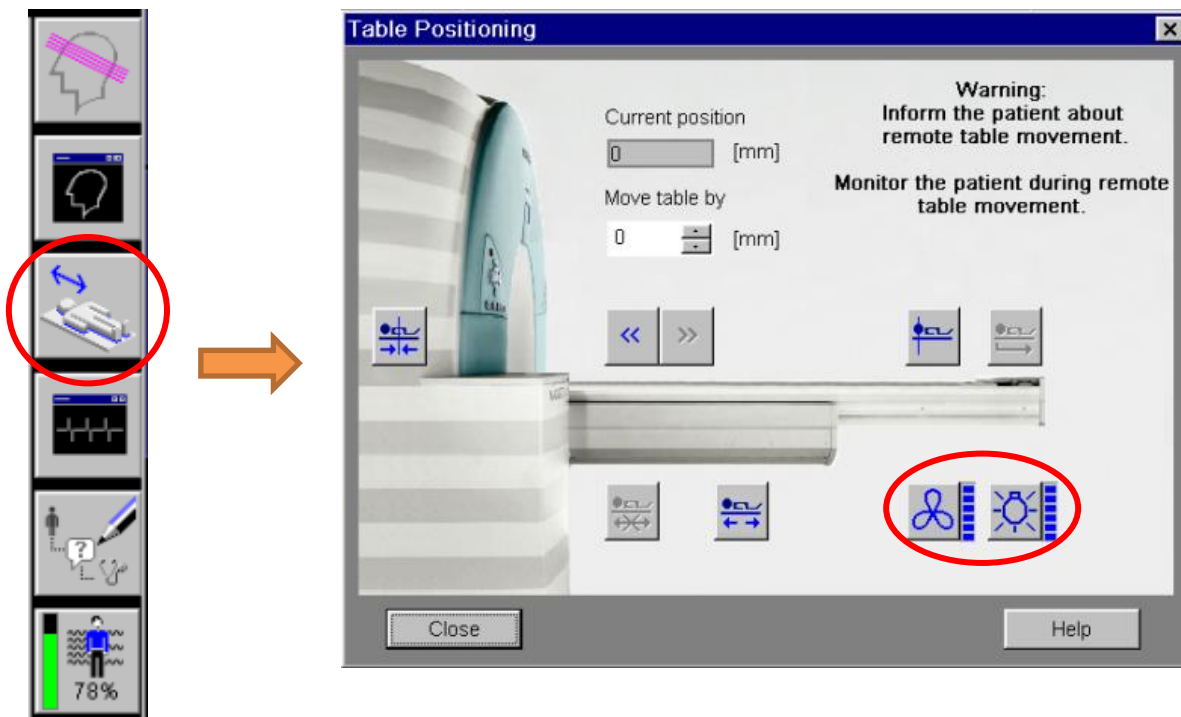
## 7.6 INTERCOM

The intercom allows communication between the researcher and subject during the measurement.

On the 7T and 9.4T system the red table stop button (5) is not in operation.



## 7.7 MAGNET BORE FAN & LIGHT





- Click on "OK".
- CTRL+ESC → Windows Explorer
  - Programs → Advanced user → PW: meduser1.
  - CTRL+ESC → Windows Explorer.
  - Go to T:\YourName\name.pdf
  - Transfer PDF file to personal folder on BUserver:  
Z:\BackedUpData\YourFolder
  - Patient → Close Patient

## 7.10 FINISH MEASUREMENT

---

- Put stimulatory devices and sensors back to their default position.
- Clean mirror and head coil.
- Renew paper cover on scanner bed.
- Place a set of new earplugs on the scanner bed.
- Export your data.
- Close patient in all used tabs of Syngo MR.
- Set projector and stimulus PC to Standby.
- Lock the magnet room.
- Place magnet room key back in key cabinet!

## 7.11 LOCAL DICOM DATA

---

All measured MRI data (dicom) is automatically stored to the Hard Drive of our Syngo system. This data is not backed up and we need to make sure that there's enough space left on the local Hard Drive for new MRI measurements. Due to its storage limitations all data older than 1 week is deleted. **Because of this make sure to export your data immediately and check afterwards within one week whether all data has been successfully exported.**

## 7.12 DEFAULT COILS

---

Please, be very careful with the available coils.

Make sure that -if you switch coils- you put the default one back when finishing your measurement.

- For 3T this is the 64 Channel Head/Neck Coil.
- For 7T this is the 32 Channel Nova Volume Coil.
  - The 32 channel coil has a set of electronics that extends from the head end of the coil.
  - This part of the coil should **NOT** rest on the ridge in the bed! Move the coil towards the foot end so that this part of the coil is not resting on the ridge.

### 7.13 MOCK SCANNER

---

The Mock scanner is a fake scanner to train your subject before a scanning session. A head motion training as a preparation tool can be performed. This is recommended for young children (8-12 years) and subjects with cognitive impairment. The head motion training is a very useful tool that allows tracking head motion of the child/subject and giving visual feedback of the fact that they moved excessively. The child/subject sees a movie that stops every time they exceed a certain threshold. The use of the Mock scanner will decrease dropouts and increase data quality.

#### 7.13.1 MOTION TRAINING

At first check if the power of the dummy scanner is on. The switch to turn on the power is located on the right side of the desk. There's a sticker with Dummy Scanner on/off above it. If the power is on, the little orange light on the switch will be glowing. Next you can turn on the stimulus pc and the radio with Algemeen on it. After logging into the PC start Datalogger and Movieplayer.

Datalogger:

- Press 'Get Temp'
- Press 'Set Offset'
- Press 'Select or Create File' button. A new window opens to let you create the database table that will contain all the data of the movements. Check that it opens in the folder of your choice and name with the coding you give the subject.
- Press 'Get Data'. A window appears asking if you are ready to start. **Do not press anything yet.**

Movieplayer:

- Press 'Select and Open DB'. When the window appears load the file you created in Datalogger.
- Check the 'Control' section and if necessary change the parameters (everything on 7 first and gradually decrease later in video).
- Press 'Select File' and choose the video. There's an Ice Age video located under D:\Dummy Scanner\Media.
- 'Get Data'

Now you can press OK on the window that previously appeared on Datalogger. (Optional: you might have to click on Switch Mode if the video does not start on the Stimulus PC after pressing 'Get Data').

After the motion training, ask if the child/subject is fine and whether they perceived the movement that the device detected. **Give the child/subject feedback!** Make the child/subject aware that moving too much causes the scan to fail. If necessary, repeat the movie.

## 8 AUTO ALIGN

AutoAlign is the method for automatic positioning and alignment of slices for an MR examination. AutoAlign assists the user in positioning the slices in a robust and reliable way regarding positioning standards and arbitrary patient positions, different patient ages, pathologies and interventions.

The specific AutoAlign Head scout scans a sagittal, T1-weighted 3D volume in the isocenter and computes the AutoAlign Head references. The resulting MPR localizer images are automatically loaded into the graphic segments of the Exam task card.

AutoAlign Head references:

- Head > Basis (sagittal and coronal orientation)
- Head > Brain (transversal orientation)
- Head > Inner ear
- Head > Orbits
- Head > Optic nerves
- Head > Temporal lobe

### 8.1 FIRST SUBJECT

---

Start the measurement

- Scan a default localizer if preferred.
- Scan the AutoAlign scout.
- Open your first protocol:
  - Reset AutoAlign reference to none (--);
  - Predefine the main orientation and reset the position to Isocenter;
  - Set the required AutoAlign matrix in the field AutoAlign of the Routine parameter card;
  - Position the slice box as required;
  - If required, define an offset for Position and Orientation;
- For all the following protocols in the same orientation.
  - Open the protocol;
  - Make sure the AutoAlign reference is set to none (--)
  - Right click on the first protocol of the same orientation.
  - Use "Copy references".
  - The slices will automatically align to the set position;
  - Apply.

When you finish the first measurement:

Copy the measured protocols into the Exam Explorer as a new program.

- For all the protocols in the same orientation as the first protocol:
  - Set "Copy reference" from the first protocol

Do not use the autoalign matrix (AutoAlign reference must be (---)) in the following protocols, but copy references. With copy references you always end up with the same position as your first protocol. With autoalign matrix in following protocols you might end up with different offset positions after changing the slice box of your first measurement when you were not happy with the autoalign offset while scanning your next subject.

Queue > Save as program. Save.

## 8.2 FOLLOWING SUBJECTS / MEASUREMENTS

---

Use the protocol you saved in the Exam Explorer with your first subject. The position of the slices should be the same as in your first subject.

- In the protocol you can (de)activate the AutoAlign option at any time.
- If you do not agree with the auto-aligned slices, you can reposition the slices manually.



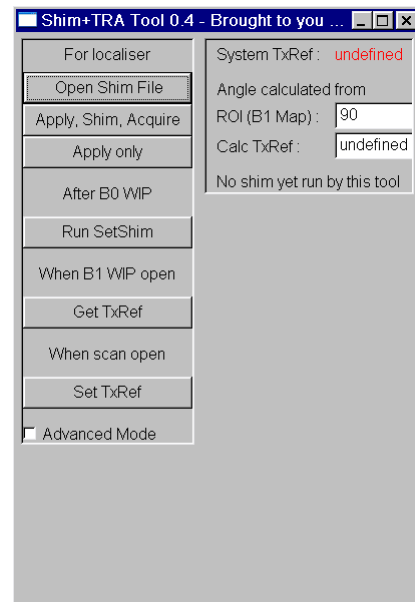
## 9 7T SHIM PROCEDURES

### 9.1 SHIM TOOL BOX

The Shim+Tra tool is a GUI which allows easy access to a few of the basic steps that are useful for doing adjustments on a Siemens UHF system. While at first it might seem complicated, in fact most of the features are quite straightforward and will be explained below. The features are also modular, so the user is committed to using all of the features. Additionally, it is only in a very specific situation where the GUI will 'take over' scanning. Thus it is in general possible for the user to run things the way that they are used to, and just use whatever features they consider useful.

#### 9.1.1 THE BASIC GUI

On startup, the basic GUI is as shown in the figure on the right. Values that are not yet known by the GUI are undefined, and the GUI knows that it has not been asked to run a shim acquisition. There are various buttons and entry items:



**Open Shim** File will open up a file browser where it is possible to select a set of shim values that have been saved previously (saving can be performed in Advanced Mode, described below). This only loads the values from the file into the GUI, but does not send them to the Siemens software.

**Apply, Shim, Acquire** will pass the shim values from the GUI to the Siemens system and then proceed to run a 3D shim, calculate the new shim currents, adjust the frequency, and then acquire the scan. The details of this are described below.

**Apply Only** passes the shim values from the GUI to the Siemens system but takes no further action.

**Run SetShim** loads the last shim map acquired with the Siemens B0 WIP into the adjustments. Effectively this is the same as the Siemens B0 WIP program 'SetShim.bat', with some additional error checking for problems such as not having a protocol open.

**Get TxRef** will copy the value of the transmitter reference from the Siemens system and store it in the GUI for future use.

**Set TxRef** will calculate, based on the apparent flip angle obtained from the B1 mapping WIP, a new transmitter reference and send this new value to the Siemens system.

**Advanced Mode** enables other buttons and entry boxes – see below.

**System TxRef:** Is where the GUI will store the transmitter reference that was used when acquiring the B1 map. This is initially undefined.

**Angle calculated from ROI (B1 Map):** is where the user will input the average angle that has been calculated from an ROI in the B1 Map. With this

and the system transmitter reference a new transmitter reference can be calculated.

**Calc TxRef:** is the new value of the transmitter reference as calculated from the System TxRef and the angle above.

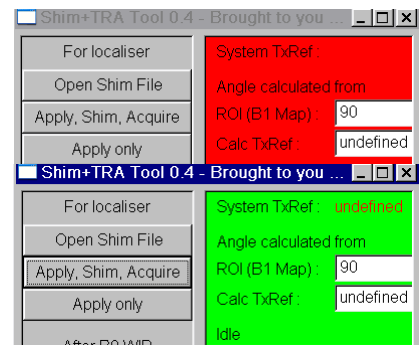
**No shim yet run by this tool** is simply an informational message to say that the GUI has not been asked to run a shim acquisition.

#### APPLY, SHIM, ACQUIRE PROCEDURE

This is the one point at which this tool will 'take over' scanning. Effectively what it does is:

1. Copies the shim values from the GUI to the Siemens system
2. Runs the '3D Shim' from the Siemens' manual adjustment page
3. Runs the 'Set Frequency' from the Siemens' manual adjustment page. It will iterate this four times if needed.
4. Starts the scan.

During the shimming and frequency adjustment procedures, the GUI will change color and message to inform the user ("Adjust with loaded shim"). It is best not to interact with the keyboard and mouse during this time to be sure that the script behaves as expected. When the shimming and frequency adjustment is finished, the GUI will change color and the message will change to 'Idle'



#### ADVANCED MODE

As might be expected, the check button Advanced Mode brings in additional buttons and entry boxes.

**Include 3<sup>rd</sup> Order** will display and try to set the 3<sup>rd</sup> order shim values.

WARNING this feature is not fully tested!

**Get System Shims** reads the values of the shims from the Siemens system into the GUI. This is the first step if the user is wanting to save their own shim values.

**Write Shim File** will open a file dialogue to save the GUI shim values to a file for later use

**Get+Set TxRef** will perform both the Get TxRef and Set TxRef as in the Basic Mode, but with one click.

**OfflineMode** is for debugging purposes only and is not fully functional.

Additionally, the shim values are displayed on the right and can be edited.

### 9.1.2 WORKFOLW SHIMTOOL

This GUI was based on the concept that, for a new subject, the first three scans to be run would be a localizer, a B0 WIP field map for shimming, and a B1 map for adjusting the system transmitter reference before going on to whatever actual scan you want to run. This is also the basis for the **labels** above the buttons in the GUI. If we call these protocols "localizer", "B0 map", "B1 map", and "Actual scan", the workflow would be:

1. Load and open "localizer" protocol ← Now at **For Localiser** in the GUI
2. Use GUI **Open Shim File** to load a set of shims
3. Use GUI **Apply, Shim, Acquire** to run an automatic shim starting at these loaded values and then acquire the localizer
4. Load and run "B0 map" protocol
5. Load and open "B1 map" protocol
6. Use GUI **Run SetShim** to load the shim maps ← Now at **After B0 WIP** in the GUI
7. Now at **When B1 WIP** open in the GUI
8. Use GUI **Get TxRef** to store system transmitter reference ← Now at **When B1 WIP** open in the GUI
9. Optional: Adjust shim values further if desired by interactive shimming in the manual adjustments, option tab (see next paragraph step 3)  
Note: adjust volume box of B1 map needs to be the same as in your actual scan, otherwise you have to calculate and apply 3D shim again and redo your interactive shim in your actual scan.
10. Run the "B1 shim" protocol
11. Get apparent flip angle from ROI in B1 map and put in GUI **Angle calculated from ROI (B1 Map)**
  - a. First load B1 map in viewing tab.
  - b. Draw ROI in your area of interest, e.g. visual cortex, center of brain.
  - c. Divide the mean in this ROI by 10. This is your flip angle for that region.
  - d. This is the flip angle you have to put in GUI.
12. Open "Actual scan" protocol
13. Use GUI **Set TxRef** ← Now at **When scan open** in the GUI
14. If you change your area of interest for later scans (different ROI in B1 map), it is possible to put a new value of the apparent flip angle into GUI **Angle calculated from ROI (B1 Map)** and use GUI **Set TxRef** to calculate the new transmitter reference value. Note that protocol for this flip angle is open.
15. Run your "Actual scan" protocol

Extra information about shimming can be found in the next paragraph.

## 9.2 SHIMMING WITHOUT SHIM TOOL BOX

If you prefer not to use the shim tool box, you can do your shimming in manual adjustments. The basic steps are the same as the shim tool.

Step	What to do	Explanation
1	<i>Run Localizer (and/or AAHscout)</i>	
2	<i>Open B0map</i> <i>Run B0</i>	The <b>B0 map</b> is used to measure B0 (inhomogeneity) and to get a B0 map with a higher resolution than default. It can be optimized by reducing the slice box even more. The size of the slice box used in this B0 map has to cover your entire slice boxes used in the following protocols!
3	<i>Open B1map</i> Run MBICsetshim.bat Move slice box Adjust shim box Open adjustments in options tab <ul style="list-style-type: none"> <li>▫ 3D shim-&gt; calculate, apply</li> <li>▫ Transmitter voltage (system value)-&gt; write down</li> <li>▫ Interactive shim -&gt; measure, stop, apply</li> <li>▫ Freq GO!</li> </ul> <i>Run B1map</i>	<p>The <b>B1 map</b> is used to measure the different flip angles in different areas of the brain.</p> <p>The <b>MBICsetshim</b> program imports the new measured B0 shim map.</p> <p>The <b>3D shim calculates</b> the new shim currents to optimize shims within the shim box</p> <p>You have to write down the <b>transmitter voltage</b> because you will need the value for calculations later on</p> <p>With the <b>interactive shim</b> the shims are optimized further. FWHM (width of the pulse received) has to be as low as possible (between 45-35 Hz) T2* (transverse relax time) as high as possible</p> <p>You can choose to skip the interactive shim at this point and perform this shim when your anatomical/functional protocol is open. Depending on the adjust volume being the same in the B1 map and the other protocols or not. (see step 5)</p>

4	<p>Load B1 map in viewing tab</p> <ul style="list-style-type: none"> <li>Go to the mid slice mid brain, select the circle tool and define a ROI, divide the mean value by 10</li> <li>Go to area of interest, select the circle tool and define a ROI, divide the mean value by 10</li> </ul>	<p>You have to calculate the transmitter voltages needed for your other protocols (anatomical, DTI, EPI etc.)</p> <p>Formula: <math>\text{new\_transm\_voltage} = (90/\text{determined angle}) * \text{transm\_voltage\_B1map}</math></p>
5	<p><i>Open actual protocol</i></p> <p>Move slice box</p> <p>Adjust shim box</p> <p>Open adjustments</p> <ul style="list-style-type: none"> <li>3D shim-&gt; calculate, apply</li> <li>Interactive shim -&gt; measure, stop, apply</li> </ul> <p>Open adjustments</p> <ul style="list-style-type: none"> <li>Transmitter voltage -&gt; enter value, apply</li> <li>Freq GO!</li> </ul> <p><i>Run actual protocol</i></p>	<p>If your adjust shim box is different than used in B1 map you have to calculate and apply the 3D shim and perform the interactive shim:</p> <p>The 3D shim calculates the new shim currents to optimize shims within the shim box</p> <p>If your shim box is the same as the shim box of your B1map-&gt; you can do the interactive shim while preparing the B1 map and copy the parameter (adjust volume). It is not necessary to repeat the interactive shimming and you can skip 3D shim and interactive shim at this stage.</p> <p>You have to enter the at step 4 calculated value for the transmitter voltage.</p>
6	<p><i>Open next protocol</i></p> <p>Move slice box</p> <p>Adjust shim box</p> <p>Open adjustments</p> <ul style="list-style-type: none"> <li>3D shim-&gt; calculate, apply</li> <li>Interactive shim</li> <li>Transmitter voltage -&gt; enter value , apply</li> <li>Freq GO!</li> </ul> <p><i>Run EPI</i></p>	<p>Enter the at step 4 calculated transmitter voltage value if a different area of interest is used</p>

	<b>Troubleshooting</b>	<b>Possible solutions</b>
	SAR too high -EPI	Decrease flip angle/ transmitter voltage Increase pulse length (max ~6500) MB & ME only Decrease fat suppression pulse Decrease number of slices
	SAR too high -DTI	Increase TR

## 10 GEOMETRICAL DISTORTION CORRECTION

To correct for geometrical distortion in EPI images you need to run about 10 extra volumes of you EPI protocol.

Open the EPI protocol to be scanned and change the volumes to 5 (BOLD card).

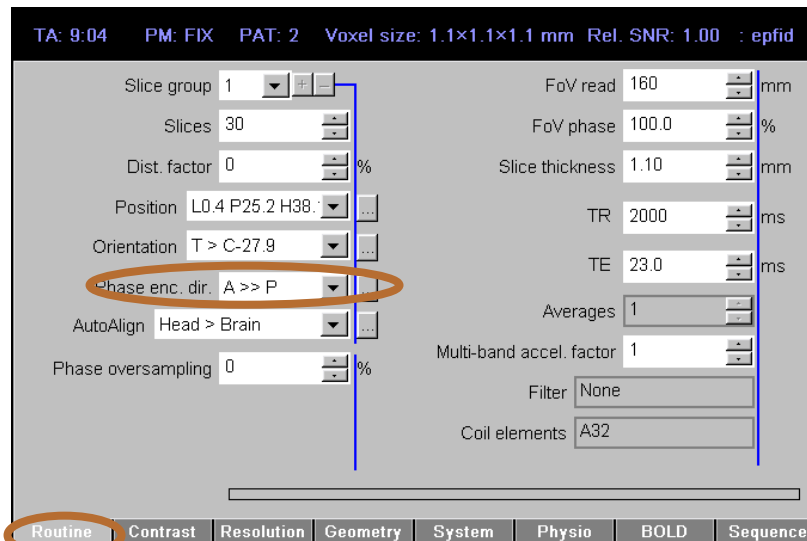
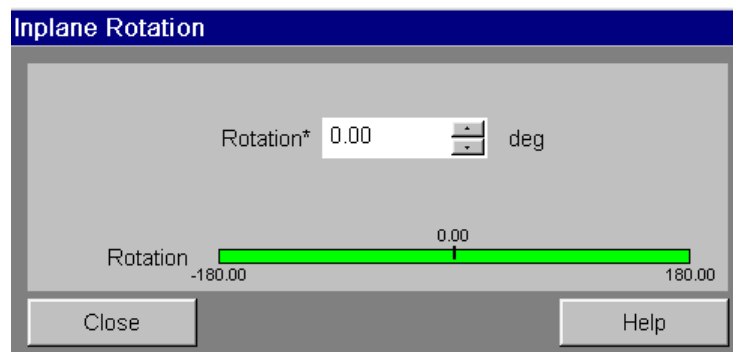
Press scan so the protocol is copied.

Open this copy and adjust the Phase encoding direction.(Routine card) Add or subtract 180 depending on your orientation. (thus AP becomes PA, RL becomes LR etc.)

Now run your normal EPI experiment with the original phase encoding direction.

Example workflow:

- Localizer
- B0 B1 etc.
- Anatomical acquisitions
- 5 EPI volumes of your preferred protocol
- 5 EPI volumes with 180° phase encode reversal
- Your normal EPI experiment run (with the same phase encode direction as in step 4)

# PERIPHERAL EQUIPMENT



## 11 EQUIPMENT RACK

### 11.1 AUDIO AMPLIFIER

Must be set on Aux2 and must be **on** for all audio. The volume of amplifier has to be low, between 15-17. Noise level in your audio will stay low.

### 11.2 MIXER

The mixer controls all audio of the subject. The small (inner) knobs adjust volume. Big (outer) knobs control left and right balance.

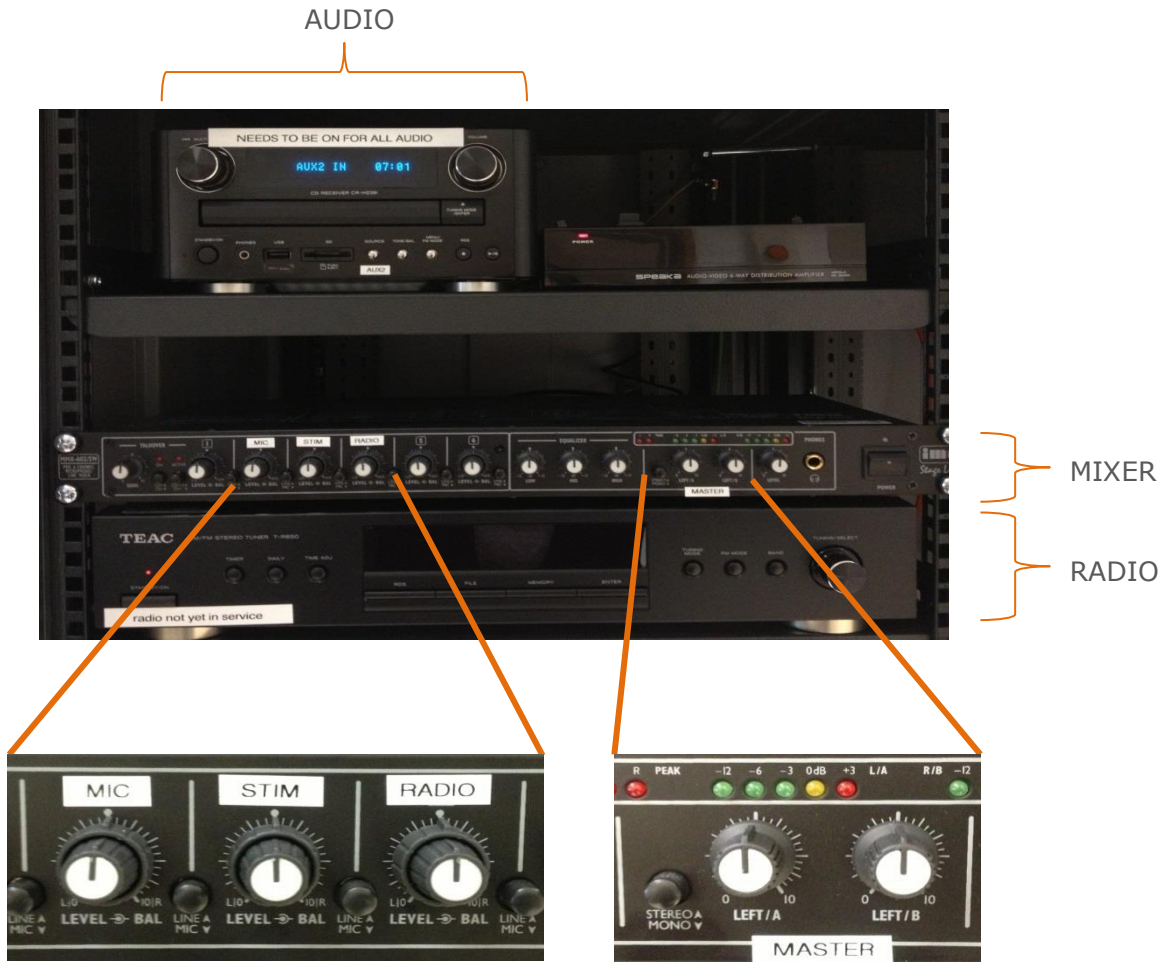
For your audio measurement the following is important:

#### STIM PC

- Sound level output of PC max 80%.
- Disable all soundcard enhancements (playback devices → properties → enhancements → disable all enhancements).
- Equal balancing output (playback devices → properties → levels → balance).

#### MIXER

- The MIC knob controls the microphone settings.
- Small button on the right-hand side of knob must be pushed in.
- Talk through microphone on desk: returns automatically to off.
- The STIM knob controls input of stimuli from the stimulus PC. Small (inner) knob adjusts volume. Set this volume so that no clipping appears. (see red lights of left and right peak indicators above Master) Big (outer) knob controls left and right balance.
- Small button on the right-hand side of knob must not be pushed in.
- The Master volume controls the output of the mixer to the amplifier.
- Small button on the left must be pushed in for mono
- Using stereo you can adjust the volume per left/right individually.
- Optimize volume by checking indicator lights. Orange light of 0dB must be blinking, but not the red light (then clipping appears). The volume of the audio amplifier can stay low.
- The Radio is not working.
- ***The standard settings are shown the picture below.***



***Return the equipment to the standard after finishing your measurement!***

### 11.3 SPEAKER

Allows researchers to hear what the subject is hearing (speaker output is left-channel only). The volume of the audio can be adjusted within the console room without affecting subject's parameters. Only left-channel output

## 11.4 INTERFACE BUTTONBOX AND JOYSTICK

This interface or respons box controls how the data of the button box are being stored. Researchers can switch between parallel mode and USB mode on the device besides the interface. USB mode is recommended. A reset must be done in order for the change in mode to take place.

### BUTTON BOX

Changing settings respons box using the button box:

- push knob
- change mode, yes
- manual config
- select setting (turn knob)
- default mode HHSC-2x4\_c, USB, HID key 12345
- reset power

Every button is given a number. The interface auto connects with the button box in the scanner room.



### JOYSTICK

Changing settings respons box using the joystick in combination with the trigger of the scanner:

- connect joystick in MR room and make sure the joystick is standing flat on the floor and is not tilted!
- push knob
- change mode, yes
- manual config
- select setting (turn knob)
- Thethyx, USB, **HID JOY COMP** (make sure to select hid joy comp otherwise you will not receive the trigger from the scanner!)
- reset power



## 11.5 SWITCH BOXES

The switchboxes allow researchers to switch input for the projector video, TBV monitor and secondary stimulus monitor. Also to switch between the EEG and Eye tracker monitor. On the 7T you can switch for video input to the goggles. The **orange light** indicates the current setting.



SWITCH BOXES

## 12 PERIPHERAL EQUIPMENT MR ROOM

### 12.1 BUTTON RESPONSE BOXES

Button response boxes can be found next to the scanner.

- Left and right hand button boxes
- Four buttons each



### 12.2 SENSIMETRIC EARPLUGS (+CANAL TIPS)

Inside the magnet room you find the in-ear system for auditory stimuli.

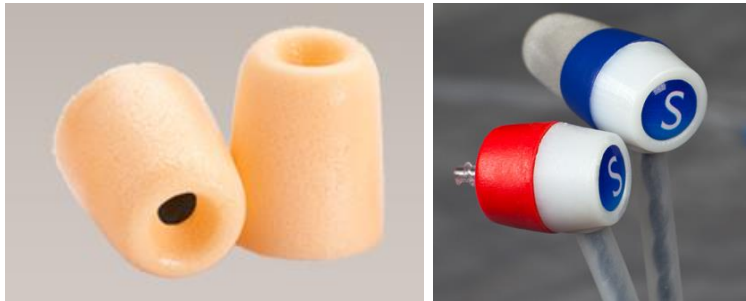
The ear buds come in different sizes:

- Slim (small)
  - Standard length
  - Short length
- Standard (medium)
- Large

They are stored in the supply box in the console room.

When applying the foam ear buds, handle with care. Do not squeeze tip when applying it on earplug!

When screwed on: gently expose a bit of the black top by pulling down the foam. Shape tip to the ear.



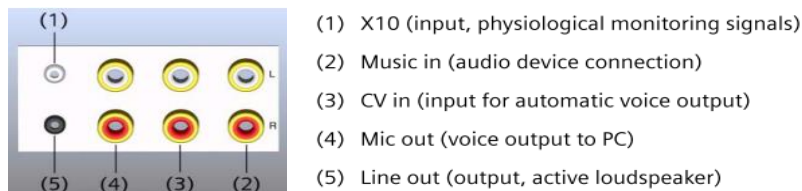
**Very expensive ear buds! Reusable for the same subject!**

The earplugs stick a bit out from the ear. In some cases the padding that is used to stabilize the head is pushing too much on the ear plugs. In that case you can use the black circular cushions that have an open space in the middle to make room for the earplugs.

### 12.3 MUSIC

---

Connections for audio equipment are located at the central unit of the intercom in back of Syngo Acquisition Workplace.



## 13 PHYSIOLOGIC SENSORS

### 13.1 CHARGING STATION

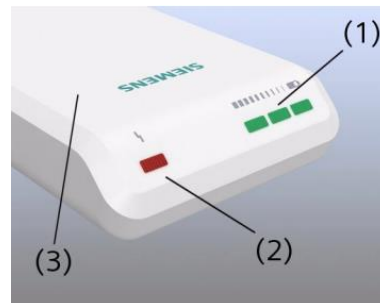
The physiologic sensors are located in the console room in the charge unit (B).

Respiratory belt, ECG electrodes and pulse sensor are available in the magnet room. Application tools (gel, wipes) are available in the supply box in the console room.

The green LEDs flash when positioned correctly.

**Always place sensor back into charging station!**

- (1) 3 Green LEDs (battery status)
- (2) 1 Red LED (fault)
- (3) Transmitter unit

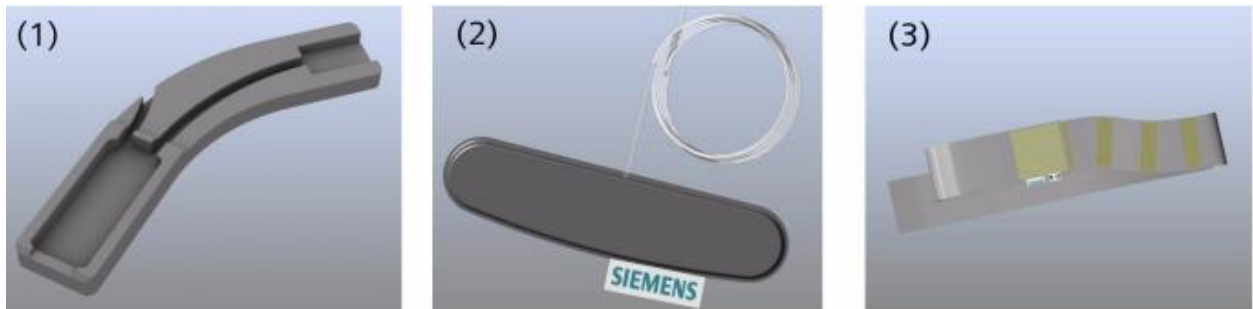


3 Green LEDs flash	Fully or nearly fully (2/3) charged accumulator
2 Green LEDs flash	1/3 to 2/3 fully charged accumulator
1 Green LED flashes	Nearly discharged accumulator; remaining operating duration is 1 hour
Red LED flashes (as regular as the green LEDs)	Transmit function deactivated, unit is positioned outside the static magnetic field; no electrode/application fault detected
Red LED is off	Transmit function activated; unit is positioned on the patient table in the static magnetic field; no electrode/application fault detected
Red LED flashes rapidly	PERU: electrode fault - one or more ECG electrodes are not applied correctly or fell off PPU: application fault - pulse sensor is not applied correctly at the finger

### 13.2 RESPIRATORY SENSOR

The unit can acquire the ECG channel as well as the respiratory channel of the subject. The ECG electrodes and respiratory cushion (attached with respiratory belt) are attached to the unit.

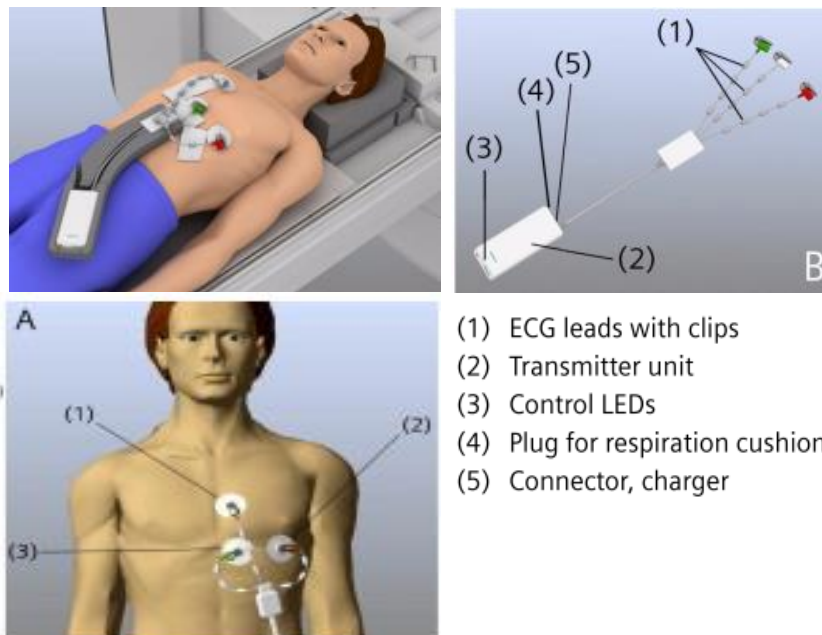
**Unit has to be placed in the application cushion to prevent skin irritation during examination.**



- (1) Application cushion
- (2) Respiratory cushion with pressure hose
- (3) Respiratory belt

### 13.3 ECG SENSOR

**Unit has to be placed in the application cushion to prevent skin irritation during examination.**



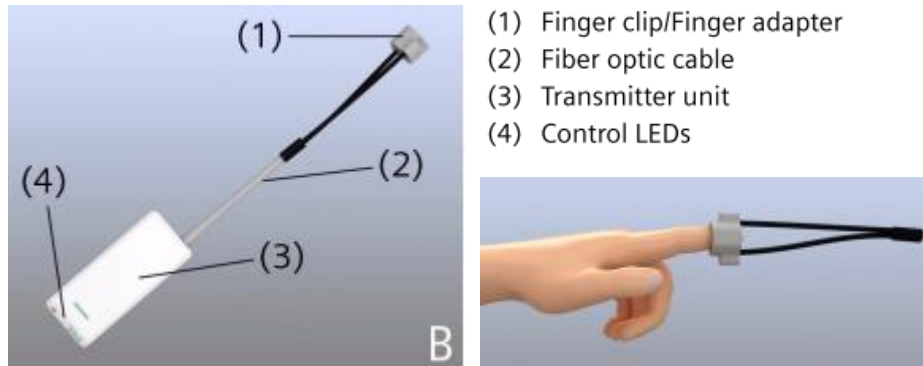
- (1) AVF – (white)
- (2) I + (red)
- (3) I -, AVF + (green)

- (1) ECG leads with clips
- (2) Transmitter unit
- (3) Control LEDs
- (4) Plug for respiration cushion
- (5) Connector, charger



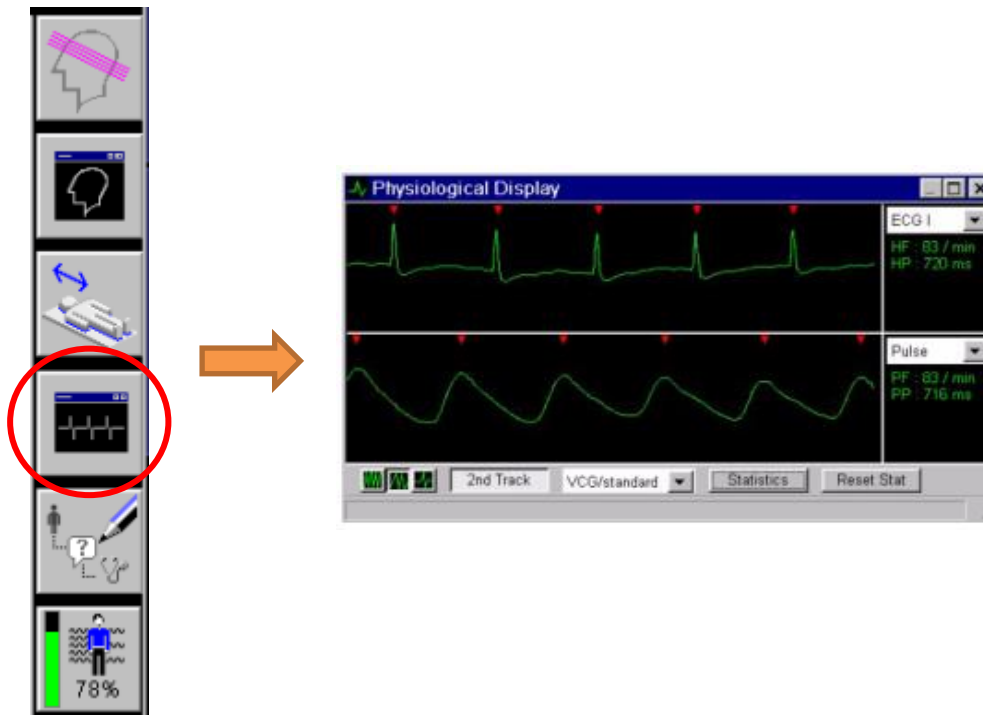
### 13.4 WIRELESS PULSE SENSOR

The unit acquires the subject's peripheral pulse. The finger clips are available in three sizes (cupboard scanner room).



### 13.5 MEASURED DATA

Measured data can be viewed at Physiological Display within Syngo MR.





## 14 STIMULUS PC

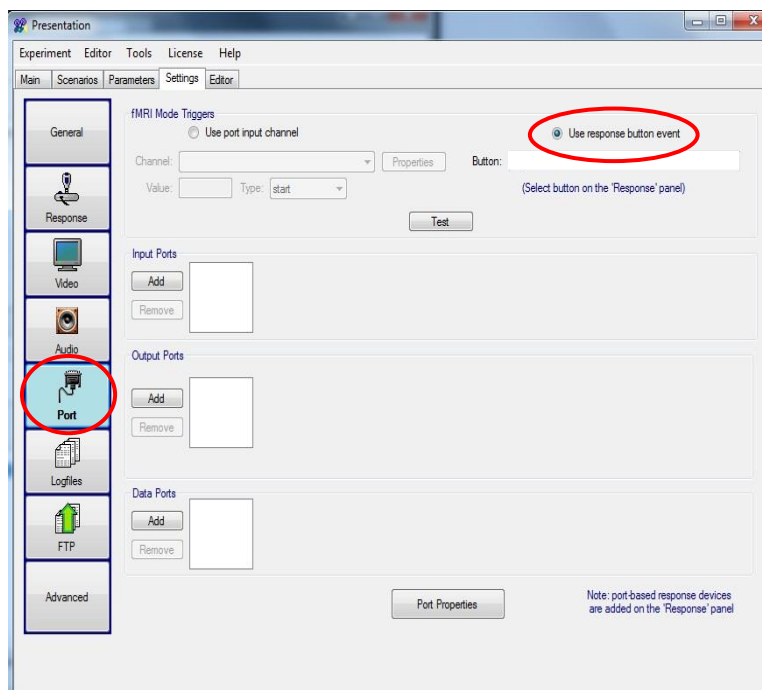
Stimulus PC can be used to present your stimuli to the subject. Different software versions are available, like presentation or e-prime to present your stimuli. It is also possible to use your laptop instead of the stimulus PC. Connections available to your laptop are video, audio, USB and LPT port. Make sure you selected the right PC on the following switch:



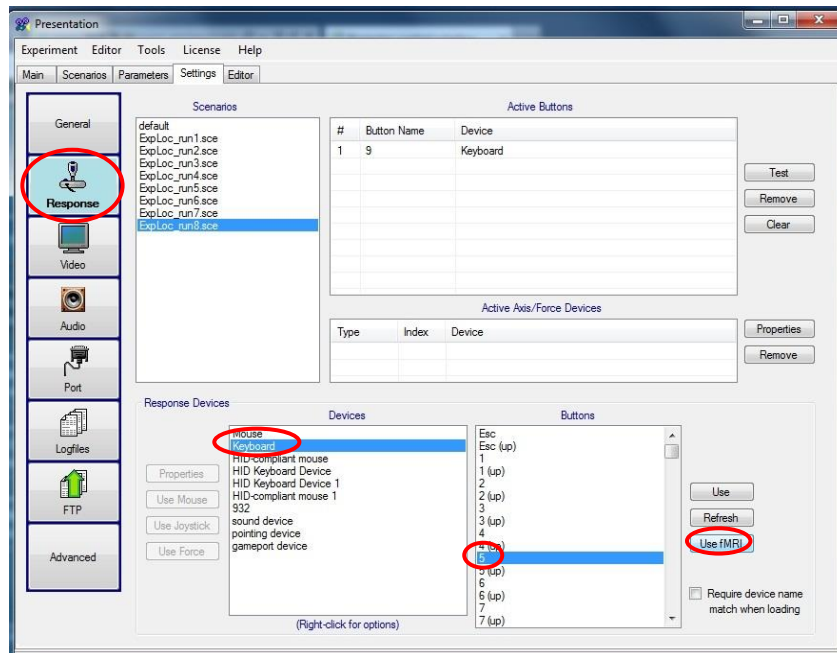
### 14.1 PRESENTATION

#### 14.1.1 USB MODE

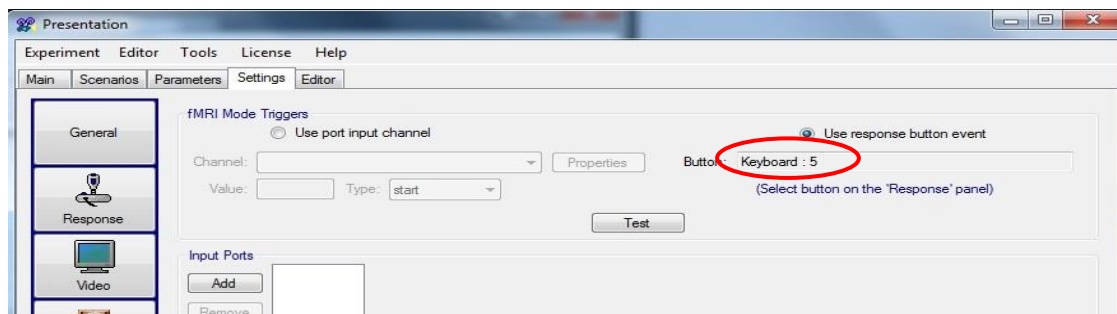
For USB trigger mode: check the “use response button event” box on the *Port panel* and return to the *Response panel*.



On the Response panel select: *Keyboard, 5*, and choose *Use fMRI*



On the port panel "Keyboard: 5" will appear.



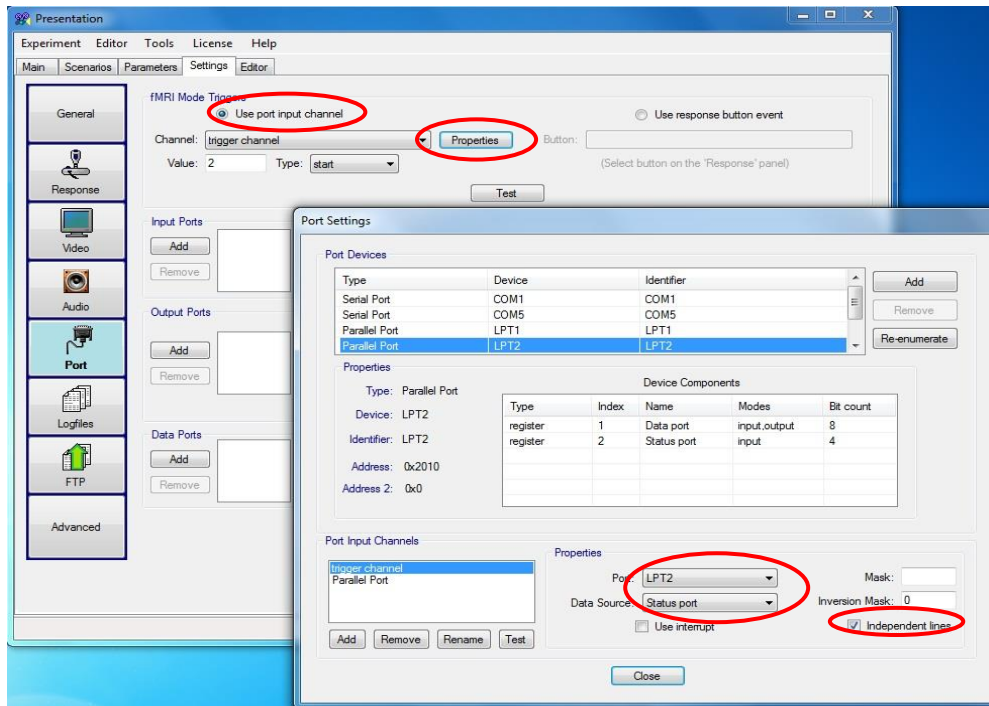
On the response panel you can choose the other buttons you need. Select *Keyboard*, the right buttons (1-4, 6-9) and *Use*. The corresponding buttons and fingers in default mode are:

- 9 - L Pinky (red)
- 8 - L Ring (green)
- 7 - L Middle (yellow)
- 6 - L Index (blue)
- 1 - R Index (blue)
- 2 - R Middle (yellow)
- 3 - R Ring (green)
- 4 - R Pinky (red)

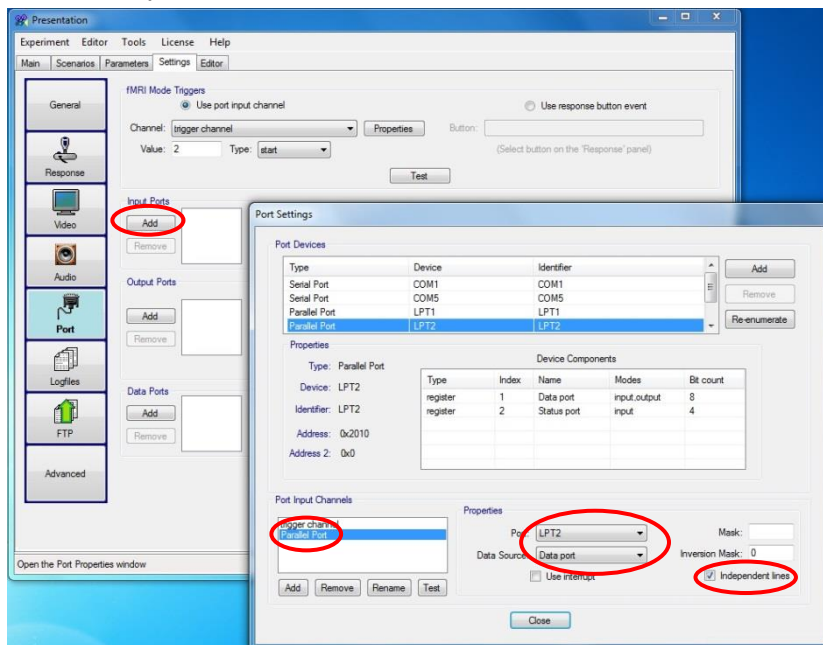
The USB mode is recommended. During programming and preparing you can use the 5 of your keyboard to simulate the trigger of the scanner. After copying your files to the stimulation pc you are ready for scanning without changing your settings.

### 14.1.2 PARALLEL PORT

However, it is possible to use the parallel port. On the *Port panel* check the “use port input channel” box. Select properties. Select LPT2, status port, check independent lines.

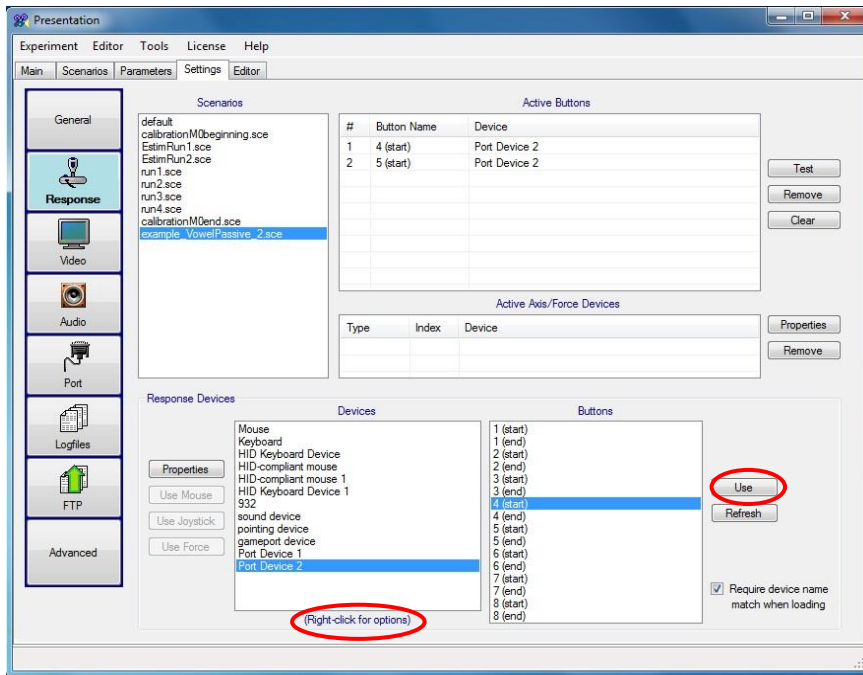


For the use of the button box: Click on Add below Input Ports. Select LPT2, data port, check independent lines.



On the response panel add your port device by clicking with your right mouse button on the "device field". Select your port device and add the buttons you need. The corresponding buttons and fingers in default mode are:

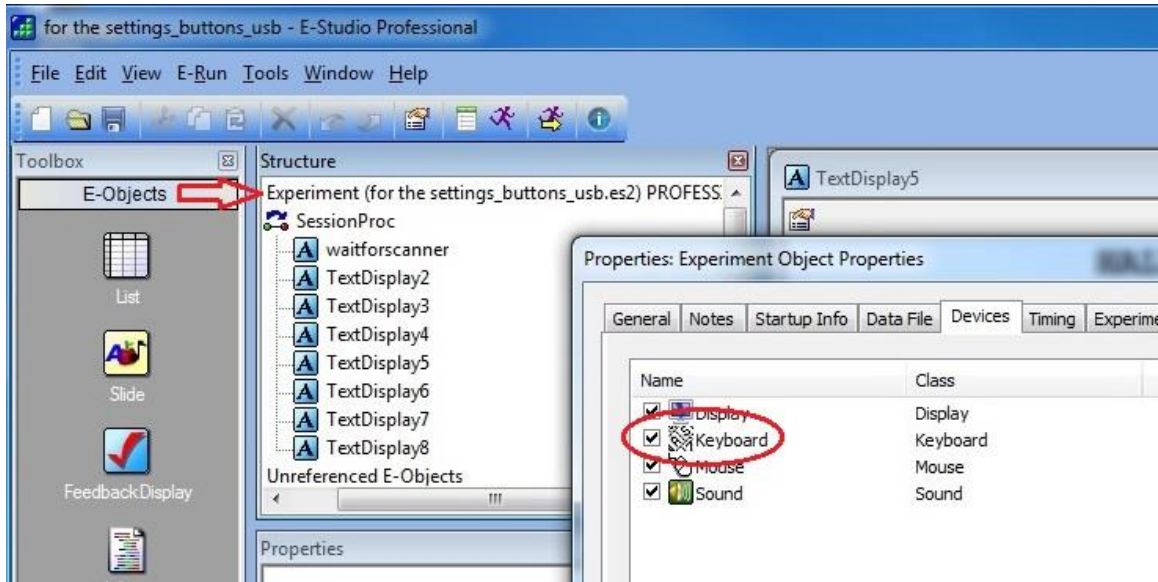
- 1 - L Pinky (red)
- 2 - L Ring (green)
- 3 - L Middle (yellow)
- 4 - L Index (blue)
- 5 - R Index (blue)
- 6 - R Middle (yellow)
- 7 - R Ring (green)
- 8 - R Pinky (red)



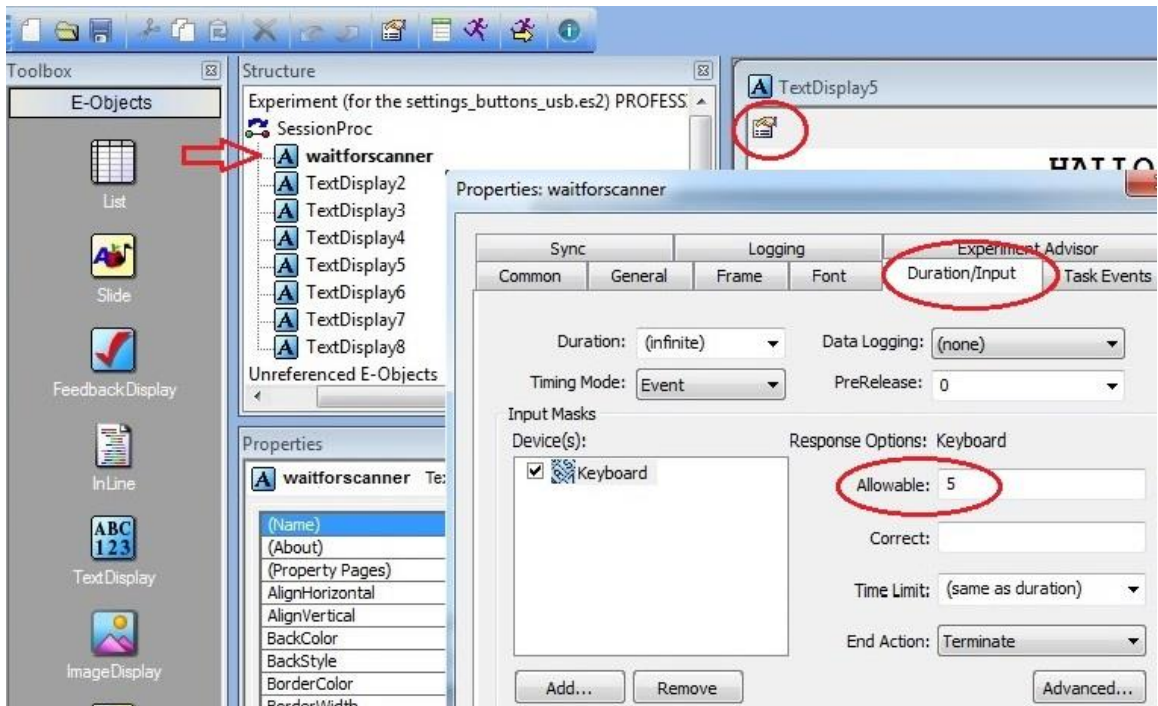
## 14.2 E-PRIME

### 14.2.1 USB-MODE

For USB trigger mode: you need the keyboard to be selected. Double-click on "Experiment" to check this.



Open a slide that should wait for a scanner trigger by double-clicking on it, double-click on the properties icon, open the Duration/Input tab, add the keyboard. Under the response options: enter 5 for the allowable.

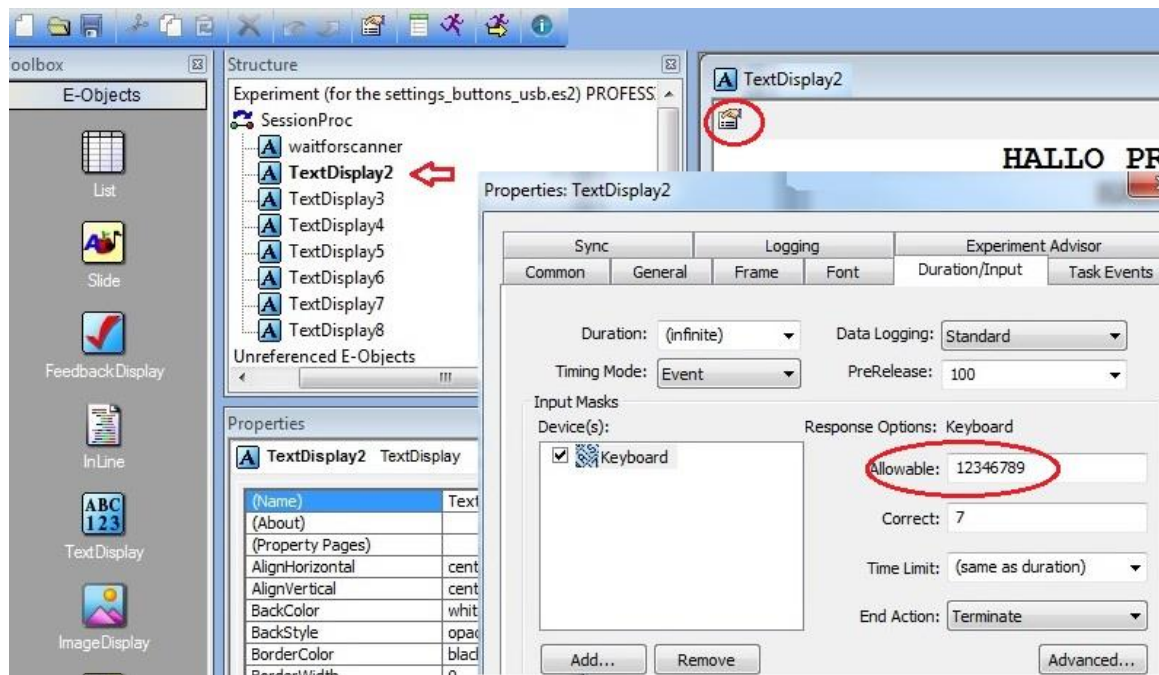


The USB mode is recommended. During programming and preparing you can use the 5 of your keyboard to simulate the trigger of the scanner. After copying your files to the stimulation pc you are ready for scanning without changing your settings.

Open a slide that should wait for input from the button boxes by double-clicking on the slide, double-click on the properties icon, open the Duration/Input tab, add the keyboard. Under response options: enter the buttons you need. (You cannot enter {ANY}, because the trigger of the scanner shows up as 5)

The corresponding buttons and fingers are:

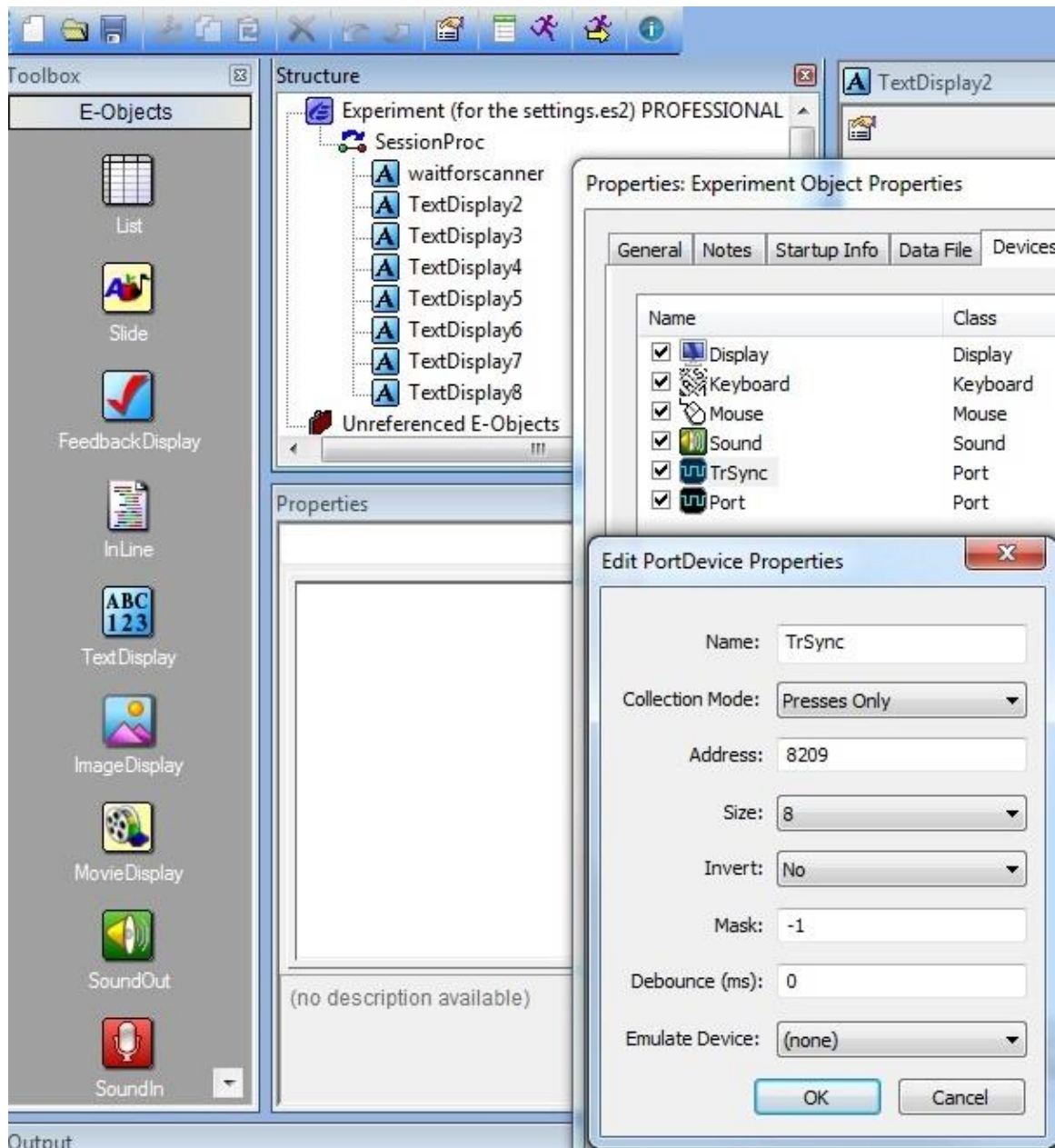
- 9 - L Pinky (red)
- 8 - L Ring (green)
- 7 - L Middle (yellow)
- 6 - L Index (blue)
- 1 - R Index (blue)
- 2 - R Middle (yellow)
- 3 - R Ring (green)
- 4 - R Pinky (red)





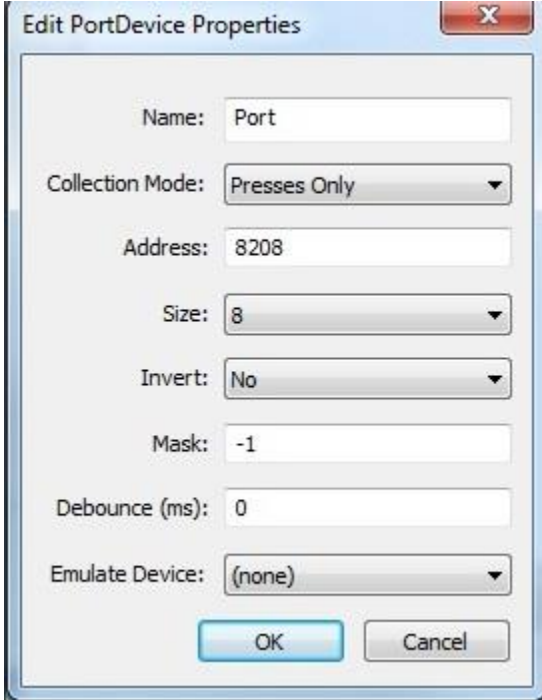
### 14.2.2 PARALLEL PORT MODE

The USB mode is recommended, but it is possible to use the parallel port. Double-click on "Experiment" and add Port, change the name in TrSync, change the addresses in 8209.



Open a slide that should wait for a scanner trigger by double-clicking on it, double-click on the properties icon, open the Duration/Input tab, add the TRsync. Under the response options: enter {ANY} for the allowable.

If you want to use the button boxes you need to add another port. Double-click on "Experiment" and add Port, change the addresses in 8208.



Open a slide that should wait for a button press by double-clicking on it, double-click on the properties icon, open the Duration/Input tab, add the Port. Under the response options: enter {ANY} for the allowable.

The corresponding buttons and fingers are:

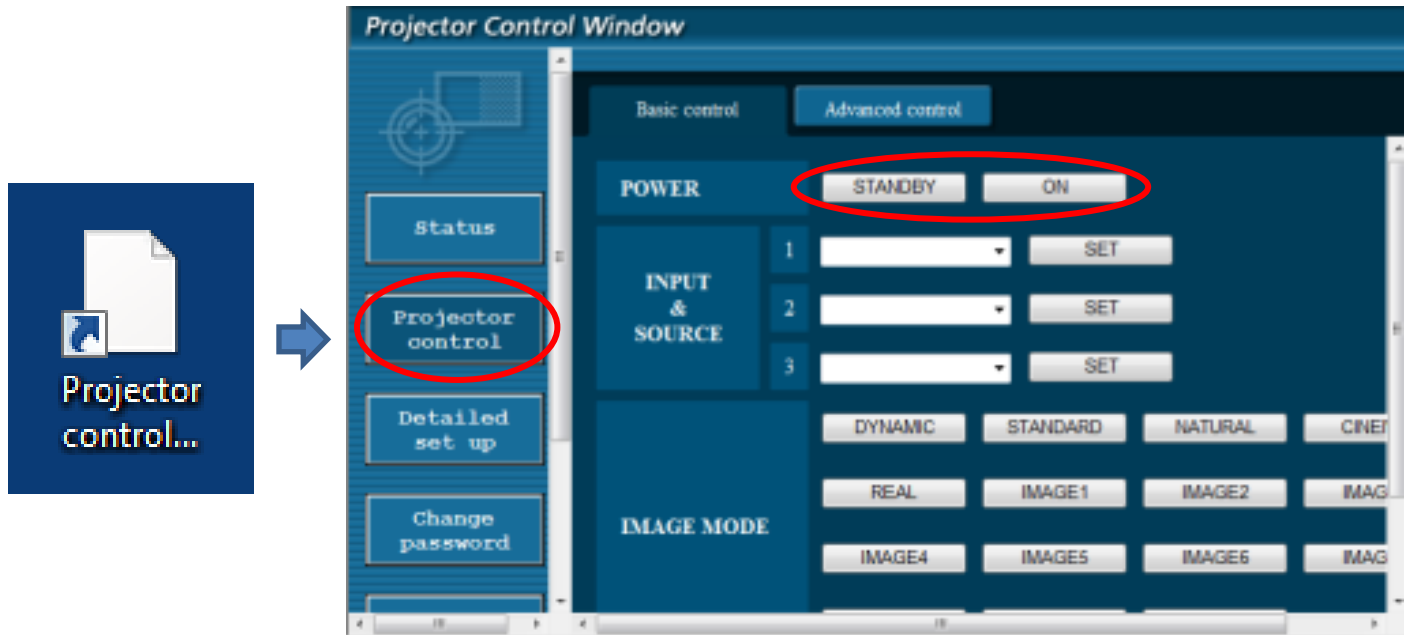
- 1 - L Pinky (red)
- 2 - L Ring (green)
- 3 - L Middle (yellow)
- 4 - L Index (blue)
- 5 - R Index (blue)
- 6 - R Middle (yellow)
- 7 - R Ring (green)
- 8 - R Pinky (red)



### 14.3 PROJECTOR CONTROL

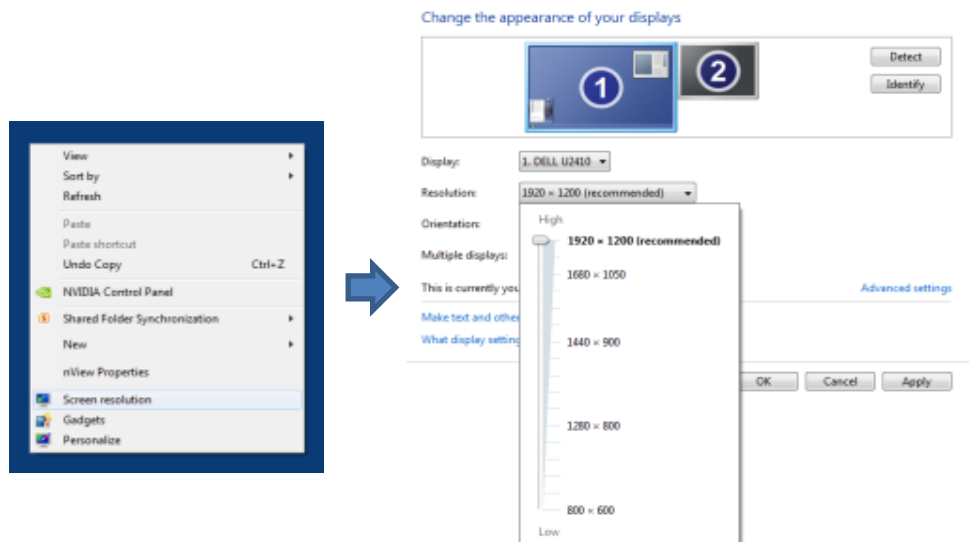
To turn the projector on or to standby:

- Open the program "Projector Control" on the desktop.
- Hit the button "Projector Control".
- Choose either "Standby" or "ON".



The resolution of the screen is recommended to be **1920\*1200**. If not, you can change this by:

- Right mouse click on desktop.
- Choose "Screen Resolution".
- Choose the desired resolution.



#### 14.4 3T PROJECTOR SETTINGS

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When using the 64 channel head/neck coil, make sure the subject is placed in the center of the coil.

If the subject has a small head, an extra cushion underneath the head might be necessary in order to have a view of the whole projection on the screen. This will elevate the head a little, the movement of the mirror is very restricted.

##### 64 CHANNEL HEAD/NECK COIL

- Distance from eye to mirror is about 15 cm, mirror to screen is 60 cm
- Image width: 40 cm
- Image height: 24.5 cm
- Image diagonal: 47 cm

#### 14.5 7T PROJECTOR SETTINGS

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The 7T has a variety of different head coils. To use the projector with the different head coils (volume/visual) the distance to the projector screen varies. Also the position of the projector screen on the table can vary. Therefore the user has to choose the right setting on the lens of the projector. The projector is located in the technical room next to the magnet room.

Two screens are available to me mounted in two positions behind the coils

- o position 1, back
- o position 2, front

The screens as well as their respective positions are labeled. Please make sure to that the labels face you when putting the screens in! Make sure that the screens are securely tightened using the mounting screws! If you touch the screens, clean them afterwards!

##### NOVA 32 CHANNEL COIL

- o Please use only screen position 1 due to cable routing
- o Please adjust the focus on the projector to position 1 (pos1-pos1)
  - Distance from eye to screen: 99 cm
  - Image width: 30 cm
  - Image height: 18 cm
  - Image diagonal: 35 cm

##### VISUAL 16 CHANNEL COIL

- o Both screen positions can be utilized using the visual coil
- o The distance from eye to screen can slightly vary depending on how you bend the mirror
  - **Screen position 1**  
Please adjust the focus on the projector to position 1 vis (pos1-pos1vis)

- Distance from eye to screen: 70 cm
- Image width: 32 cm
- Image height: 19 cm
- Image diagonal: 37 cm

### • Screen position 2

In this case, small parts of the lower right and left visual field are covered by the mirror holder

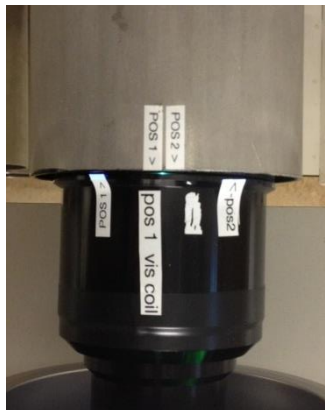
This setup gives the user the biggest visual field available

Please adjust the focus on the projector to position 2 (pos2-pos2)

- Distance from eye to screen: 29.5 cm
- Image width: 35 cm
- Image height: 21 cm
- Image diagonal: 41 cm



This setting is used with the head coil with the screen on the 1<sup>st</sup> position



This setting is used with the visual coil with the screen on the 1<sup>nd</sup> position



This setting is used with the visual coil with the screen on the 2<sup>nd</sup> position

Always set the projector to standby and standard settings when your measurement is finished!

## 15 EYE TRACKER AND GOGGLES

### 15.1 GOGGLES AND EYE TRACKER 7T (VISUAL COIL)

The binocular goggle system of the 7T incorporates eye tracking. This system can only be combined with the Life Science Visual Coil. Eye tracking for the Life Science Visual Coil can only be used in combination with the goggles, not with the projection screen.

The visual stimuli can be presented biocular (same image to each eye) and binocular (different images to each eye). The video interface is located in the equipment rack.

#### 15.1.1 HARDWARE SETUP GOGGLES

- Set screen resolution of stimulus PC to 1024x768/60 Hz! This resolution is less than the normal projector. **Set resolution back in default settings (1920x1200) after your scan session!**
- Set switchboxes in right setting:
  - Set switch box of TBV to stim.
  - Set switch box of goggle 1 and 2 to stim1, 2 or eye tracking, depending of which PC the goggle input will be.
- Set second screen of stimulus PC to extended or duplicate, depending on presenting different or the same stimuli to the left and right goggle.
- Use TBV screen for second screen (resolution 1024x768!).
- Turn on the visual system by the black power switch of the video interface.



- Check diagnostic indicators



Orange and flashing lights indicate something is wrong:  
Check cable connections, cooling system.  
No light of the alarm: System is ok, otherwise the alarm light is orange blinking.



Red/Off:  
Check output settings on source computer  
(1024x768/60 Hz)

### 15.1.2 HARDWARE SETUP GOGGLE EYETRACKING

- Set the screen resolution of the eye tracking PC and stimulus PC to (1024x768) when doing the calibration. **Set resolution back in default settings (1920x1200) after your scan session!**
- Set switch box of goggle 1 and 2 to stim1, 2 or eye tracking, depending of which PC the goggle input will be.
- Set eye tracker video switch for the small camera monitors to 1 for channel 1 and channel 2.



- Turn on tracker interface 1.



- Adjust IR level, initial setting of one-third.
- Put the video monitors in front of the window of the MR room (*you can put them on the plastic supply box*), so they can be checked inside the MR room.

### 15.1.3 PARTICIPATION PREPERATION GOGGLE EYE TRACKING

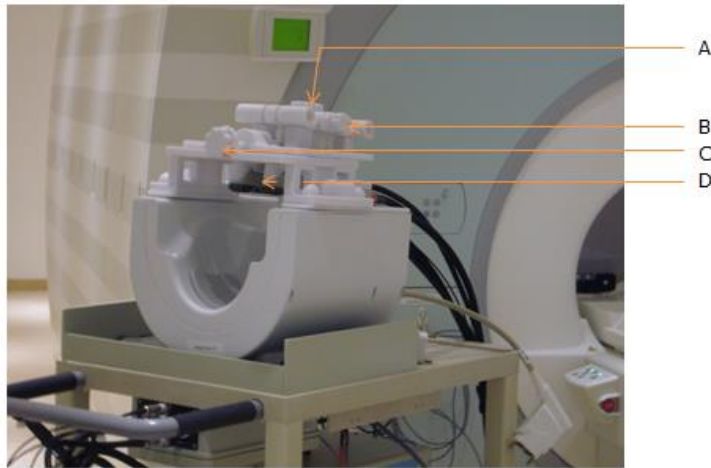
The goggles and the projector of the goggles are located on a consolidation cart in the magnet room.

- Mount and adjust glasses



- Place the head coil mount (picture) on the coil over the subjects head. Be careful to not touch the face when locking the goggles onto the coil.
- Goggles system cables face into the bore of the magnet! On the visual coil there are guiding's attached for the cables.

- The Silent Vision Glasses have adjustments for refractive correction (focus) on the side of each eyepiece. To adjust the focus move the focus slide until there is a clear image in each eye.
- The glasses can be positioned above the eyes by the 3-Axis mount.



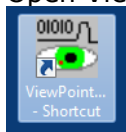
- A. Position goggles in vertical direction
- B. Position goggles in left right direction
- C. Position goggles in feet head direction
- D. Refractive correction
- Adjust the goggles so that they are presented above each eye, check by asking subject to close the eyes. A small dot of light is presented on each eyelid.
- Adjust the positioning of the goggles by looking at the camera pictures.
  - Pupils in center of eye openings in the camera pictures.
  - Adjust distance eye and goggles. The two IR illumination beams on the left and right side of the eye should overlap, so a uniform illumination area is projected over the pupil.
  - Adjust level of IR illumination if necessary (tracker interface)

PLEASE BE CAREFULL WITH CABLES AND DO NOT TURN SCREWS TOO TIGHT!!!!

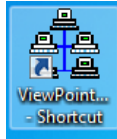
#### 15.1.4 VIEWPOINT SOFTWARE SETUP

This next section details how to get started with the software setup. The original manual for the Viewpoint software of the eye tracker can be found the BU server: [Z:\~Documentation\Manuals\\_peripheral\\_equipment](Z:\~Documentation\Manuals_peripheral_equipment) (See chapter 5 and 6)

- Open ViewPoint on the eye tracker PC:

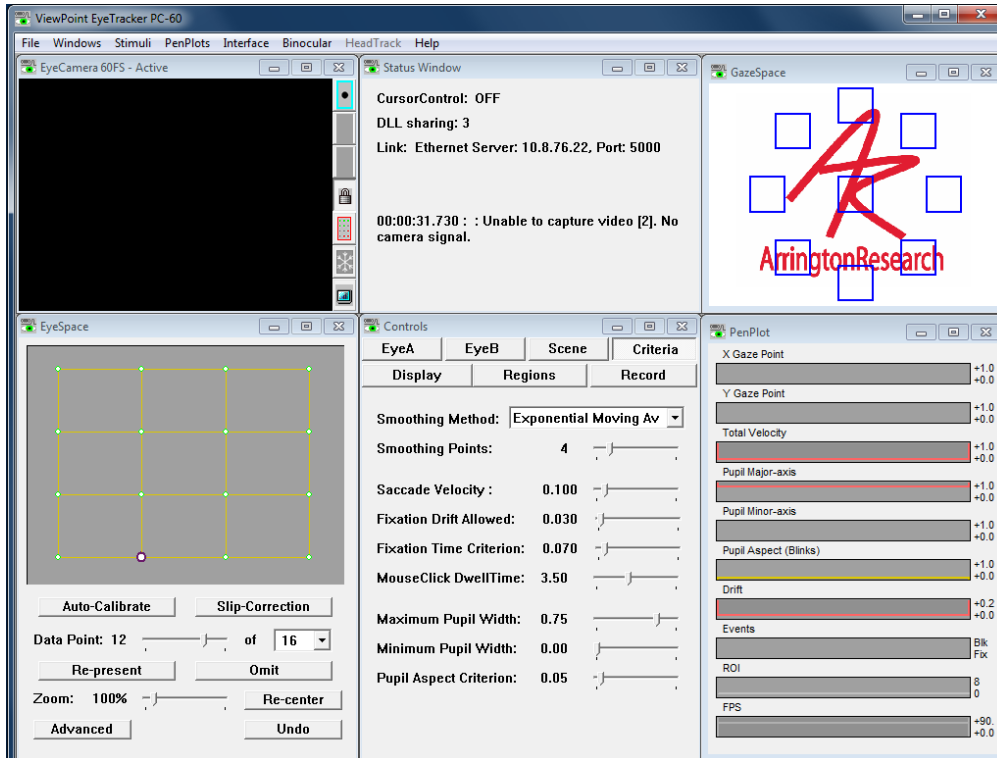


- Set up communication between Stim PC and eye tracker PC by clicking on the ViewPoint shortcut on the Stim PC.



- Use the DLL interface in your stimulus program.

Explanation Viewpoint screen:



**EyeCamera window:** Image of the eye. Adjustment of parameters that make the pupils easier to track.

**EyeSpace window:** Calibration, shows plot of calibration points before and after calibration.

**Status window:** Gives useful information recording data, can be changed to EyeCamera window by using binocular viewing mode.

**Controls:** Control of various different parameters.

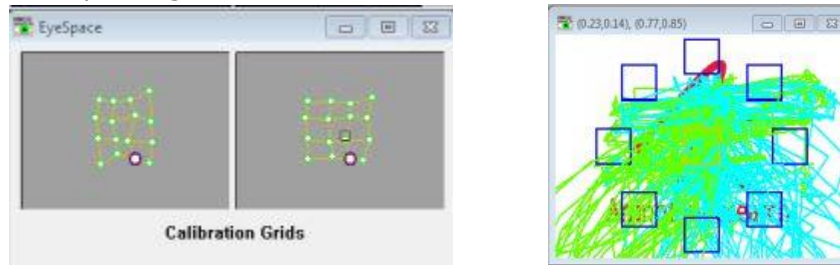
**GazeSpace window:** Trace of where the subject is looking at all times. Blinking yellow square shows the mean gazing point.

**PenPlot window:** Monitoring of the eye movements.

#### Quick start calibration setup:

- Distinguish pupil search area (EyeCamera window). Make sure this area is covering the eye, including the eyelid, to get a range of grey values. Do not include the black surrounding.
- Use standard pupil location with the ellipsoid pupil detection method. (EyeA and EyeB tab in GazeSpace window, select feature method)
- Disable AutoImage function in EyeA and EyeB tab.
- Disable the Positive-Lock Treshold-Tracking for both eyes and click Autotreshold a couple of times.
- Make calibration grid smaller than usual, as the goggle system has a limited field of view. Click regions in Controls window, select Calibration Region. Draw this new calibration region with the mouse in the GazeSpace window, approximately around the four diagonal ROIs (values e.g. (0.23, 0.14), (0.77, 0.86)).
- Start calibration with Auto-Calibrate and redo dots that are too distorted, simply by selecting the calibration point you want to redo.

Example of good calibration:



## 15.2 NANO EYE TRACKER 7T (NOVA COIL)

This eye tracker system can be used in combination with the Nova coil.

### 15.2.1 HARDWARE SETUP NANO EYETRACKER

- Set projector switch to stim or eye, depending on which PC the projector input will be.
- Turn on tracker interface 2
- Adjust IR level, initial setting of one-third
- Set eye tracker video switch for the small video monitors to 2 for channel 1 and channel 2.
- Put the video monitors in front of the window of the MR room (*you can put them on the plastic supply box*), so they can be checked inside the MR room.

(See also pictures presented in 10.1.2)



### 15.2.2 PARTICIPANT PREPERATION NANO EYE TRACKER

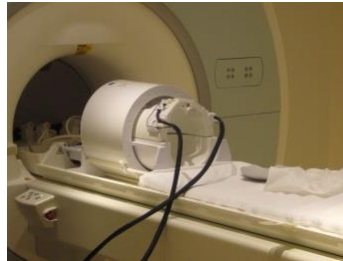
The Nano eye tracker is located in a black suitcase located on a consolidation cart in the magnet room. Please be carefull, because this is a delicate system.



- Remove mirror from NOVA coil.
- NOTE: use only MR compatible equipment! Ask support staff.
- Attach the mirror of the Nano eye tracker to the NOVA coil with the thumbscrew.



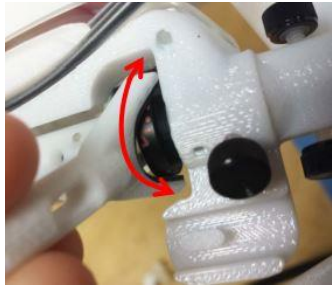
- Secure Image Guide in its clamps.
- Snap the IR fiber couple into the gasket lined grooves.



- Slide the receive coil back carefully and ask your subject to lie down on the MR table. Be careful with the Image Guide and IR fiber!
- Position receive coil over the subjects head.
- Make sure the subject is able to see the whole projection screen.
- Adjust the Nano eye tracker and check with the video monitors if the pupils are presented in the center of the monitor.
  - Loosen the Imaging Head thumbscrew.
  - Slide and rotate the Imaging Head with the Nano Adjustment Tool, until the subject's eye is visible in the video monitor. Tighten Imaging Head thumbscrew.



- Adjust focus by rotating the lens with the tool



### 15.2.3 VIEWPOINT SOFTWARE SETUP

This section is identical to the goggle eye tracker, see paragraph 10.1.4. It is not necessary to adjust the size of the calibration grid.

## 15.3 EYE TRACKER 3T

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### 15.3.1 SETUP EYE TRACKER 3T

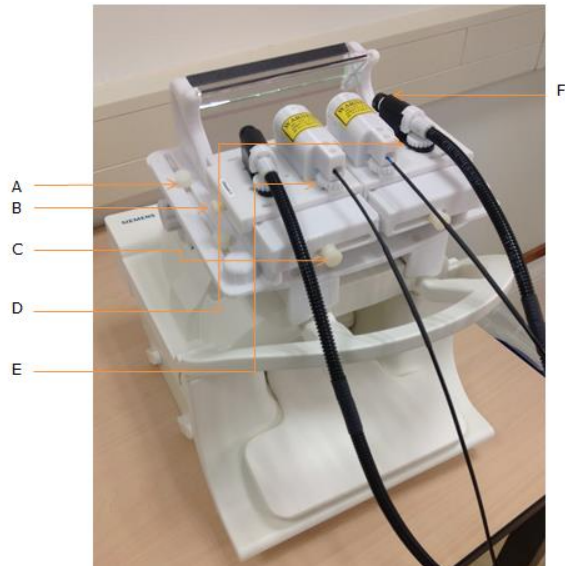
The mounting with the eye tracker is located in the console room of the Prisma fit.

- Mount the eye tracker support on the 64 channel head neck coil.
- Turn on tracker interface.
- Adjust illumination level, initial setting of one-third.
- Set projector video switch to eye.  
With this mounting system you have to change the position of the projector screen to see the complete projected screen. Change position to position eye tracker. The projector settings are:
  - Distance from eye to screen: 84 cm
  - Image width: 23.5 cm
  - Image height: 38.5 cm
  - Image diagonal: 45 cm

Change setting on the lens of the projector in the technical room to eye tracker position.

**Always set the projector to standby and standard settings when your measurement is finished! Put projector screen back at default position!**

- Adjust the eye tracker to position the eye in the camera, see picture below:



- A position of mirror to center the projection screen image to the subject's field of view, you can slide back and forward.
- B center the eye image in the video monitor, you can slide back and forward
- C center the eye image in the video monitor, you can slide left and right.

Tighten all directional lock screws.

- D+E positioning if the lenses and illumination housings, tighten using thumb wheels.
- F focus the eye image by rotating the lens

**PLEASE BE CAREFULL WITH CABLES AND DO NOT TURN SCREWS TOO TIGHT!!!!**

### 15.3.2 VIEWPOINT SOFTWARE SETUP

This section is identical to the goggle eye tracker, see paragraph 10.1.4. It is not necessary to adjust the size of the calibration grid.

## 16 EEG 256 CHANNELS

The EGI\_EEG system contains 256 channels with sponge cap. It is suitable for 3T and in future for 7T. Instead of gel an electrolyte solution on sponges in pedestals is used. Scanning for 45 minutes is possible. After this the sponges will be dehydrated. At the moment we are trying to optimize the application of the net and hydration time of the sponge cap.

Detailed information can be found at the wiki.

<http://137.120.141.83:8090/display/CU/EGI+EEG+system+development>

# DEFAULT AND TROUBLE SHOOT

## 17 DEFAULT SETTINGS 3T

### 17.1 MAGNET ROOM

- MRI table → Paper / Alarm ball / Earplugs
- 64 Head/Neck coil
- White Siemens cushions on MRI table

### 17.2 STIMULUS EQUIPMENT

#### EQUIPMENT

- Stimulus devices stored in cupboard or neatly on hooks on scanner
- Physiological sensors in charge unit (charge lights blinking)

#### TRIGGER

- Interface box:
  - Settings for Button boxes:
    - USB HHSC-2X4-C
    - HID KEY 12345
- Switch box for Trigger: USB

#### VISUAL

- Projector screen position: against 2<sup>nd</sup> wheel
- Projector filter: 0.3
- Screen resolution Stim PC: 1920x1200
- Switch box1: STIM
- Switch box2: VGA2STIM
- Switch box3: EYE

#### AUDIO

- Audio Amplifier Aux2
- Mixer :
  - MIC small button in
  - STIM small button out
  - MASTER small button out
  - All adjustment knobs centered (also outer ring)

#### PIEZO

- Switch box (top): Normal Mode
- Switch box (bottom): Piezo Normal Mode

### 17.3 CONSOLE ROOM

- Close Patient (in all tabs)
- Door Magnet room locked
- Magnet room key in key cabinet
- Turn projector off (standby)
- Power off monitor Stim PC

## 18 TROUBLESHOOTING 3T

### 18.1 TRIGGER / BUTTONBOX / JOYSTICK

Stimulation program does not receive trigger from scanner:

- Check default settings
- Check if trigger is received at interface box:
  - Circled light should flash every TR
- Now check if trigger is received at STIM PC:
  - Open notepad/word/wordpad/etc...
  - 5 should appear every TR (in USB mode)
- Still nothing in your Stimulus?
  - Check your stimulus program



### 18.2 PC/PROJECTOR SCREEN

Projector screen stays blue:

- Check switch boxes in equipment rack

Projection not focused/blurred

- Check screen position

### 18.3 AUDITORY SYSTEM

Subject does not hear/balanced L/R stimulus:

- Check if ear buds are correctly used, do not squeeze tip
- Check if the right size of ear buds are used
- Check default settings of mixer and Audio Amplifier in equipment rack
- Check the volume settings on the STIM PC

### 18.4 SCANNER

Scanner does not scan:

- Click echo sign (below) when red or yellow stripe
  - Follow instructions (do not call Siemens Service)



### 18.5 DATA

Inhomogeneous intensity distribution:

- Check if all coils are selected
- Check if anterior part of coil is recognized

Artifacts:

- Check if door is closed
- Check if subject moves too much
- Check if hairpins/etc. are still on subject

## 19 DEFAULT SETTINGS 7T

### 19.1 MAGNET ROOM

- MRI table → Paper / Alarm ball / Earplugs
- 32 channel Nova coil
- Table in home position

### 19.2 STIMULUS EQUIPMENT

#### EQUIPMENT

- Stimulus devices stored in cupboard or neatly on hooks on scanner
- Physiological sensors in charge unit (charge lights blinking)

#### TRIGGER

- Interface box:
  - Settings for Button boxes:
    - USB HHSC-2X4-C
    - HID KEY 12345
- Switch box for Trigger: USB

#### VISUAL

- Projector screen position: Back position
- Projector focus: POS 1 > ... < POS 1
- Projector filter: 0.9
- Screen resolution Stim PC: 1920x1200
- Switch box1: STIM
- Switch box2: VGA2STIM

#### AUDIO

- Audio Amplifier Aux2
- Mixer :
  - MIC small button in
  - STIM small button out
  - MASTER small button out
  - All adjustment knobs centered (also outer ring)

#### PIEZO

- Switch box (top): Normal Mode
- Switch box (bottom): Piezo Normal Mode

### 19.3 CONSOLE ROOM

- Close Patient (in all tabs)
- Door Magnet room locked
- Magnet room key in key cabinet
- Turn projector off (standby)
- Power off monitor Stim PC



## 20 TROUBLESHOOTING 7T

### 20.1 TABLE/LASER LIGHT DOES NOT RESPOND

- Go to home position if laser does not respond
- No response of table movement:
  - Check buttons in control panel, might be stuck
  - Turn table off and on again
  - Deactivate table stop alarm (on console)
  - Check table stop buttons / manual movement handle
  - Always move table back home when problem is solved (recalibration)
  - If nothing works, shutdown system

### 20.2 TRIGGER / BUTTONBOX / JOYSTICK

Stimulation program does not receive trigger from scanner:

- Check default settings
- Check if trigger is received at interface box:
  - Circled light should flash every TR
- Now check if trigger is received at STIM PC:
  - Open notepad/word/wordpad/etc...
  - 5 should appear every TR (in USB mode)
- Still nothing in your Stimulus?
  - Check your stimulus program



### 20.3 PC/PROJECTOR SCREEN

Projector screen stays blue:

- Check switch boxes in equipment rack

Projection not focused/blurred

- Check focus on projector (technical room)

### 20.4 AUDITORY SYSTEM

Subject does not hear stimulus:

- Check if ear buds are correctly used, do not squeeze tip
- Check if the right size of ear buds are used
- Check default settings of mixer and Audio Amplifier in equipment rack
- Check the volume settings on the STIM PC

### 20.5 SCANNER

Scanner does not scan:

- Click echo sign (below) when red or yellow stripe
  - Follow instructions (do not call Siemens Service)



### 20.6 DATA

Inhomogeneous intensity distribution:

- Check if all coils are selected

Artifacts:

- Check if door is closed
- Check if subject moves too much
- Check if hairpins/etc. are still on subject

# APPENDIX

## APPENDIX 1 EXPLANATION SAFETY SCREENING FORM



### Safety screening form

Version 2.1

This document describes how to use the safety screening form when scanning a research project with human subjects at the MRI scanners or when accompanying persons enter the Magnet Room at Scannexus. This document does not cover all questions about safety/contra-indications. If you have any questions you can contact the Support Team. You can also have a look at [www.mrisafety.com](http://www.mrisafety.com).

**Keep in mind that the CU has always the final responsibility in screening and safety of the subject!**

#### I have understood the following questions and answered honestly:

- Do you have an active implant?  
(pacemaker, neurostimulator, insulin pump, ossicle prosthesis, or residual leads) ☐ Yes ☐ No

*Contra-indication: Subject is not allowed to go into the Magnet Room*

- Do you have any other foreign objects in your body, except dental fillings or crowns?  
(e. g. clips on blood vessels, metal splinters in the eye or body as consequence of shooting/accident/metal worker, orthopedic implants, braces, metal wire behind the teeth, mechanical contraception spiral) ☐ Yes ☐ No

If yes, what kind of metal implant?

*Contra-indication: Clips in blood vessels, metal splinters in the eye or body, bracelets, magnetic tooth prosthesis.*

*Relative contra-indication:*

- o *Orthopedic implants, only with evidence of material on paper, type number and has been proven as safe in MRI safety.com. Implants should not be located in the RF field (7T and 9.4T). Do not scan if you are not sure!*
- o *Metal wire behind teeth is only allowed on 3T and 7T.*
- o *Mirena spiral is allowed, others not!*

- Have you had surgery to your brain, head? ☐ Yes ☐ No

*Contra-indication if aneurysm clips or other implants are implanted.*

*Surgery might affect a neurological experiment.*

- Do you suffer from epilepsy? ☐ Yes ☐ No

*Subject can be scanned, but keep in contact with the subject during scan sessions.*

*Stop scanning if seizure occurs!*

*Can be a contra-indication for a neurological study!*

- Do you suffer from any known heart rhythm disorder?  
☐ Yes ☐ No

*Scanning is possible. Do not exceed threshold of nerve stimulation.  
 Check subject regularly if he/she feels ok.*

- Do you have circulatory problems? ☐ Yes ☐ No

*Scanning is possible. Do not scan in level 1SAR mode! Subject might have bad thermo regulation.  
 Check subject regularly if he/she feels ok.*

- Are you diabetic? ☐ Yes ☐ No

*Scanning is possible. Do not scan in level 1SAR mode! Subject might have bad thermo regulation.  
 Check subject regularly if he/she feels ok.*

- Do you suffer from claustrophobia? ☐ Yes ☐ No

*Check if scanning might be possible in consultation with subject. No force! Can cost scan time!*

- Are you pregnant or do think that you might be? ☐ Yes ☐ No

*Contra-indication for scanning, not for entering the Magnet Room.*

- Do you wear jewelry/piercings that cannot be taken of? ☐ Yes ☐ No

*Contra-indication might heat up or be attracted.*

- Do you have tattoos or permanent eye make-up? ☐ Yes ☐ No

*Tattoo is relative contra indication. If tattoo is not in RF field (7T en 9.4T) and is older than 3 weeks it is allowed to scan. Warn subject about possibility of heating. If so, subject has to squeeze the alarm ball immediately and scanning has to be stopped.*

*Permanent eye make-up is contra indication, contains higher level of iron oxide!*

- Are you using drug delivery patches (e.g. nicotine) that cannot be taken of? ☐ Yes ☐ No

*Contra-indication if plasters cannot/are not allowed to be taken of.*

I have been informed to satisfaction concerning the MRI safety. I had the possibility to ask questions concerning MRI safety. All my questions are answered to my satisfaction.

**I agree with being scanned:**

Last name:

Today's date:

First name:

Date of birth:

Middle name (if any):

Height (cm):

Weight (kg):

Signature: *To be filled out by the researcher*

Name:

MR System:

Project number:

I declare that the person mentioned above has been informed orally and in writing about the MRI scan and has given their informed consent about the project mentioned above. I also declare that premature termination of participation by the person mentioned above will be of no influence on the care he or she will receive.

Function:

Signature: 

Date and time of scan: