This document contains the **Siemens 3T MRI** protocol settings, which were specifically adapted for a clinical study (NISCI trial - http://nisci-2020.eu/) to be able to measure the whole multi-parameter mapping (MPM) protocol within ~22 min.
To keep the protocol settings shorter, we deleted parameters, which does not differ from standard settings (as far as we knew) and which are redundant within PDF printouts.

For a tutorial on how to set up the parameters for the MPM protocol and reference measurements (rf_map and RF_sens_head/body, see page 2) consult the document MPM_protocol_vendor_seq_SIEMENS_setup_tutorial.pdf.

Here’s the complete list of sequences to be set up:

- rf_map
- RF_sens_head
- RF_sens_body
- MPM_T1
- MPM_PD
- MPM_MT
- MEDIC
- t2_tse_sag
- t1_tse_sag
- t2_tse_tra

For running the sequences please refer to the document MPM_protocol_operational_procedure.pdf.

rf_map TA:2:14 Voxel size:4.0×4.0×5.0 mm

Source protocol: Siemens\SequenceRegion\ServiceSequences\DefaultProtocols\rf_map

Routine		Contrast	
Slices	18	Flip angle 1	90 deg
Dist. factor	100%	Measurements	1
Position	Isocenter	Resolution	
Orientation	Sagittal	Base resolution	64
Phase enc. dir.	A >> P	Phase resolution	100%
FoV read	256 mm	Image Filter	Off
FoV phase	100%	Distortion Corr.	Off
Slice thickness	5 mm	Prescan Normalize	Off
TR	2000 ms	Normalize	Off
TE 1	14 ms	B1 filter	Off
Averages	1	Raw filter	Off
Filter	None	Elliptical filter	Off
Coil elements	{head_neck}	System	
		Shim mode	Standard

RF_sens_head TA:9.8 s PAT:Off Voxel size:4.0×4.0×4.0 mm

Source protocol: Siemens\head\library_3D\t1_fl3d_sag_p4_iso_1.0

Routine			
Nr. of slab groups	1	Prescan Normalize	Off
Slabs	1	Normalize	Off
Position	Isocenter	B1 filter	Off
Orientation	Sagittal	Raw filter	Off
Phase enc. dir.	A >> P	Elliptical filter	Off
Phase oversampling	0%	Slice resolution	100%
Slice oversampling	0%	Slice partial Fourier	Off
FoV read	256 mm	Geometry	
FoV phase	87.50%	Nr. of slab groups	1
Slice thickness	4 mm	Slabs	1
TR	4.6 ms	Position	Isocenter
TE	2 ms	Phase enc. dir.	A >> P
Averages	1	Phase oversampling	0%
Concatenations	1	Slice oversampling	0%
Filter	None	Slices per slab	44
Coil elements	{head_neck}	System	
Contrast		Coil Combine Mode	Sum of Squares
MTC	Off	Auto Coil Select	Off
Magn. preparation	None	Shim mode	Standard
Flip angle	6 deg	Sequence	
Fat suppr.	None	Introduction	On
Water suppr.	None	Dimension	3D
SWI	Off	Elliptical scanning	On
Averaging mode	Short term	Phase stabilisation	Off
Measurements	1	Averaging mode	Short term
Reconstruction	Magnitude	Multi-slice mode	Interleaved
Multiple series	Each measurement	Asymmetric echo	Off
Resolution		Contrasts	1
Base resolution	64	Bandwidth	480 Hz/Px
Phase resolution	100%	Flow comp.	No
Phase partial Fourier	Off	Allowed delay	0 s
Interpolation	Off	RF pulse type	Fast
PAT mode	None	Gradient mode	Normal
Image Filter	Off	Excitation	Non-sel.
Distortion Corr.	Off	RF spoiling	On

Rf_sens_body
same as before, but coil elements = body

MPM protocol starting next page…

MPM_T1 TA:3:50 PAT:2 Voxel size:1.0×1.0×1.0 mm

Source protocol: Siemens\head\library_3D\t1_fl3d_sag_p4_iso_1.0

Routine		Image Filter	Off
Nr. of slab groups	1	Distortion Corr.	Off
Slabs	1	Accel. factor 3D	1
Position	Isocenter	Mode	3D
Orientation	Sagittal	Unfiltered images	On
Phase enc. dir.	A >> P	Prescan Normalize	On
Phase oversampling	0%	Normalize	Off
Slice oversampling	0%	B1 filter	Off
FoV read	256 mm	Raw filter	Off
FoV phase	87.50%	Elliptical filter	Off
Slice thickness	1 mm	Slice resolution	91%
TR	18.0 ms	Slice partial Fourier	6/8
TE 1	2.46 ms	Geometry	
TE 2	4.92 ms	Nr. of slab groups	1
TE 3	7.38 ms	Slabs	1
TE 4	9.84 ms	Dist. factor	20%
TE 5	12.30 ms	Position	Isocenter
TE 6	14.76 ms	Phase enc. dir.	A >> P
Averages	1	Phase oversampling	0%
Concatenations	1	Slice oversampling	0%
Filter	Distortion	Slices per slab	176
Corr.(3D)		Multi-slice mode	Interleaved
Coil elements	HEA;HEP	Series	Interleaved
Contrast		System	
MTC	Off	Body	Off
Magn. preparation	None	Save uncombined	Off
Flip angle	25 deg	Coil Combine Mode	Sum of Squares
Fat suppr.	None	Sequence	
Water suppr.	None	Introduction	On
SWI	Off	Dimension	3D
Averaging mode	Short term	Elliptical scanning	On
Measurements	1	Phase stabilisation	Off
Reconstruction	Magnitude	Averaging mode	Short term
Multiple series	Each	Multi-slice mode	Interleaved
measurement		Asymmetric echo	Off
Resolution		Contrasts	6
Base resolution	256	Bandwidth 1	480 Hz/Px
Phase resolution	91%	Flow comp. 1	No
Phase partial Fourier	Off	Readout mode	Bipolar
Interpolation	Off	Allowed delay	0 s
PAT mode	GRAPPA	RF pulse type	Fast
Accel. factor PE	2	Gradient mode	Normal
Ref. lines PE	24	Excitation	Non-sel.
Reference scan mode	Integrated	RF spoiling	On

MPM_PD TA:3:50 PAT:2 Voxel size:1.0×1.0×1.0 mm

same as T1, but Flip angle = 4 deg

MPM_MT TA:7:52 PAT:2 Voxel size:1.0×1.0×1.0 mm

same as T1/PD, but TR = 37.0 ms, Flip angle = 6 deg, MTC = On (Contrast Card)
