

Tutorial: Running ANTx on machines without graphic support

“working without graphical user interfaces, GUIs”

This tutorial shows how to perform some basic steps without GUIs, for instance when running on an HPC-machine.

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1) OPTIONAL: How to set the paths of ELASTIX in UNIX/LINUX-system:

MAKE ELASTIX RUNNING ON UNIX/LINUX-Systems

1) SET PATH OF ELASTIX IN .bashrc-FILE

FOR INFORMATION:

see: elastix-manual (section 3.2)

see: <https://usermanual.wiki/Document/elastix490manual.1389615963/html#pf17>

Linux: Add the following lines to your .bashrc file:

```
export PATH=folder/bin:$PATH
export LD_LIBRARY_PATH=folder/lib:$LD_LIBRARY_PATH
```

...where "folder" is the path to the linux-elastix-folder (which is within the antx2-folder):

EXAMPLE:

My linux-elastix-folder is "/sc-projects/sc-proj-agtiermrt/Daten-2/ressources/antx2/mritools/elastix/elastix_linux64_v4.7/". Thus, my bashrc-file is modified as follows:

```
#-----[ELASTIX-PATH in bashrc]-----
export PATH=/sc-projects/sc-proj-agtiermrt/Daten-2/ressources/antx2/mritools/elastix/elastix_linux64_v4.7/bin:$PATH
export LD_LIBRARY_PATH=/sc-projects/sc-proj-agtiermrt/Daten-2/ressources/antx2/mritools/elastix/elastix_linux64_v4.7/lib:$LD_LIBRARY_PATH
#-----
```

2) RELOAD .bashrc-FILE & TEST ELASTIX

- save .bashrc-file, exit editor, then type the following to reload the .bashrc-file again:
source .bashrc

- check installation, by typing:

elastix

- if successful, a message is displayed:

Use "elastix --help" for information about elastix-usage.

2) OPTIONAL: Open interactive session on HPC-cluster and start Matlab

OPEN INTERACTIVE JOB on HPC-CLUSTER (optional)

```
srun --time 7-00 --mem=64G --ntasks=8 --pty bash -i
```

-Please check the parameters

LOAD MATLAB-MODULE AND START MATLAB (optional)

```
module load scientific/matlab/R2021b
```

```
matlab
```

-To access Matlab is for sure different on another machine!

3) BASICS

FROM NOW ON type in the MATLAB CMD-WINDOW...

ADD ANTx-PATHS

```
cd /sc-projects/sc-proj-agtiermrt/Daten-2/ressources/antx2/
antlink
```

GO TO STUDY-FOLDER

```
cd /sc-projects/sc-proj-agtiermrt/Daten-2/mri/projects/groeschel/
```

The study-folder is the folder where the registration of several animals of one study will be performed

UPDATE ANT-TOOLBOX

Just type `updateantx(2)` to update the toolbox. For more info type `help updateantx`

```
updateantx(2)
```

CREATE A PROJECT-FILE:

```
makeproject('projectname',fullfile(pwd,'proj.m'), 'voxsize',[.07 .07 .07], 'wa_refpath','/sc-projects/sc-proj-agtiermrt/Daten-2/ressources/anttemplates/mouse_Allen2017HikishimaLR', 'wa_species','mouse');
```

-here the project-file "proj.m" is created using a target voxelsize of 0.07x0.07x0.07 mm, the animal template is "mouse_Allen2017HikishimaLR", with species 'mouse'

- a suitable template has to be downloaded from google-drive :

<https://drive.google.com/drive/folders/1q5XOOVLvUYLqYsQJLqNRF7OK8fNwYhI9>

And should be unzipped and stored where it could be reached (do not store the downloaded template in the current project-folder!)

-This has to be done only once!

LOAD A PROJECT-FILE "proj.m"

```
loadconfig(fullfile(pwd,'proj.m'));
```

CHECK WHETHER THE PROJECT-FILE IS LOADED

```
global an;  
an
```

now you should see some fields stored in the global variable "an" (struct):

```
project: 'NEW PROJECT'  
datapath: '/sc-projects/sc-proj-agtiermrt/Daten-2/mri/projects/groeschel/dat'  
voxsize: [0.0700 0.0700 0.0700]  
wa: [1x1 struct]
```

4) IMPORT BRUKER-DATA

First we just read the file-information of the Bruker-raw from the raw-data folder stored in the current study folder (fullfile(pwd,'raw')) and store it in the w-struct.

```
w=xbrucker2nifti(fullfile(pwd,'raw'),0,[],[], 'gui',0,'show',1); % first read all data and show it
```

The w.struct contains the a table "d" with header "hd" which is listed in the CMD-window when running this command. Now you can save & reload the struct and import some data later on (advantage: loading time is reduced). To show the table again, type:

```
w.showtable(w) ; %to show the table in CMD-window
```

If graphic is supported you could also see the table in an extra window via w.showtable2(w) ;

The raw-data contain two data-sets (2 animals)

BRUKER DATA									
set	SubjectId	StudNo	ExpNo	PrctNo	MRseq	protocol	sizeMB	date	file
1	20200925MG_LAERMRT_MGR0000025	1	1	1	FLASH	01_1_Localizer_CRP	0.393216	20-Oct-2020	15:07:20 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	10	1	SINGLEPULSE	02_6_freqAdj_SINGLEPULSE	0.004096	20-Oct-2020	15:05:32 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	11	1	DtiEpi	02_7_DTI_EPI_seg_b2500_37dir	112.0666	20-Oct-2020	15:06:12 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	11	2	DtiEpi	nan	129.7613	20-Oct-2020	15:06:59 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	13	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	15:07:11 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	16	1	STEAM	04_3_Localized_shim_MGB	0.004096	20-Oct-2020	15:03:38 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	17	1	STEAM	04_3_STEAM_1H_MGB	0.004096	20-Oct-2020	15:05:13 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	19	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	15:08:29 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	2	1	FLASH	01_2_Localizer_multi_slice	1.10592	20-Oct-2020	15:09:05 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	20	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	15:05:33 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	21	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	15:04:55 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	22	1	FieldMap	B0Map-ADJ_B0MAP	1.048576	20-Oct-2020	15:05:31 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	23	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	15:05:32 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	24	1	FLASH	01_2_Localizer_multi_slice	1.10592	20-Oct-2020	15:03:47 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	25	1	RARE	03_T2_TurboRARE_CRP_MapShim	2.94912	20-Oct-2020	15:08:28 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	26	1	FieldMap	B0Map-ADJ_B0MAP	1.048576	20-Oct-2020	15:03:51 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	27	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	15:04:48 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	28	1	STEAM	04_2_STEAM_1H_IC_single	0.004096	20-Oct-2020	15:05:25 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	29	1	STEAM	04_3_Localized_shim_MGB	0.004096	20-Oct-2020	15:03:52 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	3	1	RARE	03_T2_TurboRARE_CRP	6.5536	20-Oct-2020	15:05:38 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	31	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	15:05:39 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	33	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	15:08:23 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	35	1	STEAM	04_2_STEAM_1H_IC_single	0.004096	20-Oct-2020	15:07:33 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	4	1	DtiEpi	02_1_DTI_EPI_seg_b1000_gdir	20.64384	20-Oct-2020	15:08:11 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	4	2	DtiEpi	nan	129.7613	20-Oct-2020	15:08:24 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	5	1	FieldMap	B0Map-ADJ_B0MAP	1.048576	20-Oct-2020	15:03:53 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	6	1	SINGLEPULSE	02_2_freqAdj_SINGLEPULSE	0.004096	20-Oct-2020	15:05:00 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	7	1	DtiEpi	02_3_DTI_EPI_seg_b0000_13dir	41.28768	20-Oct-2020	15:08:40 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	7	2	DtiEpi	nan	129.7613	20-Oct-2020	15:09:00 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	8	1	SINGLEPULSE	02_4_freqAdj_SINGLEPULSE	0.004096	20-Oct-2020	15:08:25 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	9	1	DtiEpi	02_5_DTI_EPI_seg_b1600_25dir	76.67712	20-Oct-2020	15:04:13 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
1	20200925MG_LAERMRT_MGR0000025	1	9	2	DtiEpi	nan	129.7613	20-Oct-2020	15:04:41 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	1	1	FLASH	01_1_Localizer_CRP	0.393216	20-Oct-2020	14:57:50 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	10	1	DtiEpi	02_7_DTI_EPI_seg_b2500_37dir	112.0666	20-Oct-2020	14:56:04 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	10	2	DtiEpi	nan	129.7613	20-Oct-2020	14:56:29 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	11	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	14:57:36 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	12	1	STEAM	04_2_STEAM_1H_IC_single	0.004096	20-Oct-2020	14:54:36 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	13	1	STEAM	04_3_Localized_shim_MGB	0.004096	20-Oct-2020	14:57:43 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	14	1	STEAM	04_3_STEAM_1H_MGB	0.004096	20-Oct-2020	14:57:16 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	15	1	FieldMap	B0Map-ADJ_B0MAP	1.048576	20-Oct-2020	14:59:45 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	16	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	14:54:32 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	17	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	14:55:28 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	18	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	14:56:48 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	19	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	14:59:15 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	2	1	FLASH	01_2_Localizer_multi_slice	1.10592	20-Oct-2020	14:59:33 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	20	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	14:56:38 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	21	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	14:54:36 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2	20200925MG_LAERMRT_MGR0000027	1	23	1	STEAM	04_2_Localized_shim_IC_single	0.004096	20-Oct-2020	14:55:32 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje

```

2 20200925MG_LAERMRT_MGR000027 1 3 1 RARE 03_T2_TurboRARE_CRP 6.5536 20-Oct-2020 14:57:06 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2 20200925MG_LAERMRT_MGR000027 1 4 1 DtiEpi 02_1_DTI_EPI_seg_b100_6dir 20.64384 20-Oct-2020 14:58:07 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2 20200925MG_LAERMRT_MGR000027 1 4 2 DtiEpi nan 129.7613 20-Oct-2020 14:58:30 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2 20200925MG_LAERMRT_MGR000027 1 5 1 SINGLEPULSE 02_2_freqAdj_SINGLEPULSE 0.004096 20-Oct-2020 14:54:33 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2 20200925MG_LAERMRT_MGR000027 1 6 1 DtiEpi 02_3_DTI_EPI_seg_b900_13dir 41.28768 20-Oct-2020 14:54:49 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2 20200925MG_LAERMRT_MGR000027 1 6 2 DtiEpi nan 129.7613 20-Oct-2020 14:55:18 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2 20200925MG_LAERMRT_MGR000027 1 7 1 SINGLEPULSE 02_4_freqAdj_SINGLEPULSE 0.004096 20-Oct-2020 14:59:22 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2 20200925MG_LAERMRT_MGR000027 1 8 1 DtiEpi 02_5_DTI_EPI_seg_b1600_25dir 76.67712 20-Oct-2020 14:58:47 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2 20200925MG_LAERMRT_MGR000027 1 8 2 DtiEpi nan 129.7613 20-Oct-2020 14:59:07 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje
2 20200925MG_LAERMRT_MGR000027 1 9 1 SINGLEPULSE 02_6_freqAdj_SINGLEPULSE 0.004096 20-Oct-2020 14:54:33 /sc-projects/sc-proj-agtiermrt/Daten-2/mri/proje

```

Here we want to import the TurboRARE-image and the DTI_EPI_seg_b100_6dir-image.
 To visualize the filtered table run the following command (note that the w-struct is used as 1st argument)
`w2=xbruker2nifti(w,0,[],[],'gui',0,'show',1,'flt',{'pro','03_T2_TurboRARE_CRP|EPI_seg_b100'});`
 the table now looks as follows:

```

-----
BRUKER DATA
-----
set SubjectId      StudNo ExpNo PrcNo MRseq  protocol      sizeMB  date      file
1 20200925MG_LAERMRT_MGR000025 1 3 1 RARE 03_T2_TurboRARE_CRP 6.5536 20-Oct-2020 15:05:38 /sc-projects/sc-
1 20200925MG_LAERMRT_MGR000025 1 4 1 DtiEpi 02_1_DTI_EPI_seg_b100_6dir 20.64384 20-Oct-2020 15:08:11 /sc-projects/sc-
2 20200925MG_LAERMRT_MGR000027 1 3 1 RARE 03_T2_TurboRARE_CRP 6.5536 20-Oct-2020 14:57:06 /sc-projects/sc-
2 20200925MG_LAERMRT_MGR000027 1 4 1 DtiEpi 02_1_DTI_EPI_seg_b100_6dir 20.64384 20-Oct-2020 14:58:07 /sc-projects/sc-

```

Now let's import these data, for this just set the 'show'-parameter to 0
`w2=xbruker2nifti(w,0,[],[],'gui',0,'show',0,'flt',{'pro','03_T2_TurboRARE_CRP|EPI_seg_b100'});`

5) VISUALIZE FILES AND FOLDERS

-type dispfiles to see a file by folder matrix in the command-window (see dispfiles for further help)
 dispfiles
 the following is displayed in the CMD-window:

```

-----
FILE x FOLDER
-----
20200925MG_LAERMRT_MGR000025 20200925MG_LAERMRT_MGR000027 counts
=====
02_1_DTI_EPI_seg_b100_6dir_1.nii + + 2/2
03_T2_TurboRARE_CRP_1.nii + + 2/2
counts 2/2 2/2
-----

```

Here we see that in the study's dat-folder now contains two animal-folders
 ("20200925MG_LAERMRT_MGR000025" and "20200925MG_LAERMRT_MGR000027") and each animal contain two files.

6) SELECTION OF ANIMALS

Before renaming files let's first select the animals we want to process:
 Here we select all animals:

```

mdirs=antcb('getallsubjects')
mdirs contains the fullpaths of the selected animals:
{'/sc-projects/sc-proj-agtiermrt/Daten-2/mri/projects/groeschel/dat/20200925MG_LAERMRT_MGR000025'}
{'/sc-projects/sc-proj-agtiermrt/Daten-2/mri/projects/groeschel/dat/20200925MG_LAERMRT_MGR000027'}

```

Alternative selection of all animals:

```

mdirs =antcb('selectdirs',[1:2])
mdirs=antcb('selectdirs','all')

```

7) RENAME FILES

Lets rename '02_1_DTI_EPI_seg_b100_6dir_1.nii' to 'dti_b100.nii'
`xrename(0,'02_1_DTI_EPI_seg_b100_6dir_1.nii','dti_b100.nii',:,'dirs',mdirs);`
 and rename '03_T2_TurboRARE_CRP_1.nii' to 't2.nii'
`xrename(0,'03_T2_TurboRARE_CRP_1.nii','t2.nii',:,'dirs',mdirs);`

Here for safety reasons, we make a copy of the original file and rename the copied fiel (copying and renaming is defined via the colon-sign (:)) as 4th input arg). To really rename the file, keep the 4th arg empty.

Now, check the renaming via dispfiles:

dispfiles

```

-----
FILE x FOLDER
-----

```

```

-----
20200925MG_LAERMRT_MGR000025 20200925MG_LAERMRT_MGR000027 counts
-----
02_1_DTI_EPI_seg_b100_6dir_1.nii + + 2/2
03_T2_TurboRARE_CRP_1.nii + + 2/2
dti_b100.nii + + 2/2
t2.nii + + 2/2
counts 4/4 4/4
-----

```

8) REGISTER “t2.nii” TO TEMPLATE (STANDARD SPACE, SS)

Registration of “t2.nii” to standard space (SS) is done in 4 steps ([1] initialization, [2] rough rigid registration, [3] segmentation and [4] warping). You can perform these steps (‘task’) isolated but must applied in the order. Rough Registration ‘is done automatically (autoreg’, 1), here we use parallel processing across animals ('parfor',1); Please check the memory and number of cores for parfor-processing.

```
xwarp3('batch','task',[1:4 ],'autoreg',1,'parfor',1, 'mdirs',mdirs(:) );
```

-let’s check whether the “t2.nii” is now in standard-space (“x_t2.nii”) and the template (“AVGT.nii”) and atlas (“ANO.nii”) is back-transformed to native-space (“ix_ANO.nii” & “ix_AVGT.nii”) via:

```
dispfiles('flt','^x.*.nii|^ix.*.nii');
```

```

-----
FILE x FOLDER
-----
20200925MG_LAERMRT_MGR000025 20200925MG_LAERMRT_MGR000027 counts
-----
ix_ANO.nii + + 2/2
ix_AVGT.nii + + 2/2
x_t2.nii + + 2/2
counts 3/3 3/3
-----

```

9) Extract the first 3d-volume from the 4D-vlume 'dti_b100.nii'

Use the following command to extract the 1st volume (4th input arg) of 'dti_b100.nii' and save as 'dti_b100_1stIMG.nii' for all animals (mdirs):

```
xrename(0,'dti_b100.nii','dti_b100_1stIMG.nii','1','dirs', mdirs );
```

and check existence of file via:

```
dispfiles('flt','^dt')
```

```

-----
FILE x FOLDER
-----
20200925MG_LAERMRT_MGR000025 20200925MG_LAERMRT_MGR000027 counts
-----
dti_b100.nii + + 2/2
dti_b100_1stIMG.nii + + 2/2
counts 2/2 2/2
-----

```

10) COREGISTER 'dti_b100_1stIMG.nii' to ‘t2.nii’

Now lets coregister the file 'dti_b100_1stIMG.nii' to the ‘t2.nii’-image:

```

z=[];
z.TASK={ '[2]' };
z.targetImg1={ 't2.nii' };           ;% TARGET-IMAGE
z.sourceImg1={ 'dti_b100_1stIMG.nii' }; ;% SOURCE-IMAGE
z.sourceImgNum1=[1];                 ;% IN CASE OF 4D-vol use 1st 3d-volume of SOURCE
z.applyImg1= "                       ; % TRAFO IS NOT APPLIED TO OTHER Images here
z.cost_fun='nmi';
z.sep=[7 2 1 0.5 0.1 0.05];
z.tol=[0.01 0.01 0.01 0.001 0.001 0.001];
z.fwhm=[4 4];
z.centering=[0];
z.reslicing=[1];                     ;% OUTPUT-IMAGE IS RESLICED TO MATCH WITH TARGET
z.interpOrder='auto';
z.prefix='r3';                        ;% OUTPUT FILE-PREFIX
z.warping=[0]; %WARPING IS "OFF"
z.isparallel=1;                       ;% PARALLEL PROCESSING ENABLED
xcoreg(0,z, mdirs);

```

check existence of file:

```
dispfiles('flt','^r3')
```

FILE x FOLDER			
	20200925MG_LAERMRT_MGR000025	20200925MG_LAERMRT_MGR000027	counts
r3c_dti_b100_1stIMG.nii	+	+	2/2
r3c_t2.nii	+	+	2/2
counts	2/2	2/2	

11) TRANSFORM ANOTHER IMAGE TO STANDARD-SPACE

Now, we want to transform the image “r3c_dti_b100_1stIMG.nii” to standard-space (1st arg: 1) for all selected animals (mdirs), using b-spline interpolation (4th arg: 4), with local reorientation estimated from the rough rigid registration step (5th arg: ‘local’) and that the input-file is located in the animal folder (6th arg: struct('source','intern')). This will create the file “x_r3c_dti_b100_1stIMG.nii”:

```
fis=doelastix(1, mdirs,{r3c_dti_b100_1stIMG.nii},4,'local',struct('source','intern'));
```

check existence of the file “x_r3c_dti_b100_1stIMG.nii”:

```
dispfiles('flt','x_*')
```

FILE x FOLDER			
	20200925MG_LAERMRT_MGR000025	20200925MG_LAERMRT_MGR000027	counts
ix_ANO.nii	+	+	2/2
ix_AVGT.nii	+	+	2/2
ix_AVGThemi.nii	+	+	2/2
x_r3c_dti_b100_1stIMG.nii	+	+	2/2
x_t2.nii	+	+	2/2
counts	5/5	5/5	

12) TRANSFORM ANOTHER IMAGE TO NATIVE-SPACE

In the same way we could also bring the template’s hemispheric mask (‘AVGThemi.nii’) to native space (‘ix_AVGThemi.nii’). For transformation to native space the 1st arg is -1, we use NN-interpolation to preserve numbers (4th arg: 0):

```
fis2=doelastix(-1, mdirs,{AVGThemi.nii},0,'local',struct('source','intern'));
```

check existence of the file ‘ix_AVGThemi.nii’:

```
dispfiles('flt','ix_*')
```

FILE x FOLDER			
	20200925MG_LAERMRT_MGR000025	20200925MG_LAERMRT_MGR000027	counts
ix_ANO.nii	+	+	2/2
ix_AVGT.nii	+	+	2/2
ix_AVGThemi.nii	+	+	2/2
counts	3/3	3/3	

13) CHECK REGISTRATION in STANDARD-SPACE - CREATE HTML-FILE

Next we create an HTML-file to visualize the overlay of the template “AVGT.nii” and “x_t2.nii” (animal in standard-space). The 3rd arg defines the output-folder, the 4th input, defines the size of the images and the number of slices to visualize:

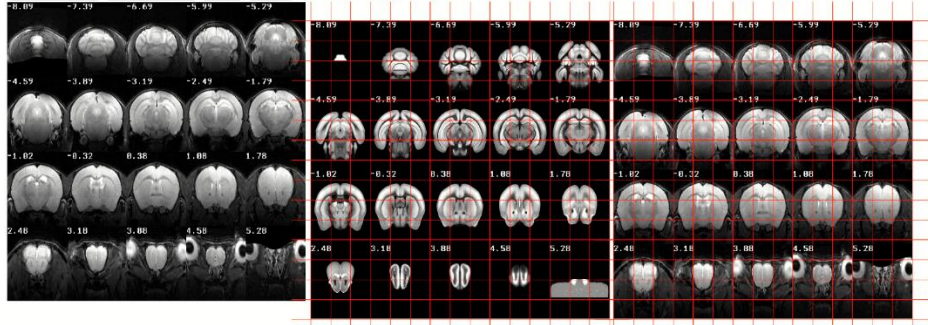
```
checkreghtml(mdirs,{AVGT.nii,'x_t2.nii'},fullfile(pwd,'checks'),struct('size',300,'slices','n20'))
```

Now you can copy the checks-folder and visualize the registration with your Web-browser (1st image: animated gif, 2nd image: 'AVGT.nii', 3rd image: 'x_t2.nii')

[\[AVGT.nii-x_t2.nii\]](#)

1) 20200925MG_LAERMRT_MGR000025

start animation stop animation -zoom +zoom click image to toggle images

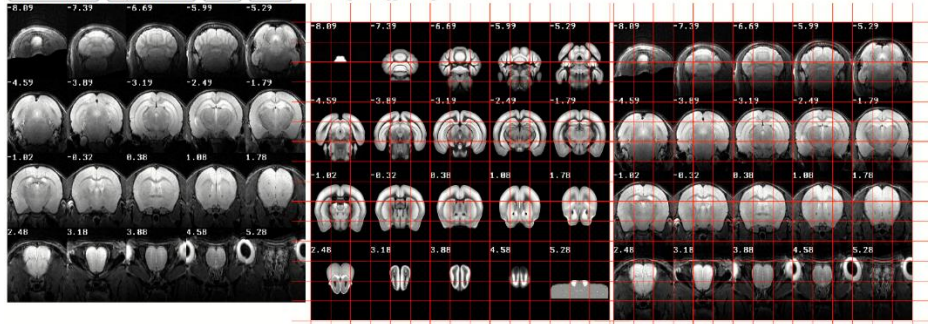


/sc-projects/sc-proj-agtlermrt/Daten-2/mri/projects/groeschel/dat/20200925MG_LAERMRT_MGR000025/AVGT.nii
/sc-projects/sc-proj-agtlermrt/Daten-2/mri/projects/groeschel/dat/20200925MG_LAERMRT_MGR000025/x_t2.nii

AVGT.nii; DIM: [164 212 158]
0.07000 0 0 -5.745
0 0.07000 0 -0.804
0 0 0.07000 -0.520

2) 20200925MG_LAERMRT_MGR000027

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/sc-projects/sc-proj-agtlermrt/Daten-2/mri/projects/groeschel/dat/20200925MG_LAERMRT_MGR000027/AVGT.nii
/sc-projects/sc-proj-agtlermrt/Daten-2/mri/projects/groeschel/dat/20200925MG_LAERMRT_MGR000027/x_t2.nii

AVGT.nii; DIM: [164 212 158]
0.07000 0 0 -5.745
0 0.07000 0 -0.804
0 0 0.07000 -0.520

14) CHECK REGISTRATION in NATIVE-SPACE - CREATE HTML-FILE

In the same, we can create the overlay of "t2.nii" and "ix_AVGT.nii" and save it as HTML-file.

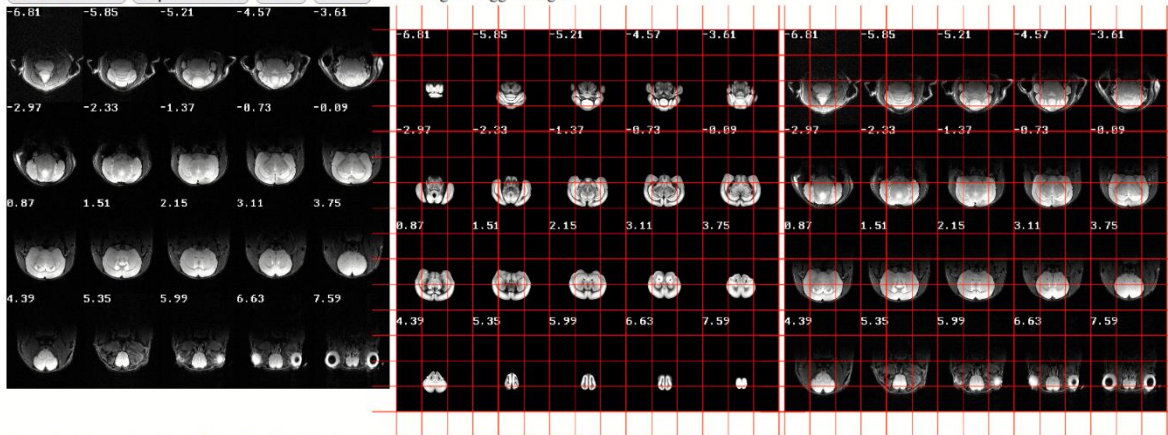
Note, here the slicing is done from the 1st-dimension ('dim': 1)

```
checkreghtml(mdirs,{'ix_AVGT.nii','t2.nii'},fullfile(pwd,'checks'),struct('size',300,'slices','n20','dim',1))
```


[ix_AVGT.nii-t2.nii]

1) 20200925MG_LAERMRT_MGR000025

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/sc-projects/sc-proj-agtiermrt/Daten-2/mri/projects/groeschel/dat/20200925MG_LAERMRT_MGR000025/ix_AVGT.nii
/sc-projects/sc-proj-agtiermrt/Daten-2/mri/projects/groeschel/dat/20200925MG_LAERMRT_MGR000025/t2.nii

ix_AVGT.nii; DIM: [256 256
0.07500 0 0 -10.5
0 0.07500 0 -9.76
0 0 0.3200 -7.77

2) 20200925MG_LAERMRT_MGR000027

start animation stop animation -zoom +zoom click image to toggle images

