



JISTOTA MODERNÍ MEDICÍNY

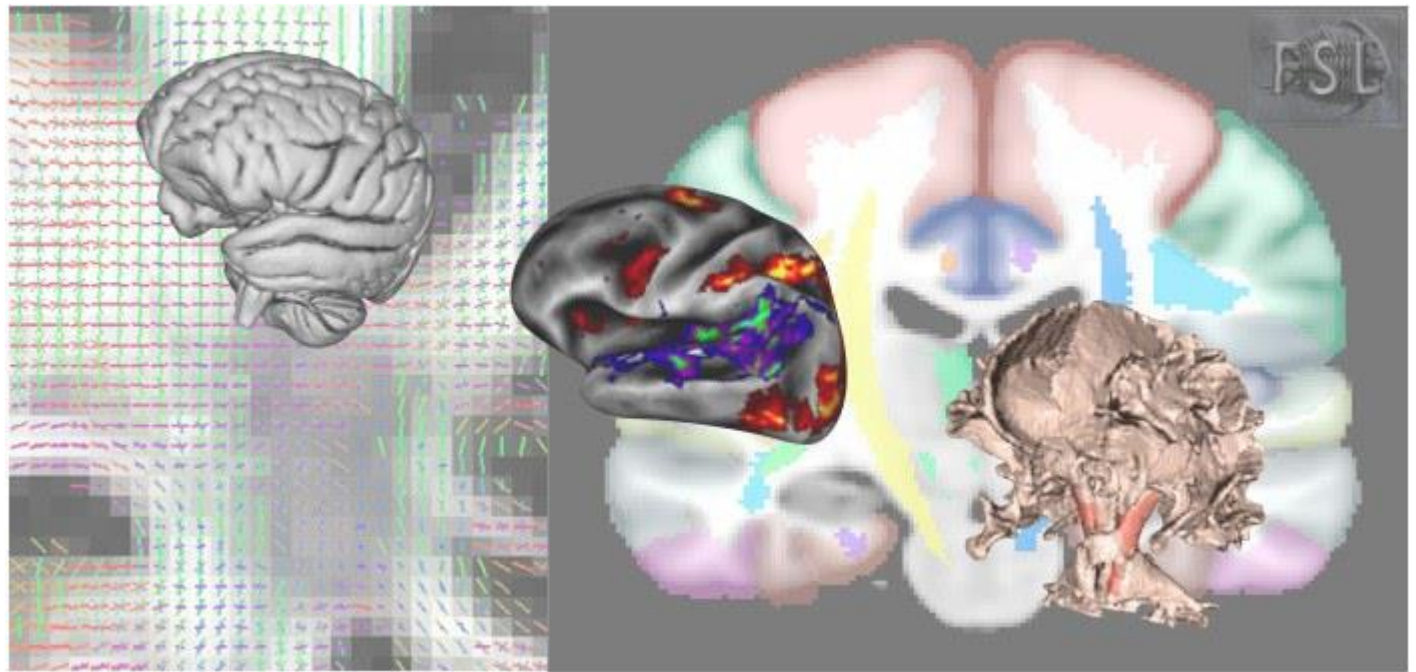
FSL

Nástroj pro automatické zpracování
neurologických obrazových dat

Jiří Trnka

FSL

- **FMRI Software Library**
- **Oxford Centre for Functional MRI of the Brain**



FSL

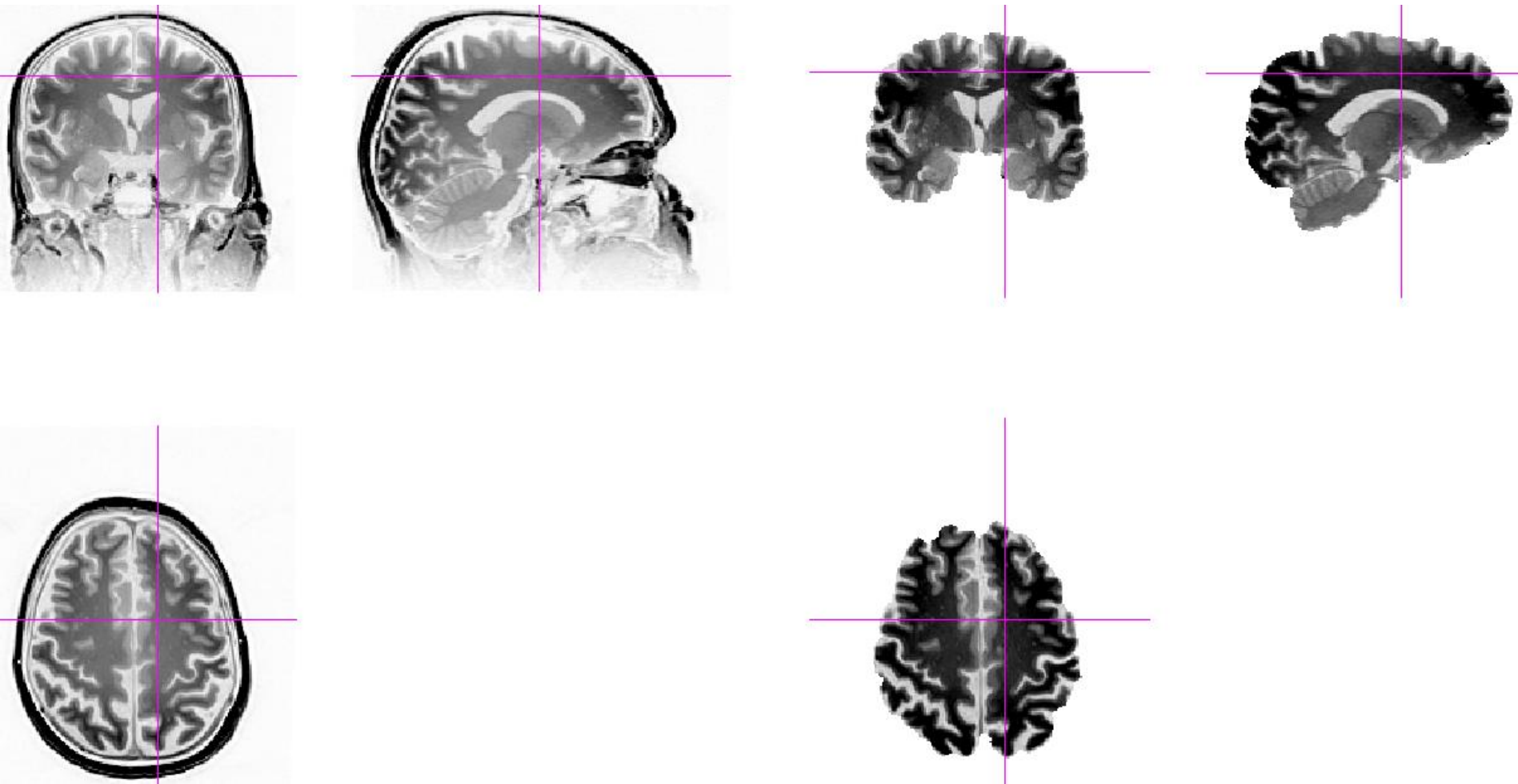
- Functional MRI
- Structural MRI
- Diffusion MRI
- GLM / Statistics



Structural MRI

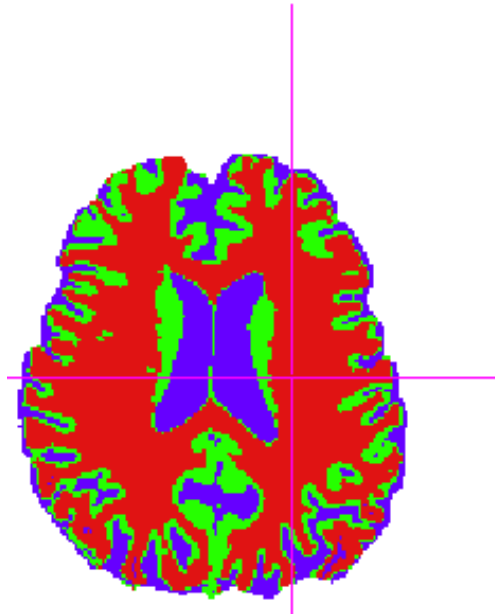
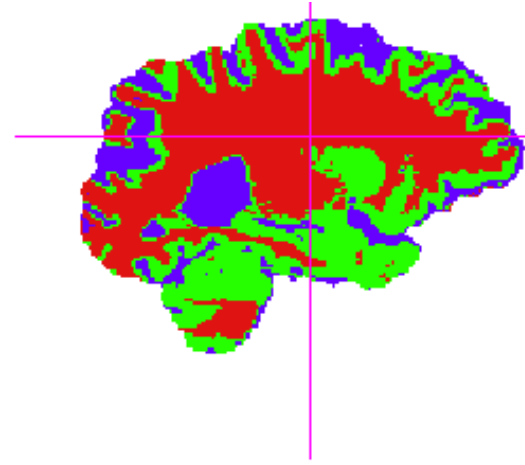
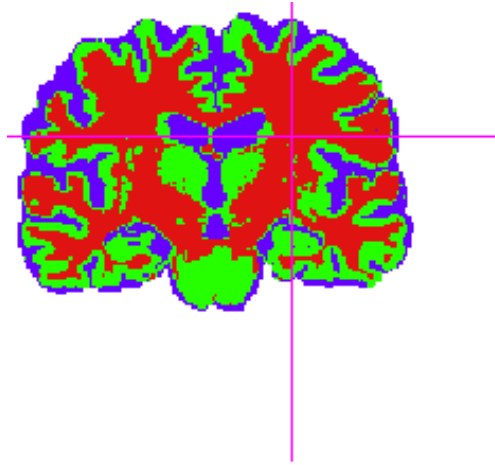
- Brain Extraction Tool
BET
- FMRI's Automated Segmentation Tool
FAST
- FMRI's Integrated Registration and Segmentation Tool
FIRST
- FMRI's Linear Image Registration Tool
FLIRT

Brain Extraction Tool **BET**



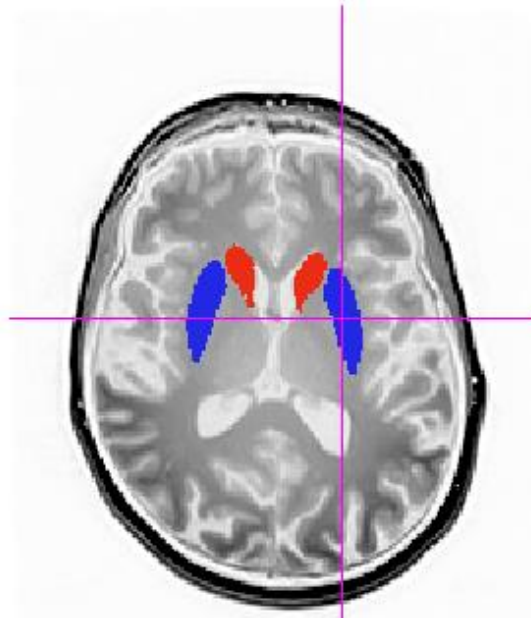
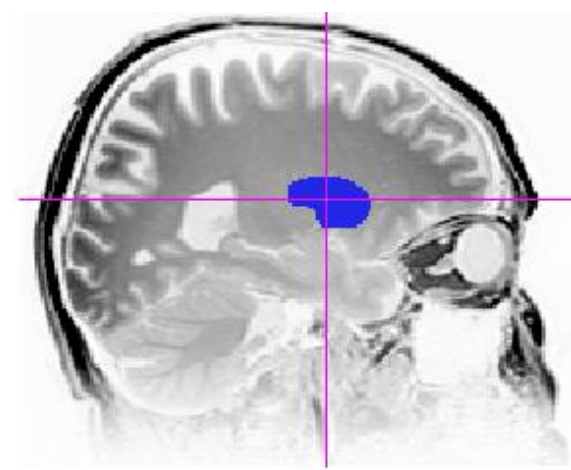
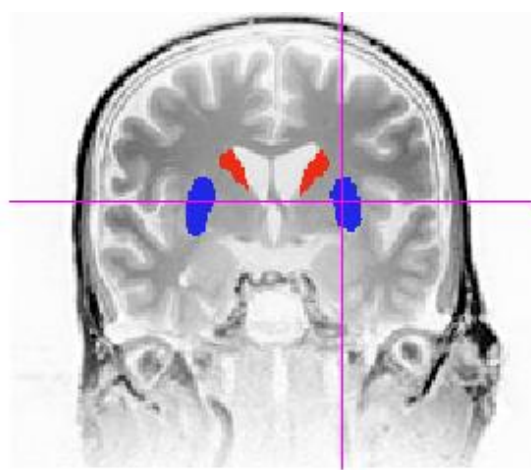
Automated Segmentation Tool

FAST



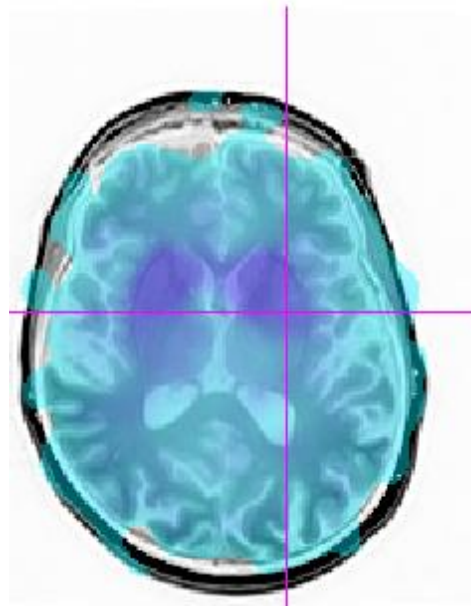
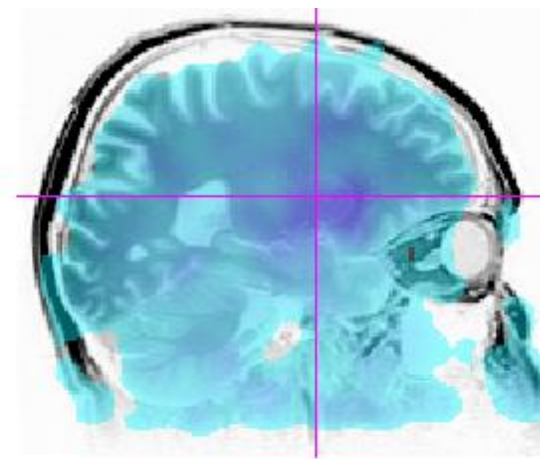
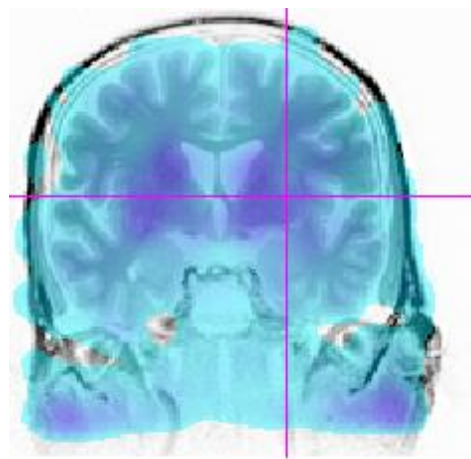
Integrated Registration and Segmentation Tool

FIRST

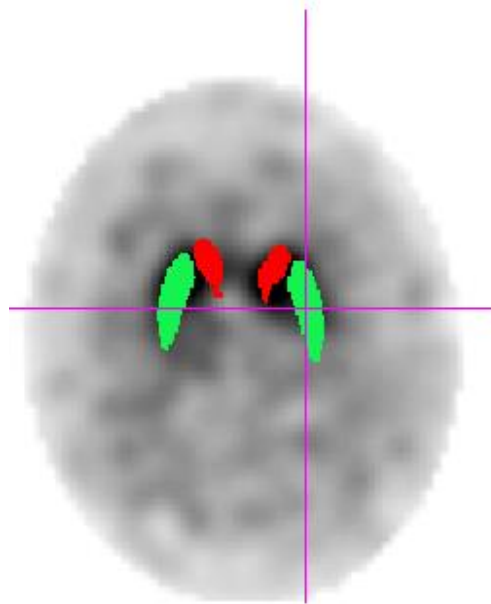
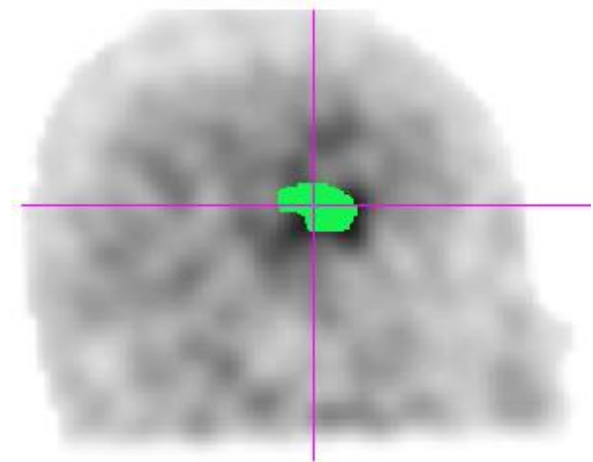
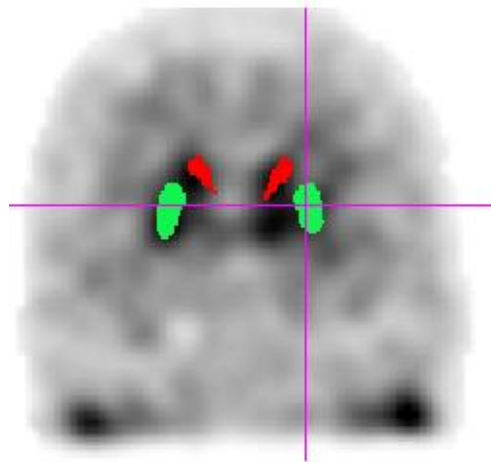


Linear Image Registration Tool

FLIRT



Masking Arithmetics Statistics



Instalace

- Zdarma
- Většina jako free open source software
- Binárky pro
 - Mac OSX
 - Linux (Debian/Ubuntu)
- NeuroDebian projekt

neuro.debian.net

Get NeuroDebian

First select what kind of operating system you are using, and then choose a download server close to you:

Ubuntu 14.04 "Trusty Tahr" (trusty) ▼

Select your operating system

MS Windows (32bit)

MS Windows (64bit)

Mac OS X

Debian GNU/Linux 6.0 (squeeze)

Debian GNU/Linux 7.0 (wheezy)

Debian GNU/Linux 8.0 (jessie)

Debian testing (stretch)

Debian unstable (sid)

Ubuntu 12.04 LTS "Precise Pangolin" (precise)

Ubuntu 14.04 "Trusty Tahr" (trusty)

Ubuntu 16.04 "Xenial Xerus" (xenial)

Ubuntu 16.10 "Yakkety Yak" (yakkety)

Germany (University of Magdeburg) ▼

system by simply copying and pasting the following two commands into a terminal window. 1

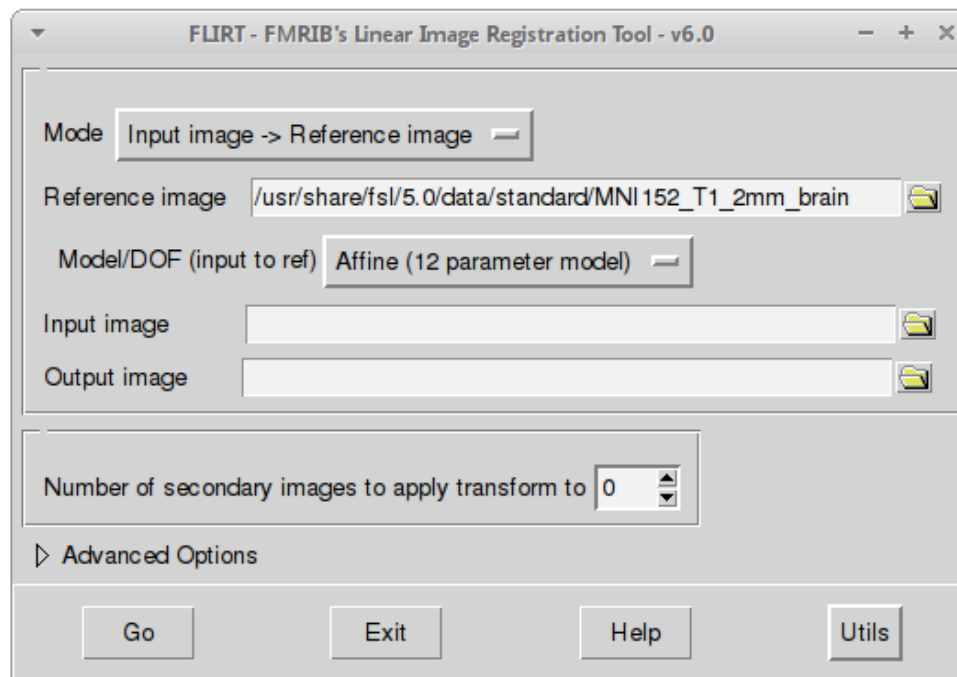
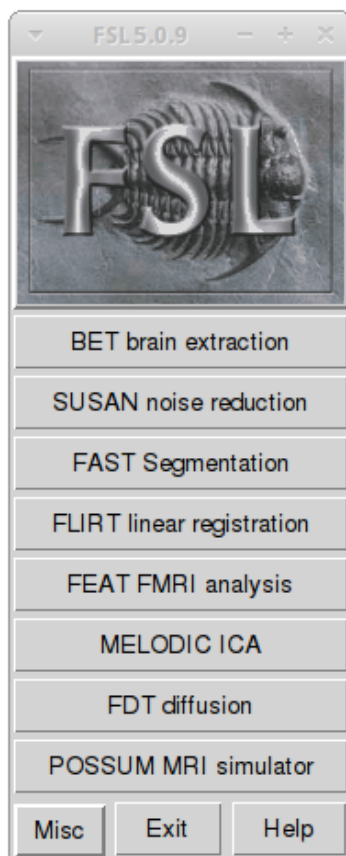
```
curl -s https://neuro.debian.net/debian/trusty/de-md.full | sudo tee /etc/apt/sources.list.d/neurodebian.sources.list  
sudo apt-key adv --keyserver hkp://pgp.mit.edu:80 --recv-keys 0xA5D32F012649A5A9
```

now you can update the package index and you are ready to install packages. Simply execute the following command in a terminal:

```
sudo apt-get update
```



Spouštění - GUI



Spouštění - CLI

fsl5.0-avscale	fsl5.0-fsl2ascii	fsl5.0-imrm	fsl5.0-siena_cal
fsl5.0-avw2fsl	fsl5.0-fsl_abspath	fsl5.0-imtest	fsl5.0-siena_diff
fsl5.0-b0calc	fsl5.0-fsladd	fsl5.0-InvertXFM	fsl5.0-siena_flirt
fsl5.0-basil	fsl5.0-fsl_anat	fsl5.0-invfeatreg	fsl5.0-siena_flow2std
fsl5.0-basil_var	fsl5.0-fslanimate	fsl5.0-invwarp	fsl5.0-sienax
fsl5.0-baycest	fsl5.0-fslascii2img	fsl5.0-invwarp_exe	fsl5.0-sigloss
fsl5.0-bedpost	fsl5.0-fsl_boxplot	fsl5.0-label2surf	fsl5.0-signal2image
fsl5.0-bedpostx	fsl5.0-fslcc	fsl5.0-lesion_filling	fsl5.0-sliceanimate
fsl5.0-bedpostx_datacheck	fsl5.0-fslchfiletype	fsl5.0-mainfeatreg	fsl5.0-slicer
fsl5.0-bedpostx_postproc.sh	fsl5.0-fslchfiletype_exe	fsl5.0-make_dyadic_vectors	fsl5.0-slices
fsl5.0-bedpostx_preproc.sh	fsl5.0-fslchpixmap	fsl5.0-Make_flobs	fsl5.0-slicesdir
fsl5.0-bedpostx_single_slice.sh	fsl5.0-fslcomplex	fsl5.0-makerot	fsl5.0-slicesmask
fsl5.0-bet	fsl5.0-fslcorrecthd	fsl5.0-maskdyads	fsl5.0-slices_summary
fsl5.0-Bet	fsl5.0-fslcpgeom	fsl5.0-match_smoothing	fsl5.0-slicetimer

fsl5.0-flirt -in mri.nii.gz -ref ../MNI152_T1_1mm.nii.gz -omat __mri2mni.mat

fsl5.0-ccops	fsl5.0-fslerrorreport	fsl5.0-medianfilter	fsl5.0-std2imgcoord
fsl5.0-checkFEAT	fsl5.0-fslfft	fsl5.0-melodic	fsl5.0-surf2surf
fsl5.0-cluster	fsl5.0-fslFixText	fsl5.0-Melodic	fsl5.0-surf2volume
fsl5.0-cluster2html	fsl5.0-fsl_glm	fsl5.0-midtrans	fsl5.0-surface_fdr
fsl5.0-concat_bvars	fsl5.0-fsl_gui	fsl5.0-mm	fsl5.0-surf_proj
fsl5.0-ConcatXFM	fsl5.0-fslhd	fsl5.0-morph_kernel	fsl5.0-susan
fsl5.0-connectedcomp	fsl5.0-fsl_histogram	fsl5.0-mp_diffpow.sh	fsl5.0-Susan
fsl5.0-contrast_mgr	fsl5.0-fslinfo	fsl5.0-mvntool	fsl5.0-swap_subjectwise
fsl5.0-convertwarp	fsl5.0-fslinterleave	fsl5.0-new_invwarp	fsl5.0-swap_voxelwise
fsl5.0-convert_xfm	fsl5.0-fslmaths	fsl5.0-Nudge	fsl5.0-systemnoise
fsl5.0-create_lut	fsl5.0-fslmeans	fsl5.0-old_betall	fsl5.0-tbss_1_preproc
fsl5.0-cutoffcalc	fsl5.0-fslmerge	fsl5.0-overlay	fsl5.0-tbss_2_reg
fsl5.0-design_ttest2	fsl5.0-fslmodhd	fsl5.0-oxford_asl	fsl5.0-tbss_3_postreg
fsl5.0-distancemap	fsl5.0-fsl_motion_outliers	fsl5.0-pairreg	fsl5.0-tbss_4_prestats
fsl5.0-drawmesh	fsl5.0-fsl_mvln	fsl5.0-perfusion_subtract	fsl5.0-tbss_deproject
fsl5.0-dtfit	fsl5.0-fslnvols	fsl5.0-pngappend	fsl5.0-tbss_fill
fsl5.0-dtigen	fsl5.0-fslorient	fsl5.0-Pnm	fsl5.0-tbss_non_FA



Skriptování (CLI)

```
echo -e -n "${BLUE}performing partial volume correction (pvc) ... ${NC}"
if [ -e datscan_reg_final_pvc.nii.gz ]
then
    echo -e "${BLUE}already done${NC}"
else
    echo ""
    if [ -e param_bet.txt ]
    then
        com="fsl5.0-bet mri.nii.gz __mri_bet.nii.gz -f `awk '{print \$1}' param_bet.txt` -g `awk '{print \$2}' param_bet.txt`; echo "$ $com"; eval $com;
    else
        com="fsl5.0-bet mri.nii.gz __mri_bet.nii.gz -f 0.4"; echo "$ $com"; eval $com;
    fi
    com="fsl5.0-fslmaths datscan_reg_final.nii.gz -mas __mri_bet.nii.gz __datscan_reg_final_mask_brain.nii.gz"; echo "$ $com"; eval $com;

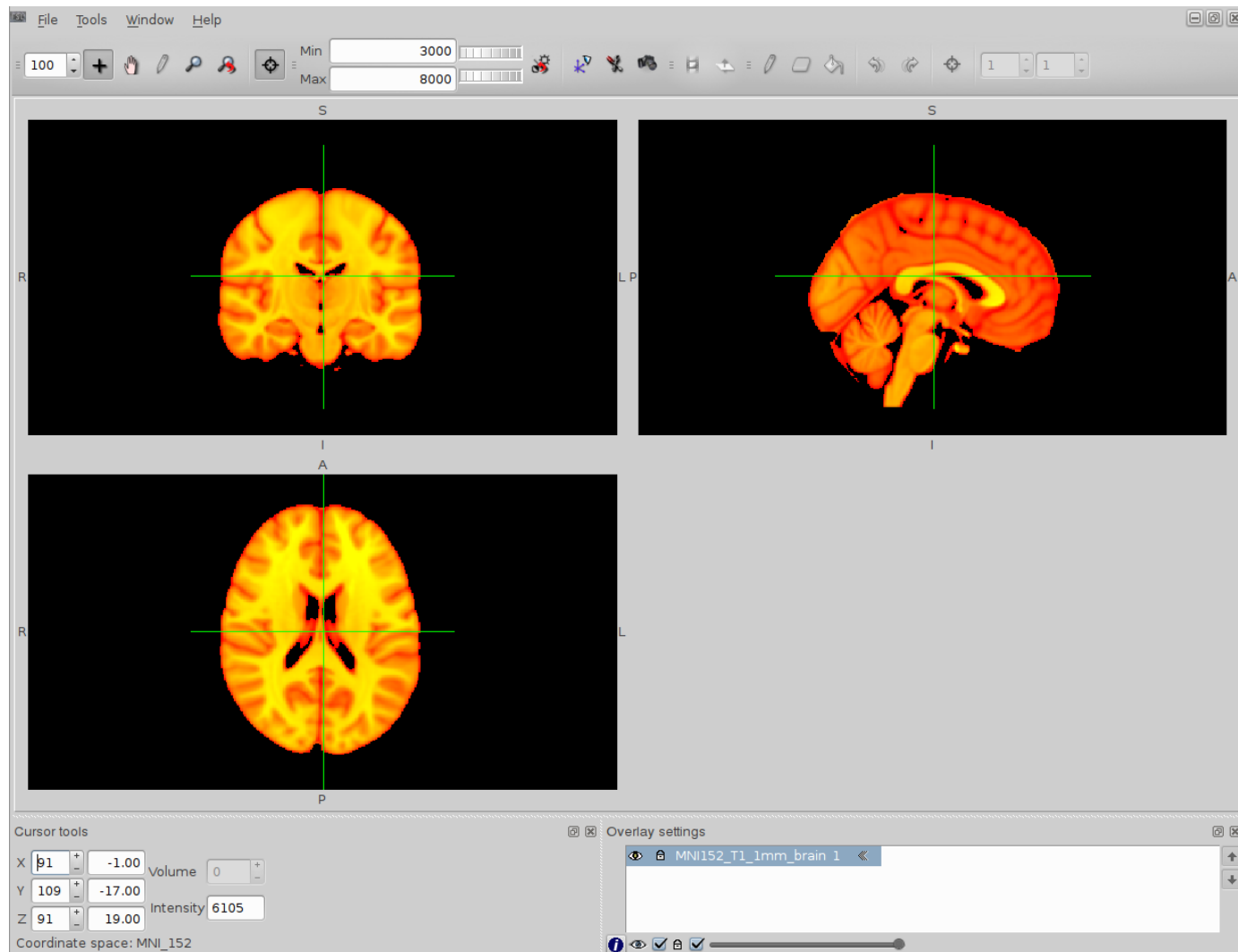
    com="fsl5.0-fslmaths __mri_bet.nii.gz -binv __mask_brain_background.nii.gz"; echo "$ $com"; eval $com;
    com="fsl5.0-fslmaths __mask_brain_background.nii.gz -add ganglia_all_fast_firstseg.nii.gz -binv __mask_brain_rest.nii.gz"; echo "$ $com"; eval $com;

    com="fsl5.0-fslmaths ganglia_all_fast_firstseg.nii.gz -thr 11 -uthr 11 -bin __mask_L_caud"; echo "$ $com"; eval $com;
    com="fsl5.0-fslmaths ganglia_all_fast_firstseg.nii.gz -thr 12 -uthr 12 -bin __mask_L_puta"; echo "$ $com"; eval $com;
    com="fsl5.0-fslmaths ganglia_all_fast_firstseg.nii.gz -thr 50 -uthr 50 -bin __mask_R_caud"; echo "$ $com"; eval $com;
    com="fsl5.0-fslmaths ganglia_all_fast_firstseg.nii.gz -thr 51 -uthr 51 -bin __mask_R_puta"; echo "$ $com"; eval $com;

    com="fsl5.0-fslmerge -tr __pvcmask.nii.gz __mask_brain_background.nii.gz __mask_brain_rest.nii.gz __mask_L_caud.nii.gz __mask_L_puta.nii.gz __mask_R_caud.nii.gz"; echo "$ $com"; eval $com;
    com="petpvc -i __datscan_reg_final_mask_brain.nii.gz -o datscan_reg_final_pvc.nii.gz -m __pvcmask.nii.gz -x 10 -y 10 -z 10 -p RBV"; echo "$ $com"; eval $com;
    echo -e "${GREEN}finished${NC}"
fi
```



FSL View



Děkuji za pozornost.

Kontakt:

Ing. Jiří Trnka, Ph.D

Oddělení radiační ochrany

Tel.: +420 224 965 969

E-mail: jiri.trnka@vfn.cz



Radiodiagnostická klinika a Ústav nukleární medicíny 1. LF UK a VFN v Praze
si dovolují Vás pozvat na přednášku

Maryellen L. Giger, Ph.D.

A. N. Pritzker Professor of Radiology

The University of Chicago

Chicago, Illinois, USA, &

Editor-in-Chief, Journal of Medical Imaging (SPIE)

Quantitative Radiomics and Deep Learning in Cancer Imaging for Precision Medicine

v úterý 25. 4. 2017 v 15 hod. v posluchárně ÚNM - U nemocnice 5, Praha 2
(zvýšené přízemí vlevo)