# **3D-UTE-GRASP reconstruction procedure (PV360 v3.3)**

## Requirement: hardware and software system

1. High performance computing cluster, unix/linux system
2. **GPU** support
3. **Slurm** workload manager
4. Software packages and version used: **matlab(2016b)**, **CUDA(8.0.44)**, **cmake(gnu/3.11.4)**, **doxygen(gnu/1.8.13)**

## Folder structure

Base folder: **Recon\_3DUTEGRASP\_PV360**

|  |  |
| --- | --- |
| **Folder** | **Description** |
| **gpuNUFFT-master** | GPU NUFFT operator **(old release used)**  Latest version can be found here, but has some issues  https://github.com/andyschwarzl/gpuNUFFT |
| **Recon\_Scripts** | 3D\_UTE\_GRASP reconstruction Matlab scripts and Slurm script  gpuNUFFT function needs gpuNUFFT complied mex file support |
| **Recon\_Data** | Reconstruction data folder  Build a separate sub folder for each scan and copy the **acqp/method/** **rawdata.job0/traj** files to each sub folder |

## Folder copy

Copy the whole folder, **Recon\_3DUTEGRASP\_PV360**, to the high performance computer

## Compile gpuNUFFT package for mex files

1. Modify **/gpuNUFFT-master/CUDA/CMakeList.txt**:   SET(MATLAB\_ROOT\_DIR "**/share/apps/matlab/2016b(Your matlab installation directory)**" CACHE STRING "MATLAB Installation Directory")
2. Go to **/gpuNUFFT-master/CUDA/build** directory
3. Command line “**module load cmake/gnu/3.11.4**” to load cmake
4. Command line “**module load matlab/2016b**” to load matlab
5. Command line “**module load cuda/8.0.44**” to load cuda
6. Command line “**module load doxygen/gnu/1.8.13**” to load doxygen

(use “**module list**” to list all the packages loaded)

(use “**module avail**” to list all the packages available)

1. Go to **/gpuNUFFT-master/CUDA/build** directory, command line “**cmake ..**” and then “**make**”
2. The five mex files are written into **gpuNUFFT-master/CUDA/bin/mex\_gpu\*** and **gpuNUFFT-master/gpuNUFFT/@gpuNUFFT/private/mex\_gpu\***
3. Copy the five mex files above to **Recon\_Scripts/@MCGPUNUGGT2/private/**

## Running the reconstruction task:

1. Modify **Processing\_Script.m** and **Processing\_Script.s** to your scan settings, including scan name, reconstruction resolution, paths, etc.
2. Go to **Recon\_3DUTEGRASP\_PV360/Recon\_Scripts/** directory
3. Command line **sbatch Processing\_script.sh**

## File description:

**Recon\_Scripts/**: Matlab scripts for the reconstruction

**@MCGPUNUFFT2**: multi coils GPU NUFFT operator

**@TV\_Temp3D**: Total variation function

**adapt\_array\_3d.m**: function

**CSL1NlCg\_4DRadial.m**: function

**Fcn\_Bruker\_Method.m**: function

**Fcn\_Compute\_Voronoi\_DCF.m**: function

**Fcn\_Extract\_From\_FID.m**: function

**Fcn\_Recon\_3D\_UTE\_GRASP.m**: function

**Fcn\_write\_analyze.m**: function

**Processing\_Script.m**: main script

**Processing\_Script.sh**: slurm job submission script

**Recon\_Data/**: Data storage folder

**P230731\_SingleEcho/**: scan folder (single echo acquisition)

(files from scan)

**acqp**: acqp file from scan

**method**: method file from scan

**rawdata.job0**: fid file from scan

**traj**: trajectory file from scan

(files saved in reconstruction in matlab .mat file)

**P230731\_SingleEcho\_rawdata.mat**: trajectory “*k*” and raw fid data “*rawdata*”

**P230731\_SingleEcho\_T005\_DCF.mat**: density compensation function, “*DCF.frame*” [nFrame, nPointsPereTrajectory, nTrajecotryPerFrame]

**/echo1/P230731\_SingleEcho\_T005\_CoilSens.mat**: coil sensitivity map [nx, ny, nz, nReceiver]

**/echo1/P230731\_SingleEcho\_T005\_ReconNUFFT.mat**: reconstructed 4D matrix “*recon\_cs*“ (complex)[nx, ny, nz, nFrame]

**P230731\_SingleEcho\_T005\_ReconGRASP.mat**: reconstructed 4D matrix “*recon\_cs*“ (real) [nx, ny, nz, nFrame]

(files saved in reconstruction in analyze format for display)

**P230731\_SingleEcho\_T005\_ReconGRASP\_3D.img&hdr**: analyze file display the last 3D frame

**P230731\_SingleEcho\_T005\_ReconGRASP\_Axial.img&hdr**: Dynamic frames of axial center slice

**P230731\_SingleEcho\_T005\_ReconGRASP\_Sagittal.img&hdr**: Dynamic frames of sagittal center slice

**P230731\_SingleEcho\_T005\_ReconGRASP\_Coronal.img&hdr**: Dynamic frames of coronal center slice

**Recon\_Data/**: Data storage folder

**P230713\_DualEcho/**: scan folder (dual echo acquisition)

(files from scan)

**acqp**: acqp file from scan

**method**: method file from scan

**rawdata.job0**: fid file from scan

**traj**: trajectory file from scan

**/echo1/** reconstructed echo 1 images

**/echo2/** reconstructed echo 2 images