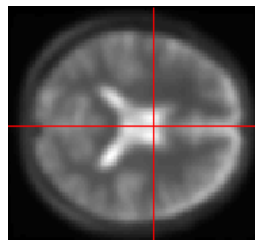


Tutorial

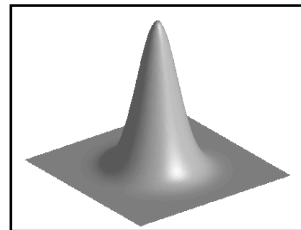
**Preprocessing Checks/
Research question and GLM**

Image time-series



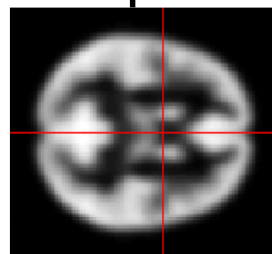
Realignment

Kernel



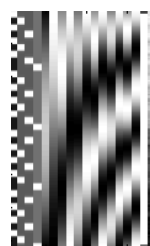
Smoothing

Normalisation

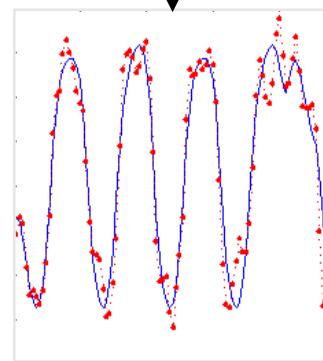


Template

Design matrix

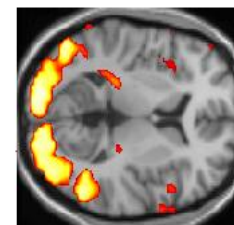
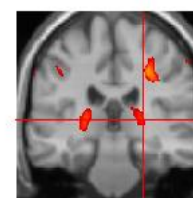
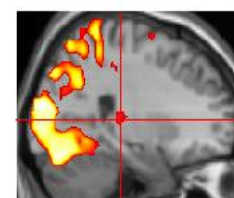


General linear model



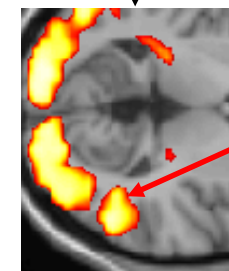
Parameter estimates

Statistical parametric map (SPM)



Statistical inference

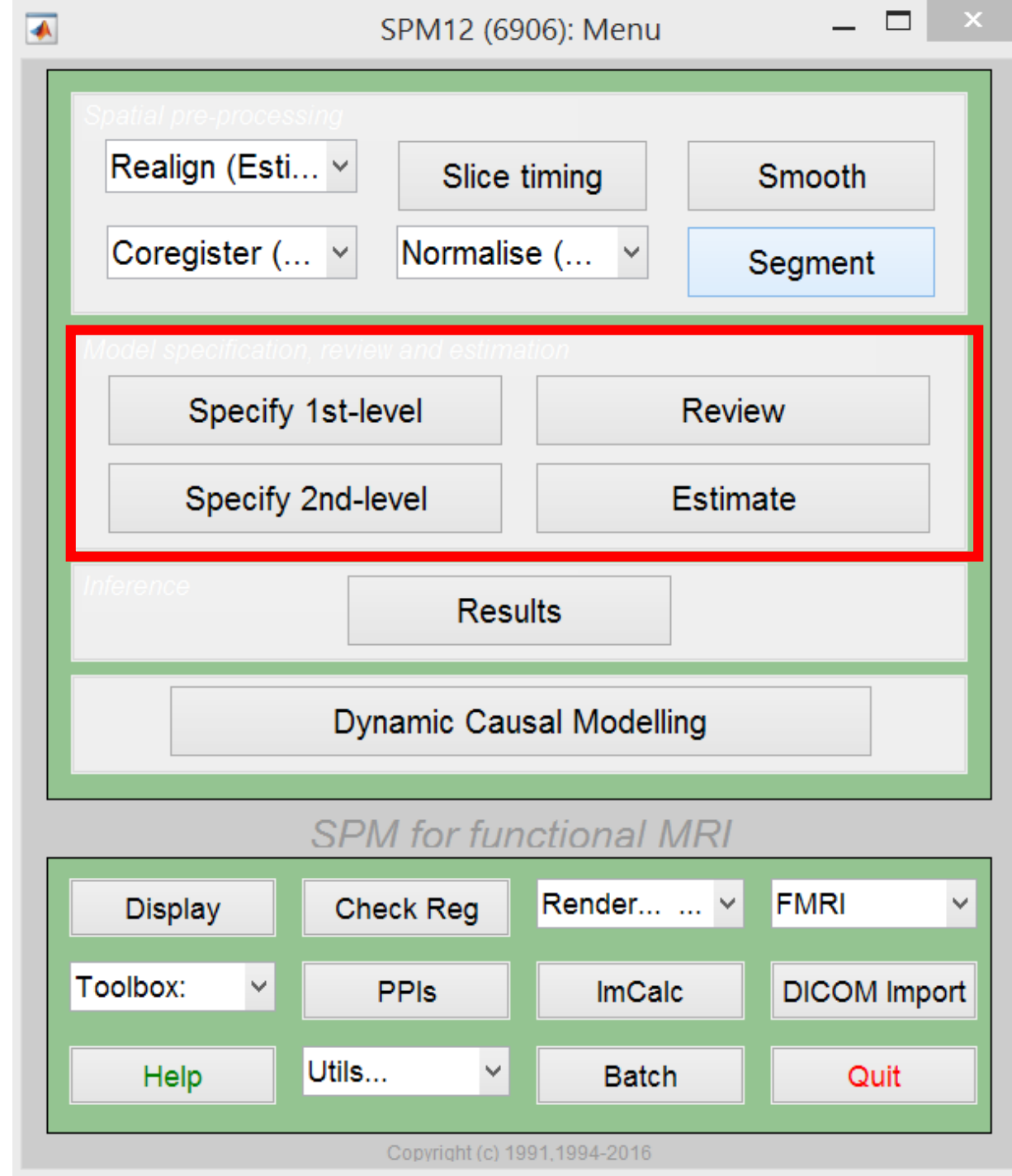
Gaussian field theory



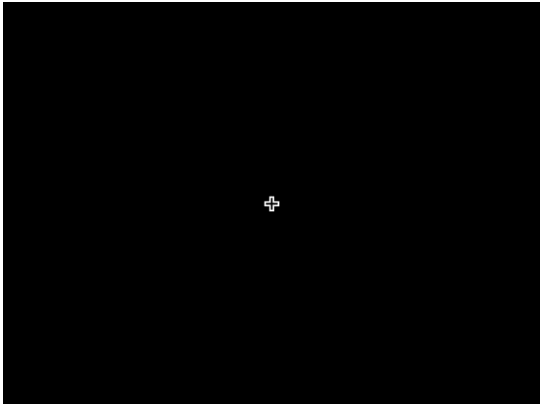
$p < 0.05$

SPM main menu

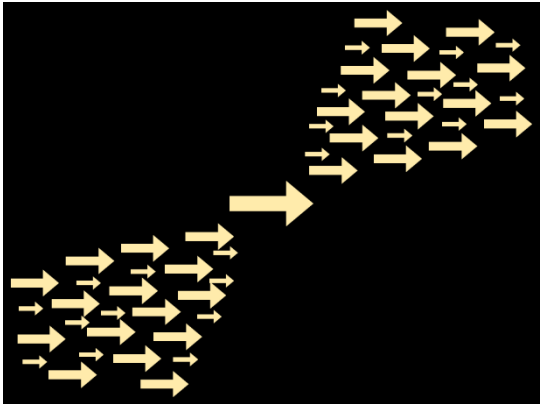
- Modeling data, performing statistics on the fMRI data.



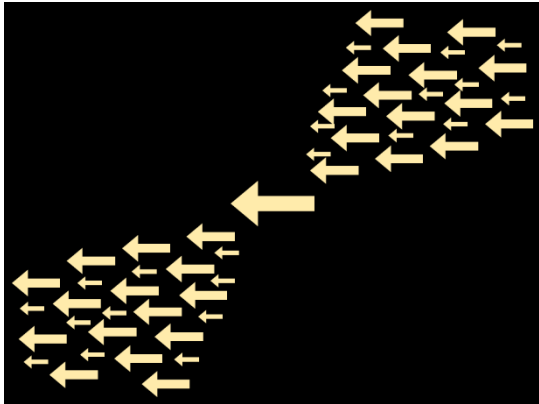
Task



Fixation



Press right

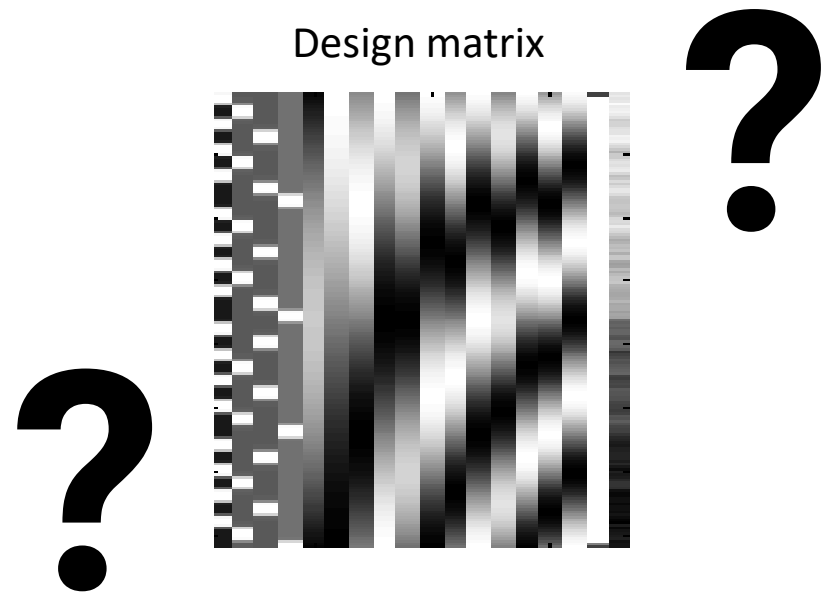


Press left

Task

What questions can we answer with this data set?

- Formulate research question
- Derive hypotheses
- How would your GLM look like?



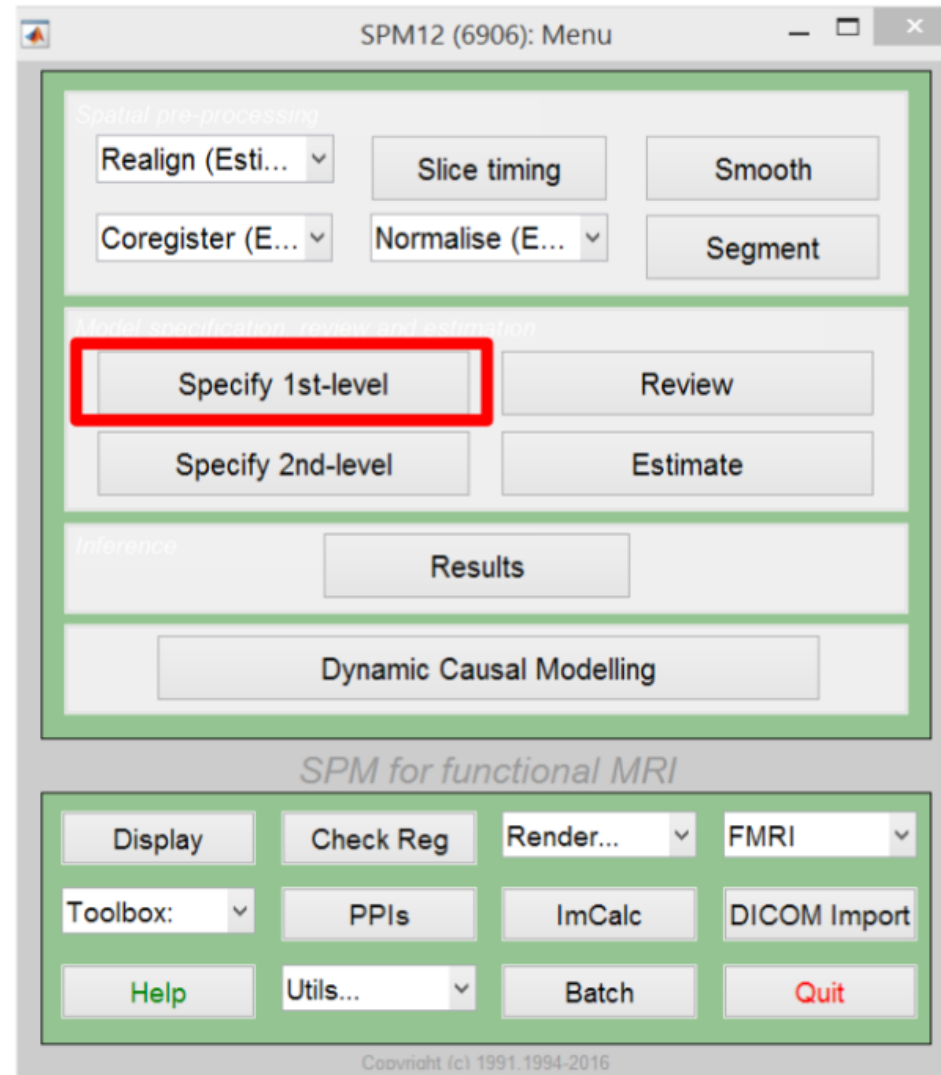
Preparation

- If you still have the files from the preprocessing ready on your computer, you do not need to do anything.
- If not you can do the following:
 - For Sub01 copy the raw functional scans from scandata to functional, and the raw structural scan from scandata to structural
 - Open MATLAB, add path to SPM12, go to the folder where you have saved the function “teach_prepro_subject.m” and type:
`teach_prepro_subject('path/to/Sub01', 1);`

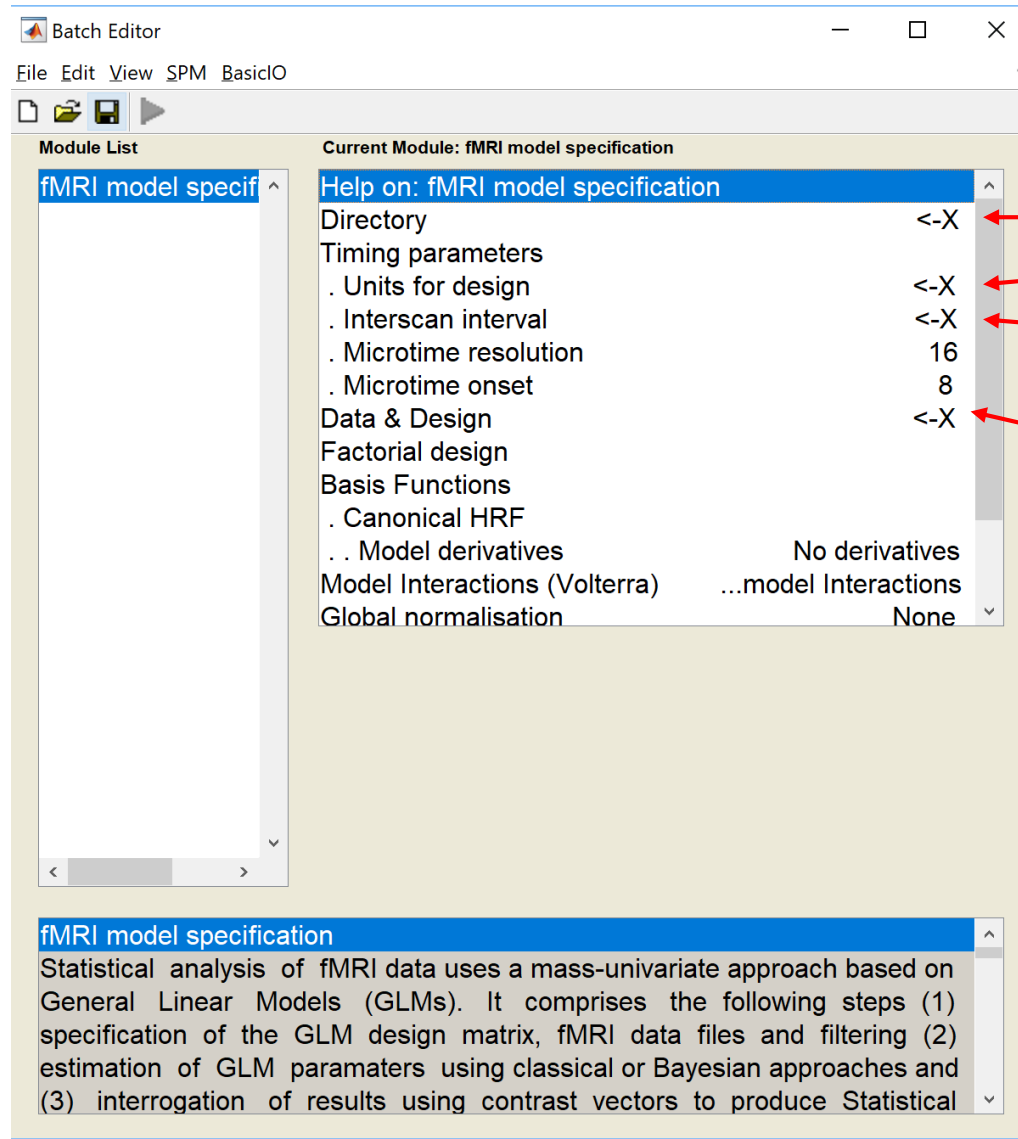
GLM – General information

- Scanning parameters: TR = 2.2 s; slice order: ascending; number of slices = 32
- Behavioral parameters:
 - In the file Behavior Summary there are:
 - tLeftStim and tRightStim → time (after scanstart) of presentation of left or right arrow.
 - tLeftPress and tRightPress → time (after scanstart) of left or right button presses

GLM – Specify first level



GLM – Set up design



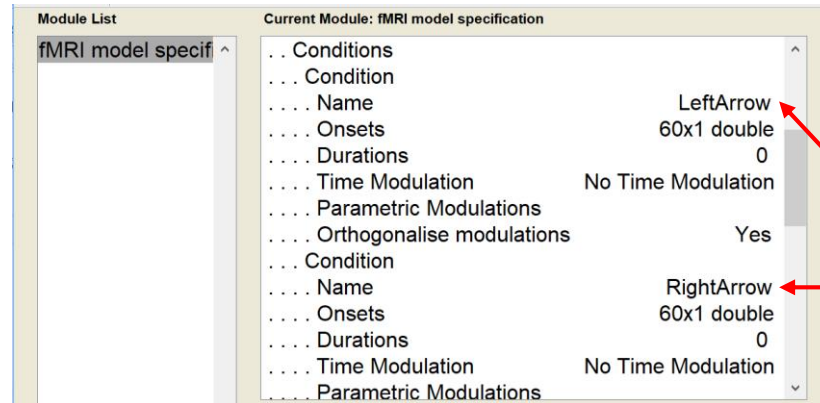
Choose directory

Choose seconds

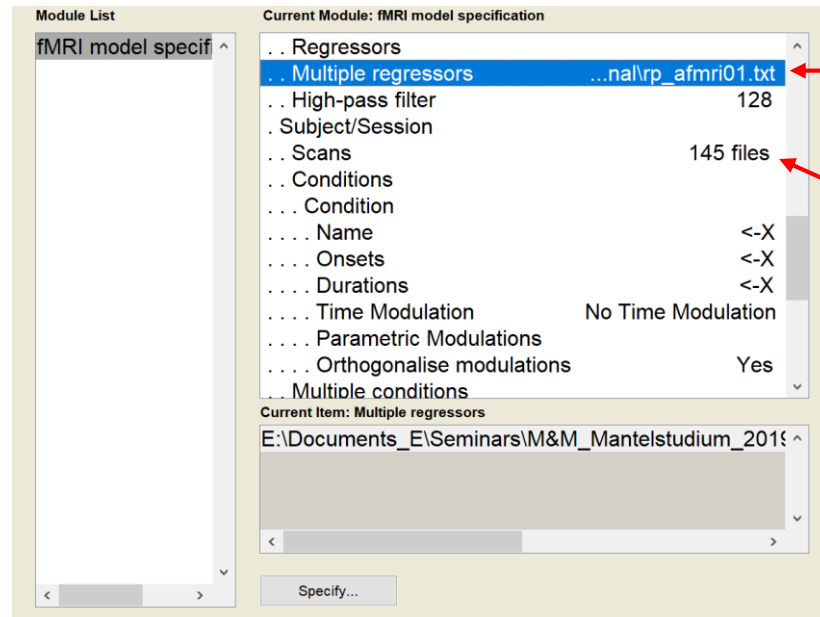
TR = 2.2 seconds

Then specify «Data & Design»

GLM – Set up design



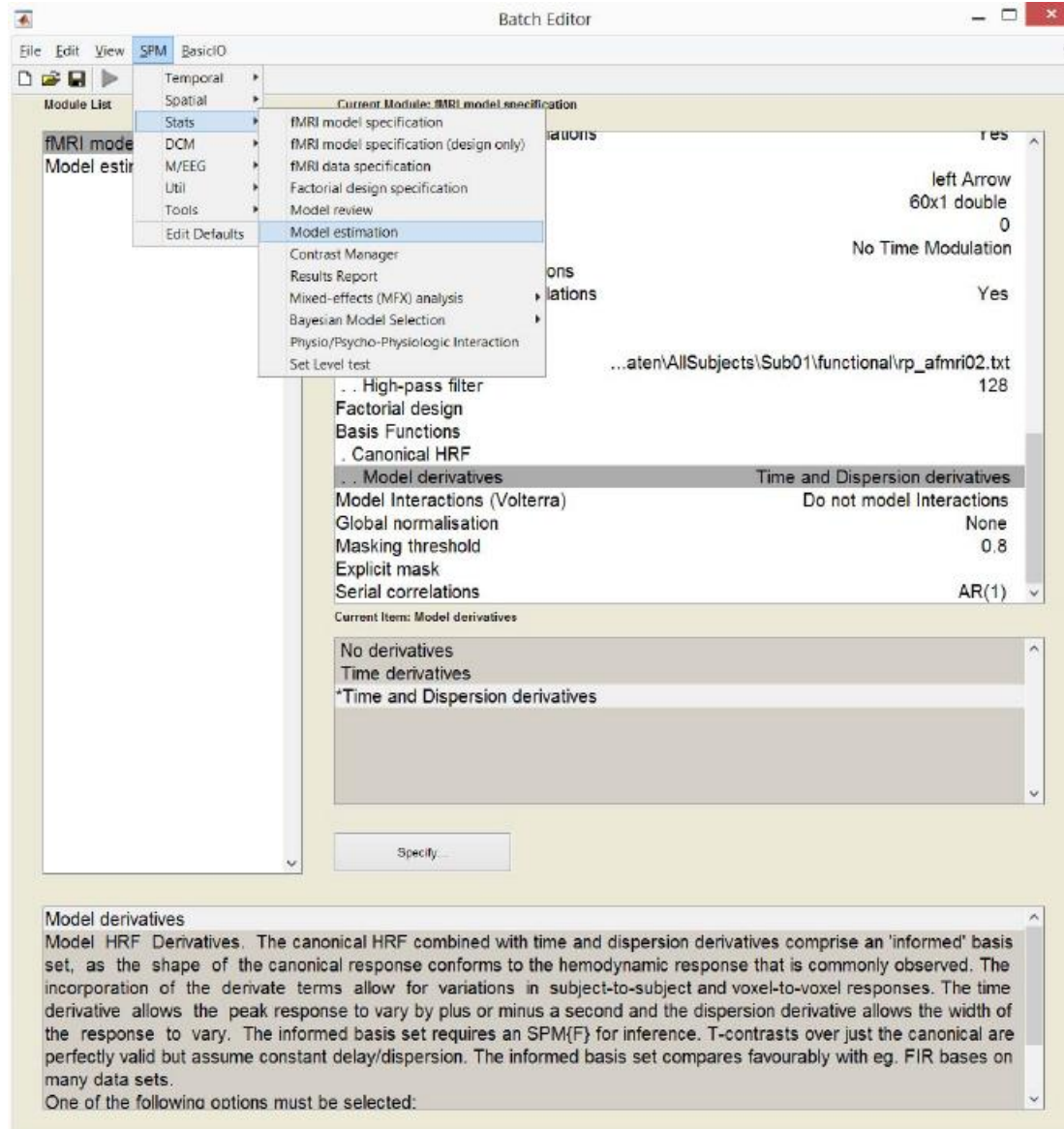
Specify design using timing from e.g. stimulus presentation.



Include movement

**Don't forget 2nd condition!
Repeat for second run!**

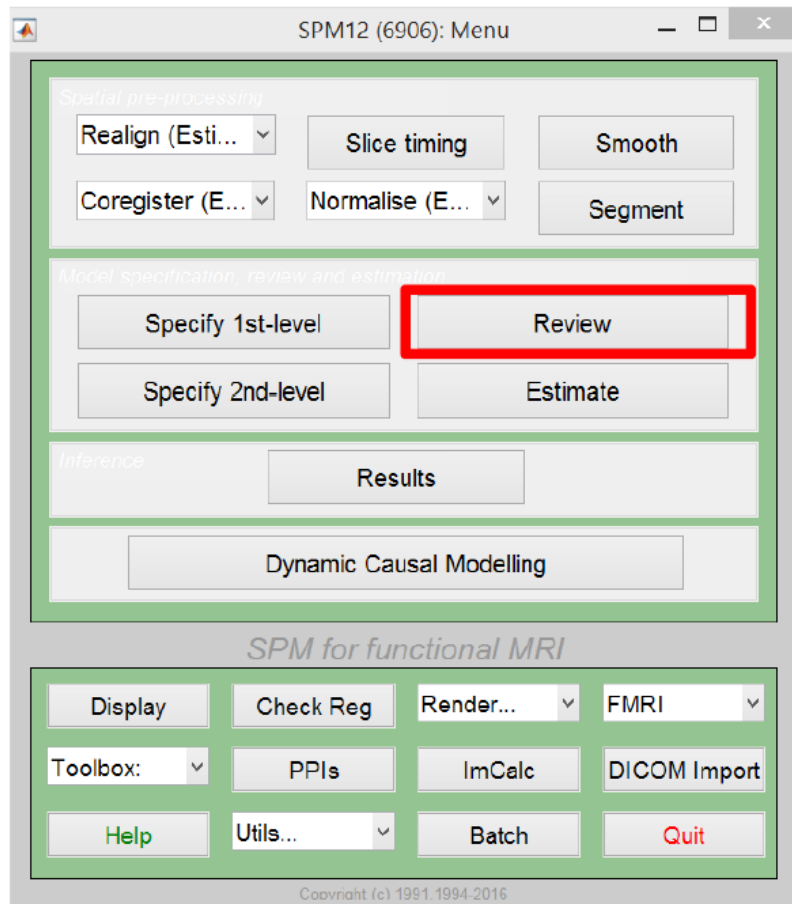
GLM – Estimate the model



The screenshot shows the SPM Batch Editor window. The 'SPM' menu is open, and 'Model estimation' is selected. The main window displays the 'Current Module: fMRI model specification' settings. The 'Model derivatives' section is expanded, showing options for 'Time and Dispersion derivatives' (selected), 'Do not model Interactions', 'None', and '0.8'. The 'Serial correlations' are set to 'AR(1)'. The 'Current Item: Model derivatives' section is also expanded, showing 'Time derivatives' and '*Time and Dispersion derivatives' (selected). A 'Specify...' button is visible at the bottom of the settings panel.

Model derivatives
Model HRF Derivatives. The canonical HRF combined with time and dispersion derivatives comprise an 'informed' basis set, as the shape of the canonical response conforms to the hemodynamic response that is commonly observed. The incorporation of the derivate terms allow for variations in subject-to-subject and voxel-to-voxel responses. The time derivative allows the peak response to vary by plus or minus a second and the dispersion derivative allows the width of the response to vary. The informed basis set requires an SPM(F) for inference. T-contrasts over just the canonical are perfectly valid but assume constant delay/dispersion. The informed basis set compares favourably with eg. FIR bases on many data sets.
One of the following options must be selected:

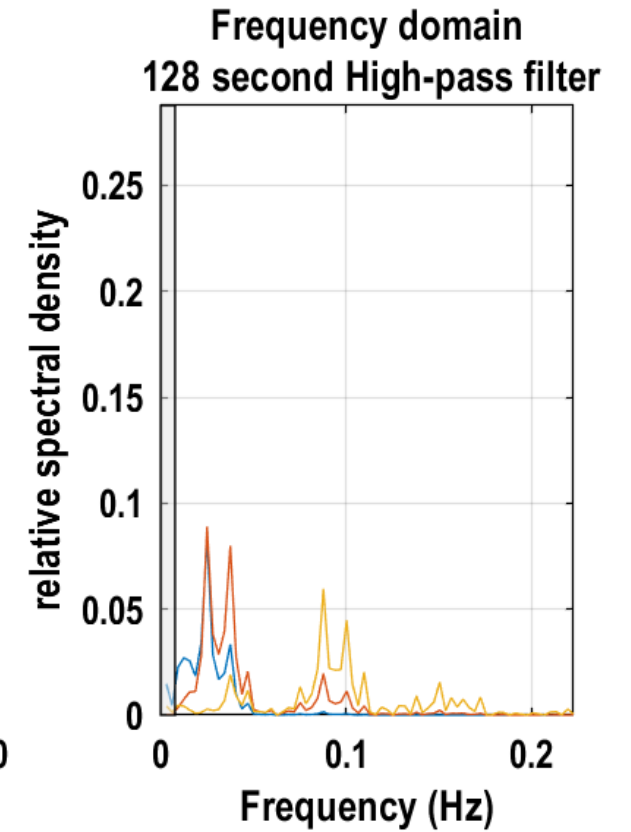
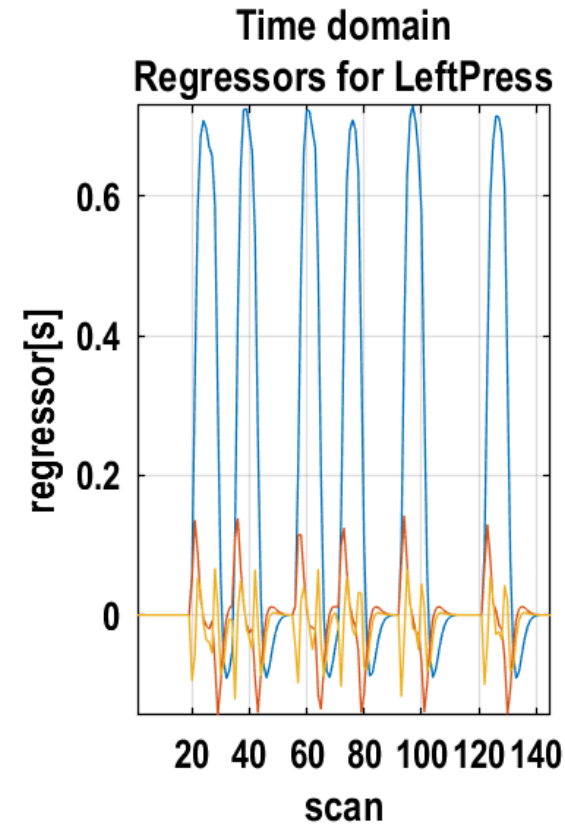
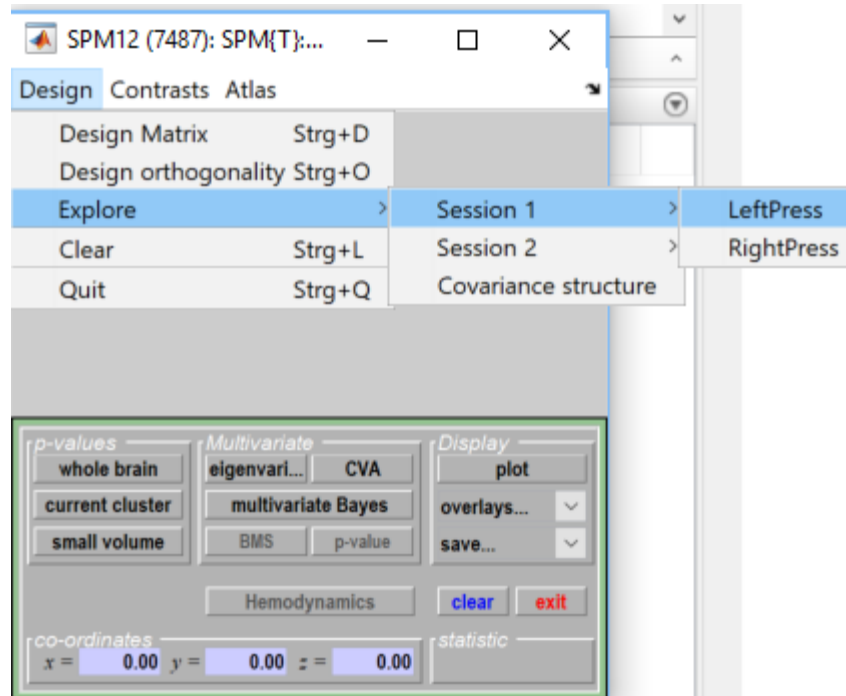
GLM – Review Design



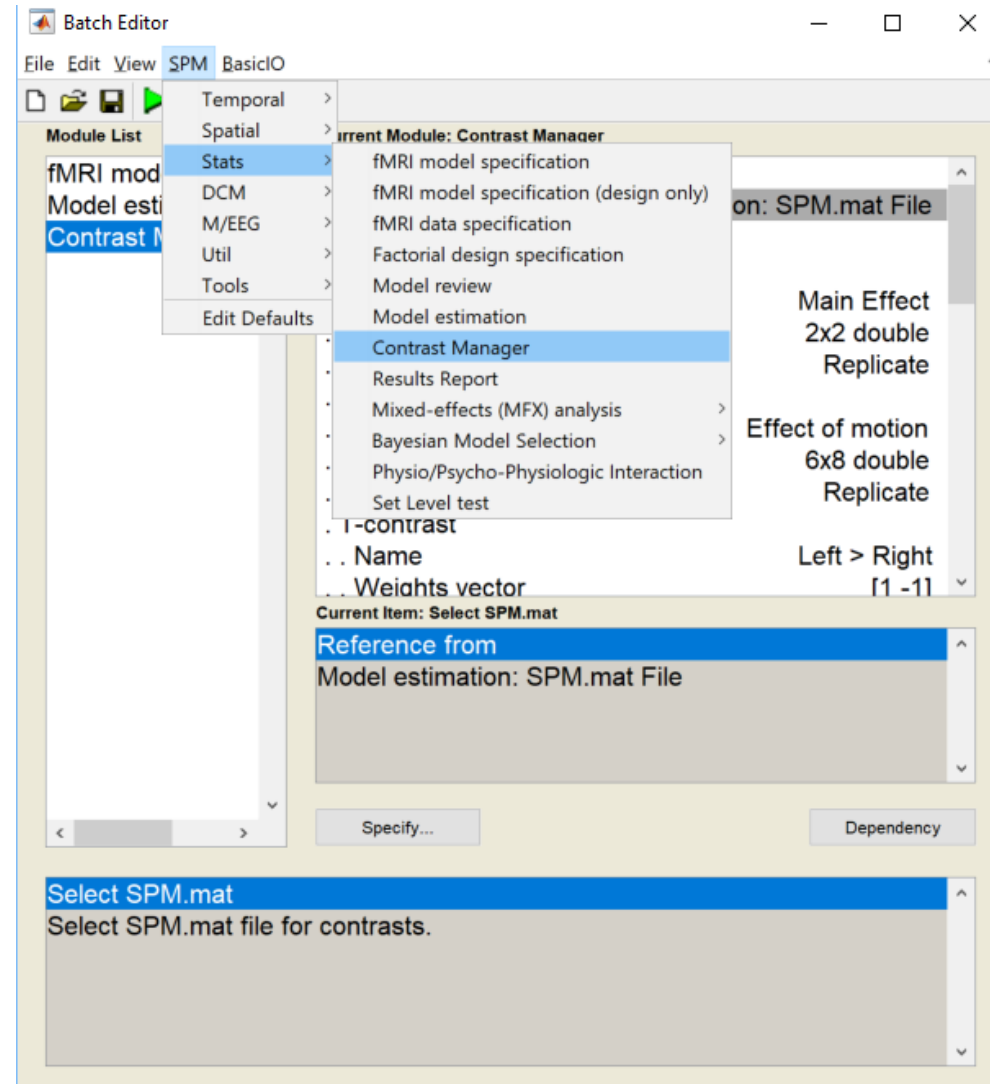
And also explore what is in the struct SPM, saved in SPM.mat

Use Check Reg to look at the new images:
beta_0001.nii etc,
ResMS.nii,
mask.nii,
RPV.nii

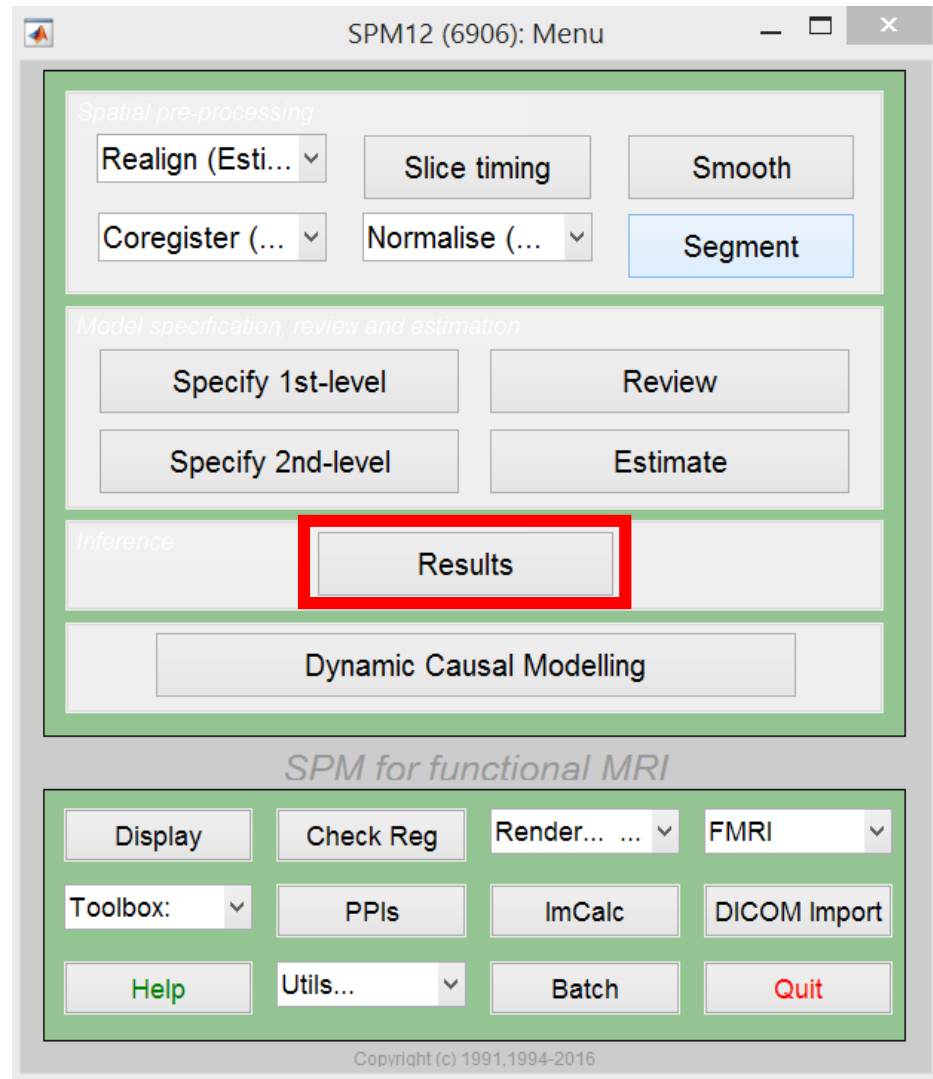
GLM – Review Design



GLM – Specify contrasts

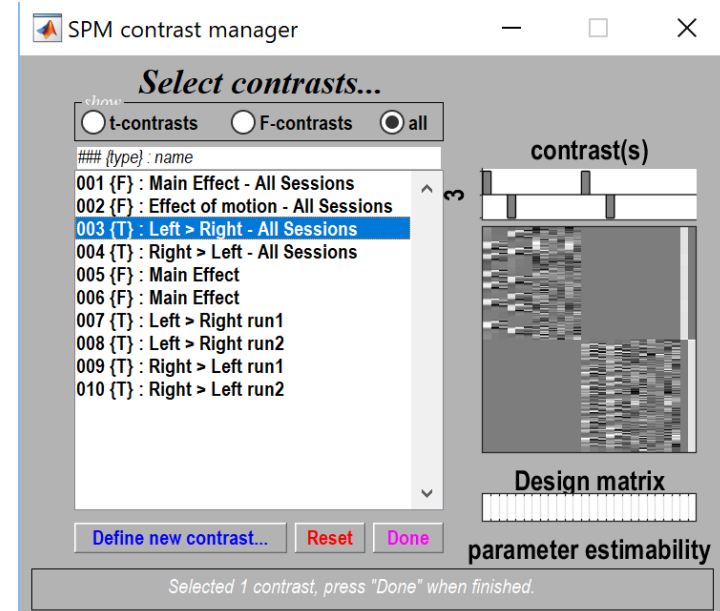


GLM – Display results



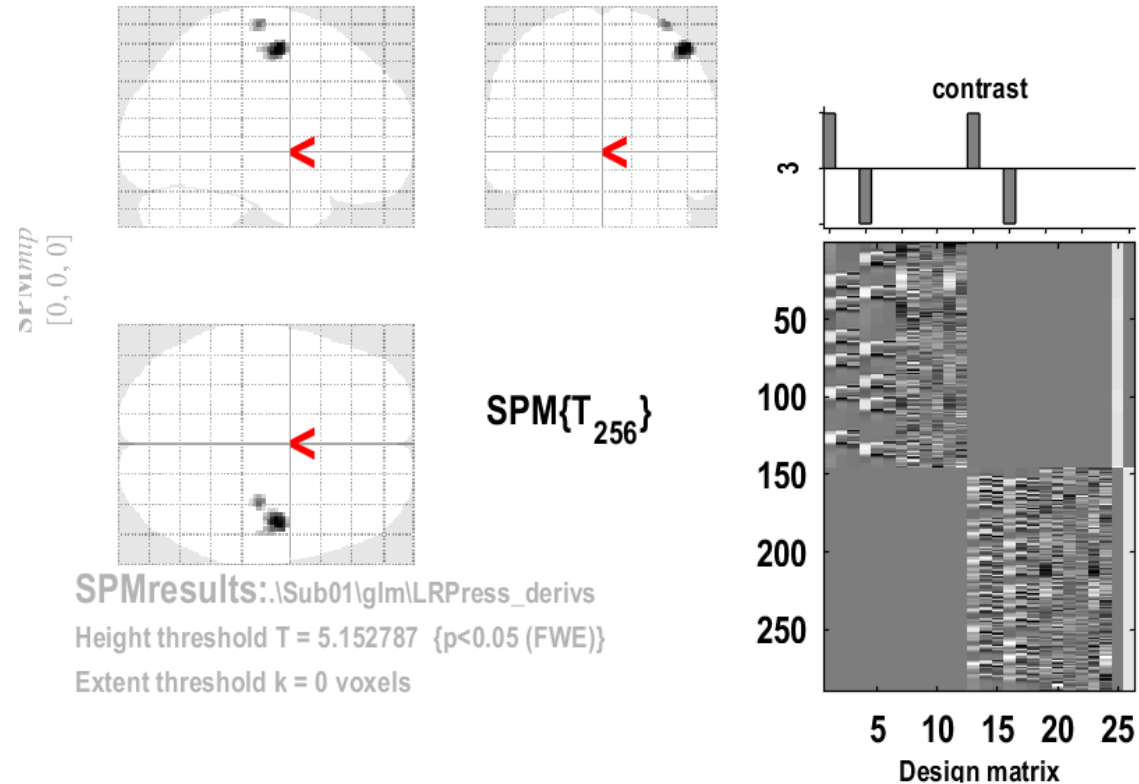
Click on Results and
select SPM.mat file

Select Contrast of interest,
e.g.:



GLM – Display results

Left > Right - All Sessions



Select:
 apply masking: none
 p value adjustment to control: FWE
 p value (FWE): 0.05
 & extent threshold (voxels): 0

Statistics: *p-values adjusted for search volume*

set-level		cluster-level				peak-level					mm mm mm		
p	c	$p_{FWE-corr}$	$q_{FDR-corr}$	k_E	p_{uncorr}	$p_{FWE-corr}$	$q_{FDR-corr}$	T	(Z_{\equiv})	p_{uncorr}			
0.002	2	0.000	0.000	105	0.000	0.000	0.000	7.91	7.48	0.000	44	-10	56
		0.000	0.000	25	0.000	0.000	0.001	6.58	6.32	0.000	36	-20	70