

HARDI reconstruction workshop'12

Time: 09.04 - 09.16 (2nd May)

Propagator denoising in sparse domains: is SWT a viable solution?

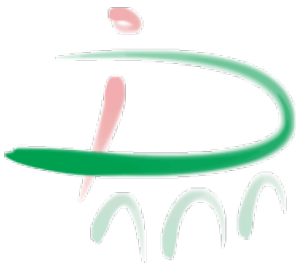
Team: NIPG

256 samples

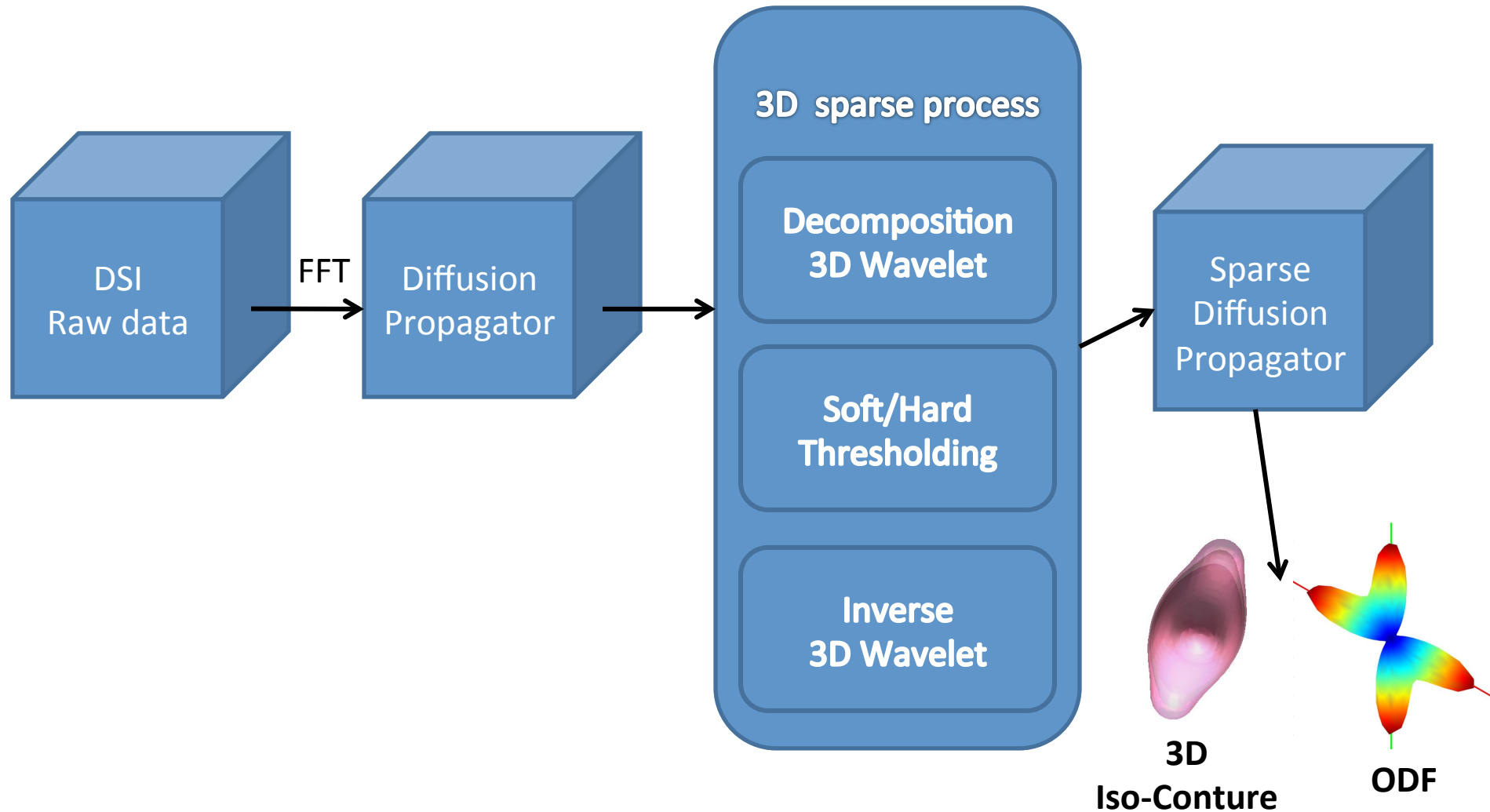
$320 \leq b \leq 8000$

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Multiscale Representations for ODF denoising in Diffusion Spectrum MRI



3D-wavelet & Thresholding

- Wavelet: “shift, multiply and sum” technique
- Using 3D-wavelet: decomposition/ reconstruction
- Orthogonal /bi-orthogonal wavelet
 - Daubechies, D4, D8
 - Cohen-Daubechies-Feauveau, CDF5/3
- Thresholding

*Hard Thresholding: is cruder, sets any coefficient less than or equal to the threshold to zero.

$$S(x) = \begin{cases} x, & |x| > T \\ 0, & |x| \leq T \end{cases}$$

*Soft Thresholding: is wavelet shrinkage, subtracted from any coefficient that is greater than the threshold. This moves the time series toward zero.

$$S(x) = x \cdot \max\left(1 - \frac{T}{|x|}, 0\right)$$

*D95 (Donoho and Johnstone, 1995)

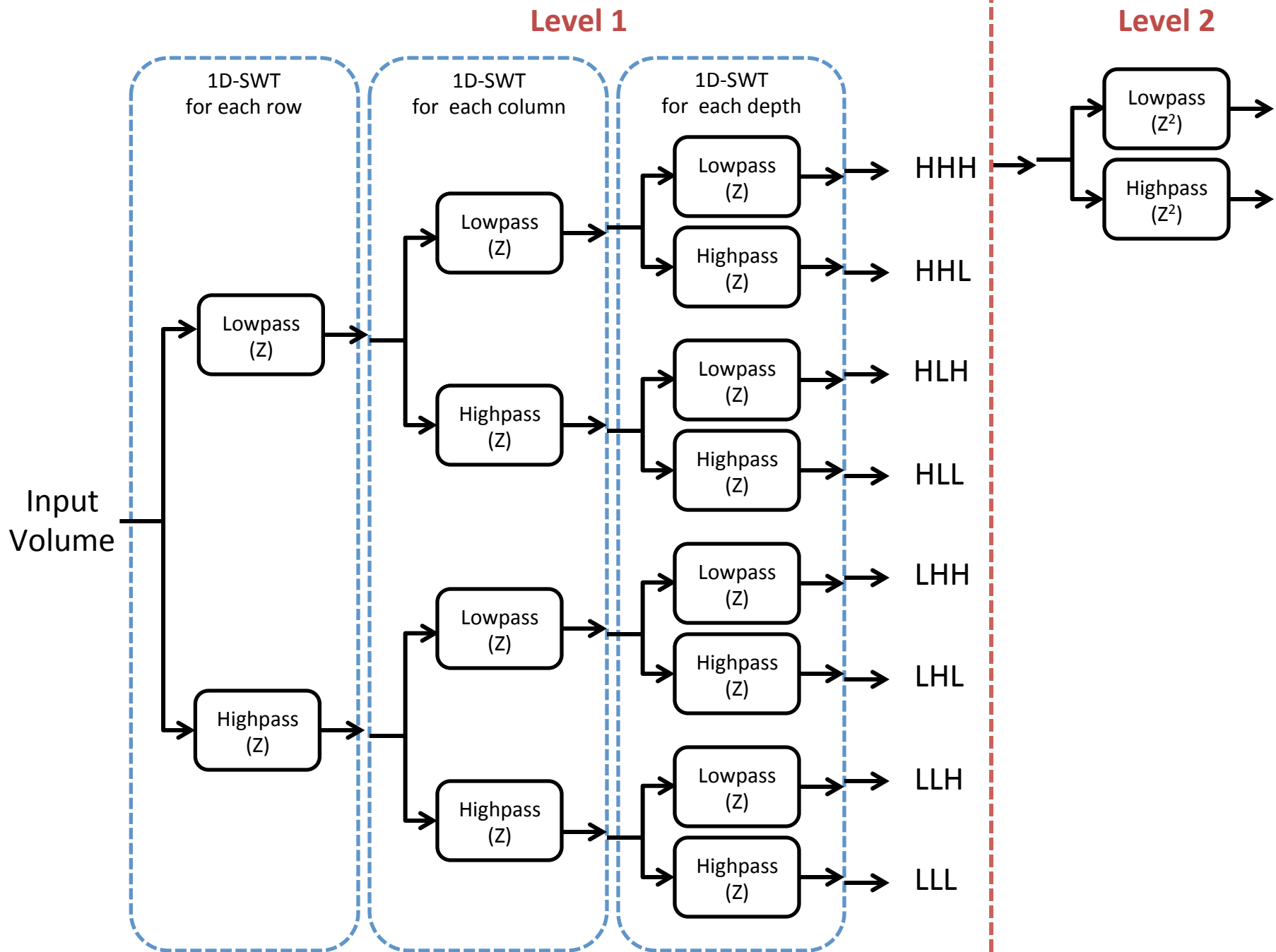


Fig. The filter architecture for 3D algorithme à trous

HARDI reconstruction workshop

*Training data (Training_IV.mat)

>>910 voxel, random angle (0-90 degree), FA (0.75-0.90), 10 different repetition (?)

*Structure field (Training_SF.mat) --> see figure 1.

>10x10, 2D-matrix, 4 fiber bundle,

*additional structure field (Training_3D_SF.mat) --> see figure 2.

>16x16x5, 3D-matrix,

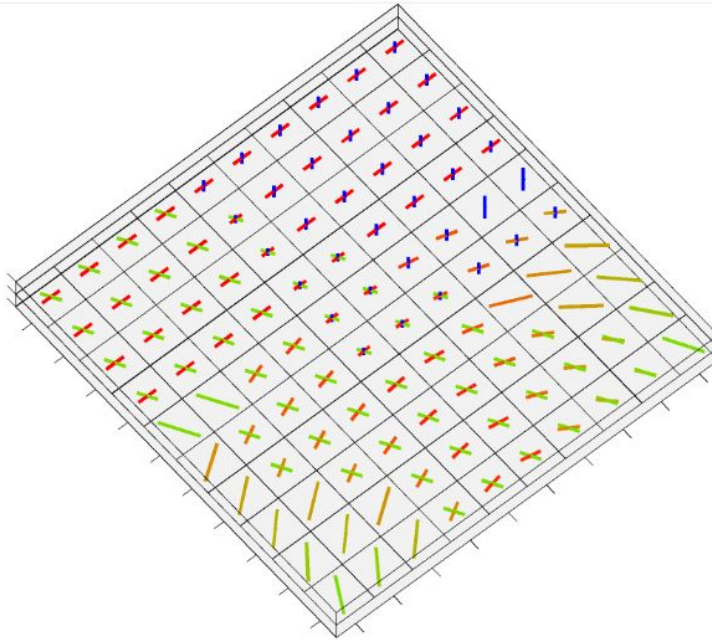


figure 1.

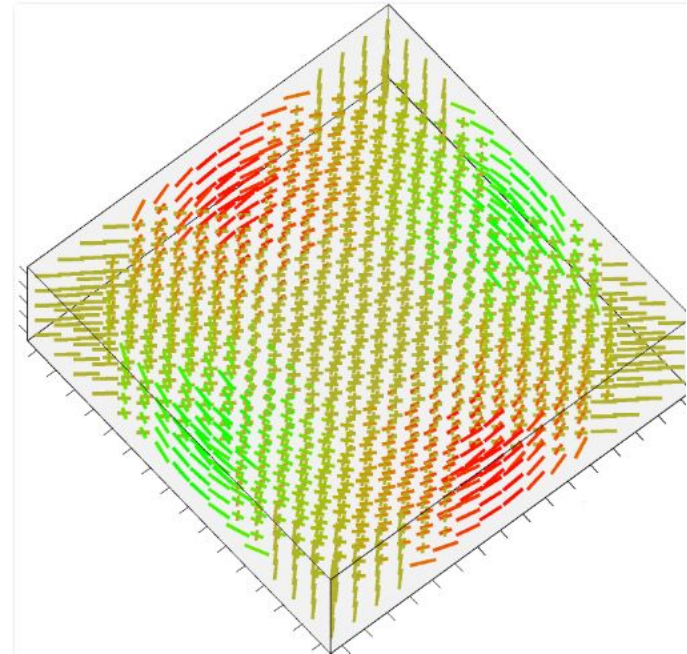
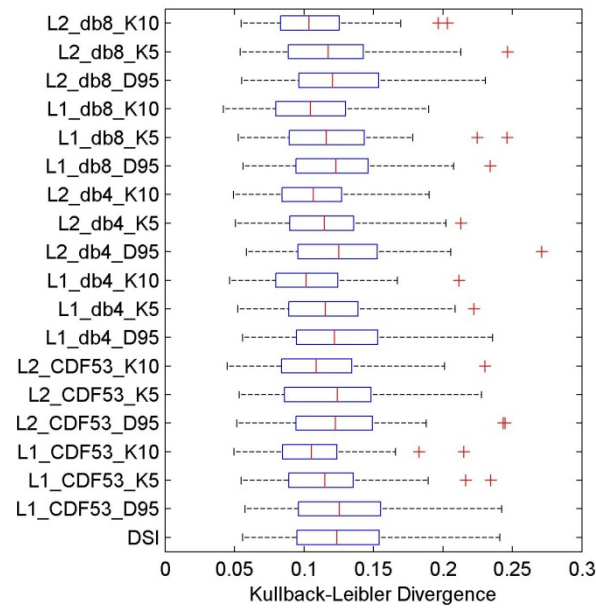


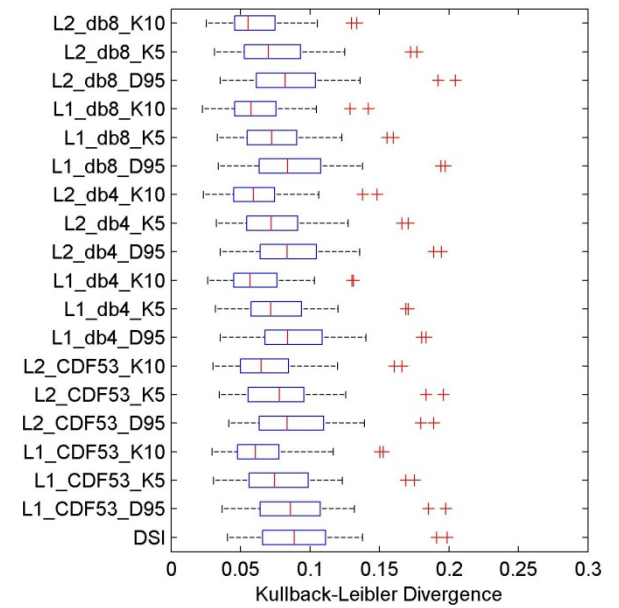
figure 2.

Training_SF

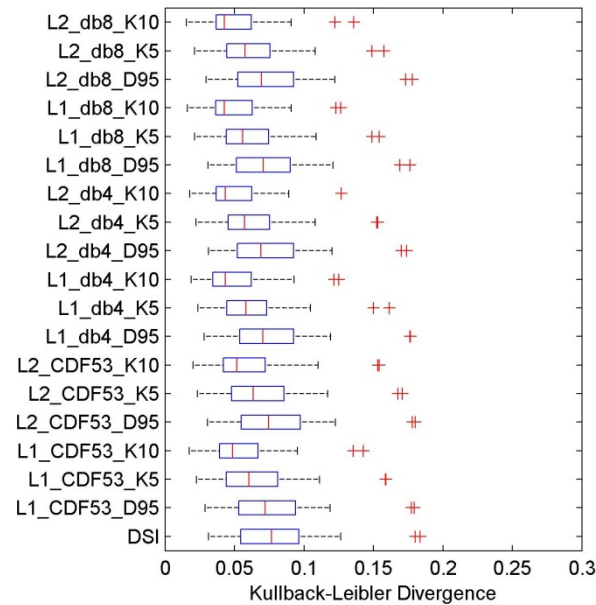
A. SNR = 10



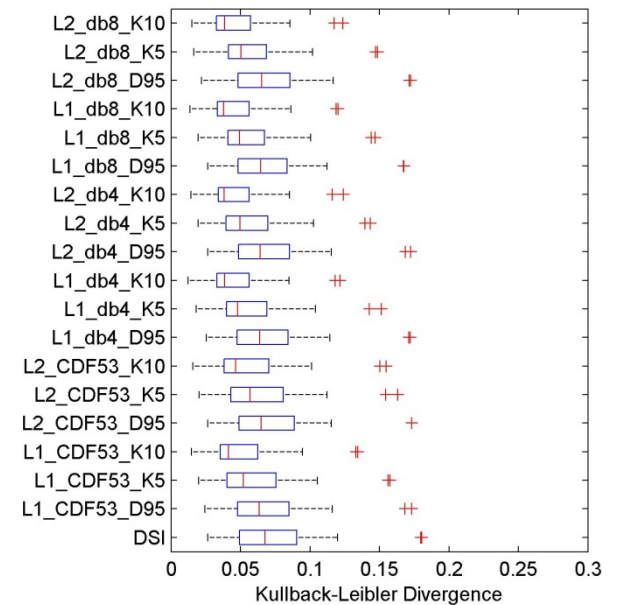
B. SNR = 20



C. SNR = 30



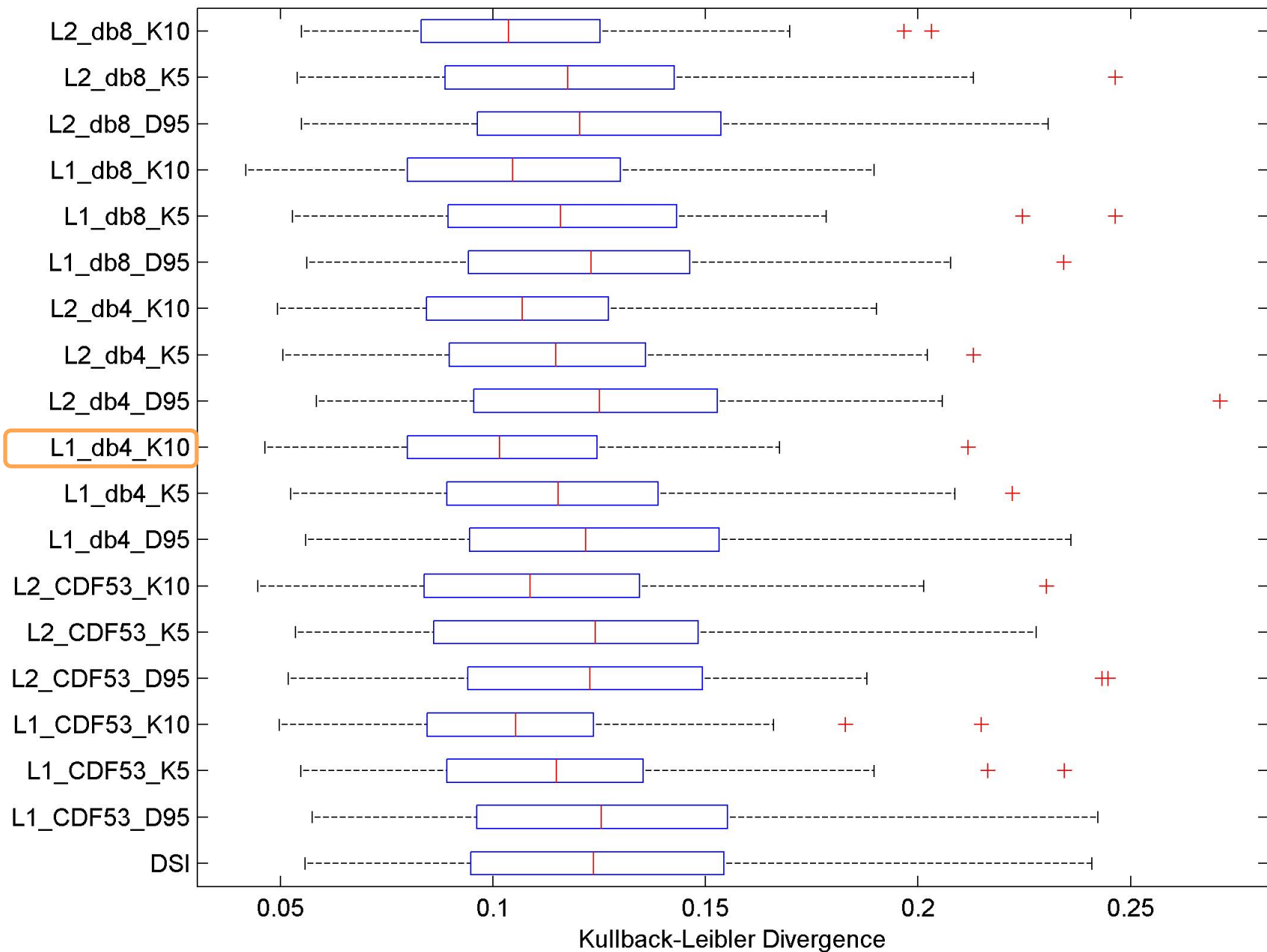
D. SNR = 40



SNR = 10

Training_SF

3D-SWT



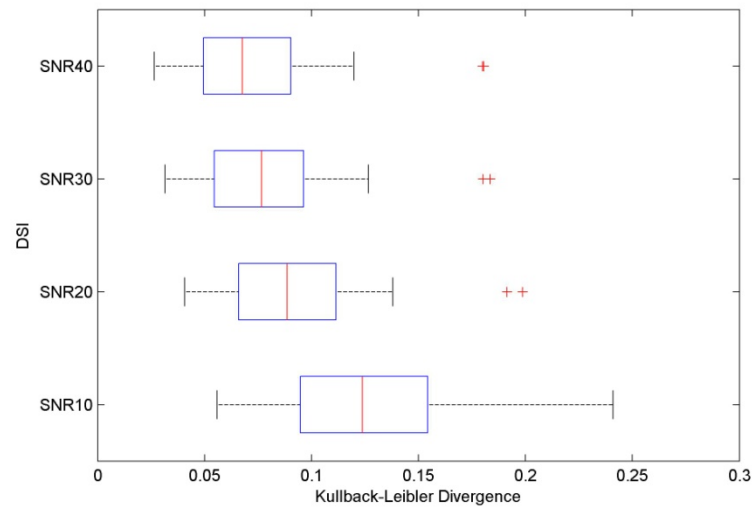
Mean value of KLD

	SNR 10	SNR 20	SNR 30	SNR 40
DSI	0.125	0.089	0.078	0.073
3D-SWT	0.103	0.061	0.051	0.047

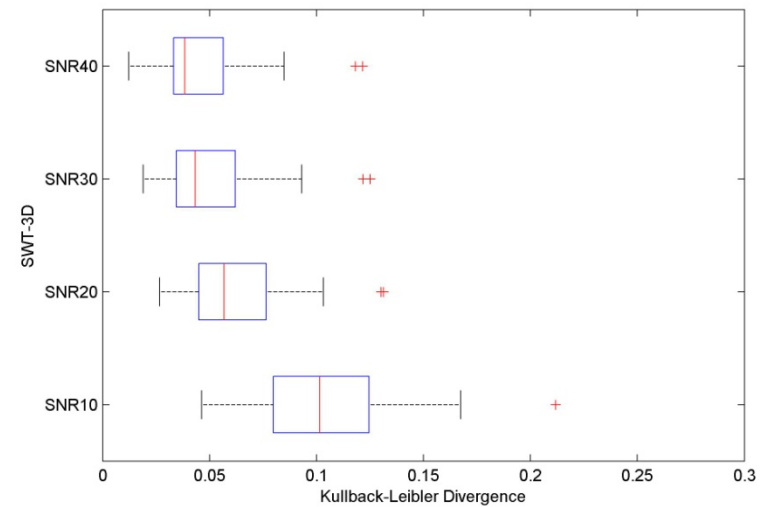
% percentage of coefficient (3D-SWT)

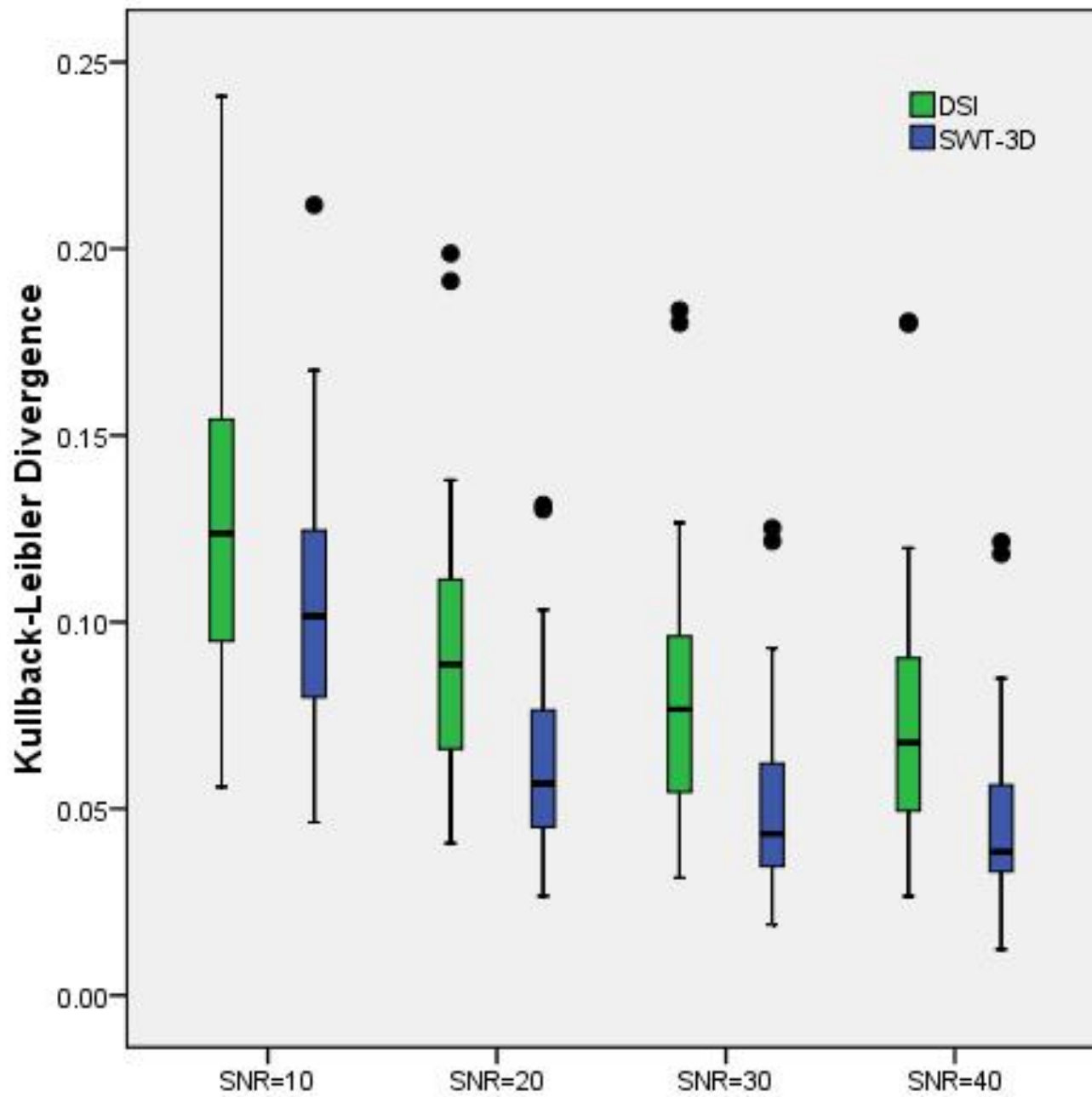
%percentage of coefficient	SNR10	SNR20	SNR30	SNR40
Max	47.0902	18.4072	18.2714	17.8020
Min	18.4214	18.2714	17.8020	17.6114

DSI



3D-SWT

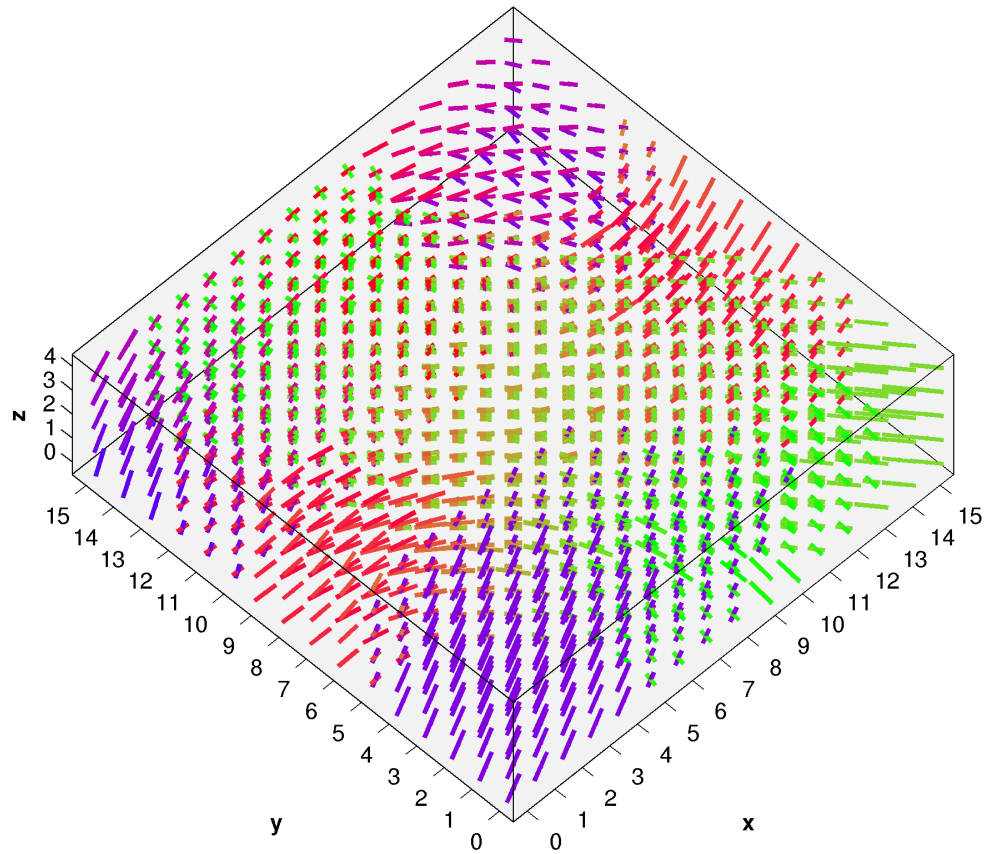




HARDI reconstruction workshop :

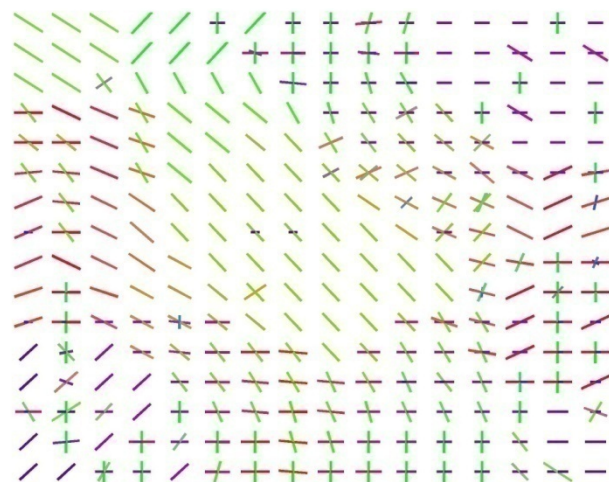
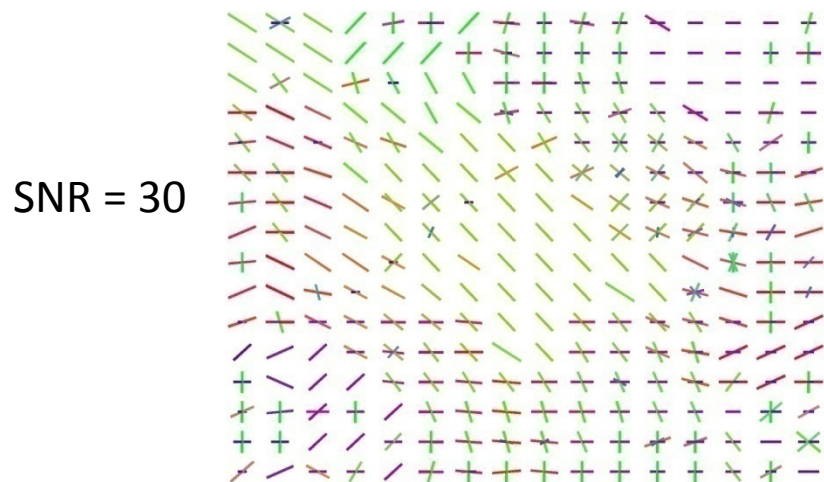
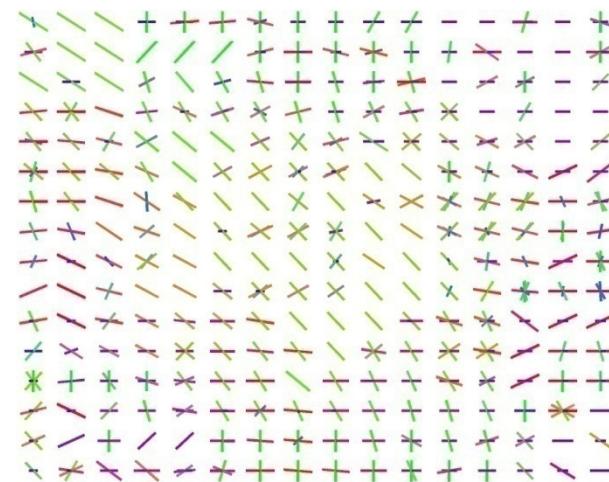
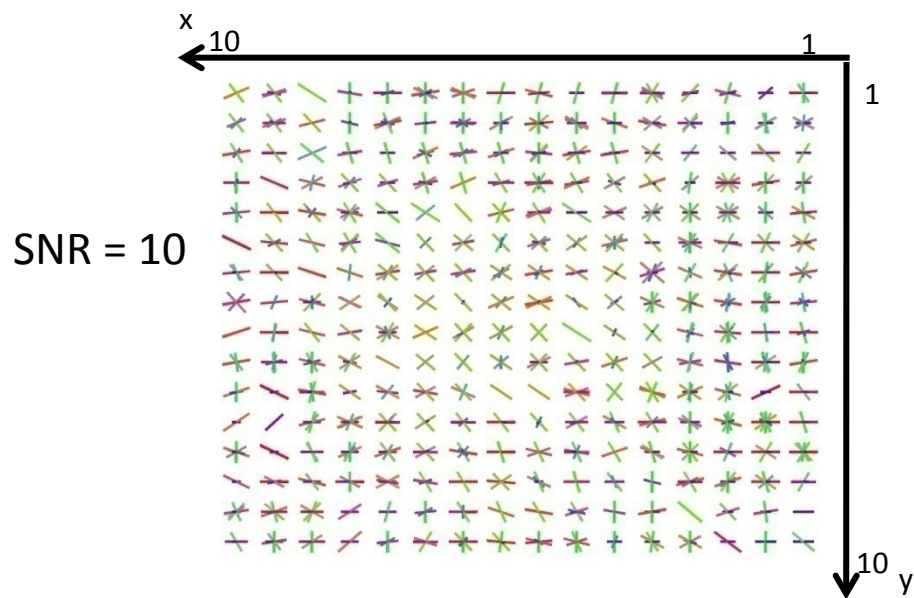
***Testing data (Testing_3D_SF.mat) --> see figure**

>16x16x5, 3D-matrix,



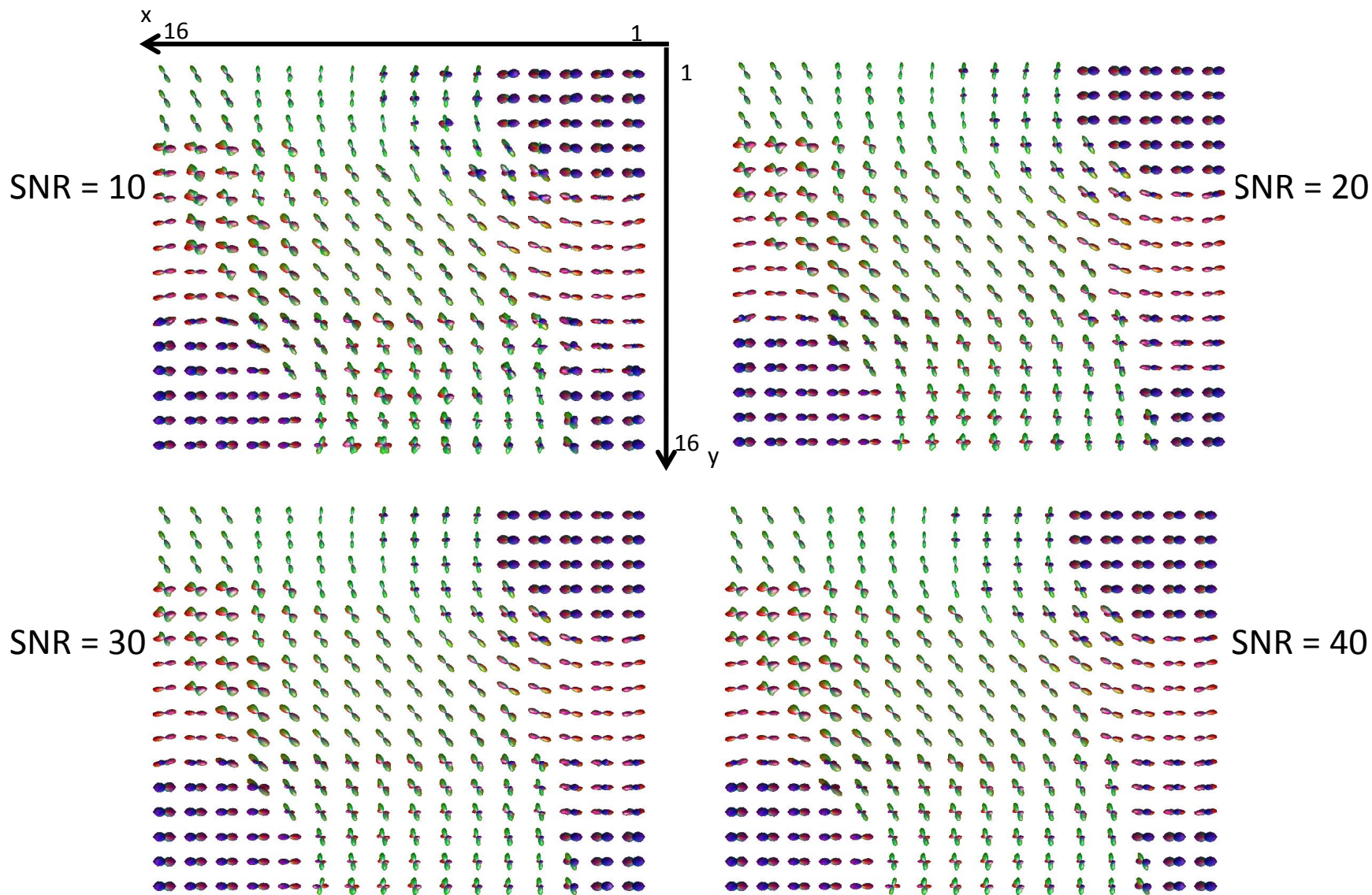
Testing_SF

Slice (z=0)



Testing_SF

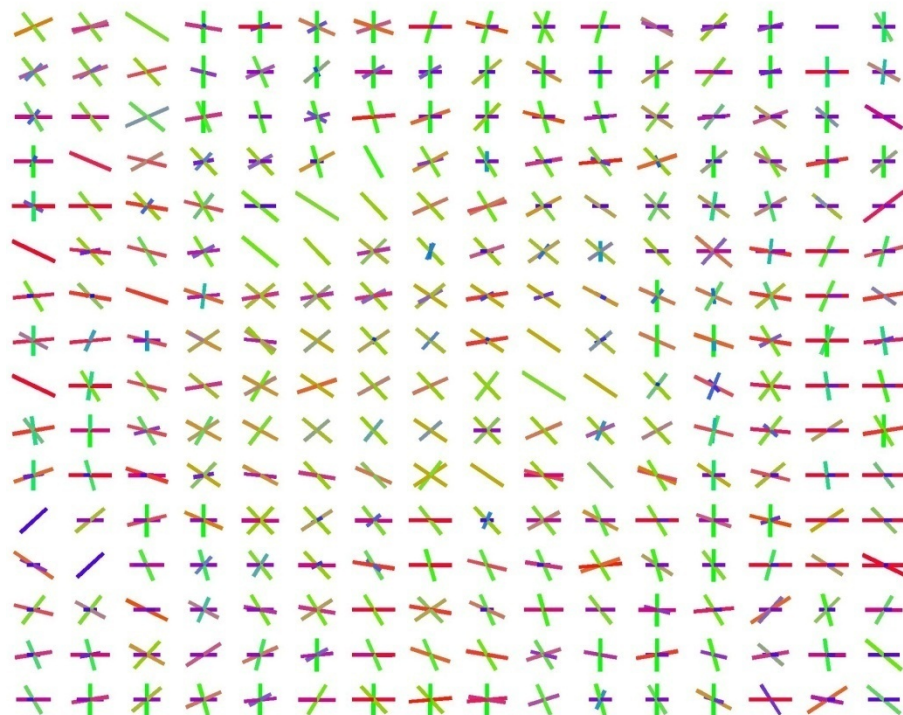
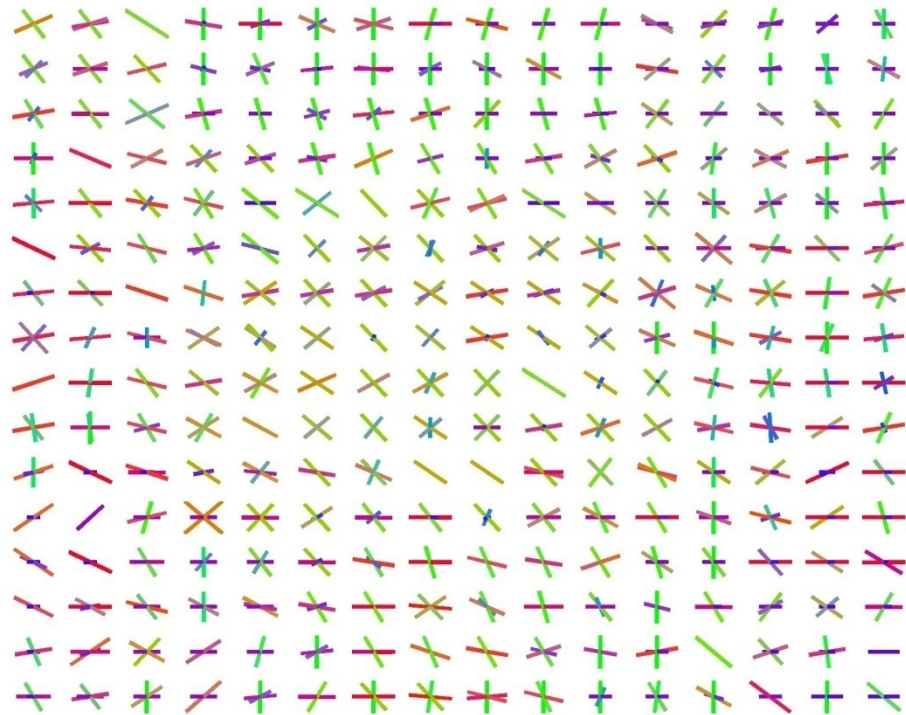
Slice (z=0)



Testing_SF (SNR = 10) Slice (z=0)

DSI

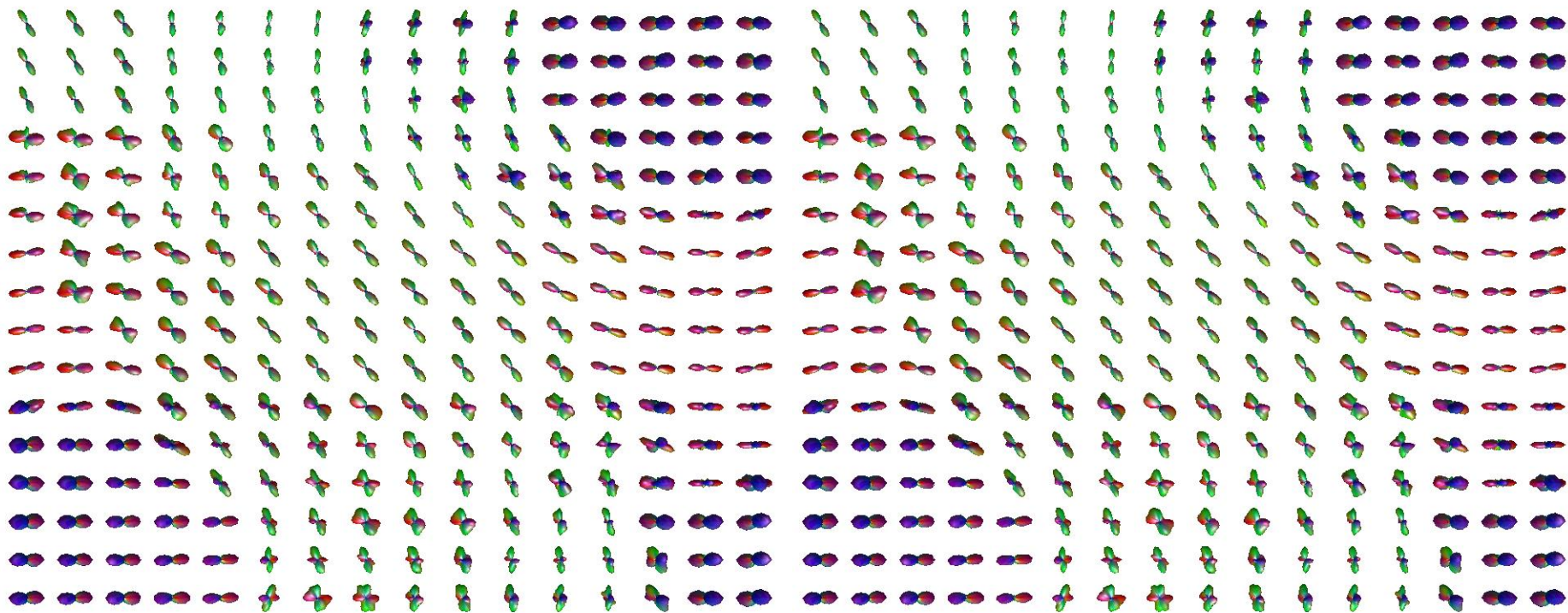
3D-SWT



Testing_SF (SNR = 10) Slice (z=0)

DSI

3D-SWT



- **Propagator denoising in sparse domains:
is SWT a viable solution?**
- Optimal denoising solution:
 - **D4:Daubechies family**
 - **L1: Single level decomposition**
 - **K10: 10 percentage of threshold**
- For more info, please don't hesitate give me suggestion!!!
 - **Time: Wednesday, 2 May , 15:30 - 17:00**
 - **Session: Image Acquisition and Reconstruction: Applications**
 - **Paper Code: WE-PO.PG.2**
 - **Paper Number: 2049**
 - **Title: MULTISCALE REPRESENTATIONS FOR ODF DENOISING IN
DIFFUSION SPECTRUM IMAGING**

Thanks for your attention!!