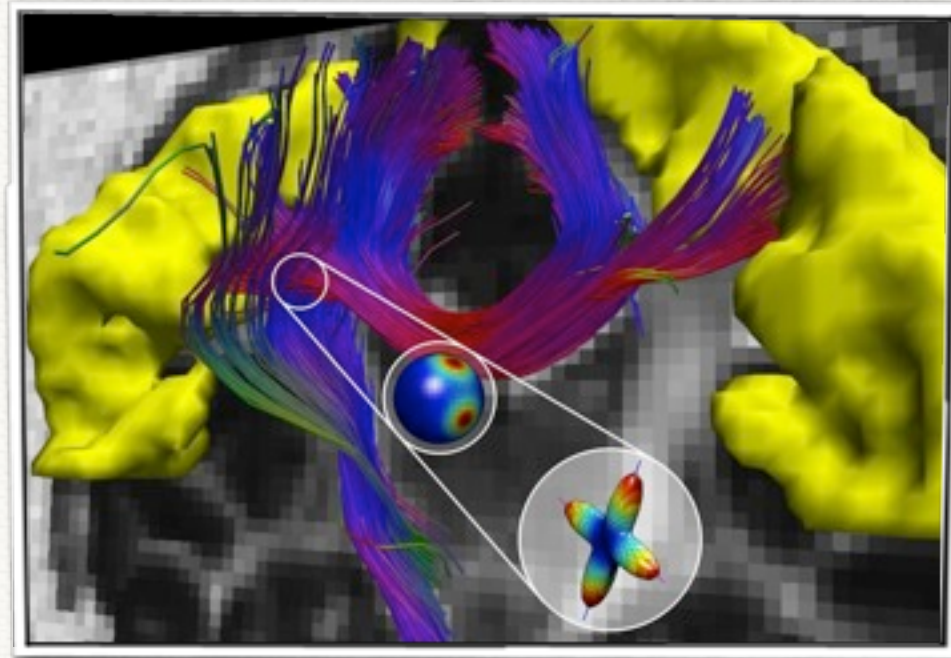


# HARDI reconstruction challenge 2013



April 7<sup>th</sup>, 2013

*Westin San Francisco Market Street  
San Francisco, CA, USA*

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Alessandro Daducci

# Organization

Dr. Emmanuel Caruyer



Prof. Maxime Descoteaux



Prof. Jean-Philippe Thiran



# Agenda

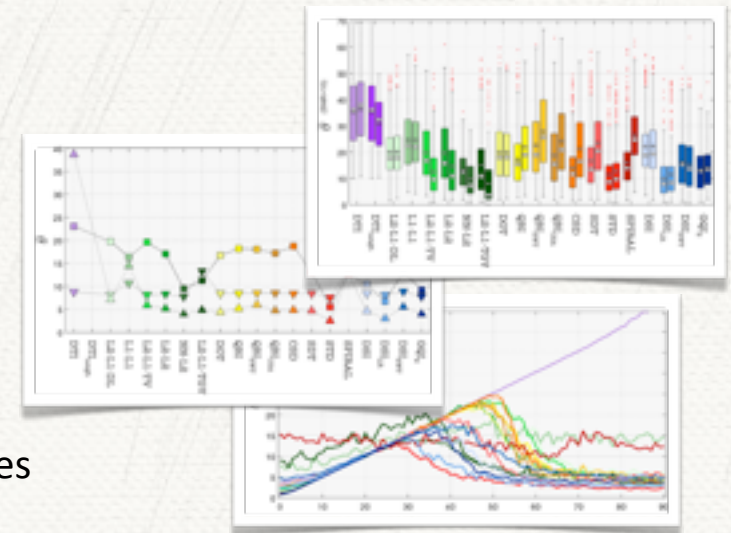
- 13:30 - 13:40 WELCOME and OPENING - *Alessandro Daducci*
- 13:40 - 13:50 TESTING DATA GROUND-TRUTH and SIGNAL GENERATION - *Emmanuel Caruyer*
- 13:50 - 14:40 **KEYNOTE** “Diffusion MRI Processing: Past, Present & Future” - *Baba C. Vemuri*
- 14:40 - 14:50 **TALK** “Team report: *ALCHEMISTS* and *SPIRAL*”
- 14:50 - 15:00 **TALK** “Team report: *CSD/SDT*, *DSID/GQID* and *PSO*”
- 15:00 - 15:30 COFFEE BREAK
- 15:30 - 15:40 **TALK** “Team report: *CRL*”
- 15:40 - 15:50 **TALK** “Team report: *FROGS*, *BLUE-DART FROGS* and *DIFFUSION WATER-FROGS*”
- 15:50 - 16:00 **TALK** “Team report: *RW-L1*”
- 16:00 - 16:10 **TALK** “Team report: *DICO LEARNING*, *CS-DSI* and *CS-SHORE*”
- 16:10 - 16:20 **TALK** “Team report: *ODF TEN DECOMP* and *STD*”
- 16:20 - 16:30 **TALK** “Team report: *THE HARDI BOYS*”
- 16:30 - 16:50 EVALUATION SYSTEM and RESULTS - *Maxime Descoteaux*
- 16:50 - 17:00 WINNERS ANNOUNCEMENT and CLOSING



# 2012 edition

## Summary

- ▶ 12 teams and 20 different algorithms evaluated
  - classical methods, e.g. DTI, QBI, DOT, CSD, DSI
  - new approaches, mostly based on compressed sensing
- ▶ Comparison based on *local measures*  
(number and orientation of fiber compartments in each voxel)
- ▶ We have learnt interesting lessons about strengths/weaknesses



## Common publication (currently under review in IEEE TMI)

### Quantitative comparison of reconstruction methods for intra-voxel fiber recovery from diffusion MRI

A. Daducci, E.J. Canales-Rodríguez, M. Descoteaux, E. Garyfallidis, Y. Gur, Y.-C. Lin, M. Mani, S. Merlet, M. Paquette, A. Ramirez-Manzanares, M. Reisert, P.R. Rodrigues, F. Seppehrband, J. Choupan, R. Deriche, G. Menegaz, V. Prckovska, M. Rivera, Y. Wiaux, J.-P. Thiran

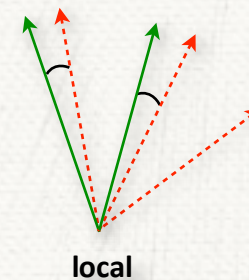
## Very important unanswered question:

What is the impact of each **LOCAL** reconstruction algorithm  
on **GLOBAL** connectivity analyses?

# 2013 edition: major improvements

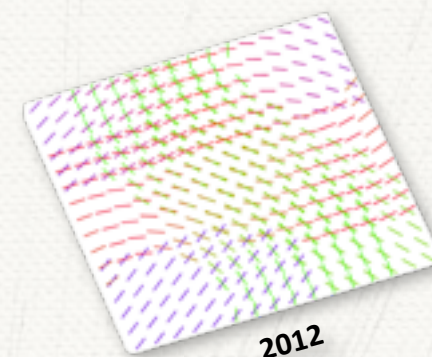
## ■ New evaluation system

- ▶ *Local accuracy* in the estimation of intra-voxel fiber configuration (number and orientation of fiber compartments)
- ▶ *Global impact* on a subsequent connectivity analysis (using the *Tractometer* approach (Côté et al, 2012))



## ■ 3 separate **sampling classes**

- ▶ DTI-like      ➔  $\leq 32$  samples with  $b \leq 1200$  s/mm<sup>2</sup> (8 submissions)
- ▶ HARDI-like   ➔ 33-64 samples with  $1500 \leq b \leq 4000$  s/mm<sup>2</sup> (13 submissions)
- ▶ Heavyweight ➔  $\geq 65$  samples with  $b \leq 12000$  s/mm<sup>2</sup> (5 submissions)



## ■ More **realistic simulations**

- ▶ Three tissue types: WM, GM, CSF (*partial volume* taken into account)
- ▶ More *complex* fiber configurations (e.g. branching, crossing, kissing)
- ▶ Advanced models accounting for both *restricted* and *hindered* diffusion

