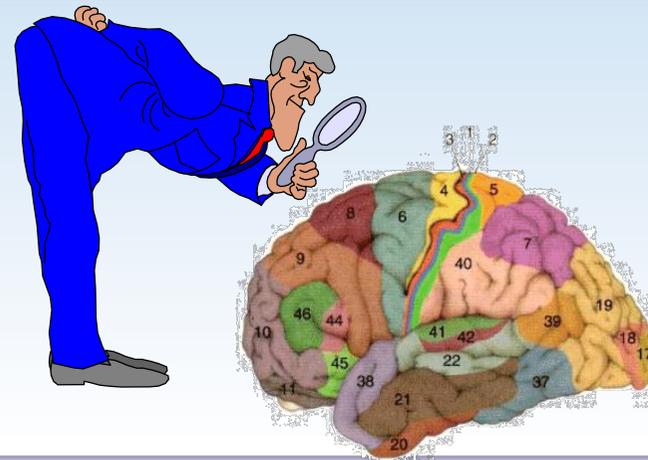


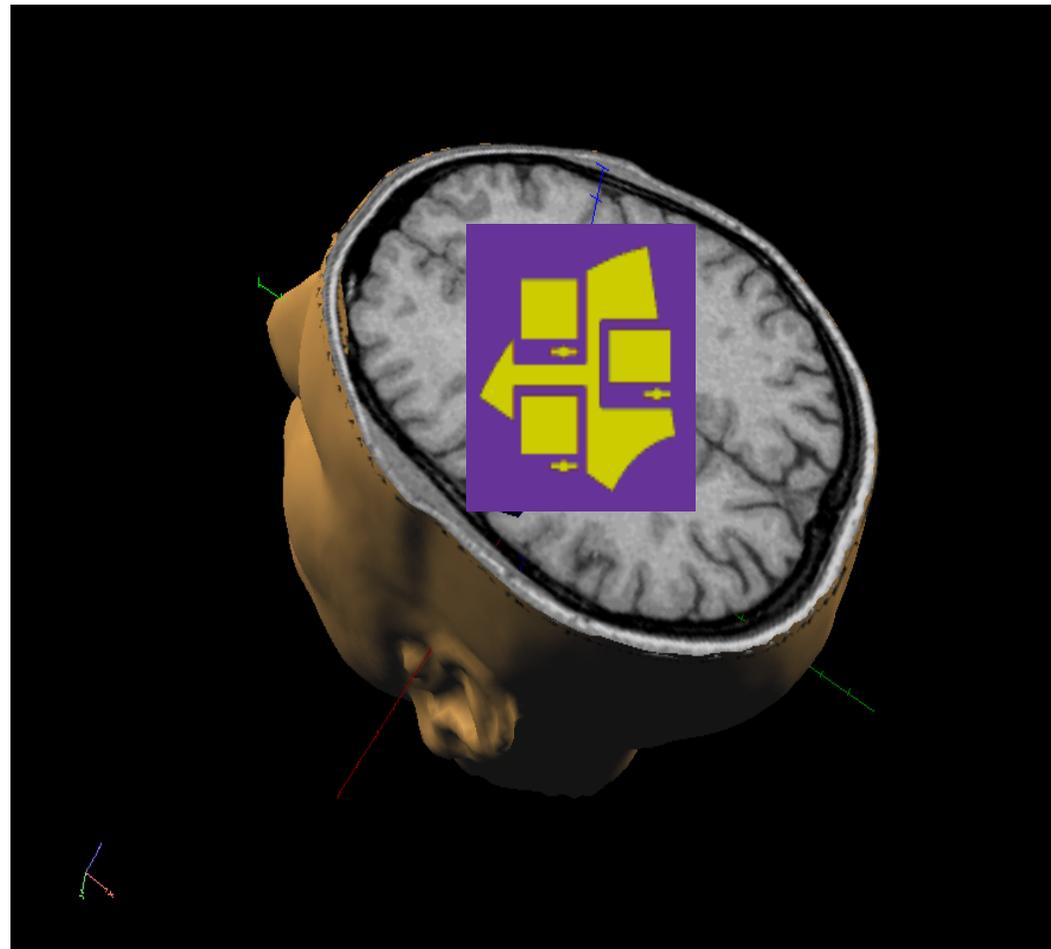
## **Networks of Cognition, People and Computers against Alzheimer's disease: an Italian idea from European to Regional scale (DECIDE)**

*Claudio Babiloni on behalf of DECIDE Consortium*

IRCCS San Raffaele Pisana, Rome  
University of Foggia

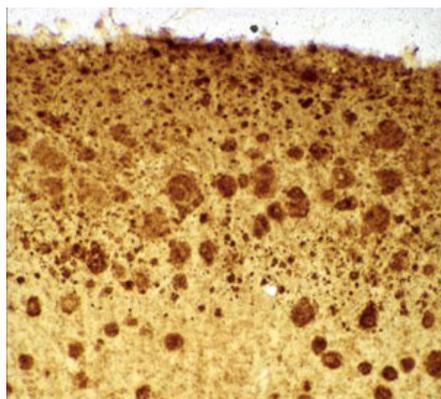
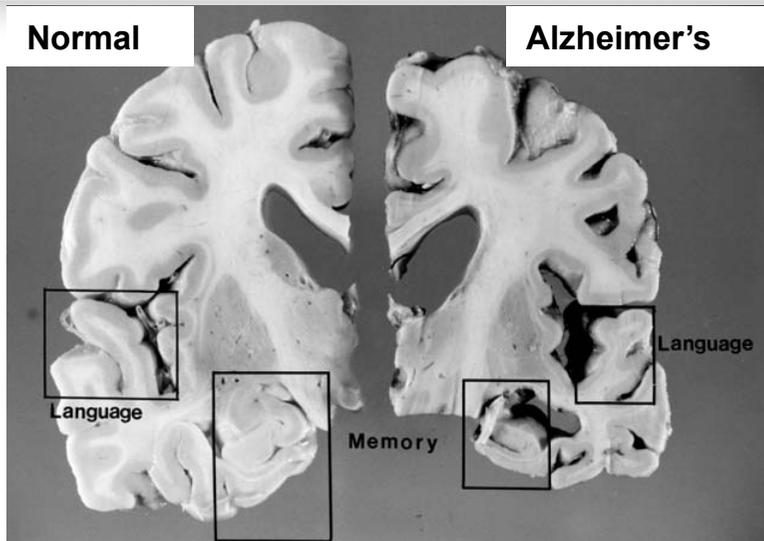


**NETWORKS OF NEURONS FOR COGNITION.** Higher brain functions depend upon the **rapid creation and dissolution** of ever changing synchronous thalamo-cortical cell assemblies (neural networks)



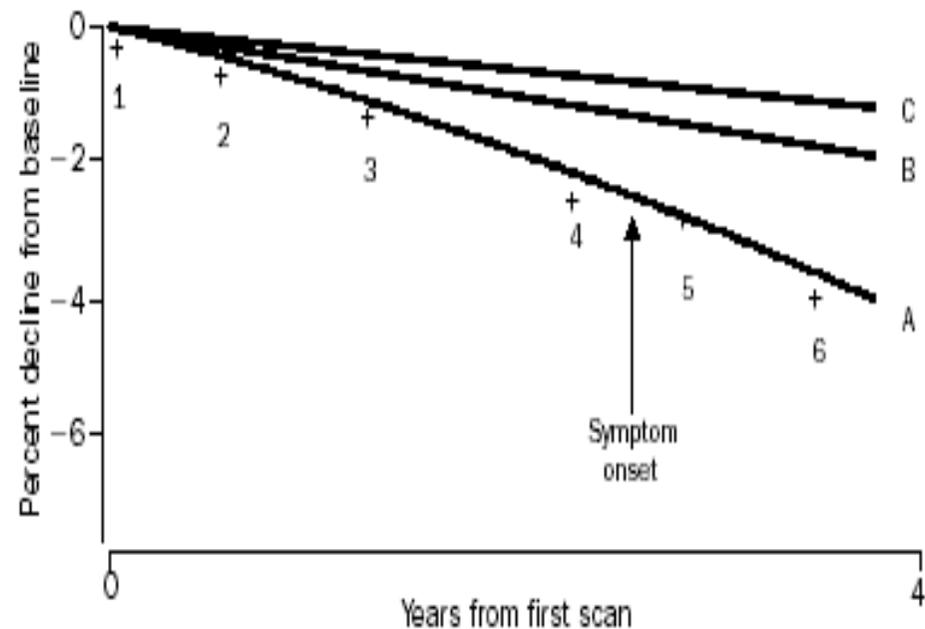
Stam CJ, de Bruin EA. Scale-free dynamics of global functional connectivity in the human brain. Hum Brain Mapp. 2004 Jun;22(2):97-109.

**DISRUPTION OF NEURAL NETWORKS FOR COGNITION. In Alzheimer's disease**, a lot of neurons and synapses are lost, particularly in the entorhinal cortex and hippocampus which are involved in memory and language functions



**Extracellular A $\beta$  plaques**  
**Intracellular tangles**

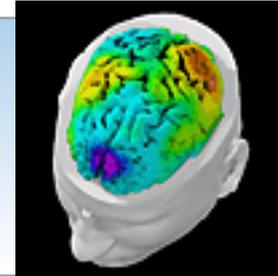
Fox, Lancet (2004)



-Over 4 million Europeans (EU27) have Alzheimer's

- In EU27 the total cost of Alzheimer's disorders (2008) was estimated to more than 100 billion Euro

# Which instrumental markers for **early diagnosis** of AD? The neuroimaging way



Normal elderly (Nold)



Mild cognitive impairment (MCI)



AD



# An Italian idea goes to Europe: the DECIDE project

## Public

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Alzheimer Europe

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**EC Call: FP7-INFRA-2010-2 – VRC**  
“Neurodegenerative disorders”  
2008

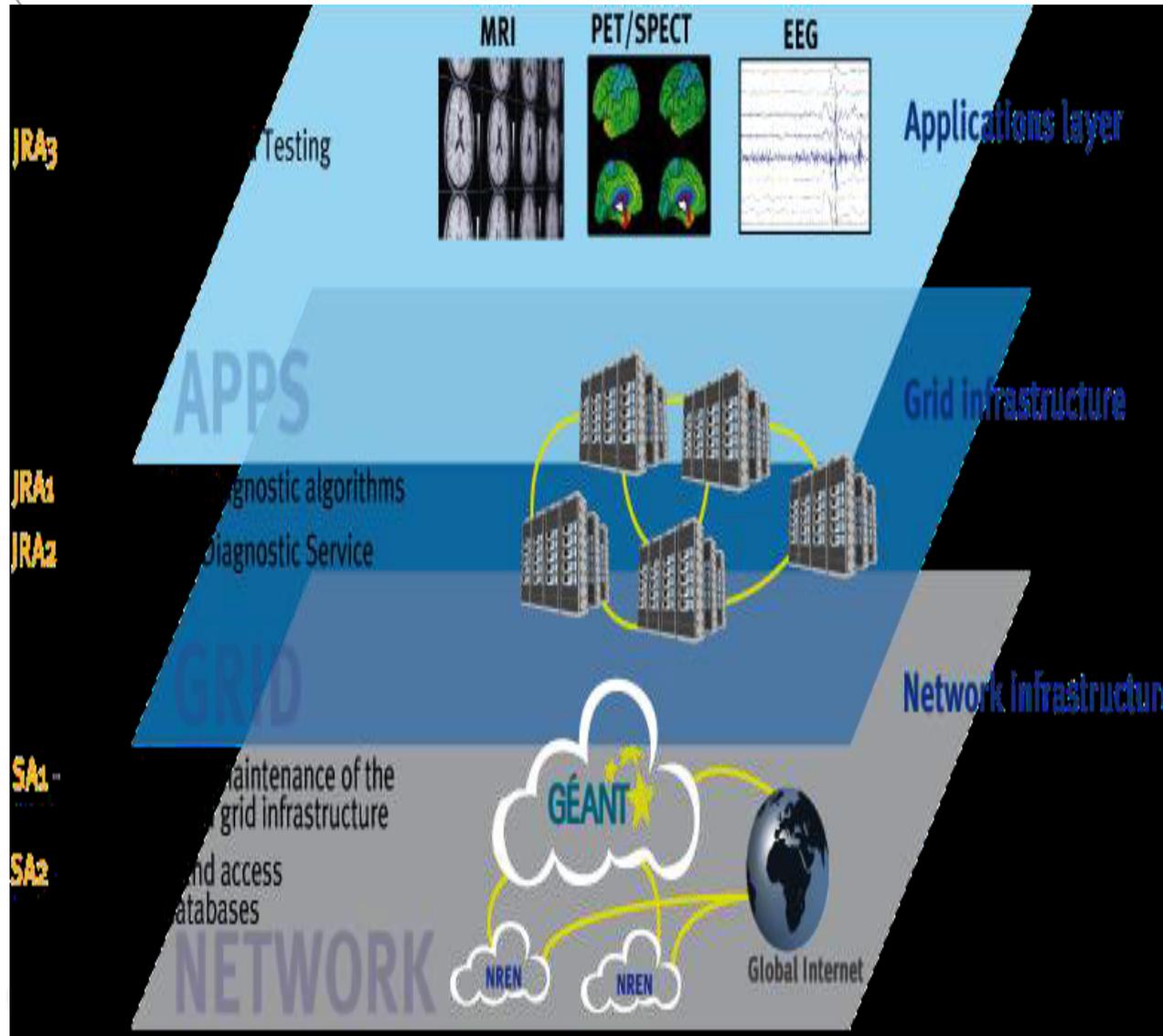
Contract n: RI-261593 \_ Project type:  
CP-CSA

Duration: 30 months (September  
2010- February 2013)

Coordinator: GARR

Total cost: € 2.4 M €

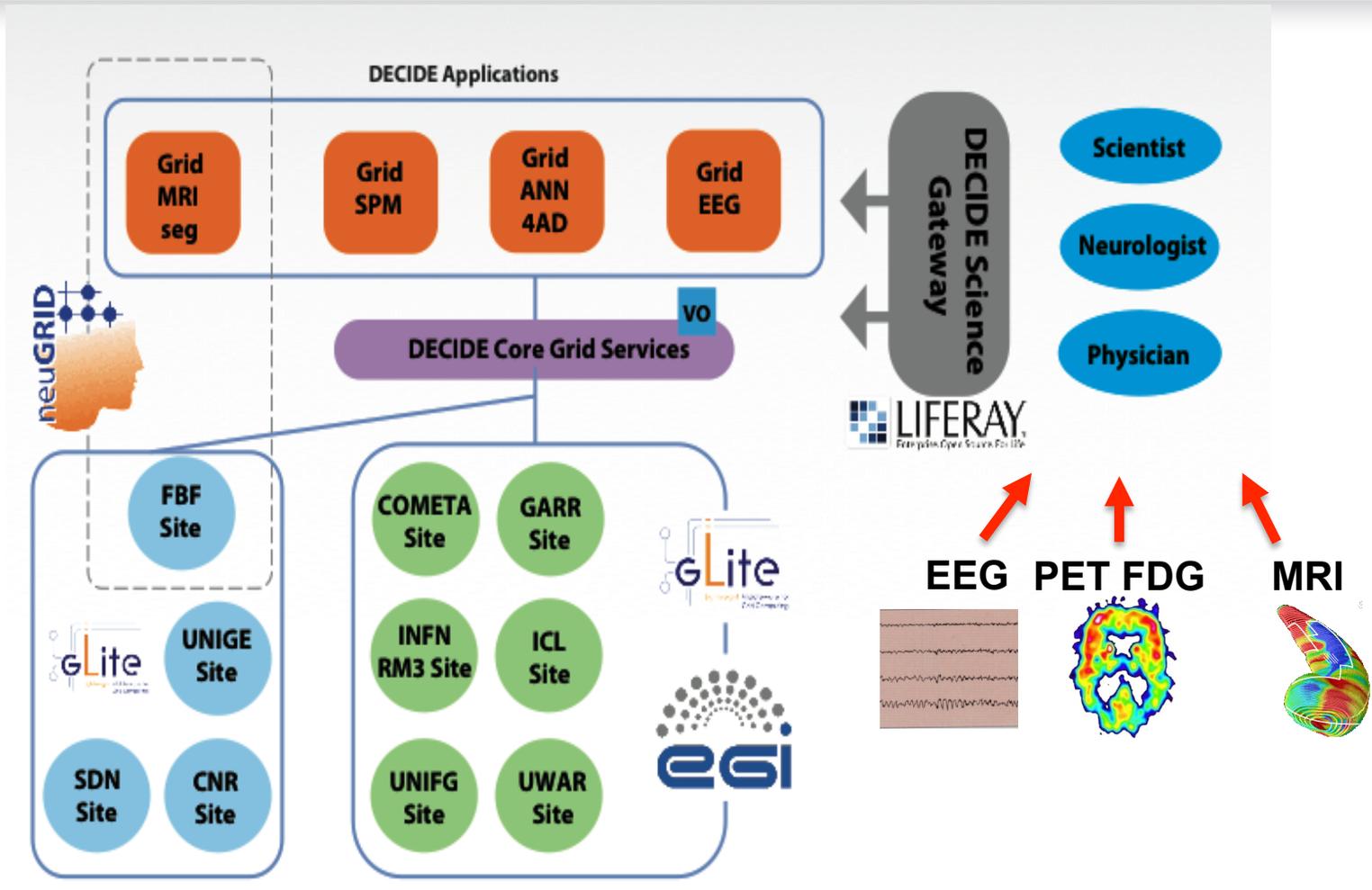
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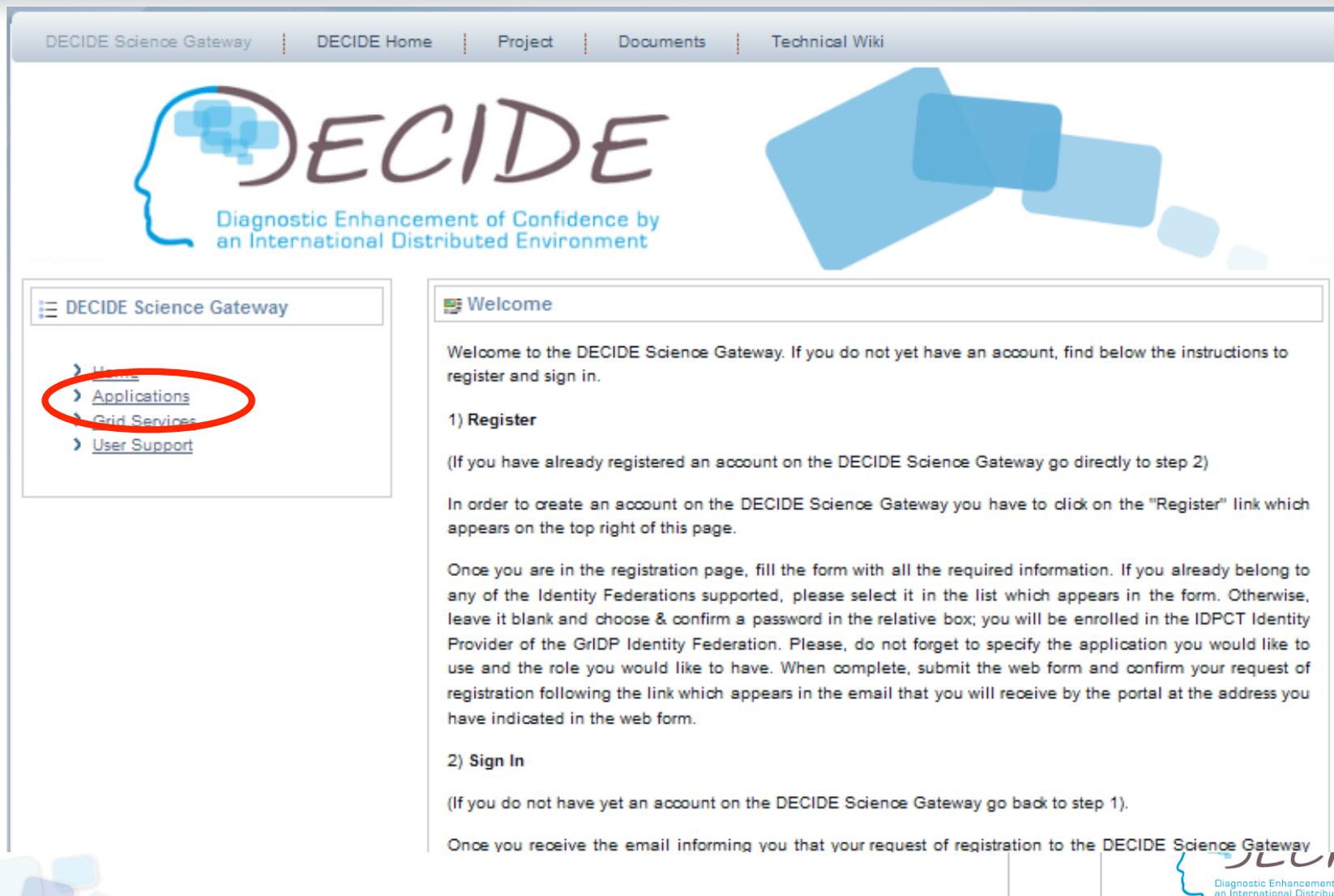
Applications for extracting **imaging markers** (structural MRI, resting state PET/SPECT, resting state EEG data)

High-level interface (Science gateway)

**DECIDE partners maintaining infrastructure nodes are specified in the circles(FBF, UNIGE, COMETA, GARR, UNIFG, and UWAR)**

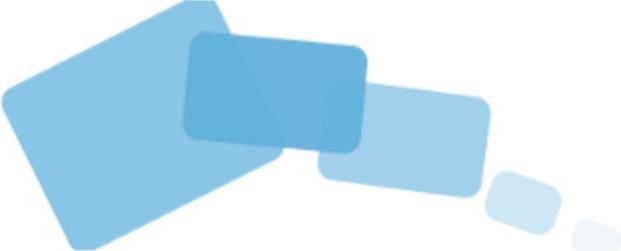


# Science Gateway: login



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 **DECIDE**  
Diagnostic Enhancement of Confidence by  
an International Distributed Environment



**DECIDE Science Gateway**

- > [Home](#)
- > [Applications](#)
- > [Grid Services](#)
- > [User Support](#)

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**2) Sign In**

(If you do not have yet an account on the DECIDE Science Gateway go back to step 1).

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 **DECIDE**  
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# Science Gateway: applications

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## DECIDE

Diagnostic Enhancement of Confidence by an International Distributed Environment

DECIDE Science Gateway

- Home
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  - GridEEG
  - GridMRISeg
  - GridSPM
- Run
  - Manage Repository
- Grid Services
- User Support

My Workspace

- Jobs
- JobsMap
- Data
- Help

### GridSPM - Set Parameters

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#### How to run the analysis

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Please upload your patient's data, choosing the appropriate file. Images have to be submitted both in DICOM and Interfile format. DICOM and Interfile format have to be archived together in .tgz format.

Follow the information on [this page](#) to follow up your analysis and retrieve results.

**Normal subjects filter selection**

Please select:

Please, note that currently filters are not applied due to the reduced number of normal subjects. Controls are shown for training purpose.

**Upload here your SPM data archive**

Select your SPM data archive in .zip or .tgz format:

SPM-PHY Matlab Release 1.0 (2012/03/28 19:48)

This is an service **Minimal user interaction**

# Science Gateway: job submit

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**DECIDE**  
Diagnostic Enhancement of Confidence by  
an International Distributed Environment

DECIDE Science Gateway

- > Home
- > Applications
  - > GridANN4ND
  - > GridEEG
  - > GridMRI/Seg
  - > GridSPM
    - > Run
    - > Manage Repository
- > Grid Services
- > User Support

My Workspace

- Jobs
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- Help

GridSPM - GRID Job submitted

**Your request has been recorded**

Your GridSPM analysis has been successfully sent to the DECIDE computing infrastructure. Check the status of your analysis at this link

**Behind the scene**

Those information are reported only for Demo purpose.

Uploaded archive: /tmp/upload\_00000304.zip Session id: 4k24ptnjojn29eh7gr1es5mbbu Job id: n.a. (async)

This is an OpenStack service

# Science Gateway: job list

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**DECIDE**  
Diagnostic Enhancement of Confidence by  
an International Distributed Environment

**Menu**

- > Home
- > Applications
- > Grid Services
- > User Support

**MyWorkspace**

- Jobs
- JobsMap
- Data
- Help

**MyJobs**

**Active Jobs List** | Done Jobs List

The table below shows the status of your jobs.  
Statuses are automatically updated every 5 minutes so there is no need to reload this page more frequently.

Copy | Print | Save | Search:

Show 10 entries | First | Previous | Next | Last

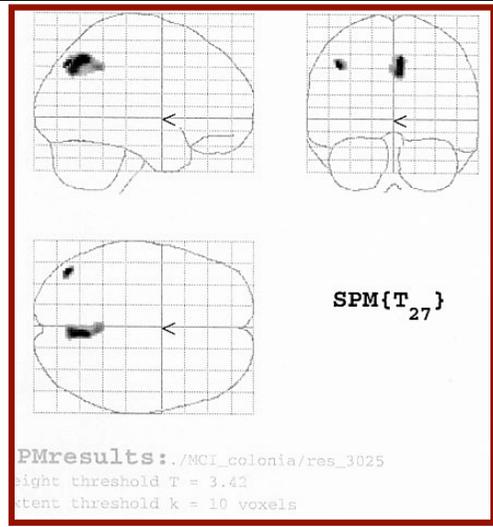
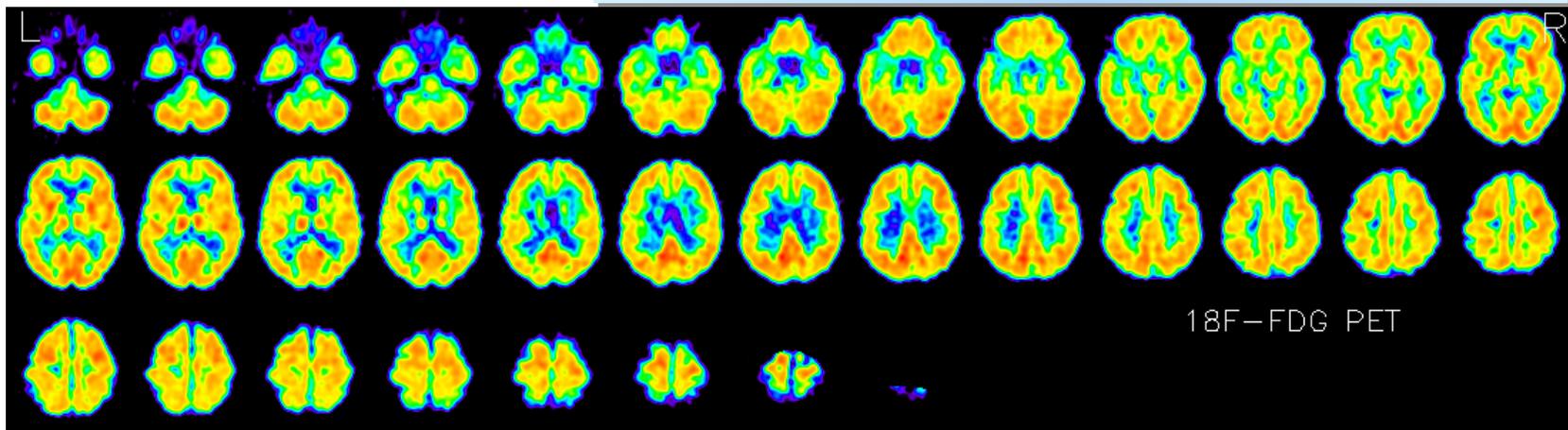
Application Name	User Description	Started on (UTC)	Status
GridSPM	GridSPM Matlab Job 2012-05-21-002909	2012-05-20 22:29:19.0	SUBMITTED
GridSPM	GridSPM Matlab Job 2012-05-21-002816	2012-05-20 22:28:16.0	SUBMITTED
GridSPM	GridSPM Matlab Job 2012-05-21-002732	2012-05-20 22:27:34.0	RUNNING
GridANN4ND	GridANN4ND Job 2012-03-29-162350	2012-03-29 14:23:51.0	

Showing 1 to 4 of 4 entries | First | Previous | 1 | Next | Last

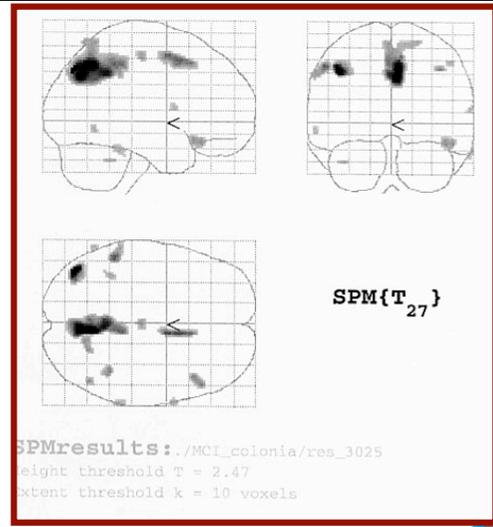
This is an service

# GridSPM application

**aMCI** ID: C03025 | Age: 82 | MMSE: 25 | CVLT: 4



p = 0.001



p = 0.01

# GridMRIseg application



Physician  
& patient's  
info

### General info

Date<sup>1</sup>: Thu Sep 6 14:36:20 CEST 2012  
 Physician: Girolamo Savonarola, MD  
 Patient ID: abbecedario  
 Age: 74 Sex: M

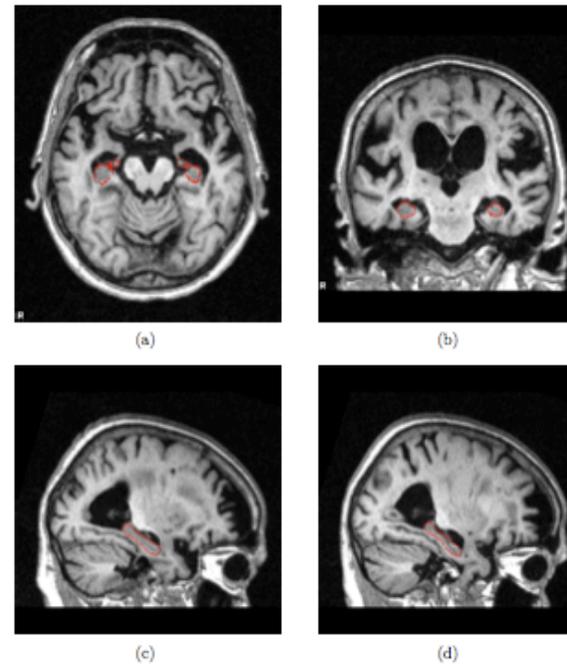
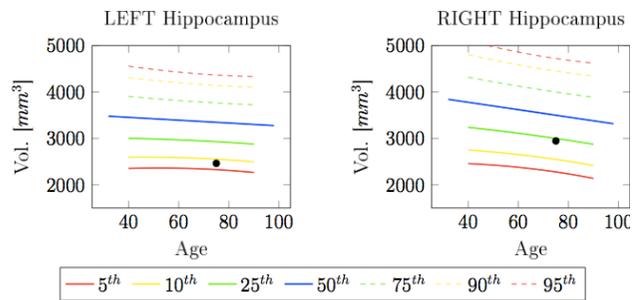
Volumes  
(FslStats @  
ICBM  
reference  
space)  
&  
Predictive  
Intervals

### ACM-AdaBoost<sup>1</sup> Results

Model: DECIDE Standard Model<sup>2</sup>

Left Volume: 2462 mm<sup>3</sup>

Right Volume: 2945 mm<sup>3</sup>



Patient's  
Registration  
&  
Hippocampi  
segmentations

Figure 1: Segmentation of the brain scan registered to the ICBM-152 template. The letter "R" identifies the Right direction. (a) Axial view. (b) Coronal view. (c) Sagittal view centered on the Right Hippocampus. (d) Sagittal view centered on the Left Hippocampus.

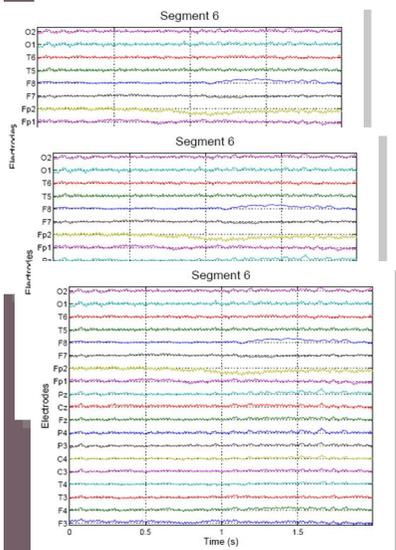
# GridEEG application

GridDATALOAD

GridEEGQUALITY

GRidDTF/COHERENCE

GridEEGSTAT

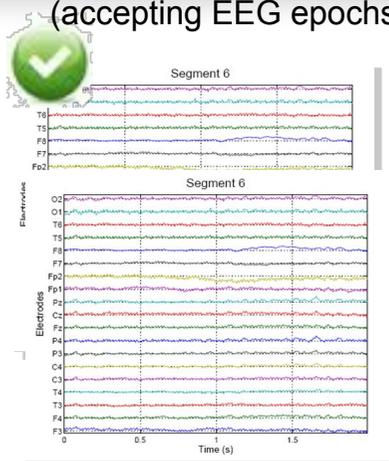


nameEEGtrials.txt

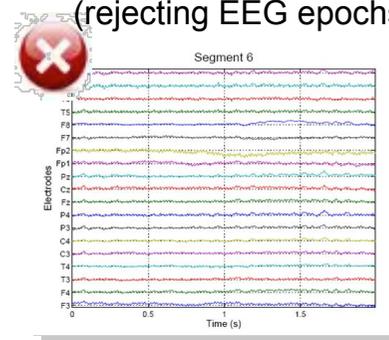
(2-sec EEG epochs in ASCII format)

Data upload

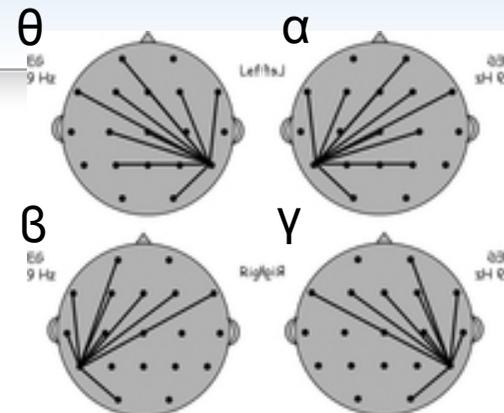
(accepting EEG epochs)



(rejecting EEG epochs)

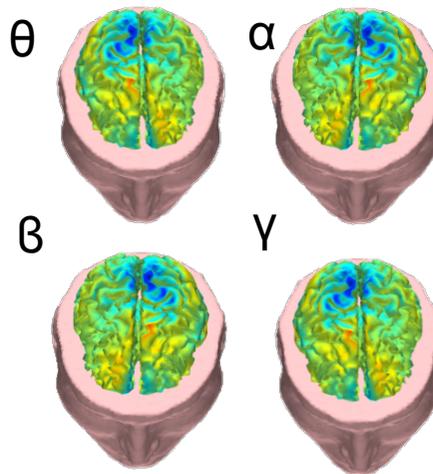


Preprocessing  
artifact detection



Model order, Frequency resolution

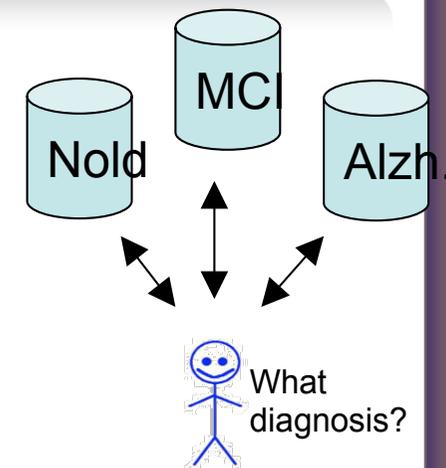
GRidEEGSOURCE



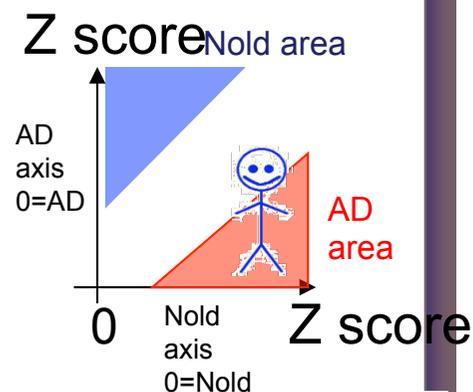
Window, Frequency resolution,...

Processing & markers

reference EEG databases



nameEEGreport.pdf



Statistics &  
send report

# Overview of DECIDE diagnostic service

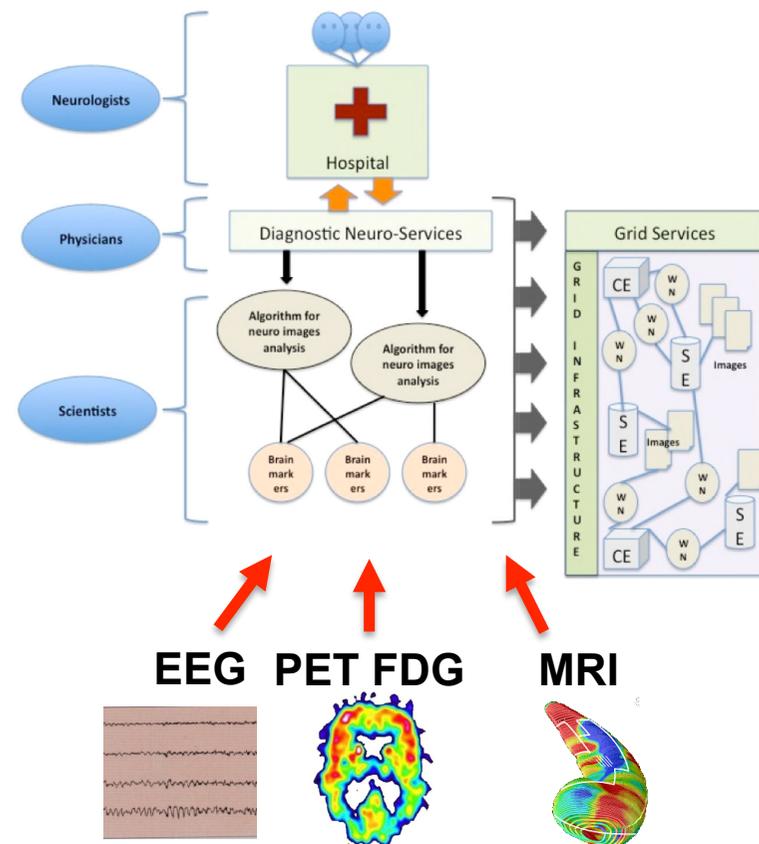
Provide the Neuroscientific and Medical community with a dedicated e-Infrastructure relying on GÉANT, EGI and NeuGrid

Deploy a secure and user-friendly service for the early diagnosis and research on dementia and other brain diseases linking large distributed DBs of multi-modal neuro-images

Validate the e-Infrastructure and the service with real patient cases

Propose a business model to ensure the sustainability of the infrastructure after the end of the project and facilitate its extension to new communities and pathologies

Disseminate the results and provide training programmes promoting the adoption of the DECIDE infrastructure and service



# An Italian idea goes to Europe: the DECIDE project

## Public

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**EC Call: FP7-INFRA-2010-2 – VRC**  
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2008

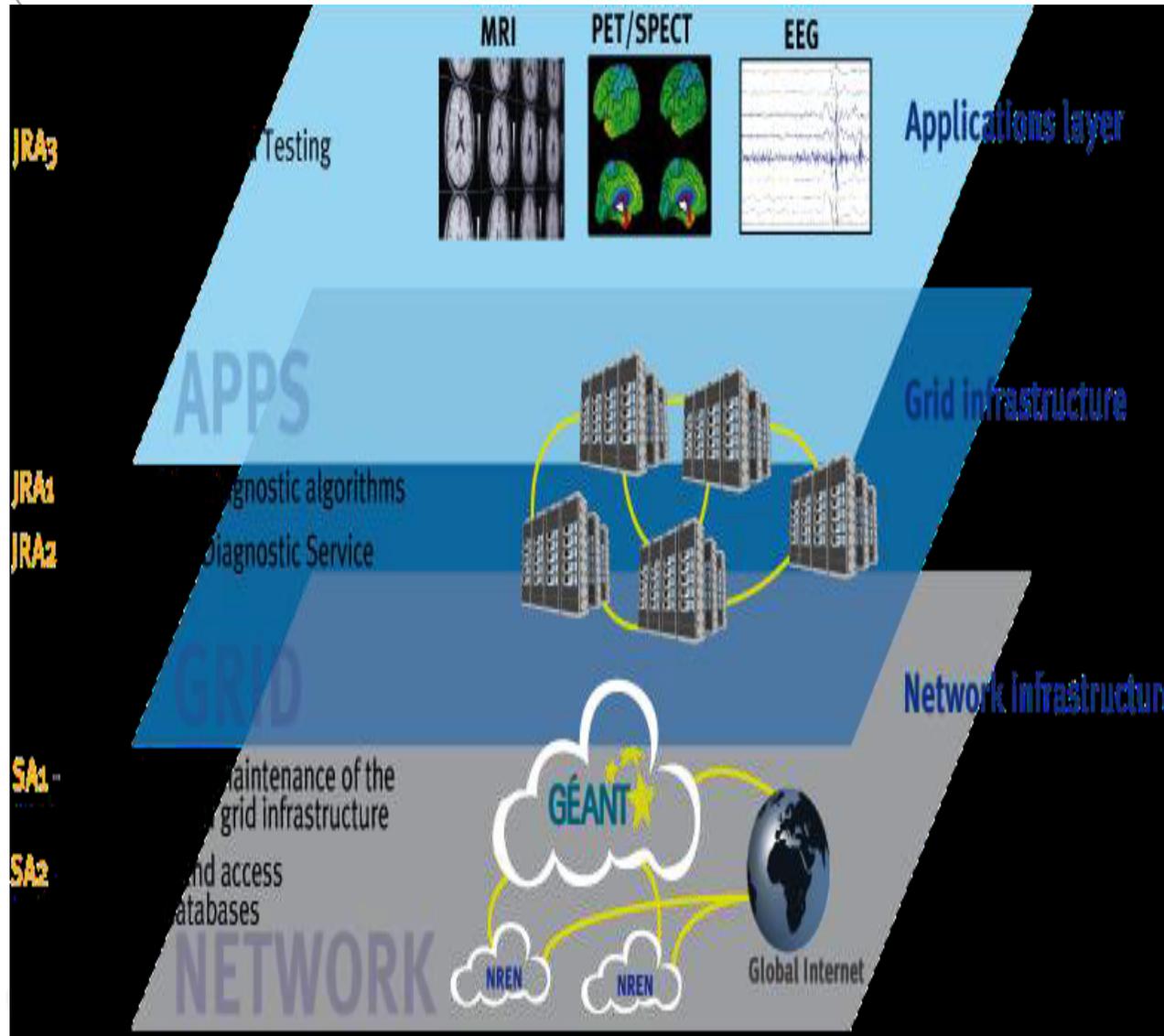
Contract n: RI-261593 \_ Project type:  
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Duration: 30 months (September  
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Total cost: € 2.4 M €

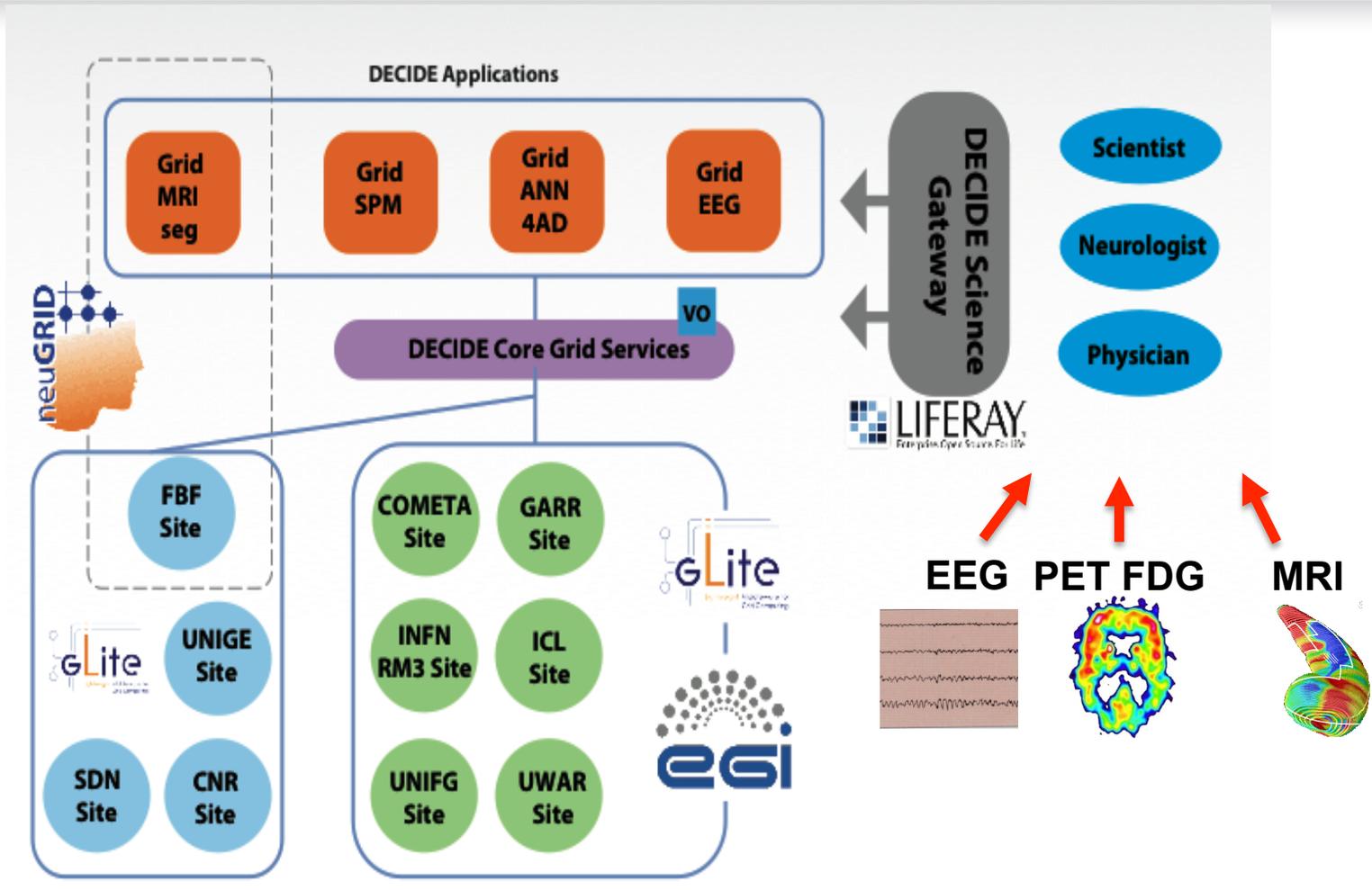
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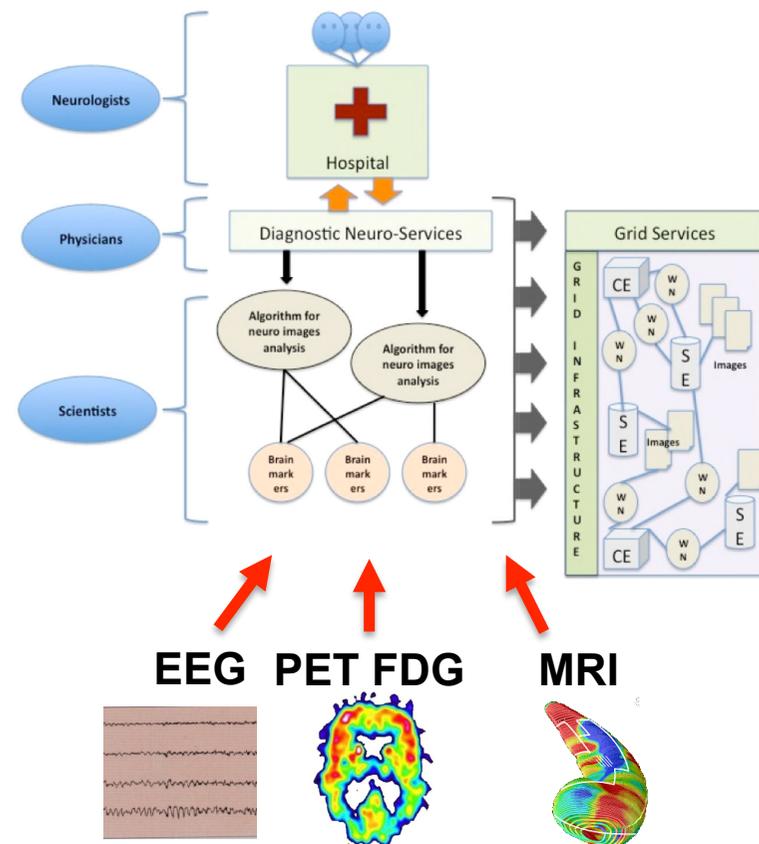
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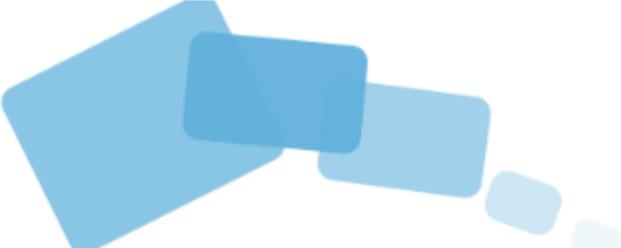
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# Science Gateway: login

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Diagnostic Enhancement of Confidence by  
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**DECIDE Science Gateway**

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Diagnostic Enhancement of Confidence by an International Distributed Environment

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SPM-PHY Matlab Release 1.0 (2012/03/28 19:48)

This is an service **Minimal user interaction**

# Science Gateway: job submit

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**DECIDE**  
Diagnostic Enhancement of Confidence by  
an International Distributed Environment

DECIDE Science Gateway

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GridSPM - GRID Job submitted

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**Behind the scene**

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Uploaded archive: /tmp/upload\_00000304.zip Session id: 4k24ptnjojn29eh7gr1es5mbbu Job id: n.a. (async)

This is an

# Science Gateway: job list

DECIDE Science Gateway | DECIDE Home | Project | Documents | Technical Wiki

**DECIDE**  
Diagnostic Enhancement of Confidence by  
an International Distributed Environment

**Menu**

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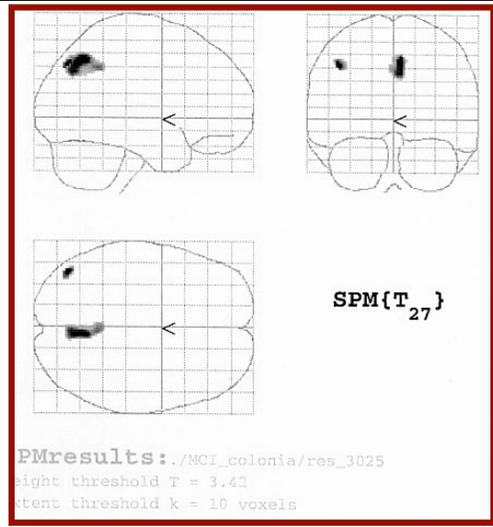
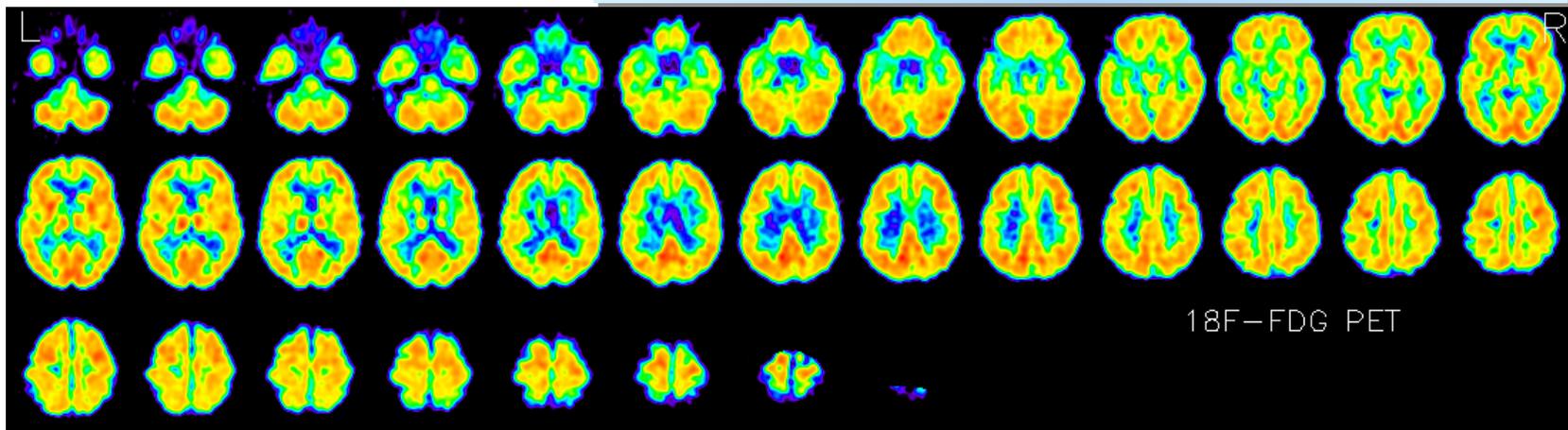
Application Name	User Description	Started on (UTC)	Status
GridSPM	GridSPM Matlab Job 2012-05-21-002909	2012-05-20 22:29:19.0	SUBMITTED
GridSPM	GridSPM Matlab Job 2012-05-21-002816	2012-05-20 22:28:16.0	SUBMITTED
GridSPM	GridSPM Matlab Job 2012-05-21-002732	2012-05-20 22:27:34.0	RUNNING
GridANN4ND	GridANN4ND Job 2012-03-29-162350	2012-03-29 14:23:51.0	

Showing 1 to 4 of 4 entries | First | Previous | 1 | Next | Last

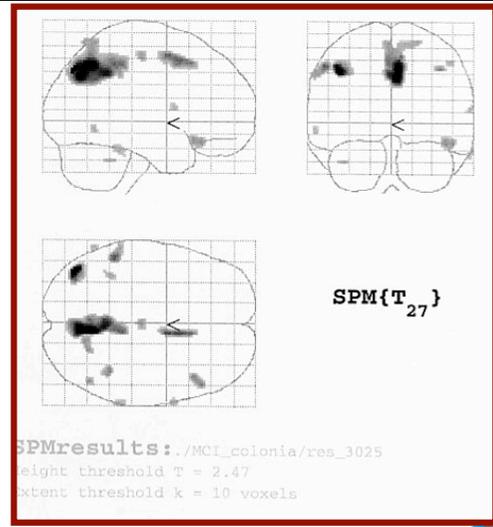
This is an service

# GridSPM application

**aMCI** ID: C03025 | Age: 82 | MMSE: 25 | CVLT: 4



p = 0.001



p = 0.01

# GridMRIseg application



Physician  
& patient's  
info

### General info

Date<sup>1</sup>: Thu Sep 6 14:36:20 CEST 2012  
 Physician: Girolamo Savonarola, MD  
 Patient ID: abbecedario  
 Age: 74 Sex: M

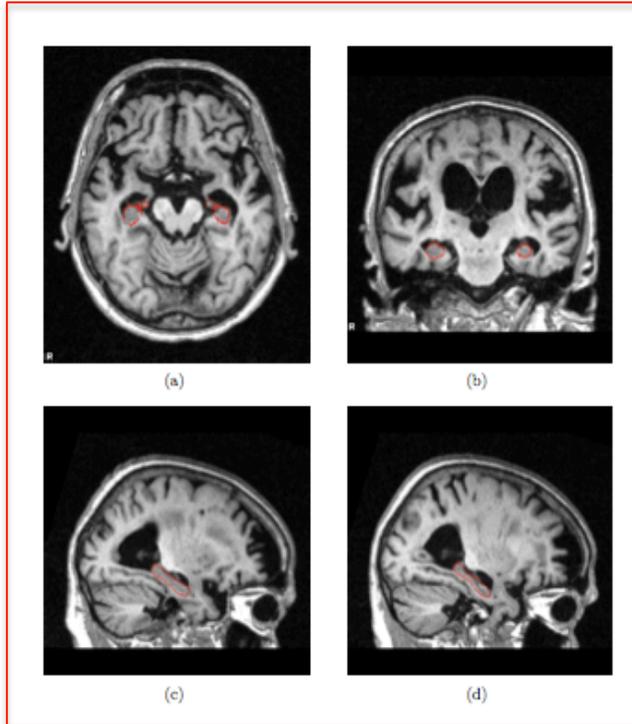
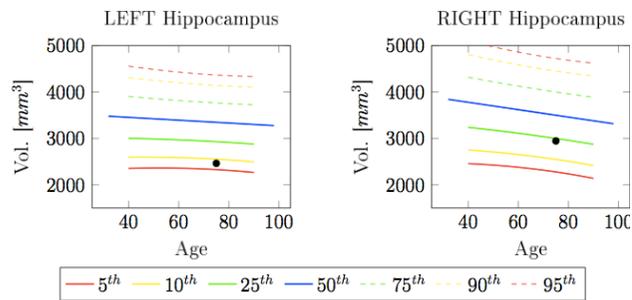
Volumes  
(FslStats @  
ICBM  
reference  
space)  
&  
Predictive  
Intervals

### ACM-AdaBoost<sup>1</sup> Results

Model: DECIDE Standard Model<sup>2</sup>

Left Volume: 2462 mm<sup>3</sup>

Right Volume: 2945 mm<sup>3</sup>



Patient's  
Registration  
&  
Hippocampi  
segmentations

Figure 1: Segmentation of the brain scan registered to the ICBM-152 template. The letter "R" identifies the Right direction. (a) Axial view. (b) Coronal view. (c) Sagittal view centered on the Right Hippocampus. (d) Sagittal view centered on the Left Hippocampus.

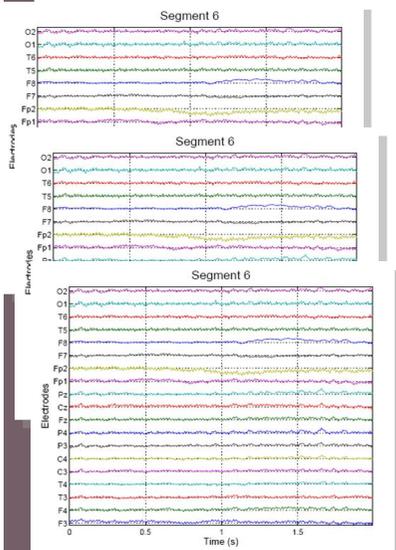
# GridEEG application

GridDATALOAD

GridEEGQUALITY

GRidDTF/COHERENCE

GridEEGSTAT

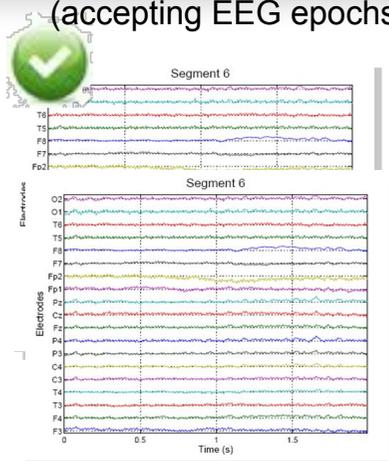


nameEEGtrials.txt

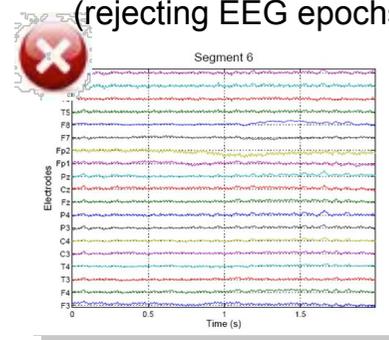
(2-sec EEG epochs in ASCII format)

Data upload

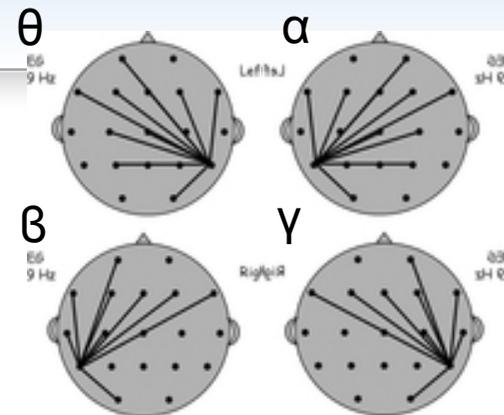
(accepting EEG epochs)



(rejecting EEG epochs)

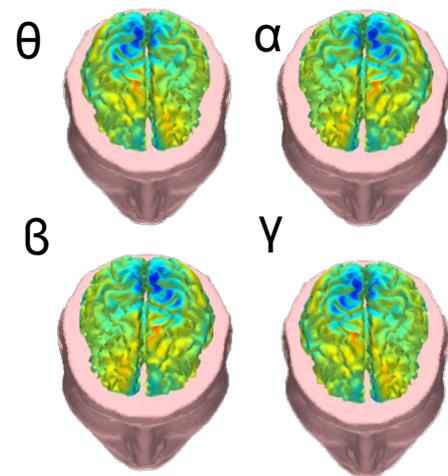


Preprocessing  
artifact detection



Model order, Frequency resolution

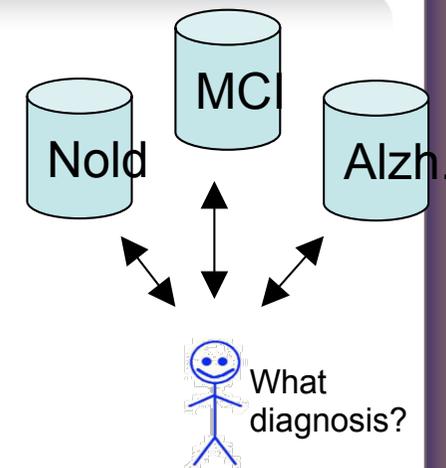
GRidEEGSOURCE



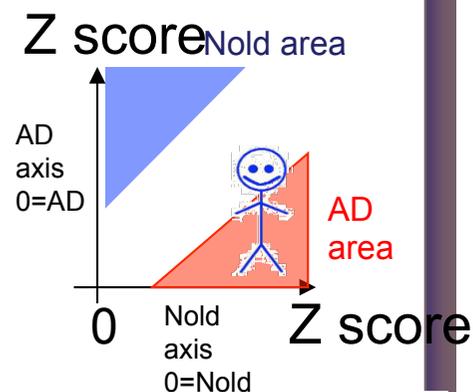
Window, Frequency resolution,...

Processing & markers

reference EEG databases



nameEEGreport.pdf



Statistics &  
send report

# The first expansion of DECIDE to Italian level: the project **GRID-CORE** for cognitive rehabilitation in AD and PD

## Public

### Academic Institutions:

- **GARR**, Rome
- University of Milan Vita-Salute San Raffaele, Italy
- - COMETA, Catania, Italy
- Catholic University of Rome Italy

## Private

### Small and Medium Enterprises (SMEs):

- **IRCCS San Raffaele Pisana**, Rome, Italy (Coordinator)



**Bando Ricerca Finalizzata:  
RF-2010-2319113**  
**“GRID-based System for the  
Evaluation of the effects of  
Cognitive Rehabilitation in Patients  
with Alzheimer’s Disease and  
Parkinson’s Disease” 2010**  
Duration: 36 months (2013-2015)  
Coordinator: IRCCS San Raffaele Pisana  
Total cost: € 241.340 M €

# The expansion of DECIDE to regional level (Puglia): the project **SMART HEALTH** for AD

## Public

### Academic Institutions:

1. Consiglio Nazionale delle Ricerche, Italia
2. IRCCS Istituto Tumori Giovanni Paolo II, Bari Italy
3. Università di Bari "Aldo Moro", Bari, Italy. Sub-contractor **Università degli Studi di Foggia**, (UNIFG),
4. Centro Regionale ICT, Italy

## Private

### Small and Medium Enterprises (SMEs):

1. Beta 8.0 Technology S.r.l., Italy
2. CeRICT S.c.r.t, Italy
3. Cooperativa EDP La Traccia, Italy
4. HC Hospital Consulting S.p.A., Italy
5. Noemalife S.p.A., Italy,
6. IRCCS SDN, Napoli, Italy
7. Telbios S.p.A., Italy
8. Telecom Italia, Italy



### Bando Ricerca PON Smart Cities and Communities "Smart health" 2012

Duration: 36 months (2013-2015)

Coordinator: IRCCS San Raffaele Pisana

Total cost: € 217.800,00 €



**Thank you  
for your kind attention!**

Find more about DECIDE at [www.eu-decide.eu](http://www.eu-decide.eu)  
or contact us for questions and collaboration opportunities at  
[info@eu-decide.eu](mailto:info@eu-decide.eu)