

# NEUROIMAGING IN N4U & EUDAT

*London 2013*

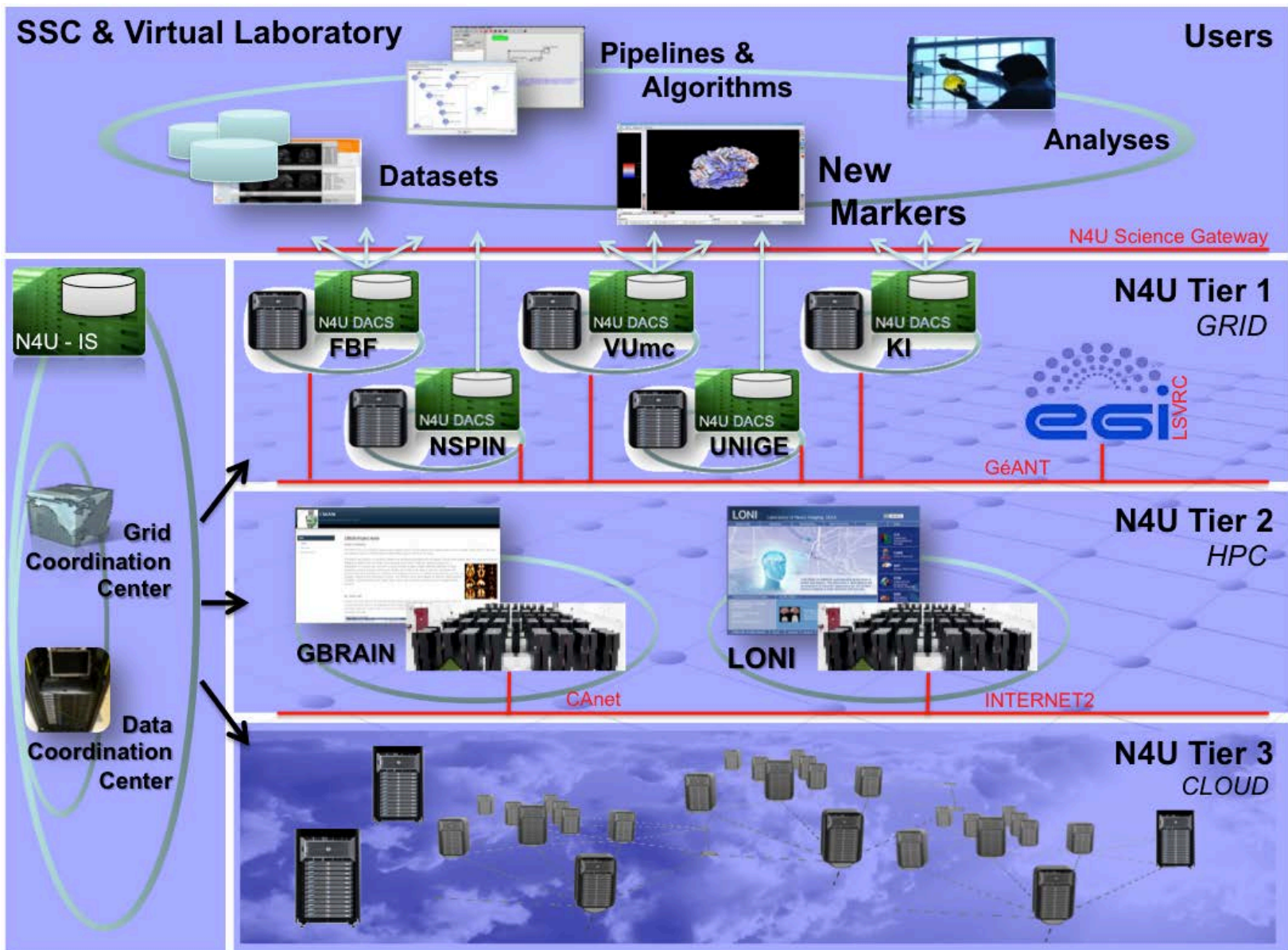
# The National Centre for Alzheimer's and Mental Diseases in Brescia

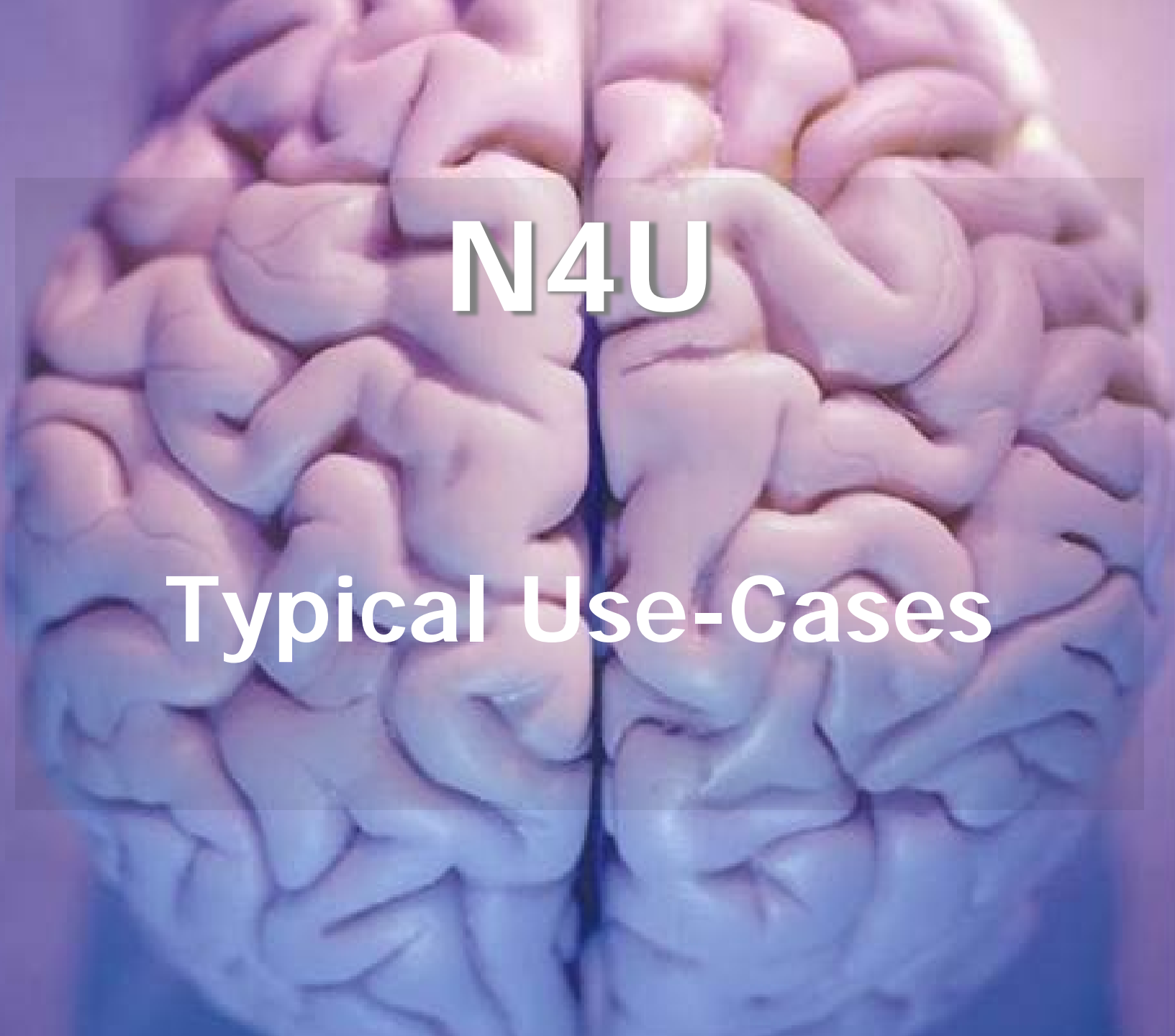


**IRCCS**  
**CENTRO SAN GIOVANNI DI DIO FATEBENEFRAPELLI – BRESCIA**  
Centro Nazionale per lo Studio e la Cura  
della Malattia di Alzheimer e Malattie Mentali



# N4U BACKGROUND





# N4U

## Typical Use-Cases

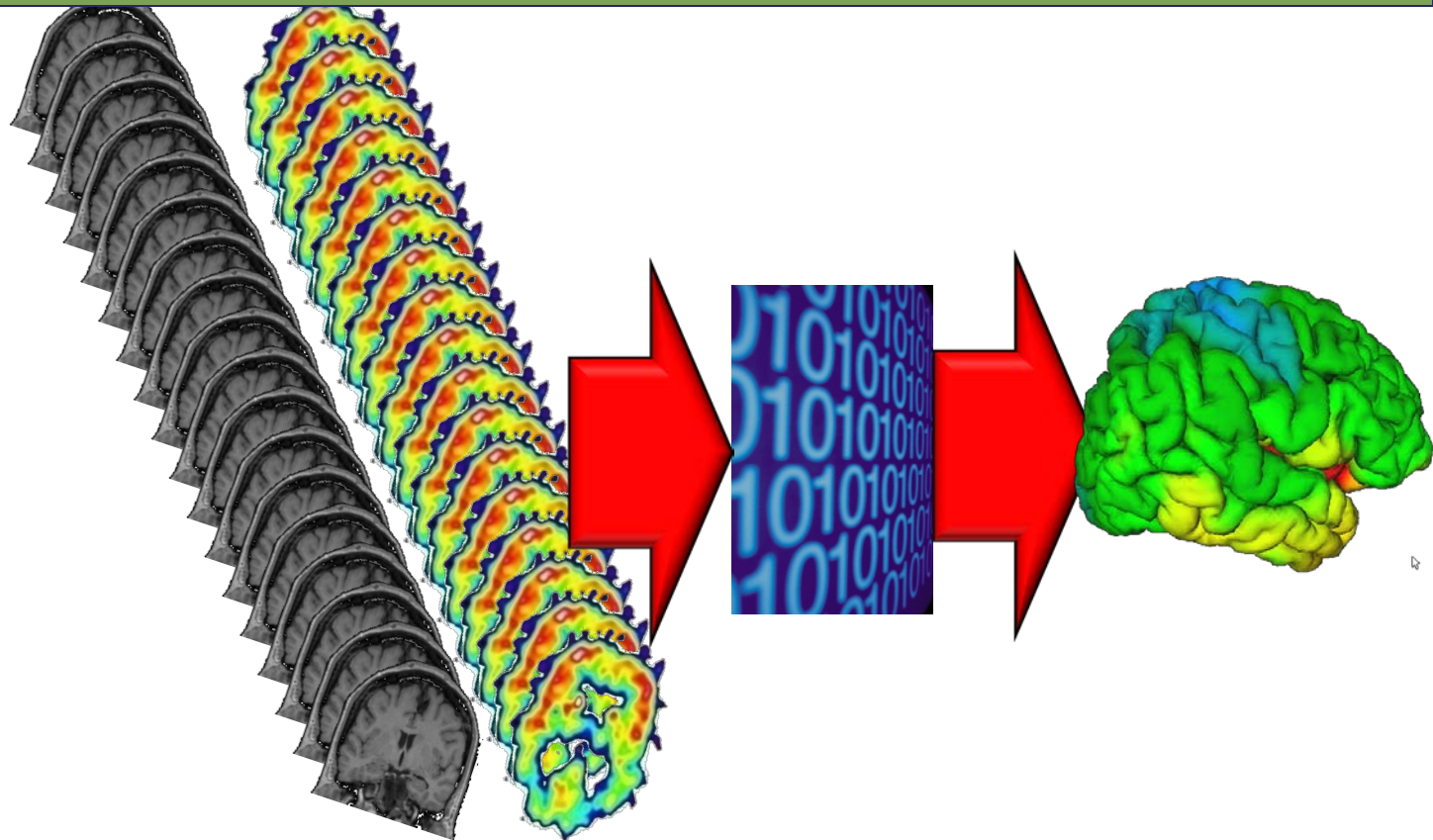
# DISEASE MARKERS YESTERDAY AND TODAY: From *ex vivo* to *in vivo* pathology

OLD TIMES

NOW AND IN THE FUTURE



Pathology



Tera datasets

Algorithms (10-100x)

10<sup>3</sup> TB  
Markers

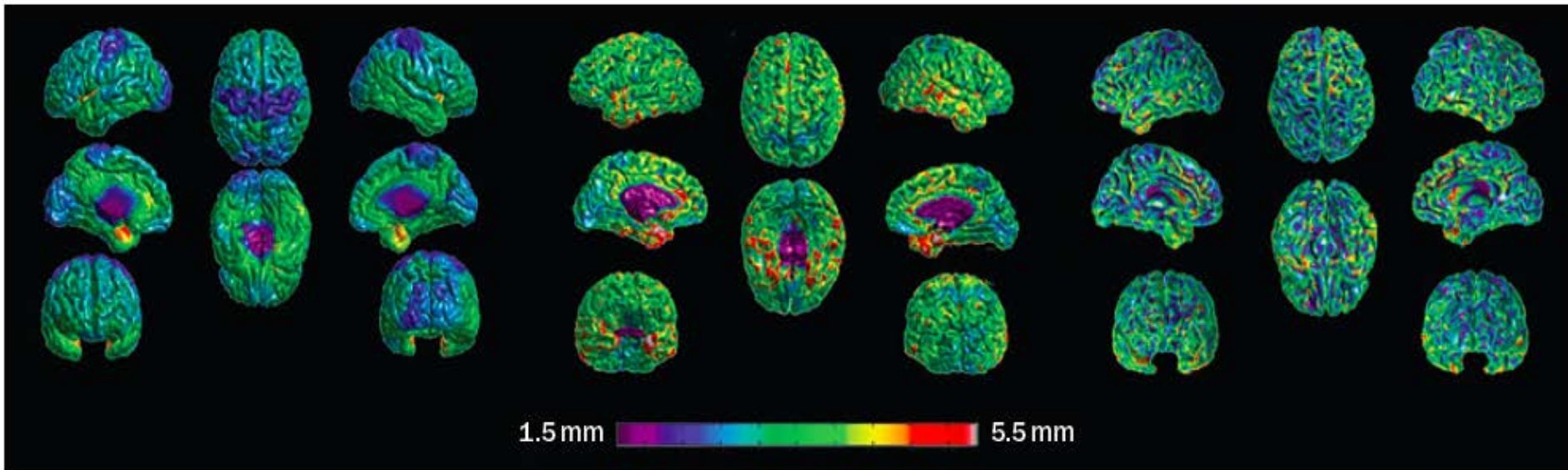
# Typical Data challenge(s)

Analyzed data	MR Scans Images Voxels	<b>6,500 ADNI</b> <b>~1,300,000</b> <b>~9,352,500,000</b>
Algorithm		<b>CIVET – FS – RIC</b>
Experiment duration on the Grid		<b>3 Months</b>
Experiment duration on single monocoore computer		<b>&gt; 15 Years</b>
Total mining operations		<b>750,810</b>
Max # of processing cores in parallel		<b>554</b>
Number of countries involved		<b>4</b>
Volume of output data produced		<b>5 TB</b>
Success rate		<b>85%</b>

CIVET

FreeSurfer

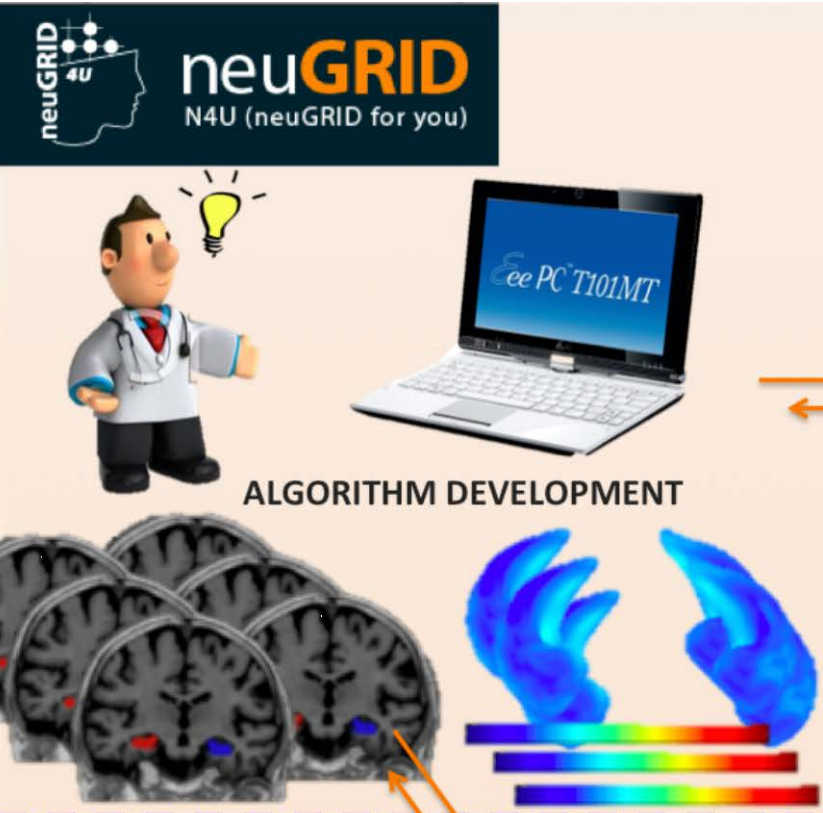
RIC-BrainVISA



**Figure 4** | Maps of mean cortical thickness in the Alzheimer's Disease Neuroimaging Initiative dataset obtained with CIVET, FreeSurfer and RIC-BrainVISA, and displayed with the same visualization tool.



# The Future Collaborative Vision



# Data Registration



## **MOTIVATION:**

- to make research data easier to find so neuroscientists can exploit them for other research purposes avoiding the duplication of already existing works
- to provide long-term links to data and allow published articles to link underlying data
  - to make research data easier to reuse and verify

## **DATA STORAGE:**

- Not well organized. Every analysis generates results with their own structure.
- Normally there is not a well organized DBMS
- Data Stored in folder (long tail data)

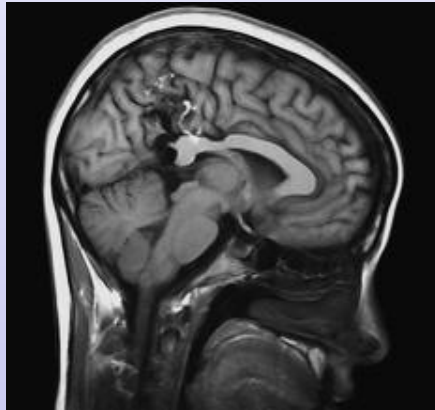
## **DATA VOLUME:**

- 5 TB years per each neuroscientist
  - 10'000 Directories
  - Up to 500 Mb per each pipeline
- Data should be ingested (preferably) at EUDAT centres



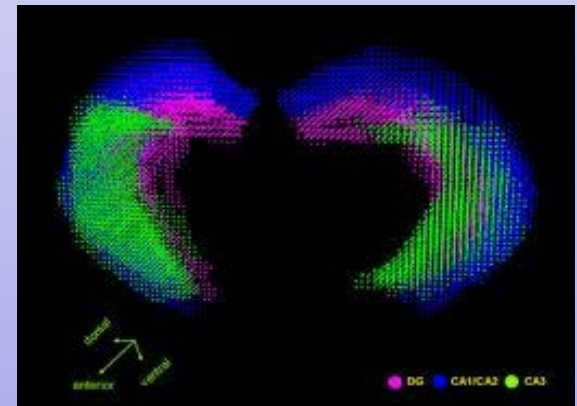
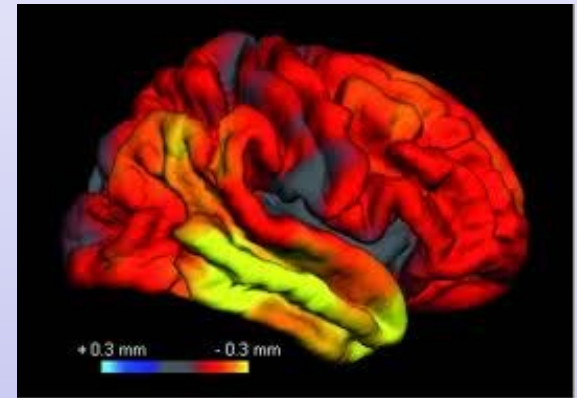
# Safe Replication

## RAW DATA



&

## PROCESSED DATA





**RESEARCH  
QUESTIONS AS PROOF  
OF CONCEPTS**

# N° Projects benefiting of N4U capabilities

ID	PI / Institution	Study Name	N° Scan to be processed
1	K. Cover, VuMC the Netherlands	Reproducibility of two algorithms for brain atrophy measures	1000
2	D. Aarsland, KI, Sweden	Structural brain changes in elderly depressive patients with and without cognitive decline	100
3	G. Spulber, KI Sweden	White matter lesion load in the AddNeuroMed cohort	120
4	J. Hillert KI, Sweden	Cortical atrophy in multiple sclerosis patients: the MS-stop project	100
5	M. Kivipelto, KI Sweden	CAIDE study: Structural MRI and cardiovascular risk factors	240
6	A Redolfi, FBF Italy	Quantitative evaluation of two prominent cortical surface reconstruction algorithms in ADNI patients: a cross sectional study	1000
7	A Redolfi, FBF Italy	ACM Adaboost Algorithm Pipeline Setup	200
8	A. Prestia, FBF Italy	Diagnostic accuracy of markers for prodromal Alzheimer's disease in 2 independent clinical series	90
9	A. Prestia, FBF Italy	Testing the dynamic model of Alzheimer's disease in two European memory clinics	90
10	G. Frisoni, FBF Italy	PharmaCog – Identification of biomarkers sensitive to disease progression – Volunteer study	520
11	G. Frisoni, FBF Italy	PharmaCog – Identification of biomarkers sensitive to disease progression – Patient study	3000
12	PJ Visser, VuMC the Netherlands	EMIF-AD – Identification of prognostic and diagnostic biomarkers for Alzheimer's Disease	To be planned
13	A. Simmons, KCL, UK	White matter lesion load in the London cohort	120
14	S. MacDonald, Victoria University, Canada	Cortical thickness and intraindividual variability in working memory	40
15	C. Follin, Lund University Hospital, Sweden	Investigation of structural changes in patients with acute lymphoblastic leukemia and craniopharyngioma that underwent cranial radiotherapy	80
16	H. Soininen, University of Eastern Finland	The FINGER study: Possible effects of multi-domain interventions on brain structures	150
17	R. Rossi, FBF Italy	BipoBorder Study	80