TESLA

Technological Equipment and Software for Life-Science Applications

Duration: 2013-2014

INFN Collaboration:

- Pisa – national/local coordinator: A. Retico
- L'Aquila - local coordinator: M. Alecci (Dip. Medicina Clinica, Sanità Pubblica, Scienze della Vita e dell'Ambiente - MESVA, Università dell'Aquila)
- Lecce - local coordinator: G. De Nunzio (Dip. Matematica e Fisica, Università del Salento)

http://www.pi.infn.it/~retico/TESLAwebsite/Tesla.html

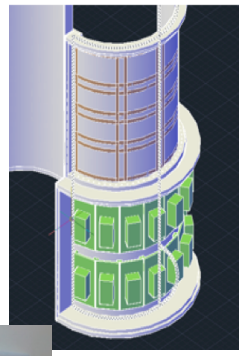
Work plan TESLA 2013-2014

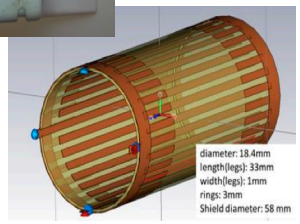
7T MR

WP1.

NEW COILS:

- 32 ch. Rx - Phased Array for human knee imaging
- Tx-Rx surface coil for human neck
- Tx-Rx volume coil for small animals





SAFETY:

- Electromagnetic Simulations
  - Power deposition in biological tissues (SAR): computation of SAR maps for real-time monitoring at 7T

1.5T, 3T, 7T MR

WP2.

IMAGE PROCESSING and ANALYSIS:

- Postprocessing of 7T image to attenuate inhomogeneities.
- Image segmentation (cartilages, tendons and bones) and quantitative image parameter computation.
- Evaluation of the predictive value of MRI data on clinical data (1.5T and 3T) and feasibility study on 7T data:
  - Structural MRI (neurodegenerative diseases);
  - Diffusion weighted imaging (brain tumor segmentation and characterization, connectivity map interpretation, …)

New RF coils for specific applications at 7 T

WP1		PI	AQ
2013	1-6 m	Numerical modeling of **Phased array coil for knee Imaging (PA16)** and of the **neck surface coil for Imaging (NEC)** in the empty condition. Numerical/analytical modeling of **Volume Small Animal Imaging Coil (SAC)** in the empty condition.	Numerical modeling of the **PA16** and of the **NEC** coils in the empty condition using Ansys software. Numerical/analytical modeling of Volume **SAC** in the empty condition using Ansys software.
	7-12 m	Set up of workbench methods for RF coil testing	
		Development of anatomic and dielectric models of the knee, of the neck and of anatomic and dielectric animal models (mouse, rat, rabbit). Acquisition of basic mechanical and electronic components for **PA16** and **NEC** coils.	Analytical modeling of the **PA16** in the loaded condition. Numerical/analytical modeling of the **NEC** in the loaded condition. Acquisition of basic electronic and mechanical components for the **SAC** coil.
		Numerical study of RF distribution of RF coil at 7T	
		Mechanical assembling of basic components for **PA16** and **NEC** coils.	Mechanical assembling of basic components for the **SAC** coil.
		Study of pulse sequences for estimating SNR, RF homogeneity and SAR at 7T for **PA16**, **NEC** and **SAC** coils.	
2014	1-6 m	Configuration and building of appropriate phantoms to be used in the scanner.	Design of the optimal matching network for the **PA16** and **NEC** coils.
		Testing of the optimal matching network and isolation for the RF coils	
	7-12 m	Implementation and test with phantoms of sequences for SNR, RF homogeneity and SAR estimate	
		Comparison of images and spectra obtained with the RF **PA16** and **NEC** prototypes with phantom and volunteers. Comparison of images and spectra obtained with the RF **SAC** prototype with phantom and animals.	

Image processing and analysis techniques

WP2		PI	LE	AQ
2013	1-6 m	**4.3.1** Development of **image filtering** techniques to recover homogeneity in 7 T structural images of the brain		
		4.3.2 Imaging the wrist at 7T with the available 32-ch coil for human head (Nova Medical Inc.). Few volunteers.		
		4.3.3 Retrospective choice of a suitable data sample for **connectome** study (HARDI acquisition protocol).	**4.3.3** Multimodality **glioma** data collection. Histological glioma data collection. Estimation of the discriminant power of textural features (correlation in-vivo and ex-vivo measures). Tuning the software system for MR image standardization.	**4.3.3** Data analysis to help in the correlation between in-vivo and ex-vivo measures, using if appropriate fluorescent microscopy data.
	7-12 m	**4.3.1** Evaluation standard registration and cortical segmentation tools on filtered 7 T brain images.		
		4.3.2 Evaluation of SNR and SCR for trabecular bone and cartilage. Structure segmentation and evaluation of: total bone volume (TBV), bone volume fraction (BVF), surface curve ratio (SCR), erosion index (EI).		
		4.3.2 sequence optimization for imaging ex-vivo vertebras and knees at 7T with the 32-ch coil for human head (Nova Medical).		
		4.3.3 Fiber tractography and cortical parcellation algorithms on each subject for connectome study.	**4.3.3** Building the multivariate/multimodality classification system with SVM and ANN.	
2014	1-6 m	**4.3.3** Connectome map extraction. Implementation of decisional systems (SVM) for connectome interpretation.	**4.3.3** Optimization of the classification system; test on new clinical data.	**4.3.3** Providing guidelines for design of the Graphical User Interface (GUI) for the glioma classification software.
	7-12 m	**4.3.2** Acquisition at 7 T of knees/vertebras of volunteer with osteoarthritis/osteoporosis with PA16 and NEC prototypes (WP1).		
		4.3.2 Analysis of images of knees and vertebras of human volunteers; Evaluation of SNR and SCR for trabecular bone and cartilage. Structure segmentation and quantification of relevant structures. Evaluation of total bone volume (TBV), bone volume fraction (BVF), surface curve ratio (SCR), erosion index (EI).		
		4.3.3 Evaluation of the impact of multivariate classification techniques on connectome data.	**4.3.3** Final evaluation of the system performance	

Milestones June 2013 (first six months)

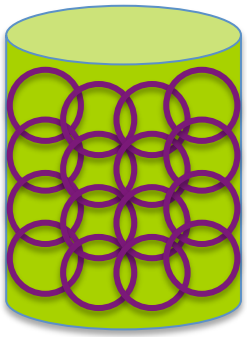
30-06-2013	Numerical modeling of all RF coil models in the empty condition (PI and AQ).	WP1
30-06-2013	Determination of geometrical and electrical parameters to build the RF coil prototypes for 7T MR system (PI and AQ). 	WP1
30-06-2013	Optimization of acquisition sequences for imaging the human wrist at 7T (PI).	WP2
30-06-2013	Identification of a data sample for connectome study and multimodality glioma data collection (PI, LE, AQ). 	WP2

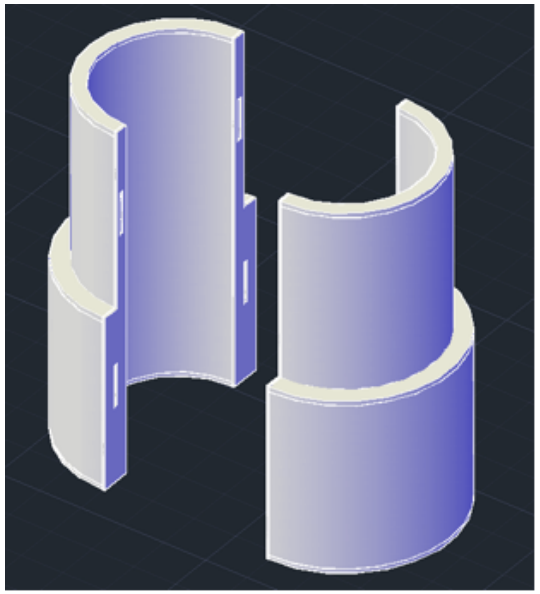
WP.1.1 @ PI: 16/32 Phased Array (PA16)

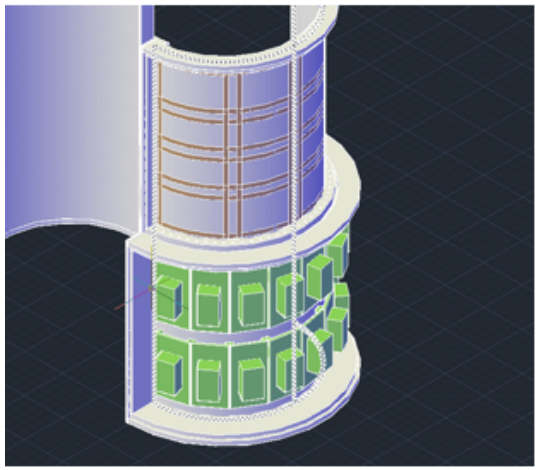
- 2 channel for quadrature transmission (already available by Nova Medical Inc.)
- 16-32 channels for parallel reception
  - Optimal SNR
- 17 cm diameter, split design

- Objective: high resolution knee/calf studies (in collaboration with Dip Med. Pisa and AOUP – see WP2)

- HW needs:
  - Fireproof plastic support
  - 16-32 preamplifiers
  - High-voltage non magnetic components



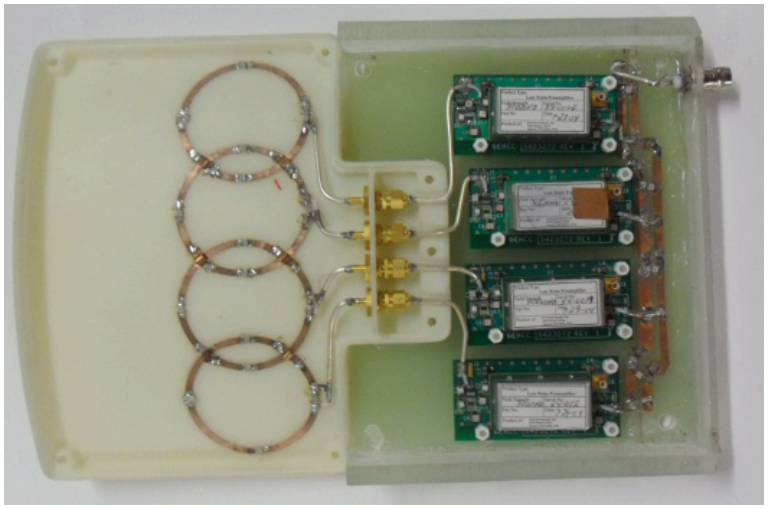


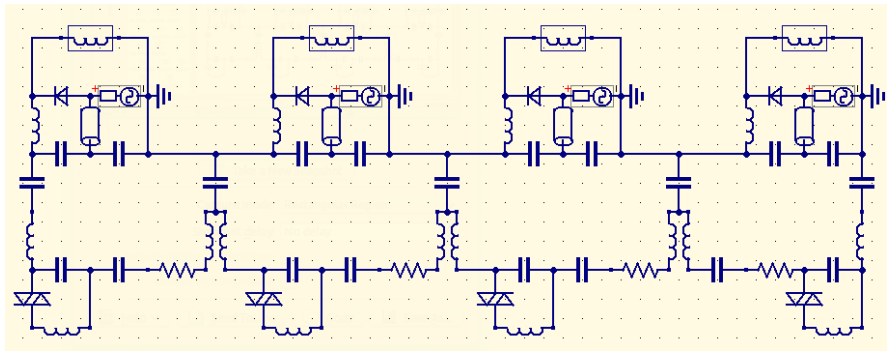


Experience with phased arrays

Phased array coil for 1H @ 7 T:

- simulation of the four interacting loops of the phased array;
- prototype realization in collaboration with Jim Tropp (senior scientist, General Electric);
- “attempt” of integration into the 7 T scanner @UCSF (preamplifiers damaged during the trip).





R. Stara @ Stanford University

Phased array coil for 1H @ 7 T:

- Capacitive decoupling with shared legs (degenerate birdcage)
- Different circuit for matching and decoupling
- Cable phasing

WP.1.2 @ UniAQ: NEC Design

- Anatomical design for best comfort and coil performance.
- Objective: High resolution studies of brainstem (neurodegenerative disease, synergy with RF-2009-1546281, dott. M. Cosottini, Unipi and AOUP)

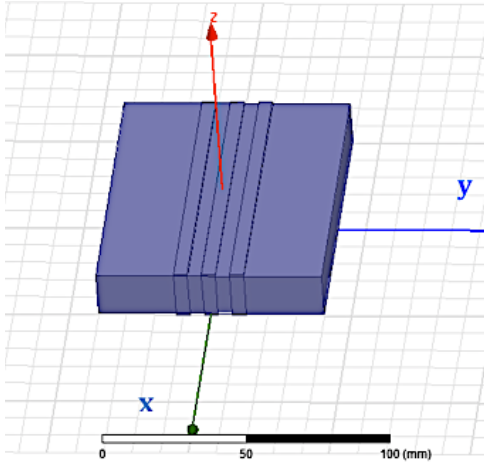
Activity report of the INFN section at the University of L'Aquila (Prof. M. Alecci)

WP.1: Development of new RF coils devoted to specific applications at 7 T.
WP.1.2 Neck Coil (NEC)

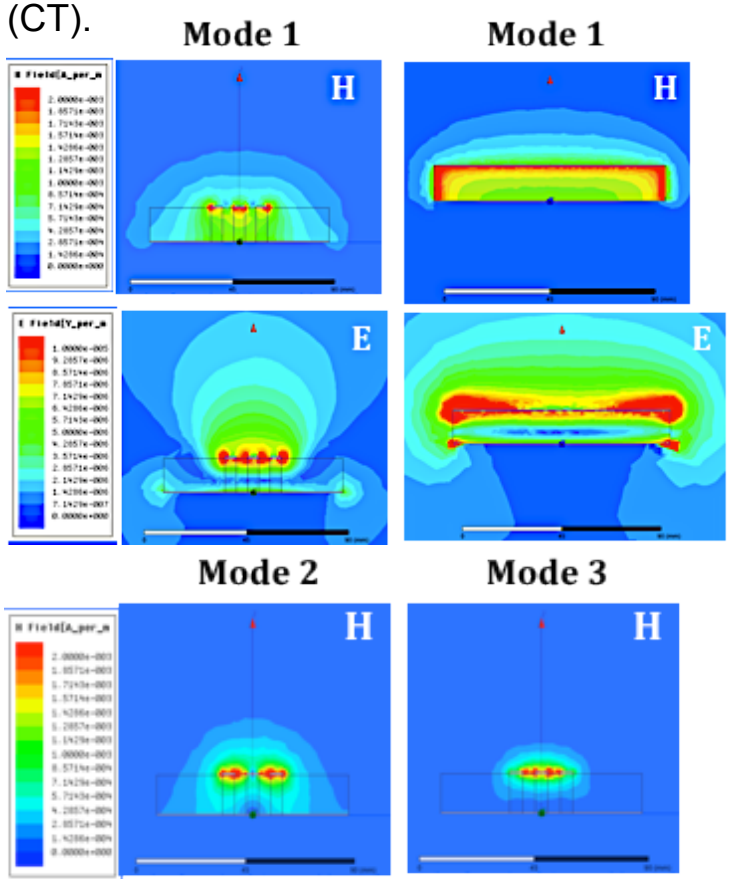
Expected Milestones, from 01 January to 30 June 2013:
- **Numerical modeling of all RF coil models in the empty condition (PI and AQ)**
- **Determination of geometrical and electrical parameters to build the RF coil prototypes for 7T MR system (PI and AQ)**

Summary of Results NEC:
- **Literature review of NECs**
- **Design of the NEC by using microstrip technology**
- **Numerical modelling of the NEC in the empty condition by means of Ansoft software**
- **Resonant frequency calculation @ 7T (proton) of the NEC in the empty condition**
- **RF magnetic (H) and (E) electric field calculations @ 7T of the NEC in the empty condition**
- **Mechanical design of the plastic holder suitable for the NEC**
- **Selection of the mechanical and electrical (capacitors) components for the NEC**

WP.1.2 @ UniAQ: NEC Design



- The NEC is designed following the microstrip model and it is made by 3 copper strips (width 5 mm, length 100 mm, thickness 0.6 mm) with relative separation of 5 mm.
- The strips are positioned on the top surface of a planar Teflon holder (100*80*15 mm^3).
- On the bottom surface of Teflon holder is positioned the ground plane (100*80*0.6 mm^3) made by continuous copper.
- The end of each copper strip is connected to ground by a tuning chip capacitor (CT).

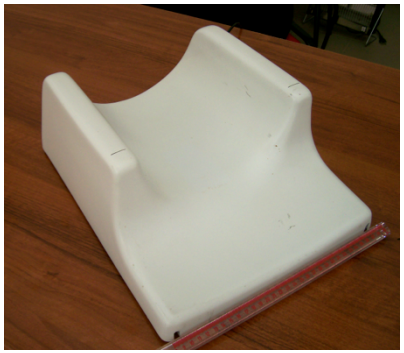


RF magnetic (H) and electric (E) RF field distribution for the fundamental Mode 1 in the trasverse (yz) and longitudinal (xz) planes.

Magnetic RF fields of Mode 2 and 3.

CT (pF)	F1 (MHz)	F2 (MHz)	F3 (MHz)
4.40	292	409	486
4.25	295	413	489
4.10	300	422	497

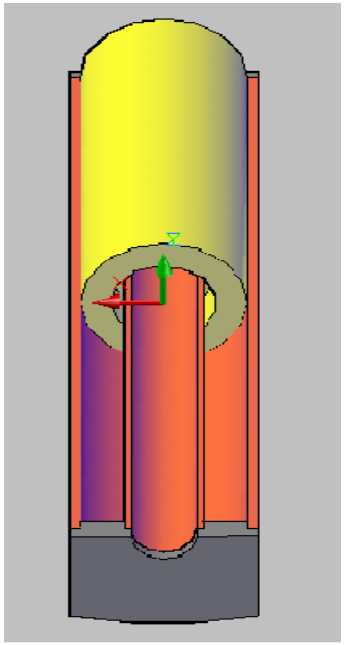
Picture of the anatomically shaped plastic holder for the NEC prototype.



WP.1.3 @ PI: Small animal coil (SAC)

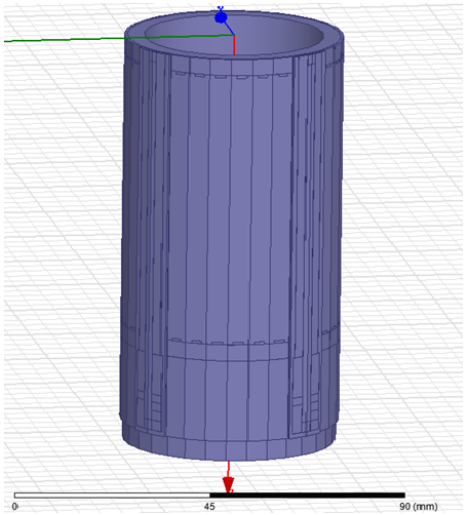
- Birdcage with 32 legs for quadrature Tx and Rx
- Just “printed” capacitors
- Very small size (3 cm diameter)

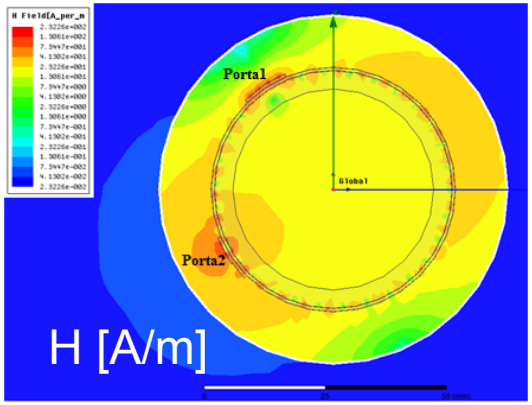
- Objective: High-resolution preclinical studies, small sample studies

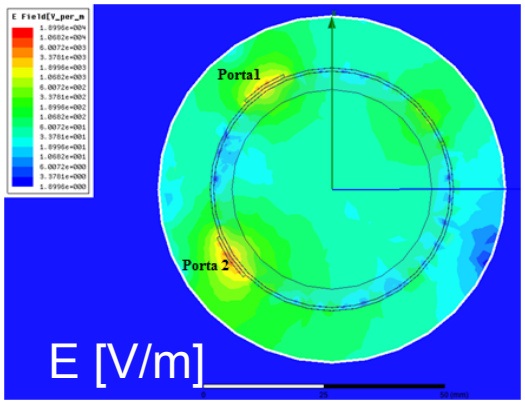


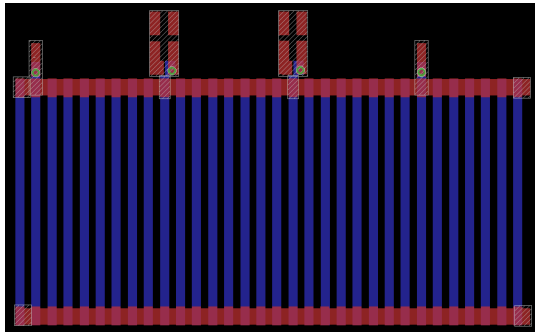
Coil simulation (HFSS):

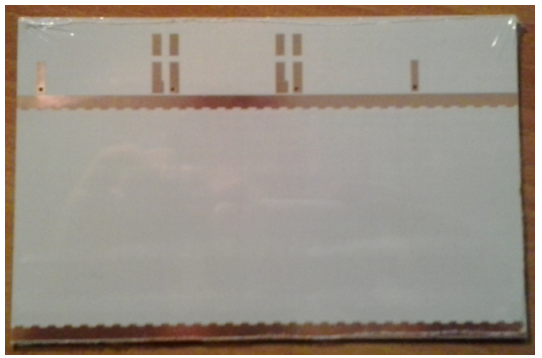
- H and E field maps



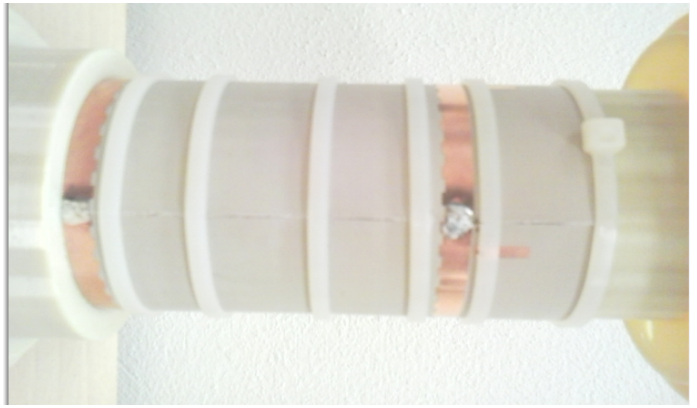








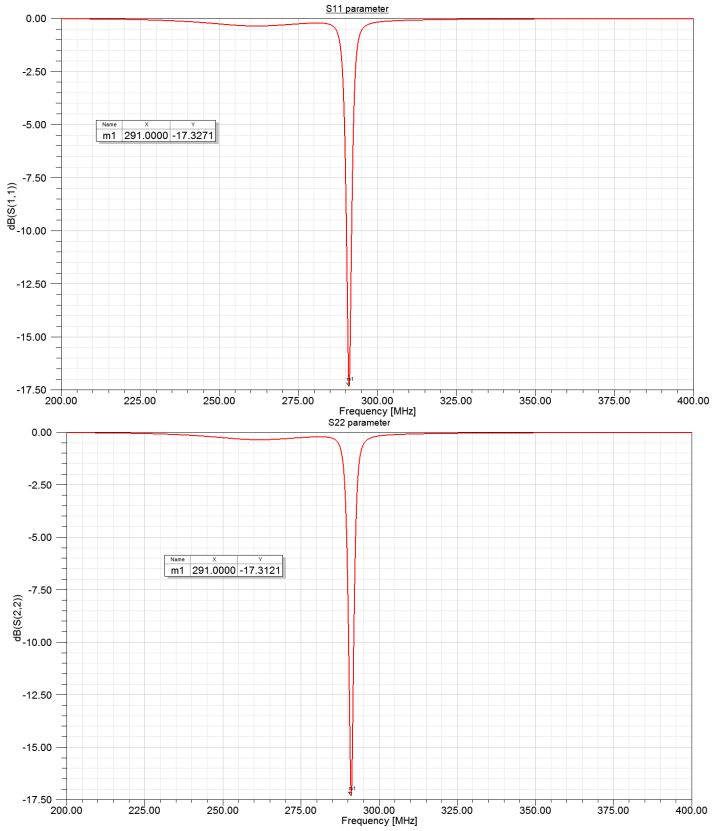
Simulation, prototype realization and measurements

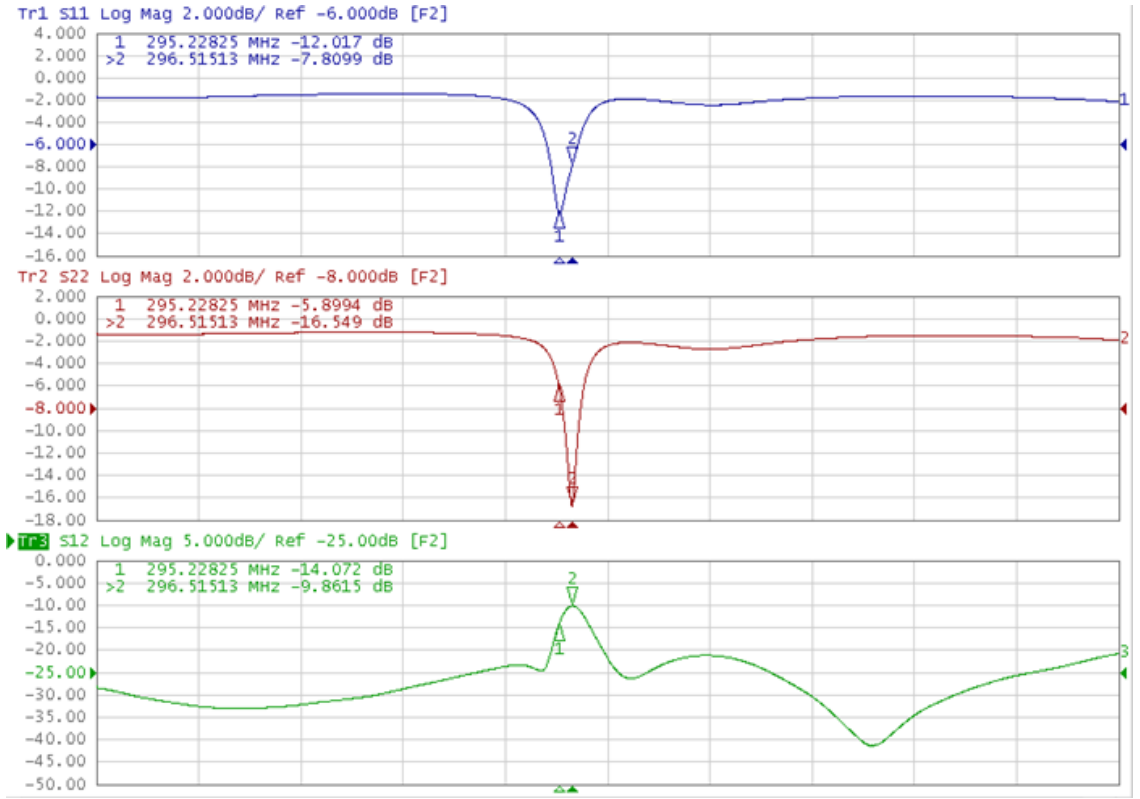


M. Gabrieli, Tesi di Laurea Magistrale in Fisica (in progress)

Relatori: A. Retico, M. Tosetti

Sviluppo e validazione di una bobina a radiofrequenza per applicazioni precliniche di risonanza magnetica a campo ultra alto

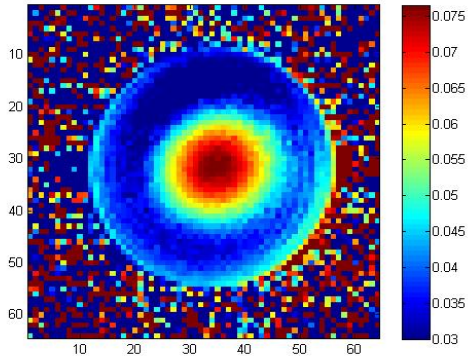




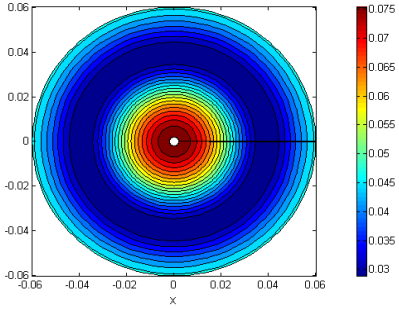
Specific Absorption Rate (SAR) monitoring

Analytical approach applied to homogeneous cylindrical phantom (G. Tiberi, IMAGO7)

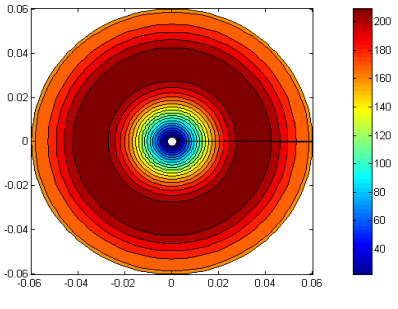
Measured B_1 field [G]



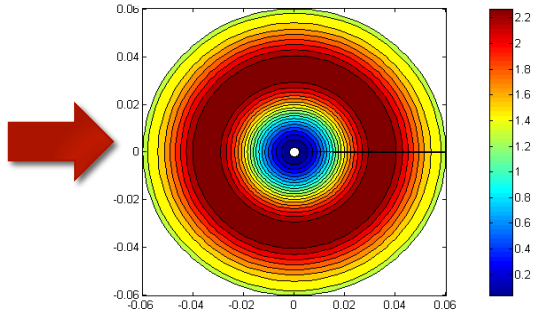
Simulated B_1 field [G]



Simulated E field [V/m]



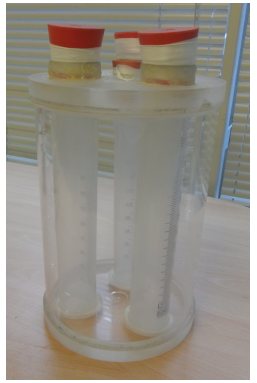
Derived SAR [W/Kg]



$$SAR = \int_{sample} \frac{\sigma(\mathbf{r})|\mathbf{E}(\mathbf{r})|^2}{\rho(\mathbf{r})} d\mathbf{r}$$

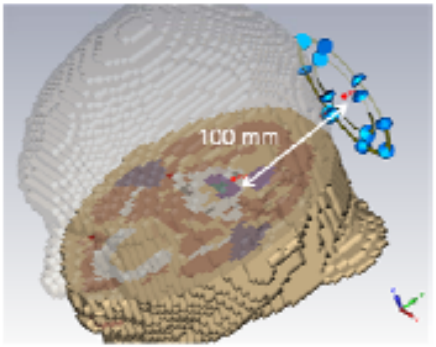
- Measure B_1^+-field with well-established gradient echo procedures.
- Employ phantoms of known geometrical and chemical/physical properties
- Feed the measured B_1^+-maps into in-house simulation software based on exact Maxwell's equation solution for line source excitation
- GOAL: *quasi*-real time local SAR monitoring

water phantom (radius = 6 cm) containing NaCl 0.1M (σ = 1 S/m)

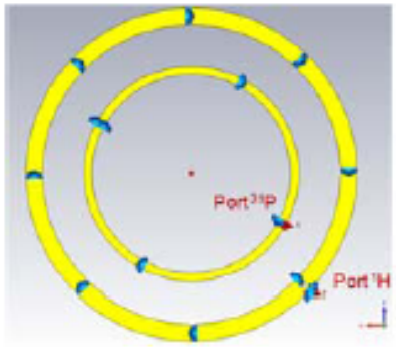


- Extension of the procedure for analyzing more realistic cases:
  - The load will be modeled as a cylinder and the complexity will be increased considering multiple eccentric insertions
  - Tests will be performed using purposely built phantoms and holders

Realistic SAR estimation with numerical models



(a)

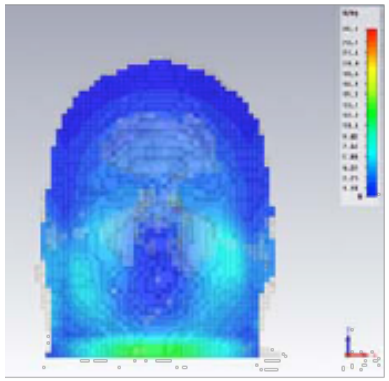


(b)

Numerical methods to handle realistic condition of use

$$B_1^+ = \frac{\theta}{2\pi\gamma\tau}$$

$$\mathrm{SAR} = \int_{\mathrm{sample}} \frac{\sigma(\mathbf{r})|\mathbf{E}(\mathbf{r})|^2}{\rho(\mathbf{r})} d\mathbf{r}$$



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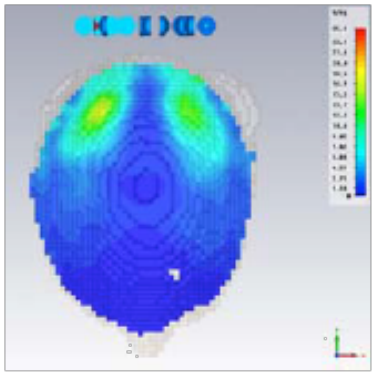

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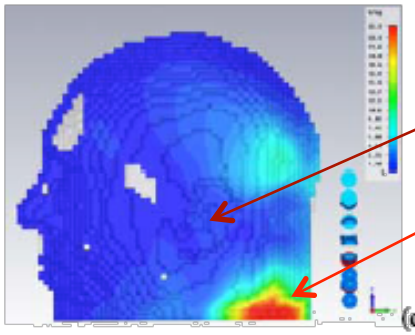


(c)

N. Fontana, G. Tiberi, R. Stara, A. Retico, M. Tosetti, A, Monorchio, "Realistic Estimation of the Local Specific Absorption Rate of Human Head in MR Scanner at 7T", *Accepted abstract at IEEE International Symposium on Antennas and Propagation and USNC-URSI National Radio Science Meeting, July 7-13, 2013, Orlando, Florida, USA.*

WP2: image processing and analysis

1.5T, 3T, 7T MR

WP2.
IMAGE PROCESSING and ANALYSIS:

- Postprocessing of 7T image to attenuate inhomogeneities.
- Image segmentation (cartilages, tendons and bones) and quantitative image parameter computation.
- Evaluation of the predictive value of MRI data on clinical data (1.5T and 3T) and feasibility study on 7T data:
  - Structural MRI (neurodegenerative diseases);
  - Diffusion weighted imaging (brain tumor segmentation and characterization, connectivity map interpretation, …)

- milestones

30-06-2013	**Optimization of acquisition sequences for imaging the human wrist at 7T (PI).**
30-06-2013	**Identification of a data sample for connectome study and multimodality glioma data collection (PI, LE, AQ). **

MRI Musculoskeletal (MSK) activities

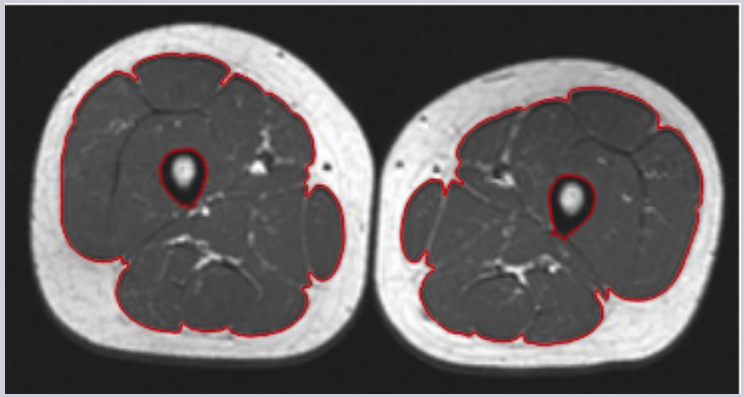
Despite UHF-MR is dominated by spectroscopy, multinuclear, and neuroimaging, there is an increasing interest for in vivo imaging of the musculoskeletal system.

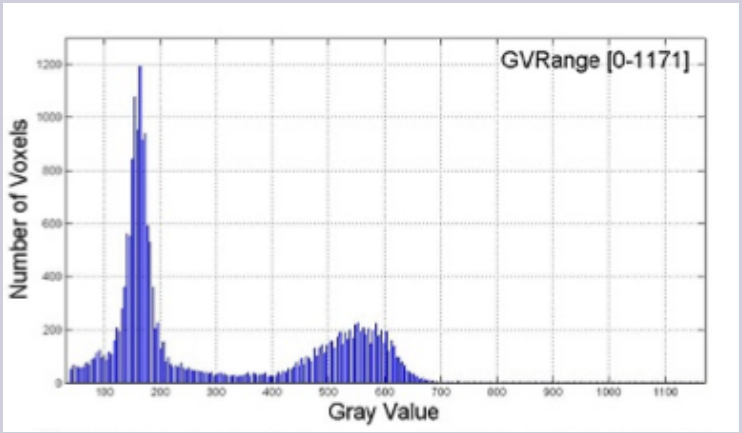
- Image analysis software @ 1.5T:
  - Analysis of healthy subjects images for muscle and fat characterization.
  - Analysis of NMD (NeuroMuscle Disorders) patients for automatic disease level staging (proposed project Min. of Health, RF 2012).

- Image acquisition @ 7T:
  - Sequence optimization and muscle and fat characterization (in terms of T1, T2 and T2* at 7 T) with ex vivo pork leg for muscle and fat acquisitions.
  - Image acquisitions “in vivo” of human calf (RF 2012).
  - Sequences optimization with ex vivo veal ossobuco for bone and cartilage acquisitions.
  - Image acquisitions “extra vivo” of human femurs after hip replacement.

Muscle/fat identification @ 1.5 T

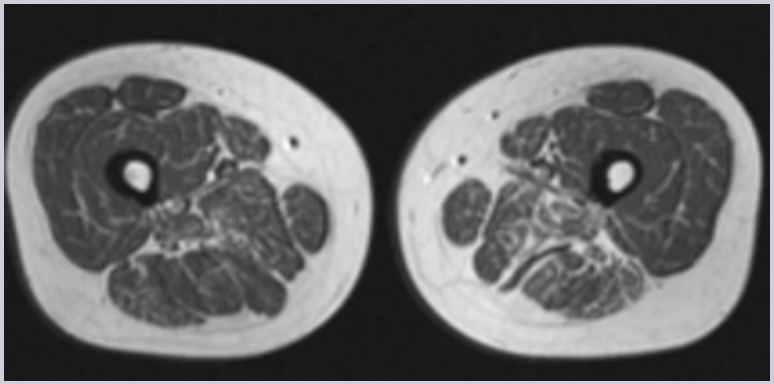
Healthy subjects (10 available)

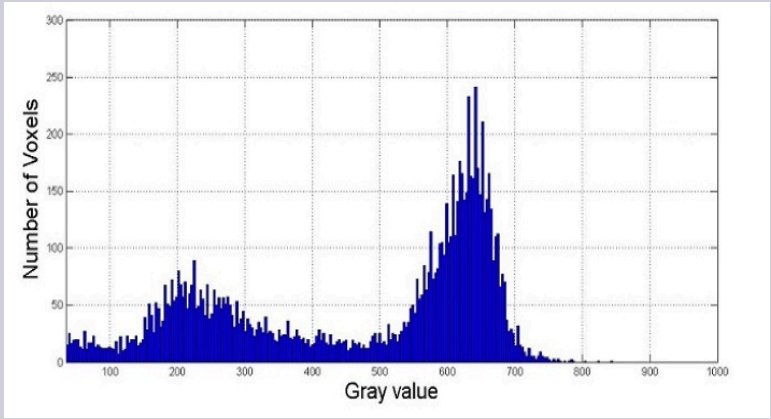




Automatic muscle segmentation

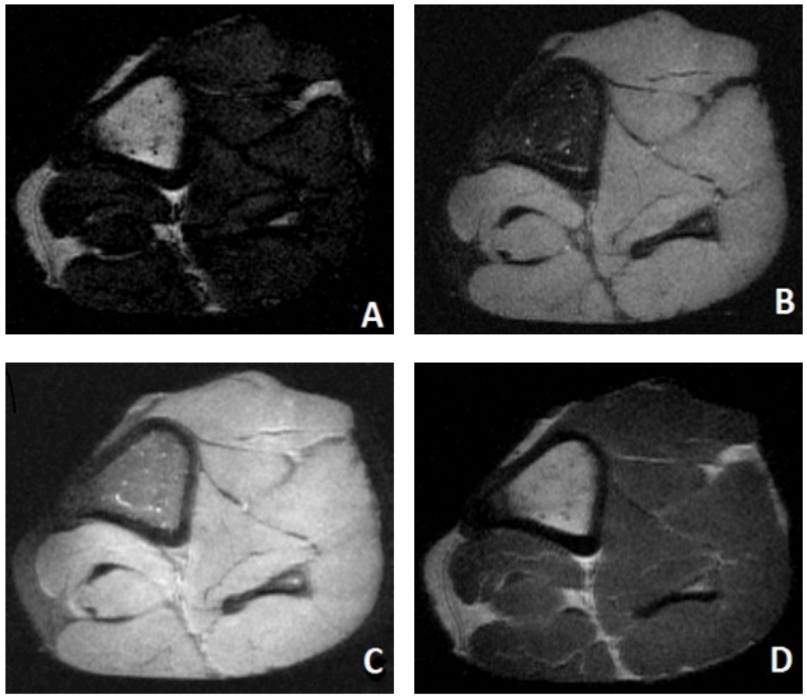
Subjects with neuromuscle disorders NMD (16 available)



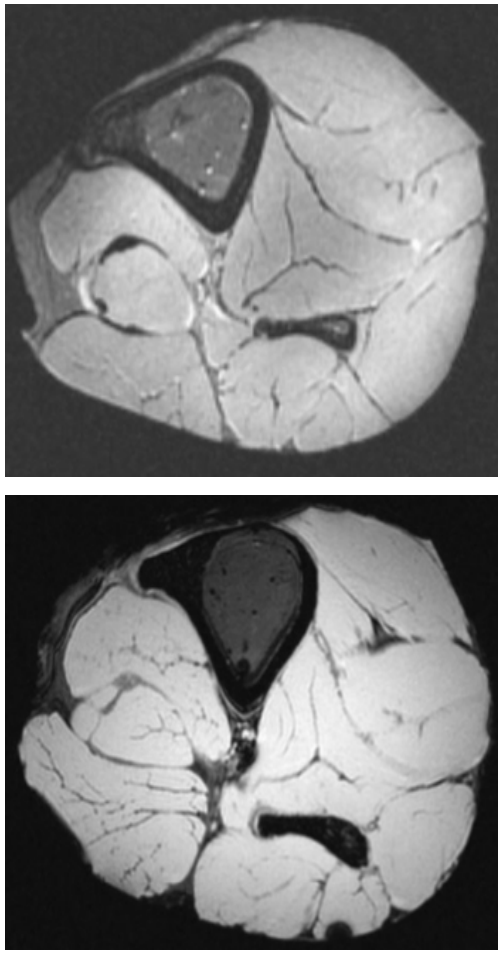


Quantification of fat infiltration

Ex-vivo pork leg @ 7T

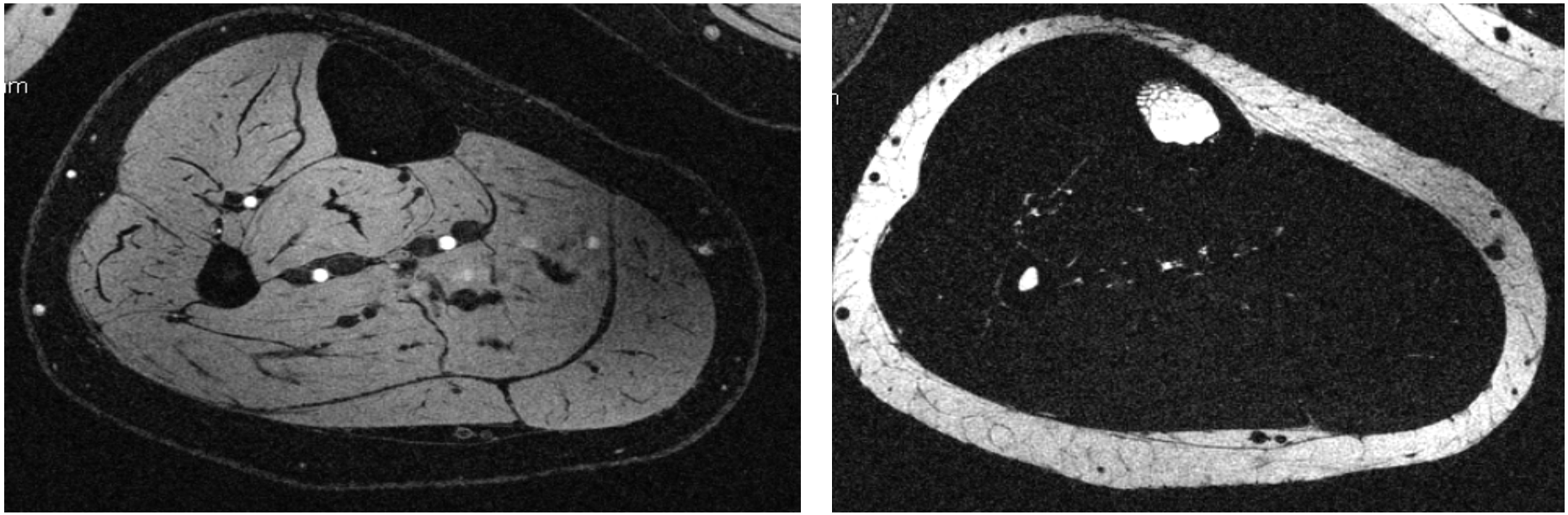


	$T_1\ (ms)$	$T_2\ (ms)$	$T_2^*\ (ms)$
$Muscle$	(1092 ± 209)	(51 ± 9)	(34 ± 9)
Fat	(562 ± 36)	(26 ± 7)	(5 ± 1)



Examples of FSE-IR at different TI (left), FE (right up) and GRE (right down) images for T1, T2 and T2* calculation and results.

In-vivo human calf @ 7 T

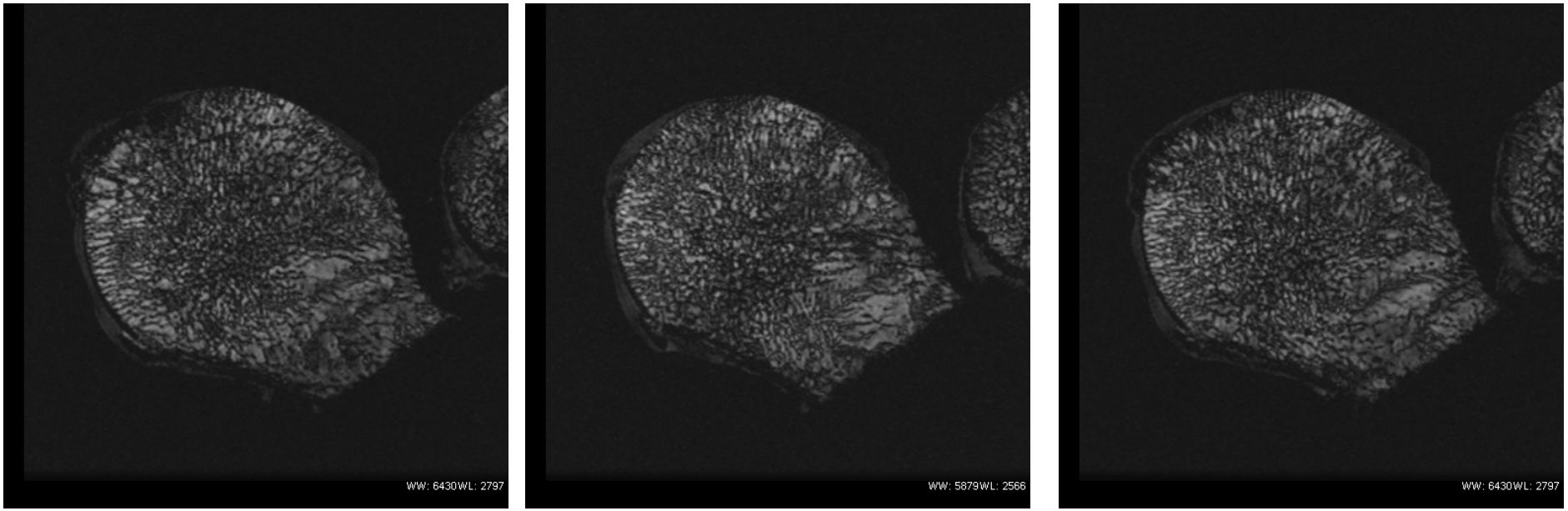


IDEAL-IQ sequence with fat (left) and water (right) suppressed.

C. Sottocornola, Tesi di Laurea Magistrale in Fisica (in progress)
Relatore: M.E. Fantacci
Methods for muscle magnetic resonance imaging at ultra high field

Human “extra vivo” heads of femur

- Quantification of bone architecture to assessment fracture risk and to measure the efficacy of therapeutic interventions in bone disease.



- Image segmentation (cartilages, tendons and bones) and quantitative image parameter computation:
  - total bone volume (TBV), bone volume fraction (BVF), surface curve ratio (SCR), erosion index (EI).

Glioma characterization through DTI data (in-vivo) and molecular analysis (ex-vivo)

- LE (G. De Nunzio, in collaboration with San Raffaele, MI)
  - Computation of statistical textural features on DTI maps (MD, FA, p & q maps); ANN classification of brain tissue to detect glioma margins. -> IN-VIVO data

- AQ (A. Cimini, Prof. of Neurobiology and Cell Biology, Department of Life, Health and Environmental Sciences University of L'Aquila), in collaboration with Neurosurgery and Neuroradiology Unit of Ospedale San Salvatore, L'Aquila.
  - Determination of glioma grade (especially glioblastoma) on the basis of molecular analysis and Magnetic Resonance Spectroscopic (MRS) data. The accumulation of lipid droplets in the glioma is correlated with its malignancy. -> EX-VIVO measurements

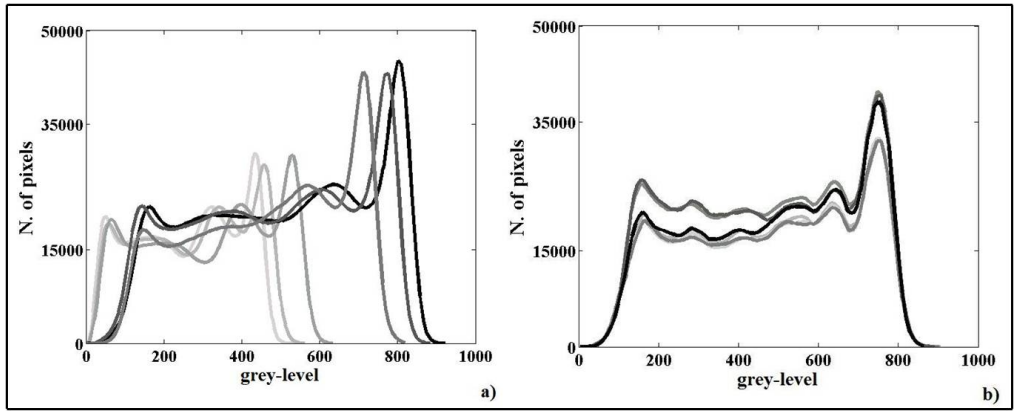
- Joint Analysis in WP2:
  - Glioma data available at Ospedale San Salvatore (AQ): DTI data and ex-vivo glioma samples.
  - Search for correlation between in-vivo textural features computed on DTI data and the signals of lipid metabolism perturbation detected ex-vivo:
    - to identify a proper intervention therapy;
    - to predict the efficacy of radiotherapy;
    - and, possibly, to identify a reliable in-vivo marker of glioma grade.

E’ possibile determinare grado e tipo dei gliomi, e individuare la presenza delle mutazioni utili a fini prognostici, in maniera non invasiva, ossia a partire dalle immagini diagnostiche di RM (eventualmente in tensore di diffusione, e in spettroscopia)?

Lecce – San Raffaele
L’Aquila – San Salvatore

Caratterizzazione del Glioma tramite feature tessiturali in DT-MRI, e individuazione delle correlazione tra parametri metabolici, genomici, proteomici, di grado e tipo del tumore, e le feature tessiturali in immagini MRI (e DT-MRI).

Standardizzazione di immagini MR provenienti dai due database disponibili (L’Aquila e S. Raffaele)



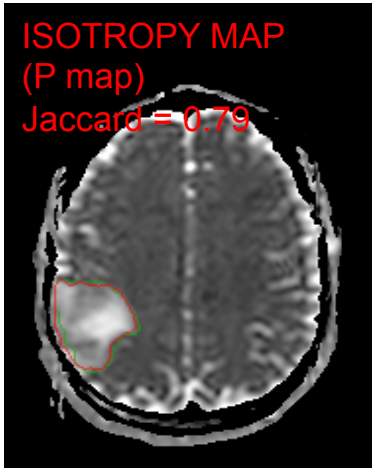
De Nunzio *et al.* (Lecce)

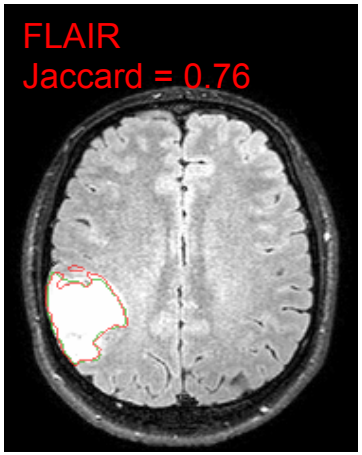
Gray-level standardization

De Nunzio, Cataldo, Carlà, "Robust intensity standardization in brain Magnetic Resonance images", submitted to Journal of Magnetic Resonance Imaging (JMRI 13-0279, may 2013)

CAD scheme:

- signal preprocessing
  (noise, standardization, etc)
- segmentation
- regions of interest
- feature calculation
- classification (ANN):
  - healthy/pathologic





Database individuato

U.O. Neuroradiologia, Ospedale San Raffaele e Università Vita-Salute

U.O.Neurochirurgia, Ist. clinico Humanitas, Univ. di Milano

48 pazienti in prima diagnosi, di cui abbiamo mappe e roi manuali ([256x256x56] no gap) di MD, FA, B0 (T2w), FLAIR, P e Q.

16 pazienti con gliomi di basso grado in progressione di malattia (follow-up, operati). Esami FA, MD, P e Q a 0, 3 e 6 mesi a seguito di chemioterapia con Temozolomide dose-dense (1 settimana on / 1 settimana off).

Unita' di neurochirurgia dell'ospedale San Salvatore dell'Aquila

6 pazienti al momento ricevuti

Pazienti con risultato istologico, modalità T1w, T2w, FLAIR, DWI. Con e senza MDC.

Modalità MRS

Unita' di neuroradiologia dell'ospedale di Casarano “Francesco Ferrari”

7 pazienti al momento ricevuti

Modalità T1w, T2w, FLAIR, DWI. Con e senza MDC.

GR-2317873

Supporting an early Autism Spectrum Disorder (ASD) diagnosis through the Support Vector Machines (SVM)

FONDAZIONE STELLA MARIS
ISTITUTO DI RICOVERO E CURA A CARATTERE SCIENTIFICO

Ministry of Health and Tuscany Government, 2013-2015

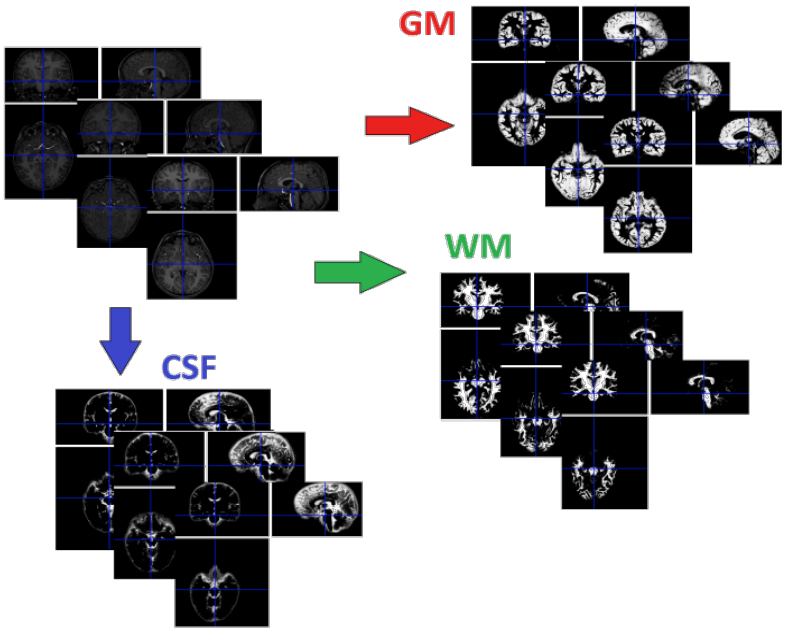
- *S. Calderoni (IRCCS Stella Maris, Pisa),*
- *A. Retico (INFN),*
- *P. Brambilla (Univ. Udine)*

- The incidence of ASD is 1 in 88 children in USA [Centers for Disease Control and Prevention, 2012]
- ASD children may benefit from early intervention [Dawson *et al.*, Randomized, controlled trial of an intervention for toddlers with autism: The Early Start Denver Model. *Pediatrics*, 125:17-23, 2010]

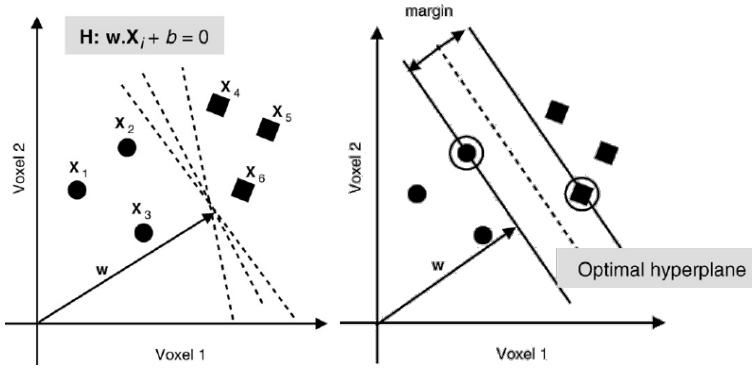
- Aim
  - To determine whether a diagnostic model based on image analysis of MRI data has a complementary role to the behavioral assessment in distinguishing ASD children from controls.
- Methods
  - Subjects: children (M and F, 18-30 months)
  - Whole-brain analysis of structural MRI data:
    - SVM identification of involved regions
    - Single-subject classification
  - ROI-based analysis of structural MRI data:
    - Classification of ROIs chosen according to a-priori knowledge of disease involvement
  - Comparison between the two decisional approaches
- Expected impact
  - Identification of early ASD brain anatomical markers to complement in the future behavioral ASD early diagnosis and to explore neuroanatomical alterations in ASD toddlers
  - Combination of whole-brain and ROI-based image classifiers to enhance the predictive power of MRI

SVM analysis workflow

- MRI images (1.5 T data) are segmented in the grey matter (GM), white matter (WM) and cerebrospinal fluid (CSF) components

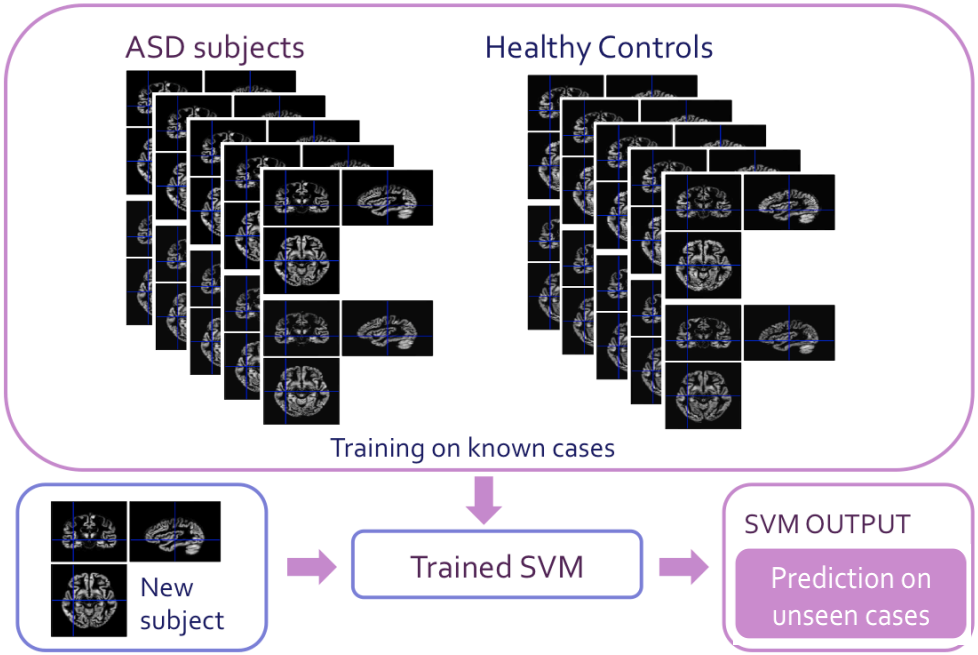


- Each GM image $x_i \in \mathbf{R}^n$ is a point in the n-dim space (n = num of GM voxels in the MR image)
- Two-class classification (ASD vs. controls): the i^{th} is labeled with $y_i \in \{-1,1\}$



Calderoni S, Retico A, Biagi L, Tancredi R, Muratori F, Tosetti M., *Female children with autism spectrum disorder: an insight from mass-univariate and pattern classification analyses,* **Neuroimage 2012; 59(2):1013-22**.

A. Giuliano, Tesi di Laurea Magistrale in Fisica, Gennaio 2013, Relatore: A. Retico
Analysis Of Brain Magnetic Resonance Images: Voxel-based Morphometry and Pattern Classification Approaches



Theses and publication ½ 2013

M. Gabrieli, Tesi di Laurea Magistrale in Fisica (in progress)
Sviluppo e validazione di una bobina a radiofrequenza per applicazioni precliniche di risonanza magnetica a campo ultra alto

C. Sottocornola, Tesi di Laurea Magistrale in Fisica (in progress)
Methods for muscle magnetic resonance imaging at ultra high field

R. Stara, N. Fontana, G. Tiberi, A. Monorchio, G. Manara, M. Alfonsetti, A. Galante, A. Vitacolonna, M. Alecci, A. Retico, and M. Tosetti, *Validation of Numerical Approaches for Electromagnetic Characterization of Magnetic Resonance Radiofrequency Coils,* ***Progress In Electromagnetics Research M*****, Vol. 29, p. 121-136, (2013).**
doi:10.2528/PIERM12122113

M. Costagli, D.A.C. Kelley, R. Stara, G. Tiberi, M. Cosottini, M. Tosetti
Tissue Border Enhancement by Inversion Recovery Acquisition
International Society of Magnetic Resonance in Medicine, **ISMRM 2013,** Aprile 2013, Salt Lake City, Utah, USA,

N. Fontana, G. Tiberi, R. Stara, A. Retico, M. Tosetti, A, Monorchio,
Realistic Estimation of the Local Specific Absorption Rate of Human Head in MR Scanner at 7T
IEEE International Symposium on Antennas and Propagation and USNC-URSI National Radio Science Meeting **IEEE APS/URSI 2013**, July 7-13, Orlando, Florida, USA.

Michela Tosetti, *Applications And Instrumentation For 7T MRI*
invited talk at 15th International Workshop on Radiation Imaging Detectors, **iWoRID 2013**, 23-27 June 2013, Paris

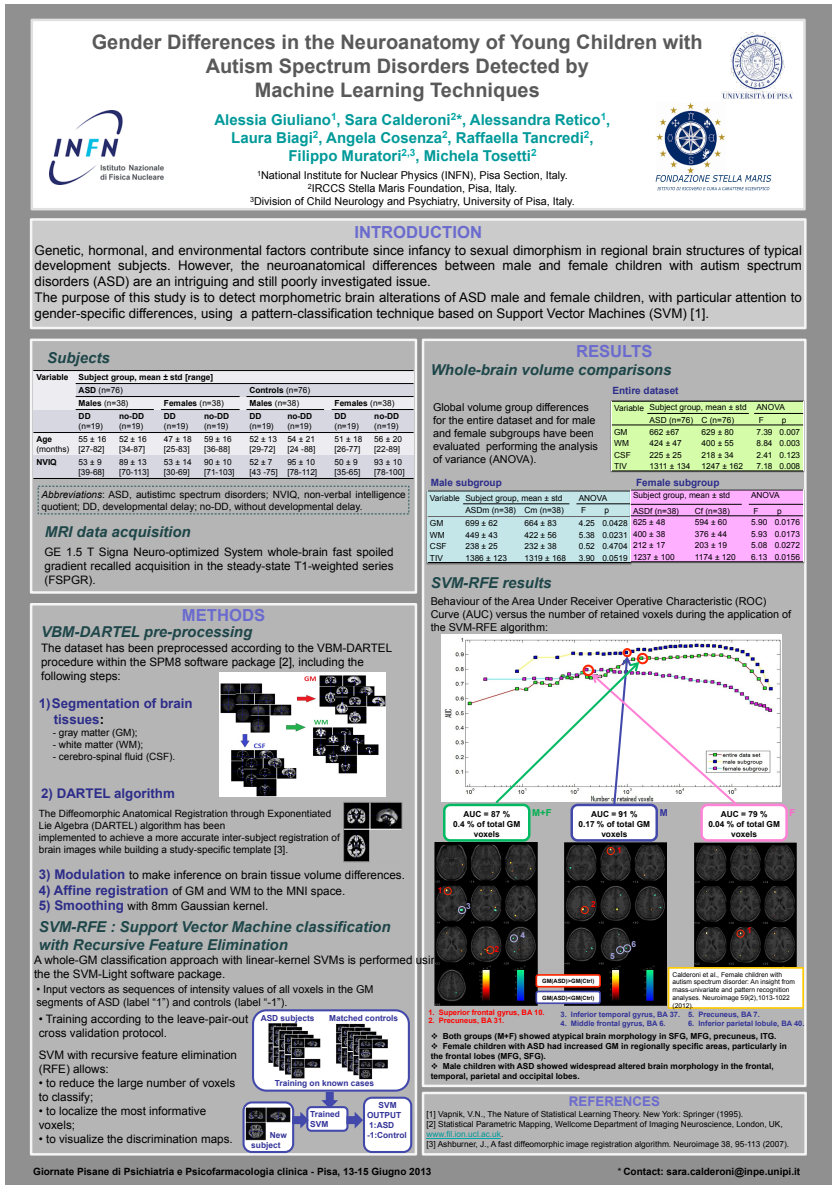
Thesis and publications ½ 2013

A. Giuliano, Tesi di Laurea Magistrale in Fisica, Gennaio 2013, Relatore: A. Retico
Analysis Of Brain Magnetic Resonance Images: Voxel-based Morphometry and Pattern Classification Approaches

A. Giuliano, S. Calderoni, F. Muratori, L. Biagi, M. Tosetti, A. Retico.
Multivariate analysis of structural MRI data to detect gender-related brain abnormalities in children with autism spectrum disorder,
EPOS C2275, ECR 2013, 7-11 March Vienna.
DOI:10.1594/ecr2013/C-2275

S. Calderoni, A. Retico, A. Giuliano, L. Biagi, M. Tosetti and F. Muratori.
Gender Differences in the Neuroanatomy of Young Children with Autism Spectrum Disorders Detected by Machine Learning Techniques,
International Meeting for Autism, IMFAR 2013, 2-4 May Donostia-San Sebastian, Basque Country, Spain.

A. Retico
Quantitative methods for neuroimaging data analysis, Lecture at the X Seminar on Software for Nuclear, Subnuclear and Applied Physics, June 2013, Alghero



Miglior poster al Convegno Nazionale *Giornate Pisane di Psichiatria e Psicofarmacologia Clinica,* Pisa Giugno 2013.

Proposte di finanziamento esterno su temi sinergici

- Bando Ministero della Salute 2012 (risposte fine luglio?)
  - RF: *Muscle imaging in neuromuscular disorders: conventional, high and ultrahigh field imaging studies for coming into a focus* **HW e SW**
    - R. Battini (Stella Maris) - F. Arrigoni (Medea) – A. Retico (INFN)
  - RF: *Clinical markers of chilhood apraxia of speech and its neurobiological and genetic correlates* **SW**
    - A. Chilosi (Stella Maris) - R. Guerrini (Meyer) – A. Retico (INFN)
  - GR: *Lipids, lipid-related proteins as prognostic factors for gliomas* **HW e SW**
    - Raysi Dehcordi Soheila (Neurochirurgia UniAQ), E. Benedetti (Biologia, UniAQ), A. Retico (INFN)
- PRIN 2012:
  - *Progetto, realizzazione e test di configurazioni di bobine innovative a radiofrequenza per la risonanza magnetica a campo ultra alto (7T) mediante l'impiego di metamateriali* **HW**
    - A. Monorchio (ing UniPI) - M. Alecci (UniAQ) - A. Retico (INFN)
- Unita' INFN = responsabile + associati che vogliono partecipare nelle varie sedi

	Milestones 2013	Data completamento
WP1	Building of the necessary components for the RF coils (PI and AQ).	31-12-2013
WP1	Identification of suitable sequences for SNR, RF homogeneity and SAR evaluation in 7T applications (PI and AQ).	31-12-2013
WP1	Development of analytical/numerical approach for local SAR evaluation (PI).	31-12-2013
WP2	Homogeneity recovery by image-filtering techniques in 7T brain images (PI).	31-12-2013
WP2	Segmentation of relevant MSK structures in 7T images and evaluation of quantitative parameters on relevant structures (PI and LE).	31-12-2013
WP2	Multivariate classification techniques for autism data sample (PI).	31-12-2013

	Milestones 2014	Data completamento
WP1	RF coil prototypes assembling, workbench testing and integration in the 7T system (PI and AQ).	30-06-2014
WP2	Multivariate classification techniques for glioma data sample (LE and AQ).	30-06-2014
WP1	Implementation and test with phantoms of pulse sequences for estimating SNR, B1 mapping and SAR at 7 T (PI and AQ).	31-12-2014
WP1	In-vivo acquisitions of images and spectra (PI and AQ).	31-12-2014
WP2	Final evaluation of the decisional systems implemented for autism and glioma data (PI, LE and AQ).	31-12-2014
	Writing of internal report and papers suitable for publications on peer-reviewed journals (PI, LE and AQ).	31-12-2014

Manpower TESLA

Tot = 12.5 FTE + tecnol. PI

PISA

Ricercatori						
	Nome	Età	Contratto	Qualifica	Aff.	%
1	Del Guerra Alberto		Associato	Prof. Ordinario	CSN V	20
2	Fantacci Maria Evelina		Associato	Ricercatore	CSN V	100
3	Fontana Nunzia		Associato	Dottorando	CSN V	40
4	Manara Giuliano		Associato	Prof. Ordinario	CSN V	30
5	Monorchio Agostino		Associato	Prof. Associato	CSN V	30
6	Retico Alessandra		Dipendente	Ricercatore	CSN V	100
7	Scelfo Danilo		Associato	Specializzando	CSN V	40
8	Stara Riccardo		Associato	Dottorando	CSN V	100
9	Stefanini Arnaldo		Associato	Ass.Senior	CSN V	--
10	Toncelli Alessandra		Associato	Ricercatore	CSN II	100
11	Tosetti Michela		Associato	Primo Ricercatore	CSN V	20
				Numero Totale Ricercatori	11	FTE 5.8

	Nome	Età	Contratto	Qualifica	%
	Moggi Andrea		Dipendente	Tecnologo	?
				Numero Totale Tecnologi	FTE ?

L' Aquila	Qualifica	%
M. Alecci	Prof Ass Fis/07 Univaq	60
A. Galante	Ric Fis/07 Univaq	60
M. Alfonsetti	Ric Fis/07 Univaq	60
A. Vitacolonna	Specializzanda Fis/07 Univaq	60
A.M. Cimini	Prof Ass BIO/06 Univaq	30
TOTALE	**Num tot ricercatori: 5**	**FTE: 2.7**

Lecce	Qualifica	%
Giorgio De Nunzio	RIC - Univ Salento, Dip. Matematica e Fisica	80
Rosella Cataldo	RIC - Univ Salento, Dip. Matematica e Fisica	70
Maurizio Quarta	RIC - Univ Salento, Dip. Matematica e Fisica	50
Marina Donativi	ASSEGNISTA RICERCA Dip. Matematica e Fisica	100
Matteo Rucco	Dottorando INFORMATICA	100
Totale	**Num tot ricercatori: 5**	**FTE: 4.0**

Richieste sui servizi di sezione

- Progettazione meccanica e Officina meccanica:
  - Realizzazione supporti meccanici
  - Stampe 3D

- Servizio di elettronica:
  - Etching di circuiti.

- Calcolo:
  - run FreeSutrfer su database di ~ 100 casi????
    (richiede almeno 4 GB di RAM)

Proposed budget 2013

preliminary

Pisa		Richieste (kE)
Missioni	Partecipazione all'Italian chapter dell'ISMRM (1-2 persone, conf fee ~200E). Spostamenti INFN Pisa-Imago7. ISMRM 2014, Milano.	**4**
Consumo	Condensatori non magnetici di alta qualità a capacità fissa o variabile. Lastre/tubi di plexiglass/nylon per supporti. Stampa 3D di supporti per bobine con materiali ignifughi. Cavi e connettori non magnetici. Preamplificatori. Substrati in DUROID per etching.	**14**
Lic SW	Rinnovo licenza FEKO	**2**
Totale		**20**

Richiesta totale: 45 kE

L'Aquila		Richieste (kE)
Missioni	Test dei prototipi in campo magnetico e sessioni di presa dati ad Imago7 (Pisa); partecipazione all'Italian chapter IT-ISMRM; Convegno nazionale SIF; Convegno nazionale AIFM. ISMRM 2014, Milano	**3**
Consumo	Materiali per i supporti meccanici delle bobine, lastre, cilindri e tubi in plexiglass o nylon; PCB; condensatori non magnetici di alta qualità a capacità fissa e a capacità variabile (trimmer); cavi non magnetici, connettori, adattatori RF.	**11**
Lic SW	Rinnovo licenza HFSS	**2**
Totale		**16**

Lecce		Richieste (kE)
Missioni	Partecipazione all'Italian chapter dell'ISMRM (1-2 persone, conf fee ~200E). ISMRM 2014, Milano. Trasferte per riunioni di collaborazione. Trasferte Lecce-L'Aquila e Lecce-Pisa per riunioni e sessioni di presa dati.	4
Consumo	Memorie di massa interne ed esterne, memorie RAM.	2
Invent.	Workstation for advanced graphical interaction and programming	3
Totale		9

Finanziamento GR-2317873

Convenzione Stella Maris – INFN
Convenzione n 244 – GR 2010 2317873, deliberazione Consiglio direttivo n. 12711 del 28 marzo 2013.

Totale su tre anni

Descrizione	Variato
TRATTAMENTO MISSIONI	17.000,00
PUBBLICAZIONI E RIVISTE	3.000,00
ALTRI MATERIALI DI CONS	5.000,00
LICENZE SOFTWARE	6.500,00
	31.500,00

Borsa di studio neolaureato per 1 anno (Bando INFN 15707/2013)