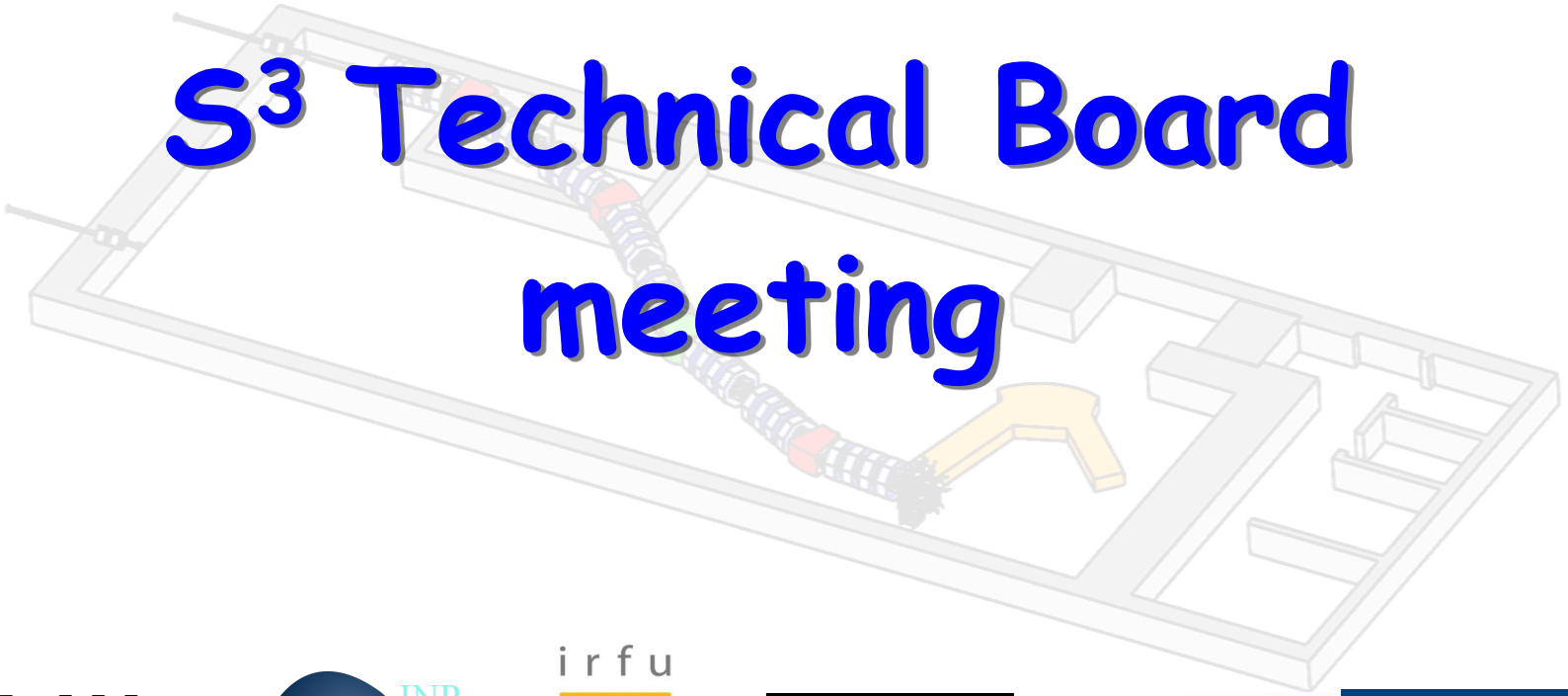
S³ Technical Board meeting



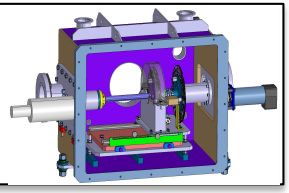
http://pro.ganil-spiral2.eu/spiral2/instrumentation/s3

NIM B 266, 4162 (2008), IJMPE-Nuclear Physics, Vol. 18, (2009)
Tours 2009 Proceedings, AIP conference series

S^3 Baseline

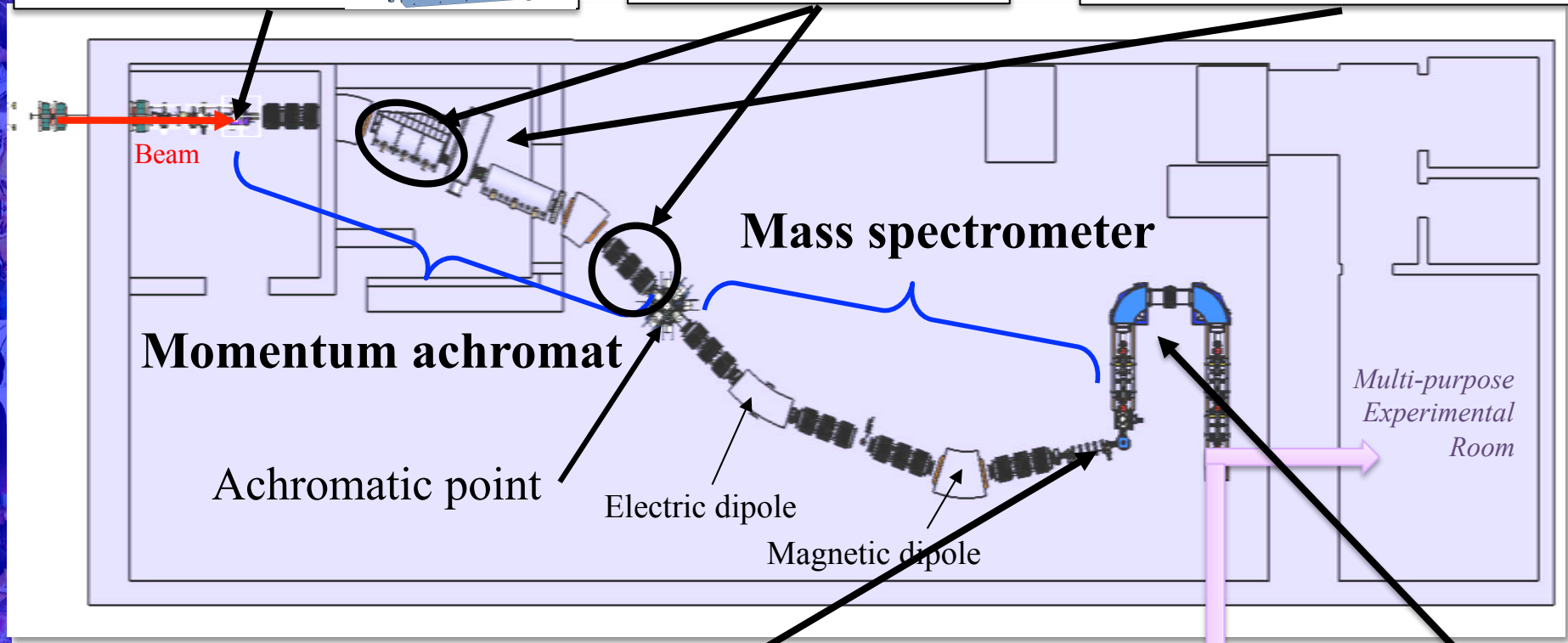
Principle : Two-stage selection (Bp & m/q) that will achieve very good rejection of both the beam and adjacent mass channels of reaction products

High power
Rotating targets
including actinides

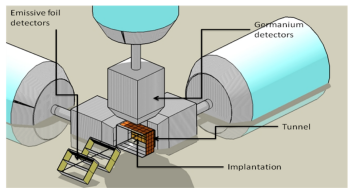


Large acceptance
Multipoles
Opened and closed

External Beam dump
& Movable fingers
Get rid of >99,9% of the beam



Implantation-decay station
At the mass dispersive
plane



DESIR

Low
Energy
Branch

Reviews
&
Near term milestones

Magnet Conceptual Design Report

Magnet Conceptual Design Report (EDMS Id I-021972)

The aim of this CDR was to present the status of the ion-optical design, magnet designs and technology options, safety studies and mechanical integration of the full S3 system to ***provide a basis for a decision on technologies to be used for the hardware components****. This includes performance evaluations, construction and operating cost estimates and a project timeline including technical choices, planning, cost estimates, safety approach and risk analysis.*

A review will consist on-submitting comments on CDR by a panel of experts :

Physics: P. Greenlees (JYU)

Optics: M. Winkler (GSI) & W. Mittig (MSU)

Magnet designers: V. Kashikhin (Fermi Lab), A Zeller (MSU) & D. Tommasini (CERN)

December 2010 : Videoconf meeting was scheduled for discussion of the comments from the panel of experts

A total of 70 questions were collected by the expert panel

I-023893 v.1: *S3 Magnet Conceptual Design Report review report*

Summary of the MCDR

Proposal for closed magnets :

Superconducting closed triplets are definitely chosen for the Mass Separator (4 triplets) and we assume that the choice of 3 additional superconducting closed triplets in the Momentum Achromat will improve performance and flexibilty and does not increase significantly the risk levels of the project.

Proposal for the open magnet :

MOSAR V2 :

- Best performances on the paper
- Possibility to add octupoles (increase performance and flexibility)
- Work is still needed to finish mecanical design
- Timeline and, of lesser importance, budget are drawback of MOSAR

Classical Open magnet :

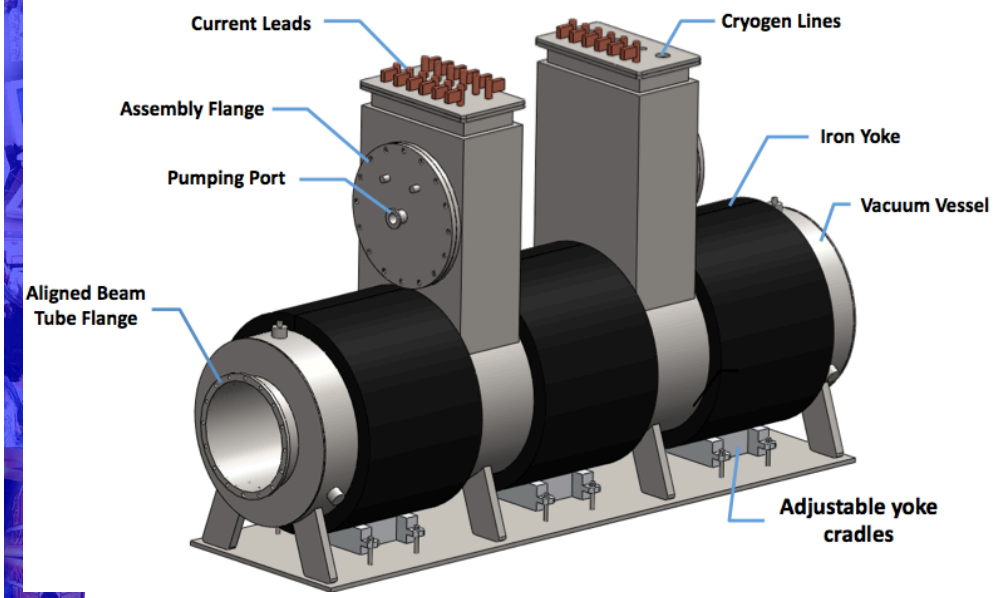
- Performances is lower than MOSAR
- No octupoles possible
- Design is essentially completed
- Timeline is not on the critical path

We would propose to still continue on the MOSAR design in order to make a decision for the open multipoles no later than end 2010 (it will be possible to decide the use of a Room Temperature open triplet without impact on the planning, , since a Room Temperature open triplet needs 18 less months than the superconducting open triplet to be studied manufactured and delivered)

This process should not delay any decision on the other components like the MASS SEPARATOR.

Hardware multiplet technology

7 triplets required

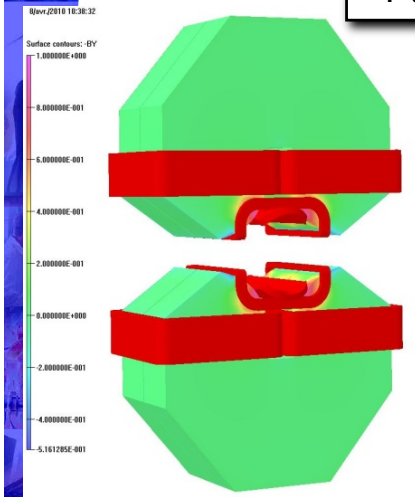


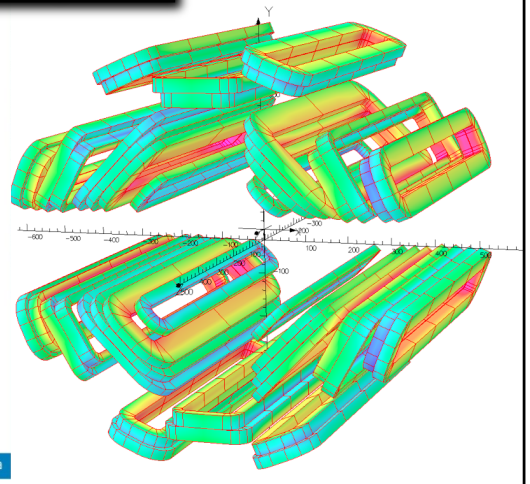
SC multipoles option :

- Each singlet has quadrupole, sextupole, & octupole coils, with 30-cm warm bore diameter & 40-cm effective length
- Pole-tip fields at 15 cm required for 2 T-m rigidity:
  Quadrupole : 1.0 T, Sextupole: 0.4 T, Octupole: 0.4 T
- The cryogenic system requires 60 Watts of 4.5K cooling power with liquid nitrogen pre-cooling
- Each triplet has 3 coils with ~400 A or lower current leads

Pre design study ANL & SACM/Irfu/CEA
High quality and cost-effective solution

1 triplet required





GANIL-Irfu

Irfu

Classical multipoles option :

- Each singlet has quadrupole & sextupole coils
- Maximum gradient are : G=6T/m and 8T/m^2
- High power required ~ 330 kW per triplet

Design study GANIL & SACM/Irfu

SC multipoles option :

- Each singlet has quadrupole, sextupole,
- maximum field on the coils is about 5.6 T, a value that is compatible with a superconducting state of the NbTi coils.

MOSAR concept SACM/Irfu/CEA

Outcome – Ask to the experts

Is the spectrometer design is optimized ?

Is the spectrometer flexible and open for future evolution ?

Are the optical calculations reliable ?

Are the technologies to be used for the hardware components is optimized ?

Are the contingency well estimated ?

Are the cost estimates reliable ?

Are safety issues well addressed ?

Is the time schedule realistic ?

Overall we got positive feedbacks from the expert panel. They did not raise any objections to these questions.

Trade-off open triplet

- **Our initial plan (written in CDR in July):**
  - → **To focus studies on the MOSAR concept to be able to take a decision on the open multipole magnet by Xmas time, or at least to validate the MOSAR concept.**

    (The Mosar concept gave better optical results and appeared to give us more flexibility).

- **Revealed Drawbacks since July:**
  - **Mechanical integration of Octupoles coils is not possible**
  - **Fringe field outside the acceptance -> pathologic beam trajectories hitting the chamber**

→ In December we have started a new phase:

~ two working months (until end of February), working exclusively on the RT option to eventually take the definitive open triplet technology decision

Trade off for the Open triplet

Room Temperature *vs* Superconducting

Bring the RT magnet to the same definition level than the SC to make the choice

Identified tasks *(SC: Superconducting option; RT: Room Temperature option)*

- **Task 0: Assessment of the impact on physics *(Ganil, Irfu)***

  - ***Task SC1: Study of New Optics with MOSAR (no activities until trade off)***
  - ***Task SC2: Activation (long/short term) (no activities until trade off)***
  - ***Task SC3: Heat transfer to the cryostat (no activities until trade off)***

- **Task RT1: consolidation of RT study and generation of field maps *(Ganil)***
- **Task RT2: Optical optimization with RT multipoles field-maps *(Ganil, Irfu)***
- **Task RT3: RT Open Triplet & Beam Dump architecture feasibility *(Irfu)***

➔ Comparative pre-studies wil be available at end of february

Near-term Milestones

➔ **October 14th: Construction permit for SPIRAL2 phase 1**

➔**December 16th: SPIRAL2 COPIL (Steering Committee)**

- Decision to construct AEL buildings (Specific infrastructure is still an option)

➔**Dec 22th: S3 Steering Committee**

Initial agencies to be represented on the S3 Steering Committee:

CNRS/IN2P3 - F. Azaiez
CEA/DSM/Irfu - P. Chomaz
GANIL - S. Gales
Argonne National Laboratory - R. Janssens representative

Main funding agencies that are currently likely to be contributing to the S3 construction phase
Representatives of other laboratories or agencies will join as soon as they commit significant financial contributions

- Status of the projet
- Conclusion of the CDR review
- Management plan
- Near term development plan

➔**Jan 20th : S³ EQUIPEX**

➔**Begining 2011 : DOE/ Alternative Selection and Cost Range Reviews (Critical Decision 1 review)**

The DOE Critical Decision 1 review has the goals to Allow Expenditure of funds for preliminary design and to approve long-lead procurement if necessary.

2011 Milestones

• **March 2011: Preliminary Design Report for the separator** after the trade off of the open triplet (including optics optimization) and a preliminary architecture for the intricate Beam Dump / open triplet assembly.
This PDR allows the study/fabrication of closed triplet prototype.

• **End 2011: Critical Design Review (or TDR…)** for the separator, when we have some results of the closed triplet prototype, the detailed design of the Beam Dump (including cooling) and the open triplet.

The dipoles, diagnostics and the vacuum system are straightforward to build and don't constraint the rest of the separator
Beginning 2011, call for tenders for
- *Dipoles + power supplies + associated vacuum chambers + supports*
- *Vacuum system*
- *diagnostics*

➔ This plan has been accepted by the S^3 SC

policy/time line for the separator only as we don't want to wait until the other S3 subsystems are at the same level as the separator as it will delay the reviews that we need in 2011

Project planning

⇨ **The overall schedule of S^3 project is driven by multipoles schedules.**

7 superconducting closed triplets

Start of call for tender: March 2011
Order placement: July 2011
End of qualification of prototype: Oct 2011
End of production (24 months): August 2013

(with conditional stages dependent on the qualification of prototype and on the Critical Definition Review to be held at the end of 2011)

And considering for the open triplet either a superconducting baseline or a room temperature option:

1 superconducting open triplet (MOSAR)

Start of call for tender: March 2011
Order placement: August 2011
End of qualification of prototype: Avril 2012
End of production: May 2014

1 conventional open triplet

Start of call for tender: Sept 2011
Order placement: March 2012
End of production: March 2013

Construction in several phases ?

The development of S^3 will be conducted using a phase approach as all the different configurations have to be commissioned set by step. This will allow possible sequence of commitments from the funding agencies.

Phase		Target system	Spectrometer	Detection	LEB	FISIC	Timeline	Budget
0	Commissioning First decay spectroscopy experiments LoI-2, LoI-6, LoI-11	- 1 target station - Gaussian beam on target (no beam raster)	MA + MS	Existing system	NO	NO	Ready for Sept 2013	7.2 M€
1.1	Decay spectroscopy LoI-2, LoI-11, LoI-17	- 1 target station - Flat beam on target (beam raster) - Actinide target	MA + MS	New Implantation decay station	NO	NO	To be defined	
1.2	GS property	- 1 target station - Flat beam on target (beam raster)	MA + MS	Tape station	Yes	NO		
	LoI-3, LoI-4, LoI-5, LoI-18				LISOL			
	LoI-10, LoI-6				HRS			
2.1	Atomic Physic (LoI-1)	1 stripper station	MA + MA (change the ED by a MD) New Beam dump	No	No	Yes		
2.2	In-beam spectrsocopy	- 1 target station - Flat beam on target (beam raster)		Ancillary detection system	NO	NO		

Safety milestones

- November 2010: IRSN recommendations for the Safety report updated
  Radiological inventory, radioprotection, Contamination, Actinide target (Handling, storage, transportation, Confinement, ...)

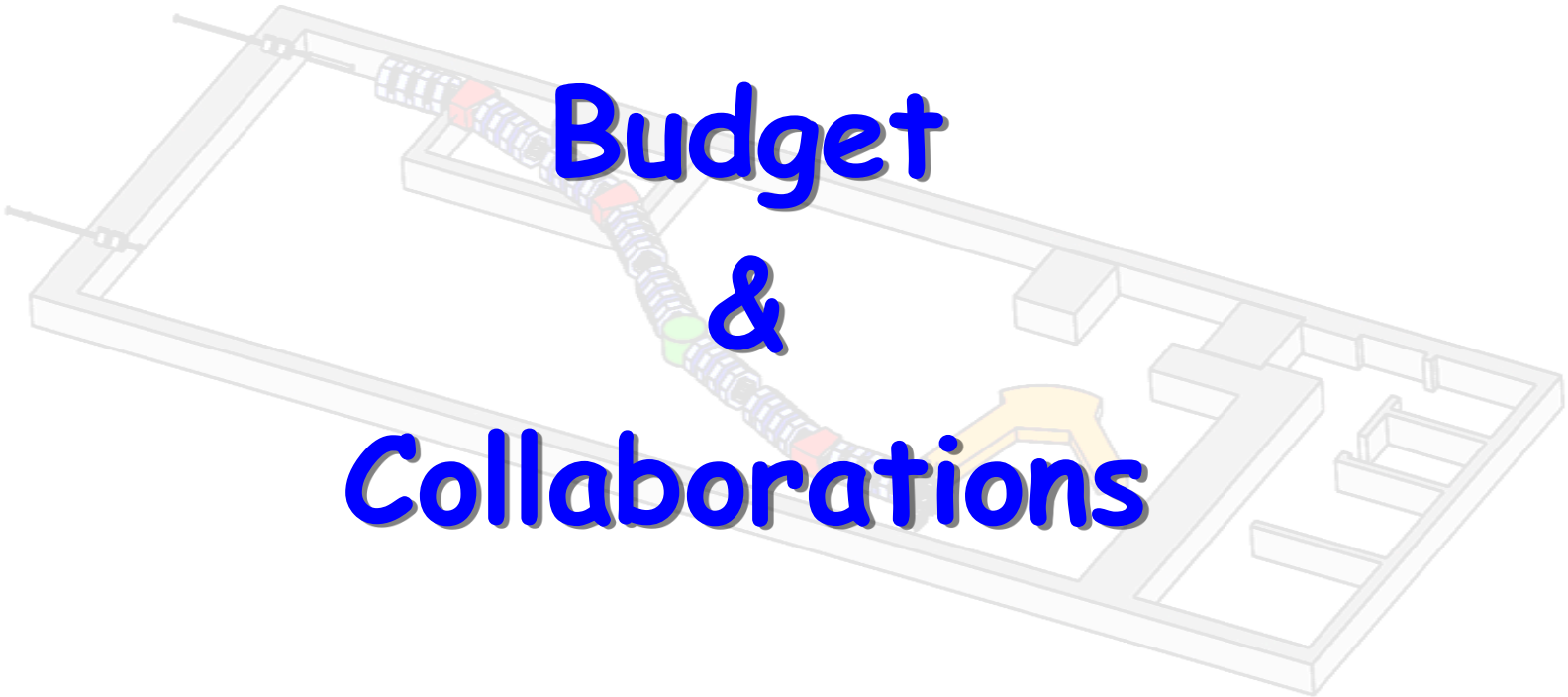
- June 2011: Draft Safety Report

- December 2011: Final version of the Safety Report (Including all S3 safety aspects)

- January 2012 – December 2012 : RS instruction by safety authority

- January 2013: Operating license

➔ Milestones to prepare the safety files

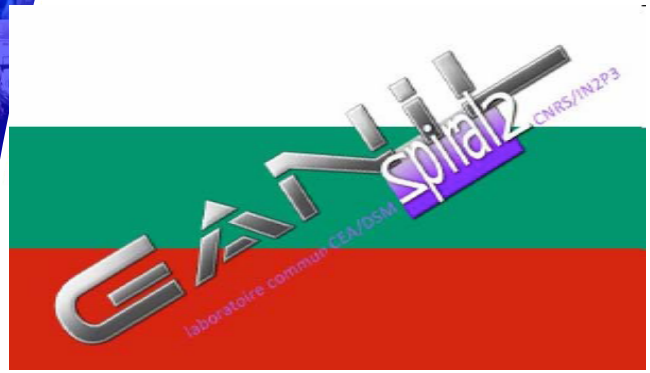


Budget
&
Collaborations

S³ Product Breakdown Structure

Code PBS	Arborescence Produits / Product breakdown structure Niv 1	Niv 2	Niv 3	Niv 4	Niv 5	Niv 6	Niv 7	Niv 8	
8500	Salles de Physique								
8510	**S3**								13044,169
8511		GENERAL (management)							276,500
8512		S3 FACILITY EQUIPMENT AND FLUIDS							1 970,000
8513		VACUUM							382,916
8514		TARGETS							435,350
8515		SUPPORTS & ALIGNMENT							272,000
8516		MAGNETIC DIPOLES							388,000
8517		ELECTRIC DIPOLE							500,000
8518		OPEN TRIPLET							659,250
8519		CLOSED SC TRIPLETS							2 843,750
851A		SEPARATOR DIAGNOSTICS							212,000
851B		MOMENTUM DISPERSIVE BEAM DUMP							320,000
851C		SLITS							60,000
851D		CRYOGENICS							850,000
851E		UPSTREAM BEAM LINE							325,002
851F		DETECTION SYSTEMS							1 277,300
851G		LOW ENERGY BRANCH							2 272,101
851H		COMMANDS & CONTROLS							
851I		DECONSTRUCTION							

Bulgarian Collaboration



New call for Bulgarian institutes and companies for participation in the SPIRAL2 project and associated detection systems (PARIS & S^3)

F. Lutton (GANIL)

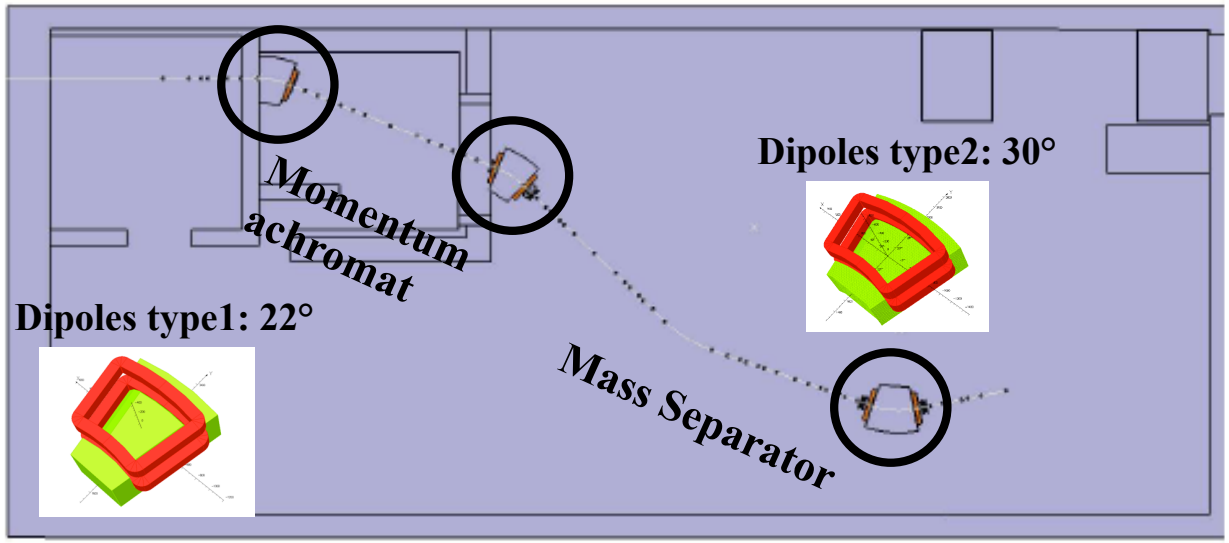
Construction of

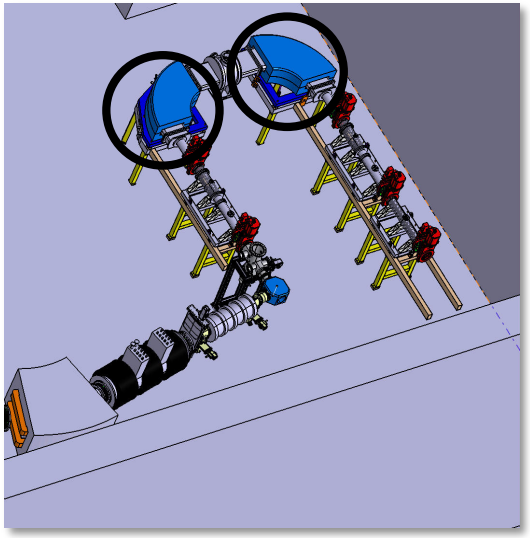
- all the S3 beam line supports
- vacuum chambers for the Upstream beam line, achromatic point, mass focal plane and the low energy branch
- slits for the achromatic point, energy dispersive plane & mass dispersive plane

Dead line: by the end of January 2011

IMP Collaboration

中国科学院近代物理研究所
Institute of Modern Physics, Chinese Academy of Sciences





MH Stodel, M. Duval (GANIL)

S3 Meeting at IMP Lanzhou, 4-6TH october 2010

Yuan He (IMP), Lizhen Ma (IMP), Xiaogi Zhang (IMP), Qinggao Yao (IMP), Bin Zhang (IMP), Nolen Jerry (ANL), Robert Janssens (ANL), Marc-Hervé Stodel (GANIL) and Hervé Savajols (GANIL)

Collaboration with IMP:

• The design and construction of **3 magnetic dipoles** (2 for the momentum achromat and 1 for the mass separator) and associated vacuum chambers, supports, as well as the magnetic measurements (GANIL WP)
The design and construction of the **electric dipole** for S3 (ANL WP)
*IMP will provide the quotations **by November 5th** for designing, processing and measurement of two magnets of 22 degree and for physical design and calculation of electric dipole.*
• IMP will continue the design and construction of **four magnets of degree of 90°**, following the first stage of execution

Addendum of the MoU between Ganil and IMP in preparation

India Collaboration with TIFR & BARC

LIA INDIA-France (GANIL 21 et 22 Octobre)

Réunion constructive avec l'annonce d'engagements Indien importants au projet SPIRAL2 et aux détecteurs associés

S3 project Construction of the movable finger

- Detailed design for the movable finger (it will be provided by IRFU 2011)
- Then the construction can be started and it will last for 12 months
- Installation 2013

Dead line: by the end of December 2010

KU Leuven Collaboration

FWO research grant:

"Laser-based production and spectroscopy of exotic nuclei using a gas cell coupled to S3, the Super Separator Spectrometer".

- Salary of one technician for 4 years (50.000 €/year)
- 70.000 € for equipment
- 20.000 €/year for 4 years (functioning money)

New ANR LISOL Setup : IPNO, GANIL, CSNSM, IPHC, KU Leuven In 2012 ?

KATHOLIEKE UNIVERSITEIT LEUVEN

Workshop FLNR Dubna - GANIL/SPIRAL2
IPN Orsay, Room "Salle des Conseils"
November 8th - November 9th

Topic	Contact Persons	To be done
Joint FLNR-S3 Letter of Intent on study of SHE at S3/SPIRAL2	**H. Savajols** - A. Popeko	LoI to be submitted to the SPIRAL2 SAC by June 2011
Actinide target development	**C. Stodel** - A. Yeremin	1 meeting + 1 page of addendum to MoU by March 2011
Gas catcher – joint development?	H. Savajols – **A. Rodin**	1 meeting + 1 page of addendum to MoU by March 2011
Focal plane setup for S3 and FLNR separators	B. Gall - **A. Popeko**	1 meeting + 1 page of addendum to MoU by March 2011
Diagnostics for high current stable beams	**P. Ausset** - I. Kalagin	1 meeting + 1 page of addendum to MoU by March 2011
Construction of low-energy beam lines for SPIRAL2 Phase 2	**F. Varenne** - I. Kalagin	1 meeting + 1 page of addendum to MoU by June 2011
Diagnostics for high intensity RNB (development & construction of beam profilers & CAVIAR)	**Ch. Jamet/J.L. Vignet** – S. Lukyanov	1 meeting + 1 page of addendum to MoU by March 2011
High-Voltage platform for ECR source	Ch. Barué - **B. Gikal**	1 meeting + 1 page of addendum to MoU by June 2011

Equipements d'Excellence

S3 Super Separator Spectrometer

A new Instrument
For **Fondamental research**
In **Nuclear Physic** and
In **Atomic Physics**

Coordinator: H. Savajols, GANIL – savajols@ganil.fr

Budget: **8 000 000 €** for the construction phase (2011-2014)*
**Additional funding for the exploitation phase (2014-2010) will come later, i.e. Running cost, Maintenance and training*

Coordinating institution: **GANIL**
Partner Laboratories:

- ✓ A. Drouart (CEA/Irfu)
- ✓ K. Hauschild (IN_2P_3/CSNSM)
- ✓ B. Gall (IN_2P_3/IPHC)
- ✓ S. Franchoo (IN_2P_3/IPNO)
- ✓ E. Lamour (INSP/UPMC)

Collaboration
170 physiciens du monde entier

ANR EQUIPEX

Tranche	Equipment	Cost (K€) for EQUIPEX	m.m	Non permanent staff
1	Management	291,5	36	
1	Upstream beam line (The target system are founded by the CPER)	325	70	30
1	Total Momentum Achromat	2898	153	78
1	Total Mass Separator	2740	92	66
1	Total Cryogenics	850	12	
1	Total Detection final setup	1277,3	265.5	126
1	Total Low energy branch	2272	41	60
1	Total FISIC	2000,3	155	96
1	Total Nuclear Safety		33	36
1	Total Specific Infrastructure	1970		
1	**Total tranche 1 Equipment**	**14624,1**	**859,5**	**492**

1	**Total Manpower requested at the ANR (non-permanent staff)**	**2561,1**
1	**GRAND TOTAL**	**17185,2**

➔ EQUIPEX grant covers 50% of the total requested budget
➔ Additional funding are still necessary
➔ We are waiting for ANR evaluation and recommendations
➔ Consortium of agreement (end 2011)

Equipex CDD

	doctorants	Commentaire	Post-docs	Commentaire	CDD Ingé.	Commentaire	CDD tech.	Commentaire
Management install Ganil			0		36	Nuclear Safety	18	projeteur
Upstream Beam Line / Targets	12				18			
Separator-spectrometer	36		24	Beam optics	12	vacuum, cryo	9	Méca Mosar
					18	Magnetism / Mosar	9	Méca Beam Dump
					9	Méca Mosar		
					9	Méca Beam Dump		
Detection	12		24	IPHC	12	CSNSM electronics		
					12	IPHC integration		
					18	CSNSM SL		
			24	Irfu detection	24	Irfu électronique		
Low Energy Branch	12		36	IPNO	12	IPHC tape station		
FISIC			24	INSP	36		36	
Totaux (h.mois)	72		132		216		72	

Grand total (h.mois)	492

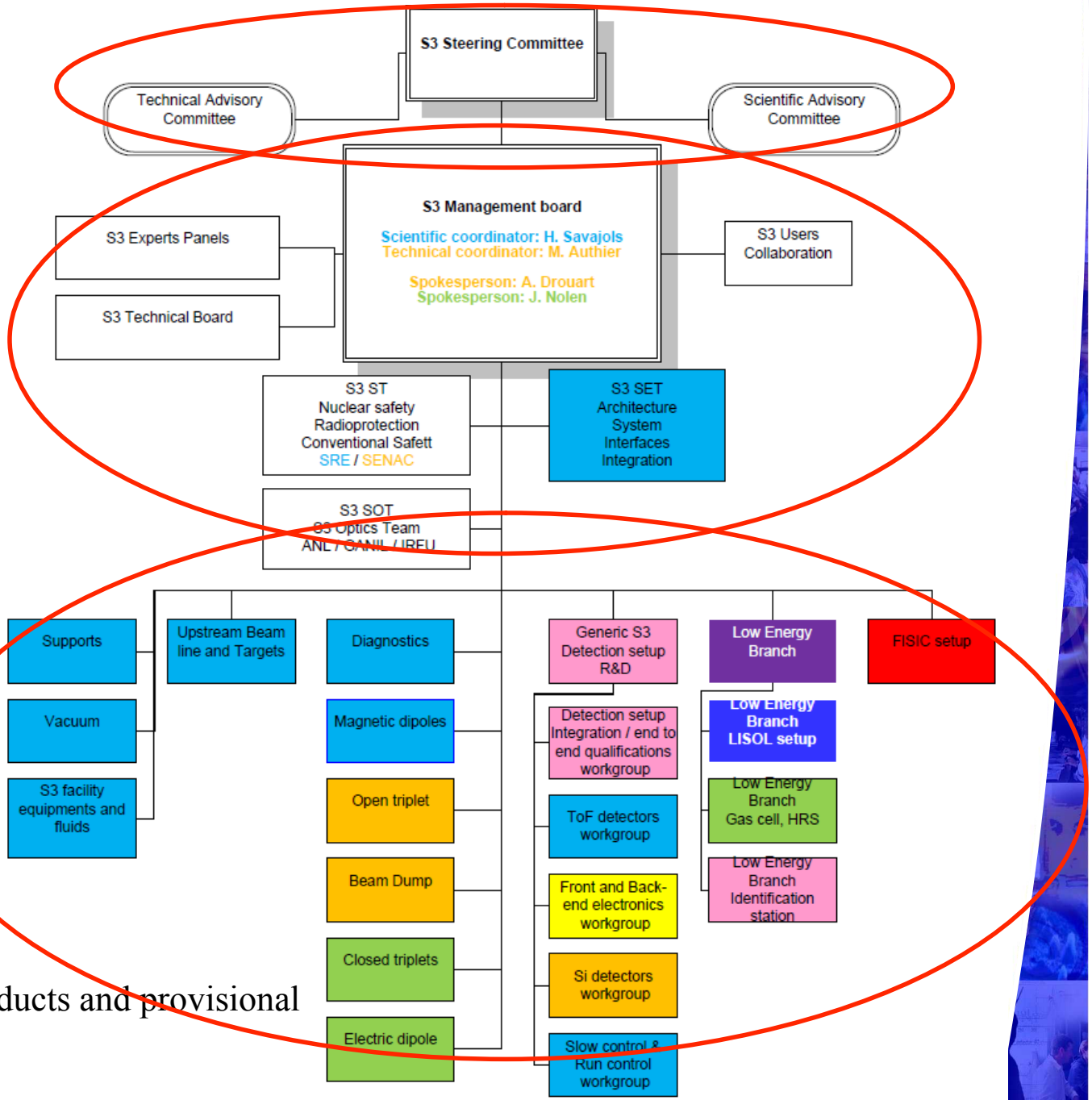
Organisations
&
Responsabilities

Project organisation

	S³ MANAGEMENT	S3-DM-8510-I-023851
	PROJECT ORGANISATION	Page 3 sur 25

Project Management

- Multi-institutes
- GANIL
- CNRS/IN2P3/CSNSM
- CNRS/IN2P3/IPHC
- CNRS/IN2P3/IPNO
- CEA/DSM/IRFU
- CNRS / Université Pierre et Marie Curie-Paris 6 / INSP
- Argonne National Laboratory
- KU Leuwen



S^3SC > Project level 1 > S^3 products and provisional working groups

Responsibility & Main Contribution

Institute	Responsibility	Participation
GANIL	- S^3 Scientific Coordination - S^3 safety (conventional & nuclear) - S^3 Architecture/System - S^3 Integration - S^3 supporting equipment - S^3 vacuum - S^3 facility equipments & fluids - Diagnostics - Magnetic dipole - Upstream Beam line - Targets - TOF detector working group - S^3 Slow control & Run control working group	- S^3 Physics & users board - Separator Optics Team - Low energy branch identification station - Detection setup Front end & Back end working group
CEA, DSM/IRFU	- S^3 Spokesperson - S^3 Technical Coordination - S^3 radioprotection - Open triplet - Dispersive plan Beam Dump - Si detectors working group coordination	- S^3 Physics & users board - Separator Optics Team - Detection setup Front end & Back end working group
ANL	- S^3 Spokesperson - Separator Optics Team coordination - Closed triplets - Electric Dipole - Low Energy branch gas cell - Low Energy Branch HRS	- S^3 Physics & users board - Separator Optics Team - Detection setup Front end & Back end working group
CNRS, IN2P3/CSNSM	- S^3 Detection setup Front end & Back end working group coordination	- S^3 Physics & users board - Si detectors working group coordination
CNRS, IN2P3/IPHC	- S^3 Detection setup R&D coordination - Detection Integration working group coordination - Low Energy Branch Identification station	- S^3 Physics & users board - Si detectors working group
CNRS, IN2P3/IPNO	- Low Energy Branch coordination	- S^3 Physics & users board
CNRS, UPMC/INSP	- FISIC setup	- S^3 Physics & users board
KU Leuwen	- Low Energy Branch LISOL Setup	- S^3 Physics & users board