SPIRAL2: Status Report and DESIR@SPIRAL2

M. Lewitowicz

on behalf of the SPIRAL2 Project Team and Physics Collaborations
GANIL/SPIRAL1/SPIRAL2 facility

SP2 Beam time: 44 weeks/y
GANIL Beam time: 35 weeks/y
ISOL RIB Beams: 28-33 weeks/y
GANIL+SP 2 Users: 700-800/y

LINAC:
- 33MeV p
- 40 MeV d
- 14.5 AMeV HI

A/q=6 Injector option

A/q=2 source
- p, d, \(^{3,4}\)He 5mA

A/q=3 HI source
Up to 1mA

RIB Production Cave
Up to \(10^{14}\) fiss./sec.

CIME cyclotron RIB at 1-20 AMeV
(up to 9 AMeV for fiss. fragments)

Neutrons For Science

S3 separator-spectrometer

HRS+RFQ Cooler

DESIR Facility
low energy RIB

GANIL/SPIRAL 1
today

Cost: 200M€
Funded

SPIRAL2 is one of the ESFRI list projects (40 most important EU research infrastructure projects)
Up to 2.3 kg HD UC$_2$

2H, 2H, Converter 

n, n, 

UCx, IS 

Fission fragments 

e.g. $^9$Be(n,α)$^6$He $10^{13}$pps 

HI, HI, Target 

1+, 1+, 1+ 

UCx, IS 

Fission fragments 

e.g. $^{14,15}$O, $^{11}$C, $^{102-106}$Sn

More in the talk of P. Delahaye
Regions of the Chart of Nuclei Accessible with SPIRAL 2 Beams: LINAC & RIB

Production of radioactive beams/targets:
- \((n,\alpha)\), \((p,n)\) etc.
- \(N=Z\) Isol+In-flight
- Fusion reaction with n-rich beams
- Fission products (with converter)
- Fission products (without converter)
- Deep Inelastic Reactions with RIB/stable beams

Energy range of SPIRAL2 RIB: \(\leq 60\text{keV and 1-20 MeV/nucl.}\)

+ SPIRAL1 with new beams!

M. Lewitowicz 5/31/2010
### Operation of GANIL/SPIRAL1/SPIRAL2 in 2015 ☺ or 2020 ☹

**DESIR (typical example)**

29 weeks of RIB/year:
- 10 weeks of ISOL RIB from SPIRAL2
- 4 weeks from S3
- 15 weeks from SPIRAL1

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#### Table 1

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M. Lewitowicz 5/31/2010
SPIRAL 2 timeline

Construction Phase 1
LINAC, NFS, S3

Commissioning Phase 1

Stable ion beams from LINAC

Construction Phase 2
RIB, DESIR

Commissioning Phase 2

RIB
# SPIRAL2 Phase 1 timeline

## Accelerator building and associated experimental hall

<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
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<tr>
<td>Elaboration of programme</td>
<td>2009</td>
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<tr>
<td>Tenders buildings - jury meetings</td>
<td>February 2008, June 2008</td>
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<tr>
<td>Conceptual study of buildings (APS+)</td>
<td>2009</td>
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<tr>
<td>Submission of dossiers to ASN (the Nuclear Safety Authority)</td>
<td>April 2009</td>
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<tr>
<td>Request Permit of construction</td>
<td>July 2009</td>
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<tr>
<td>Conceptual design of buildings (APD)</td>
<td>2010</td>
</tr>
<tr>
<td>Public enquiry &amp; IRSN instruction</td>
<td>2010</td>
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<tr>
<td>Permit of construction granted</td>
<td>May 2010</td>
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<tr>
<td>Construction of buildings</td>
<td>2011</td>
</tr>
<tr>
<td>Hand-over of the tunnel zones</td>
<td>April 2011</td>
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<tr>
<td>Hand-over of the premises at ground level</td>
<td>July 2011</td>
</tr>
<tr>
<td>Installation of équipement</td>
<td>2012</td>
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<tr>
<td>First beams</td>
<td>February 2012</td>
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<tr>
<td>Tests and operation</td>
<td>2013</td>
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On the critical path
Phase One Construction

Underground level: - 9.50 m

 Injector area (Q/A 1/3)
 Free room for Q/A 1/6
 Superconducting LINAC

Neutrons for Science Area (NFS) & Multipurpose Research Area (SRI)
Reserved space for + Exp Area / + LINAC

Beam to the PRODUCTION target

133 m

Scientific Council of GANIL – May 6th, 2010
Marcel Jacquemet
IPN Orsay
Cavities Type B

Status:
All cavities delivered and tested:
1st Cryomodule delivered in December

Scientific Council of GANIL – May 6th, 2010
SPIRAL2 Buildings

More in the talk of J.C. Thomas
# SPIRAL2 Phase 2 timeline

## Production building and associated experimental hall

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<td>Submission of dossiers to ASN (Phase 2)</td>
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<td>Construction of the buildings</td>
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<td>Hand-over of parts of the buildings (for beams lines installation)</td>
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### Notes
- ★: Event occurred
- ★: Event scheduled
Towards construction of the DESIR facility

• Full technical design of the DESIR building and associated tunnels will be done by **middle of 2011**
• Decision on the construction of DESIR to be taken by **spring 2012** once the precise cost estimate is available
• 4 scenarios seem to be possible today:
  • Construction of full DESIR facility
  • Construction of 3 tunnels (from S3, RIB production building and SPIRAL1) during the SPIRAL2 Phase 2 and smaller DESIR building (DESIR Phase 1)
  • Construction of 3 tunnels (from S3, RIB production building and SPIRAL1) during the SPIRAL2 Phase 2 and construction of DESIR building later
  • No construction budget available for DESIR in the SPIRAL2 Phase 2
From physics idea to the SPIRAL2 experiments and instruments


SPIRAL2 Baseline project construction phase

SPIRAL2 Brain-storming phase

5 Topical Workshops

SPIRAL2 White Book

SPIRAL2 Letters of Intent

Detector Design Phase

New detector Collaborations Formed

SPIRAL2 New detector TDR

National Scientific Councils

Requests for funds at national funding agencies

Detector Construction Phase

Detector MoU

Detector Project organization

Detector Construction

Detector Commissioning

Day 1 Experiments

Lol Day 1 SPIRAL2 Phase 1 (HI Stable beams)

Lol Day 1 SPIRAL2 Phase 2 (RIB)

Day 1 Experiment Proposals

EU FP7 Preparatory Phase

Each phase initiated & followed up by the SPIRAL2 SAC in a close collaboration with the SPIRAL2 project & GANIL management

M. Lewitowicz
New detectors to be used at SPIRAL 2

DESIR

ACTAR & GET

AGATA

NEDA

EXOGAM 2

PARIS

HELIOS

GASPARD

FAZIA

MoU

S3

Momentum Achromat

Mass Separator

NFS

MoU

MoU

MoU

MoU
ESFRI process and EU FP7 SPIRAL 2 Preparatory Phase contract (EC grant: 3.9 M€, 2008-2011, 25 partners) aims in the organisation and signature of the International Consortium for the construction of SPIRAL2 and the associated detectors - future intern. status of GANIL

**Recently:**
- Additional budget of 0.2M€ for the construction of SPIRAL2
- ACTAR included in the SPIRAL2PP
- Extension of the SPIRAL2PP project by 12 months requested -> end by October 31, 2011

MoU on DESIR to be signed by October 2011

http://www.spiral2pp.eu
From physics idea to the SPIRAL2 experiments and instruments


SPIRAL2 Baseline project construction phase

SPIRAL2 Brain-storming phase

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M. Lewitowicz
Call for Letters of Intent for Day 1 SPIRAL2 Phase 1 Experiments (with S3 and NFS) in May 2009

NFS & S3 Workshops in May/June 2009

Dead-line for LoI July 20\textsuperscript{th}, 2009

Evaluation of the LoI at the SAC meeting on September 11\textsuperscript{th}, 2009 at Colloque GANIL in Giens

Definition of the first beams and detectors necessary for Day 1 experiments by the SPIRAL2 Project

Evaluation of the updated and new LoIs by SAC: June 24 & 25\textsuperscript{th}, 2010
Day 1 SPIRAL2 Phase 2 Letters of Intent

✓ Preliminary SAC request for the most requested Day 1 SPIRAL2 RIB (isotope, intensity, energy) sent to the users by March 3rd, 2010 (dead-line March 31st, 2010)

❖ List of the RIB proposed by SPIRAL2 and an approximate date of the first experiments (validated by SPIRAL2 Project and Director of GANIL) by beginning of June 2010

• Call for Letters of Intent for Day 1 SPIRAL2 Phase 2 Experiments (with RIB) in the beginning of June 2010 by SAC

• Collaboration Workshops June – November 2010

• Dead-line for Lols: middle of December 2010

• Evaluation of the LoI at the SAC meeting January 26-28, 2011 (SPIRAL2 Week 2011)

• Analysis of the SAC recommendations and technical/safety constraints by SPIRAL2 -> final decision on the first TIS(s) by February 2011
### RIB requested for SPIRAL2 Day 1 Phase 2 experiments

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<th>Light RIB ( Z&lt;20 )</th>
<th>20(&lt;Z&lt;70) RIB (Fission-Fragments)</th>
<th>Heavy RIB ( Z&gt;70 )</th>
<th>Total</th>
<th>n-rich</th>
<th>p-rich</th>
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<td>28</td>
<td>181</td>
<td>1</td>
<td>210</td>
<td>82%</td>
<td>18%</td>
<td>19</td>
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<tr>
<td>DESIR RIB</td>
<td>20</td>
<td>100</td>
<td>22</td>
<td>142</td>
<td>87%</td>
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<td><strong>Total</strong></td>
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**The most requested:** \(^{94}\text{Kr}, ^{132}\text{Sn}, ^{140,142}\text{Xe}, ^{78}\text{Ni}\)

- Users expect from the SPIRAL2 a very large variety of RIB (thus produced with many different targets and ion-sources) already in the beginning of the operation of the facility
- UCx production target should be considered already in the beginning of the operation of the facility
- 40% of all requested RIB are beams at low energies to be used at the DESIR facility.
Main Topics (*presented by*):

- Theory for SPIRAL 2 - *M. Ploszajczak*
  
  *Preceded by two introductory talks on theory*

- From few to many nucleons; a tale on recent advances (and challenges) in nuclear many-body theory by *M. Hjorth-Jensen – Univ. of Oslo/MSU*

- New ideas and new results in the nuclear energy density functional approach by *J. Dobaczewski – Univ. of Warsaw and Univ. of Jyväskylä*

- HELIOS project for SPIRAL2 - *B. Back*
- NEDA neutron detector - *J.J. Valiente Dobon*
- ACTAR - *P. Roussel-Chomaz*
- DESIR - *D. Lunney*
- EXOGAM2 - *G. de France*
- FAZIA - *G. Poggi*
- S3 - *J. Nolan*
- PARIS – Status Report
- GASPARD – Status Report
The DESIR facility status report:

The SAC is impressed by the high-level, experienced expert group involved in the design of the HRS and finds the proposed “alpha”-shape solution very attractive. The work on SHIRaC is equally impressive, (…).

There was no new information on the experimental stations (...) the research programme previously presented is excellent; the technical configuration (HRS, SHIRaC, etc.) now proposed is very convincing and the SAC expects that it is consolidated in further studies.

It appears prudent that at this point the DESIR facility, proposed for phase 2 of the SPIRAL2 project, be made part of the official project and as such supported by the French agencies. The DESIR collaboration has the potential to be the carrier of a broad and scientifically strong international involvement in the research programme at SPIRAL2.
Next SPIRAL2 SAC meeting on June 24-25, 2010

• Evaluation of the updated and new LoIs for experiments with Day 1 SPIRAL2 Phase 1 (with NFS and S3)
• Theory for SPIRAL2 (follow-up)

• In parallel to the SAC closed session:
  • SPIRAL2 Theory – Experiment meeting (Coordinator H. Goutte)

Goals:
• Share with all theoreticians future experimental projects (LoIs, detectors),
• Identification of the theory group(s) interested by the joint work with experimentalists for each (if possible) LoI,
• Compare predictions of different theoretical approaches,
• Identify the necessary improvements and new theoretical developments,
• Identification of actions dedicated to improve resources available for theory groups (ANR, EU projects, dedicated requests to CNRS, CEA etc.)
• To work out jointly the best proposals of future experiments.
DESIR@SPIRAL2  2010-2012  Milestones

• DESIR Collaboration Workshop **May 26-28**

• Call for Letters of Intent for Day 1 SPIRAL2 Phase 2 Experiments (with RIB) in the **beginning of June 2010** by SAC

• Dead-line for Lols: **middle of December 2010**

• Tests of the prototype of RFQ cooler **before the end of 2010**

• Detailed design study of HRS **before the end of 2010**

• Evaluation of the LoI at the SAC meeting **January 26-28, 2011** (SPIRAL2 Week 2011)

• Detailed technical design of the DESIR building and associated tunnels by **middle of 2011**

• DESIR MoU to be signed by **October 2011** (deliverable of SPIRAL2 PP)

• Decision on the construction of DESIR building by **spring 2012**