

Final Report  
of the

**EURISOL**  
*Design Study*

(2005-2009)

**A DESIGN STUDY FOR A  
EUROPEAN ISOTOPE-SEPARATION-ON-LINE  
RADIOACTIVE ION BEAM FACILITY**

**November 2009**

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EURISOL Design Study  
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**A DESIGN STUDY FOR A  
EUROPEAN ISOTOPE-SEPARATION-ON-LINE  
RADIOACTIVE ION BEAM FACILITY**

Co-ordinated by  
Yorick Blumenfeld and Graziano Fortuna

A report to the European Commission

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## Foreword

This report summarises the work done during the 4½ years of the EURISOL Design Study, which was co-funded by the European Commission under the 6<sup>th</sup> Framework Programme: “Structuring the European Research Area”. Technically, the project was a Research Infrastructure Action, and the contract was for a Design Study implemented as a “Specific Support Action”.

The full title of the EURISOL Design Study was “European Isotope Separation On-Line Radioactive Beam Facility”. It followed on from the EURISOL Feasibility Study which was led by Jean Vervier during the 5<sup>th</sup> Framework Programme.

Twenty “Participant” institutions signed a Consortium Agreement, and engaged to contribute manpower and resources to the Design Study, with some expenses being eligible for reimbursement by the European Commission. The total amount of this reimbursement was 9.16 million euros. Another 21 institutions around the globe joined the Design Study as “Contributors”, making resources, expertise and manpower, and in some instances beam time, available to the Study.

The EURISOL Management Board expresses its thanks to all Participants and Contributors for their unstinting support for the Design Study. Without the cooperation of all these institutions, their directors, scientific and technical staff, post-docs and students, it would not have been possible for the project to succeed as it has done.

The commitment, hard work and leadership skills of the task leaders, who constituted the Coordination Board, were the driving forces of the study. We thank the members of the Steering Committee, representing their respective Participant institutes for their commitment and support. Thanks are also due to the International Advisory Panel who took an intense interest in the project and gave invaluable advice to both the Steering Committee and the Management Board. We also extend our thanks to the Site Investigation Panel who performed a difficult task with enthusiasm. We must also thank Graziano Fortuna, who initiated the Design Study and was Project Leader for the first two years, until his other commitments conspired to make this impossible.

Finally, I extend my personal thanks to my colleagues who have served on the Management Board, and those on the Management Support Team, with whom it has been a pleasure to work and who have made things much easier in the coordination and day-to-day running of the Design Study.

Yorick Blumenfeld

*Project Leader  
EURISOL Design Study*

## Participant Institutions



**GANIL:**

Grand Accélérateur National d'Ions Lourds, Caen, France



**CNRS/IN2P3:**

Centre National de la Recherche Scientifique/ Institut National de Physique Nucléaire et de Physique des Particules, France



**INFN:**

Istituto Nazionale di Fisica Nucleare, Italy



**CERN:**

European Organization for Nuclear Research, Geneva, Switzerland



**UCL:**

Université Catholique de Louvain, Centre de Recherches du Cyclotron, Louvain-la-Neuve, Belgium



**CEA:**

Commissariat à l'Energie Atomique (Direction des Sciences de la Matière), Paris, France



**NIPNE:**

"Horia Hulubei" National Institute for Physics and Nuclear Engineering, Bucharest-Magurele, Romania



**JYU:**

University of Jyväskylä, Jyväskylä, Finland



**LMU:**

Ludwig Maximilians Universität München, München, Germany



**FZJ:**

Forschungszentrum Jülich GmbH, Jülich, Germany



**FI:**

Institute of Physics, Vilnius, Lithuania



**UW:**

Warsaw University, Warsaw, Poland



**SAV:**

Institute of Physics - Slovak Academy of Sciences, Bratislava, Slovakia



**U-Liverpool:**

The University of Liverpool, Liverpool, United Kingdom



**GSI:**

Gesellschaft für Schwerionenforschung m.b.H. Darmstadt, Germany

## Participant Institutions (continued)



**USDC:**  
Universidade de Santiago de Compostela, Santiago de Compostela



**STFC:**  
Science and Technology Facilities Council, United Kingdom



**PSI:**  
Paul Scherrer Institute, Villigen, Switzerland



**IPUL:**  
Institute of Physics, University of Latvia, Salaspils, Latvia



**SU-MSL:**  
Stockholm University–Manne Siegbahn Laboratory, Stockholm, Sweden

The institutions listed above were contractors to the EURISOL consortium. Those listed below were contributing institutions, but received no direct funding from the European Commission

## Contributor Institutions



**U-FRANKFURT:**  
Johann Wolfgang Goethe-Universität, Frankfurt, Germany



**BINP:**  
Budker Institute of Nuclear Physics of Novosibirsk, Novosibirsk, Russia



**VNIITF:**  
Russian Federal Nuclear Center - Zababakhin Institute of Technical Physics, Snezhinsk, Russia



**PNPI:**  
Petersburg Nuclear Physics Institute, Gatchina, Russia



**ORNL:**  
Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA



**ANL:**  
Argonne National Laboratory, Argonne, Illinois, USA



**KAERI:**  
Korea Atomic Energy Research Institute, Daejeon, South Korea

## Contributor Institutions (continued)



**JAERI:**

Japan Atomic Energy Research Institute, Kashiwa, Japan



**TRIUMF:**

Tri-University Meson Facility, Vancouver, Canada



**SOREQ:**

Soreq Nuclear Research Centre, Yavne, Israel



**U-MAINZ:**

Johannes Gutenberg Universität Mainz, Mainz, Germany



**KVI:**

Kernfysisch Versneller Instituut Groningen, Groningen, The Netherlands



**U-SURREY:**

The University of Surrey, Guildford, United Kingdom



**U-YORK:**

The University of York, Heslington, United Kingdom



**U-PAISLEY:**

University of Paisley, Paisley, United Kingdom



**VINCA:**

VINCA Institute of Nuclear Sciences, Laboratory of Physics, Belgrade



**U-UPPSALA:**

Uppsala University, Uppsala, Sweden



**NSCL:**

National Superconducting Cyclotron Laboratory, Michigan State University, East Lansing, Michigan, USA



**FNAL:**

Fermi National Accelerator Laboratory, Batavia, Illinois, USA



**HUG:**

Hospital University of Geneva, Geneva, Switzerland



**ITN:**

Nuclear Technology Institute, Lisbon, Portugal

## ***Steering Committee Members***

### ***Representatives of Participant Institutions:***

Nicolas Alamanos (*CEA, France*)  
Juha Äystö (*JYU, Finland*)  
Jose Benlliure (*USDC, Spain*)  
Emil Běták (*IP-SKS, Slovakia*)  
Heinz Brücher (*FZJ, Germany*)  
Enrico Chiaveri (*CERN, Switzerland*) [2005]  
Janis Freibergs (*IPUL, Latvia*)  
Heinz Gaggler (*PSI, Switzerland*)  
Sydney Galès (*GANIL, France*) [2006–2009]  
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Dominique Guillemaud-Mueller (*IN2P3, France*)  
Gilbert Guignard (*CERN, Switzerland*) [2005–2007]  
Dieter Habs (*LMU, Germany*) [2005–2006]  
Jerzy Jastrebski (*UW, Poland*)  
Anders Källberg (*SU-MSL, Sweden*)  
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Marc Loiselet (*UCL, Belgium*)  
Paul Nolan (*U. Liverpool, United Kingdom*)  
Arturas Plukis (*FI, Lithuania*)  
Gabriele Puglierin (*INFN, Italy*)  
John Simpson (*STFC, United Kingdom*)  
Klaus Sümmerer (*GSI, Germany*)  
Peter Thirolf (*LMU, Germany*) [2006–2009]  
Dave Warner (*CCLRC, United Kingdom*) [2005]  
Nicolae Zamfir (*NIPNE, Romania*)

### ***Ex officio observers (by invitation):***

Roy Aleksan (*ESGARD Project Leader*) [2005–2009]  
Brian Fulton (*NuPECC Chairman*) [2006–2007]  
Alex Mueller (*EURONS Project Leader*) [2005–2008]  
Muhsin Harakeh (*NuPECC Chairman*) [2005]  
Gunter Rosner (*NuPECC Chairman*) [2008–2009]

## ***Management Board***

Yorick Blumenfeld (*IPNO/CERN*) – *EURISOL DS Project Leader* [2007–2009]

Peter Butler (*Liverpool University*)

Graziano Fortuna (*INFN*) – *EURISOL DS Project Leader* [2005–2006]

Mats Lindroos (*CERN*)

## ***Management Support Team***

Alberto Andrighetto (*INFN*) [2005–2006]

Rosella Battistella (*INFN*) – *Administrative and legal issues*

Sandrine Bon (*IPNO*) [2007]

John Cornell (*GANIL*) – *Technical Coordinator*

Michele Gulmini (*INFN*) – *Database* [2008–2009]

Céline Hovaguimian (*IPNO*) [2006]

Michele Comunian (*INFN*) [2005–2006]

Domenico Lazzarato (*INFN*) – *Website* [2007–2009]

Jacques Lettry (*CERN*) – *Target Consultant* [2008–2009]

## ***International Advisory Panel***

Sytze Brandenburg (*KVI, The Netherlands*)

Witek Nazarewicz (*ORNL/U. Tennessee, United States of America*)

Paul Schmor (*TRIUMF, Canada*) – *Chairman*

## ***Site Investigation Panel [2008]***

Alan Shotter (*U. Edinburgh, United Kingdom*) – *Chairman*

Giacomo Cuttone (*INFN-LNS, Italy*)

Don Geesaman (*ANL, United States of America*)

Alex Mueller (*IN2P3, France*)

Steve Myers (*CERN, Switzerland*).



## ***Coordination Board***

Task 1: Management of EURISOL Design Study	Graziano Fortuna ( <i>INFN</i> ) [2005–2006] Yorick Blumenfeld ( <i>IPNO/CERN</i> ) [2007–2009]
Task 2: Multi-MW Target Station	Helge Ravn ( <i>CERN</i> ) [2005] Yacine Kadi ( <i>CERN</i> ) [2005–2009]
Task 3: Direct Target	Jacques Lettry ( <i>CERN</i> ) [2005] Thierry Stora ( <i>CERN</i> ) [2005–2009]
Task 4: Fission Target	Luigi Tecchio ( <i>INFN-LNL</i> )
Task 5: Safety & radioprotection	Danas Ridikas ( <i>CEA</i> ) [2005–2007] Jean-Christophe David ( <i>CEA-IRFU</i> ) [2008–2009]
Task 6: Heavy-Ion Accelerator Design	Marie-Hélène Moscatello ( <i>GANIL</i> )
Task 7: Proton Accelerator Design	Alberto Facco ( <i>INFN-LNL</i> )
Task 8: Superconducting Cavity Development	Sébastien Bousson ( <i>IPNO</i> )
Task 9: Beam Preparation	Ari Jokinen ( <i>JYU</i> )
Task 10: Physics & Instrumentation	Robert Page ( <i>U. Liverpool</i> )
Task 11: Beam Intensity Calculations	Karl-Heinz Schmidt ( <i>GSI</i> ) [2005–2007] Aleksandra Kelić ( <i>GSI</i> ) [2008–2009]
Task 12: Beta-Beam Aspects	Michael Benedikt ( <i>CERN</i> )

### ***Ex officio observers (by invitation):***

Vittorio Paladino (*INFN Naples, representing the BENE network*)

Roland Garoby (*CERN, representing the HIPPI network*)