



RIKEN  
NiSHiNA  
CENTER

# The EURICA Spectrometer

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ピータードルネンバル



September 12<sup>th</sup>, 2011



# Outline

General Comments

EURICA

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Summary

- General Comments
- EURICA Setup
  - ❖ Configuration and location
- Physics Case
- EURICA Status
  - ❖ Organization
  - ❖ Time-line
  - ❖ Work Tasks



# *General Comments*



# *A Brief History and Context*

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## Summer 2010–Fall 2010

- Decision to stop the RISING campaign at GSI in 2011 (to prepare for AGATA demonstrator and DESPEC campaign) **triggered interest from the science community** for a campaign in 2012/13 at the RIBF in RIKEN
- Initial **institutional contacts** led to the exchange of supporting letters and (at that point in time) to tentative resource commitments for the potential realization

## Winter 2010–Spring 2011

- Contacts with the **Owners Committee (OC)** for the EUROBALL cluster detectors defined the schedule
- As a project by the research community, a **general collaboration workshop** was organized at RIKEN for May 23/24 to broadly define the science case, to identify the technical, project-management, and resource aspects and **to formally establish the EURICA collaboration**
- Construction proposal was submitted to **RIBF NP-PAC (deadline May 15)**
- EURICA project proposal was submitted to the **OC on July 1**



# General Aspects

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- The EURICA collaboration has **free and open access** to any researcher interested in joining
- The research program and approval of individual experiments is strictly **based on science quality/priority**, as peer-reviewed by the RIBF NP-PAC
- The size of the collaboration is expected to be around **≈200 scientists** (already more than 160 have signed up and indicated specific research interests; international participation is very strong)



# *RISING Setup at GSI*

General Comments

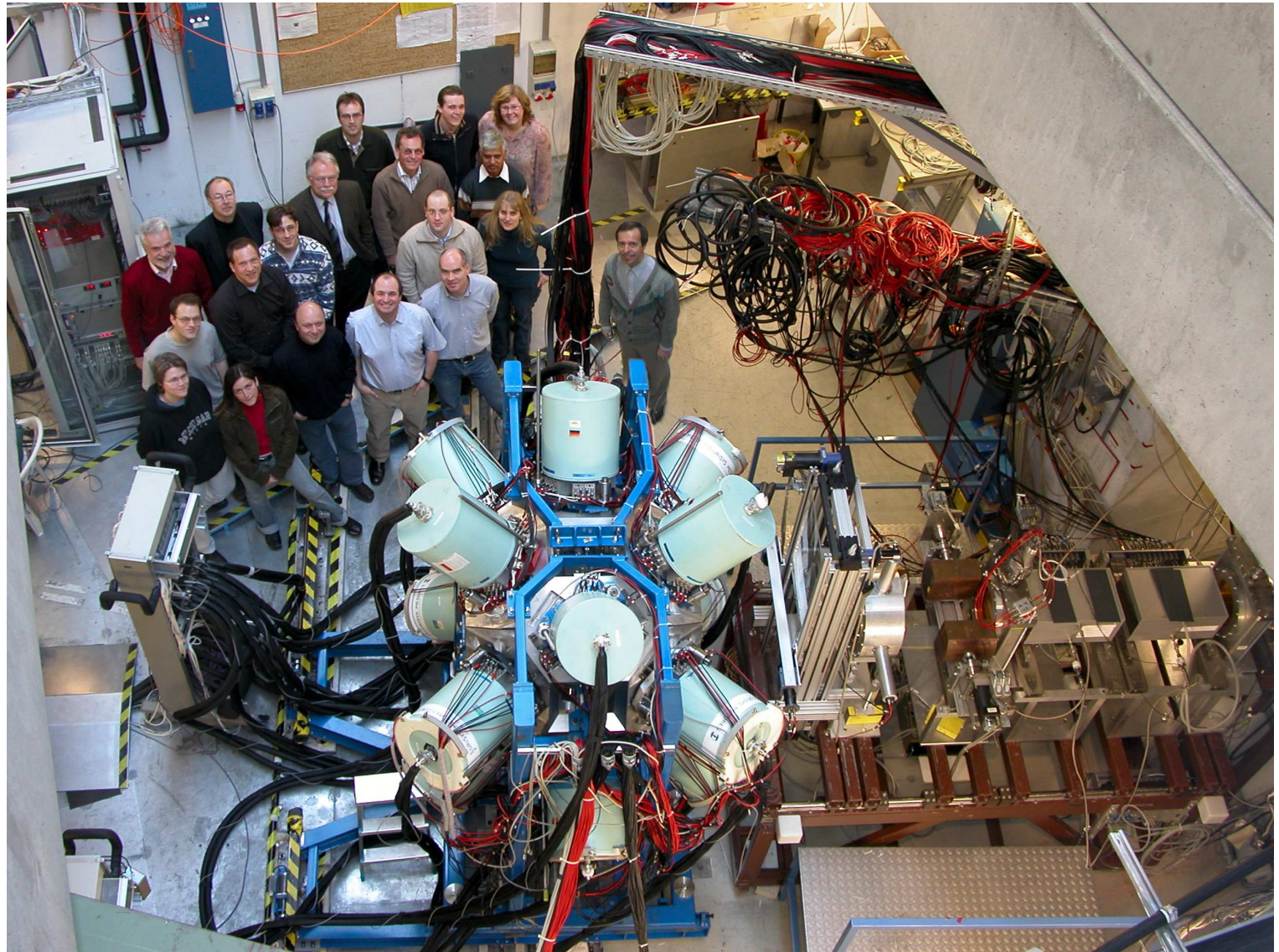
❖ RISING Setup at GSI

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# *EURICA*





# *What is EURICA?*

General Comments

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❖ What is EURICA?

❖ RIBF Overview

❖ EURICA Location

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Summary

**EU** ROBALL

**RI** KEN

**C** luster

**A** rray



# What is EURICA?

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❖ What is EURICA?

❖ RIBF Overview

❖ EURICA Location

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**EU** ROBALL

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**C** luster

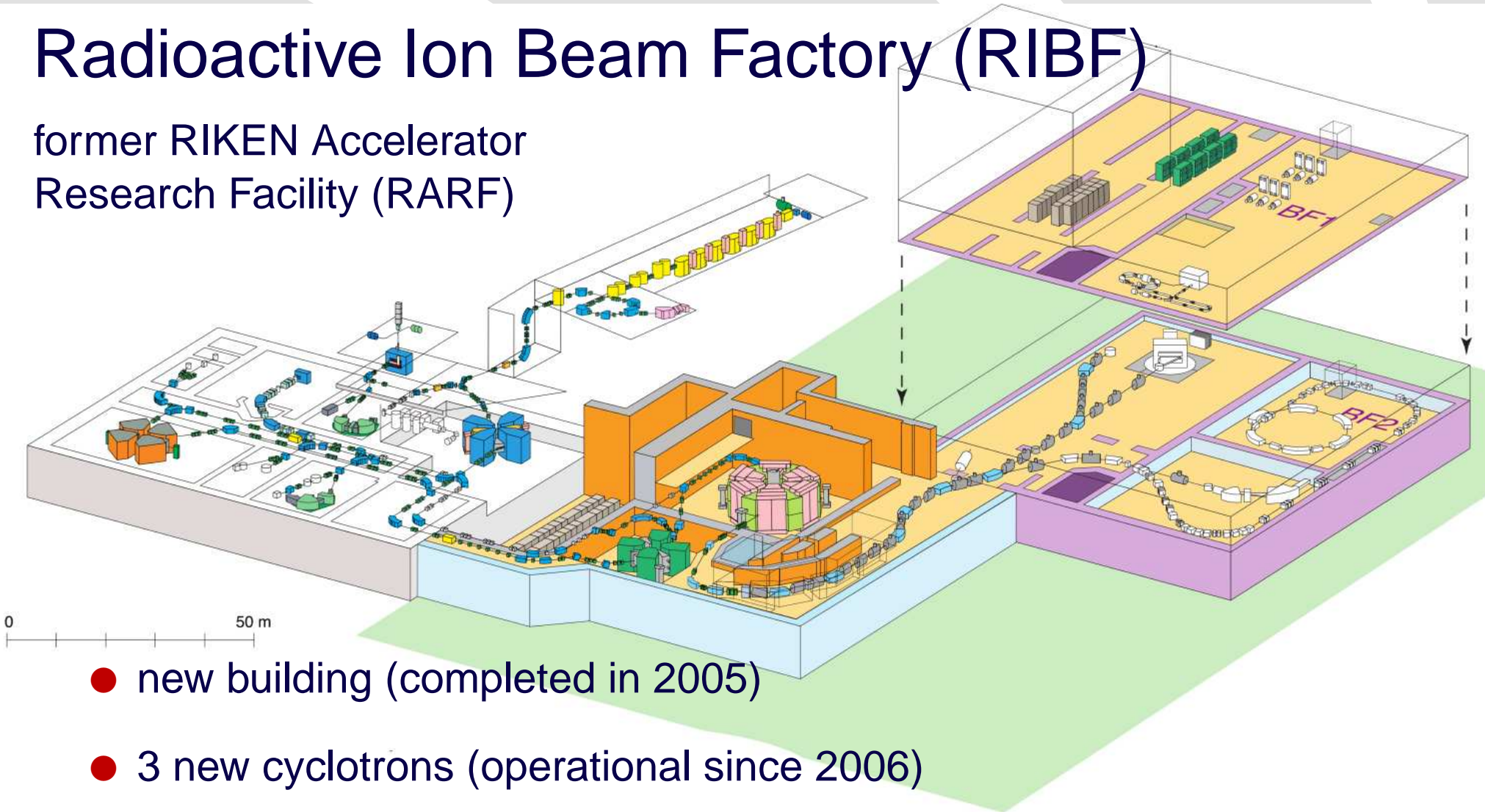
**A** rray

- Collaboration that uses high-efficiency Ge-spectrometer for isomeric and  $\beta$ -delayed  $\gamma$ -ray spectroscopy at RIKEN
- 12 Cluster detectors
  - ❖ 84(88) crystals
    - High granularity
    - 15 % photopeak efficiency at 662 keV
- Ancillary detectors, e.g. the SIMBA array



## Radioactive Ion Beam Factory (RIBF)

former RIKEN Accelerator  
Research Facility (RARF)





# Superconducting Ring Cyclotron (SRC)

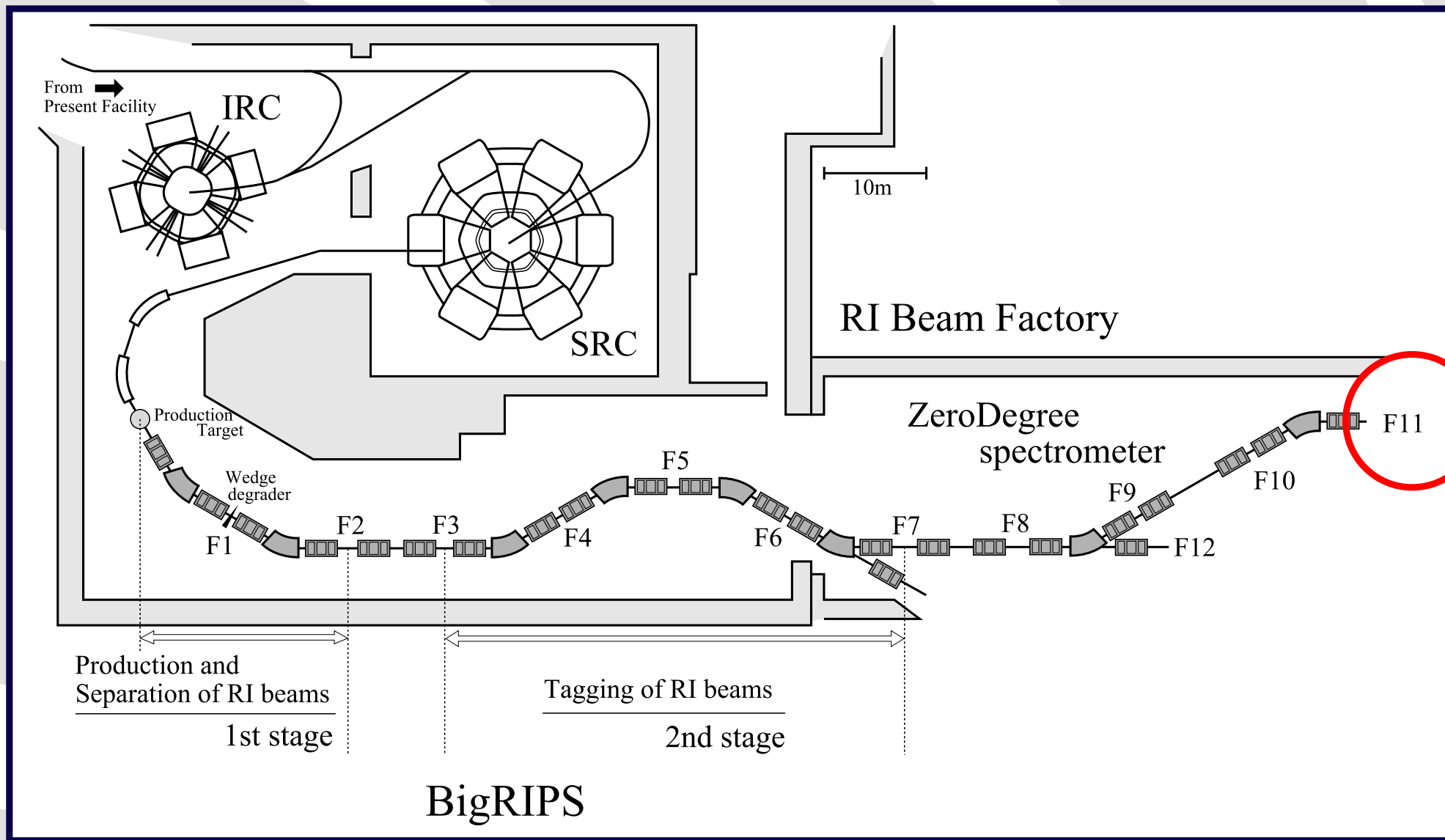


Intensities of 345 MeV/u beams from the SRC:

Nucleus	Beam Intensity / pA	
	Achieved	Expected FY 2011/12
$^{48}\text{Ca}$	230	200
$^{86}\text{Kr}$	30	30
$^{124,136}\text{Xe}$	(10)	10
$^{238}\text{U}$	0.8	5

- $K = 2500$  MeV
- 8300 tons
- 5.36 m extraction radius
- 6 sector magnets
- four main RF cavities

# EURICA Location

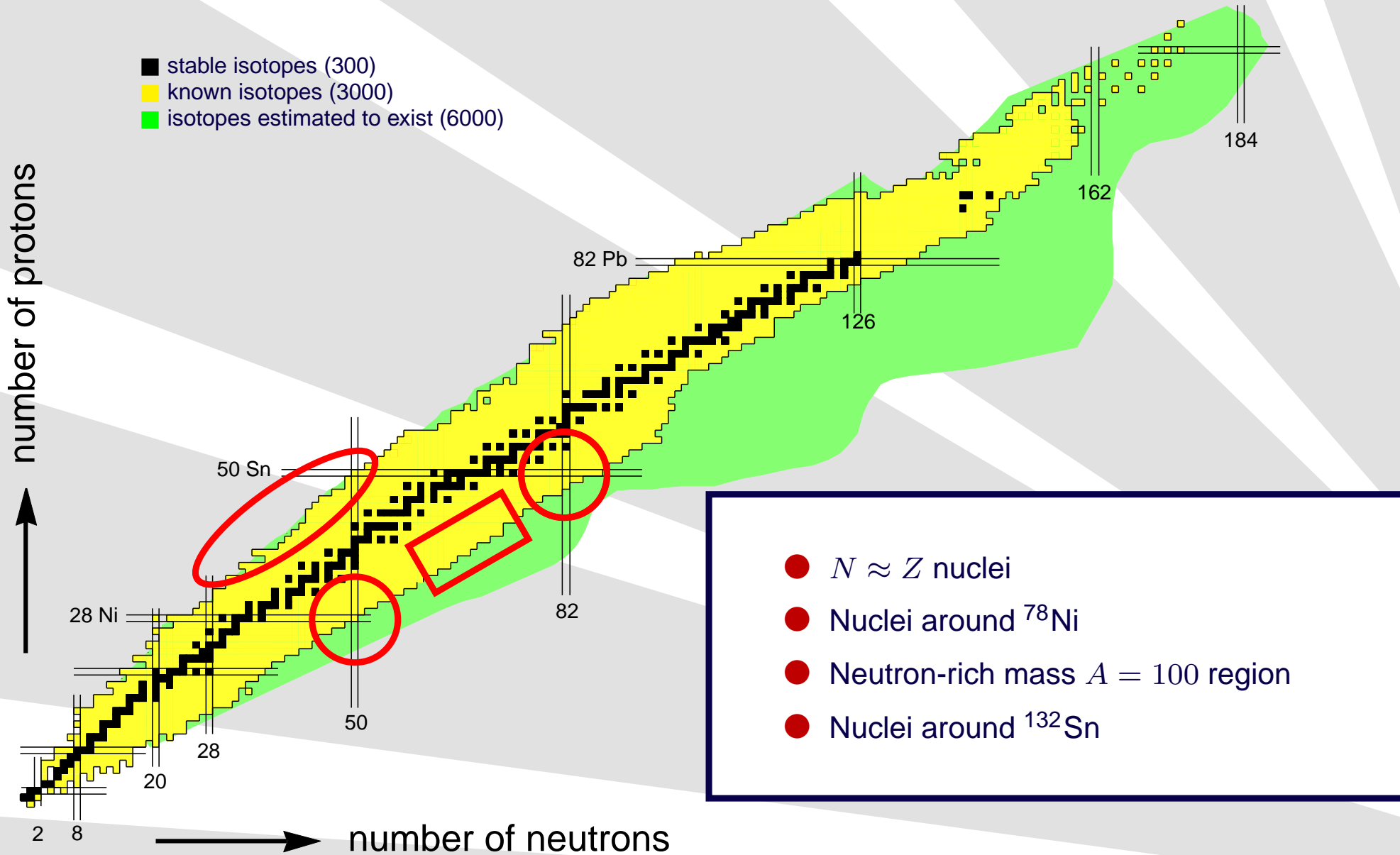




# *Physics Case*



# Regions of Interest



# Physics Case From First Workshop (May 23-24, 2011)

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❖ Regions of Interest

❖ **First Workshop**

❖ Second Workshop

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Summary

Nuclei of Interest	Spokesperson	Primary Beam
$^{41}\text{Si}$	Z. Li	$^{48}\text{Ca}$
$^{64,66}\text{Se}$	B. Rubio, Y. Fujita, W. Gelletly	$^{78}\text{Kr}$
$^{71}\text{Kr}$	G. de Angelis, F. Recchia	$^{78}\text{Kr}$
$^{55}\text{Sc}$	J. Valiente Dobon, G. de Angelis	$^{86}\text{Kr}$
$^{77}\text{Cu}$	E. Sahin, V. Modamio	$^{86}\text{Kr}$ or $^{238}\text{U}$
$^{78}\text{Zr}$ , $^{82}\text{Mo}$	A. Gadea	$^{124}\text{Xe}$
$^{100}\text{Sn}$	M. Lewitowicz, R. Krücken, S. Nishimura	$^{124}\text{Xe}$
$^{127}\text{Ag}$ , $^{129}\text{Cd}$	H. Watanabe	$^{136}\text{Xe}$
$^{70,72}\text{Fe}$	G. Benzoni, H. Watanabe	$^{238}\text{U}$
$^{78}\text{Ni}$	S. Nishimura	$^{238}\text{U}$
$^{81}\text{Cu}$	M. Niikura	$^{238}\text{U}$
n-rich Ge, Se, Kr	A. Odahara	$^{238}\text{U}$
$^{92,94}\text{Se}$	R. Krücken	$^{238}\text{U}$
$^{110,112}\text{Mo}$	T. Bäck, E. Ideguchi	$^{238}\text{U}$
$^{108,110}\text{Zr}$	T. Sumikama	$^{238}\text{U}$
$^{128}\text{Pd}$	G. Lorusso	$^{238}\text{U}$
$^{132,134}\text{Cd}$ , $^{136,138}\text{Sn}$	A. Gadea, A. Jungclaus, G. Simpson	$^{238}\text{U}$
$^{137}\text{Sb}$ , $^{138,139}\text{Te}$	R. Lozeva	$^{238}\text{U}$
n-rich Ba and Xe	A. Odahara	$^{238}\text{U}$
$^{170}\text{Dy}$	H. Watanabe	$^{238}\text{U}$





# In Addition Today

General Comments

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❖ Regions of Interest

❖ First Workshop

❖ **Second Workshop**

Status

Summary

Nuclei of Interest	Spokesperson	Primary Beam
$^{94}\text{Ag}$ , $^{96}\text{Cd}$	B. Wadsworth	$^{124}\text{Xe}$
$^{73,75,77}\text{Ni}$	D. Sohler	$^{86}\text{Kr}$ or $^{238}\text{U}$
$^{74}\text{Ni}$	G. de Angelis	$^{86}\text{Kr}$ or $^{238}\text{U}$
$^{88}\text{Ge}$ , $^{90}\text{Se}$	V. Werner	$^{238}\text{U}$
$^{92,94}\text{Se}$	A. Garnsworthy	$^{238}\text{U}$
Neutron-rich Zr region	A. Brucce	$^{238}\text{U}$
Below $^{132}\text{Sn}$	S. Lalkovski	$^{238}\text{U}$
Neutron-rich $Z \approx 60$	E. Ideguchi	$^{238}\text{U}$



# *Status, Organization and Work Tasks*

# GAMMAPOOL Approval on July 27<sup>th</sup>

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❖ GAMMAPOOL

❖ Structure

❖ Work Tasks

❖ Status and  
Time-Line

❖ Coming to RIKEN

❖ Collaboration

Summary

The Gammapool committee has discussed your EURICA bid at its meeting on July 27<sup>th</sup>. The project is supported by a rich and attractive physics case and the committee is impressed by the unique opportunities and the large support base that the project has gathered in a short period of time. We also note very positively the significant commitment by RIKEN in terms of beamtime, resourcing and manpower and we have no doubt that the project will reap large scientific rewards.

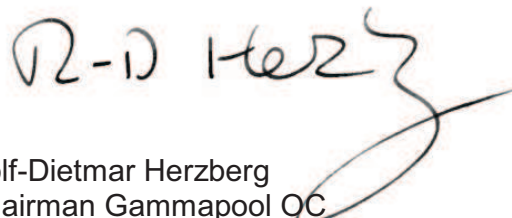
We therefore **approve**, conditional on the signing of an appropriate MoU, the following request:

- a) 88 Cluster Capsules sufficient for 12 Cluster detectors, including 12 Cryostats
- b) 88 HV elbows
- c) 1 Manipulator
- d) Specialist equipment for mounting/dismounting to be agreed with GSI

The committee **approves** this loan for use until June 30<sup>th</sup> 2013. The items listed under b,c and d need to be agreed with the homebase of the Cluster detectors, GSI. Full records of assembly, test and repair are standard conditions of any loan and will form a part of the MoU. Good communication between the EURICA and PRESPEC campaign managers will be essential.

We ask to be kept informed of the progress of the project and will ask for an update by July 1<sup>st</sup> of every year, which should include a list of publications and PhD theses based on the use of Gammapool resources. We also ask that the use of Gammapool resources is acknowledged in all appropriate publications.

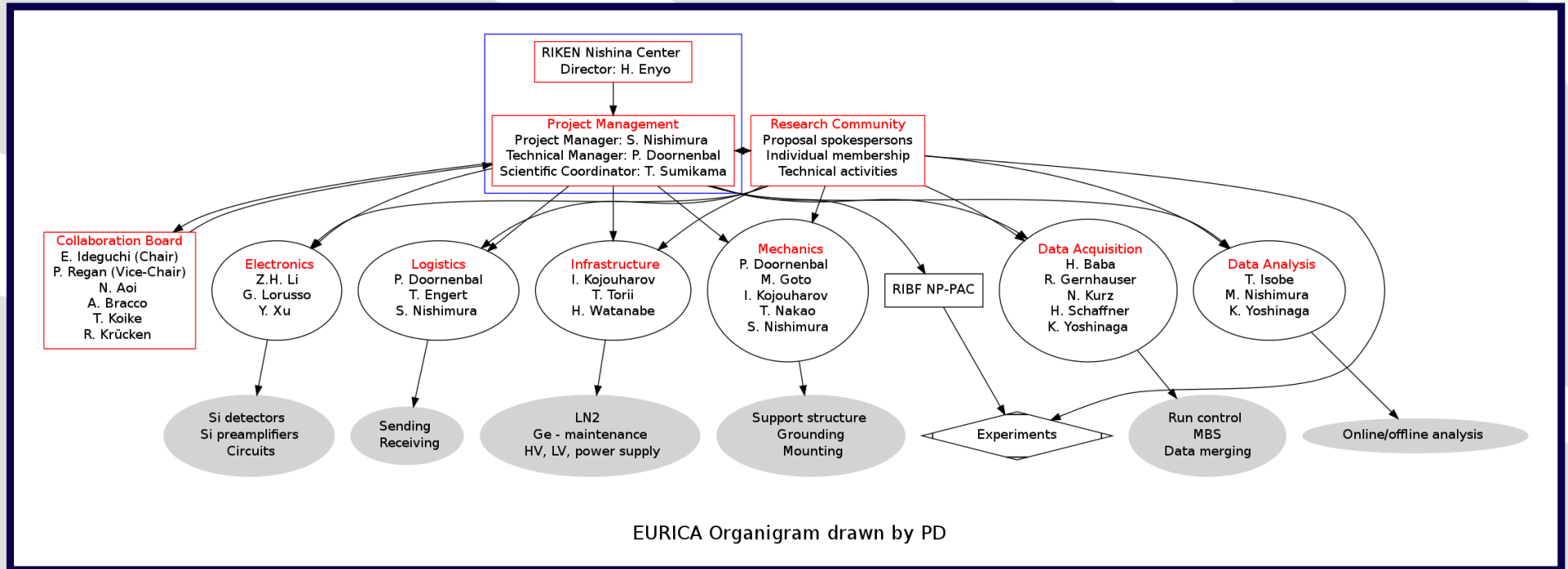
Yours sincerely



Rolf-Dietmar Herzberg  
Chairman Gammapool QC



# Organizational Structure





# Work Tasks

## ● Infrastructure

- ❖ Liquid nitrogen pipeline (BigRIPS Team: M. Otake)
- ❖ Liquid nitrogen filling system (H. Watanabe (procured))
- ❖ cables (RINEI, procured)

## ● Mechanics

- ❖ Support structure and rail system (G-Tec, procured)

## ● Logistics (SN, PD, T. Engert, ...)

- ❖ Shipment of detectors, electronics, support structure

## ● Electronics: DGF, Circuit, ... (H. Schaffner, Zh. Li, K. Yoshinaga, ...)

## ● Detectors

- ❖ Ge-Detectors (I. Kojouharov, Y. Torii...)
- ❖ Nishimu-DSSSD (G. Lorusso, Z. Xu)
- ❖ TUM SIMBA array (Munich Group)

## ● Data acquisition and analysis (N. Kurz, H. Schaffner, R. Gernhäuser, H. Baba, K. Yoshinaga, ...)



# *EURICA Status and Time-Line*

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- May 23<sup>rd</sup>–24<sup>th</sup>: 1<sup>st</sup> EURICA Workshop at RIKEN
- September 12<sup>th</sup>: 2<sup>nd</sup> EURICA Workshop at GSI

# EURICA Status and Time-Line

- May 23<sup>rd</sup>–24<sup>th</sup>: 1<sup>st</sup> EURICA Workshop at RIKEN
- September 12<sup>th</sup>: 2<sup>nd</sup> EURICA Workshop at GSI

Task \ Time	2011										2012			
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
Letter of Intent														
Last PreSpec Experiment														
EURICA Workshop														
Construction Proposal														
MoU and Proposal														
Shipment of Support Structure														
Shipment of Electronics														
Construction of Rail System														
EURICA Workshop														
Shipment of Detectors														
Construction of LN <sub>2</sub> Pipeline														
Exp. Proposal Subm.														
Ass. of Support Structure														
Assembling of Clusters														
LN <sub>2</sub> Filling system														
Assembling of Electronics														
RIBF NP-PAC Meeting														
Mounting of Clusters														
Commissioning w/o Beam														
Commissioning w. Beam														
EURICA Experiments														



# EURICA Status and Time-Line

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❖ GAMMAPOOL

❖ Structure

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❖ Status and  
Time-Line

❖ Coming to RIKEN

❖ Collaboration

Summary

- Support structure shipment this/next week
- Cluster/electronics flight cases arrive at GSI this/next week
- Proposal submission deadline not decided yet. Probably middle/end of October
- 10<sup>th</sup> RIBF NP-PAC meeting early December
- Commissioning in March 2012 with  $^{18}\text{O}$  beam  $\rightarrow$   $^{16}\text{N}$  for  $5 \mu\text{s}$  isomer at 120 keV
- 40-50% of the overall beam time available for the RIBF during FY2012 for EURICA experiments





# Young Researcher Programs

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- Short-term International Program Associates (for PhD students)
  - ❖ Three months up to one year
  - ❖ Three application periods/year
  - ❖ 158,000 ¥/month living allowance
  - ❖ On-campus housing or 70,000 ¥/month housing allowance
- Short-term Japanese Society for the Promotion of Science Fellowships
  - ❖ Three months up to one year
  - ❖ Six application periods/year
  - ❖ Living allowances of 200,000 ¥/month for PhD students and 362,000 ¥/month for post-docs
- More information will be put on web-page shortly
  - ❖ <http://ribf.riken.jp/EURICA/>



# EURICA Collaboration (as of 2011/09/10)

A. Algora<sup>1</sup>, N. Aoi<sup>2</sup>, H. Baba<sup>3</sup>, T. Bäck<sup>4</sup>, Ch. Bauer<sup>37</sup>, G. Benzoni<sup>5</sup>, N. Blasi<sup>5</sup>, M. Bostan<sup>6</sup>, A. Bracco<sup>5,7</sup>, S. Brambilla<sup>7</sup>, A. Bruce<sup>44</sup>, L. Cáceres<sup>8</sup>, B. Cakirli<sup>39</sup>, F. Camera<sup>5,7</sup>, W.N. Catford<sup>18</sup>, I. Celikovic<sup>8,9</sup>, J. Chiba<sup>10</sup>, E. Clément<sup>8</sup>, F. Crespi<sup>5,7</sup>, P.V. Cuong<sup>46</sup>, G. de Angelis<sup>11,12</sup>, G. de France<sup>8</sup>, N. de Séréville<sup>13</sup>, F. Didierjean<sup>14</sup>, Zs. Dombradi<sup>40</sup>, C. Domingo-Pardo<sup>1</sup>, M. Doncel<sup>15</sup>, P. Doornenbal<sup>3</sup>, G. Duchêne<sup>14</sup>, N. Erduran<sup>16</sup>, Th. Feastermann<sup>20</sup>, E. Farnea<sup>11,12</sup>, S. Franchoo<sup>13</sup>, Y. Fujita<sup>2</sup>, A. Gadea<sup>1</sup>, A. Garnsworthy<sup>17</sup>, W. Gelletly<sup>18</sup>, J. Gerl<sup>19</sup>, R. Gernhäuser<sup>20</sup>, S. Go<sup>21</sup>, A. Gottardo<sup>11,12</sup>, S. Grévy<sup>22</sup>, G. Hackman<sup>17</sup>, F. Hammache<sup>13</sup>, T. Hayakawa<sup>23</sup>, Ch. Hinke<sup>20</sup>, Y. Hirayama<sup>24</sup>, H. Hua<sup>25</sup>, L.T.Q. Huong<sup>46</sup>, T. Huyuk<sup>1</sup>, F. Ibrahim<sup>13</sup>, Y. Ichikawa<sup>3</sup>, E. Ideguchi<sup>21</sup>, N. Imai<sup>24</sup>, N. Inabe<sup>3</sup>, H. Ishiyama<sup>24</sup>, T. Isobe<sup>3</sup>, S. Jeong<sup>24</sup>, A. Jungclaus<sup>26</sup>, D. Kameda<sup>3</sup>, L.H. Khiem<sup>46</sup>, I. Kojouharov<sup>19</sup>, K. Kolos<sup>13</sup>, T. Komatsubara<sup>27</sup>, A. Korichi<sup>28</sup>, R. Krücken<sup>17</sup>, T. Kubo<sup>3</sup>, N. Kurz<sup>19</sup>, A. Kusoglu<sup>6</sup>, F. Le Blanc<sup>13</sup>, J. Lee<sup>3</sup>, S. Leoni<sup>5,7</sup>, M. Lewitowicz<sup>8</sup>, Z.H. Li<sup>3,25</sup>, X. Li<sup>25</sup>, Zh. Li<sup>41</sup>, M. Liu<sup>42</sup>, W. Liu<sup>41</sup>, Zh. Liu<sup>43</sup>, G. Lorusso<sup>3</sup>, R. Lozeva<sup>14</sup>, S. Lunardi<sup>11,12</sup>, I. Matea<sup>13</sup>, D. Mengoni<sup>11,12</sup>, C. Michelagnoli<sup>11,12</sup>, B. Million<sup>5</sup>, H. Miyatake<sup>24</sup>, V. Modamio<sup>11,12</sup>, C.B. Moon<sup>29</sup>, K. Morimoto<sup>3</sup>, T. Motobayashi<sup>3</sup>, T. Nagatomo<sup>3,30</sup>, T. Nakamura<sup>31</sup>, T. Nakao<sup>3</sup>, M. Nakhoshtin<sup>18</sup>, D. Napoli<sup>11</sup>, M. Niikura<sup>13</sup>, H. Nishibata<sup>32</sup>, M. Nishimura<sup>3</sup>, S. Nishimura<sup>3</sup>, F. Nowacki<sup>14</sup>, J. Nyberg<sup>33</sup>, A. Odahara<sup>32</sup>, R. Orlandi<sup>26</sup>, S. Pietri<sup>19</sup>, A. Pipidis<sup>11</sup>, Zs. Podolyak<sup>18</sup>, B. Quintana<sup>15</sup>, M. Ramdhane<sup>34</sup>, F. Recchia<sup>12</sup>, P. Regan<sup>18</sup>, O. Roberts<sup>44</sup>, B. Rubio<sup>1</sup>, E. Sahin<sup>11,12</sup>, M. Sako<sup>3,35</sup>, H. Sakurai<sup>3,36</sup>, H. Schaffner<sup>19</sup>, H. Scheit<sup>37</sup>, T. Shimoda<sup>32</sup>, P. Shury<sup>3,27</sup>, K. Sieja<sup>14</sup>, G. Simpson<sup>34</sup>, D. Sohler<sup>40</sup>, T. Sonoda<sup>3</sup>, O. Sorlin<sup>8</sup>, I. Stefan<sup>13</sup>, K. Steiger<sup>20</sup>, D. Steppenbeck<sup>3</sup>, T. Sumikama<sup>10</sup>, H. Suzuki<sup>3</sup>, J. Takatsu<sup>32</sup>, H. Takeda<sup>3</sup>, S. Takeuchi<sup>3</sup>, D. Testov<sup>13</sup>, G. Thiamova<sup>34</sup>, J.C. Thomas<sup>8</sup>, T.D. Trong<sup>46</sup>, H. Ueno<sup>3</sup>, C. Ur<sup>11,12</sup>, Zs. Vajta<sup>40</sup>, J. Valiente Dobon<sup>11,12</sup>, D. Verney<sup>13</sup>, Y. Wakabashi<sup>23</sup>, T. Waku<sup>38</sup>, Y. Wang<sup>41</sup>, H. Watanabe<sup>3</sup>, Y. Watanabe<sup>24</sup>, V. Werner<sup>45</sup>, O. Wieland<sup>5</sup>, H.J. Wollersheim<sup>19</sup>, Z. Xu<sup>36</sup>, M. Yalcinkaya<sup>6</sup>, H. Yamaguchi<sup>21</sup>, Y. Ye<sup>25</sup>, A. Yoshimi<sup>3</sup>, K. Yoshinaga<sup>3,10</sup>, Y. Zhang<sup>42</sup>, Y. Zheng<sup>42</sup>, and X. Zhou<sup>42</sup>

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<sup>11</sup>LNL, Legnaro, Italy

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<sup>15</sup>LRI - University of Salamanca, Spain

<sup>16</sup>University of Akdeniz, Antalya, Turkey

<sup>17</sup>TRIUMF, Vancouver, Canada

<sup>18</sup>University of Surrey, Guildford, UK

<sup>19</sup>GSI, Darmstadt, Germany

<sup>20</sup>TU München, Germany

<sup>21</sup>CNS, University of Tokyo, Japan

<sup>22</sup>CENBG Bordeaux, France

<sup>23</sup>JAEA, Tokai, Japan

<sup>24</sup>KEK, Tokai, Japan

<sup>25</sup>Peking University, China

<sup>26</sup>CSIC, Madrid, Spain

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<sup>29</sup>Hoseo University, Chun-Nam, Korea

<sup>30</sup>ICU, Tokyo, Japan

<sup>31</sup>Tokyo Institute of Technology, Japan

<sup>32</sup>Osaka University, Japan

<sup>33</sup>Uppsala University, Sweden

<sup>34</sup>LPSC Grenoble, France

<sup>35</sup>Kyoto University, Japan

<sup>36</sup>University of Tokyo, Hongo, Japan

<sup>37</sup>TU Darmstadt, Germany

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<sup>45</sup>Yale University, USA

<sup>46</sup>Vietnam Academy for Science and Technology, Hanoi, Vietnam



# *Summary*



# Summary

General Comments

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Physics Case

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Summary

- The OC approved the loan of 88 crystals, sufficient for 12 Clusters until June 30<sup>th</sup>, 2013
- Shipment of equipment will start from next week, MoU between EURICA and OC in preparation
- Vast physics case, need to coordinate proposals → main purpose of today's workshop
- Dead-line for proposal submission will be middle/end of October
- All important information will be put on the web-page after this workshop.

❖ <http://ribf.riken.jp/EURICA/>



***THE END***



General Comments

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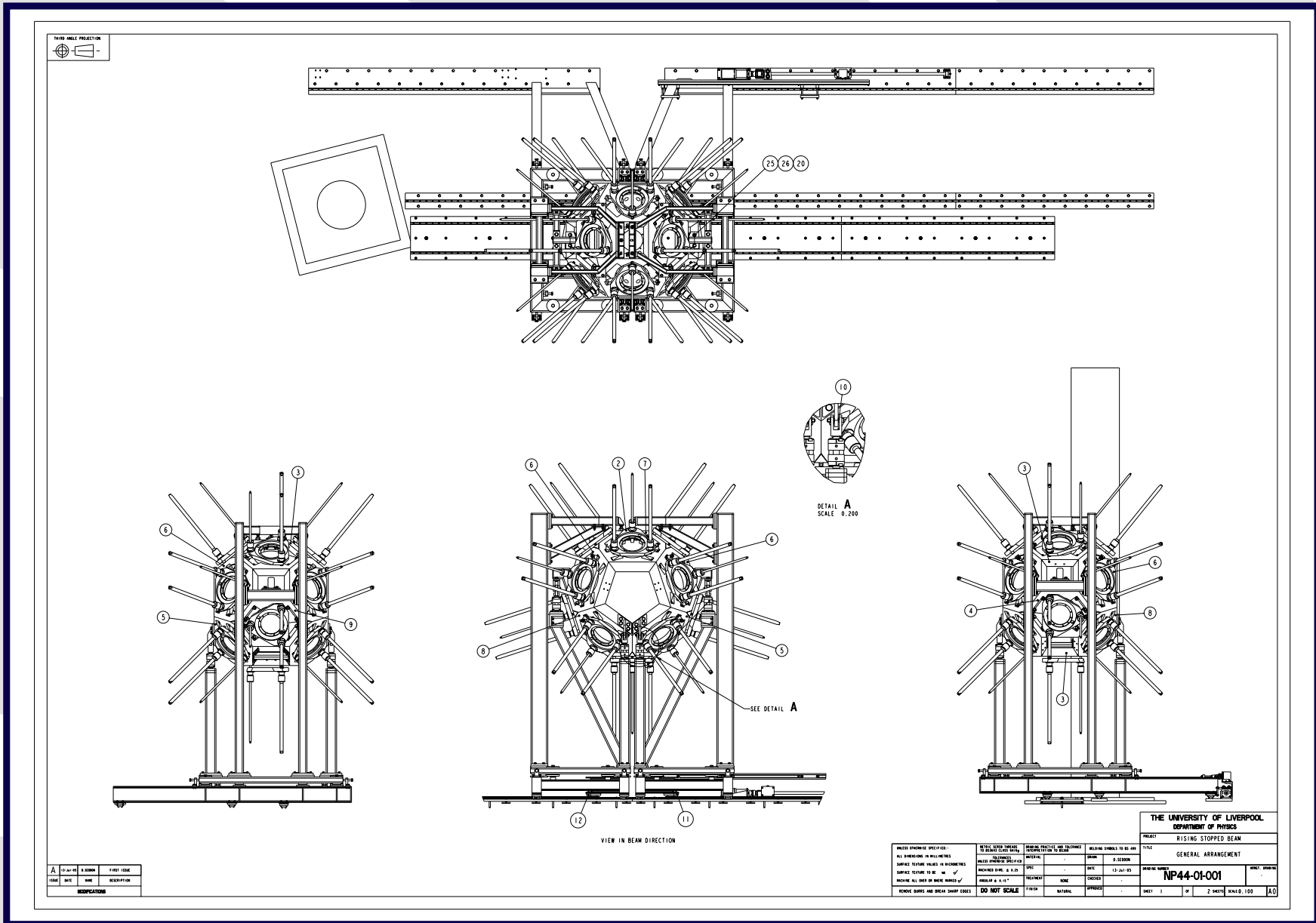
Status

Summary

# ***Backup slides from now***



# Frame





# DAQ

General Comments

EURICA

Physics Case

Status

Summary

- We plan a phone conference on July 26th, 10h00 JST (17h00 CET)
- We will combine RIKEN DAQ and GSI/MBS DAQ with time stamps. Possible time stamp modules are TITRIS or LUPO. Baba-san would like to have a manual for TITRIS.
- Time-stamping was already performed in a previous beta-decay experiment in which the data had to be stored first, i.e., online analysis was impossible.
- We don't have to share run control and data format.
- Slow control of DGF modules used for the Cluster detectors depends on the vme processors real-time operating system lynxos used at gsi for mbs daq systems. No adjustment is necessary for the slow control.
- DAQ readout:
  - ❖ SIMBA: 1 VME crate
  - ❖ CLUSTER: 1 VME crate + 3 CAMAC crates for xia DGF modules, 1 VME crate for Ge timing
  - ❖ BigRIPS: 1 VME crate for scalers up to 10 CAMAC crates controlled by CC/Net modules.
  - ❖ No decision/conclusion was made on the data analysis so far. In the previous 100Sn experiment the Cracow code based on the Go4 and ROOT was used. The code is "hardwired" to Jurek Grebosz.





# *Collaboration Board Tasks*

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Summary

- Elect a chair and vice chair among its members
- Confirm a Project Manager
- Organize / coordinate experimental campaigns
- Interact with resource providers / auxiliary equipment
- Monitor the project base on reports received from the Project Manager
- Decide on modifications of the project proposed by the Project Manager
- Review scientific progress of each experimental campaign based on the reports received from the individual experimental spokespersons



# Commissioning

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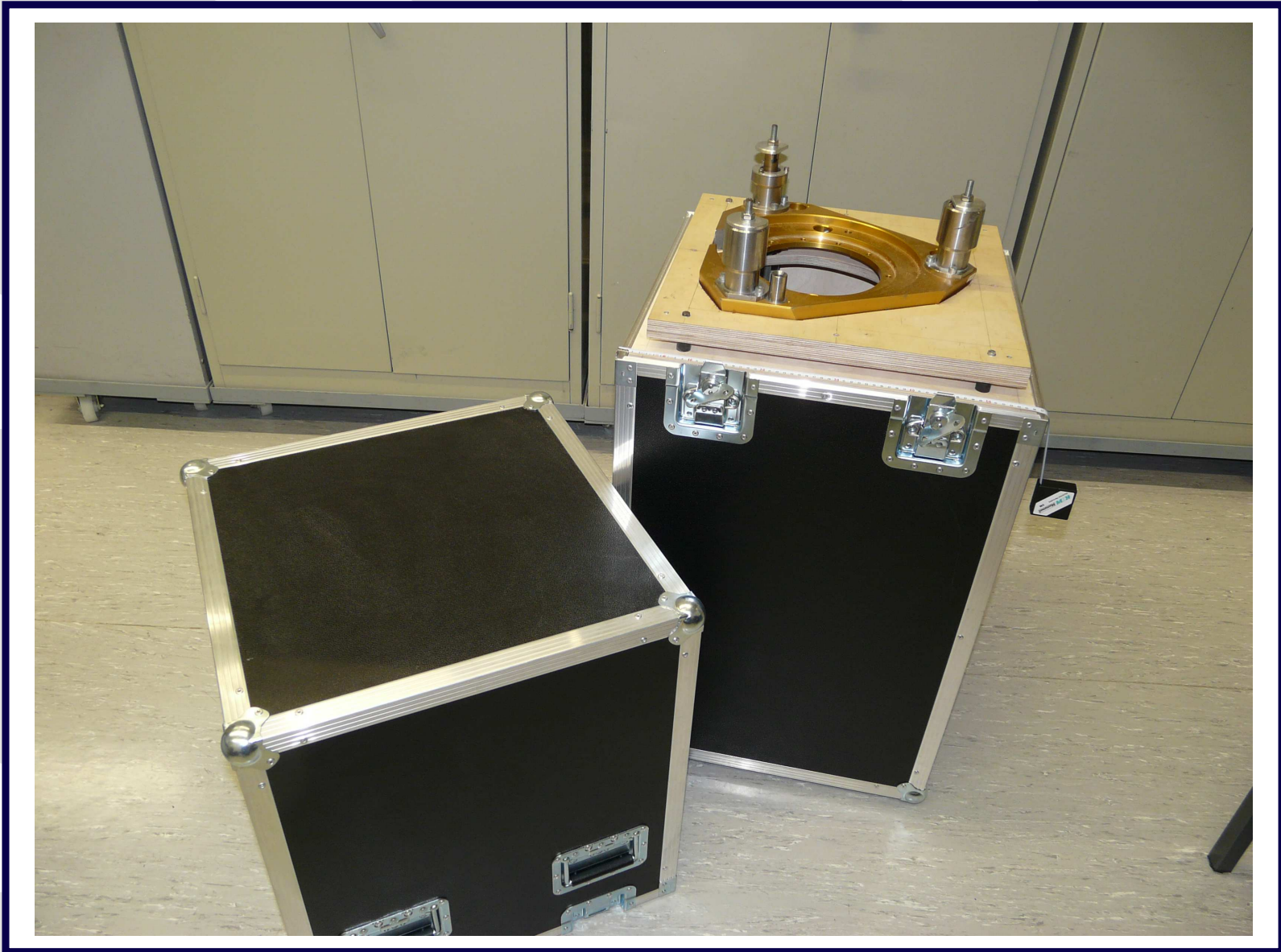
Summary

## 4 days of beam time needed for:

- Debugging ind. det. systems including trigger setting
- Confirm event-matching
- Test new electronics for Si-array (dual read-out)
- Prepare analysis framework for real experiment
- Low/high rate test runs
- Investigate Prompt flash
- Optimize dead-time
- Investigate background from upstream (beam dependent)



# Fligh Case

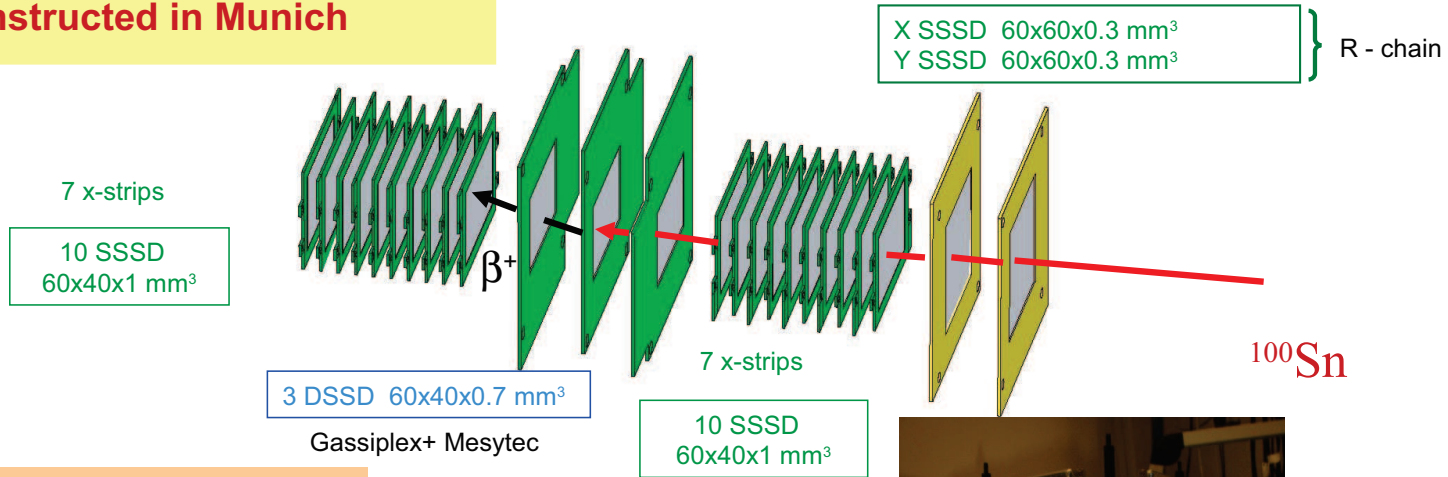




# SIMBA

## Silicon Implantation Detector and Beta Absorber SIMBA constructed in Munich

Technische Universität München



Number of pixels in the implantation zone: 3x60x40 = 7200

- 4π - Detector for
- α - decay
  - β - decay
  - proton emission

5MeV positrons stop in 10mm silicon

Half life between a few ms and at least some seconds depending on the background

