

# Minutes of the Fourth Meeting of the Physics & Instrumentation Task of the EURISOL Design Study

INFN Pisa, 11<sup>th</sup> April 2006

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**Present:** N. Alamanos, B. Blank, Y. Blumenfeld, P.A. Butler, A. Bonaccorso, P. Chomaz, A. Cunsolo, G. Georgiev, F. Gulminelli, A. Kordyasz, H. Mach, A. Mengoni, N.A. Orr, R.D. Page, G. Poggi, N. Severijns, K. Subotic

1. **Apologies:** C. Angulo, P.T. Greenlees, R.C. Lemmon, O. Naviliat, P.M. Walker

2. **Presentations of sub-task representatives and discussion:** presentations were made, from which the following ideas for specimen experiments and instruments emerged. The presentations are available on the EURISOL Task web site (<http://ns.ph.liv.ac.uk/eurisol>).

a) **Limits of stability** (B. Blank)  $\beta$ -delayed 2-proton and multi-neutron emission will be studied as probes of nucleon correlations and decay spectroscopy along the neutron drip line up to  $Z \sim 20$  will also be pursued. These studies will require an  $8\pi$  (possibly  $12\pi$ ) detection system. Measurements of the ground state and excited states in  $^{26-28}\text{O}$  from 2p knockout from  $^{28-30}\text{Ne}$  will require a neutron detector array and a sweeper magnet to detect the fragment. A fragment separator will be needed for  $\gamma$ -ray spectroscopy. It was not clear that secondary fragmentation will allow a significant expansion in the number of nuclei that can be produced and studied, but a forthcoming FRS experiment measuring  $^{132}\text{Sn}$  fragmentation should provide information on this.

b) **Ground state properties** (G. Georgiev) Mass measurements will require a precision Penning trap. Possible isomer production mechanisms with post-accelerated beams were considered. Isomer properties near closed shells and Coulomb excitation of nuclei in ground states and isomeric states will be investigated.

c) **Single particle & collective properties** (A. Bonaccorso, Y. Blumenfeld) New ideas on deep inelastic reactions on heavy targets to probe wavefunctions more deeply into the nuclear volume were discussed. Knockout reactions to measure spectroscopic factors in the lead region were proposed and would require a forward focused spectrometer and neutron detectors. A spectrometer (possibly following the GRAPA concept) would be required for charged particle and  $\gamma$ -ray detection in direct reactions probing single particle states in neutron-rich nuclei. Giant monopole resonance studies will be investigated using active target detection systems.

d) **Superheavy elements** (R.D. Page) A recoil separator will be required for both decay studies and in-beam spectroscopy of very heavy nuclei. In beam spectrometers for both  $\gamma$ -ray and conversion electron spectroscopy will be required. The possibilities for recycling the unreacted primary beam will be investigated and ideas for atomic physics measurements will be evaluated. Better calculations of production cross sections are required. The instrumentation should also be suitable for compound nucleus reactions leading to lighter nuclei.

e) **Phase transitions/nuclear reactions & dynamics** (F. Gulminelli) A device measuring with low identification and energy thresholds the mass ( $A \lesssim 50$ ) and charge ( $Z \lesssim 70$ ) of emitted particles and fragments with a large angular acceptance as presently under study in the FAZIA R&D will be required for experiments studying transport properties and phase transitions. Neutron detection will also be needed, possibly within the same device. It should also be possible to couple a forward focused spectrometer to such a device. For specific measurements such as hot giant dipole resonances a gamma-ray detector system will be also required (this could be the same as for c)) as well as high granularity particle detectors for correlation measurements over a limited angular range.

f) **Astrophysics** (A. Mengoni) The **CARINA Network** is currently considering a gamut of capture reactions and related processes to identify the most significant ones. Mass measurements and decay spectroscopy experiments will also be important, as will resonance, scattering and transfer reactions. A list of experimental tools was suggested, which should provide a pragmatic

starting point for the report. A hot lab for separating radionuclides for neutron capture cross section measurements was proposed.

g) **Neutrino interactions** No presentation was made.

h) **Fundamental interactions** (N. Severijns)  $\beta$ -decay measurements using advanced spectroscopic techniques will be required. MOT, Paul and Penning traps will be essential tools. One challenge for the future is to provide polarized beams for all these traps.

A report summarizing the selected specimen experiments is one of the milestones for the Physics and Instrumentation Task and is now overdue. A template will be circulated as soon as possible to aid the preparation of the report. [**Action: P. Chomaz**].

**A deadline of 19<sup>th</sup> May 2006 for submitting the completed templates to R.D. Page was agreed.**

3. **Beam requirements:** N.A. Orr presented a distillation of the conclusions from the extensive discussions during the Trento workshop. It was suggested that the low energy accelerator for astrophysics measurements could be viewed as a piece of experimental equipment, since it would not fall into the remit of the Heavy Ion Post-Accelerator Task.

4. **Issues for EURISOL DS Management:** None

5. **Any Other Business:** The funding situation for RIA was discussed. The ideas for an ISOL User Community were also considered.

6. **Forthcoming EURISOL meetings:** There will be a joint meeting of the Heavy Ion Post-Accelerator, Beam Preparation and Physics and Instrumentation tasks in Paris on 2<sup>nd</sup> May 2006. There will also be a joint meeting of the Beam Intensity Calculations, Driver Accelerator and Superconducting Cavity Design Tasks on 5<sup>th</sup> May 2006. The next meeting of the Co-ordination and Management Boards will take place at PSI on 15<sup>th</sup>-16<sup>th</sup> June 2006. The EURISOL Town Meeting will be on 27<sup>th</sup>-28<sup>th</sup> November 2006 at CERN.

7. **Date & venue of next meeting:** Provisionally agreed for 2<sup>nd</sup>-3<sup>rd</sup> October 2006 in Bordeaux. This is subject to confirmation.