RESEARCH PROGRAMME

LHC
SPS
PS
AD
ISOLDE Facility
Irradiation Facility
Neutrino Platform
GRADE
CTF3
R&D
Non-accelerator experiments

RESEARCH ACTIVITIES

Experiments and Projects under Study
Recognized Experiments
Completed Experiments

RELATED LINKS

EP Department
Users' Office
Scientific Committees
Conditions for experiments
Accelerators and Beams
Machine Schedules

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Experiment(s)

Programme	Name	Synonym	Title	Date Of Approval	Status
R&D	RD51		Development of Micro-Pattern Gas Detectors Technologies	05-12-2008	In-Progress

Role(s)

0 results

Past Participation(s)

0 results

The CERN Experimental Programme

Grey Book database

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RD51

Development of Micro-Pattern Gas Detectors Technologies

SYNONYM:
RESEARCH PROGRAMME: R&D
APPROVED: 05-12-2008
BEAM:
STATUS: In-Progress

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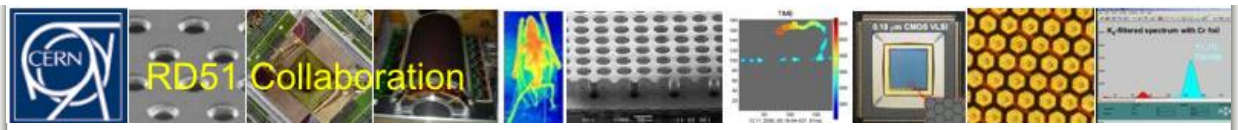
Total: 8

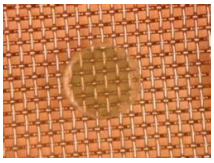


RD51 Collaboration
Development of Micro-Pattern Gas Detectors Technologies

The proposed R&D collaboration, RD51, aims at facilitating the development of advanced gas-avalanche detector technologies and associated electronic-readout systems, for applications in basic and applied research. **The main objective of the R&D programme is to advance technological development and application of Micropattern Gas Detectors.**

The invention of Micro-Pattern Gas Detectors (MPGD), in particular the Gas Electron Multiplier (GEM), the Micro-Mesh Gaseous Structure (Micromegas), and more recently other micro pattern detector schemes, offers the potential to develop new gaseous detectors with unprecedented spatial resolution, high rate capability, large sensitive area, operational stability and radiation hardness. In some applications, requiring very large-area coverage with moderate spatial resolutions, more coarse Macro-patterned detectors, e.g. Thick-GEMs (THGEM) or patterned resistive-plate devices could offer an interesting and economic solution. The design of the new micro-pattern devices appears suitable for industrial production. In addition, the availability of highly integrated amplification and readout electronics allows for the design of gas-detector systems with channel densities comparable to that of modern silicon detectors. Modern wafer post-processing allows for the integration of gas-amplification structures directly on top of a pixelized readout chip. Thanks to these recent developments, particle detection through the *ionization of gas* has large fields of application in future particle, nuclear and astro-particle physics experiments with and without accelerators.

The RD51 collaboration involves ~ 450 authors, 75 Universities and Research Laboratories from 25 countries in Europe, America, Asia and Africa. All partners are already actively pursuing either basic- or application-oriented R&D involving a variety of MPGD concepts. The collaboration established common goals, like experimental and simulation tools, characterization concepts and methods, common infrastructures at test beams and irradiation facilities, and methods and infrastructures for MPGD production.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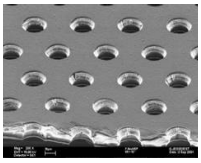
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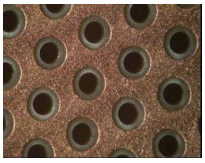
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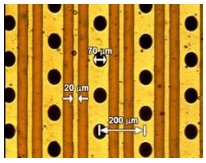
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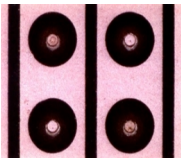
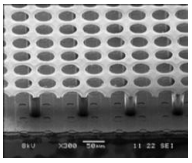

microPIC


Ingrid

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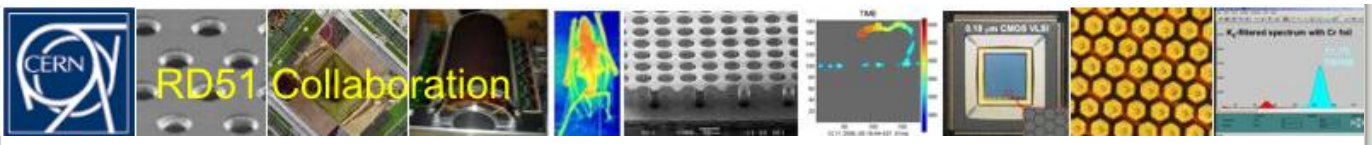
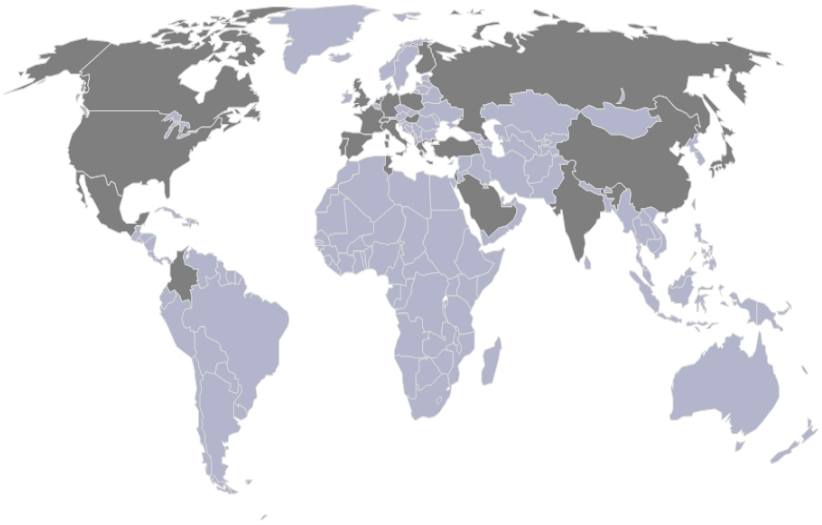


RD51 MPGD Collaboration

~450 Authors from 75 Institutes from 25 Countries



- RD51 in CERN Experiment Database
- List of RD51 Members by Institute (last update, March 10)
- List of RD51 Members in alphabetical order (last update, Oct 08)
- List of RD51 Collaboration Board Representatives (last update, Dec 09)

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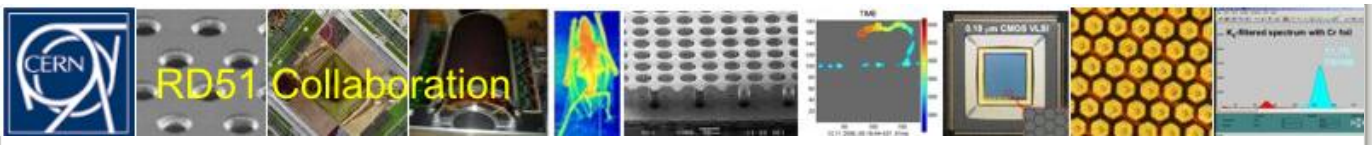

RD51 Management

Collaboration Board

Concerning all scientific matters the Collaboration is governed by the RD-51 Collaboration Board (CB), which is also responsible for coordinating the financial planning and other resource issues of the Collaboration and, in particular, for managing the Common Fund. The CB is composed of one representative from each collaborating Institute, with voting rights; the Spokespersons, the Finance Coordinator, and the Secretary of the CB as ex-officio members.

Collaboration Board Chairperson and Deputy

Silvia Dalla Torre
Trieste University and INFN, Italy

Andy White
University of Texas, Arlington, USA

Spokespersons

Leszek Ropelewski
CERN, Switzerland

Maxim Titov
CEA Saclay, France

Management Board

The Management Board (MB) supervises the progress of the work program along the lines defined by the CB and prepares decisions for and makes recommendations to the CB. The MB comprises five members elected by the CB from among the members of the Collaboration along with the following Ex officio members: the two Spokespersons, the CB Chairperson, and Deputy Chairperson, the Finance Coordinator, and the Secretary of the MB.

Amos Breskin
The Weizmann Institute of Sciences, Israel

Ioannis Giomataris
CEA Saclay, France

Paul Colas
CEA Saclay, France

Hans Taureg
CERN, Switzerland
Finance Coordinator
MB Secretary

Harry van der Graaf
NIKHEF, The Netherlands

Secretariat

Veronique Wedlake
CERN, Switzerland

Safety

Matteo Alfonsi
CERN, Switzerland

Former Management Board Members

Klaus Desch
Bonn University, Germany

Fabio Sauli
CERN, Switzerland

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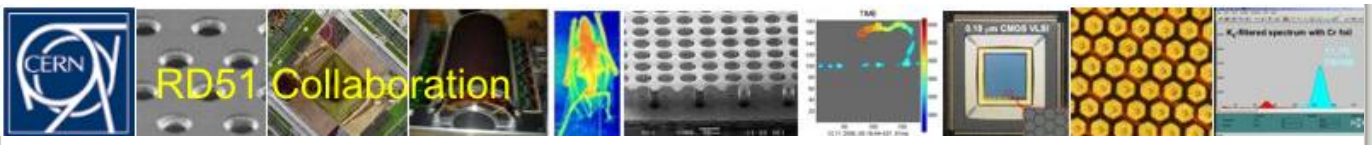
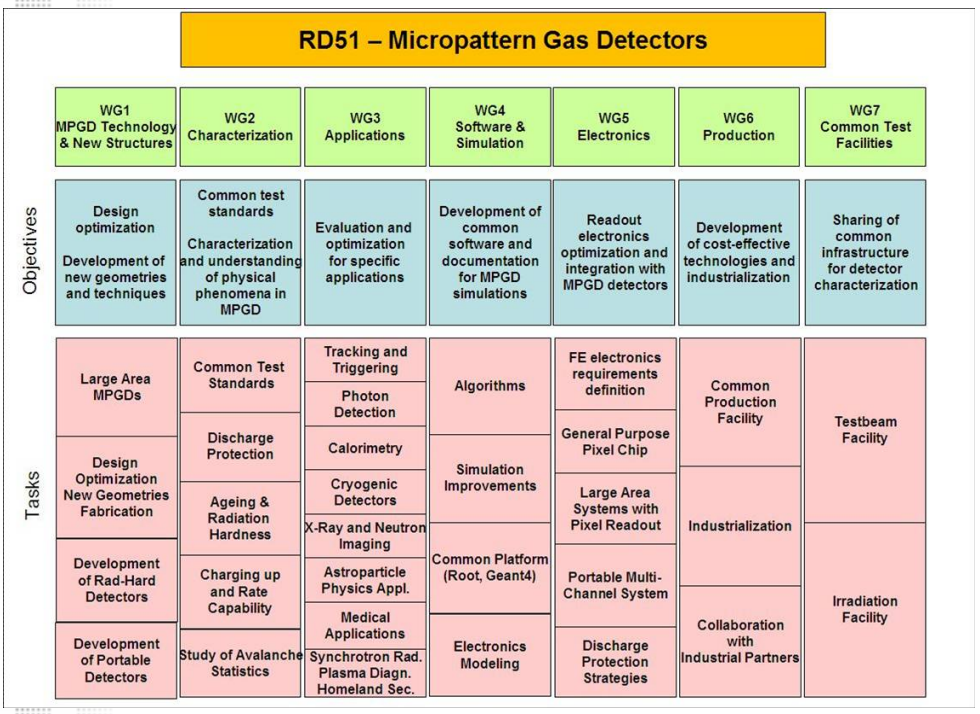


Scientific Organization

The scientific organization is structured in seven working groups (WG) each being defined through a set of tasks. Working-group conveners coordinate the R&D tasks of the respective working groups.

Working Group Conveners

WG1	Paul Colas (CEA Saclay), Serge Duarte Pinto (CERN)
WG2	Harry van der Graaf (NIKHEF), Maximilien Chefdeville (IN2P3/LAPP), Diego Gonzalez-Diaz (Universidad de Zaragoza)
WG3	Andy White (University of Arlington, TX)
WG4	Rob Veenhof (CERN), Carlos Alberto Bastos De Oliveira (Lawrence Berkeley National Lab, CA, USA)
WG5	Hans Muller (CERN), Jochen Kaminski (Bonn University)
WG6	Rui De Oliveira (CERN), Fabien Jeanneau (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR)
WG7	Eraldo Oliveri (CERN), Yorgos Tsipolitis (NTU Athens)



Working Group Description

WG1 - Technological Aspects and Development of New Detector Structures

The objectives of this WG are both the optimization of fabrication methods for MPGDs and the development of new multiplier geometries and techniques. These objectives are pursued via selected tasks: (1) Development of techniques to manufacture large area modules with reduced material budget

and minimum dead regions; new materials, including low-radioactivity ones for rare-event detectors; (2) Design optimization including fabrication procedures and the development of new MPGD geometries for bulk Micromegas, micro bulk Micromegas and single-mask GEMs, Thick GEMs (THGEM), Resistive Electrode Thick GEMs (RETGEM), Micro-Patterned Resistive Plate Chambers (MPRPC), Micro Hole And Strip Plates (MHSP), charge-dispersive readout and integration of gas-amplification structures on top of a CMOS readout chip by wafer postprocessing (InGrid); (3) Development of radiation-hard detectors; and (4) Design of portable sealed detectors.

WG2 - Common Characterization and Physics Issues
In this WG, a common effort towards the development of common standards for the characterization and comparison of different technologies will be made. The collective knowledge on the physics of discharges in MPGD detectors will be bundled and solutions towards more efficient prevention of and protection against discharge will be made. Systematic studies on ageing and radiation hardness of MPGDs will be performed and a common database on radiation hardness and ageing properties of materials will be created in order to arrive at radiation-hard detectors capable of operating beyond the limits of present devices. The tasks in the WG are: (1) Development of common test standards (comparison of different technologies in different laboratories); (2) Discharge studies and spark-protection developments for MPGDs; (3) Generic aging and material radiation-hardness studies (creation of database of "radiation-hard" materials & detectors depending on application, commercially available materials, cleanliness requirements, validation tests for final detector modules, gas system construction, working remedies); (4) Charging up (gain stability issues) and rate capability; (5) Study of avalanche statistics: exponential versus Polya (saturated-avalanche mode).

WG3 - Applications
Several applications impose specific new requirements and challenges on the production and properties of MPGDs. While the development of the applications itself is carried out in the individual laboratories, the collaboration will collect the requirements coming from these specific applications. The individual tasks are structured according to these applications: (1) MPGD based detectors for tracking and triggering; (2) MPGD based Photon Detectors (e.g. for RICH); (3) Applications of MPGD based detectors in Calorimetry; (4) Cryogenic Detectors for rare events; (5) X-ray and neutron imaging (6) Astroparticle physics applications; (7) Medical imaging and diagnostics applications; (8) Synchrotron Radiation, Plasma Diagnostics and Homeland Security applications.

WG4 - Simulations and Software Tools
In this WG, a common, open-access, maintainable software suite for the simulation of MPGD detectors will be developed. The existing tools for the simulation of primary ionization, transport and gas amplification will be extended, in particular to improve the modeling at very small scales. An effort will be made in order to integrate the tools into the Geant 4 package to make them easier to maintain and directly applicable within arbitrary geometry and field configurations. Also the modeling of the electronics response to the detector signals has to be improved. This will also make the simulation applicable to systems with very high granularity such as CMOS pixel readout. The tasks are: (1) Development of algorithms (in particular in the domain of very small scale structures); (2) Simulation improvements; (3) Development of common platform for detector simulations (integration of gas-based detector simulation tools to Geant 4, interface to ROOT); and (4) Development of simplified electronics modeling tools.

WG5 - MPGD related electronics
The availability of highly integrated electronics systems for the charge readout of high granularity MPGD systems poses a non-trivial problem to many of the modern MPGD applications. The specifications of such systems for the different fields of application will be collected. For the classical configuration of charge collecting pads or strips an easy-to-use portable readout solution will be developed. Ultimate granularity is achieved by using the inputs of a CMOS pixel readout chip directly as a charge collecting anode. The specifications of such a readout chip will be worked out and a common effort will be made towards a next-generation pixel chip for MPGD readout. The tasks are: (1) Definition of front end electronics requirements for MPGDs; (2) Development of general purpose pixel chip for active anode readout; (3) Development of large area detectors with pixel readout; (4) Development of portable

multichannel data acquisition systems for detector studies; and (5) Discharge protection strategies.

WG6 - Production

In this working group cost-effective, industrial technology solutions will be developed and transferred to industry. A common "production facility" based on the MPGD workshop at CERN will be developed and maintained and procedures for industrialization will be set up. The tasks are: (1) Development and maintenance of a common production facility; (2) MPGD production industrialization (quality control, cost-effective production, and large-volume production), (3) Collaboration with Industrial Partners.

WG7 - Common Test Facilities

The development of robust and efficient MPGDs entails the understanding of their fundamental properties and performance at several stages of their development. This implies a significant investment for detector test beam activities to perform the R&D needed, to test prototypes and to qualify final detector system designs, including integrated system tests. The measurements in test-beam facilities cover efficiencies, noise, time, position and energy resolutions - basically all the critical performance parameters for new detector systems. Additionally, characterization of specific detector behaviors operated in large particle background demands some targeted aging tests in irradiation facilities.

A common effort in this direction is needed because the number of groups involved in MPGD development has grown very significantly and will still do so during the coming years. As members of the RD-51 collaboration, research groups will get easier access to the facilities inside RD-51 collaborating institutes and at CERN, and, most important, share resources, make common requests and group experiments. The two tasks are (1) Development and maintenance of common "Test-Beam Facility"; and (2) Development and maintenance of common "Irradiation Facility".

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26.03.2010, 09:00

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Annex 1

Institutes in the RD-51 Collaboration and Names of their Representatives to the Funding Agencies

	country	town	institute	represented by
1	Belgium	Gent	Dept of Subatomic and Radiation Physics, University Gent	Michael Tytgat
2	Canada	Ottawa	Carleton University	Alain Bellerive
3	Chili	Valparaiso	Departamento de Fisica, Universidad Tecnica Federico Santa Maria	William Brooks
4	China	Beijing	Lab. of Radiation Physics, Tsinghua University	Yulan Li
5	China	Hefei	Institute of Modern Physics, University of Science and Technology of China	Xiaoliang Wang
6	China	Lanzhou	Institute of Nuclear Research, Lanzhou University	Xiaodong Zhang
7	China	Wuhan	Huazhong Normal University	Daicui Zhou
8	Finland	Helsinki	Sensor Center	Kari Kurvinen
9	Finland	Helsinki	Helsinki Institute of Physics	Francisco Garcia
10	France	Annecy le Vieux	LAPP	Catherine Adloff
11	France	Gif sur Yvette	CEA IRFU (Saclay)	Paul Colas
12	France	Grenoble	Institut Max von Laue – Paul Langevin (ILL)	Bruno Guerard
13	France	Lyon	Institut de Physique Nucleaire, Universite de Lyon	Laktineh Laktineh
14	France	Nantes	SUBATECH	Dominique Thers
15	France	Palaiseau	Laboratoire Leprince-Ringuet	D.Bernard
16	France	Rustrel	Observatoire de la Cote d'Azur	Pierre Salin
17	Germany	Bonn	Physikalisches Institut Rheinische Friedrich-Wilhelms Universität	Klaus Desch
18	Germany	Braunschweig	Physikalisch-Technische Bundesanstalt	Volker Dangendorf
19	Germany	Darmstadt	GSI	Bernd Voss
20	Germany	Freiburg	Physikalisches Institut Albrecht-Ludwigs Universität	Ulrich Landgraf Deputy: M.Schumacher
21	Germany	Garching	Physik Department E18 Technische Universität Műnchen	Bernhard Ketzer
22	Germany	Hamburg	DESY	Ties Behnke
23	Germany	Műnchen	Max-Planck-Institut für Physik	Hubert Kroha

	country	town	institute	represented by
24	Great Britain	Sheffield	University of Sheffield	Neil Spooner
25	Greece	Athens	INP NCSR "Demokritos"	Georgios Fanourakis
26	Greece	Athens	National Technical University of Athens	Yorgos Tsipolitis
27	Greece	Athens	University of Athens	Christine Kourkoumelis
28	Greece	Thessaloniki	Aristotle University of Thessaloniki	Dimitrios Sampsonidis
29	Hungary	Budapest	KFKI Research Institute for Particle and Nuclear Physics	Gergö Hamar
30	Hungary	Budapest	Eötvös Loràn University	Dezsö Varga
31	India	Kolkata	Saha Institute of Nuclear Physics	Supratik Mukhopadhyay
32	India	Kolkata	VECC	S.Chattopadhyay
33	India	Mumbai	Tata Institute of Fundamental Research	K.P.Singh
34	Israel	Rehovot	Weizmann Institute of Sciene	Amos Breskin
35	Italy	Alessandria	Universita del Piemonte Orientale Alessandria and INFN Torino	Daniele Panzieri
36	Italy	Bari	INFN and University	Maria Gabriella Catanesi
37	Italy	Frascati	LNF-INFN	Giovanni Bencivenni
38	Italy	Monserrato	INFN and University Cagliari	Alessandro Cardini
39	Italy	Naples	INFN and University	Mariagrazia Alviggi
40	Italy	Novara	TERA Foundation	Fabio Sauli
41	Italy	Pisa	University of Siena and INFN Pisa	Stefano Lami
42	Italy	Rome	Sanita Group, INFN	Evaristo Cisbani
43	Italy	Trieste	INFN and University	Silvia Dalla Torre
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45	Korea, Republic of	Changwon	Changwon National University	C.H.Hahn
46	Mexico	Mexico City	Universidad National Autonoma de Mexico	Guy Paic
47	Netherlands	Amsterdam	NIKHEF	Harry van der Graaf
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49	Portugal	Coimbra	University of Coimbra	Joaquim dos Santos

	country	town	institute	represented by
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51	Russia	Dubna	JINR	Igor Golutvin
52	Russia	Gatchina	St Petersburg Nuclear Physics Institute	Alexey Khanzadeev
53	Russia	Moscow	Institute for Nuclear Research, Russian Academy of Sciences	Andrey Reshetin
54	Russia	Novosibirsk	Budker Institute of Nuclear Physics	Alexei Buzulutskov
55	Spain	Bellaterra	IFAE Barcelona	Federico Sanchez
56	Spain	Valencia	Universidad Politecnica de Valencia (UPVA)	José F. Toledo Alarcón
57	Spain	Valencia	Instituto de Fisica Corpuscular (IFIC)	Markus Ball
58	Spain	Zaragoza	University of Zaragoza	Igor G. Irastorza
59	Switzerland	Geneva	CERN PH and EN/ICE	Hans Taureg
60	Switzerland	Geneva	DPNC, section de physique, Université de Genève	Alain Blondel
61	Switzerland	Zurich	Institute for Particle Physics, ETH Zurich	Andre Rubbia
62	Tunisia	Tunis	Centre National des Sciences et Technologies Nucleaire	Nidhal Kahlaoui
63	Turkey	Bursa	Department of Physics, Uludag University	Ilhan Tapan
64	USA	Argonne, IL	Division of High Energy Physics Argonne National Laboratory	David Underwood
65	USA	Arlington, TX	University of Texas, Arlington	Andy White
66	USA	Cambridge, MA	MIT	Bernd Surrow
67	USA	Charlottesville, VA	Dept of Physics, University of Virginia	Nilanga Liyanage
68	USA	Melbourne, FL	Florida Institute of Technology	Marcus Hohlmann
69	USA	Tucson, AZ	Dept. of Physics, University of Arizona	Kenneth Johns
70	USA	Upton, NY	Brookhaven National Laboratory	Venetios Polychronakos
71	USA	Williamsburg, VA	Physics Department, College of William and Mary	Charles F. Perdrisat

The European Organization for Nuclear Research (CERN)

And

Department of Physics, Uludag University

declare that they agree on the present Memorandum of Understanding for the RD-51 Collaboration.

Done in Geneva

on 16/7/2009

For CERN

Sergio Bertolucci
Director for Research and
Scientific Computing

Done in Bursa

on 18 May 2009

For Uludag University

Mete Cengiz
Rector, Uludag University