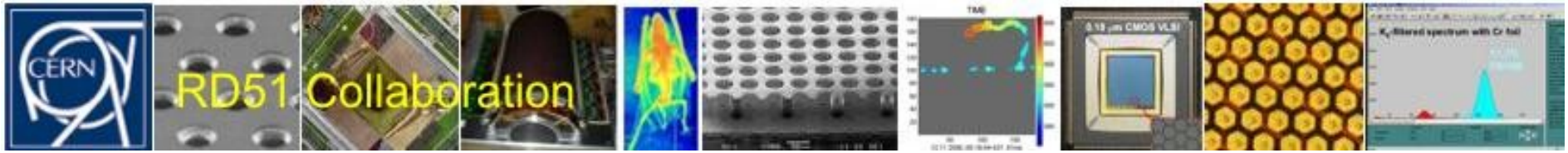


The RD51 Collaboration News

Leszek Ropelewski, CERN, Switzerland
Maxim Titov, CEA Saclay, France

7th RD51 Collaboration Meeting, CERN, 13-15 April 2011

RD51 Collaboration

- 75 institutes
- ~ 450 people involved
- Representation (Europe, North America, Asia, South America, Africa)

Freiburg , Germany, May 2010

Collaboration meetings & events:

RD51 mini week (19-20 July 2010)
RD51 mini week (17-18 January 2011)

6th RD51 Collaboration Meeting, Bari (07-10 October 2010)
7th RD51 Collaboration Meeting, CERN (13-15 April 2011)

RD51 Simulation School (19-21 January 2011)

105th LHCC Meeting AGENDA OPEN Session (23-24 March 2011)

Bari, Italy, October 2010

LHCC RD51 Status Report
Summary and Outlook

- consolidation of the Collaboration and MPGD community integration

- considerable progress in MPGD technologies in particular large area GEM, THGEM, Micromegas; some picked up by experiments (including sLHC upgrades) for feasibility studies and prototyping

- secured future of the MPGD technologies development through the TE MPE workshop upgrade and FP7 AIDA contribution (upgrade in progress)

- improved MPGD simulation software framework allows for first applications

- Infrastructure for common RD51 test beam facility (~20 user groups)

- Development of common, scalable electronics (17 development and user groups)

- TTN; contacts with industry for large volume production

LHCC RD51 Status Report
2011 RD51 plans and request

RD51 would like to continue common project activities:

- Large area detectors and new MPGD technologies development
- Development and support of the simulation tools
- Support and production of SRS electronics
- Completion of the MPGD production upgrade
- Maintenance of the RD51 beam facility

The Collaboration would like to ask for continuation of limited support :

- Access to test beam facility (including the possibility to keep “semi permanent” setup).
- Access to CERN TE MPE Printed Circuit Workshop (similar to present availability level)
- Access to Silicon Bonding Laboratory
- Access to central computing resources for MPGD simulations.
- Limited amount of office space

RD51 Collaboration Web Page

http://rd51-public.web.cern.ch/RD51-Public

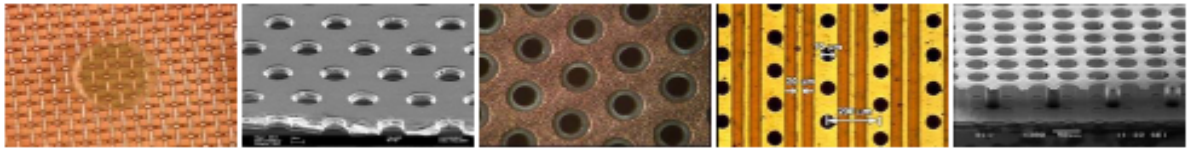
Home | Organization | WG Activities | Meetings | Documents | Safety | Other Links

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 ~ 350 authors, 59 Universities and Research Laboratories from 20 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.



Micromegas | GEM | THGEM | MHSP | Ingrid

RD51 Conference Contributions, Seminars

http://rd51-public.web.cern.ch/RD51-Public/Documents/ConferenceContributions.html

http://rd51-public.web.cern.ch/RD51-Public/Documents/Seminars.html

RD51 Collaboration Internal Notes

2011

RD51-NOTE-2011-006 – "On the low-temperature performances of THGEM and THGEM/G-APD multipliers in gaseous and two-phase Xe*" (by A. Bondar, A. Buzulutskov, A. Grebenuk, E. Shemyakina, A. Sokolov, D.Akimov, I. Alexandrov and A. Breskin)
RD51-Note-2011-005 –" Modelling of avalanches and streamers by finite elements with COMSOL: step-by-step guide", Notes for the RD51 Simulation School, CERN, Jan. 19-21 2011, (by P. Fonte)
RD51-Note-2011-004 –"Thermal Stretching of Large-Area GEM Foils Using an Infrared Heating Method" (by Michael Staib, Bryant Benson, Kondo Gnanvo, Marcus Hohlmann, Amilkar Quintero)
RD51-Note-2011-003 –"On the operation of a Micropattern Gaseous UV Photomultiplier in Liquid-Xenon" (by S. Duval, A. Breskin, R. Budnik, W.T. Chen, H. Carduner, M. Cortesi, J.P. Cussonneau , J. Donnard, J. Lamblin, P. Le Ray, E. Morteau, T. Oger, J.S. Stutzmann and D. Thers)
RD51-Note-2011-002 –"Infrared scintillation yield in gaseous and liquid argon for rareevent experiments" (by A. Buzulutskov, A. Bondar, A. Grebenuk)
RD51-Note-2011-001 - "Further Developments and Tests of Microstrip Gas Counters with Resistive Electrodes" (by R. Oliveira, V. Peskov, Pietropaolo, P.Picchi).

Internal Notes:

2009 – 7
2010 – 9
2011 – 6

2010

RD51-Note-2010-009 – "Gas Flow Simulations for gaseous detectors" (by D. Abbaneo, S. Bally, H. Postema, A. Conde Garcia, J. P. Chatelain, G. Faber, L. Ropelewski, S. Duarte Pinto, G. Croci, M. Alfonsi, M. Van Stenis, A. Sharma, L. Benussi, S. Bianco, S. Colafranceschi, F. Fabbri, L. Passamonti, D. Piccolo, D. Pierluigi, A. Russo, G. Saviano, A. Marinov, N. Zaganidis, N. Turini, E. Oliveri, G. Magazzu, Y. Ban, H. Teng, J. Cai)
RD51-Note-2010-008 – "Construction of the first full-size GEM-based prototype for the CMS high-eta muon system" (by D. Abbaneo, S. Bally, H. Postema, A. Conde Garcia, J. P. Chatelain, G. Faber, L. Ropelewski, S. Duarte Pinto, G. Croci, M. Alfonsi, M. Van Stenis, A. Sharma, L. Benussi, S. Bianco, S. Colafranceschi, F. Fabbri, L. Passamonti, D. Piccolo, D. Pierluigi, G. Raffone, A. Russo, G. Saviano, A. Marinov, M. Tytgat, N. Zaganidis, M. Hohlmann, K. Gnanvo, M.G. Bagliesi, R. Cecchi, N. Turini, E. Oliveri, G. Magazz`u, Y. Ban, H. Teng, J. Cai)
RD51-Note-2010-007 – "First tests of "bulk" MICROMEGAS with resistive cathode mesh" (by R. Oliveira, V. Peskov, Pietropaolo, P.Picchi)
RD51-Note-2010-006 – "A spark-resistant bulk-micromegas chamber for high-rate applications" (by T. Alexopoulos, J. Burnens, R. de Oliveira, G. Glonti, O. Pizzirusso, V. Polychronakos, G. Sekhniaidze, G. Tsipolitis, J. Wotschack)
RD51-Note-2010-005 – "Characterization of GEM Detectors for Application in the CMS Muon Detection System" (by D. Abbaneo, S. Bally, H. Postema, A. Conde Garcia, J. P. Chatelain, G. Faber, L. Ropelewski, E. David, S. Duarte Pinto, G. Croci, M. Alfonsi, M. van Stenis, A. Sharma, L. Benussi, S. Bianco, S. Colafranceschi, D. Piccolo, G. Saviano, N. Turini, E. Oliveri, G. Magazzu', A. Marinov, M. Tytgat**, N. Zaganidis, M. Hohlmann, K.* Gnanvo, Y. Ban, H. Teng, J. Cai)
RD51-Note-2010-004 - "Detection and Imaging of High-Z Materials with a Muon Tomography Station Using GEM Detectors" (by K. Gnanvo, B. Benson, W. Bittner, F. Costa, L. Grasso, M. Hohlmann, J.B. Locke, S. Martoiu, H. Muller, and M. Staib)
RD51-Note-2010-003 - "Further evaluation of a THGEM UV-photon detector for RICH and comparison with MWPC" (by V. Peskov, M. Cortesi, R. Chechik and A. Breskin)
RD51-Note-2010-002 - "Imaging of high-Z material for nuclear contraband detection with a minimal prototype of a Muon Tomography station based on GEM detectors" (by Kondo Gnanvo, Leonard V. Grasso III, Marcus Hohlmann, Judson B. Locke, Amilkar S. Quintero, Debasis Mitra)
RD51-Note-2010-001 - "First Tests of MICROMEGAS and GEM-like Detectors Made of a Resistive Mesh" (by R. Oliveira, V. Peskov, F. Pietropaolo, P. Picchi)

RD51 Collaboration Organization

Consolidation around common projects: large area MPGD R&D, CERN/MPGD production facility, common electronics developments, software tools, beam tests

WG1: large area Micromegas, GEM; THGEM R&D; MM resistive anode readout (discharge protection); design and detector assembly optimization; large area readout electrodes and electronics interface

WG2: double phase operation, radiation tolerance, discharge protection, rate effects, single-electron response, avalanche fluctuations, photo detection with THGEM and GridPix

WG3: applications beyond HEP, industrial applications (X-ray diffraction, homeland security)

WG4: development of the software tools; microtracking; neBEM field solver, electroluminescence simulation tool, Penning transfers, GEM charging up; MM transparency and signal, MM discharges

WG5: scalable readout system; Timepix multi-chip MPGD readout

WG6: CERN MPGD Production Facility; industrialisation; TT Network

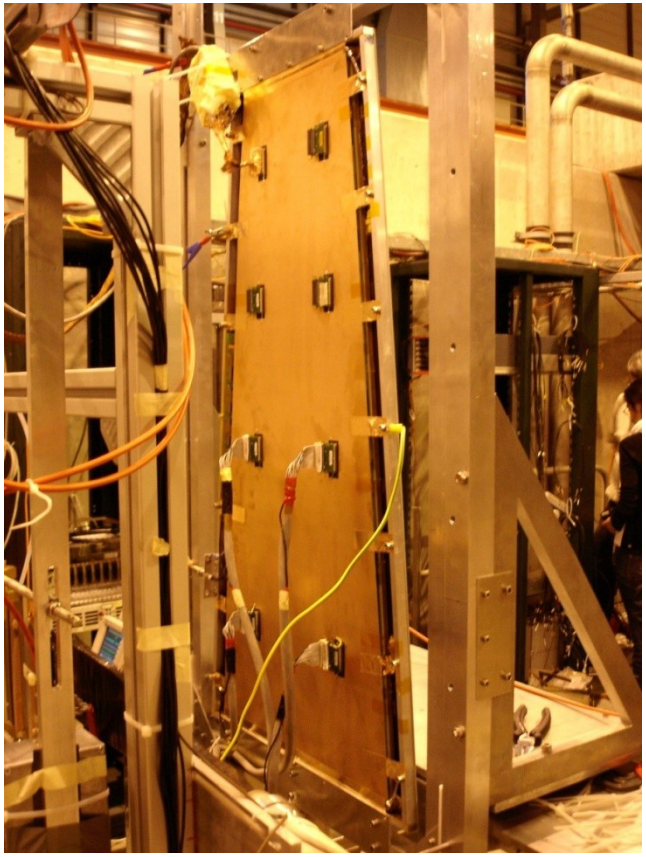
WG7: RD51 test beam facility

CMS High Eta MPGD Project (GE1/1 1.6>η>2.1)

CMS High Eta MPGD - Workshop (30 September 2010)

Gatto ? Collaboration 15 institutes, 60 participants

Large Prototype: GE1/1
Beam Test @ RD51 setup
October 2010



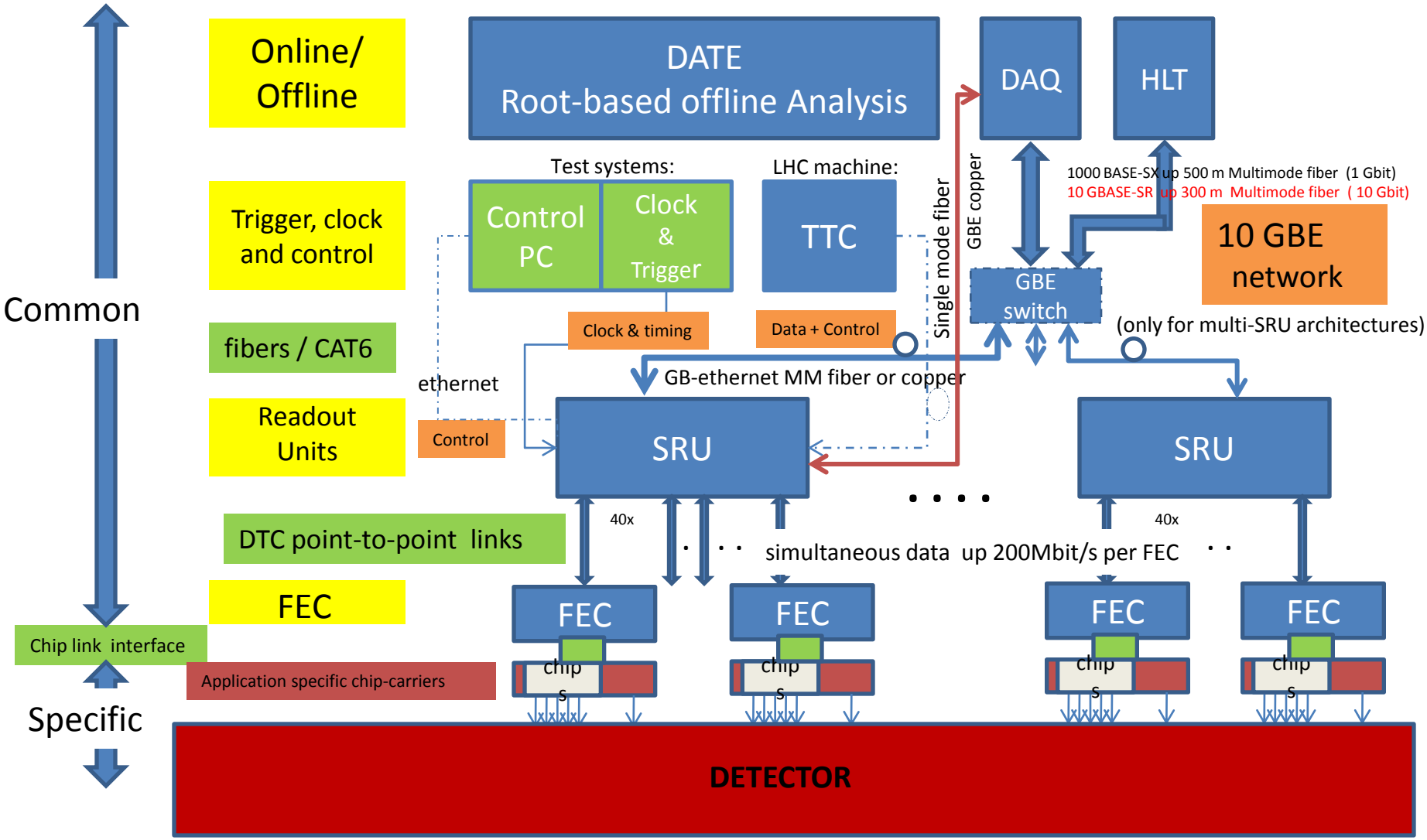
MicroMegas detectors for the upgrade of the ATLAS muon system

MAMMA Collaboration (21 institutes, including Arizona, Athens, BNL, CEA Saclay, CERN, Naples) in close collaboration with CERN/TE-MPE (R. de Oliveira) & CERN/PH-DT

1.2 x 0.6 m^2 prototype chamber with 2048 readout strips (0.5 mm strip pitch) during construction in CERN/TE-MPE workshop

WG5: Electronics for MPGDs

SRS general readout architecture



WG5: Electronics for MPGDs

SRS registered developers and users

Experiment/Team	Detector	Activity
DAQ team ALICE and RD51-CERN	ALICE DAQ upgrade Detector upgrade ALICE (DAQ, CALO etc) SRS system modules	Extension of DATE to Gigabit Ethernet Slow controls Program for SRS R&D and management of SRS Electronic design SRS hybrids, ADC, SRU, Firmware etc
ALICE , CCNU Wuhan, CN and ALICE ORNL Oak Ridge, USA	ALICE DCaL and PHOS Calorimeters ALICE EMCaL and DCal Calorimeter	DTC link protocol and Adapter, Firmware, SRU Electronics Design
ATLAS Coll, MM, short term, CERN, CH	Micromega (Res. Strip) protos	Hybrid adapter to MM chamber
ATLAS Coll. MM, med. Term, CERN USA	N x MICROMEGA DETECTORS	New Hybrids and Adapters
Bonn and Mainz Uni. DE	TPC	Timepix adapter to SRS FEC
Florida Tech. Univ, USA	GEM for Muon Tomography (MTS)	Offline and Online developments link for DATE users RD51
LIP, Coimbra, PT	micropatterned RPC for s. animal PET upcoming application in Astroparticles	Tester...Can take some technical work (manual soldering, cables,etc)
HELSINKI, HIP, Finland	GEM detector and Si- 3D	Online and Offline
Istituto Superiore di Sanita INFN Roma, IT	GEM TRACKER	share information, common dev.
INP, Novosibirsk, USSR	Triple GEM with small angle stereo readout	?
LAPPP, Annecy, Fr	bulk MicroMega	hybrid design for SRS with MICROROC chip
MEXICO, UNAM, MX	TGEM	?
SAHA Inst Nucl Phys,KOLKATA, IN	MICROMEGAS	?
UPV Valencia, NEXT Collaboration, ES	Xe-filled TPC with PMT and SiPM readout via SRS	FEC card design, Firmware modules Online and Offline
USTC Shanghai, CN USTC Shanghai, CN	GEM and MIcroMegas	work on hybrids
Zaragoza Univ, ES	MicroMegas	test and assembly of MM

CERN experiments (large systems)

- ATLAS CSC upgrade MicroMegas
- ALICE EMCaL new readout backend
- NA62 Straw tracker MicroMegas

HEP experiments (medium systems)

- NEXT Collaboration, dual Beta decay
- BUDKER, INP, triple-GEM Deuteron

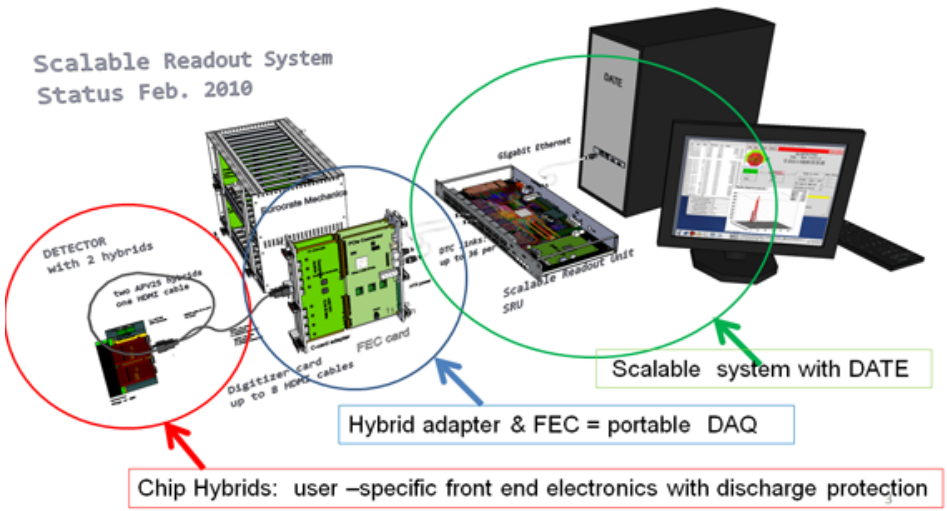
Public usage with Cosmic Tomography

- FIT Florida, homeland security, GEMs
- Geoscienes Azur CRNS - Water quality

R&D with MPGD's (small systems)

- Weizmann Inst, THGEM tests
- Tsinghua Univ, GEM Imaging
- Bonn/Mainz Univ, Timepix readout
- Helsinki HIP, GEM detector
- LIP Coimbra, micropattern RPC, for PET
- INFN Trieste, THGEM photon detection
- MEXICO UNAM, THGEM
- SAHA Kolkatta, MicroMegas
- USTC Shanghai, GEM and MicroMegas
- Zaragoza Univ, GEM and MicroMegas
- CE Saclay, MicroMegas
- ..... some more non-confirmed

physical overview SRS of RD51

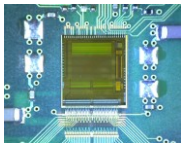


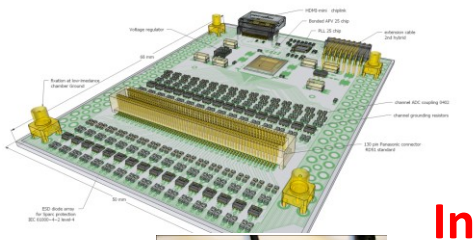
ADC frontend adapter
for APV and Beetle chips

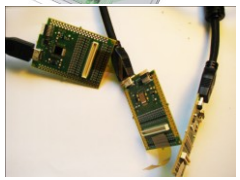
ADC plugs into FEC to make a 6U readout unit for up to 2048 channels
18 ADC V1.0 produced in 2010
18 ADC V1.1 waiting for production 2011

Frontend hybrids

so far all based on APV25 chip
Version 1 proto: 5 working
Version 2 users: 11
Version 3 systems: 16 (CERN PCB + bonding workshops)
320 (ELTOS + Hybrid SA) = ongoing





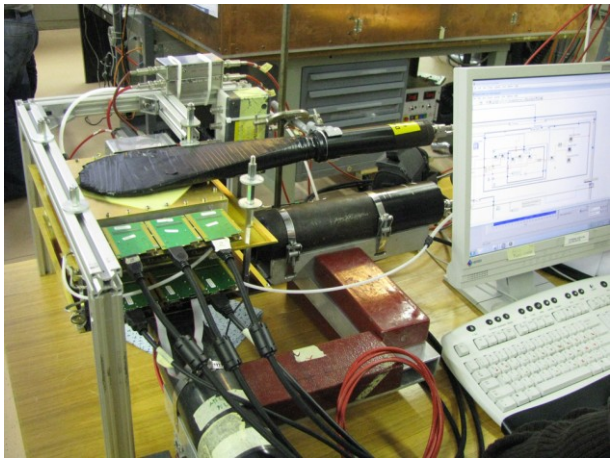


FEC cards

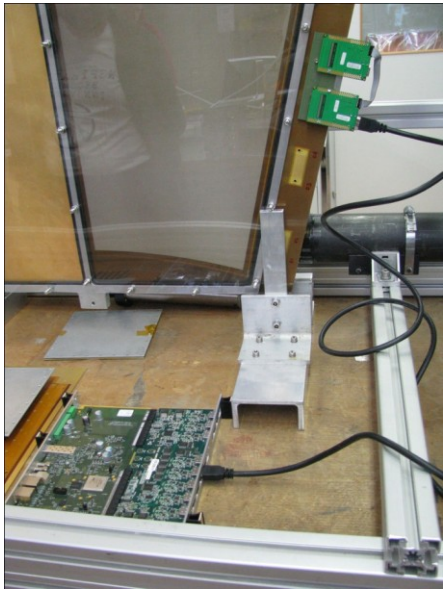
Virtex-5 FPGA, Gb-Ethernet, DDR buffer, NIM and LVDS pulse I/O
High speed Interface connectors to frontend adapter cards
22 FECs V1.1 produced in 2010
16 FEC V1.3 ready for production
all users booked

Industrial partners survey for the production !!

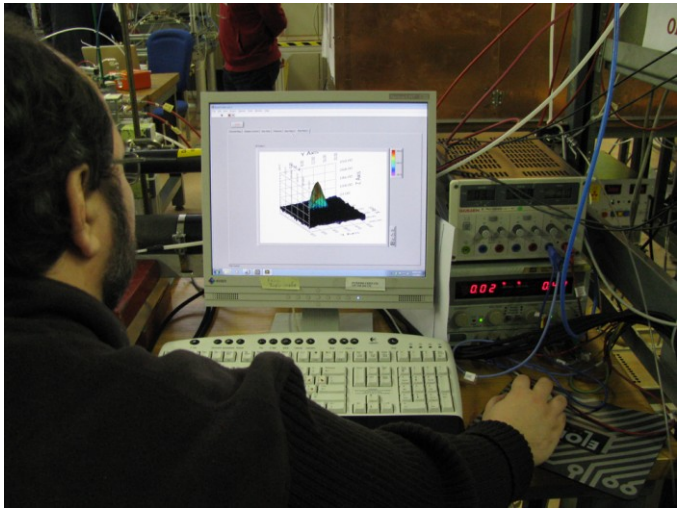
First SRS systems: ATLAS MAMMA



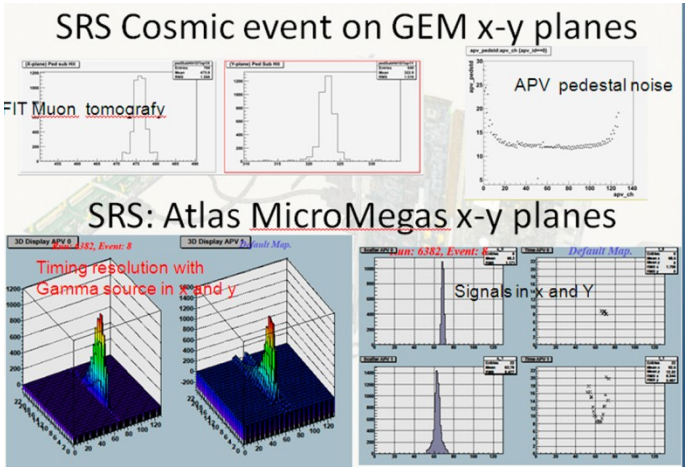
MicroMegas test with cosmic trigger



CSC –sized Micromegas



Online display



WG4: MPGD Simulation Tools

C++ version of Garfield:

• C++ class that has the functionality of the Garfield Fortran for gas has been developed. Lots of effort went into benchmarking and validating the new C++ code.
• Gas properties (*i.e.* Magboltz) and primary ionization (*i.e.* Heed) have been implemented.
•Drift path integration algorithms and **analytic field calculations** had already been translated, and it opens the path to TPC-like calculations.
•**Microscopic**, MC and Runge-Kutta charge transport techniques are in place.
•Progress is being made in a second generation and final **interface to Geant4** from Garfield C++.
•**Silicon detectors** implementation in Garfield

Maintenance:

•Ionization processes – Heed and MIP (cluster size distribution, electron range and Fano limit)
•Field calculations – BEM method validated for MPGD
•Gas properties – Magboltz tables extended and updated (Ar, Xe, He, Ne; GeH_4,SiH_4, $C_2H_2F_4$)
(Import ant in view of the next generation electroluminescent detectors for dark matter and double beta decays searches)

Generic studies:

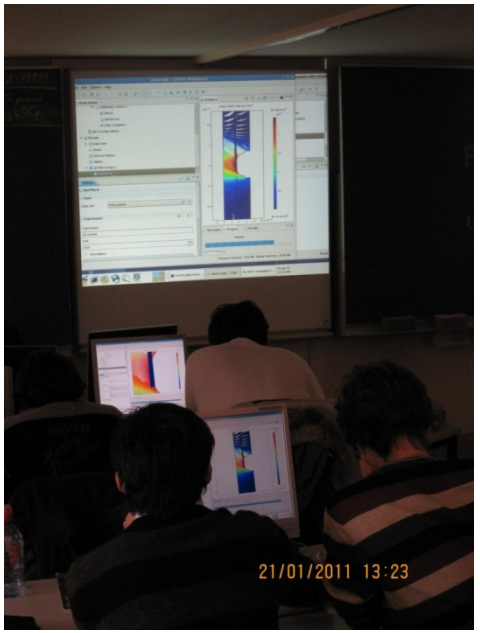
•Penning transfers – published (2010 JINST 5 P05002)
•Avalanche statistics and gain fluctuations –published (NIM 624 (2010)78-84)
•Neutron detection in gases – in progress
•Photon feedback (ALICE TPC & MicroMegas) – in progress

Modeling:

•MicroMegas transfer properties
•GEM charging up

RD51 Simulation School

RD51 Simulation School (19-21 January 2011)



Contents:

Introduction to Geant4
Introduction to FEM, COMSOL
Field calculations
Transport of electrons in small-scale devices
Calculation of signals and their processing

25 participants; enthusiastic feedback

WG6: TE/MPE/EM Workshop upgrade

- Last year, agreement was reached with CERN management to purchase the subset of machines necessary to carry out R&D on large size GEM (2m x 0.5 m) & Micromegas (2m x 1m) and the associated large size read-out boards in the current CERN TE/MPE/ME facility.
- Additional funds for the workshop will come from the FP7 AIDA project

	market survey	call for tender	order	ready
GEM				
– 1 continuous polyimide etcher	x	x	x	06/2011
– 1 Cu electroetch line	x	x		06/2011
Micromegas				
– 1 large laminator	x	x	x	06/2011
– 1 large Cu etcher	x			09/2011
– 1 large UV exposure unit	x	x	x	06/2011
– 1 large resist developer	x			09/2011
– 1 large resist stripper	x			09/2011
– 1 large dryer	x	x	x	06/2011

Machines should be available in 2011 → according to the schedule

WG6: TE/MPE/EM Workshop upgrade

- CERN investment:
  - Equipments for large size GEM manufacturing (2m x 0.5m)
  - Equipments for large size MicroMegas manufacturing (2m x 1m)
  - Participation of 4 technicians (15% of their time)

- AIDA contribution:

AIDA KICK-OFF MEETING (16-18 February 2011)

  - Finance a technician during 2 years to:
    - Set up the new equipment
    - Produce large prototypes for: (non exhaustive list)

      - SLHC ATLAS Muon detector upgrade
      - CMS Muon detector upgrade
      - KLOE2 inner tracker (Frascati)
      - STAR tracker
      - Panda inner tracker (Munich)
      - FAIR/CBM trackers (GSI)
      - Florida Tech university (homeland security)
      - ILC calorimeters (Lapp Annecy, Arlington Texas)
      - Large area, High spatial resolution Tracker at Jefferson Lab
      - Etc…

WG6: Technology Industrialization
Potential partners

THGEM Technology – ELTOS S.p.A. (Italy)

GEM Technology

- New Flex (Korea, Seoul)
- Tech-ETCH (USA, Boston)
- Scienergy (Japan, Tokyo)
- Keerthi Industries (India)
- MicroMETAL GmbH (Germany, Muellheim)

Micromegas Technology

- TRIANGLE LABS (USA, Nevada)
- SOMACIS (Italy, Castelfidarco)
- CIREA (France, CHOLET)

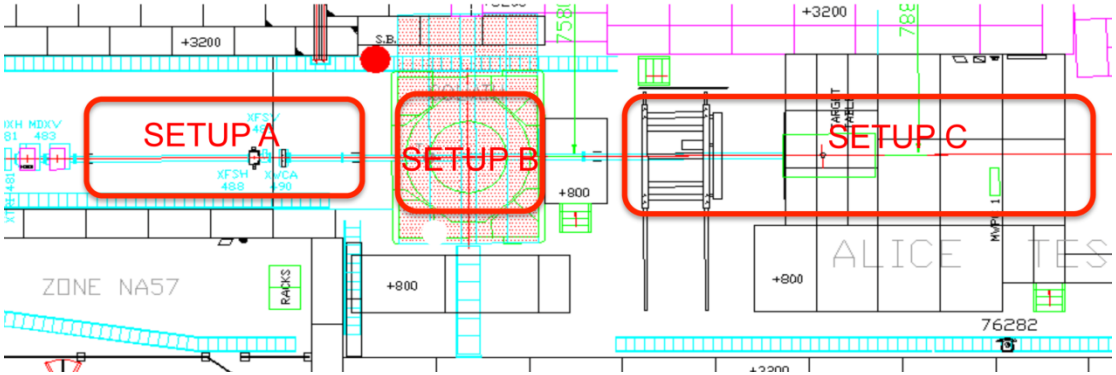
Industrial test runs for each technology foreseen in 2011 after selection of the best candidates !!!

SACLAY bulk MicroMegas workshop

- Very inventive detectors being tried.
- Double-sided : coarse readout on one side, finer multiplexed readout on the other side
- Bulk with thin meshes
- Also trying thick meshes (90% cheaper)
- The Saclay bulk workshop is now ready to help

Clas12 double sided bulk MicroMegas

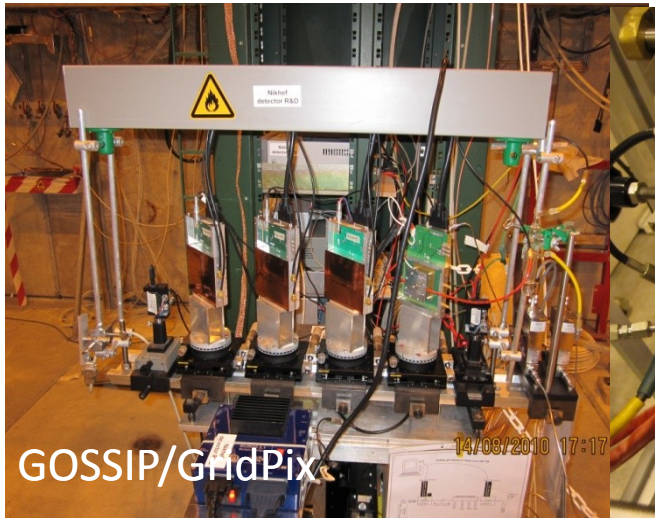
WG7: Test Beam Facility at H4 SPS

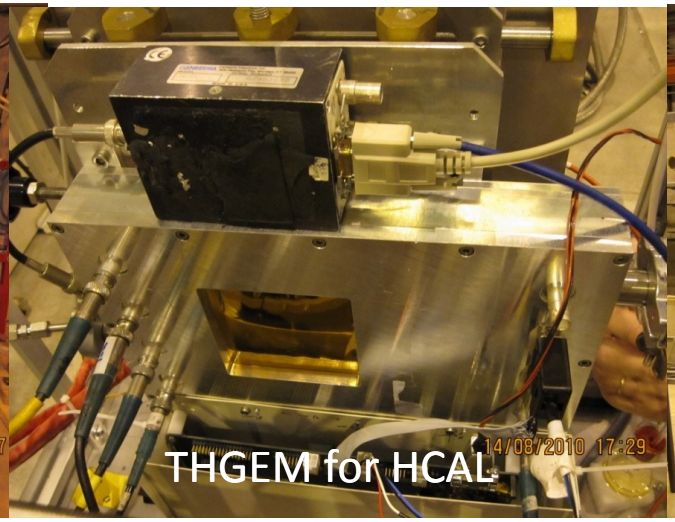


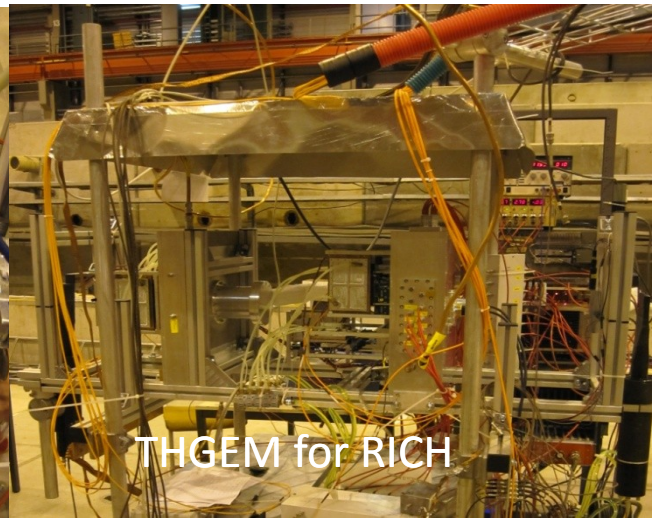
2011 RD51 beam allocation

[The PS/SPS/AD Users Schedule]

- 27/June - 4/July (8 days)
- 9/August - 21/August (13 days)
- 17/October - 24/October (7 days)







Excellence in Detectors and Instrumentation Technologies
CERN, Geneva, Switzerland - 31 January - 10 February 2011

"GEM Detectors"

The principles of GEM-based detectors and their applications will be explained. GEM detectors will be assembled, and afterwards tested in X-ray stands. Concepts such as detection of X-rays will be explained and pulse height gain, and counting rate measurements will be carried out.

Professors of excellence and Tutors: L.Ropelewski, G.Bencivenni

"GridPix and Micromegas"

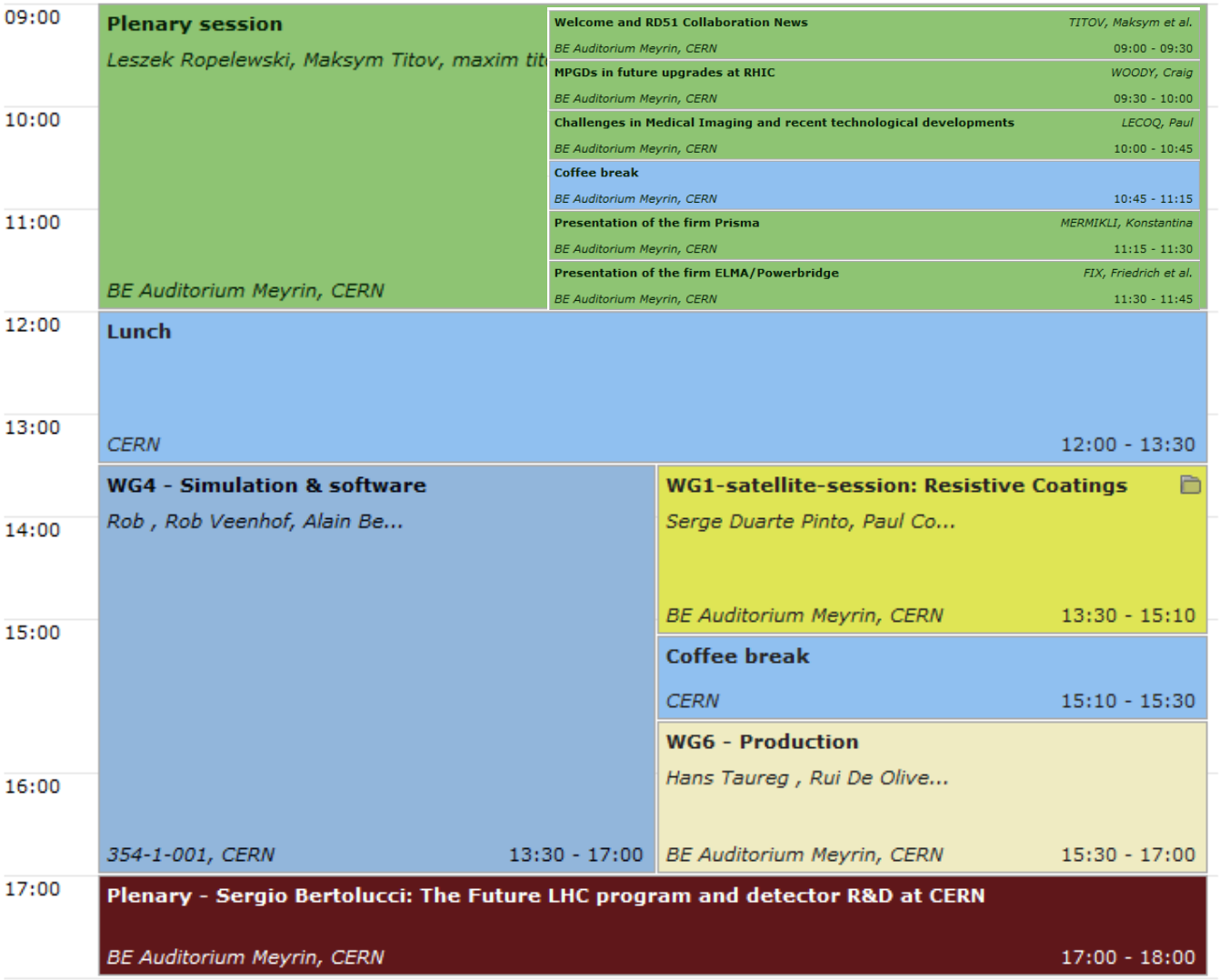
The set-up consists of two tests stations:

A complete GridPix/Gossip detector(s): PolaPix, Dice, Gossip including gas system, new miniHV supplies and readout systems. Students will operate the set-up and take data with various sources and cosmic rays, followed by data analysis: track fitting, dE/dX, interaction of ionization radiation with gas.

The second set-up consists of a 10x10 cm2 bulk Micromegas read out by a charge preamp, amplifier- shaper and a Multi-Channel analyzer, and a 1726-channel TPC in a gasbox, read out by T2K electronics. Fundamental concepts such as X-ray conversion, diffusion, electron collection and gas amplification will be understood via measurements with a full DAQ and analysis chain.

Professors of excellence and Tutors: H.van der Graaf, P.Colas

Wed 13/4


09:00
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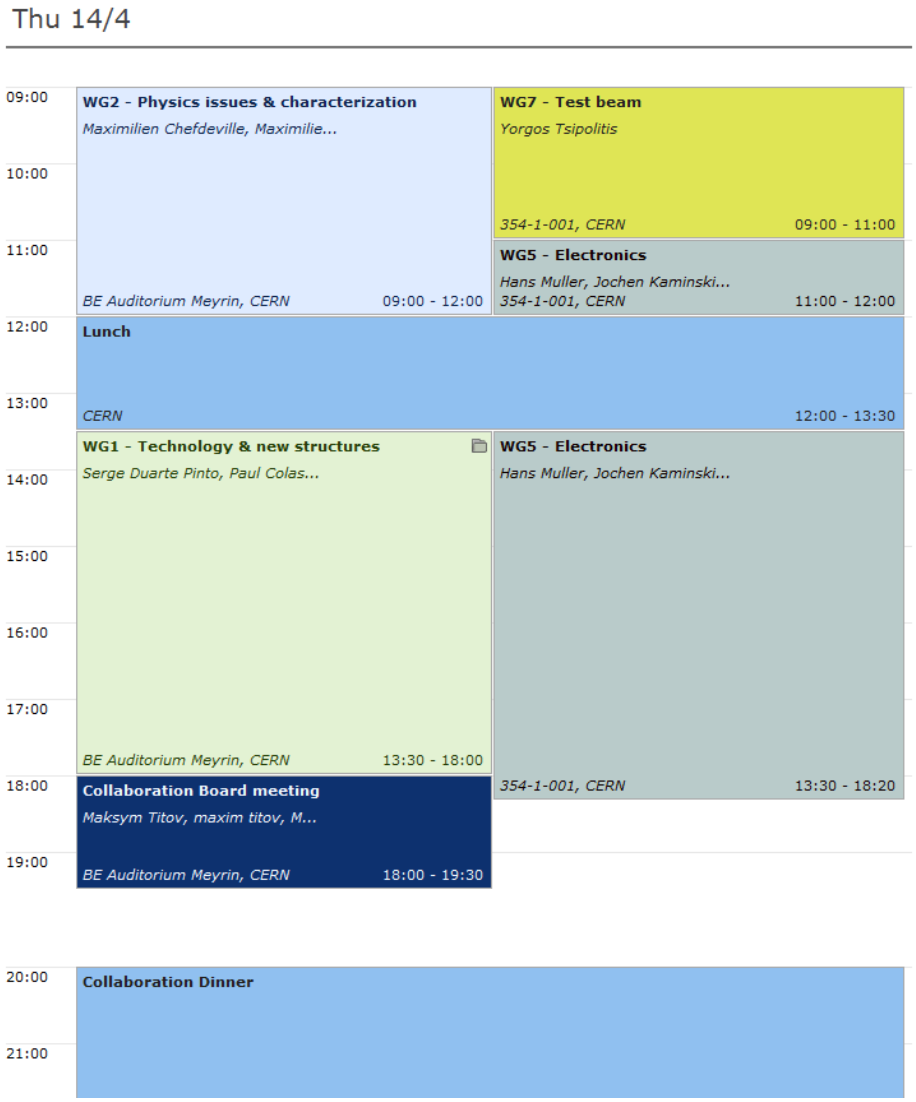
18:00
Plenary session
Leszek Ropelewski, Maksym Titov, maxim tit
BE Auditorium Meyrin, CERN
Welcome and RD51 Collaboration News
TITOV, Maksym et al.
BE Auditorium Meyrin, CERN
09:00 - 09:30
MPGDs in future upgrades at RHIC
WOODY, Craig
BE Auditorium Meyrin, CERN
09:30 - 10:00
Challenges in Medical Imaging and recent technological developments
LECOQ, Paul
BE Auditorium Meyrin, CERN
10:00 - 10:45
Coffee break
BE Auditorium Meyrin, CERN
10:45 - 11:15
Presentation of the firm Prisma
MERMIKLI, Konstantina
BE Auditorium Meyrin, CERN
11:15 - 11:30
Presentation of the firm ELMA/Powerbridge
FIX, Friedrich et al.
BE Auditorium Meyrin, CERN
11:30 - 11:45
Lunch
CERN
12:00 - 13:30
WG4 - Simulation & software
Rob , Rob Veenhof, Alain Be...
354-1-001, CERN
13:30 - 17:00
WG1-satellite-session: Resistive Coatings
Serge Duarte Pinto, Paul Co...
BE Auditorium Meyrin, CERN
13:30 - 15:10
Coffee break
CERN
15:10 - 15:30
WG6 - Production
Hans Taureg , Rui De Olive...
BE Auditorium Meyrin, CERN
15:30 - 17:00
Plenary - Sergio Bertolucci: The Future LHC program and detector R&D at CERN
BE Auditorium Meyrin, CERN
17:00 - 18:00

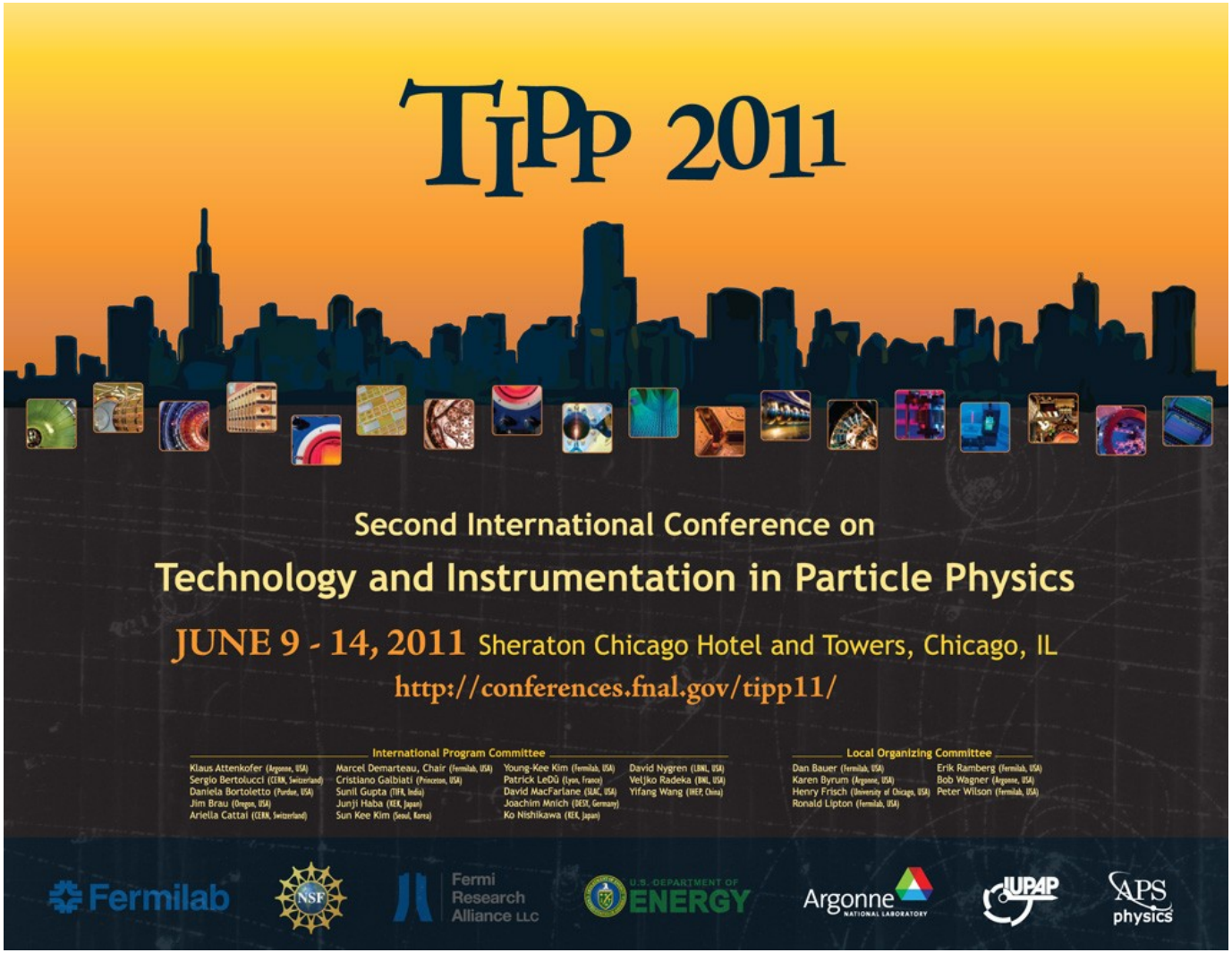


Subjects for CB:

Proposal for RD51 Common Projects Funding from the RD51 Common Fund

Preparation for the RD51 management elections: CB chair, spokesperson(s)

[Technology and Instrumentation in Particle Physics - TIPP 2011]



MPGD2011 2nd International Conference on Micro Pattern Gaseous Detectors

7th RD51 Collaboration Meeting
Social Event
Thursday Evening 14th April 2011

La Villa du Lac
93, chemin du Châtelard
01220 Divonne-les-Bains
Tél. : 33 (0)4 50 20 90 00

Bus Departure: CERN Reception, Building 33 at 20h00
Bus Return: CERN Reception, Building 33 at 23h30