

RD51 Collaboration News

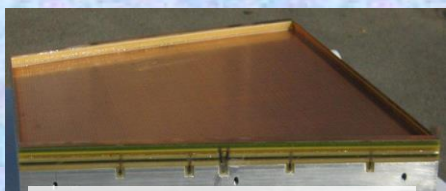
Leszek Ropelewski, CERN, Switzerland
 Maxim Titov, CEA Saclay, France



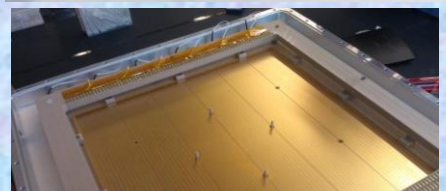
MM for ATLAS upgrade



GEM for CMS upgrade

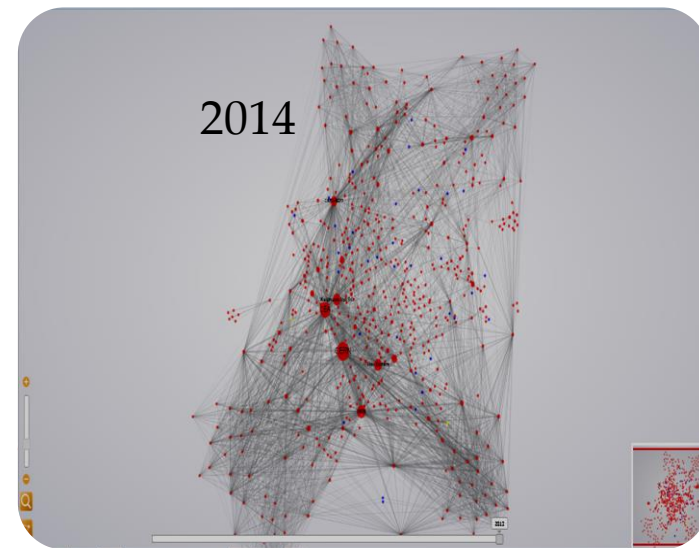
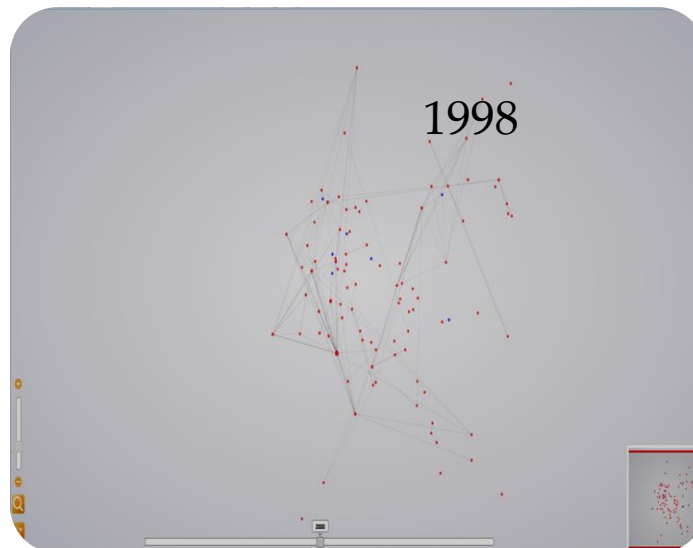


GEM for ALICE TPC upgrade



THGEM for COMPASS upgrade

A fundamental boost is offered by RD51: from isolate MPGD developers to a world-wide network



RD51 MiniWeek at CERN, June 16-19, 2014

Today: **RD51 Collaboration MiniWeek (Jun. 16-19, 2014)**

<https://indico.cern.ch/event/323839/other-view?view=standard>

Monday, June 16 (30-7-018 - Kjell Johnsen Auditorium)

13:30 – 15:00 RD51 Plenary Session

15:00 – 18:00 WG5 Electronics

Tuesday, June 17 (31-3-004)

09:00 – 13:00 WG1 MPGD Technologies and New Structures

14:00 - 18:30 WG4 Software

Wednesday, June 18 (30-7-018 - Kjell Johnsen Auditorium)

09:00- 18:00 Special ALICE-TPC /RD51 Workshop

Thursday, June 19 (30-7-018 - Kjell Johnsen Auditorium)

09:00 – 13:00 WG6 Production and Industrialization

14:00 - 17:00 WG2 Physics Issues

The 2nd RD51 Academia-Industry Matching Event has been moved to the RD51 MiniWeek in December (Dec. 8-12)

RD51 Collaboration Notes

<https://espace.cern.ch/test-RD51/RD51%20internal%20notes/Forms/AllItems.aspx>

RD51 INTERNAL NOTES

2011

RD51-Note-2011-017 - "Transport properties of operational gas mixtures used at LHC" (by Y. Assran, A. Sharma)

RD51-Note-2011-016 - "THGEM-based detectors for s laboratory and beam evaluation" (by L. Arazi, H. Natal da R. Azevedo, A. Rubin, M. Cortesi, D. S. Covita, C. A. B. Oli Park, J. Yu, R. Chechik, J. M. F. dos Santos, M. Breidenbac A. Veloso, A. Breskin)

RD51-Note-2011-015 - "Detection and removal of short M. Kalliokoski, T. Hildén, R. Lauhakangas, P. Karppinen, T Garcia, J. Heino and E. Tuominen)

RD51-Note-2011-014 - "Optical Scanning System for Qu (by M. Kalliokoski, T. Hilden, F. Garcia, J. Heino, R. Lauhaka Turpeinen)

RD51-Note-2011-013 - "Test beam results of the GE1/1 upgrade of the CMS high-eta muon system" (by D. Abbaneo Armagnaud, P. Aspell, Y. Ban, S. Bally, L. Benussi, U. Berza Bunkowski, J. Cai, J. P. Chatelain, J. Christiansen, S. Colafr Garcia, E. David, G. de Robertis, R. De Oliveira, S. Duarte Pinto, S. Ferry, F. Formenti, L. Franconi, K. Gnanvo, A. Gutierrez, M. Hohlmann, P. E. Karchin, F. Loddo, G. Magazzu, M. Maggi, A. Marchioro, A. Marinov, K. Mehta, J. Merlin, A. Mohapatra, T. Moulik, M. V. Nemallapudi, S. Nuzzo, E. Oliveri, D. Piccolo, H. Postema, G. Raffone, A. Rodrigues, L. Ropelewski, G. Saviano, A. Sharma, M. J. Staib, H. Teng, M. Tytgat, S. A. Tupputi, N. Turini, N. Smilkjovic, M. Villa, N. Zaganidis, M. Zientek)

RD51-Note-2011-012 - "Construction and Performance of Large-Area Triple-GEM Prototypes for Future Upgrades of the CMS Forward Muon System" (by M. Tytgat, A. Marinov, N. Zaganidis, Y. Ban, J. Cai, H. Teng, A. Mohapatra, T. Moulik, M. Abbrescia, A. Colaleo, G. de Robertis, F. Loddo, M. Maggi, S. Nuzzo, S. A. Tupputi, L. Benussi, S. Bianco, S. Colafranceschi, D. Piccolo, G. Raffone, G. Saviano, G. Magazzu, E. Olivieri, N. Turini, T. Fruboies, D. Abbaneo, C. Armagnaud, P. Aspell, S. Bally, U. Berzano, J. Bos, K. Bunkowski, J. P. Chatelain, J. Christiansen, A. Conde Garcia, E. David, R. De Oliveira, S. Duarte Pinto, S. Ferry, F. Formenti, L. Franconi, A. Marchioro, K. Mehta, J. Merlin, M. V. Nemallapudi, H. Postema, A. Rodrigues, L. Ropelewski, A. Sharma, N. Smilkjovic, M. Villa, M. Zientek, A. Gutierrez, P. E. Karchin, K. Gnanvo, M. Hohlmann, M. J. Staib)

RD51-Note-2011-007 - "First observation of Cherenkov rings with a large area CsI-TGEM-based RICH prototype" (by V. Peskov, G. Bencze, A. Di Mauro, P. Martinengo, D. Mayani, L. Molnar, E. Nappi, G. Paic, N. Smirnov, H. Anand, I. Shukla)

RD51-Note-2011-006 - "On the low-temperature performances of THGEM and THGEM/G-APD multipliers in gaseous and twophase Xe" (by A. Bondar, A. Buzulutskov, A. Grebenuk, E. Shemyakina, A. Sokolov, D. Akimov, I. Alexandrov and A. Breskin)

Modelling of avalanches and streamers by finite elements with de", Notes for the RD51 Simulation School, CERN, Jan. 19-21

Thermal Stretching of Large-Area GEM Foils Using an Infrared el Staib, Bryant Benson, Kondo Gnanvo, Marcus Hohlmann,

On the operation of a Micropattern Gaseous UV Photomultiplier val, A. Breskin, R. Budnik, W.T. Chen, H. Carduner, M. Cortesi, ird, J. Lamblin, P. Le Ray, E. Morteau, T. Oger, J.S. Stutzmann

Infrared scintillation yield in gaseous and liquid argon for rare-Buzulutskov, A. Bondar, A. Grebenuk)

"Further Developments and Tests of Microstrip Gas Counters (by R. Oliveira, V. Peskov, Pietropaolo, P.Picchi).

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 Notes: 2 in 2014
8 in 2013
12 in 2012
17 in 2011;
9 in 2010;
7 in 2009

Please submit results of your work, in parallel with journal publication, as RD51 Note:

→ Efficient way to disseminate your results to the MPGD/RD51 community
(rd51-all email goes to ~ 500 people)

Annual RD51 Report to the LHCC (June 4, 2014)

<https://indico.cern.ch/event/319702/>

- **WG1:** Continuation of the R&D support for the experiments and LHC upgrades
- **WG2:** Generic R&D (long-term stability, quality control); RD51 Common Projects
Development of new structures and consolidation of the existing structures
- **WG3 (NEW): Applications** - organization of series of specialized workshops disseminating MPGD applications beyond fundamental physics – RD51, potential users and industry (e.g. dosimetry, neutron detection, medical physics, ...)
- **WG4:** Development and Maintenance of Software & Simulation Tools; basic studies & software support for the RD51 community
- **WG5:** Development and Maintenance of the SRS Electronics; An extended support for the SRS including new developments and implementations of additional features
- **WG6:** MPGD Production and QA Control - GEM, MicroMegas, Thick GEM; completion of the industrialization of main technologies
- **WG7:** Maintenance and extension of the RD51 Lab and Test-Beam Infrastructure
- **WG (NEW): MPGD Education and Training** : organization of schools for students and newcomers & academic training
- Participation in the funding requests / funding contributions: Marie-Curie/GASNET, AIDA2

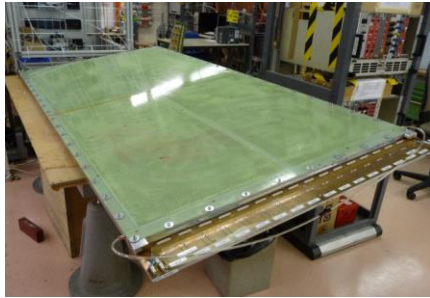
WG1: Continuation of the R&D Support for the LHC Upgrades

MM for the ATLAS Muon System Upgrade:

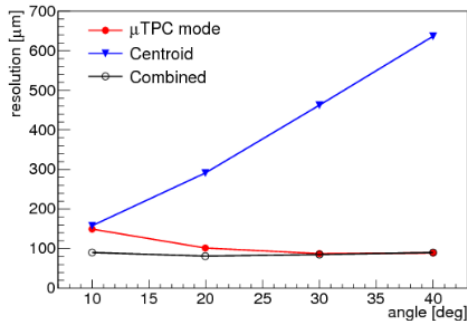
R&D Started in 2007 within the RD51 collaboration:

Standard Bulk MM suffers from limited efficiency at high rates due to discharges induced dead time

Solution: Resistive Micromegas concept



2.4 x 1m²
MM resistive chamber
constructed and
characterized at
CERN RD51 lab



➤ Resolution for inclined tracks (μTPC method) better than 80 μm

➤ MM can operate in magnetic field

NSW Technical Design Report (TDR) approved by LHCC (October 2013) →

~ 1280 m² of resistive MM will be installed (LS2) in ATLAS → the largest MM system, ever built
→ FOSTER INDUSTRIAL PRODUCTION NEEDS

GEMs for the CMS Muon System Upgrade:

R&D Started in 2009 within the RD51 collaboration:

Single-mask GEM technology (instead of double-mask)
→ Reduces cost /allows production of large-area GEM

Self-stretching technique: assembly time reduction from 3 days → 2 hours

GE1/1-I 2010	GE1/1-II 2011	GE1/1-III 2012	GE1/1-IV 2013	GE1/1-V 2014
<ul style="list-style-type: none"> 1st 1m-class type 2 x 4 readout sectors Spacers All glued 	<ul style="list-style-type: none"> 1st GE1/1 type 3 x 8 readout sectors Spacers All glued 	<ul style="list-style-type: none"> NS2 technology Outer frame still glued to drift Gap sizes: 3/1/2/1 mm 	<ul style="list-style-type: none"> Complete mechanical construction 6 types produced at several sites 	<ul style="list-style-type: none"> Final design Optimal acceptance in eta and phi Short+long version

Future work will focus on stability and uniformity of GEMs, and development of electronics, ...

During the LHC End-Year stop of 2016/2017, two GEM super-chamber demonstrators will be installed

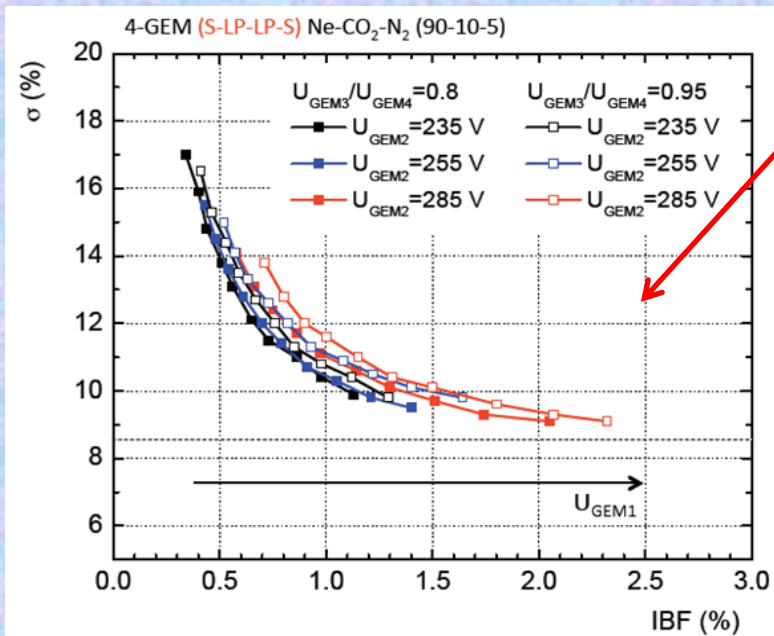
WG1: Continuation of the R&D Support for the LHC Upgrades

ALICE TPC Upgrade

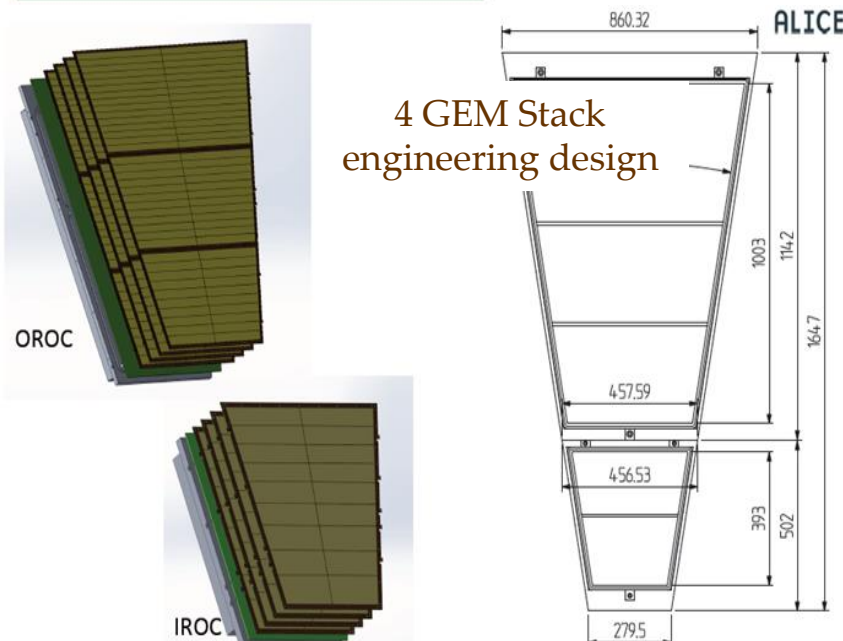
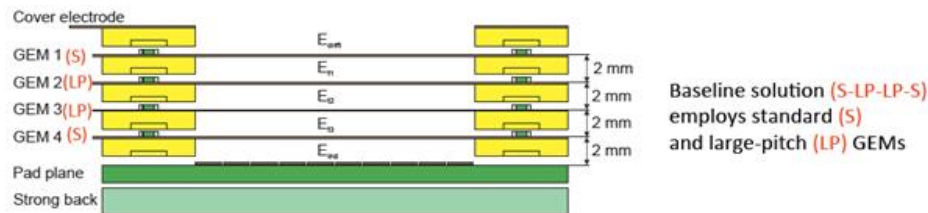
→ replace MWPC with GEM

- Continuous TPC readout at 50 kHz
- Physics requirement: IBF < 1%, energy: $\sigma(E)E < 12\%$ achieved

Energy resolution vs IBF (4-GEM detector):

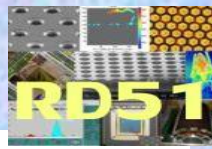


- TDR Baseline Solution: 4-GEM Stack
- Also option under study: Micromegas + 2 GEM



Special ALICE TPC / RD51 workshop will be organized on June 18th, 2014 (during the RD51 Collaboration Week)

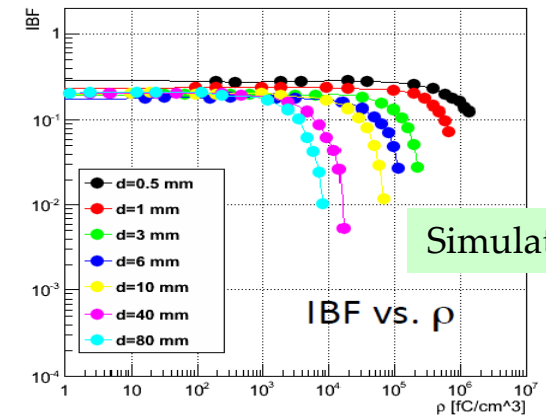
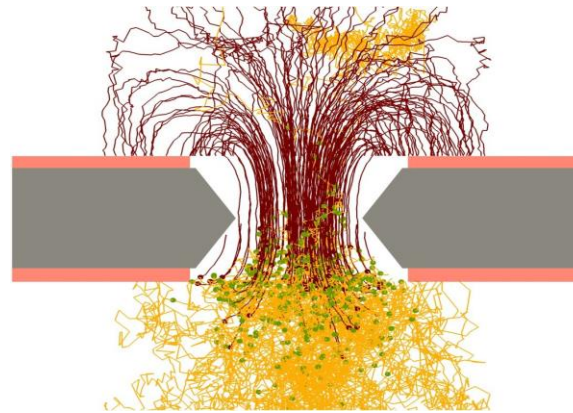
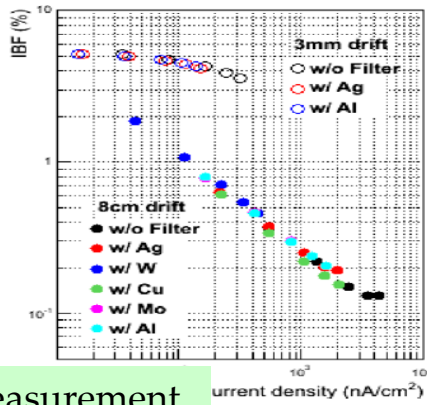
WG4: MPGD Simulation Tools



Applications:

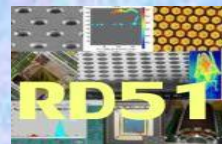
- GEM: multiplication process and polyimide properties; charging up effects
- MicroMegas: timing and effects of resistive layers
- TPC GEM: ion backflow

➔ ALICE TPC end-cap upgrade studies: rate dependence of the Ion Back Flow in GEM



Summary of simulation improvements in 2013:

- Systematic calculations of GEM charging-up as function of hole shape; these reproduce the trends observed in experimental data
- Measurements in Krakow for numerous gas mixtures of energy transfer rates which permit much more accurate avalanche gain calculations
- Start of a collaboration with Coimbra on ion transport measurements in mixtures and start of an effort to model ion transport microscopically, which will help to predict charging-up and ion feedback
- Measurement in Orsay at particularly low gain and low noise of the avalanche fluctuations in He/iso, Ne/iso and Ar/isobutane (these fluctuations are reproduced by MC run)



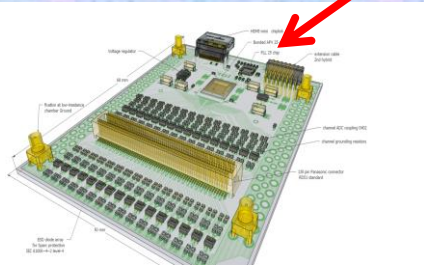
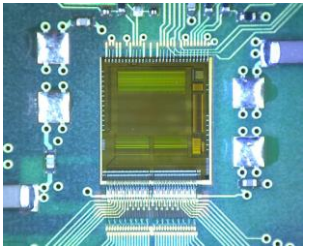
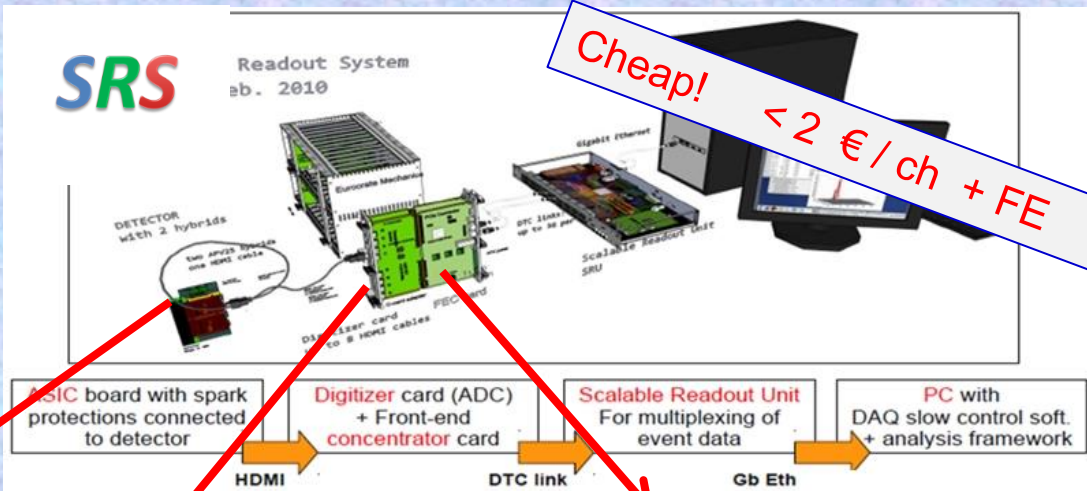
WG5: Development of Scalable Readout System (SRS) for MPGD

RD51 Development / Industrialization: portable multi-channel readout system (2009-2012)

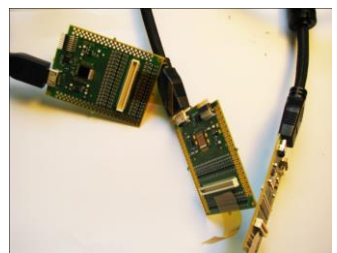
- ❖ Scalable readout architecture: from ~ 100 channels up to very large LHC systems (> 100 k ch.)
- ❖ Project specific part (ASIC) + common acquisition hardware and software

Physical Overview of SRS:

- Scalability from small to large system
- Common interface for replacing the chip frontend
- Integration of proven and commercial solutions for a minimum of development
- Default availability of a very robust and supported DAQ software package



Frontend hybrids:
based on
APV25, VFAT, Beetle,
VMMx and Timepix
chips



ADC frontend adapter for APV and Beetle chips

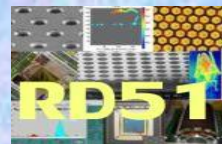
ADC plugs into FEC to make a 6U readout unit for up to 2048 channels



FEC cards (common):

Virtex-5 FPGA, Gb-Ethernet, DDR buffer, NIM and LVDS pulse I/O, High speed Interface connectors to frontend adapter cards





WG5: Development of Scalable Readout System (SRS) for MPGD

“SRS Classic” (developed by RD51):
 → Produced by PRISMA (Greece),
 sold via CERN store

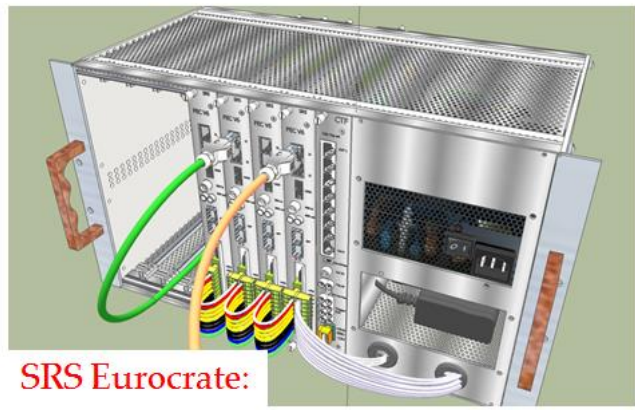
EicSys Germany reworked “SRS classic”
 into ATCA → functionally equivalent
 “SRS Classic” with triple channel density

**SRS IP and licence
 has been finalized**
 (KN2288/KT/PH/203A, SRS ;
 CERN + IFIN HH Bucharest
 + UPV Valencia)

→ 1st license taker (EicSys
 GmbH, Hamburg)

→ royalties to CERN/RD51
 if sold outside RD51 and/or
 research domain

SRS - CLASSIC → SRS - ATCA



SRS

SRS Progress (May 2013- May 2014):

User purchases from ~ 30 teams:

- ~ 40 SRS classic (CERN store) - 250 kFs
- ~ 10 SRS classic parts (RD51) - 50 kFs
- 4 SRS - ATCA (EicSys GmbH) - 70 kFs

Total SRS turnaround 12 month ~ 370 kFs

Major SRS experiments and plans for 2014/15

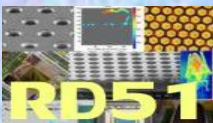
Planned 2014-2015 Experiments with SRS readout (130 k APV channles, 15k VMM channels, 10k Beetle channels, 10 k

Nr. Channels	EDH Nr	type of SRS	Experiments	Name	Team
15 k APV		SRS Classic	JPARC E16 experiment first phase	Tomonori Takahashi	RIKEN Nishia / E16
30 k APV		SRS Classic	JPARC E16 experiment second phase	Tomonori Takahashi	RIKEN Nishia / E16
72 k APV		SRS ATCA	JLAB SBS GEM back tracker	Kondo Gnanvo	Univerity Virginia
15 k VMM		SRS ATCA	ATLAS NSW test systems	Joerg Wotschack	CERN
10 k Beetle		SRS ATCA	ALICE FOCAL Si tracker	David Silvermyr	ORNL
10 k SiPM		SRS ATCA + SRS Classic	NEXT TPC readout system	Jose Toledo	UPV Valencia / NEXT
Timepix arrays		SRS Classic	LC TPC project	Jochen Kaminski	Bonn Univ
8k APV		SRS classic	T2DM2 Project	Stephane Gaffet	LSBB Laboratoire CRNS / Rustrel
10 PMT		SRS ATCA	CETAL High Intensity laser	Sorin Martoiu	IFIN-HH

➤ SRS is Very successful → to be used outside MPGD fields (e.g SiPM, ...)

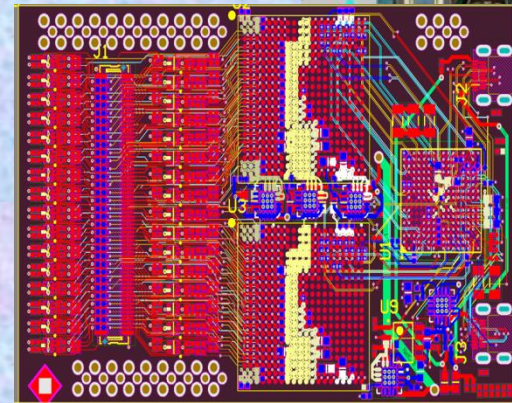
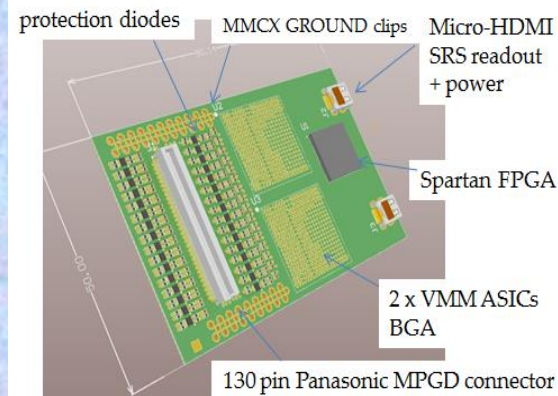
➤ Number of SRS APV channels sold: 2010- 2012- 25k; 2012-2013 – 50k; 2013-2014 – 60k; 2014-2015 – 130k

WG5: Development of Scalable Readout System (SRS) for MPGD



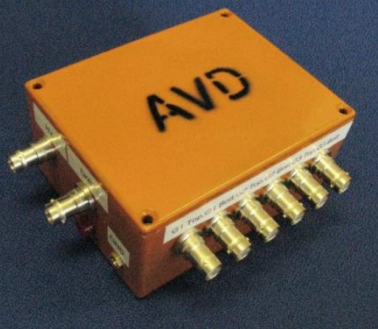
Synergy between RD51 & ATLAS NSW:

- Design of 128 –channel hybrid plug-compatible with 128 channel APV hybrid
- VMM is the new, 64 channel, digital readoutchip with Z-suppression (RD51 baseline RD51)



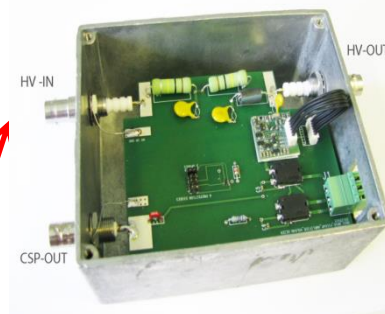
AVD active Voltage Divider for GEMs

Several prototypes built: tested OK with triple GEM incl. readout of GEM foil voltages via SRS
 New version: continued operation with short circuit on one GEM foil sector



Trigger pickup box for MPGD meshes

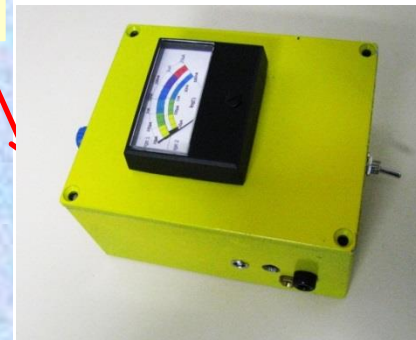
5 TP boxes built and are used. Integrate HV filter and charge sensitive preamplifiers



RD51: Towards complete SRS-Lab equipment for MPGDs

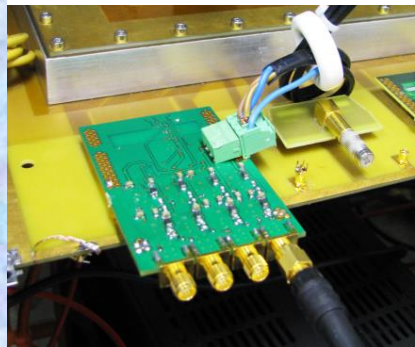
Femto-ampere measuring box

Several FEMTO built: sensitivity from 10 fA – to 1 uA. Tested Ok with MPGD detector pickup. New version: larger analogue display, triax input connect
 Oscilloscope 50 Ohm output



QUAD MPGD signal amplifier 2 GHz, 25dB

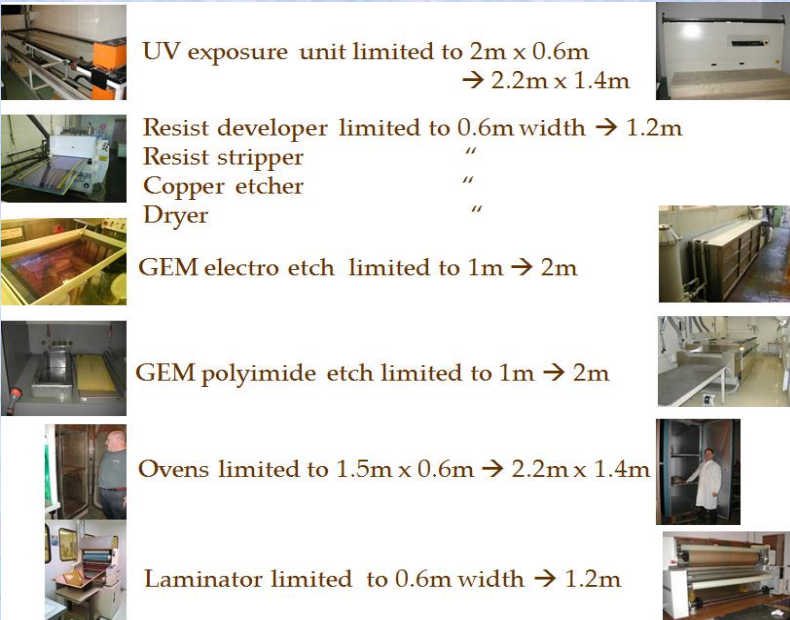
One prototypes built: tested on MicroMega 1 channel works OK 3 channels have ringing problem . New version: Improvement of shielding, new 50 OHM PCB



WG6: RD51 – MPGD Production at CERN



- ❖ Currently CERN-MPGD workshop is the UNIQUE MPGD production facility (generic R&D, detector components production, quality control)
- ❖ Upgrade of the workshop equipment approved by CERN management (Nov. 2009) → installation of the new infrastructure (to fabricate 2x1m² Bulk MM & 2x0.5m² GEM) COMPLETED



UV exposure unit limited to 2m x 0.6m
→ 2.2m x 1.4m

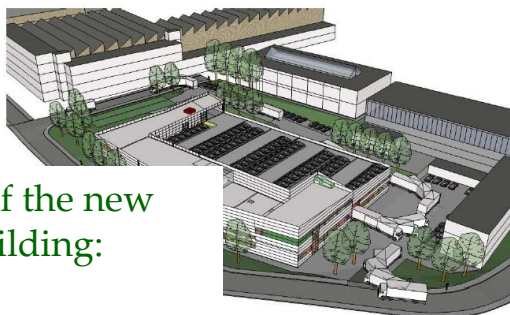
Resist developer limited to 0.6m width → 1.2m
Resist stripper " "
Copper etcher " "
Dryer " "

GEM electro etch limited to 1m → 2m

GEM polyimide etch limited to 1m → 2m

Ovens limited to 1.5m x 0.6m → 2.2m x 1.4m

Laminator limited to 0.6m width → 1.2m



CERN Building 107
Basis of Design

Construction of the new workshop's building:

Start : beginning 2012
Completion: mid of 2015

MPGD Projects using new equipment (detector size):

- SBS tracker GEM - 600 x 500 mm²
- ALICE TPC upgrade GEM - 600 x 400 mm²
- CMS muon GEM - 1.2m x 450mm
- ATLAS NSW muon MM - 2m x 1m
- COMPASS Micromegas GEM/MM - 500x 500mm²
- BESIII GEM - 600 x 400 mm²
- KLOE GEM - 700 x 400 mm²
- SOLID GEM - 1.1m x 400mm
- CLAS 12 MM - 500 x 500 mm²
- LSBB (geoscience) MM - 1m x 500 mm

Most of them are still at R&D phase, but a few are close to full production :

- SBS Tracker 100 GEMs
- ALICE TPC upgrade 250 GEMs
- COMPASS pixel MM 20 GEM + MM
- BESIII 15 GEM
- CLAS 12 30 MM
- CMS 450 GEM
- **ATLAS NSW ~2000 MM-PCB; 1280 m² area**

WG6: MPGD Technology Industrialization



Technology Industrialization → transfer “know-how” from CERN workshop to industrial partners

GEM Technology (contacts):

- Mecharonix (Korea, Seoul)
- New Flex (Korea, Seoul)
- Tech-ETCH (USA, Boston)
- Scienergy (Japan, Tokyo)
- TECHTRA (Poland, Wroclaw)

GEM Licenses signed by:

- ✓ Mecharonics, 21/05/2013
- ✓ TECH-Etch, 06/03/2013
- ✓ China IAE, 10/01/2012
- ✓ SciEnergy, 06/04/2009
- ✓ Techtra, 09/02/2009
- ✓ CDT, 25/08/2008
- ✓ PGE, 09/07/2007

MicroMegas Technology(contacts):

- ELTOS S.p.A. (Italy)
- TRIANGLE LABS(USA, Nevada)
- SOMACIS (Italy, Castelfidardo)
- ELVIA (France, CHOLET)

THGEM Technology (contacts):

- ELTOS S.p.A. (Italy),
- PRINT ELECTRONICS



GEM Industrialization Status (May 2014):

TECH-ETCH:

- The GEM single mask process is fully understood, many 10cm x 10cm have been produced and characterization is being performed.
- A first batch of 30cm x 30cm GEM is being produced.
- The next step will be to raise to the CMS GE1/1 size of 1m x 0.5m.

TECHTRA:

- The production line is operational
- The process for 10cm x 10cm GEM is now stable
- The GEM single mask process is fully understood and many 10cm x 10cm GEM have been produced.
- A batch of 30cm x 30cm Single mask process GEM is being produced.

Mecharonics:

- 10cm x 10cm double mask GEM have been produced and tested.
- We will receive soon at CERN soon a 30cm x 30cm double mask set for evaluation.

Micromegas Industrialization Status (May 2014):

ELVIA:

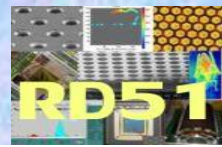
- Bulk Micromegas detectors are routinely produced with sizes up to 50cm x 50cm.
- The resistive screen printing process is still under evaluation and most probably a training will be organized at ELVIA premises to finalize it
- We are waiting the offer for the production of 2304 Boards for NSW ATLAS

ELTOS:

- Many small size bulk Micromegas detectors have been produced (100 pieces), the resistive screen printing is also still under evaluation.
- We are waiting the offer for the production of 2304 Boards for NSW ATLAS

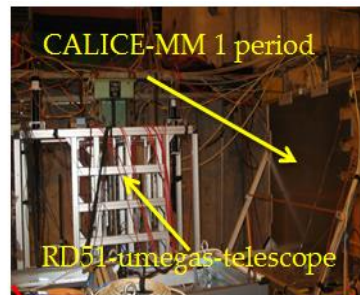
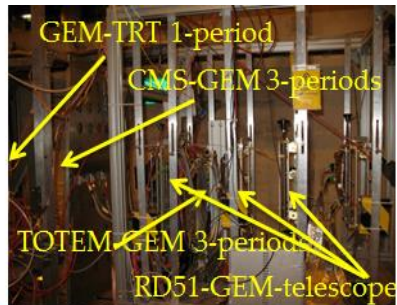
Waiting for an offer for production of ~ 2000 MM-PCB/
1280 m² of MM-resistive for ATLAS NSW from ELVIA/ELTOS

WG7: Common Test Beam Facility at H4 SPS and DT GDD Lab Infrastructure

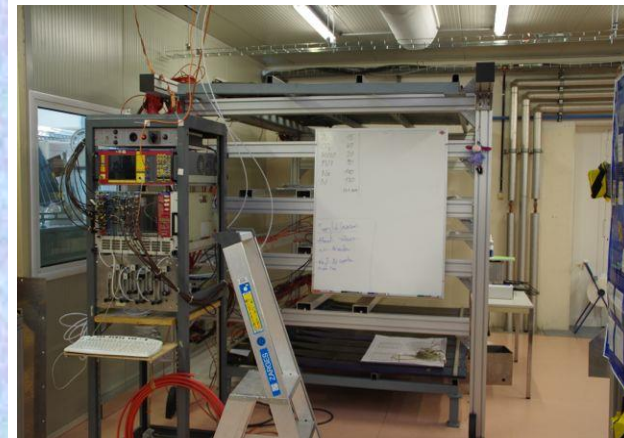
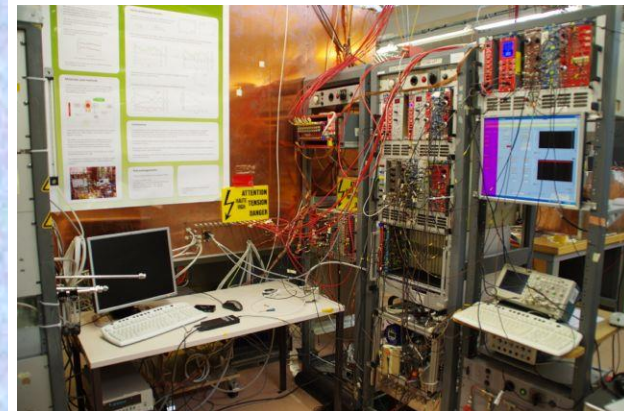


- **Common RD51 Test-Beam Infrastructure:** 3 beam telescopes (1 Bulk MM, 1 resistive MM & 1 triple-GEM with SRS readout), HV, gas & power lines ...
→ Fall 2014: Resume RD51 test-beam activities (e.g. interested groups are ALICE, CMS, ...)
- **Extension and improvement of the RD51 DT-GDD Lab Infrastructure**

RD51 Common Test Beam Facility @ H4 SPS:



RD51 Lab Facility @ CERN:



2008-2013:

More than 20 RD51 groups participated



Special Event in Ukraine: "90 Years Anniversary of G. Charpak Birth" (Lviv, July 21, 2014)

As the part of the **Trans-European School of High Energy Physics** that will take place in Basivka in the Lviv region (Western part of Ukraine) from July 17th to July 24th:

<http://teschool14.lal.in2p3.fr> (we encourage students to apply !!!)

❖ **Special Event Dedicated to the 90 Years Anniversary of G. Charpak Birth** will take place on July 21, 2014

❖ The "Charpak Event" is organized under the Patronage of the French Embassy in Ukraine and the EU Commission.

→ Scientific session of 3.5 hours long will be organized: comments are appreciated

The image shows a website for the Institut Français in Ukraine. At the top, it says "INSTITUT FRANÇAIS" and "UKRAINE KIEV - KHARKIV". Below that, there are navigation links: "QUI SOMMES-NOUS ? APPRENDRE LE FRANÇAIS MÉDIATHÈQUE PROGRAMMATION ÉTUDES". The main heading is "ÉCOLE TRANS-EUROPEENNE DE PHYSIQUE DES HAUTES ÉNERGIES" with the date "22.05.2014". Below this is a banner for the "Trans-European School of High Energy Physics" in Basivka, Lviv Region, Ukraine, from July 17-24, 2014. The banner features a scenic image of a lake and trees. On the left, it lists "Topics" such as Standard Model, Precision tests of Standard Model, Beyond Standard Model, Heavy Flavours, Neutrino Physics, Instrumentation, and Accelerators. On the right, it lists the "Program Committee" and "Advisory Committee" members. At the bottom, there are logos for various institutions and a contact information section.

L'Ambassade de France en Ukraine participe cette année à l'organisation d'une [Ecole trans-européenne de physique des hautes énergies](#). Cet événement scientifique de haut niveau se tiendra à Basivka (dans la région de Lviv) du 17 au 24 juillet.

Deux événements satellites seront organisés à Lviv le 21 juillet :

- un colloque à l'occasion du 90^{ème} anniversaire de la naissance de M. Georges Charpak (prix nobel de physique 1992)
- une réunion des "laboratoires clés" d'Ukraine