RD51/WG1 status and future

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WG1 topics and tasks

New Structures and Technologies

Optimization of fabrication methods for MPGDs and development of new multiplier geometries and techniques.

Various specific goals are pursued : improve performance, stability, reliability, ease of operation, cost, etc…
Overlap with almost all other WGs : WG2 (performance and operation, physics at work in MPGDs), WG4 (simulation, software), WG5 (electronics and DAQ), WG6 (production), WG7 (tests).

Tasks :
1- optimization of fabrication methods for MPGDs and the development of new multiplier geometries and techniques.
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)
Additive and micro-additive fabrication.
3- Development of radiation-hard detectors and low-radioactivity detectors;
4- Portable sealed detectors.

Highlights of WG1 since MPGD19 in La Rochelle

New materials:
Ceramic GEMs
Glass GEMs
DLC-coated GEMs
Cellulosic GEMs
RETGEMs

Fabrication methods:
Coating, coverlays
Additive fabrication : metals, insulators and resistive materials
Micro-additive fabrications : shape the fields

Structures
Double- and triple-mesh structure
Multi-layered THGEM
Achinos amplification structure
Charge spreading by resistive-capacitive anode
Charge spreading by capacitive coupling
Floating-strip anode
Piggyback
Small-pad Micromegas

Highlights of WG1 since MPGD19 in La Rochelle

Performance and stability
- Discharge limitation/mitigation (materials and geometry)
- Charging up and gain stability
- Resistive electrodes for stability and charge spreading
- Optical readout
- Precise timing (picosec, RPWELL FTM)
- Use of electro-luminescence, negative ions

Operating conditions
- MPGDs in cryogenic environment
- High pressure operation

In WG1 we also **review regularly projects** all along their life, from R&D to data taking
- Commissioning of detector in operation or in construction
- Lessons learned from long standing detector operation

(ATLAS/NSW, CMS muon GEM chambers, ALICE, T2K, Migdal, DUNE DP, MAGIX

Improvements to the operation mode

- **Meetings**

In person meetings are always preferred, but remote attendance should be maintained.

WGs should start later and end earlier to meet the needs of three time zones. This implies shorter meetings and therefore being more selective with the talks.

Once per year WGs should update the collaboration on the progress and standing issues.

Rotation/turnover/addition of WG conveners - enhance the involvement in RD51 organisation of young collaborators - bring new ideas and steam and secure the future of the various WGs.

Non-MPGD gaseous detectors must be represented : addition of one convener.

Common projects

We attach great importance to the Common Projects, as a motor of the collaboration. We support the present effort to make them more attractive and allowing more cross-fertilization between groups.

Liaise with CERN EU office to facilitate successful applications

Advertise status (yearly reports at Collaboration meetings) and possibilities

Strong review for granting the project and follow up process

Cooperative for raw materials, connectors, probes, …

FUTURE

- Try to comply with ECFA R&D Roadmap. RD51 -> DRDC1
- Accept other gaseous detectors : RPCs, wire chambers, straw tubes (already started this week)
  - They have to be represented in the organization and management
  - We should not be too overwhelmed : R&D is mainly in MPGDs and there are synergies on gases, materials, electronics,…
- Let us care about the program : should not be too CERN-centered or Europe-centered (do not forget Snowmass process, Asian initiatives, etc…)
- Deal with the heavy review process (EDP, DRDC) : LHCC was not ideal anyway.

Example from Tiago Silva on why exploring new geometries to cope with European Strategy roadmap organization

1) Large ton dual-phase (PandaX-4T, LZ, DarkSide -20k, Argo 200k, ARIADNE, ...)
2) Light dark matter, solar axion, 0nbb, rare nuclei&ions and astro-particle reactions, Ba tagging)
3) R&D for 100-ton scale dual-phase DM/neutrino experiments

"The 2021 ECFA detector research and developement roadmap," 2021, doi: 10.17181/CERN.XDPL.W2EX