WP5

Gaseous calorimeters

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Task ID	Task	Performance Goal	ECFA DRD Theme
T1	Conception, construction and characterization of large sampling elements for calorimeters	Large and thin gaseous detectors are needed for future calorimeters. However, one needs to ensure that the response of such detectors is uniform in terms of efficiency and particle cluster size. The two previous are used to reconstruct the energy when binary or multi-threshold readout is used. The gaseous detectors need thus to be conceived and built having in mind such a uniformity. To achieve such a uniformity, precise mechanical structure should be adopted. In addition, the gas distribution system of the detectors should enable a uniform renewal of the gas inside the detectors. .	1.1, 1.3
T2	Timing performance of gaseous detectors for calorimeters	Recent studies have shown that time information could help to separate close-by showers but also to evaluate the contribution of delayed neutrons. Some gaseous detectors can provide excellent time information However a good uniformity of time performance is needed to properly exploit such an interesting feature	
T3	Readout electronics for calorimeter gaseous detectors	Development of novel Scalable Readout Systems for Gaseous Detectors. Development of new FPGA-based readout system that matches the data throughput of the electronics	

Milestones and Deliverables	Title	Description	Start Date	End Date
M1.1	Conception of small detectors of the different technologies	Conception of small detectors of the different technologies (M)RPC, MicroMegas, µRWELL, RPWELL) equipped with electronics readout with pads of a few cm^2 to test their efficiency and their uniformity	0	12M
M1.2	Realization of large detectors with different technologies	Realization of medium-size detectors (L > 20 cm, l > 20 cm) with different technologies featuring efficient gas circulation systems, small dead zones and equipped with Active Sensitive Units (ASU) hosting readout electronics allowing to measure efficiency and uniformity	12M	24M
D1.1	Construction and performance studies of large detectors of different technologies	Construction and performance studies of large detectors of different technologies (M)RPC, MicroMegas, µRWELL, RPWELL) instrumented with pickup pads of 1 cm^2, featuring dead zones less than 2%, highly uniform response to MIPs and time resolution of better than a few nanoseconds as well as high detection rate capabilities up to a few KHz/cm2. The new detectors should be designed to fulfil the requirements of compactness required to be part of highly granular hadronic calorimeters using PFA techniques.	0	36M

- We had had only two meetings during 2024 that were dedicated essentially to the organisation more than on the activities. A presentation on MPGD-calo beam test results was given in the 2d DRD1 general meeting.

- We identified the most challenging elements
  - Large surface (ok for MRPC and 50 cm x 50 cm seems feasible within 2 years)
  - New readout electronics with precise time measurement

This workpackage is strongly correlated to the activities to WP1 (Tracking calorimeters) in DRD6 with which the electronics development will be shared. An ASIC called CALOROC is being concevied and will be produced in 2025. This will be used for MRPC. MPGD intends to use FATIC but it is also possible to use APV (low threshold) or VMM (timing).

We will discuss with OMEGA group the possibility to have the same ASIC for MRPC and MPGD as was done for HR/µROC

Conclusion

WP5 deliverable is achievable within 3 years starting from January 2025