10 MUONS

Coordinator: U. Gasparini

The goal of this task is twofold: the development and integration in the CMS software environment of the simulation, reconstruction and analysis tools needed to fully exploit the capabilities of the CMS experiment in producing physics results using muons in the event final state; the detailed study of these capabilities and the definition of the strategies to obtain the optimal response in the various physics channels of interest, in close coordination with the other PRS tasks dealing with different physics objects.

10.1 Muon Detector Simulation

Coordinator: *Coordinator name*

This item covers the simulation issues specific to the muon sub-systems, assuring the implementation and integration of the relevant code in the OSCAR simulation program. In particular, the proper simulation in the GEANT4 framework of the physics processes involved in the muon detection, including multiple scattering, muon showering and δ-ray production, neutron background parameterization and punchtrhough effects, must be cross-checked against test-beam available data and already existing GEANT3 simulation results. The existing muon digitization code presently developed in the ORCA framework must also be included in the OSCAR program.

Deliverable 10.1 − A	**Hit simulation and digitization in muon detector.**
Description:	Mantenance of existing simulation code in CMSIM and its porting in OSCAR/GEANT4. Porting in OSCAR of digitization code from ORCA.
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or “before xxx”, or “after yyy”.*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.1 − B	**Verification of simulation model.**
Description:	Study of muon showering modelling, δ-ray production, punchthrough effects.
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or “before xxx”, or “after yyy”.*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.1 − C	**Neutron background parameterization.**
Description:	Provide neutron parameterization in CSC,DT and RPC chambers, according to latest shielding geometry.
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or “before xxx”, or “after yyy”.*
Constraints:	*Describe constraints, assumptions and risks.*

10.2 Muon Detector Reconstruction

Coordinator: *Coordinator name*

This item covers the reconstrution issues specific to the muon sub-systems, assuring the implementation and integration of the relevant code in the ORCA program. In particular the maintenance of already existing hit reconstruction, L1 trigger simulation and local track reconstruction code in the Drift Tubes, RPC and CSC muon systems must be guaranteed, as well as further developments to improve the code performance and to allow transparent usage of the code at the following stages of the reconstruction, including integration with other detectors and studies of alignment and calibration issues.

Deliverable 10.2–A	**Muon L1 trigger simulation in ORCA.**
Description:	Mantenance and update of L1 trigger primitive generation in CSC, DT and RPC systems. Global Muon Trigger simulation code.
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.2–B	**Local track reconstruction in muon system.**
Description:	Mantenance and update of muon track candidates reconstruction code in muon system.
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

10.3 Muon Detector Alignment, Calibration, and Databases

Coordinator: *Coordinator name*

The aim of this sub-task is the development of the software tools needed for the alignment and calibration studies in the muon system. In particular, the interface of existing muon alignment software with the ORCA reconstruction, together with the development of general software tools to displace/rotate in ORCA the muon subdetector units, is mandatory to study mis-alignment effects at different reconstruction/selection stages (L1 trigger, HLT, off-line) , to link the muon and the tracker alignment systems and to develop strategies for aligment corrections using the event data. As far as calibration is concerned, the simulation of realistic trigger syncronization data and specific behaviour of electronic-channels to be recorded in the Calibration Database must be provided, and strategies for calibration updating using event data must be studied. Finally, tools for converting the existing geometry detector database developed within CMSIM to a GENT4/OSCAR format, including recent and possible future updates, also from engineer drawings, must be developed.

Deliverable 10.3–A	**Geometry database.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.3–B	**ORCA interface to muon alignment software.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.3–C	**Tools for alignment studies in ORCA and strategy for aligment with tracks.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.3−D	**Calibration database and tools for trigger syncronization.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

10.4 Muon Test-Beams and Monitoring

Coordinator: *Coordinator name*

This item has to provide and mantain transparent and user-friendly interface of muon test-beam data to the event object database of CMS, allowing the usage of reconstruction code developed in the ORCA framework in the test-beam analysis activities. Tools for online software (e.g. event monitoring) and forthcoming combined test-beam activities (e.g DT+RPC , CSC+RPC) must be provided as well.

Deliverable 10.4−A	**Interface of muon test-beam data to CMS ODBMS.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.4−B	**Muon test-beam monitoring.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.4−C	**Muon reconstruction in test-beam data with ORCA.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.4−D	**Common software for combined Test-beams.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

10.5 Muon Physics Objects

Coordinator: *Coordinator name*

The goals of this sub-task are the muon identification at the different stages of the reconstruction and event selection (L2 and L3 triggers, off line), the definition of algorithms to identify and select interesting events for the different Physics channels with muon(s) in the final state, the development of benchmark physics analyses using the full detector simulation and reconstruction chain developed in the OSCAR and ORCA frameworks. Tools for common issues with other sub-detectors (e.g. muon-tracker matching, energy isolation algorithms, minimum ionizing particle definition) must be developed in close collaboration with other PRS groups. The setting-up of Monte Carlo productions, including the configuration of MC generators and the definition of relevant samples needed for bacgkround rejection and benchmark signal studies, is a crucial part of this sub-task activity.

Deliverable 10.5−A	**Muon L2 trigger selection.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.5−B	**Muon L3 trigger selection.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.5−C	**Muon identification.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*

Deliverable 10.5−D	**Configuration of MC productions for HLT and Physics TDR studies.**
Description:	*Elaborate on purpose and functionality.*
Responsible:	*Responsible person*
Client/Sponsor:	*Who wants the deliverable? As specific as possible.*
Completion date:	*A date, or "before xxx", or "after yyy".*
Constraints:	*Describe constraints, assumptions and risks.*