



# Memorandum of Understanding

# Between US CMS Group at Vanderbilt University and the US CMS Software and Computing Project at Fermilab

# August 2010

# 1. Introduction

This Memorandum of Understanding (MOU) describes the collaboration between the US CMS group at Vanderbilt University (VU) and the United States Compact Muon Solenoid Software and Computing (USCMSSC) project at Fermilab, as part of the U.S. CMS Research Program, to conduct nuclear physics research using the CMS detector at the Large Hadron Collider (LHC) at CERN. On behalf of USCMSSC, VU will establish and maintain a USCMSSC Tier-2 regional center facility on the campus of Vanderbilt University. This center, referred to as a Tier-2 center in the rest of this MOU document, will operate as an essential component of USCMS. This MOU also describes the relevant contribution of the USCMSSC project in the global CMS experiment to provide Tier-1 tape archival storage resources and file transfer services for data analysis tasks, including integration and commissioning, to the US CMS group at Vanderbilt University, together with other participants of the seamless grid environment. Any additional activities need to be agreed with the USCMSSC PM who will take into account both the work plans of US CMS group at Vanderbilt University as a Tier-2 center and the work plans of USCMS.

The main purpose of this collaboration is the design and operation of the Tier-2 regional computing facility for providing computing and storage resources to the US CMS nuclear physics research program, including operational support and user support, and for deployment and integration of grid-enabled software needed by CMS. The detector is described in the CMS Technical Proposal, December 15, 1994, the Technical Design Reports, and subsequent technical documents elaborating that design. Requirements for software and computing, including the USCMSSC work plan for Tier-2 regional computing facilities, are described in the USCMS Software and Computing Project Plan [1] and the Project Management and Acquisition Plan (PMAP) for the Vanderbilt Tier-2 [2]. The contribution of the USCMSSC collaboration to the CMS Project is defined by the scope of work determined by these documents.

The VU Tier-2 center will be part of the US CMS production scale, grid enabled distributed environment for physics data event reconstruction, analysis and event simulation. This concept is partially described in the NSF proposal for the U.S. CMS Research program [3]. This work will be performed as part of the USCMSSC project, as explained in the USCMS Software and the PMAP. USCMS and the VU Tier-2 center are partners in the Open Science Grid consortium [4] and are collaborating with the CERN LHC Computing Grid (LCG) project [5] and LHC regional centers around the world to deliver the distributed Grid-based computing environment for LHC physics research. The work by VU of providing the Tier-2 center as a robust grid enabled environment for USCMSSC forms the basis of this MOU.

The USCMSSC project management infrastructure and the project office reside at Fermilab, with a branch office at UC Los Angeles. The USCMSSC project manager (PM) is responsible for USCMSSC project management and reports to the USCMSSC Project Management Group (PMG).

This MOU describes the contributions of the USCMSSC project at Fermilab and the US CMS group at Vanderbilt University to achieve objectives for the Tier-2 center at Vanderbilt. Activities to be performed at Vanderbilt University and at Fermilab are specified in the PMAP. It is understood that these tasks may later be modified or that additional responsibilities may be added. The Vanderbilt Tier-2 project is also subject to an MOU between CMS and Vanderbilt University. Copies of that MOU and the PMAP are being provided to all the signees of this MOU.

The normal period of performance will be the US fiscal year (October 1 - September 30). This MOU will have a lifetime of 5 years, beginning at the start of US FY2011.

# 2. Personnel

# 2.1 List of Scientific Personnel

Participating scientists at Vanderbilt University committed to USCMSSC over the full project period are listed below. No support for these individuals comes from any project funds. The USCMSSC fraction refers to the fraction of research time committed to USCMSSC.

Name	CMS Fraction	Other Research Commitments/Comments
Charles Maguire	80%	PHENIX
Julia Velkovska	10%	PHENIX, CMS-DQM

#### 3. Software Project Management Responsibilities

#### 3.1. PMAP Estimated Cost and Deliverables

The PMAP contains a cost estimate of the items needed to complete the Vanderbilt Tier-2 project, and the funds needed by the USCMSSC at Fermilab to perform its tape archive data storage mission for the nuclear physics research component in CMS. By this MOU, the US CMS group at Vanderbilt University and the USCMSSC at Fermilab agree to make a best effort to provide items assigned at a cost not to exceed the PMAP base cost estimates. Procedures to be followed in the event of a necessary variation of cost from the base cost are described in section 3.3 below. The current description of tasks to be performed by the University, possibly with other institutions, is given in the summary.

#### 3.1.1. Release, Deployment & Documentation

Unless specifically indicated otherwise here, all software products developed by US CMS group at Vanderbilt University shall be released following standard CMS release mechanisms. The official release of the software shall be authorized by the USCMSSC project office in consultation with the L2 Manager. The US CMS group at Vanderbilt University shall be responsible for assuring acceptable deployment of the delivered software product within overall CMS software environment. The Vanderbilt University group shall be responsible for providing well-commented source code and associated design, and architecture documentation in adequate electronic formats. Delivery of the adequate documentation shall be a precondition of an official release.

# 3.1.2. Testing, Installation and Commissioning

The US CMS group at Vanderbilt University shall participate in the testing, installation, commissioning, and associated problem resolution of their contributed items. Adequate test plans shall be used during commissioning. The group will participate in the demonstration of the software as necessary. The US CMS group at Vanderbilt University will also participate in the maintenance and operation of these items. A software configuration management system, including a software repository that is compatible with the CMS software repository structure will be in place.

# 3.2. Coordination and Reporting

The USCMSSC manager for the Tier-2 program functions as the USCMSSC Level-2 project manager (L2) for the work described in this MOU, and is a signatory to this MOU. The institution contact person for activities at US CMS group at Vanderbilt University is Julia Velkovska. The task manager for USCMSSC activities carried out at US CMS group at Vanderbilt University is Charles Maguire.

The technical progress of the design, implementation, and testing of these components will be reported by the above-named task manager on a monthly basis to the USCMSSC L2 manager, who in turn will report subsystem progress to the USCMSSC PM. The PM will, in turn, report to the Fermilab PMG.

Technical reporting to CMS project management shall be performed by the USCMSSC PM. Financial reporting to CMS will be made by the USCMSSC PM.

Any changes to the scope of the project defined in PMAP and the associated cost must be documented in consultation with the USCMSSC L2 manager and pre-approved by USCMSSC PM using the change control mechanism established by the USCMSSC project office.

# 3.3. Procurement Authorization

The USCMSSC PM delegates obligation authority regarding the designated PMAP items to the authorized financial officer at VU subject to the following requirements. The base cost of the items in the PMAP is stated without contingency. The officer agrees that these cost ceilings cannot be exceeded without the authorization the PM and the relevant L2 manager.

# 3.4. Reporting to USCMSSC Project Management

The US CMS group at Vanderbilt University will report all USCMSSC related expenditures and labor charges together with associated technical progress in each item of work in the PMAP regardless of the specific nature of the funding support. This detailed reporting will be done on a quarterly basis through the L2 Manager to the USCMSSC PM and thence to the US DOE-NP regional operations office. Any request for variance from the base cost must be immediately reported to the L2 manager. Any significant variance in schedule from the base schedule must be immediately reported to the USCMSSC PM through the L2 manager.

The US CMS group at Vanderbilt University agrees to furnish complete documentation of the quality control and the performance tests that are carried out for USCMSSC. Further, the institution agrees to furnish accurate documentation of all software that it provides to the USCMSSC project in electronic format. Submission to CMS document server will be used whenever possible. This includes design documents, source code, user and programming guides and test documents.

The US CMS group at Vanderbilt University agrees, with this document, to set up and maintain a ledger of a form compatible with the one used by USCMSSC project management. The Institution agrees to provide and maintain this ledger so as to provide timely information to the L2 Manager, the USCMSSC project office, and the US DOE-NP operations office.

# 3.5. Collaboration with Other Groups and Institutions

Design, implementation and installation related to USCMSSC will be carried out in close communication and collaboration with other groups working on this and related subsystems.

# 4. Contribution of the US CMS group at Vanderbilt University (as host institution)

Subject to adequate funding by DOE-NP the US CMS group at Vanderbilt University will provide support for the scientific and technical personnel as indicated in section 2 during this period of performance. By this MOU VU agrees to provide the services of the responsible financial officer. Standard practices used at VU for cost accounting will be applied to the USCMSSC project activities by US CMS group at Vanderbilt University.

# 4.1. Effort

Subject to adequate funding by DOE-NP the US CMS group at Vanderbilt University will provide support for the scientific and technical personnel as indicated in section 2. This contribution refers only to support provided outside the USCMSSC project.

# 4.2. Services

The support services of the US CMS group at Vanderbilt University will be available to the USCMSSC project to the degree required to carry out the responsibilities of the US CMS group at Vanderbilt University.

# 4.3. Facilities and Equipment

Vanderbilt University facilities and equipment will be made available to the USCMSSC project to the degree necessary to carry out the design, implementation, integration, commissioning and operation responsibilities of the group.

# 4.4. Operating Costs

VU, subject to the availability of funds from DOE-NP, will support the normal research operating expenses (such as physicists' salaries, travel expenses, miscellaneous supplies, administrative support, etc.) of the CMS group working on the USCMSSC project. Tracking of the US CMS group at Vanderbilt University will be done using appropriate effort reporting codes.

# 5. Costs and Funding

The cost of developing the Vanderbilt Tier-2 project is covered under the PMAP document submitted to the US DOE-NP in August 2010. These project funds will be provided over the lifetime of the project. The US CMS group at Vanderbilt University agrees not to exceed the costs shown in the PMAP subject to the procedures given in section 3.3.

Before the beginning of each US fiscal year, the US CMS group at Vanderbilt University will provide to USCMSSC project at Fermilab an estimate of the tape storage requirements for that year to be incurred by the nuclear physics research program. The USCMSSC project will then provide estimates of the costs of meeting those requirements, including tape media, tape storage devices, and operating expenses. Upon mutual agreement of the USCMSSC project manager and the Vanderbilt Tier-2 project manager, these costs will be invoiced to Vanderbilt University, to be paid out of the Vanderbilt Tier-2 project funds as designated in the PMAP.

All equipment items bought using DOE-NP funds at both Vanderbilt University and Fermilab will be properly marked as the property of DOE-NP.

#### 6. General Considerations

#### 6.1. Facility Operations

The US CMS group at Vanderbilt University shall be responsible for assuring the operation of the USCMS Tier-2 computing facilities and for assuring acceptable deployment of CMS specific and Grid related software packages at those facilities. Responsibilities include system administration and installation, maintenance, verification and local site support for grid middleware, authorization, authentication and accounting infrastructure, and security incident response. Facilities are expected to follow current best practices for site administration and security infrastructure.

The USCMSSC at Fermilab agrees to receive raw data from the CMS detector during heavy ion beam operations at the LHC, archive that data to appropriate tape storage systems, and make that data available for transfer to the Tier-2 site operated by the US CMS group at Vanderbilt University. External network connections between Fermilab and Vanderbilt, and internal network connections at each site, will be maintained and monitored appropriately by USCMSSC at Fermi lab and Vanderbilt University to assure that the data transfers are accomplished satisfactorily.

Working with USCMSSC, all CMS related software products should be deployed by US CMS group at Vanderbilt University in a timely manner. The US CMS group at Vanderbilt University, working with the USCMSSC, agrees to provide support for the system for the duration of the project according to service level agreements to be subsequently defined. US CMS group at Vanderbilt University agrees to provide a high level of reliability and availability for the system. Any outage or abrupt maintenance shutdown shall be recorded and analyzed to minimize future disruptions. Adequate notices must be given to USCMSSC for routine maintenance and upgrades.

The priority for the utilization of the project supported hardware resources are subject to negotiations between the USCMSSC project and the Tier-2 site managers. All members of the US-CMS physics community are expected to have the right to utilize site resources. However, preference for underutilized computing resources at the Vanderbilt Tier-2 site shall be given to other DOE-NP program users as the discretion of the DOE-NP Science Office.

# 6.2. Software Engineering Practices

The US CMS group at Vanderbilt University agrees to implement adequate level of software quality assurance and software configuration management procedures for software delivered to the USCMS project. Software developers from the US CMS group at Vanderbilt University agree to familiarize themselves with standard software engineering best practices and to adhere to them. All major components will undergo appropriate validation testing.

# 6.3. Software Design and Implementation Guidelines

The principal investigator at US CMS group at Vanderbilt University, Prof. Charles F. Maguire, is responsible for implementing software design and coding guidelines that is compatible with the CMS code and design rules and guidelines.

# 7. Schedules and Milestones

US CMS group at Vanderbilt University will make every effort to carry out their institutional responsibilities consistent with the schedule for the USCMSSC infrastructure development effort. These schedules may have to be changed as the project progresses. The US CMS group at Vanderbilt University will notify the USCMS project office any significant changes to scope, cost and schedule that might affect the USCMS project as soon as possible. These changes must be documented in writing and communicated through the L2 manager and must be approved by the USCMSSC PM.

# 8. Summary of Work Done at US CMS group at Vanderbilt University

The objective of the work done at the US CMS group at Vanderbilt University Tier-2 center is to implement an important component of the computing infrastructure for CMS. The technical personnel from US CMS group at Vanderbilt University will collaborate with personnel at the USCMSSC Tier-1 center at Fermilab and other Tier-2 centers to deploy a robust computational grid to conduct at the Vanderbilt Tier-2 center physics data event reconstruction, data analysis and simulation for CMS experiment. They will also execute various support tasks related to analysis software, quality assurance and user and developer support.

# 9. References

- 1. U.S. CMS Software and Computing Project Management Plan, version 2.07, August 2001, revised February 2004
- 2. Project Management and Acquisition Plan for the Vanderbilt Tier-2, submitted to the US DOE-NP in August 2010
- 3. U.S. CMS Research Program Proposal [Should have the CMS-HI equivalent too]
- 4. Open Science Grid consortium. http://www.opensciencegrid.org/
- 5. LHC Computing Grid Project, http://lcg.web.cern.ch/LCG/home/main.htm

# **10.** Change Log of USCMSSC and VU MOU

VersionIssue DateConcurrenceDescription of Change
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1.0   HM   Original	1.0	HM	Original
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#### 11. Makers and Concurrence

The following persons concur in the terms of this Memorandum of Understanding. These terms will be updated as appropriate in Amendments to this Memorandum.

Makers of this Memorandum:

Lothar A T Bauerdick Project Manager U.S. CMS Software and Computing	(date)	Professor Charles F. Maguire, Principal Investigator and Tier-2 Proj VU	(date) ect Manager
Ken Bloom L2 Manager U.S. CMS Software and Computing	(date)	Professor Robert Scherrer, Chair, Department of Physics & Astro VU	(date) onomy,
Bob Cousins Deputy Research Program Manager U.S. CMS	(date)	Professor Carolyn Dever, Dean, School Art and Sciences VU	(date)
		Professor Dennis Hall, Vice Provost for Research Dean of the Graduate School VU	(date)
Concurrence:			
Hugh Montgomery Associate Director, Fermilab Chair, USCMSSC Project Management	(date) Group		
Dan Green USCMS Research Program Manager Fermilab	(date)		
Signed copy sent to:			

Lucas Taylor, CPT Resource and Planning Manager