

**Fermilab**

## **TECHNICAL SCOPE of WORK**

Between

The Minos Collaboration

and

The Fermilab Computing Sector

for

Support of Computing used in the Operation of the Minos Experiment

May 26, 2015

Version 1.0

### **Abstract:**

This document is the Technical Scope of Work (TSW), formerly known as a Memorandum of Understanding (MOU), between the Fermilab Computing Sector (CS) and the Minos collaboration for support of the Computing Systems used by the Minos experiment. This document is intended to clarify the roles and responsibilities of the two parties in supporting the computing resources based upon the requirements agreed to at the time of publication.

## Table of Contents

1	Introduction.....	4
1.1	Overview of Computing Sector Support.....	5
1.2	Overview of Minos Experiment Services and Activities.....	5
2	Core Computing Services.....	6
2.1	Authentication and Directory Services.....	6
2.2	Backup and Restore.....	6
2.3	Central Web Hosting.....	6
2.3.1	Apache Central Web Server - Shared Virtual Host.....	6
2.4	Data Center Services.....	6
2.5	Database Hosting.....	6
2.5.1	MySQL.....	7
2.6	Desktop Services.....	7
2.7	Email.....	7
2.7.1	Mail Lists.....	7
2.8	Enterprise Support Services.....	7
2.9	Network Services.....	7
2.10	Networked Storage Hosting.....	11
2.10.1	Bluearc.....	11
2.10.2	AFS.....	11
2.11	Service Desk.....	11
2.12	Video Conferencing.....	11
3	Scientific Computing Services.....	12
3.1	Engineering and Electronics.....	12
3.2	Grid and Cloud Computing.....	12
3.2.1	Grid Responsibilities.....	12
3.2.2	FermiGrid.....	13
3.2.3	FermiCloud.....	13
3.2.4	GridFTP.....	14
3.2.5	Accounting Service.....	14
3.2.6	Jobsub.....	14
3.2.7	FIFEMON.....	14
3.3	GPCF.....	14
3.4	PREP.....	14

3.4.1	Prep Logistics .....	14
3.4.2	PREP Electronics.....	14
3.5	Scientific Collaboration Tools .....	15
3.5.1	Experiment Collaboration Logbook (ECL).....	15
3.5.2	Redmine.....	15
3.5.3	CVS/Subversion/GIT .....	15
3.5.4	UPS/UPD .....	15
3.5.5	CVMFS .....	15
3.5.6	Build Service .....	15
3.6	Control Room .....	15
3.7	Data Acquisition (DAQ) .....	16
3.7.1	<i>Minos</i> Detector Computing Systems:.....	16
3.7.2	SLA and deviations.....	16
3.7.3	Computing Sector responsibilities .....	16
3.7.4	<i>Minos</i> responsibilities.....	16
3.7.5	Joint responsibilities.....	16
3.8	Scientific Data Management.....	17
3.8.1	SAM .....	17
3.8.2	IFDH .....	17
3.8.3	File Transfer Service (FTS).....	17
3.9	Data Movement and Storage .....	17
3.9.1	Overview .....	17
3.9.2	dCache .....	17
3.9.3	Enstore.....	17
3.10	Scientific Database Applications .....	17
3.11	Offline Processing Operations Service .....	17
3.12	Scientific Frameworks.....	17
3.13	Simulation Software.....	18
4	Miscellaneous.....	18
5	Document Revision History.....	18
6	Service Level Agreements .....	19

## 1 Introduction

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This document is the Computing Sector – Minos Technical Scope of Work (TSW) that describes in more detail than the Minos –Fermilab TSW, the responsibilities of the Fermilab Computing Sector (CS) and the Minos collaboration personnel for computing services used by the Minos experiment.

This document applies both to the Minos and Minos Plus experiments. For the sake of brevity, the term Minos used hereafter applies to both experiments.

The TSW:

- Will be reviewed on a yearly basis by all the parties to the agreement and amended as requirements change.
- Shall be valid until the end of data analysis for the Minos experiment.
- Shall cover the long-term computing needs of the experiment including any data preservation needs.
- Shall reflect the computing requirements provided each year in the Computing Sector Strategic and Tactical plans and the SPPM, to which the Minos experiment provides substantial input.
- Shall refer to the requirements for computing capacity and hardware covered in separate Minos Computing Requirements documents.
- Shall not include activities funded under the Minos experiment project funds.
- Shall not include activities or equipment funded with PPD funds

The following organizational units are involved in support activities under this TSW:

- The Computing Sector (CS), including the Office of the Chief Information Officer (OCIO), the Core Computing Division (CCD), and the Scientific Computing Division (SCD).
- The Minos Collaboration. Minos Batch/Simulation/Core Computing group, Minos online/data acquisition group, the Minos Analysis Coordinator and the Minos physics analysis groups.

**Contacts:**

- Minos: Computing Sector Liaison to the Minos collaboration (Arthur Kreymer )
- Computing Sector: Service Level Manager, OCIO (Brian Mckittrick)

## 1.1 Overview of Computing Sector Support

Computing Sector service support is provided as specified in the *FNAL Foundation Service Level Agreement (SLA)*, which applies to all Computing Sector supported services, except as amended by service-specific Service Level Agreements (SLAs). It is important to note that in general:

- Computing Sector support is provided on an 8x5 basis unless otherwise specified and agreed.
- Additional Service Level Agreements apply for specific services (such as Networking, Database, Grid and Cloud Computing, Storage, Engineering, etc.). These additional SLAs are published in the Service Level Management (subtopic of ITIL Processes and Functions) topic in CD-DocDB.
- All services provided by the Computing Sector are managed through the Computing Sector Service Desk (<http://servicedesk.fnal.gov/>, or 630-840-2345).

In the event of issues with any service, Minos collaboration personnel shall utilize the Service Desk interface to report any issues. For off hours (outside of the standard 8x5 business hours of Monday-Friday, 8AM to 5PM), the support escalation procedure is to telephone the service desk at 630-840-2345 and select the option to page the on-call service desk personnel.

Computing at Fermilab is governed by the *Fermilab Policy on Computing* (<http://security.fnal.gov/policies/cpolicy.html>) This policy covers all Fermilab-owned computers and any computer, regardless of ownership, when it is connected to the Fermilab network (and/or showing a Fermilab address).

Significant Computing Sector change and maintenance activities shall be coordinated with the Minos collaboration. Similarly, the collaboration shall advise and consult with the Computing Sector prior to performing activities that might result in unusual usage patterns or impose unusually large loads on computing systems.

## 1.2 Overview of Minos Experiment Services and Activities

The details of the Minos systems are documented in *The Minos Technical Design Report (TDR)* (<http://minos-docdb.fnal.gov/cgi-bin/ShowDocument?docid=337>) Below we summarize the major points to provide a context for the set of services that require operational support.

The Minos experiment is in a mature phase and it is not anticipated that substantial changes will be made to the existing model and procedures. It is acknowledged that the computing models for many of the Intensity Frontier experiments will have significant similarities, and that leveraging those similarities to provide for common solutions is in the best interests of Computing Sector and Minos. Both parties will seek to identify and exploit such opportunities.

The data flows and computing model for Minos is well established. Raw data is stored on disk and tape at Fermilab and primary reconstruction of this data occurs on the General Purpose (GP) Grid Cluster at Fermilab. Production output is stored on disk and archived to tape. The reconstructed data is read from disk and further processed and reduced on the FermiGrid GP cluster to produce analysis datasets. These are stored on disk at Fermilab and backed-up to tape. All data through this phase is cataloged in SAM with appropriate metadata. Physicists use the combined interactive and batch services available on the MINOS cluster and the GP cluster as well as other FermiGrid resources. Additional disk

storage that is accessible from the Minos cluster and GP Grid cluster are needed to support this analysis activity. All datasets of current interest reside on disk, with tape used only for long term archival. The data processing capacity and data rates are based on experience for the last 10 years.

## 2 Core Computing Services

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### 2.1 Authentication and Directory Services

The Minos collaboration will utilize the standard Authentication and Directory Services offerings:

- Kerberos Authentication Services
- Services Domain Authentication Services

These services will be provided under the standard Authentication and Directory Services SLA.

### 2.2 Backup and Restore

The Minos collaboration will utilize the standard Backup and Restore Services.

### 2.3 Central Web Hosting

The Minos collaboration has its main web pages on the standard Central Web Hosting Services and these will be supported.

#### 2.3.1 Apache Central Web Server - Shared Virtual Host

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This SLA provides

24x7 availability (99.2% uptime)

Offering Support Availability: 8x5 Monday through Friday,

8 AM – 5 PM U.S. Central Time not including Fermilab work holidays

The Minos collaboration has the following websites covered by this SLA

<http://www-numi.fnal.gov>

<http://nusoft.fnal.gov/minos>

<http://minos.fnal.gov>

### 2.4 Data Center Services

The Minos collaboration will utilize the standard Data Center Services.

### 2.5 Database Hosting

The Minos collaboration utilizes the Standard Database Hosting Services

Databases at the Far Detectors site are not supported by the Fermilab Computing Sector. The requirements for supporting the Far Detector database service are managed by the Minos project.

There is one database accessed directly by the experiment, the Conditions database

### 2.5.1 MySQL

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Conditions data recording configuration – beam parameters, detector calibrations, detector alignment, etc.

## 2.6 Desktop Services

The Minos collaboration will utilize the standard Desktop Services

## 2.7 Email

The Minos collaboration will utilize the standard FermiMail Email Services.

### 2.7.1 Mail Lists

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The Minos collaboration will utilize the standard FermiMail Mail List (LISTSERV) Services

## 2.8 Enterprise Support Services

The Minos collaboration will utilize the standard Enterprise Support Services including support for an instance of the document management system (DocDB) for use by Minos. DocDB is critical to Minos operations. 24x7 service availability with 8x5 service support is requested.

## 2.9 Network Services

The Far detector LAN at Soudan and the Near detector LAN at Fermilab have been configured and installed by the Fermilab network group. The strategy for the Soudan LAN support is to incorporate the operation and management into the Fermilab campus network support effort. The Fermilab policy that defines the campus network as a restricted central service is extended to include the local network at Soudan. The Minos collaboration will utilize the standard network services together with the following enhanced services:

- Configuration, monitoring and support of the network switches deployed at Minos Far and Near detectors
- Configuration and monitoring of the site connections for Minos Far and Near Detectors
- Configuration and monitoring of the WAN connections for Minos Far Detector
- Configuration of public IPv4 address blocks with mapping to the fnal.gov and minos-soudan.org domains
- Configuration of private VLANs in support of the Minos DAQ
- Configuration of Access Control Lists for Minos Far and Near Detector LANs
- Configuration, monitoring and support of DNS, NTP and DHCP services utilized by Minos collaboration
- Access to the shared pool of “cold” spares for replacing failed hardware and hardware components deployed for Minos networks
- Maintain a dedicated pool of hardware spares for Minos if requested and corresponding funds are provided

The supported devices for the Minos network are listed in Table 1 and the Support levels for the enhanced services are listed in Table 2 below.

**Table 1. Network switches supported for the Minos experiment**

<b>Service Area: Network</b>		
<b>Use</b>	<b>Responsible</b>	<b>Devices</b>
Minos Near Detector DAQ	Fermilab Network Group	r-minos-nd-1, s-minos-surface-1
Minos Far Detector DAQ	Fermilab Network Group relying on the University of Minnesota support at Soudan Mine	r-s-soudan-1, s-soudan-{1,2}, s-soudan-daq-1, s-soudan-daqspare1, s-soudan-south-{1,2}, t-uplogix-soudan, s-soudan-daqmgmt-1
Pseudo-Wires WAN	Fermilab Network Group relying on ESnet and the University of Minnesota support	r-s-bdr,r-s-bdr-2,r-s-soudan-1

**Table 2. Network support levels for the Minos experiment**

<b>Service Area: Network</b>	<b>Service Level Commitments</b>				
	<b>Service Availability Schedule</b>	<b>Support Availability</b>	<b>Incident Response</b>	<b>Incident Resolution</b>	<b>Request Response</b>
The Minos Far and Near Detector Network LAN infrastructure	24x7	24x7	Foundation	Foundation	Foundation
End System Connections	24x7	8x5	Foundation	Foundation	Foundation
Wireless LAN	N/A	N/A			
Minos Far/Near Detector VLANs	24x7	8 x5	Foundation	Foundation	Foundation
Primary WAN pseudo-wire	24x7	24x7	Map to Foundation High	Foundation	Foundation
Secondary WAN pseudo-wire	24x7	8x5	Foundation	Foundation	Foundation
DNS, NTP servers	24x7	24x7	Map to Foundation High	Foundation	Foundation
ACL configurations and updates	24x7	8x5	Foundation	Foundation	Foundation

The Foundation SLA/OLAs agreement is described in CS-DocDB-4042. More details on Network Services SLA are described in CS-DocDB-4312.

- Minos is responsible for notifying Fermilab about changes to Minos’s requirements or new computing deployments as early as possible. Minos should be aware that significant lead-time may be necessary should there be a need to change an existing service or current infrastructure to accommodate a change in the Minos's needs.
- Minos is responsible for providing a single point of contact that Network Services will be using for scheduling network maintenance or any other work that could affect and potentially disrupt Minos Network Services.
- Minos is responsible for providing a single point of contact that Network Services will be using for emergency communication.

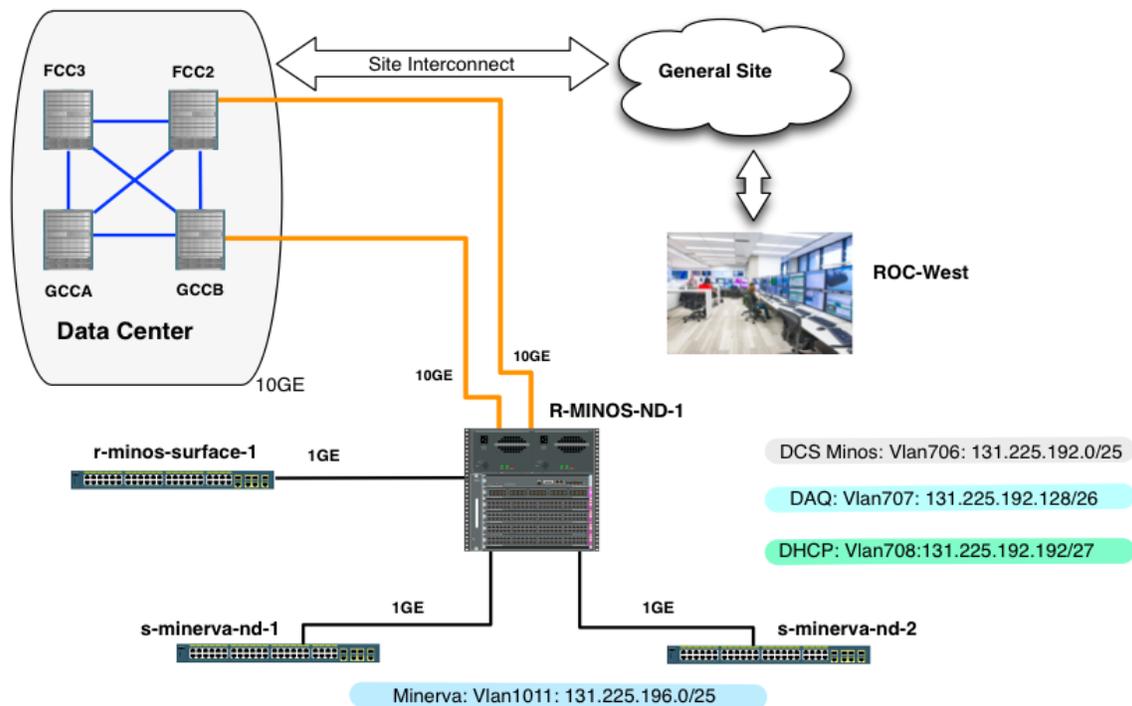


Figure 1: Minos Near Detector Network

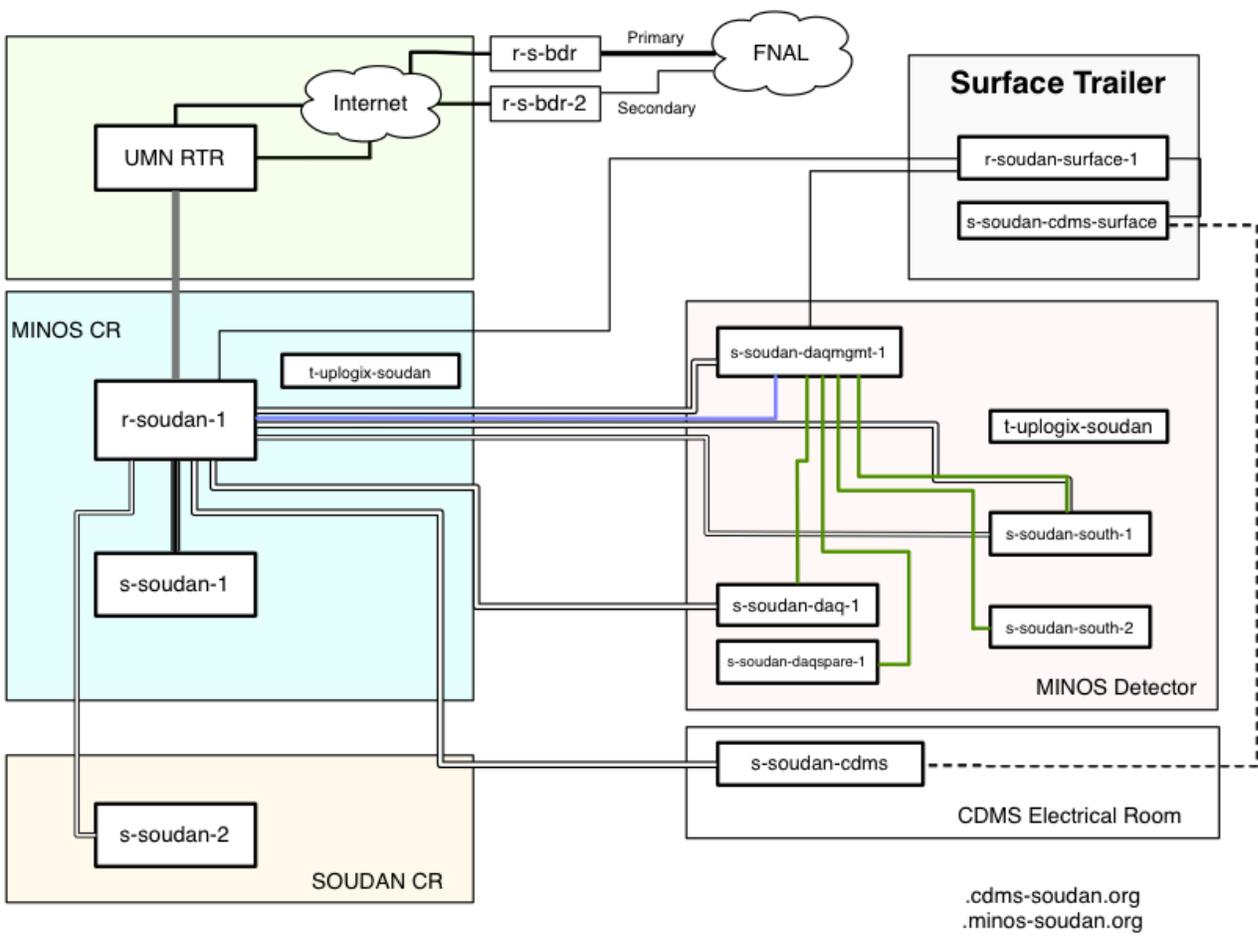


Figure 2: Minos Far Detector Network

## 2.10 Networked Storage Hosting

The Minos collaboration will utilize the standard Networked Storage Hosting Services listed below

### 2.10.1 Bluearc

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The Minos collaboration uses the following BlueArc volumes.

The app areas for for code development and local access at Fermilab.

The data areas are for volatile Project files, primarily accessed from Fermilab.

All permanent managed data goes into the dCache/Enstore described elsewhere.

- blue2:/minos/data2
- blue3:/nusoft/data
- if-nas-0:/minos/app
- if-nas-0:/nusoft/app
- blue2:/fermigrid-fermiapp
- blue2:/fermigrid-data

### 2.10.2 AFS

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Minos uses the standard (/afs/fnal.gov/files/home/\*) AFS space for the home directories of its members. It will move home directories to the new /nashome as soon as is practical.

Minos will move its web pages from /afs/fnal.gov/files/expwww/numi to /web/sites/minos.fnal.gov as soon as is practical.

## 2.11 Service Desk

The Minos collaboration will utilize the standard Service Desk Services. The Service Desk Service SLA describes the expectations and responsibilities of the customer (Minos) and the Computing Sector

## 2.12 Video Conferencing

The Minos collaboration will utilize the standard Video Conferencing Services.

- Readytalk is used for meetings
- Point to point Video is used to certify new remote shift stations

## 3 Scientific Computing Services

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### 3.1 Engineering and Electronics

The Minos collaboration is not planning to utilize the standard Engineering and Electronics Services.

### 3.2 Grid and Cloud Computing

The Minos collaboration depends on the standard Grid and Cloud Computing Services. Scientific Computing System, Scientific Data Storage and Access, and Grid and Cloud Services provide support for Minos data analysis and processing systems under the Foundation SLA with 8x5 support. The number of batch slots, experiment data storage size and performance, and common job submission and monitoring tools are provided as part of these services. The needs for each year are proposed and agreed to through the Fermilab Scientific Portfolio Management process.

Minos development of simulation, reconstruction and analysis is ongoing, and makes use of

- Grid computing resources (FermiGrid).
- Disk storage for Project areas
- Disk storage for managed data.
- Tape storage for managed data.
- Support for specialized service machines (i.e. VMs for Nearline, Calibration, OS testing, physical systems for data management )

#### 3.2.1 Grid Responsibilities

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##### 3.2.1.1.1 Computing Sector responsibilities

1. Operation and support for use of local Grid accessible resources agreed to with the collaboration.
2. Support and consulting for the use of offsite resources through the Open Science Grid.
3. Provide consultation with offline personnel from the collaboration on issues related to grid utilization.
4. Develop and provide training and documentation in the recommended use patterns of the above resources.

##### 3.2.1.1.2 Minos responsibilities

5. Validate users authorized to access Minos grid computing resources. The collaboration will further provide personnel for the roles of “Group Managers”, “Operations Contact”, “Security Contact” and “Spokesperson”, pursuant to the “Establishing Grid Trust with Fermilab” document.
6. Document the local grid and interactive computing resources required to meet the physics goals of the collaboration.

7. Ensure that Minos users are informed as to the appropriate usage patterns for all computing resources. Work with CS personnel as needed to investigate and address operational issues or utilization efficiency issues.
8. Perform job submission and data processing tasks.
9. Provide user support for job submission and job tracking, and user documentation and education on the use of Minos computing resources.
10. Provide job submission or monitoring tools that are specific to Minos.

#### 3.2.1.1.3 Joint responsibilities

11. Meet as needed to discuss operational issues affecting the use of computing systems, best practices for using the systems, user support issues, utilization strategies, or other items of mutual interest with respect to the computing systems.
12. Investigate and deploy suitable mechanisms for transferring executables, database information, etc., to remote worker nodes for the purpose of Monte Carlo generation, and for transferring generated files back to Fermilab.

### 3.2.2 FermiGrid

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The Minos collaboration uses the standard FermiGrid Services. The Minos collaboration relies on FermiGrid as the ensemble of interfaces and services to access the Fermilab computing infrastructure. The data-intensive computing activities, such as reconstruction, are run on FermiGrid and remote systems like OSG. Purely compute-intensive tasks, such as monte-carlo generation, are run on University computing facilities. CS takes responsibility to manage the ensemble of the services that allow access to the computing infrastructure at Fermilab at the level described in the SLA.

Experiments that use Grid resources must establish the appropriate Grid Trust Agreements prior to use of the Fermilab Campus Grid (FermiGrid) resources.

See <http://cd-docdb.fnal.gov/cgi-bin/ShowDocument?docid=3429>

In addition to the Fermilab Policy on Computing, specific additional policies apply to Grid computing activities on FermiGrid.

<http://fermigrd.fnal.gov/policy.html>

Further policies apply to Grid resources accessed via the Open Science Grid (OSG) collaboration. <http://www.opensciencegrid.org/>

### 3.2.3 FermiCloud

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Minos makes use of standard CS Virtualized and Cloud Services.

### 3.2.4 GridFTP

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The Minos collaboration uses GridFTP Services. For transferring the output of Grid jobs, Minos relies on a Globus GridFTP server configured to maintain both user and *group* id file ownership.

### 3.2.5 Accounting Service

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The Minos collaboration will use the standard Gratia Accounting Services.

### 3.2.6 Jobsub

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The Minos collaboration will utilize the standard FIFE Jobsub Services. JobSub is an ensemble of services to submit and manage jobs to local and remote resources. The ensemble includes a user-facing interface for job management, which encapsulates the semantic of experiment-specific use cases, job queuing and resource matching services, basic provisioning services, as well as input / output sandbox transfer service. Minos relies on this service for the submission of all jobs to resources, either local or remote, dedicated or opportunistic, public or private or commercial.

### 3.2.7 FIFEMON

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The Minos collaboration will utilize the standard FIFEmon Services. FIFEmon is the service that monitors the status of submitted jobs. FIFEmon shows the status of the jobs as they go through their lifecycle e.g. submitted, idle, running, and completed. The service allows the user to “drill down” at an increasing level of detail for those jobs of particular interest.

## 3.3 GPCF

Minos uses servers in GPCF for interactive analysis, testing batch jobs, and monitoring. The Computing Sector is responsible for operation and support of GPCF.

## 3.4 PREP

The Minos collaboration will utilize the standard PREP Services

### 3.4.1 Prep Logistics

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The Minos collaboration will utilize the standard PREP Logistics Services. PREP support is through standard replace and repair procedures with the availability of the Prep service window being 9.30am -4pm 5 days a week. All PREP loans are authorized under a TSW. Experiments sign full TSW's with the division heads organized by the Directorate Office of Program Planning. Test beam experiments do the same, save that the CS signature has been delegated by the Division head to the PREP Scientific Manager.

### 3.4.2 PREP Electronics

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The Minos collaboration will utilize the standard PREP Electronics Services

There is a TSW template for offsite loans signed by the User, PREP Scientific Manager, and Associate Director for Program Planning. Expansions beyond the “PREP list” in a TSW are normal, expected, and by negotiation. There are no explicit Service Level Agreements (SLA's). Implicit in the pool model is that working spares are available to replace failures and diagnose issues. PREP, when asked, will do whatever it can to get a running experiment that is down, back to taking data. This includes spares, replacements, and technical consulting with the Techs and managers as required.

The Minos experiment utilizes a broad array of electronics in the operation of the DAQ system and the experiment as a whole. The equipment required includes standard test and laboratory equipment (e.g., oscilloscopes, voltage meters, current load boxes, NIM crates and associated modules), basic data acquisition systems needed to interface with other laboratory systems, and Minos-specific hardware procured from outside vendors or built in-house.

### **3.5 Scientific Collaboration Tools**

The Minos collaboration will utilize the standard Scientific Collaboration Tools Services.

#### **3.5.1 Experiment Collaboration Logbook (ECL)**

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Minos will utilize the Enhanced ECL service for detector operations.

#### **3.5.2 Redmine**

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The Minos collaboration depends on the standard Redmine Services.

#### **3.5.3 CVS/Subversion/GIT**

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The Minos collaboration will utilize the standard CVS/Subversion/GIT Services. Minos code repositories are hosted through `cdcv.fnl.gov` Redmine core repository and collaboration management system.

#### **3.5.4 UPS/UPD**

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The Minos collaboration will utilize the standard UPS/UPD Services

#### **3.5.5 CVMFS**

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The Minos collaboration will utilize the standard CVMFS Services.

#### **3.5.6 Build Service**

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The Minos collaboration will utilize the standard Build Service Services

### **3.6 Control Room**

The Minos collaboration will utilize the standard Experiment Desktop Services.

The MINOS control room (CR) is co-located with other Neutrino experiments in the ROC-W on WH1W. The control room hosts standard Fermilab desktops and displays on the general laboratory network. These machines are designed and configured to be generic display stations. Any machine can perform any control room function, and no single machine is considered a critical system for operations. These control room workstations are supported under the SLA for Minos control room computing.

Wilson Hall building management provides airflow and electricity to the ROC-W. Networking provides equipment to connect computers and other devices to the network, however networking equipment relies on WH building air for cooling and WH electrical service to operate.

### 3.7 Data Acquisition (DAQ)

The Minos collaboration will utilize the standard Scientific Computing Services. These services include support for the Minos collaboration DAQ systems (OS installation and patching) and other Minos collaboration desktops

The Minos DAQ computing is configured with infrastructure to provide each system with:

- Serial console port access,
- Remote power on/off via network controllable PDUs,
- Full access (to the bios level) via keyboard/video/mouse servers that are accessible via TCP/IP.

#### 3.7.1 *Minos Detector Computing Systems:*

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- Hardware support (replacement under warranty) for approximately 10 server nodes at each site ( Near, Soudan )
- Hardware support (replacement under warranty) for support infrastructure (consoles, PDUs, etc.)
- System administration for approximately 10 SLF6 systems, including configuration management, software updates and security Patches

#### 3.7.2 *SLA and deviations*

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All computer systems will comply with Fermilab Security policies, with exemptions obtained under those policies for elements that cannot meet Baseline standards. These exemptions are usually needed only for DAQ systems, for which there are special controls.

#### 3.7.3 *Computing Sector responsibilities*

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- Installation of, updates, security and other patches for the Scientific Linux OS
- Monitoring and system administration services
- Installation and support of the PUPPET configuration management software.
- The hardware is under maintenance contract with the corresponding equipment's vendor

#### 3.7.4 *Minos responsibilities*

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- Install and support of all online application software, and Fermilab supported physics toolkits and utilities needed.
- 1. Provide schedules for deploying security patches to all systems that are consistent with Lab security policies
- Provide an expert from the collaboration who can assist system administrators.
- Since files produced by the detector DAQ systems are irreplaceable, Minos will provide enough "spool" disk area to allow for the storing of at least several days of data in case of an outage of offline data handling systems.

#### 3.7.5 *Joint responsibilities*

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Any system or support level Change planning, requests and documentation

## 3.8 Scientific Data Management

### 3.8.1 SAM

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Minos utilizes the Enhanced SAM metadata system and associated services, including the samweb client, SAM projects, and monitoring.

### 3.8.2 IFDH

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Minos utilizes the Standard IFDH file access tools.

### 3.8.3 File Transfer Service (FTS)

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Minos utilizes the Enhanced FTS file transfer services.

## 3.9 Data Movement and Storage

### 3.9.1 Overview

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Raw data is archived to Fermilab Enstore tape via dedicated Minos dCache read/write pools, sized to retain all files on disk. A second copy of raw data is written to tapes in a different building at Fermilab. We keep another copy of Far data files at the University of Minnesota. All production datasets are written to the Fermilab dCache system, with archival to tape where appropriate. All datasets of current interest are kept on disk.

### 3.9.2 dCache

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Minos utilizes the Standard dCache Storage Services, including tape backed, scratch, and persistent pool groups.

### 3.9.3 Enstore

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Minos utilizes the Standard Enstore Storage Service, including normal and Small File Aggregation services.

## 3.10 Scientific Database Applications

Minos will utilize the Standard IFBEAM database services.

Minos is being given a special, unique copy of the IFBEAM Collector files, for use by Minos legacy database applications. This service will continue through the end of Minos data taking in 2016. It is critical that the device data eventually be complete. Support for this service is best effort, 8x5.

## 3.11 Offline Processing Operations Service

Minos will utilize the Standard OPOS services for Experiment Offline Production Processing.

## 3.12 Scientific Frameworks

The Minos experiment requires support for the following packages:

- SoftRelTools as a legacy package for which no maintenance is expected

- ROOT analysis package.
- UPS/UPD

### 3.13 Simulation Software

The Minos collaboration relies on Geant and Genie for detector simulation.

## 4 Miscellaneous

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This section is reserved for miscellaneous items not covered above.

## 5 Document Revision History

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<b>Date</b>	<b>Version</b>	<b>Author(s)</b>	<b>Comments</b>
2-Apr-2014	V0.00	Keith Chadwick	Template
9-Apr-2014	V0.1	Keith Chadwick	Import Minos information from prior MOU
20-Mar-2014	V0.9	Arthur Kreymer	Revised and corrected
20-Mar-2014	V0.9	Arthur Kreymer	Revised and corrected
25-Mar-2015	V0.95	Arthur Kreymer	Cleanup
18-Apr-2015	V0.951	Arthur Kreymer	Cleanup, back to strict .docx
20-Apr-2015	V0.952	Arthur Kreymer	Better Network graphics
28-Apr-2015	V0.961	Arthur Kreymer	Per Votava, cleaned up, added OPOS
12-May-2015	V0.97	Arthur Kreymer	Updated CWS, DocDB as requested
13-May-2015	V0.981	Arthur Kreymer	Cosmetic SAM and GPCF, moved ECL to SCT removed obsolete SDM
15-May-2015	V0.99	Arthur Kreymer	Added special IFBEAM file copy

## 6 Service Level Agreements

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Service Level Agreements are located in the CS DocDB system,  
with URLs of the form

<http://cd-docdb.fnal.gov/cgi-bin/ShowDocument?docid=>

<b>Service Name</b>	<b>docid</b>
Foundation	4042
Authentication and Directory Services	4314
Backup and Restore Service	4315
Central Web Hosting	4321
IMAC Services	4773
Database Hosting	4664
Desktop Services	3716
Experiment Offline Production Processing	5418
Network Services	4312
Networked Storage Hosting	4311
Service Desk	4591
Video Conferencing	4313
Data Storage and Access	5032

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