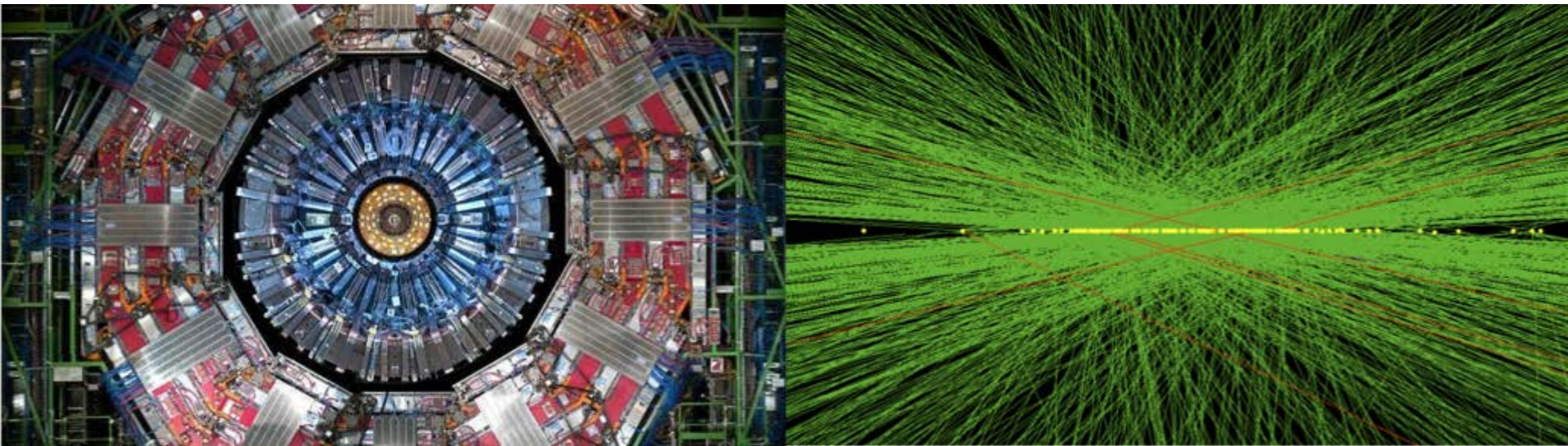




HL-LHC CMS Upgrade ES&H Plan

T.J. Sarlina, HL-LHC CMS ES&H Manager
ESH and QA Review
November 29, 2018





Biographical Sketch

- CMS Upgrade ES&H Manager (T.J. Sarlina)
 - Assistant Radiation Safety Officer for Meson Department (1979-1982)
 - Fermilab Senior Safety Officer for Research Division and Particle Physics Division (1982-2002)
 - Project Scheduler (2002-2008)
 - CDF Upgrade Project, DO Upgrade Project, Minerva, Dark Energy Camera.
 - Project Manager at Fuel Tech, Inc. (2008-2010)
 - Air Pollution Control Projects (power plants and refineries) in Hong Kong, Guangzhou, Liaoning Province. Austin, TX and Seattle, WA.
 - Associate Project Manager for ESH and QA for NOvA (2010-2014)
 - Constructed and commissioned Near Detector at Fermilab and Far Detector in Ash River, MN.
 - Fermilab Quality Assurance Manager (2014-2017)
 - Transitioned the Fermilab QA Program from consultant led to internally owned.
 - Fermilab Quality Assurance Specialist (2017-present)
 - Supporting the Fermilab QA Program under Jemila Adetunji, IERC QA Coordinator, CMS US HL-LHC ESH Manager



DOE O 413.3B Change 5 Requirements

- National Environmental Policy Act (NEPA)
 - Minimal impact
 - Categorical Exclusion issued in January 2018
 - <https://cms-docdb.cern.ch/cgi-bin/DocDB/ShowDocument?docid=13483>
- Integrated Safety Management Plan
- Preliminary Hazard Analysis Report



Integrated Safety Management Plan



CMS-doc-13395

HL-LHC CMS Detector Upgrade Project

Integrated Safety Management Plan

Fermi National Accelerator Laboratory

CMS-doc-13395

November 13, 2018



Fermi National Accelerator Laboratory Angular Snip

- Key Elements
 - Conduct work to ensure protection of workers, the public, the environment, and equipment
 - Roles & Responsibilities for ISM Implementation
 - Includes support from the Fermilab ESH&Q Section
 - Requires each institution to provide an independent ES&H contact
 - NEPA requirements have been met and resulted in a Categorical Exclusion determination

CERN DocDB # 13395



ES&H Oversight

- US CMS Project Manager has overall responsibility
- ES&H Manager works with L2 Managers to evaluate institution ES&H programs and will conduct site visits as necessary
- Level 2 Managers oversee work within their WBS
- Each university or laboratory group will demonstrate compliance with the Project ES&H requirements
- And will provide
 - Name and contact information for institutional safety contact responsible for conducting safety reviews.
 - Institutional list of ESH Contacts **CERN DocDB # 13605**



Major Work or Assembly Sites per WBS

WBS #	WBS Description	Facilities
402.02.03	Outer Tracker: Sensors	Brown, Rochester, Fermilab
402.02.04	Outer Tracker: Electronics	Fermilab, Princeton, Rutgers
402.02.05	Outer Tracker: Modules	Brown, Fermilab, Princeton, Purdue, Rutgers
402.02.06	Outer Tracker: Mechanics	Fermilab
402.02.07	Outer Tracker: Integration	Fermilab
402.04.03	Endcap Calorimeter: Sensors	Brown, Fermilab, Texas Tech
402.04.04	Endcap Calorimeter: Modules	Carnegie Mellon, Texas Tech, UC Santa Barbara
402.04.05	Endcap Calorimeter: Cassettes	Fermilab
402.04.06	Endcap Calorimeter: Backing Hadronic	Fermilab, FSU, Maryland, NIU, Rochester
402.04.07	Endcap Calorimeter: Electronics and Services	Fermilab, Minnesota
402.06.03	Trigger / DAQ: Cal Trigger	Wisconsin
402.06.05	Trigger / DAQ: Correlator Trigger	Wisconsin
402.06.06	Trigger / DAQ: DAQ	Fermilab, CERN
402.08.03	Timing Layer: Barrel Timing Layer	Virginia, Caltech, KSU, CERN
402.08.04	Timing Layer: Endcap Timing Layer	Fermilab, Nebraska, Kansas



Institutional ES&H Contacts (partial list)

Institution	PI (email) phone	ES&H Responsible
U. of Nebraska Lincoln	FP: Ken Bloom (kenbloom@unl.edu) MTD: Frank Golf (Frank.Golf@cern.ch)	Brenda Osthus (Bosthus1@unl.edu) 402-472-4927
U. of Kansas	FP: Alice Bean (abean@ku.edu) MTD: Chris Rogan (christophersrogan@gmail.com)	Michael Lemon (mlemon@ku.edu) 785-864-2851
Kansas State	FP: Andrew Ivanov (Andrew.Ivanov@cern.ch) MTD: Yurii Maravin (yurii.maravin@cern.ch)	Christina M. Aguilera (cmaguilera@ksu.edu) 785-532-4297
UCSB	FM: Jeffrey Richman (richman@hep.ucsb.edu) MTD: David Stuart (stuart@physics.ucsb.edu) EC: Joeseeph Incandela (Joseph.Incandela@cern.ch)	Alex Moretto (amoretto@ucsb.edu) 805-893-4899
U. of Minnesota	EC: Jeremiah Mans (jimmans@physics.umn.edu) BC: Roger Rusack (rusack@physics.umn.edu)	Brian Andersson (ander213@umn.edu) 612-624-6584
Rutgers	TD: Eva Halkiadakis (evahal@rutgers.edu) OT: Yuri Gershtein (gershtein@physics.rutgers.edu)	Steve Schnetzer (steves@physics.rutgers.edu) 848-445-8975
U. of Wisconsin	FM: Kevin Black (kblack@buphy.bu.edu) TD: Sridhara Dasu (dasu@hep.wisc.edu)	Paul Umbeck (paul.umbeck@wisc.edu) 608-262-9739
U. of Virginia	BC: Robert Hirosky (bob.hirosky@gmail.com) MTD: Chris Neu (chris.neu@virginia.edu)	Thomas Leonard (rtl5p@virginia.edu) 434-982-4911
Brown	OT: Meenakshi Narain (narain@hep.brown.edu)	Linda Olmsted (linda_olmsted@brown.edu) 401-863-7697
Caltech	MTD: Maria Spiropulu (smaria@caltech.edu)	Jason Trevor (trevor@hep.caltech.edu) 626-395-6560
Carnegie Mellon	EC: Manfred Paulini (paulini@heps.phys.cmu.edu)	Barry Luokkala (luokkala@cmu.edu) 412-268 2756
Florida State University	EC: Todd Adams (tadams@fnal.gov)	Thomas L. Jacobson (TJacobson@admin.fsu.edu) 850-644-7687
Princeton	OT: Daniel Marlow (marlow@princeton.edu) MTD: Christopher Tully (cgtully@princeton.edu) TD: Isobel Ojalvo (iojalvo@princeton.edu)	Geoff Gettelfinger (gettelf@princeton.edu) 609-245-4404
Texas Tech Univeristy	EC: Nural Akchurin (nural.akchurin@ttu.edu)	Matt Roe (Matt.Roe@ttu.edu) 806-742-3876



Balanced Priorities

- The ES&H program is fully integrated into the Project with safety having the same priority as cost and schedule
- Hazards will be evaluated and mitigation strategies will be put in place to keep employees and equipment safe and to protect the environment
- Every person engaged in Project activities has the responsibility and authority to stop work when they believe the activity they are involved in, or observe, is unsafe
- ES&H concerns will be brought to the attention of the appropriate L2 Manager, the ESH Manager, and the Project Manager
- Incidents resulting in personnel injuries or significant equipment damage may result in a formal work stop



ES&H Expertise

- Fermilab ESH&Q Section will provide subject matter experts
 - R. Lewis: Particle Physics Division – Division Safety Officer (DSO)
 - PPD DSO is responsible to complete Occurrence Reporting and Processing System (ORPS) or Computerized Accident Incident Reporting System (CAIRS) reports
 - Additional personnel available on an as-needed basis if other expertise required (FESHCom Subcommittees)
- Independent University ES&H personnel will be involved at all production and testing sites
- CMS ESH Manager will work with CERN LEXGLIMOS (Large Experiment Group Leader in Matters of Safety)
- Integration, installation and commissioning stages at CERN will be covered by CERN ES&H personnel



Codes and Standards

- Code requirements may vary between the United States and CERN
- This is not expected to present a problem due to the fact that Fermilab has had significant involvement with CMS over time, is aware of CERN requirements, and has provided equipment to CERN in the past
- CERN code and standard compliance is evaluated as part of the standard review cycle
- Should questions arise, discussion of deliverable requirements will be coordinated primarily between the Level 2 Managers and CERN personnel



PRELIMINARY HAZARD ANALYSIS REPORT



CMS-doc-13394

HL-LHC CMS Detector Upgrade Project Preliminary Hazard Analysis Report

HL-LHC CMS Detector Upgrade Project

Preliminary Hazard Analysis Report (pHAR)

Fermi National Accelerator Laboratory

CMS-doc-13394

November 11, 2018



- Covers design, prototyping, pre-production, and testing at U.S. institutions
- Proactive identification of project hazards and plans for mitigation
- Hazards are typical of those expected during detector upgrades

CERN DocDB # 13394



pHAR Hazard Summary

WBS Number	WBS Description	Mechanical Hazards	Leak & Spill Hazards	Electrical Hazards	Fire Hazards	Oxygen deficiency and CO ₂ toxicity Hazards	Cryogenic Hazards	Laser Hazards	Radiation Hazards	Flammable Material	Toxic Material Hazards	Environmental Hazards	ESD Hazards
402.01	Management: Management support												
402.02.03	Outer Tracker: Sensors			X	X				X				X
402.02.04	Outer Tracker: Electronics			X	X				X	X			X
402.02.05	Outer Tracker: Modules	X	X	X	X				X				X
402.02.06	Outer Tracker: Mechanics	X		X	X	X	X			X	X	X	
402.02.07	Outer Tracker: Integration	X		X	X	X	X						X
402.04.03	Endcap Calorimeter: Sensors	X	X	X	X				X	X			X
402.04.04	Endcap Calorimeter: Modules	X	X	X	X				X	X			X
402.04.05	Endcap Calorimeter: Cassettes	X		X	X	X	X		X	X	X		X
402.04.06	Endcap Calorimeter: Backing Hadronic				X			X	X	X		X	
402.04.07	Endcap Calorimeter: Electronics and Services			X	X				X	X			X
402.06.03	Trigger / DAQ: Cal Trigger			X	X					X			X
402.06.05	Trigger / DAQ: Correlator Trigger			X	X					X			X
402.06.06	Trigger / DAQ: DAQ												
402.08.03	Timing Layer: Barrel Timing Layer	x		X	X	X	X		X	X			X
402.08.04	Timing Layer: Endcap Timing Layer	X		X	X	X	X		X	X			X



pHAR Hazard Summary

- Mechanical (Cranes, Rotating equipment)
- Leaks and Spills (Oils, solvents, chemicals)
- Electrical (Shock, Arc flash)
- Fire
- ODH/CO₂ (ODH Class 0 at SiDet)
- Cryogenic (CO₂)
- Lasers
- Radiation (Sources)
- Flammable Materials
- Toxic Materials (Solvents, glues, epoxies)
- Environmental (Oils, solvents, chemicals)
- ESD (Electrostatic Discharge Damage)



pHAR Hazard Analysis Worksheets

CMS Upgrade Project Preliminary Hazard Analysis Report v1.8

Attachment A

Hazard Analysis Worksheets

HAZARD: Electrical

HAZARD INITIATOR: Contact with energized equipment, electrical shock/arc flash from exposed conductors, defective equipment, substandard equipment, improper procedure.

HAZARD CONSEQUENCE: Personnel injury, equipment damage, program delay.

COMMENTS: Both commercially available and custom designed equipment will be used for sensor and electronics testing.

RISK ASSESSMENT PRIOR TO MITIGATION

CONSEQUENCE High Moderate Low Minimal

PROBABILITY Likely Occasional
 Probable Remote

RISK Critical High Moderate Low Minimal

MITIGATING FACTORS (DESIGN)

- All equipment meets applicable NEC and NEMA codes and FNAL safety requirements.



Hazard Codes (From QAM 12030)

HAZARD SEVERITY (CONSEQUENCE):

Critical High Medium Low Minimal

MISHAP PROBABLILITY (Could occur once in):

Annual 2 years 10 years 30 years 100 years

RISK ASSESSMENT CODE:

Critical High Medium Low Minimal



pHAR Worksheets

- The current Hazard Consequence listings on the worksheets use outdated ratings and don't align with QAM 12030
- The Project does not have any Critical ratings on any of the Hazard Analysis Worksheets
- The preliminary HAR but will be updated to reflect the current QAM 12030 ratings prior to the CD-1 mini-Review, currently scheduled for February 2019



Summary

- ES&H resources have been assigned with defined roles and responsibilities
- We have established the hierarchy of ES&H controls to participating institutions
- We have met the requirements of 413.3B to conduct NEPA review and have both an ISM Plan and a preliminary HAR
- We have addressed the comments from the previous review
- We are ready for the Director's Review and the DOE CD-1 mini-Review in the coming year