



# Executive Session Kickoff

Joe Lykken, Mike Lindgren

CMS HL-LHC CD-1 Readiness Directors' Review

March 19<sup>th</sup>, 2019

# Executive Session Kickoff of the CMS HL-LHC CD-1 Readiness Directors Review

08:00 - 09:00

## Executive Session

*Zoom information:*

*Join Zoom Meeting*

*<https://fnal.zoom.us/j/348461954>*

*One tap mobile*

*+16465588656,,348461954# US (New York)*

*+16699006833,,348461954# US (San Jose)*

*Dial by your location*

*+1 646 558 8656 US (New York)*

*+1 669 900 6833 US (San Jose)*

*Meeting ID: 348 461 954*

*Find your local number: <https://zoom.us/u/abaRB468V9>*

Convener: Michael Lindgren (Fermilab)

Location: Fermilab ( Comitium (WH2SE) )



# Building for Discovery

Strategic Plan for U.S. Particle Physics in the Global Context

Report of the Particle  
Physics Project  
Prioritization Panel (P5)

**Recommendation 10:** Complete the LHC phase-1 upgrades and continue the strong collaboration in the LHC with the phase-2 (HL-LHC) upgrades of the accelerator and both general-purpose experiments (ATLAS and CMS). **The LHC upgrades constitute our highest-priority near-term large project.**

- Fermilab is committed to the success of the P5 plan
- Fermilab is committed to the integrity of the P5 priorities
- In particular, Fermilab is committed to, and takes responsibility for, the success of the U.S. CMS HL-LHC Upgrades, both as a DOE project and as an essential contribution to an international scientific endeavor

# Schedule context from the charge

A shutdown of the LHC accelerator complex is planned to begin in 2024, which will result in the LHC delivering much higher luminosities than the current running conditions in the period from 2026-2035. The new operating conditions require upgrades to the aging CMS tracker system, the barrel and the end-cap calorimeters and associated readout electronics, the muon system readout electronics and the trigger and data acquisition system, as well as the installation of a new timing detector.

# Previous review context from the charge

The U.S. CMS HL-LHC upgrade comprises both NSF and DOE projects. The NSF project is reviewed separately. The DOE project was comprehensively reviewed in June 2018, and the Tracker, Endcap Calorimeter and Trigger/DAQ subsystems were deemed to be at a CD-1 level of maturity. However, the MIP Timing Detector was considered not mature enough to proceed to CD-1. The DOE review committee further pointed out some of the project documentation needed to be updated, especially in the ESH and QA areas.

# Review Team

## Project Management

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## Cost/Schedule

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## ES&H

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## Outer Tracker

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## End Cap Calorimetry

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## Trigger-DAQ

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## MTD

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\*Subcommittee chair



# DOE Critical Decision 1

		TOTAL PROJECT COST (TPC)	\$750M or more	Less than \$750M to \$400M	Less than \$400M to \$100M	Less than \$100M to \$50M*	Less than \$50M* to \$20M	Less than \$20M to \$10M**
<b>DECISION / REQUIREMENTS<sup>1</sup> / APPROVAL<sup>2</sup></b>								Delegation Allowed
<b>CD-1~APPROVE ALTERNATIVE SELECTION AND COST RANGE</b>			S-4	SC-1	SC-1	SC-AD	SC-AD	SC-AD
PRIOR TO CD-1~CONCEPTUAL DESIGN	Approve Acquisition Strategy		Reviewed by SC-28 Approved by SC-1	Reviewed by SC-28 Approved by SC-1	Reviewed by SC-28 Approved by SC-2	Reviewed by SC-28 Approved by SC-AD	Reviewed by SC-28 Approved by SC-AD	Reviewed by SC-28 Approved by SC-AD
	Approve Preliminary Project Execution Plan (PEP)		S-4	Reviewed by SC-28 Approved by SC-1	Reviewed by SC-28 Approved by SC-2	Reviewed by SC-28 Approved by SC-AD	Reviewed by SC-28 Approved by SC-AD	Reviewed by SC-28 Approved by SC-AD
	Appointment of the Federal Project Director (FPD)		S-4	SC-1	SC-1	SC-AD	SC-AD	SC-AD
	Approve Integrated Project Team (IPT)		S-4	SC-1	SC-2	SC-AD	SC-AD	SC-AD
	Develop a Risk Management Plan		Project	Project	Project	Project	Project	Project
	Comply with the One-for-One Building Space Replacement		Project	Project	Project	Project	Project	Project
	Complete a Conceptual Design		Project	Project	Project	Project	Project	Project
	Document High Perf. & Sustainable Bldg. & Sustainable Env. Stewardship considerations		Project	Project	Project	Project	Project	Project
	Conduct a Conceptual Design Review		Team external to project	Team external to project	Team external to project	Team external to project	Team external to project	Team external to project
	Complete a Conceptual Design Report		Project	Project	Project	Project	Project	Project
	Prepare a Preliminary Hazard Analysis Report		Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab
	Develop and Implement an Integrated Safety Management Plan		Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab
	Establish Preliminary Quality Assurance Program (QAP)		Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab
	Identify general Safeguards and Security requirements for the recommended alternative		Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab
	Complete National Environmental Policy Act (NEPA) Strategy by issuing a determination (i.e., EIS, EA)		Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab	Site Office or Lab
	Conduct Independent Project Review or External Independent Review		ICE or ICR by PM & SC-28	ICE or ICR by PM & SC-28	ICE or ICR by APM with SC-28	SC-28	SC-28 Tailored	SC-28 Tailored
Update PDS, or other funding documents for MIE and OE projects, and OMB 300s, if applicable.		SC-AD	SC-AD	SC-AD	SC-AD	SC-AD	SC-AD	
Nuclear Facility	Hazard Cat. 1,2,3 Nuclear Facility--Update Safety Design Strategy (SDS)		SBAA & FPD, w/ CNS or CDNS concurrence, as appropriate	SBAA & FPD, w/ CNS or CDNS concurrence, as appropriate	SBAA & FPD, w/ CNS or CDNS concurrence, as appropriate	SBAA & FPD, w/ CNS or CDNS concurrence, as appropriate	SBAA & FPD, w/ CNS or CDNS concurrence, as appropriate	SBAA & FPD, w/ CNS or CDNS concurrence, as appropriate
	Hazard Category 1, 2, and 3 nuclear facilities, conduct an Independent Project Review (IPR)		PSO	PSO	PSO	PSO	PSO	PSO
	Hazard Cat. 1,2,3 Nuclear Facility--Prepare a Conceptual Safety Design Report (CSDR)		SBAA via the CSVr	SBAA via the CSVr	SBAA via the CSVr	SBAA via the CSVr	SBAA via the CSVr	SBAA via the CSVr
	Hazard Cat. 1,2,3 Nuclear Facility--Prepare Conceptual Safety Validation Report (CSVr)		SBAA	SBAA	SBAA	SBAA	SBAA	SBAA
Hazard Cat. 1,2,3 Nuclear Facility--Initiate a Code of Record		Project	Project	Project	Project	Project	Project	
POST CD-1	Submit approved CD or equivalent documents to APM		SC-28	SC-28	SC-28	SC-28	SC-28	SC-28
	Allow expenditure of PED, MIE OR OE funds for project design.		Project	Project	Project	Project	Project	Project
	Submit budget request for the remainder of TPC if CD-2 is approved w/ 1 year of OMB submission		SC-AD	SC-AD	SC-AD	SC-AD	SC-AD	SC-AD
	Update PARS II with monthly status		Prog. Mgr. & FPD No Earned Value (EV)	Prog. Mgr. & FPD No Earned Value (EV)	Prog. Mgr. & FPD No Earned Value (EV)	Prog. Mgr. & FPD No Earned Value (EV)	Prog. Mgr. & FPD No Earned Value (EV)	Prog. Mgr. & FPD No Earned Value (EV)
	Continue with Monthly or Quarterly Project Reporting/Meeting		SC-AD Invite SC-1 and SC-28	SC-AD Invite SC-1 and SC-28	SC-AD Invite SC-2 and SC-28	SC-AD to invite SC-28	SC-AD to invite SC-28	SC-AD to invite SC-28
	Develop an Acquisition Plan if applicable							
Nuc	Hazard Cat. 1,2,3 Nuclear Facility--Develop a Check-out, Testing & Commissioning Plan		Project	Project	Project	Project	Project	Project

# **This Director's Review will assess the project's readiness to proceed to CD-1 and address the following specific questions for CD-1:**




1. Does the acquisition strategy document a carefully considered analysis of alternatives that support the preferred alternative?
2. Does the conceptual design satisfy the performance requirements?
3. Does the conceptual design report and supporting documentation adequately justify the stated cost range and project duration?
4. Do the project's plans to execute the work make the most efficient use of the financial, human, and technical resources available to them at the participating national labs and universities when they are the most efficient choice?



## **This Director's Review will assess the project's readiness to proceed to CD-1 and address the following specific questions for CD-1:**

5. Does the proposed project team have adequate management experience, design skills, and laboratory support to produce a credible technical, cost, and schedule baseline?
6. Are the ESH&Q aspects of the project being properly addressed and is the ESH&Q planning currently sufficient for this stage of the project?
7. Is the documentation required by DOE O413.b for CD-1 approval complete and in good order?
8. Has the project satisfactorily responded to the recommendations from previous reviews?

# Agenda, Tuesday morning plenary

- 09:00 **Lab Intro 10'**  
Speaker: Dr. Joseph Lykken (Fermilab)
- 09:10 **The CMS HL-LHC Upgrades 30'**  
Speaker: Patricia McBride (Fermilab)
- 09:40 **Overview of the US CMS HL-LHC Upgrade Project 45'**  
Speaker: Vivian O'Dell (Fermilab)  
Material: [Slides](#) 
- 10:25 **Coffee Break 15'**
- 10:40 **L2 Overview: MIP Timing Detector 50'**  
Speaker: Christopher Neu (University of Virginia)  
Material: [Slides](#) 
- 11:30 **Outcome of MTD Technical Review and Recent Progress 20'**  
Speaker: David Stuart  
Material: [Slides](#) 
- 11:50 **MTD Cost, Schedule, Risk and Outcome of OPSS Review 20'**  
Speaker: Frank Chlebana (Fermilab)  
Material: [Slides](#) 

# Agenda, Tuesday afternoon plenary

13:05 - 16:15

## Plenary Session

*First Day - Plenary overview of L2 areas*

Location: Fermilab ( One West )

### 13:15 **L2 Overview: Outer Tracker 45'**

Speaker: Steve Nahn (Fermilab)

Material: [Slides](#) 

### 14:00 **L2 Overview: Endcap Calorimeter 45'**

Speakers: Jeremiah Mans, Jeremiah Mans (University of Minnesota)

Material: [Slides](#) 


### 14:45 **L2 Overview: Trigger/DAQ 45'**

Speaker: Jeffrey Berryhill (Fermilab)

Material: [Slides](#) 

### 15:30 **Project Overall Cost/Schedule/Risk Evaluation 45'**





Speakers: Dr. Lucas Taylor (Fermilab), Lucas Taylor

Material: [Slides](#) 

16:15 - 18:00

## Executive Session

# Endcap Breakout, Wednesday morning


- 09:00 **Endcap Calorimeter: Concentrator ASIC 40'**  
Speaker: James Hirschauer (Fermi National Accelerator Laboratory)  
Material: **Slides** 
- 09:45 **Endcap Calorimeter: Planning for CD3A 30'**  
Speaker: Harry Cheung (Fermilab)  
Material: **Draft (March 12)**  
- 10:20 **Endcap Calorimeter: Recent Progress Summary 25'**  
Speakers: Jeremiah Mans, Jeremiah Mans (University of Minnesota)
- 11:00 **Cassette R&D Progress and Production Plans (Site Visit) 50'**  
Speaker: Zoltan Gece (Fermilab)  
Material: **Slides** 

Cost & Schedule  
drill-downs would  
be particularly  
valuable here.

# MIP Timing Detector Breakout, Wednesday morning

09:00 **BTL Overview: Including LYSO, Assembly, System Testing, I&C 40'**

Speaker: Dr. Adi Bornheim (Caltech)

Material: [Slides](#) 


09:40 **In-depth: BTL SiPMs 15'**

Speakers: Prof. Mitchell Wayne (University of Notre Dame), Mitchell Wayne

Material: [Slides](#) 

09:55 **In-depth: BTL Concentrator Card 15'**


Speaker: Yurii Maravin

Material: [Slides](#) 

10:10 **Coffee 15'**

10:25 **ETL Overview: Including LGADs, System Testing, I&C 30'**

Speaker: Artur Apresyan (Fermilab)

Material: [Slides](#) 


10:55 **In-depth: ETROC ASIC 30'**

Speaker: Dr. Ted Liu (Fermilab)

Material: [Slides](#)  


11:25 **In-depth: ETL Assembly 15'**

Speaker: Frank Golf (UCSD)

Material: [Slides](#) 









11:40 **Remaining R&D, Plans for CD-3b, Readiness for CD-2 20'**

Speaker: Christopher Neu (University of Virginia)

Material: [Slides](#) 

Cost & Schedule  
drill-downs would  
be particularly  
valuable here.


# Outer Tracker Breakout, Wednesday morning

- 09:00 **Plan for CD3a - Sensors 20'**  
Speaker: Steve Nahn (Fermilab)  
Material: [Slides](#) 
- 09:30 **Progress on Automation 20'**  
Speakers: Leonard Spiegel (FNAL), Meenakshi Narain (Brown University)  
Material: [Slides](#) 
- 10:00 **Status of the Irradiation Test Facility 15'**  
Speaker: Dr. Petra Merkel (Fermi National Accelerator Laboratory)  
Material: [Slides](#) 
- 10:20 **Progress with Macro-Pixel Subassemblies 15'**  
Speakers: Steve Nahn (Fermilab), Dr. Anadi Canepa (Fermilab), Dr. Petra Merkel (Fermi National Accelerator Laboratory), Dr. Ron Lipton (Fermilab), Prof. Yuri Gershtein (Rutgers University)  
Material: [Slides](#) 
- 10:40 **Progress on Site Infrastructure 5'**  
Speaker: Steve Nahn (Fermilab)  
Material: [Slides](#) 
- 10:50 **Test Systems and QC Plans 15'**  
Speaker: Dr. Anadi Canepa (Fermilab)  
Material: [Slides](#) 
- 11:10 **Outer Tracker Risk Status 5'**  
Speaker: Steve Nahn (Fermilab)  
Material: [Slides](#) 
- 11:30 **Path to Baseline 30'**  
Speaker: Steve Nahn (Fermilab)  
Material: [Slides](#) 

# TDAQ Breakout, Wednesday morning


09:00 **TDAQ project management plan and schedule** 1h0'

Speaker: Jeffrey Berryhill (Fermilab)

Material: **Slides** 


10:00 **TDAQ L1 Trigger algorithms, firmware, and testing status** 1h0'

Speaker: Nhan Tran (FNAL)

Material: **Slides** 

11:00 **TDAQ L1 trigger hardware R&D** 1h0'

Speakers: Prof. Sridhara Dasu (University of Wisconsin), Mr. Thomas Gorski (University of Wisconsin)

Material: **Slides** 





# Management Breakout, Wednesday morning

09:00 **Overview of B/O session 10'**

09:10 **ESH Overview and Response to Previous Reviews 20'**

Speaker: Mr. Tj Sarlina (ESHQ Section)

Material: [CMS ESH pdf](#)  [Slides](#) 


09:30 **Procurement Process and Issues 20'**

Speaker: Linda Collins

Material: [Slides](#) 

09:50 **Science flowdown/requirements/international connections 20'**

Speakers: Prof. Christopher Hill (OSU), Prof. Christopher Hill (The Ohio State University)

Material: [Slides](#) 

10:10 **Quality Assurance Implementation and Response to Previous Reviews 20'**

Speaker: Mr. Tj Sarlina (ESHQ Section)

Material: [CMS QA pdf](#)  [Slides](#) 

10:30 **coffee break 20'**

10:50 **QAP Implementation by Subprojects 20'**

Speaker: Dr. Carol Wilkinson (US CMS)

Material: [pdf Subproject QAP](#)  [ppt Subproject QAP](#) 

11:10 **DOE O 413.3B documentation review and process 25'**

Speaker: Dr. Vaia Papadimitriou (Fermilab)

Material: [DOE Order 413.3B documentation](#) 

# Executive Sessions, Google Doc Reporting

## Wednesday:

13:00 - 16:30 Executive Session: Executive Session / impromptu questions to project

## Thursday:

08:00 - 11:00 Executive Session: Executive session / writing / closeout dry run

**We will develop the report as a Google Document, and will speak to the final draft document at the closeout.**

**Closeout: Thursday 11:00**

# DOE Perspective

HEP general remarks

FSO general remarks

# Discussion