Connection to International CMS

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Director’s Review: Management Breakout Session
February 2, 2016
International Context
- The International CMS Organization for HL-LHC Upgrades
- Relationship between US management and International management (draft NSF CDR charge)

Status of the International Project
- Approval and Review Process and Current Status
- Timeline towards international TDRs

Implication for the US-CMS Project
- Formalizing agreement on scope and responsibilities
- Reviewing
- Systems/Integration Engineering (draft NSF charge)
- Minimizing US vulnerabilities to international planning (draft NSF charge)
International Context
The HL-LHC Upgrade Program is embedded in the International CMS Organization

- The individual detector upgrades reside within the detector projects under the Project Manager, typically with a deputy PM for upgrades
- Upgrade Coordination provides oversight across all projects to ensure a coherent upgrade program, and provides the links to Technical Coordination, Physics Coordination, Offline resources etc

Deputy UCs now J. Spalding (FNAL) & L Malgeri (CERN)
Upgrade Coordination reports to three boards in CMS: MB, FB and CB
- Management Board (see previous slide)
- Finance Board: includes designated link person for each Funding Agency
- Collaboration Board: includes representative from each institution

US-CMS Operations and Upgrade managers attend all three: MB, FB, CB

Currently a deputy international Upgrade Coordinator is the International CMS HL-LHC Liaison in the US-CMS Upgrade Project Office

Several US physicists play leading roles in the international projects (see MB chart again on next slide - and more at L2/L3 levels in the projects)
HL-LHC Upgrades in International CMS

US is ~30% of CMS
- Connection between individual US and International Projects is at the L2/L3 manager level
- Overall coordination between US PM office and International UC office
- A role of the International Liaison in US PM Project Office is to ensure coherence in US and international upgrade management - planning, reporting and reviewing
Status of the International Project
CERN Approval Process – committees

- LHC-Committee (LHCC) reviews technical scope (Technical Proposal, TDRs)
- Upgrade Cost Group (UCG) reviews costs: CORE cost (essentially M&S in CHF w/o contingency), and labor in FTE
  - Both recommend to the CERN Research Board (RB) for approval
  - LHCC, UCG and RB present to the Resource Review Board (RRB) for endorsement (RRB includes reps from all funding agencies)

CERN Approval Process – steps

1. Technical Proposal and Scope Document → approval of preliminary design, and overall scope/cost envelope for the upgrade program
2. Technical Design Report for each subdetector project → approval of project baseline
3. CMS Engineering Design Review (report to LHCC) → approve start of construction
CMS Status

- CMS has Step 1 Approval
  - Documentation includes physics motivation and performance studies, description of technical scope for full upgrade program, detailed CORE cost estimates and labor estimates
    - “Technical Proposal for the Phase II upgrades of CMS”
    - “The CMS Phase II Upgrade Scope Document”

- Now embarking on process towards TDRs for Step 2
  - TDR timelines can be different for each project
  - Developing detailed designs supported by targeted physics/performance studies, and further cost analysis
  - Detailed schedules and milestones for each project
  - Model for scope sharing among international partners
Timeline Towards International TDRs

- Plan series of internal Comprehensive Reviews leading to TDR and EDR.
  - 2016 reviews will focus on R&D plans, design studies and overall project plan (schedule and milestones)
  - 2017 reviews will focus on the design, cost update, resource needs and agreement on responsibility sharing for the upcoming TDRs

CRs and target submission dates for TDRs

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<th>2016</th>
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<td>initial Comprehensive Review cycle: R&amp;D plans, design studies, schedule and milestones</td>
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<td>CR: internal review of design, cost, resource needs, responsibility matrix (Tracker, Calorimeters, Muon Systems)</td>
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<td>Submit Tracker TDR to LHCC, UCG</td>
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<td>Submit Muon and Barrel Calorimeter TDRs to LHCC, UCG</td>
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<td>Submit Endcap Calorimeter TDR to LHCC, UCG</td>
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<td>internal review of Trigger architecture and responsibility matrix</td>
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<td>CR: progress to EDR (Tracker, Calorimeters, Muon Systems), to TDR (Trigger, DAQ)</td>
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- TDRs for Tracker, Calorimeters and Muon Systems will be submitted in 2017. Trigger and DAQ will be submitted at the end of 2019
- Scope and responsibility agreement will be described in the TDRs and formalized with MoUs following TDR approval.
Implication for the US Project
Responsibility Agreements

- Description of work/deliverable by country/ institution
- A non-binding plan for the TDR, formalized as agreement in MoUs following TDR approval
- If CD-1 and PDR are prior to TDR approval, CMS can document the working agreements for US responsibilities from the internal CRs

Note: all the work described in this review has been fully discussed with the international management, within the projects and in Upgrade Coordination
Implications for the US Project

- The CORE cost matrix (the M&S cost sharing by country) will be developed on a timeline for the TDR approvals
  - Within each project under PM and UC oversight
  - Across projects: coordinated via a sub-group of the FB and reported at the FB

- FB and sub-group are chaired by the CMS Resource Manager (a CERN appointment)

- US managers (Ops and Upgrade) attend FB and subgroup (again, the US will be well informed of the process)

- Note: The CORE cost is not used for managing the US project, since all costs are developed independently in the US process
Implications for the US Project

- **Reviewing**
  - International CMS CR and EDR reviews include outside experts with regular reporting to LHCC/USG
  - US project work will be included in these reviews/reports
  - Will coordinate reviews to optimize mutual benefit of international and US reviews

- **Project Tools**
  - Project currencies and tools will be different → need translation:
    - International: CORE and FTE, estimate quality flags, in Merlin +Excel reporting to LHCC/USG
    - US: Full resource loading and contingency, in Primavera P6 reporting to Funding Agencies
International CMS oversight of systems engineering and integration is under Technical Coordination. The Technical Coordinator is a CERN appointment with responsibility for safety and other policies/procedures at CERN.

- The TC runs the TC-Group that includes engineering and design of common systems, compatibility of designs, and detector installation.
- The TC conducts the technical review process, joint with the Upgrade Coordinator for the HL-LHC work.
- The US Project Engineers in the Project Office will interface with TC engineering and reviewing to ensure the necessary coherence and US. L2/3 Managers include this interface in project planning.
- In general the International Liaison in the US Project Office is responsible for ensuring that the US project is well coordinated with both UC and TC.
US Project Vulnerabilities due to International Planning

- Change in international planning
  - Essential that the international management (Project PMs, UC, TC and CMS Spokespersons) are well informed of the plans and status of the US Project
  - And that the proposed US deliverables and timelines are acceptable to international CMS (initially), and formally agreed (by the time of the TDRs)
  - There are high-level (MB, FB) and mid-level (per project) meetings to ensure good communication and coordination

- US reliance on non-US deliverables
  - Several components needed for the US Project will be provided by international collaborators
  - It is the responsibility of the US L2 Managers to ensure that the international plans and schedules are properly integrated into US planning, and are monitored as part of the US process
  - The L2 will inform the US PM and International Liaison of any issues
  - Both the International Liaison and L2 Manager will follow the US and International reviews of the projects

Note: these responsibilities are bi-directional: The US Project will keep the International CMS fully informed of any risks and plan or schedule changes

- Key: clear responsibilities and communication lines, and close coordination and cooperation