1 Report of the U.S. CMS Resource Manager

The funding provided by DOE and NSF to the U.S. CMS Operations Program for 2002 through 2015, as well as the funding guidance for 2016 through 2019, is shown in Figure 1.

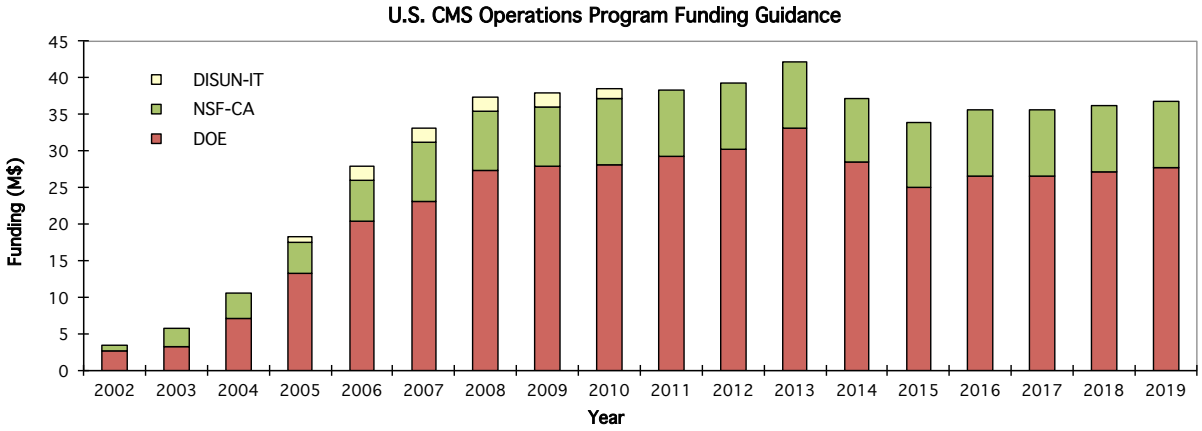

Figure 1: The annual U.S. CMS Operations Program funding provided by DOE and NSF. For 2002 through 2015 the chart shows the actual funding, while for 2016 onward the current funding guidance is shown.

Resources are distributed and tracked across the three areas through which the Operations Program is implemented: Detector Operations (DetOps), Software and Computing (S&C), and Common Operations (ComOps). ComOps is a category for items that would otherwise belong in both, or neither, of the other two categories.

Internal budget reviews for calendar year 2015 took place in August and September of 2014. Through this process, U.S. CMS Management developed a detailed spending plan. This plan was further refined through the March 2015 joint NSF/DOE Operations Program review.

Primarily during the first quarter of the calendar year, Statement of Work (SOW) agreements were established with each institution that is providing a deliverable in exchange for Operations Program funding. The SOWs specify the tasks to be carried out, as well as any portions of salaries, materials and services (M&S), travel funding, or cost of living adjustments (COLA) to be paid from the Operations Program budget. The SOWs must be approved by U.S. CMS Operations Program management, by the Fermilab Director Designee, and by representatives of the collaborating group and institution. Through September of 2015, a total of 109 SOWs (71 DOE and 38 NSF) were produced and approved. After a SOW is approved, any additional changes are considered and, if approved, enacted through a Change Request procedure.

Table 1 shows the Spending Plan Change Log which captures revisions that were made prior to SOW approvals, as well as modifications implemented through Change Requests. The information is reported here down to the level-2 subsystem categories within DetOps, S&C, and ComOps. There was a relatively large number of Change Requests relating to Phase 2 (HL-LHC) Upgrade R&D this quarter. These are summarized separately in Table 2. The CY15 spending plan, as of the end of Q3, is shown for DOE and NSF funds in Table 3. The plan will continue to evolve slightly as Change Requests are executed.

Once funds have been committed through purchase orders, in the case of DOE, and sub-awards, in the case of NSF, they are considered obligated. Figure 2 shows the obligations in the areas of DetOps, S&C, and ComOps, as compared to the spending plan, for DOE funds. The spending plan is plotted as if expenditures are carried out in even allocations each month, but this is intentionally not the case due to equipment purchases and the larger of the transfers to CERN-based Team Accounts, the latter of which are targeted for when exchange rates are favorable.

Spending through Universities and CERN Team Accounts is budgeted and tracked according to the calendar year, while spending at Fermilab has historically been budgeted according to the fiscal year. Of special note is that this year we have transitioned to reporting based on calendar year rather than based on fiscal year. There are two features of Figure 2 related to this transition. First, obligations for DOE spending at Fermilab in the last three months of calendar year 2014 have been included in the plotted obligations for 2015. Second, to accommodate the three month offset between fiscal year and calendar year, a buffer of $3M has been allocated this year, drawing from carry over from previous years. This is indicated by the difference between the solid and dashed blue lines. Figure 3 shows the total obligations and the spending plan, for NSF funds. Of the $9M in NSF funding, $2.5M in

Table 1: Spending Plan Change Log for CY15 Q3

U.S. CMS Detector Operations Change Control Activity						
WBS	**Subsystem**	**Change Request Number**	**Description of Change**	**CY15Q3 Plan**	**Change $**	**CY15Q4 Plan**
11	Endcap Muon		Insurance rate change	$1,836,040	$456	$1,836,496
12	Hardon Calorimeter	CR-030, CR-031	Contractor time reduction; CR-030: Engineering labor at Iowa; CR-031: COLA decrease and Maryland SWF increase	$1,598,163	$5,495	$1,603,658
13	Trigger	CR-015	U Florida TA COLA Adjustment	$919,475	$6,666	$926,141
14	Data Acquisition			$780,208	$0	$780,208
15	Electromagnetic Calorimeter			$841,815	$0	$841,815
16/17	Tracker (Fpix&SiTrk)			$732,798	$0	$732,798
18	Detector Support			$258,262	$0	$258,262
19	BRIL	CR-002	TA M&S and COLA reduction; Princeton SWF increase	$388,180	$0	$388,180
30	Phase 2 Upgrade R&D	CR-031 to CR-044	See table of Phase 2 Upgrade R&D Change Requests	$3,237,253	$777,702	$4,014,955
11-18,30	**Detector Operations**			**$10,592,194**	**$790,319**	**$11,382,513**

U.S. CMS Common Operations Change Control Activity						
WBS	**Subsystem**	**Change Request Number**	**Description of Change**	**CY15Q3 Plan**	**Change $**	**CY15Q4 Plan**
21.2	Common Costs (M&OA, LS1, Loan)	CR-085, CR-086, CR-087, CR-088, CR-089	CR-085: NSF M&O-A and LS1 actual exchange rate, CR-086: DOE LS1 actual exch. rate and early payment, CR-087: DOE M&O-A payment 1 actual excahnge rate, CR-088: DOE M&O-A payment 2 actual excahnge rate, CR-089: DOE M&O-A payment 3 actual excahnge rate	$5,415,822	($513,049)	$4,902,773
21.3	RCMS			$554,413	$0	$554,413
21.4	LHC Physics Center	CR-082	Brown SWF support	$635,637	$38,542	$674,179
21.5	Operations Support	CR-078, CR-079, CR-081, CR-084, CR-090	CR-078: Fairfield EndCap Calorimeter activities; CR-079 UCLA CSC Project Manager; CR-081: Cornell HL-LHC deputy project manager; CR-084: Boston SWF support; SOWs for Wisconsin and Nebraska SWF; CR-090: Caltech SWF support	$1,455,591	$329,080	$1,784,671
21.6	Program Office		Pre-SOW adjustment	$1,029,394	$20,000	$1,049,394
21.7	E&O	CR-083	Notre Dame outreach professional	$286,480	$59,000	$345,480
21.8	Collaboration Support			$10,000	($7,500)	$2,500
21	**Common Operations**			**$9,387,337**	**($73,927)**	**$9,313,410**

U.S. CMS Software and Computing Change Control Activity						
WBS	**Subsystem**	**Change Request Number**	**Description of Change**	**CY15Q3 Plan**	**Change $**	**CY15Q4 Plan**
22.1	Fermilab Facilities		None this quarter	$6,556,269	$0	$6,556,269
22.2	University Facilities			$4,142,508	$0	$4,142,508
22.3	Computing Operations			$1,129,031	$0	$1,129,031
22.4	Computing Infrastructure and Services			$2,106,931	$0	$2,106,931
22.5	Software and Support			$1,951,086	$0	$1,951,086
22.6	Technologies & Upgrade R&D			$899,330	$0	$899,330
22.7	S&C Program Management & CMS Coordination			$694,276	$0	$694,276
22	**Software and Computing**			**$17,479,431**	**$0**	**$17,479,431**
U.S. CMS Operations Program Total				**$37,458,962**	**$716,392**	**$38,175,354**

Table 2: Phase 2 (HL-LHC) Upgrade R&D Change Requests in CY15 Q3

Phase 2 Upgrade R&D Change Requests in CY15 Q3			
Change Request Number	**Institution**	**Description**	**Change $**
CR-031	CERN	Purchase of HGC prototype sensors	$60,000
CR-032	UCSB	Engineering design of front-end ASIC, HGC module	$190,000
CR-033	Minnesota	Technical labor & M&S for cassette for test beam	$40,000
CR-034	Maryland	Qualification and testing of rad tolerant scintillator	$35,000
CR-035	FNAL	HGCAL R&D labor	$30,000
CR-036	Minnesota	M&S funds for HGCAL test cassettes	$10,000
	UCSB	M&S funds for HGCAL test cassettes	($10,000)
CR-037	Cornell	Engineer for fwd pixel mechanical modeling	$29,343
CR-038	CERN	HGCAL R&D labor	$10,000
	FNAL	HGCAL R&D labor & adjustment	$10,000
	Minnesota	HGCAL labor, M&S, and travel	$30,000
CR-039	Ohio State	HL-LHC tracker upgrade L2 manager support	$46,123
CR-040	Iowa	Shashlik R&D completion	$50,000
CR-041	Caltech	Shashlik R&D completion	$60,000
CR-042	Virginia	Shashlik R&D completion	$85,000
CR-043	Notre Dame	Shashlik R&D completion	$85,000
CR-044	Brown	Outer tracker test beam labor & travel	$10,584

subawards went out this quarter, in addition to spending directly at Princeton.

Resources deployed at CERN, and paid directly in Swiss francs, account for approximately 28% of the 2015 spending plan. This carries considerable exposure to the exchange rate. A rate of 0.9 CHF/USD has been used for planning, while the actual rate in CY15 Q3 averaged 0.96 CHF/USD. Figure 4 shows the allocated budgets and year-to-date spending through the Team Accounts that are used for expenditures at CERN. Spending for labor and cost of living adjustments occurs at a fairly constant rate. Figure 4 does not include the last 823K CHF of the Upgrade Common Fund payments and the 3,827K CHF M&O-A payments, as these are each made through multiple payments to a separate Team Account.

Table 3: Spending plan at the end of CY15 Q3, for funds from DOE, NSF, and the total.

WBS	Subsystem	DOE Funds	NSF Funds	Total
11	Endcap Muon	$1,501,776	$334,720	$1,836,496
12	Hadron Calorimeter	$1,530,247	$73,411	$1,603,658
13	Trigger	$778,331	$147,810	$926,141
14	Data Acquisition	$780,208	$0	$780,208
15	Electromagnetic Calorimeter	$841,815	$0	$841,815
16/17	Tracker (Fpix-SiTrk)	$703,520	$29,278	$732,798
18	Detector Support	$258,262	$0	$258,262
19	BRIL	$115,300	$272,880	$388,180
30	Phase 2 Upgrade R&D	$3,263,171	$751,785	$4,014,955
11-19,30	**Detector Operations**	**$9,772,630**	**$1,609,884**	**$11,382,513**
21.2	Common Costs (M&OA,LS1,UpgrdLoan)	$3,894,968	$1,007,805	$4,902,773
21.3	Run Coordination and Monintoring	$554,413	$0	$554,413
21.4	LHC Physics Center	$674,179	$0	$674,179
21.5	Operations Support	$1,595,945	$188,726	$1,784,671
21.6	Program Office	$931,844	$117,550	$1,049,394
21.7	Education and Outreach	$229,000	$116,480	$345,480
21.8	Collaboration Support	$2,500	$0	$2,500
21	**Common Operations**	**$7,882,849**	**$1,430,561**	**$9,313,410**
22.1	Fermilab Facilities	$6,556,269	$0	$6,556,269
22.2	University Facilities	$111,217	$4,031,291	$4,142,508
22.3	Computing Operations	$713,568	$415,463	$1,129,031
22.4	Software and Support	$1,677,995	$428,936	$2,106,931
22.5	Computing Infrastucture and Services	$1,694,841	$256,245	$1,951,086
22.6	Technologies & Upgrade R&D	$206,191	$693,139	$899,330
22.7	S&C Program Management and CMS Coordination	$464,016	$230,260	$694,276
22	**Software and Computing**	**$11,424,097**	**$6,055,334**	**$17,479,431**
U.S. CMS Operations Program Total		**$29,079,575**	**$9,095,779**	**$38,175,354**

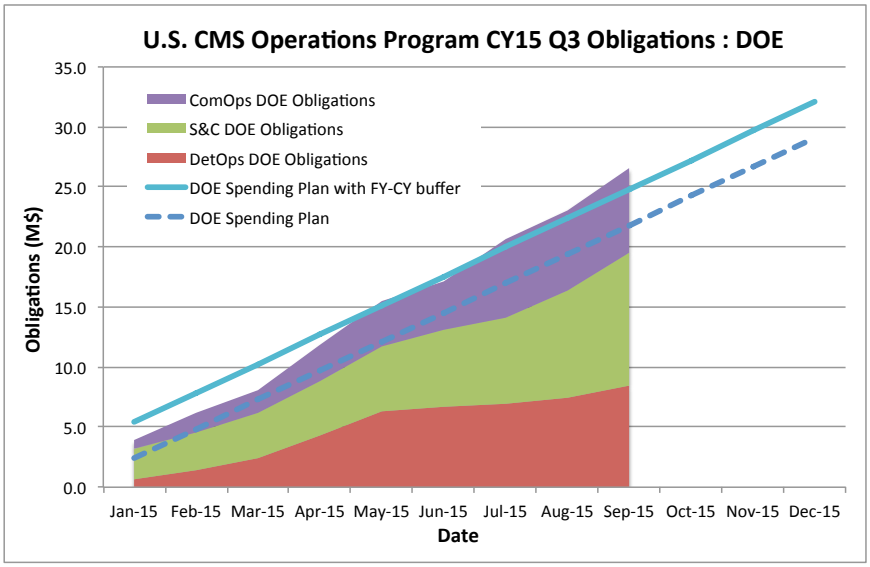

Figure 2: Obligations and spending plan for DOE funds. The spending plan is indicated with the assumption of equal monthly increments just as a rough guide. The lines show the spending plan with (solid) and without (dashed) a required buffer to bridge the difference between fiscal year and calendar year for funds spent at Fermilab, as described in the text.

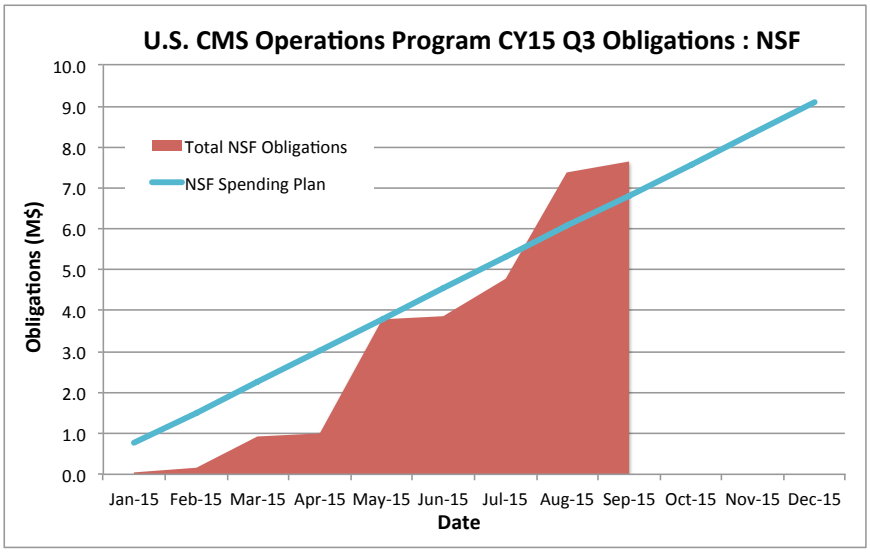

Figure 3: Obligations and spending plan for NSF funds. The spending plan is indicated with the assumption of equal monthly increments as a rough guide.

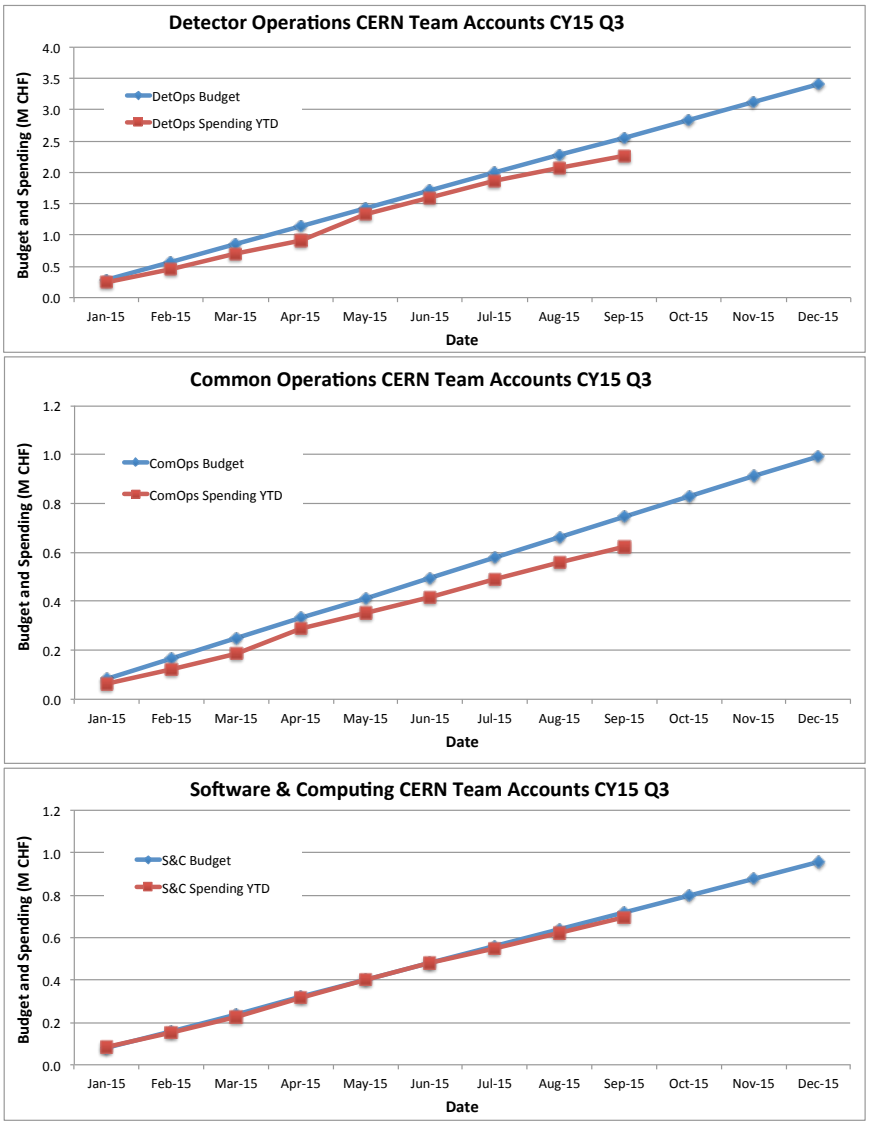

Figure 4: Budget plan and year-to-date spending, in Swiss francs, through DetOps (top), ComOps (middle), and S&C (bottom) Team Accounts.