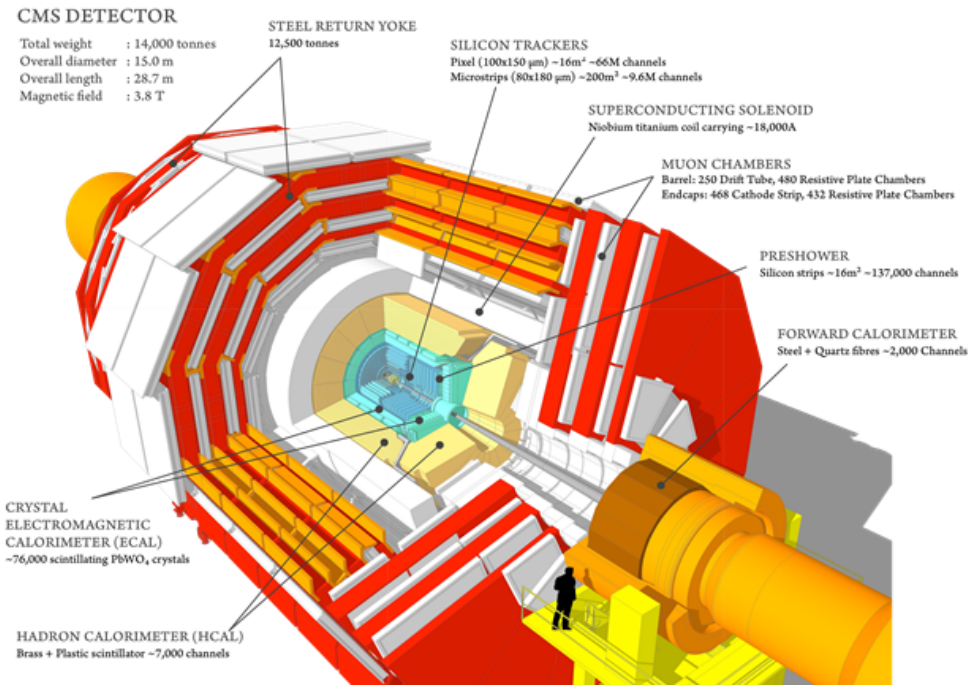
U.S. CMS Compact Muon Solenoid Operations Program Quarterly Report for the Period Ending December 31, 2016

U.S. CMS Operations Program

Abstract



Program Manager's Summary

During this quarter, the fourth quarter of **calendar year 2016** (2016Q4),

To Be Completed…

For the agency review, we provide the Resource Manager report in the next section. The remainder of the quarterly report is scheduled for early February.

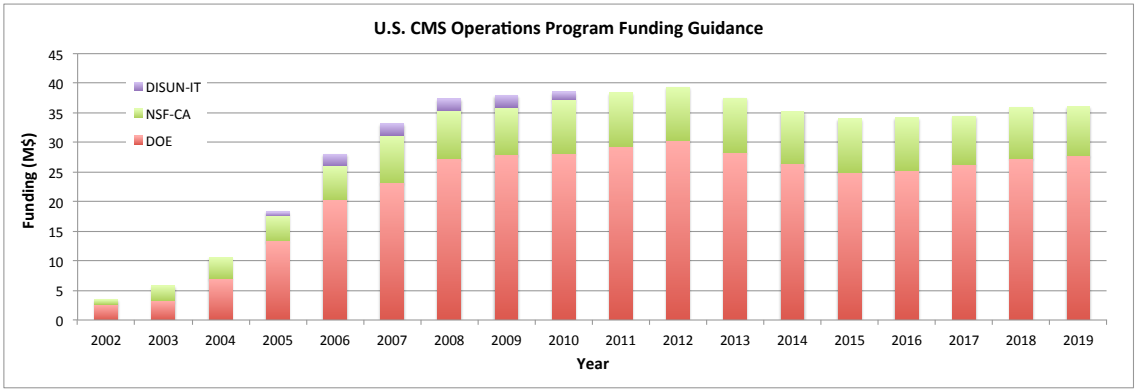


Figure 1: The annual U.S. CMS Operations Program funding provided by DOE and NSF. For 2002 through 2016 the chart shows the actual funding, while for 2017 onward the current funding guidance is shown. This figure does not include the $1M NSF supplement provided in 2016 specifically for Phase2 Upgrade R&D.

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 2016, as well as the funding guidance for 2017 through 2019, is shown in Figure 1.

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 2016 took place in September of 2015. As a new source of input to the planning process, the Resource Allocation Advisory Board met 19 times from June through November, and issued a report of findings and recommendations. Through these processes, U.S. CMS Management developed a detailed spending plan, while taking into account updated guidance from the funding agencies.

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 the end of 2016, a total of 135 SOWs (83 DOE and 52 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 2 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. The CY16 spending plan, as of the end of Q4, is shown for DOE and NSF funds in Table 3.

Once funds have been committed through purchase orders, in the case of DOE, and sub-awards, in

U.S. CMS Detector Operations Change Control Activity						
WBS	**Subsystem**	**Change Request Number**	**Description of Change**	**CY16Q4 Plan**	**Change $**	**CY16Q4 End**
11	Endcap Muon	CR-028	Northeastern travel funds for postdoc for CSC electronics work during technical stop	$1,973,709	$5,700	$1,979,409
12	Hardon Calorimeter			$1,891,408	$0	$1,891,408
13	Trigger			$826,216	$0	$826,216
14	Data Acquisition			$985,340	$0	$985,340
15	Electromagnetic Calorimeter			$882,913	$0	$882,913
16/17	Tracker (Fpix & SiTrk)		Adjustment	$854,097	($225)	$853,872
18	Detector Support			$119,165	$0	$119,165
19	BRIL			$343,754	$0	$343,754
30	Phase 2 Upgrade R&D	CR-048	UCSB M&S going toward wire bonder for developing practices and procedures for silicon module assembly	$4,665,796	$101,300	$4,767,096
11-19,30	**Detector Operations**			**$12,542,400**	**$106,775**	**$12,649,175**

U.S. CMS Common Operations Change Control Activity						
WBS	**Subsystem**	**Change Request Number**	**Description of Change**	**CY16Q4 Plan**	**Change $**	**CY16Q4 End**
21.2	Common Costs (M&OA)			$4,025,837	$0	$4,025,837
21.3	RCMS			$543,397	$0	$543,397
21.4	LHC Physics Center			$1,072,937	$0	$1,072,937
21.5	Operations Support	SOW	M&S for prototype amplifier ASICs to study photodiodes for precision timing	$2,084,311	$20,868	$2,105,179
21.6	Program Office			$1,205,115	$0	$1,205,115
21.7	E&O			$283,809	$0	$283,809
21	**Common Operations**			**$9,215,407**	**$20,868**	**$9,236,275**

U.S. CMS Software and Computing Change Control Activity						
WBS	**Subsystem**	**Change Request Number**	**Description of Change**	**CY16Q4 Plan**	**Change $**	**CY16Q4 End**
22.1	Fermilab Facilities			$5,933,423	$0	$5,933,423
22.2	University Facilities			$3,952,858	$0	$3,952,858
22.3	Computing Operations			$865,105	$0	$865,105
22.4	Computing Infra and Services			$2,439,484	$0	$2,439,484
22.5	Software and Support			$1,548,158	$0	$1,548,158
22.6	Technologies & Upgrade R&D			$855,475	$0	$855,475
22.7	S&C Program Management & CMS Coordination			$615,406	$0	$615,406
22	**Software and Computing**			**$16,209,910**	**$0**	**$16,209,910**

U.S. CMS Operations Program Total				**$37,967,717**	**$127,643**	**$38,095,360**

Figure 2: Spending Plan Change Log for CY16 Q4.

WBS	Subsystem	DOE Funds	NSF Funds	Total
11	Endcap Muon	$1,439,439	$539,970	$1,979,409
12	Hadron Calorimeter	$1,762,981	$128,427	$1,891,408
13	Trigger	$685,137	$141,080	$826,216
14	Data Acquisition	$985,340	$0	$985,340
15	Electromagnetic Calorimeter	$882,913	$0	$882,913
16/17	Tracker (Fpix & SiTrk)	$713,881	$139,991	$853,872
18	Detector Support	$119,165	$0	$119,165
19	BRIL	$172,321	$171,433	$343,754
30	Phase 2 Upgrade R&D	$2,898,733	$1,868,363	$4,767,096
11-19,30	**Detector Operations**	**$9,659,911**	**$2,989,264**	**$12,649,175**
21.2	Common Costs (M&OA)	$3,237,813	$788,024	$4,025,837
21.3	Run Coordination and Monitoring	$436,697	$106,700	$543,397
21.4	LHC Physics Center	$1,072,937	$0	$1,072,937
21.5	Operations Support	$1,787,336	$317,843	$2,105,179
21.6	Program Office	$1,087,565	$117,550	$1,205,115
21.7	Education and Outreach	$173,224	$110,585	$283,809
21	**Common Operations**	**$7,795,573**	**$1,440,702**	**$9,236,275**
22.1	Fermilab Facilities	$5,933,423	$0	$5,933,423
22.2	University Facilities	$114,524	$3,838,334	$3,952,858
22.3	Computing Operations	$397,140	$467,965	$865,105
22.4	Computing Infrastucture and Services	$1,981,797	$457,687	$2,439,484
22.5	Software and Support	$1,286,983	$261,175	$1,548,158
22.6	Technologies & Upgrade R&D	$69,822	$785,653	$855,475
22.7	S&C Program Management and CMS Coordination	$289,670	$325,736	$615,406
22	**Software and Computing**	**$10,073,359**	**$6,136,551**	**$16,209,910**
U.S. CMS Operations Program Total		**$27,528,843**	**$10,566,516**	**$38,095,360**

Figure 3: Spending plan at the end of CY16 Q4, for funds from DOE, NSF, and the total.

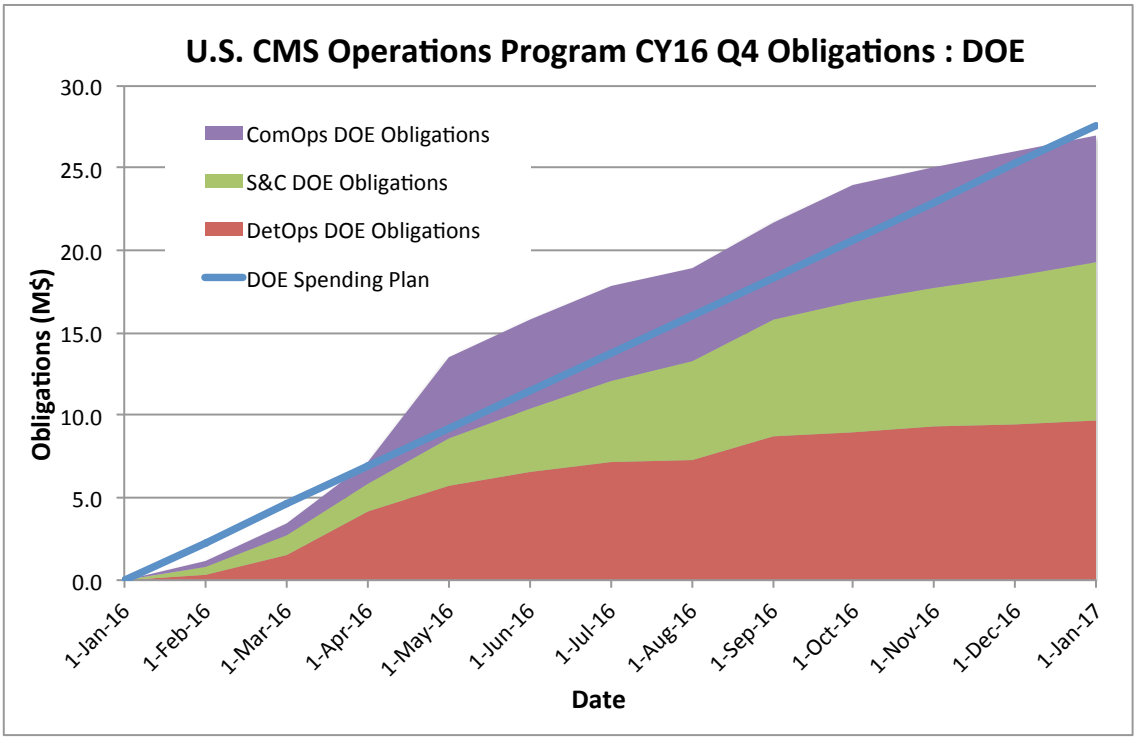


Figure 4: Obligations and spending plan for DOE funds. The spending plan is indicated with the assumption of equal monthly increments just as a rough guide.

the case of NSF, they are considered obligated. Figure 4 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. Spending at Fermilab has historically been budgeted according to the fiscal year, however this is the second year that we are reporting all activities based on calendar year. Figure 5 shows the total obligations and the spending plan, for NSF funds. Of the $9M in NSF funding (plus $1M Phase2 R&D supplement), $1,337K in 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 27% of the 2016 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 CY16 Q4 averaged 1.00 CHF/USD. Figure 6 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 6 does not include the 3,756K CHF M&O-A payments, as these are each made through multiple payments to a separate Team Account.

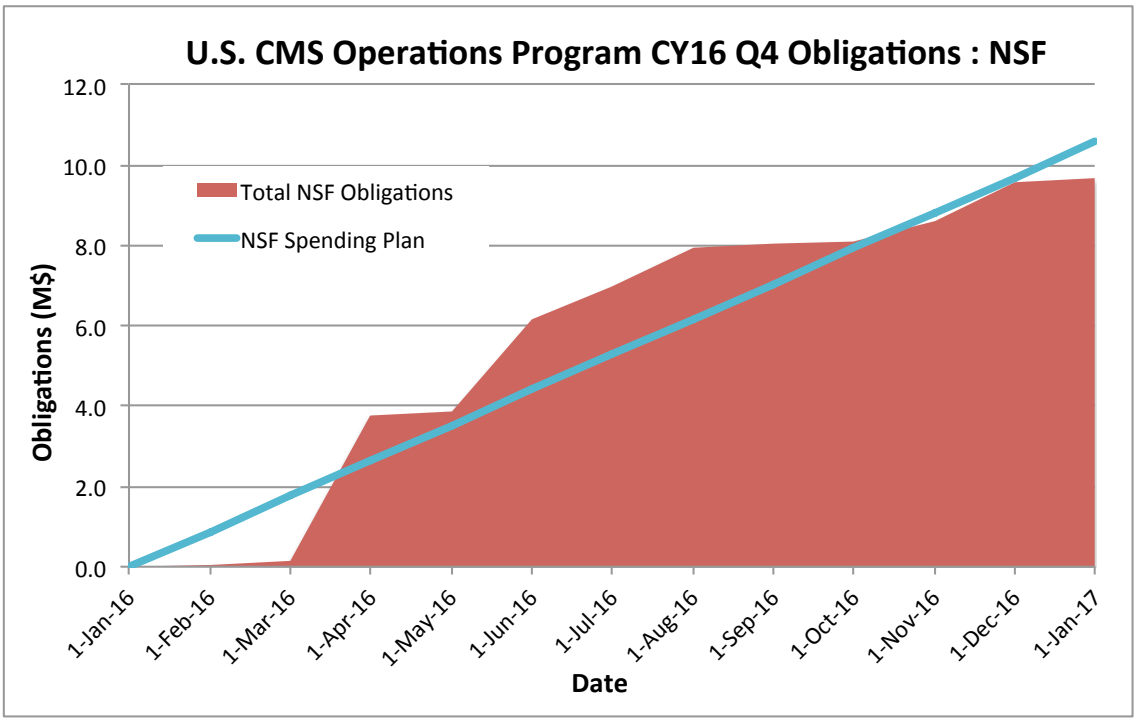


Figure 5: Obligations and spending plan for NSF funds. The spending plan is indicated with the assumption of equal monthly increments as a rough guide. Since NSF funding is transitioning from the end of one five-year Cooperative Agreement to another, Princeton and 15 institutions that receive sub-awards have been granted six month no cost extensions. This will allow institutions to complete their invoicing, and will enable proper allocation of the Phase2 supplement which arrived relatively late in 2016. These are the primary reasons the obligations at the end of the year are lower than the corresponding spending plan.

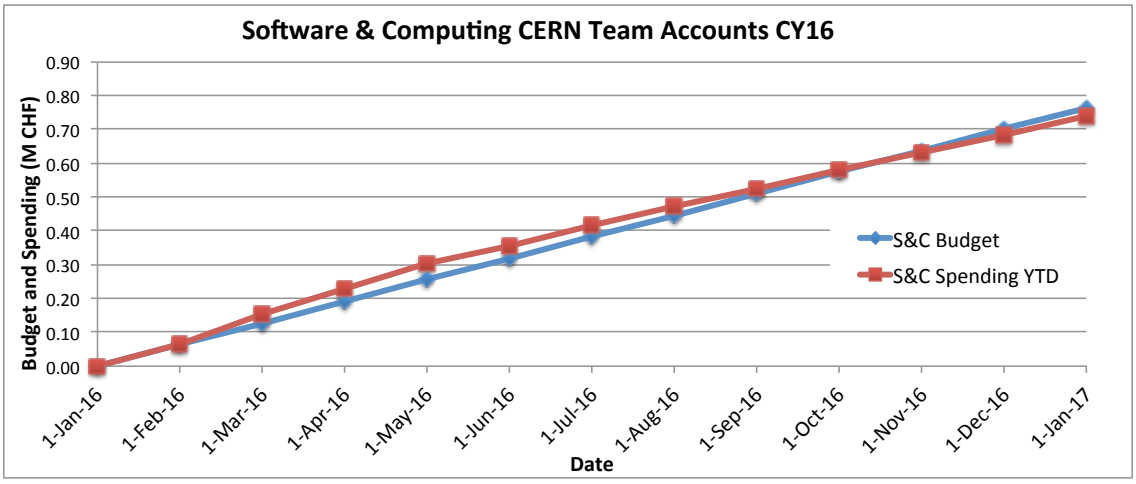


Figure 6: Budget plan and year-to-date spending, in Swiss francs, through DetOps (top), ComOps (middle), and S&C (bottom) Team Accounts.