

---

# Budget and Schedule

Brenna Flaugher  
Fermilab Meeting  
March 13, 2019

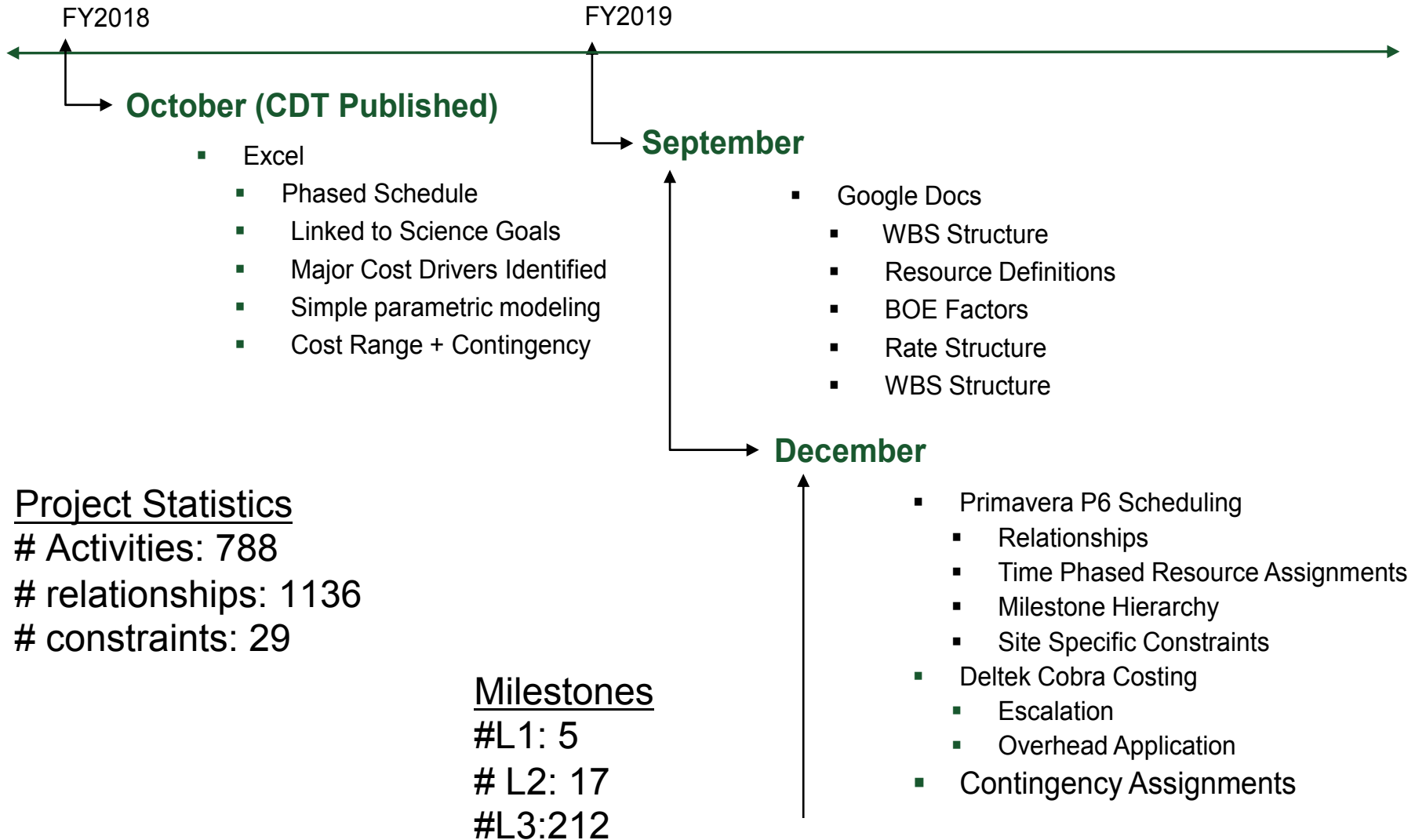
# Notional DOE/NSF Project Development Timeline

	DOE	NSF	Comments
CY2019	Interim Project Office		Coordinate pre-project development
Q2 FY2019	Critical Decision 0		Based on CDT Report and Funding Concept
Q2 FY2019	Initial Input to Decadal Survey		Reference Design and Initial Project Plans
Q1 FY2020	DOE Lead Laboratory	NSF Lead Institution	Project Organization and Team
Q1 CY2021	Decadal Survey Results		
Q2 FY2021	CD1, 3a (CDR Review)	CDR, PDR Readiness Review	Coordinated Review Plans
FY2022	CD2 Approved	PDR	NSB Approves MREFC Budget Request
FY2023	CD3b Approved	FDR	NSB Approval
FY2027	CD4 Approved	MREFC Project Complete	Technically driven schedule

# DOE/HEP Critical Decisions (see <https://opss.fnal.gov/critical-decision-overview/>)

2019	CD0	Approve Mission Need	Indicates alignment of project goals with DOE mission, includes rough cost and schedule estimate, DOE/HEP starts planning for project long term funding
April 2021	CD1	Approve Alternative Selection and Cost Range	Evaluation of the project's conceptual design, cost and schedule range. <b>Long lead procurements can start.</b>
2022	CD2	Approve Performance Baseline	Preliminary design of the project and the baseline scope, cost, and schedule. Design cost and schedule are "locked in."
2023	CD3	Approve Start of Construction	Approval of the project's final design, cost and schedule
2027	CD4	Approve Start of Operations or Project Completion	CD-4 provides recognition that the project's objectives have been met

# In ramp up to Dec. DSR Review we developed a detailed cost and schedule.



# Dec. 2018 Schedule and Critical Path



## Dec. 2018 Cost Estimate

Preliminary, Bottoms up, technically driven (it was not constrained by potential realistic funding profile).

Control Account	Base \$M			Total \$M
	Direct + Indirect	Escalation	Contingency	
1.01, 1.03 - Project Management & Systems Engineering	33.01	3.78	3.68	40.47
1.02 - R&D & Pre-Project Development	22.00	-	-	22.00
1.04 - Large Telescope	86.33	10.78	35.40	132.51
1.05 - Small Telescope	58.75	7.52	22.49	88.76
1.06 - Detectors and Readout	140.40	12.37	54.11	206.88
1.07 - Sites & Infrastructure	55.76	7.71	22.92	86.38
1.08 - Observation Control and Data Acquisition Systems	24.06	2.30	7.89	34.25
1.09 - Data Management	28.77	3.89	15.30	47.97
1.10 - Integration and Commissioning	27.18	4.33	15.76	47.28
<b>Grand Total</b>	<b>476.26</b>	<b>52.67</b>	<b>177.56</b>	<b>706.50</b>

# Since the Dec. Review we have been focused on rationalizing approach across all WBS's

Post Review, the following changes were implemented to the integrated cost and schedule

- Issued CMB-S4 planning document
  - **Captured pre-CD-1 in WBS 1.01(PM) and 1.02 (R&D)**
  - Defined Systems Engineering Interfaces
  - Standardized # reviews, travel costs
- Updated WBS Structure
  - Created new WBS Lvl 2s
  - Added Chile and South Pole, Detectors and Readout/System Test
  - Removed System Engineering (placed in PM structure)
- Updated Inputs
  - Removed duplication of efforts across the project
  - Cleaned up SAT/Integration and Commissioning
  - Updated PM staffing
  - **Added R&D activities (so we are ready to track them and provide monthly updates) and constrained funding in first 2 years**

## Current Cost Estimate (~\$613M) Work in progress!

- The current estimate is fully loaded, escalated, and includes 35% contingency
- December 2019 Review total was \$706.5M
- Cost and schedule cleanup is still in progress
- The granularity is larger at L2 than at the Dec. Review to allow more options for distributing well identified scope
- Cost without R&D and  $\frac{2}{3}$  cost of scientific effort (similar to CDT) is \$588M.
- Cost is being developed with even distribution of SATs. Once that is stable we will calculate the effects of changing this distribution

Control Account	Total \$M with Cont.
1.01 - PM & SE	37.84
1.02 - R&D	24.15
1.03 - Detectors	89.33
1.04 - Readout/Sys Test	105.04
1.05 - LAT	111.80
1.06 - SAT	75.45
1.07 - DAQ	24.96
1.08 - DM	43.38
1.09 - Chile	62.15
1.10 - South Pole	38.76
<b>Total</b>	<b>612.86</b>



# DSR Review (Dec 2018) Schedule: The Cost and Schedule driver for the project is the Detector Fabrication

End date came out to be Feb. 2028. We are looking for ways to speed it up

Project Milestones			Now – April 2021 Pre-conceptual R&D and Design Dev
MS000	Directors Review - Washington Dec	11-Dec-18*	~2 years
MS001	R&D Proposal to DOE & CDR Proposal to NSF	21-Dec-18*	
MS002	Initial Input to the Decadel Survey	29-Mar-19*	
MS003	L1 - CD0 Approval	01-Apr-19*	
MS004	NSF CDR Review	30-Sep-19*	~2 years pre-production
M0007	L2 D&R - Detector and Readouts Preproduction START	01-Apr-21	
MS006	L1 - CD1/3A/ NSF PDR Approval	01-Apr-21*	
MS008	L1 - CD2/3B NSF FDR Approval	31-Mar-22*	
MS009	L2 LAT - LG Telescopes Design Complete	13-Jul-22	~3 years production
MS010	L2 D&R - Detector and Readouts Production START	15-Feb-23	
MS011	L1 - CD3 Approval	29-Sep-23*	
MS012	L2 Sites - South Pole logistics base ready for telescope commissioning	01-Nov-23	
MS014	L2 LAT - Pre-ship review complete ready for LG Tele 1 to SHIP to Pole	19-Mar-24	
MS013	L2 Sites - Chile permission for major construction granted	01-May-24	
MS016	L2 LAT - LG Telescope #2 to SHIP to Chile	10-Sep-24	
MS015	L2 Sites - Chile ready for telescope installation	24-Oct-24	
MS017	L2 Sites - Accept LG Tel #1 from contractor	09-Jan-25	~2 years assembly, test, deploy
MS019	L2 LAT - LG Telescope #3 to SHIP to Chile	07-Mar-25	
MS020	L2 D&R - Detector and Readouts Production Complete	23-Dec-25	
MS018	L2 SAT - First SAT 1 Ready to Ship	06-Feb-26	
MS021	L2 LAT - Accept Cam #1 in US Complete	19-Feb-26	
MS022	L2 Sites - Camera #2 Arrives at Pole	06-May-26	
MS023	L2 I & C - LG Telescope #1/Camera #2 Commissioning Complete at Pole	29-Jan-27	
MS024	L2 DM - Challenge Milestones Complete	13-Sep-27	
MS025	L2 I&C - LG Telescope #3/Camera #3 Commissioning Complete - Chile	10-Feb-28	
MS026	L1 - CD4 Approval, Start of Operations	26-Jan-29	

# Next Steps

---

## **March:**

Finish cost and schedule cleanup, include feedback from Detector and Readout Task Force Phase 1, including feedback/impact on cost and schedule from number of detector types and and frequencies

## **April:**

Cost and schedule scrubbing, include feedback from Detector and Readout Task Force Phase 2 (modules)

Broad effort, we will be scheduling dedicated time for internal review

**Make sure cost and schedule match technical developments, technical requirements and further development of DSR**

## **May-June:**

Final Cost and Schedule review pre-DSR submission

# Extra slides

---

# Current Cost Estimate : work in progress, not for distribution

Preliminary, bottoms up,

Effort in first two years (pre-CD-1) is constrained funding requested for the R&D activity plan and to support the Interim project office

Control Account	Base \$M			Total \$M
	Direct + Indirect	Escalation	Contingency	
1.01 - Project Management & Systems Engineering	31.41	2.99	3.44	37.84
1.02 - R&D	24.15	-	-	24.15
1.03 - Detectors	61.90	4.27	23.16	89.33
1.04 - Readout & System Test	72.75	5.05	27.23	105.04
1.05 - Large Telescope	73.58	9.24	28.99	111.80
1.06 - Small Telescope	51.55	4.34	19.56	75.45
1.07 - Observation Control and Data Acquisition Systems	16.96	1.53	6.47	24.96
1.08 - Data Management	28.31	3.83	11.25	43.38
1.09 - Chile	40.36	5.68	16.11	62.15
1.10 - South Pole	25.09	3.62	10.05	38.76
<b>Grand Total</b>	<b>426.05</b>	<b>40.55</b>	<b>146.26</b>	<b>612.86</b>