



# Muon Campus AIP

## Change Request Form

**CR#:Cryo022**

<b>1) DATE:</b> 6/13/17	<b>2)WBS:</b> Cryo1	<b>3) Originator:</b> Ken Domann <i>KD</i>
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**4) WBS Description of Primary Affected Tasks:** Muon Campus Cryogenics - AIP

**5) Technical Description & Primary Motivation for Change:** There are several motivations for this change. First, the schedule for the Cryo distribution box (CDB), being fabricated and designed in industry, is significantly delayed. The new expected delivery date is October-November 2017, extending the project end date till March 2018. This expands the oversight duration and effort. Second, while we provided for the procurement of Transfer line A, we did not allow for cost of installing the line to the CDB. Next, a modification to the roof (locally increase its height) is needed. In our present baseline, we overlooked the fact that the phase separator valves cannot be serviced without this additional local roof height increase. Finally, there is necessary instrumentation associated with the CDB that is missing from the present baseline scope. The interface milestone Cryo Mu2e Distribution Box Cold (Mu2e Interface) has slipped from 7/15/17 to 1/25/18. However, this delay will not impact the Mu2e project. The net effect is to increase the budget by \$167,773 with a corresponding decrease in contingency.

**6) Assessment of Cost Impact (Use attachments if needed):** See attached.

**7) Assessment of Schedule Impact (Use attachments if needed):** See attached.

**8) Secondary Impact & Other Comments:** N/A

<b>9) Approvals:</b>		
AIP Project Manager:	<i>Mandal / Zan</i>	Date: 6-21-17
AIP Project Coordinator:	<i>Mandal / Zan</i>	Date: 6/22/17
AD Div Director:	<i>S. Nagar</i>	Date: 6/22/17
Directorate:	<i>S. Nagar</i>	Date: 6/22/17

### Cryo CR022 Schedule Information

UID	WBS	Name	Start	Finish	Dur	Base St	Base Fin	Comments
<b>1</b>	<b>Cry01</b>	<b>Muon Campus Cryogenics - AIP</b>						
2777	Cry01.01	Cryo AIP Milestones	6/3/13	1/25/18	1165 d	6/3/13	9/29/17	
2778	Cry01.01.01	Cryo AIP Management Milestones	6/3/13	1/25/18	1165 d	6/3/13	6/22/17	
2784	Cry01.01.01.04	Finish Cryo AIP Project	1/25/18	1/25/18	0 d	1/25/18	1/25/18	New baseline dates
2787	Cry01.01.02	Interface milestones	1/8/14	1/25/18	1016 d	1/8/14	7/15/17	
2791	Cry01.01.02.05	Cryo MuZe Distribution Box Cold (MuZe Interface)	1/25/18	1/25/18	0 d	1/25/18	1/25/18	New baseline dates
2804	Cry01.01.03	Project Plan Milestones	6/17/13	1/25/18	1155 d	6/17/13	9/29/17	
2991	Cry01.01.03.06	Transfer Line MC1 - MC2 Installed	11/16/17	11/16/17	1 d	11/16/17	11/16/17	New baseline dates
2990	Cry01.01.03.07	MuZe Cryo Distribution Box Delivered	12/13/17	12/13/17	1 d	12/13/17	12/13/17	New baseline dates
2802	Cry01.01.03.08	MuZe Acceptance Tests Complete	1/25/18	1/25/18	0 d	1/25/18	1/25/18	New baseline dates
2803	Cry01.01.03.09	Project Complete	1/25/18	1/25/18	0 d	1/25/18	1/25/18	New baseline dates
829	Cry01.02	Cryo Project Management	6/17/13	4/30/18	1222 d	8/1/13	6/22/17	
2761	Cry01.02.01	General Project OS	6/17/13	4/30/18	1222 d	8/1/13	6/22/17	
3018	Cry01.02.01.09	Cryo AIP General Project OS - FY18	10/2/17	4/30/18	145 d	10/2/17	4/30/18	New task
3013	Cry01.02.01.10	Cryo Final Safety Documents	5/1/17	10/4/17	110 d	5/1/17	10/4/17	New task
840	Cry01.05	Cryo Experiment interfaces	7/17/12	11/15/17	1341 d	8/19/13	11/17/16	
1456	Cry01.05.01	MuZe Interface Connection	7/17/12	11/15/17	1341 d	5/22/14	11/17/16	
3014	Cry01.05.01.18	Modify Ceiling to Accommodate Phase Separator Valve Access	9/1/17	10/13/17	30 d	9/1/17	10/13/17	New task
2531	Cry01.05.01.21	MuZe is connected	11/15/17	11/15/17	0 d	11/15/17	11/15/17	New baseline dates
2831	Cry01.07	Testing/Checkout	10/22/14	1/18/18	810 d	10/31/14	5/22/17	
2824	Cry01.07.02	MuZe Cryo Checkout	11/16/17	1/18/18	40 d	11/16/17	1/18/18	New baseline dates
2837	Cry01.07.03	MuZe ORC	1/18/18	1/18/18	0 d	1/18/18	1/18/18	New baseline dates
2972	Cry01.09	MuZe Acceptance Tests	11/16/17	1/25/18	45 d	11/18/16	12/19/16	
2611	Cry01.09.01	Cryo MuZe Acceptance Tests	11/16/17	1/25/18	45 d	11/16/17	1/25/18	New baseline dates
2937	Cry01.10	Cryo Distribution Box (CDB)	4/15/15	1/12/18	689 d	4/15/15	4/14/17	
2962	Cry01.10.03	Procurement and Fabrication of CDB	2/1/16	12/12/17	472 d	10/6/15	4/14/17	
2954	Cry01.10.03.12	Vendor Ship CDB to Fermilab	11/3/17	11/3/17	1 d	11/3/17	11/3/17	New baseline dates
2953	Cry01.10.03.13	Fermi Perform safety review of CDB	11/6/17	11/17/17	10 d	11/6/17	11/17/17	New baseline dates
2952	Cry01.10.03.14	Acceptance tests at Fermilab	11/20/17	12/11/17	14 d	11/20/17	12/11/17	New baseline dates
2951	Cry01.10.03.15	CDB received and accepted	12/12/17	12/12/17	1 d	12/12/17	12/12/17	New baseline dates
2970	Cry01.10.04	Ancillary Components	4/15/15	1/12/18	689 d	4/15/15	4/6/17	
3015	Cry01.10.04.09	Install Transfer Line A	12/13/17	1/12/18	20 d	12/13/17	1/12/18	New task
2963	Cry01.10.04.10	Feedbox valves related to CDB	9/14/17	12/8/17	60 d	9/14/17	12/8/17	New baseline dates
3020	Cry01.10.04.11	TL from Helium dewar to CDB for acceptance test	10/2/17	10/27/17	20 d	10/2/17	10/27/17	New task
2823	Cry01.13	MuZe Checkout complete	1/25/18	1/25/18	0 d	1/25/18	1/25/18	New baseline dates

## Cryo CR022 Labor Delta

UID	WBS	Name	New Hours	Old Hours	Delta Hours	Comments
	<b>1 Cryo1</b>	<b>Muon Campus Cryogenics - AIP</b>	<b>38050</b>	<b>37288</b>	<b>762</b>	
	<b>829 Cryo1.02</b>	<b>Cryo Project Management</b>	<b>3060</b>	<b>2654</b>	<b>406</b>	
	<b>2761 Cryo1.02.01</b>	<b>General Project OS</b>	<b>3060</b>	<b>2654</b>	<b>406</b>	
	<b>3018 Cryo1.02.01.09</b>	<b>Cryo AIP General Project OS - FY18</b>	<b>88</b>	<b>0</b>	<b>88</b>	<b>New task</b>
		<b>FNAD_AC_EXP_PHYST</b>	<b>30</b>	<b>0</b>	<b>30</b>	
		<b>FNTD_PRJ_MNGR</b>	<b>58</b>	<b>0</b>	<b>58</b>	
	<b>3013 Cryo1.02.01.10</b>	<b>Cryo Final Safety Documents</b>	<b>318</b>	<b>0</b>	<b>318</b>	<b>New task</b>
		<b>FNTD_MECH_DESIGN_EN</b>	<b>155</b>	<b>0</b>	<b>155</b>	
		<b>FNPD_MECH_DESIGN_EN</b>	<b>155</b>	<b>0</b>	<b>155</b>	
		<b>FNPD_MECH_DESIGNER</b>	<b>8</b>	<b>0</b>	<b>8</b>	
	<b>840 Cryo1.05</b>	<b>Cryo Experiment interfaces</b>	<b>7284</b>	<b>7236</b>	<b>48</b>	
	<b>1456 Cryo1.05.01</b>	<b>Mu2e Interface Connection</b>	<b>7114</b>	<b>7066</b>	<b>48</b>	
	<b>3014 Cryo1.05.01.18</b>	<b>Modify Ceiling to Accommodate Phase Separator Valve Access</b>	<b>48</b>	<b>0</b>	<b>48</b>	<b>New task</b>
		<b>FNPD_MECH_DESIGN_EN</b>	<b>24</b>	<b>0</b>	<b>24</b>	
		<b>FNPD_MECH_DESIGNER</b>	<b>24</b>	<b>0</b>	<b>24</b>	
	<b>2937 Cryo1.10</b>	<b>Cryo Distribution Box (CDB)</b>	<b>5607</b>	<b>5299</b>	<b>308</b>	
	<b>2970 Cryo1.10.04</b>	<b>Ancillary Components</b>	<b>1605</b>	<b>1297</b>	<b>308</b>	
	<b>3015 Cryo1.10.04.09</b>	<b>Install Transfer Line A</b>	<b>208</b>	<b>0</b>	<b>208</b>	<b>New task</b>
		<b>FNPD_MECH_ASMBY_TECH</b>	<b>128</b>	<b>0</b>	<b>128</b>	
		<b>FNTD_WELDER</b>	<b>64</b>	<b>0</b>	<b>64</b>	
		<b>FNPD_MECH_DESIGN_EN</b>	<b>16</b>	<b>0</b>	<b>16</b>	
	<b>3020 Cryo1.10.04.11</b>	<b>TL from Helium dewar to CDB for acceptance test</b>	<b>100</b>	<b>0</b>	<b>100</b>	<b>New task</b>
		<b>FNPD_MECH_ASMBY_TECH</b>	<b>40</b>	<b>0</b>	<b>40</b>	
		<b>FNTD_WELDER</b>	<b>20</b>	<b>0</b>	<b>20</b>	
		<b>FNTD_MECH_DESIGN_EN</b>	<b>20</b>	<b>0</b>	<b>20</b>	
		<b>FNPD_MECH_DESIGNER</b>	<b>20</b>	<b>0</b>	<b>20</b>	

## Cryo CR022 Material Delta

UID	WBS	Name	New M&S	Old M&S	Delta	Comment
1	Cryo1	Muon Campus Cryogenics - AIP	\$3,602,476	\$3,560,776	\$41,700	
829	Cryo1.02	Cryo Project Management	\$154,998	\$148,298	\$6,700	
2761	Cryo1.02.01	General Project OS	\$154,998	\$148,298	\$6,700	
3018	Cryo1.02.01.09	Cryo AIP General Project OS - FY18	\$6,700	\$0	\$6,700	New task
840	Cryo1.05	Cryo Experiment interfaces	\$347,581	\$317,581	\$30,000	
1456	Cryo1.05.01	MU2 Interface Connection	\$347,581	\$317,581	\$30,000	
3014	Cryo1.05.01.18	Modify Ceiling to Accommodate Phase Separator Valve Access	\$30,000	\$0	\$30,000	New task
2937	Cryo1.10	Cryo Distribution Box (CDB)	\$1,175,453	\$1,170,453	\$5,000	
2970	Cryo1.10.04	Ancillary Components	\$295,042	\$290,042	\$5,000	
3020	Cryo1.10.04.11	TL from Helium dewar to CDB for acceptance test	\$5,000	\$0	\$5,000	New task

Cryo CR022 Pre CR CAP

Control Account: WBS (4)	Resource: TYPE	Results	FY12	FY13	FY14	FY15	FY16	FY17	Cumulative
Cry01.02.01.01 Cryo AIP General Project Oversight - FY13									
		Scheduled	0.00	51,346.42	0.00	0.00	0.00	0.00	51,346.42
Cry01.02.01.02 Cryo AIP General Project Oversight - FY14									
		Scheduled	0.00	3,594.06	129,557.05	0.00	0.00	0.00	133,151.10
Cry01.02.01.03 Cryo AIP General Project Oversight - FY15									
		Scheduled	0.00	0.00	2,134.07	30,214.73	0.00	0.00	32,348.80
Cry01.02.01.04 Cryo AIP General Project Oversight - FY16									
		Scheduled	0.00	0.00	0.00	3,820.92	170,506.37	0.00	174,327.29
Cry01.02.01.05 Cryo AIP General Project Oversight - FY17									
		Scheduled	0.00	0.00	0.00	0.00	5,329.44	162,348.00	167,677.44
Cry01.02.01.07 Cryo AIP Gen Proj OS - FY15 Supp									
		Scheduled	0.00	0.00	0.00	74,049.03	0.00	0.00	74,049.03
Cry01.03 Cryo Basic Engineering									
		Scheduled	0.00	33,093.96	236,082.70	0.00	0.00	0.00	269,176.66
Cry01.04.01 LN2 system									
		Scheduled	0.00	4,514.95	409,013.92	0.00	0.00	0.00	413,528.87
Cry01.04.02 Gas management system									
		Scheduled	0.00	57,841.53	178,224.26	0.00	0.00	0.00	236,065.78
Cry01.04.03 ODH system									
		Scheduled	0.00	0.00	49,757.63	0.00	0.00	0.00	49,757.63
Cry01.04.04 Cryo Refrigerator system									
		Scheduled	0.00	149,077.19	1,134,055.74	152,524.20	0.00	0.00	1,435,657.13
Cry01.04.05 Cryo Compressor System									
		Scheduled	0.00	59,453.27	367,138.94	0.00	0.00	0.00	426,592.21
Cry01.04.06 Cryo Interconnect Piping									
		Scheduled	0.00	225,594.62	512,339.28	0.00	0.00	0.00	737,933.91
Cry01.04.07 Cryo Interconnect Electrical & Controls									
		Scheduled	0.00	46,627.36	119,526.30	0.00	0.00	0.00	166,153.66
Cry01.04.08 Cryogenic Fluids									
		Scheduled	0.00	0.00	0.00	261,857.93	0.00	0.00	261,857.93
Cry01.05.01 MuZe Interface Connection									
		Scheduled	0.00	0.00	70,813.93	320,085.24	704,422.87	94,691.54	1,190,013.59
Cry01.05.02 g-2 interface connection									
		Scheduled	0.00	27,198.92	0.00	0.00	0.00	0.00	27,198.92
Cry01.06 Cryo Safety Documents									
		Scheduled	0.00	0.00	155,311.42	0.00	0.00	0.00	155,311.42
Cry01.07 Testing/Checkout									
		Scheduled	0.00	0.00	0.00	65,416.12	0.00	67,810.80	133,226.92
Cry01.08 Cryo g-2 Acceptance Tests									
		Scheduled	0.00	0.00	11,968.50	102,502.33	0.00	0.00	114,470.83
Cry01.09 Cryo MuZe Acceptance Tests									
		Scheduled	0.00	0.00	0.00	0.00	0.00	94,731.00	94,731.00
Cry01.10 Cryo Distribution Box (CDB)									
		Scheduled	0.00	0.00	0.00	322,703.66	1,105,006.77	657,176.60	2,084,887.04
Cry01.14 MC-1 Refrigerator Upgrades									
		Scheduled	0.00	0.00	0.00	0.00	155,882.14	133,317.14	289,199.28
Grand Total									
		Scheduled	0.00	658,342.28	3,375,923.74	1,333,174.17	2,141,147.60	1,210,075.08	8,718,662.88

Cryo CR022 Post CR CAP

Control Account: WBS(4)	Resource Type	Results	FY12	FY13	FY14	FY15	FY16	FY17	FY18	Cumulative
Cryo1.02.01.01 Cryo AIP General Project Oversight - FY13		Scheduled	0.00	51,346.42	0.00	0.00	0.00	0.00	0.00	51,346.42
Cryo1.02.01.02 Cryo AIP General Project Oversight - FY14		Scheduled	0.00	3,594.06	129,557.05	0.00	0.00	0.00	0.00	133,151.10
Cryo1.02.01.03 Cryo AIP General Project Oversight - FY15		Scheduled	0.00	0.00	2,134.07	30,214.73	0.00	0.00	0.00	32,348.80
Cryo1.02.01.04 Cryo AIP General Project Oversight - FY16		Scheduled	0.00	0.00	0.00	3,820.92	170,506.37	0.00	0.00	174,327.29
Cryo1.02.01.05 Cryo AIP General Project Oversight - FY17		Scheduled	0.00	0.00	0.00	0.00	5,329.44	162,348.00	0.00	167,677.44
Cryo1.02.01.07 Cryo AIP Gen Proj OS - FY15 Supp		Scheduled	0.00	0.00	0.00	74,049.03	0.00	0.00	0.00	74,049.03
Cryo1.02.01.09 Cryo AIP General Project OS - FY18		Scheduled	0.00	0.00	0.00	0.00	0.00	0.00	26,722.06	26,722.06
Cryo1.02.01.10 Cryo Final Safety Documents		Scheduled	0.00	0.00	0.00	0.00	0.00	43,874.33	1,268.26	45,142.58
Cryo1.03 Cryo Basic Engineering		Scheduled	0.00	33,093.96	236,082.70	0.00	0.00	0.00	0.00	269,176.66
Cryo1.04.01 LN2 system		Scheduled	0.00	4,514.95	409,013.92	0.00	0.00	0.00	0.00	413,528.87
Cryo1.04.02 Gas management system		Scheduled	0.00	57,841.53	178,224.26	0.00	0.00	0.00	0.00	236,065.78
Cryo1.04.03 ODH system		Scheduled	0.00	0.00	49,757.63	0.00	0.00	0.00	0.00	49,757.63
Cryo1.04.04 Cryo Refrigerator system		Scheduled	0.00	149,077.19	1,134,055.74	152,524.20	0.00	0.00	0.00	1,435,657.13
Cryo1.04.05 Cryo Compressor System		Scheduled	0.00	59,453.27	367,138.94	0.00	0.00	0.00	0.00	426,592.21
Cryo1.04.06 Cryo Interconnect Piping		Scheduled	0.00	225,594.62	512,339.28	0.00	0.00	0.00	0.00	737,933.91
Cryo1.04.07 Cryo Interconnect Electrical & Controls		Scheduled	0.00	46,627.36	119,526.30	0.00	0.00	0.00	0.00	166,153.66
Cryo1.04.08 Cryogenic Fluids		Scheduled	0.00	0.00	0.00	261,857.93	0.00	0.00	0.00	261,857.93
Cryo1.05.01 Mu2e Interface Connection		Scheduled	0.00	0.00	70,813.93	320,085.24	704,422.87	125,292.07	15,615.62	1,236,229.74
Cryo1.05.02 g-2 interface connection		Scheduled	0.00	27,198.92	0.00	0.00	0.00	0.00	0.00	27,198.92
Cryo1.06 Cryo Safety Documents		Scheduled	0.00	0.00	155,311.42	0.00	0.00	0.00	0.00	155,311.42
Cryo1.07 Testing/Checkout		Scheduled	0.00	0.00	0.00	65,416.12	0.00	37,673.46	31,071.60	134,161.18
Cryo1.08 Cryo g-2 Acceptance Tests		Scheduled	0.00	0.00	11,968.50	102,502.33	0.00	0.00	0.00	114,470.83
Cryo1.09 Cryo Mu2e Acceptance Tests		Scheduled	0.00	0.00	0.00	0.00	0.00	0.00	97,400.62	97,400.62
Cryo1.10 Cryo Distribution Box (CDB)		Scheduled	0.00	0.00	0.00	322,703.66	1,105,006.77	491,188.15	212,076.91	2,130,975.49
Cryo1.14 MC-1 Refrigerator Upgrades		Scheduled	0.00	0.00	0.00	0.00	155,882.14	133,317.14	0.00	289,199.28
Grand Total		Scheduled	0.00	658,342.28	3,375,923.74	1,333,174.17	2,141,147.60	993,693.14	384,155.06	8,886,436.00