12GeV Commissioning and Initial Physics Plans

Arne Freyberger Operations Dept. Accelerator Division JLAB

January 13, 2012



Arne Freyberger Operati12GeV Commissioning and Initial Phys. January 13, 2012



Outline



2 12 GeV Strawman

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6MSD Lessons

What can we learn from the 6MSD in regards to 12GeV commissioning and the initial physics program?

- Potential for damaging (destroying) equipment is non-zero.
- Impact of the loss of beam line components can be large in terms of scheduling and waiting for repaired components.
 - There will be a need to be flexible the first few years has the weakest elements are flushed out of the system.
- Machine will be a challenge to commission and understand.
- Beam Quality may not be completely under control.
 - C100 for example
 - Pathlength

12 GeV Strawman: circa 2010

Task	Duration
🕀 ங Spring 2013 Run	42
🕀 🗾 Fall 2013 Run	122.9
🖶 😎 Spring 2014 Run	112
🕀 式 Fall 2014 Run	130
🕀 🚾 Spring 2015 Run	133
🕀 🔂 Fall 2015 Run	123
🖲 🚾 Spring 2016 Run	98



- Assumes 12 month shutdown (might be longer)
- Assumes 35 weeks of operation per Fiscal Year (might be less)
- Assumes 2 run periods per year (Spring/Fall) (might be more efficient to have one long run period Sept→May).

12 GeV Generic Strawman: circa 2012

			20	13		20	14			20	15			20	16		2017
Task	Dur	ration	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
🐵 ங Accelerator Run I: 2.2GeV/pass to 2R, tune-mode beam	1	6.7		-													
🕀 ங Accelerator Run II: E>1.1GeV/pass, tune-mode beam	1	16.8			-	-											
	1	16.6					-	-									
🐨 👽 Dogleg Upgrade Complete		0						•									
- 😴 CD4A-I 12GeV, 5.5 pass capable installed	1	0						٠									
CD4A-II 11GeV, 5 pass beamline to A/B/C installed	1	0						•									
- 😴 CD4A-III 12GeV beamline to D installed		0						•									
──		0	-					•									
- 😴 CD4A-V Hall-D civil complete	1	0						٠									
		18							-								
- 😴 CD4B-I Hall-B Operational, >2nA >6GeV 3pass		0								+							
──		0								٠							
CD4B-III Hall-D Operational, >2nA >10GeV 5.5pass	1	0								٠							
Physics Run I: E>2GeV/pass		16.6									-						
• S Physics Run II: Physics driven configuration		20											-				
Physics Run III: Physics driven configuration		14.5															
			8														

- Same plan with names that aren't tied to dates.
- Assumes a 16 Month Shutdown
- There is a possibility of Physics during the later Accelerator runs.
- Lets walk through this one run at a time.

Accelerator Run |

			20	013		20	14			20	15			20	16		2017
TdSK	Dur	ation	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Accelerator Run I: 2.2GeV/pass to 2R, tune-mode beam	1	6.7		-													
Recover: Beam up to 5MeV	1	1		h													
E Spin up 1pass beam to 2R	4	5.7															
😔 ங Accelerator Run II: E>1.1GeV/pass, tune-mode beam	1	16.8			-	-											
	1	16.6					-	-									
- 👽 Dogleg Upgrade Complete	£	0						٠									
CD4A-I 12GeV, 5.5 pass capable installed	4	0						٠									
CD4A-II 11GeV, 5 pass beamline to A/B/C installed	4	0						•									
- 👽 CD4A-III 12GeV beamline to D installed	1	0						•									
── CD4A-IV >2nA 2.2GeV 1-pass transported	£	0						•									
- 👽 CD4A-V Hall-D civil complete	£	0						٠									
	£	18							-								
─	4	0								•							
── CD4B-II Hall-C Operational, >2nA >6GeV 3pass	1	0								•							
─	£	0								٠							
🛞 ங Physics Run I: E>2GeV/pass	£	16.6									-						
🐵 ங Physics Run II: Physics driven configuration	1	20											-	-			
🐵 転 Physics Run III: Physics driven configuration	1	14.5													Ţ		

Duration 6 weeks

Goal 1-pass spin up, with RF at 2.2 GeV per pass Risks RF and Magnets.... Physics No!

Accelerator Run II

			20	013		20	14			20	15			20	16		2017
Task	Dura	ation	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Accelerator Run I: 2.2GeV/pass to 2R, tune-mode beam	1	6.7		-													
⊡ S Accelerator Run II: E>1.1GeV/pass, tune-mode beam	1	16.8			-												
🕀 📼 3-pass spin up (BSY)	1	2			0h												
• = 12GeV Magnet/Optics characterization	1	4			1												
🗉 📼 Hall-A Detector Checkout	1	1			- 14												
🕖 📼 5.5-pass spin up to D	1	4			- H	ĥ											
🗉 📼 4/5/5.5 pass Magnet/Optics characterization: Push energ	1	5.7															
🕀 ங Accelerator Run III: E Various 2-hall operation?	1	16.6						-									
🕞 👽 Dogleg Upgrade Complete	1	0						٠									
- 👽 CD4A-I 12GeV, 5.5 pass capable installed	1	0						•									
—	1	0						•									
- 😴 CD4A-III 12GeV beamline to D installed	1	0						•									
─	1	0						•									
CD4A-V Hall-D civil complete	1	0						•									
⊕ 🔜 Accelerator Run IV: E>2GeV/pass 2-hall operation	1	18							-								
- 😴 CD4B-I Hall-B Operational, >2nA >6GeV 3pass	1	0								•							
- 😴 CD4B-II Hall-C Operational, >2nA >6GeV 3pass	1	0								٠							
── CD4B-III Hall-D Operational, >2nA >10GeV 5.5pass	1	0								•							
⊕ 🛐 Physics Run I: E>2GeV/pass	1	16.6									-	-					
🐵 ங Physics Run II: Physics driven configuration	1	20											-	-			
🗄 💽 Physics Run III: Physics driven configuration	1	14.5												J			,

Duration 17 weeks

- Goal 3-pass spin up, with a stretch goal of 5.5 pass spin up. Magnet and beam transport characterization.
- Issues Pathlength system will restrict energy configuration. Injector C100 must be installed before this run.

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Accelerator Run III

			20	13		20	14			20	15			20	16		2017
Task	DL	Iration	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
🛞 🚾 Accelerator Run I: 2.2GeV/pass to 2R, tune-mode beam	1	6.7															
⊕ ங Accelerator Run II: E>1.1GeV/pass, tune-mode beam	1	16.8			-	-											
S Accelerator Run III: E Various 2-hall operation?		16.6					-	-									
	1	5						Ь									
		1					9	ĥ									
Beam to HallD: E>2GeV/pass?		3						•B-1									
		7.5						5									
- 👽 Dogleg Upgrade Complete	1	0						◆									
- 😴 CD4A-I 12GeV, 5.5 pass capable installed	1	0						•									
CD4A-II 11GeV, 5 pass beamline to A/B/C installed		0						٠									
- 👽 CD4A-III 12GeV beamline to D installed		0						•									
── CD4A-IV >2nA 2.2GeV 1-pass transported		0						•									
- 👽 CD4A-V Hall-D civil complete		0						•									
		18							-								
- 👿 CD4B-I Hall-B Operational, >2nA >6GeV 3pass		0								٠							
- 😴 CD4B-II Hall-C Operational, >2nA >6GeV 3pass		0								٠							
─		0								•							
⊕ 🛐 Physics Run I: E>2GeV/pass		16.6									-						
🐵 ங Physics Run II: Physics driven configuration		20											-	_			
🛞 🔁 Physics Run III: Physics driven configuration	1	14.5															

Duration 17 weeks

- Goal 1/2/3 pass separation, 5.5pass beam characterization.
- Issues Need upgraded doglegs (pathlength) for this run.
- Physics Beam to Hall-D, 3wk for transport tests. Hall-A physics (passes 1/2/3) if separators work and beam quality acceptable?

Accelerator Run IV

Tesh	Duration	20	013		20	014	-		20	15			20	16		2017
Task	Duration	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Accelerator Run I: 2.2GeV/pass to 2R, tune-mode beam	6.7		-													
🛞 ங Accelerator Run II: E>1.1GeV/pass, tune-mode beam	16.8			-												
	16.6															
🕞 👽 Dogleg Upgrade Complete	۱ O						٠									
CD4A-I 12GeV, 5.5 pass capable installed	• 0						•									
CD4A-II 11GeV, 5 pass beamline to A/B/C installed	• 0	1.1.1.1					•									
CD4A-III 12GeV beamline to D installed	• 0						•									
CD4A-IV >2nA 2.2GeV 1-pass transported	• 0	1.1.1.1					•									
- 👽 CD4A-V Hall-D civil complete	• 0						•									
Accelerator Run IV: E>2GeV/pass 2-hall operation	(18							-								
multiple beam operations characterization multiple beam operations multiple multiple beam operations multiple mul	4 3							Dh								
	(4							- F	h							
Transport B&C characterization/optimization	(4							5	<u>ار الا</u>							
🗉 🚍 4/5 pass separation	(4								N							
🕀 🚍 Hall B&C Detector Checkout	4 3															
CD4B-I Hall-B Operational, >2nA >6GeV 3pass	· 0								•							
😨 CD4B-II Hall-C Operational, >2nA >6GeV 3pass	• 0	****							•							
CD4B-III Hall-D Operational, >2nA >10GeV 5.5pass	· 0								•							
Physics Run I: E>2GeV/pass	16.6									-						
Physics Run II: Physics driven configuration	• 20											-		,		
Physics Run III: Physics driven configuration	14.5															

Duration 18 weeks Goal 2-hall operations, 4&5 pass separation Issues Separators, physics quality beam? Physics Hall-A engineering/Physics run (passes 1/2/3), B&C detector tests,

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Physics Run |

	-		20	13		20	14			20	15			20	16		2017
Task	Dura	ation	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
🛞 ங Accelerator Run I: 2.2GeV/pass to 2R. tune-mode beam	1	6.7															
⊕ 🛐 Accelerator Run II: E>1.1GeV/pass, tune-mode beam	1	16.8			-	-											
	1	16.6					-	-									
🕞 👽 Dogleg Upgrade Complete	1	0						٠									
CD4A-I 12GeV, 5.5 pass capable installed	1	0						٠									
CD4A-II 11GeV. 5 pass beamline to A/B/C installed	1	0						٠									
CD4A-III 12GeV beamline to D installed	1	0						•									
── CD4A-IV >2nA 2.2GeV 1-pass transported	1	0						•									
CD4A-V Hall-D civil complete	1	0						٠									
	1	18							-								
─	1	0								٠							
- 😴 CD4B-II Hall-C Operational, >2nA >6GeV 3pass	1	0								•							
── ── CD4B-III Hall-D Operational, >2nA >10GeV 5.5pass	1	0								٠							
Physics Run I: E>2GeV/pass	1	16.6									-	-					
machine restoration for Physics Run I	1	1									h						
	1	4										h					
🕀 🚍 HallD physics beam establishment, background optimiz	1	3									4	d-					
HallD engineering run(HallA physics?)	1	8.5										•					
Physics Run II: Physics driven configuration	1	20											-				
Physics Run III: Physics driven configuration	1	14.5													Ţ		

Duration 17 weeks

Goal Beam optics procedure finalization, 3-hall operation

Issues Hopefully fewer than last run.

Physics Hall-D engineering run, Hall-A Physics, Hall-B/C?

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Physics Run II

Test	Durati	_	20	013		20	14			20	15			20	16		2017
Task	Duratio	on	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Accelerator Run I: 2.2GeV/pass to 2R, tune-mode beam	1 6	5.7															
🛞 ங Accelerator Run II: E>1.1GeV/pass, tune-mode beam	1 16	5.8			-	-											
	1 16	5.6															
😨 Dogleg Upgrade Complete	1	0						٠									
- 👽 CD4A-I 12GeV, 5.5 pass capable installed	1	0						٠									
- 😴 CD4A-II 11GeV, 5 pass beamline to A/B/C installed	1	0						٠									
- 😴 CD4A-III 12GeV beamline to D installed	1	0						•									
CD4A-IV >2nA 2.2GeV 1-pass transported	1	0						•									
- 😨 CD4A-V Hall-D civil complete	1	0						٠									
	1	18							-								
- 😴 CD4B-I Hall-B Operational, >2nA >6GeV 3pass	1	0								•							
─	1	0								•							
CD4B-III Hall-D Operational, >2nA >10GeV 5.5pass	1	0								٠							
🛞 ங Physics Run I: E>2GeV/pass	1 16	5.6									-		,				
😑 ங Physics Run II: Physics driven configuration	1	20											-	-			
Machine restoration for Physics Run II	1	1											Ь				
HallA physics Run HallA physics	1	8											5	Ъ			
🕀 🚍 Hall B and C engineering runs	1	11											6				
Physics Run III: Physics driven configuration A statement of the statement of t	1 14	1.5															
																	1

Duration 20 weeks Goal 3-hall operation, 5-pass capable

Issues Hopefully fewer than last run.

Physics Hall-A Physics, Hall B&C engineering runs

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Physics Run III

Test	Duration	2	013		20	14			20	15			20	16		2017
Task	Duration	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
🐵 ங Accelerator Run I: 2.2GeV/pass to 2R, tune-mode beam	6.7		-													
🛞 ங Accelerator Run II: E>1.1GeV/pass, tune-mode beam	16.8			-	-											
	16.6															
- 👽 Dogleg Upgrade Complete	(0						٠									
- 👽 CD4A-I 12GeV, 5.5 pass capable installed	۱ O						•									
CD4A-II 11GeV, 5 pass beamline to A/B/C installed	(0						•									
CD4A-III 12GeV beamline to D installed	(0	~ ~ ~ ~					•									
CD4A-IV >2nA 2.2GeV 1-pass transported	(0	1.1.1.1					•									
- 👽 CD4A-V Hall-D civil complete	• 0						•									
	(18							-								
- 👽 CD4B-I Hall-B Operational, >2nA >6GeV 3pass	(0								٠							
─	(0	~~~~							+							
CD4B-III Hall-D Operational, >2nA >10GeV 5.5pass	(0	1.1.1							•							
🕀 ங Physics Run I: E>2GeV/pass	16.6									-						
B Physics Run II: Physics driven configuration	(20											-		,		
😑 ங Physics Run III: Physics driven configuration	14.5														_	
machine restoration for Physics Run III	(1													H	1	
Hall B and C pre-physics runs	8													- F	- -	
E HallA/D physics Run	5.5															
Hall-A Experiment NNNNN	5.5														1	
Hall-D Experiment NNNNN	5.5														4	

Duration 15 weeks

Goal 3-hall operation, 5-pass capable Issues Hopefully fewer than last run. Physics Physics in all halls

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Summary

Tesh	0		20	013		20	14			20	15			20	16		2017
Task	Durati	ion	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
🐵 🎫 Accelerator Run I: 2.2GeV/pass to 2R, tune-mode beam	(6.7		-													
	(1	6.8			-	-											
	1	6.6															
- 👽 Dogleg Upgrade Complete		0						٠									
CD4A-I 12GeV, 5.5 pass capable installed	1 C	0						٠									
CD4A-II 11GeV, 5 pass beamline to A/B/C installed	1	0						٠									
CD4A-III 12GeV beamline to D installed	1 C	0						•									
──		0						•									
- 😴 CD4A-V Hall-D civil complete	1	0						٠									
Accelerator Run IV: E>2GeV/pass 2-hall operation Accelerator Run IV: E>2GeV/pass 2-hall operator Run IV:	1	18							-								
CD4B-I Hall-B Operational, >2nA >6GeV 3pass	1	0								•							
─ ♥ CD4B-II Hall-C Operational, >2nA >6GeV 3pass	1	0								٠							
CD4B-III Hall-D Operational, >2nA >10GeV 5.5pass	1	0								٠							
Elimination Physics Run I: E>2GeV/pass	(1	6.6									-						
Physics Run II: Physics driven configuration	1 C	20											-				
Physics Run III: Physics driven configuration	1 1	4.5															

- This is the baseline plan, based on
 - 16 Month Shutdown
 - 35 weeks of operation per year
 - Two 17.5'ish week run periods per year, with 8.5'ish week *downs* between runs.
- It will be changed to accommodate reality
- First beam to Hall-C in Accelerator Run IV: Present guess is Feb-May 2015