

Addendum II to the Joint Project Document for the Research and Development Phase of the Indian Institutions and Fermilab Collaboration

Fermilab Documentation Deliverables

1. Introduction

The Joint Project Document (JPD) for the R&D Phase of the IIFC Collaboration details schedules for various hardware and software deliverables. Addendum I to the JPD establishes revised dates for DAE deliverables based on adjustments described therein. Addendum II is a first pass at listing the deliverables from DOE to DAE, on HPSA technology documentation, focusing presently only on areas directly relevant to the PIP-II linac. The documents listed in this Addendum are understood to represent a subset of the ultimate DOE deliverable on HPSA technologies, which may extend beyond PIP-II specific R&D, and hence should not be interpreted as limiting.

2. Primary Engineering Documentation

Supporting documentation to be provided by Fermilab is shown in the tables below for each major component/system under joint development. Documentation is organized within two phases, labelled “prototype” and “final design”. These phases have different engineering documentation because to the fluid nature of R&D, which in most cases requires the fabrication and testing of a prototype prior to completion of a final design.

The tables list Fermilab engineering documentation deliverables only. Fermilab will not be providing all required engineering documentation for all systems, in particular systems for which DAE holds the primary responsibility during the R&D phase. However, in all cases development starts with a Functional Requirements Specification (FRS) which is the responsibility of Fermilab.

Supporting documentation is identified in stages, conforming to requirements of engineering processes at Fermilab as outlined in the Fermilab Engineering Manual, with specific application to IIFC as described in TeamCenter document ED0005292. For each sub-component the TeamCenter identifier for the corresponding EPDM (Engineering Process Document Management) is provided (see green headers). The EPDM provides an index to the various engineering documents associated with a component or sub-assembly. The EPDM is a living document, and is updated as new documentation becomes available.

Dates are provided as currently known (July 2017). In some cases dates are not yet known because they are contingent upon the pace of progress either in areas where DAE is in the lead or because of uncertainties within the prototype phase. In these cases best guesses are provided (and may be subject to future adjustment. In a few cases they are listed as to be determined (TBD).

	A	B	C	D
1	PIP-II PHYSICS DESIGN			
2				
3	Accelerator Physics Design			
4		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
5	Conceptual Design Report	Done	NA	http://pip2-docdb.fnal.gov/cgi-bin/ShowDocument?docid=113
6	Technical Design Report	Apr-19	NA	Available at CD-2
7	Detailed Design	NA	Apr-20	Available at CD-3
8	Commissioning Plan	NA	Apr-20	Available at CD-3
9	PIP-II Machine Advisory Committee Reports	Ongoing	Ongoing	https://indico.fnal.gov/categoryDisplay.py?categId=366
10				
11	Beam dynamics design (linac+ring)			
12		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
13	Start-to-end simulations	Done	Apr-19	CDR and references therein
14	Error analyses	Done	Apr-19	CDR and references therein
15	Notes on design choices & reasons	Done	Apr-19	CDR and references therein
16	Studies on beam halo & beam loss	Done	Apr-19	CDR and references therein
17	Studies on injection into ring	Done	Apr-19	CDR and references therein
18	Optics files	Done	Apr-19	http://pip2-docdb.fnal.gov:8080/cgi-bin/ShowDocument?docid=119

Table 1: Accelerator Physics Design

	A	B	C	D
1	RFQ			
2				
3		TC: ED00001227		
4		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
5	FRS	Done	NA	Available - see EPDM
6	Risk assessment	Done	NA	Available - see EPDM
7	TRS	Done	NA	Available - see EPDM
8	Preliminary Design Review Documentation	Done	NA	Not available at Fermilab
9	3D Models	Done	NA	Available at Fermilab
10	Engineering drawings	Done	NA	Available at Fermilab
11	Procurement Readiness Review Documentation	Done	NA	Available at Fermilab
12	Engineering Note(s)	Done	NA	Available at Fermilab
13	Final Design Review Documentation	Done	NA	Available at Fermilab
14	Manufacturing Process Documents	Done	NA	Available at Fermilab
15	QA Documentation and Travelers	Done	NA	Not available at Fermilab
16	Interface Specification	Done	NA	Not available at Fermilab
17	Operational Readiness Clearance	Done	NA	Available upon request
18	Commissioning Documentation	Done	NA	Bead-pull, tuning report, acceleration results; available upon request

Table 2: RFQ

	A	B	C	D
1	325 MHz SSR1			
2				
3	SSR1 Bare Cavity	TC: ED0001240		
4		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
5	FRS	Done	NA	Included in jacketed cavity FRS
6	Risk assessment	Done	NA	Included in jacketed cavity RA
7	TRS	Done	NA	Included in jacketed cavity TDR
9	3D Models	Done	Jun-18	
10	Engineering drawings	Done	Jun-18	
12	Engineering Note(s)	Done	Jun-18	
14	Manufacturing Process Documents	Done	Jun-18	Available - see EPDM
15	QA Documentation and Travelers	Done	Jul-20	Available via Vector with VPN connection
16				
17	SSR1 Jacketed Cavity	TC: ED0001234		
18		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
19	FRS	Done	NA	Available - see EPDM
20	Risk assessment	Done	NA	Available - see EPDM
23	TRS	Dec-17	Jun-18	In process
24	3D Models	Done	Jun-18	Available - see EPDM; update following SSR1 operations as required
25	Engineering drawings	Done	Jun-18	Available - see EPDM; update following SSR1 operations as required
27	Engineering Note(s)	Done	Jun-18	Available - see EPDM
28	Final Design Review Documentation	Done	Jun-18	Available - see EPDM
29	Manufacturing Process Documents	Dec-17	Jun-18	In process
30	QA Documentation and Travelers	Done	Aug-20	Available via Vector with VPN connection
34	SSR1 Tuner	TC: ED0001246		
35		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
36	FRS	Done	NA	Available - see EPDM
37	Risk assessment	Done	NA	Available - see EPDM
40	3D Models	Done	May-19	Available - see EPDM; update following SSR1 operations as required
41	Engineering drawings	Done	May-19	Available - see EPDM; update following SSR1 operations as required
42	Procurement Readiness Review Documentation	Done	May-19	Incorporated into FDR
43	Engineering Note(s)	NA	NA	
44	Final Design Review Documentation	Done	May-19	Available - see EPDM
46	QA Documentation and Travelers	Sep-17	May-20	Only issued in event of discrepancies
48	Operational Readiness Clearance	Sep-17	Oct-20	
49				
50	SSR1 Coupler	TC: ED0001258		Same as SSR2 coupler
51		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
52	FRS	Done	NA	Available - see EPDM
53	Risk assessment	Done	NA	Available - see EPDM
55	Preliminary Design Review Documentation	Done	N/A	Available - see EPDM
56	TRS	Dec-17	Oct-18	
57	3D Models	Done	Oct-18	Available - see EPDM
58	Engineering drawings	Done	Oct-18	Available - see EPDM
60	Engineering Note(s)	NA	NA	
61	Final Design Review Documentation	Dec-17	Oct-18	FDR only if design changes
62	Manufacturing Process Documents	Done	Nov-18	Available - see EPDM
63	QA Documentation and Travelers	Done	Nov-20	Available via Vector with VPN connection
66				
67	SSR1 Cryomodule	TC: ED0001256		
68		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
69	FRS	Done	NA	Available - see EPDM
70	Risk assessment	Done	NA	Available - see EPDM
72	Preliminary Design Review Documentation	Done	NA	Available - see EPDM
73	TRS	Dec-18	Dec-19	Re-do as necessary after testing in PIP2IT
74	3D Models		Dec-19	Available - see EPDM
75	Engineering drawings	Jun-18	Dec-19	
76	Procurement Readiness Review Documentation	Jun-18	Dec-19	Cold mass (Jun-17) and CM review (Jun-18)
77	Engineering Note(s)	Jun-18	Dec-19	
78	Final Design Review Documentation	Jun-18	Dec-19	Re-do as necessary after testing in PIP2IT
80	QA Documentation and Travelers	Dec-18	Oct-21	
81	Interface Specification	Done	Dec-19	Available - see EPDM
82	Operational Readiness Clearance	Dec-18	Dec-21	Approval of the Engineering Note

Table 3: SSR1

	A	B	C	D
1	325 MHz SSR2			
2				
3	SSR2 Bare Cavity	TC: ED0001248		
4		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
5	FRS	Done	NA	Included in jacketed cavity FRS
6	Risk assessment	Done	NA	Included in jacketed cavity RA
7	TRS	May-18	Nov-20	Included in jacketed cavity TRS
8	Preliminary Design Review Documentation	Feb-18	TBD	Fermilab responsible for conducting review, DAE to set dates
13	Final Design Review Documentation	Dec-18	Nov-20	Fermilab responsible for conducting review, DAE to set dates
18				
19	SSR2 Jacketed Cavity	TC: ED0001235		
20		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
21	FRS	Done	N/A	Available - see EPDM
22	Risk assessment	Mar-17	N/A	
23	TRS	May-18	Nov-20	Jointly developed
24	Preliminary Design Review Documentation	Feb-18	TBD	Fermilab responsible for conducting review, DAE to set dates
30	Final Design Review Documentation	Dec-18	Nov-20	Fermilab responsible for conducting review, DAE to set dates
35				
36	SSR2 Tuner	TC: ED0001252		
37		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
38	FRS	Done	Jun-20	Available - see EPDM
39	Risk assessment	Oct-18	Jun-20	
41	Final Design Review Documentation	Oct-18	TBD	Fermilab responsible for conducting review, DAE to set dates
51				
52	SSR2 Coupler	TC: ED0001258		Same as SSR1 coupler
53				
54	SSR2 Cryomodule	TC: ED0001257		
55		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
56	FRS	Done	NA	Available - see EPDM
57	Risk assessment	Dec-18	NA	
59	Preliminary Design Review Documentation	TBD	TBD	Fermilab responsible for conducting review, DAE to set dates
65	Final Design Review Documentation	Nov-20	Dec-22	Fermilab responsible for conducting review, DAE to set dates
68	Interface Specification	Nov-20	Dec-22	

Table 4: SSR2

	A	B	C	D
1	650 MHz LB650			
2				
3	LB650 Bare Cavity	TC: ED0001241		
4		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
5	FRS	Done	N/A	Included in jacketed cavity FRS
6	Risk assessment	Done	N/A	Included in jacketed cavity RA
7	TRS	TBD	N/A	Included in jacketed cavity TRS
8	Preliminary Design Review Documentation	Done	N/A	Fermilab responsible for conducting review, DAE to set dates
13	Final Design Review Documentation	TBD	TBD/w-DAE	Fermilab responsible for conducting review, DAE to set dates
18				
19	LB650 Jacketed Cavity	TC: ED0005156		
20		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
21	FRS	Done	Jun-20	Available - see EPDM
22	Risk assessment	Done	Jun-20	Available - see EPDM
23	TRS	TBD	Jun-20	Developed jointly
24	Preliminary Design Review Documentation	Jul-17	N/A	Fermilab responsible for conducting review, DAE to set dates
29	Final Design Review Documentation	TBD	Jun-20	Fermilab responsible for conducting review; DAE to set dates
34				
35	LB650 Helium Vessel	TC: ED0001242		
36		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
37	FRS	Done	Jun-20	Included in jacketed cavity FRS
39	TRS	TBD	Jun-20	Included in jacketed cavity FRS
40	Preliminary Design Review Documentation	Jul-17	N/A	Fermilab responsible for conducting review; DAE to set dates
45	Final Design Review Documentation	TBD	Jun-20	Fermilab responsible for conducting review; DAE to set dates
50				
51	LB650 Tuner	TC: ED0001253		Same as HB650 Tuner
65				
66	LB650 Coupler	TC: ED0001260		Same as HB650 Coupler
67				
68	LB650 Cryomodule	TC: ED0001254		Note: This design to be based on HB650 done at Fermilab. Engineering documents from HB650 will be provided as available.
69		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
70	FRS	Done	Jun-20	Available - see EPDM
71	Risk assessment	Dec-17	Jun-20	
72	TRS	TBD	Jun-20	Jointly developed
73	Preliminary Design Review Documentation	TBD	N/A	Fermilab responsible for conducting review; DAE to set dates
78	Final Design Review Documentation	TBD	Jun-20	Fermilab responsible for conducting the review; DAE responsible for setting the date
81	Interface Specification	TBD	Jun-20	Included in TRS

Table 5: LB650

	A	B	C	D
1	650 MHz HB650			
2				
3	HB650 Bare Cavity	TC: ED0001249		
4		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
5	FRS	Done	NA	Included in jacketed cavity FRS
6	Risk assessment	Done	NA	Included in jacketed cavity TRS
7	TRS	Apr-18	Dec-18	Included in jacketed cavity RA
8	Preliminary Design Review Documentation	Done	NA	Available - see EPDM
9	3D Models	Done	Jun-20	Available - see EPDM
10	Engineering drawings	Done	Jun-20	Available - see EPDM
11	Procurement Readiness Review Documentation	Jan-18	Jun-20	To be developed by DAE for b=0.92, not done for b=0.90; Fermilab responsible for conducting review, DAE to set dates
12	Engineering Note(s)	Done	Jun-20	Available - see EPDM
13	Final Design Review Documentation	Done	Jun-20	Available - see EPDM
14	Manufacturing Process Documents	Done	Jun-20	For b=0.90
15	QA Documentation and Travelers	Done	Jun-20	For b=0.90
18				
19	HB650 Jacketed Cavity	TC: ED0005154		
20		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
21	FRS	Done	NA	Available - see EPDM
22	Risk assessment	Done	NA	Available - see EPDM
23	TRS	Apr-18	Jun-20	Pankaj Kumar original draft - needs formalizing and new release date
24	Preliminary Design Review Documentation	Done	NA	Available - see EPDM; Issues from PDR will be resolved in FDR
25	3D Models	Done	Jun-20	Available - see EPDM
26	Engineering drawings	Done	Jun-20	Available - see EPDM
27	Procurement Readiness Review Documentation	Done	Jun-20	Available - see EPDM
28	Engineering Note(s)	Jan-18	Jun-20	
29	Final Design Review Documentation	Mar-18	Jun-20	
30	Manufacturing Process Documents	TBD	Jun-20	Material and welding certs, code requirements, etc.
31	QA Documentation and Travelers	Done	Jun-20	
34				
35	HB650 Helium Vessel	TC: ED0001250		
36		<i>Prototype Phase</i>	<i>Final Design Phase</i>	<i>Remarks:</i>
37	FRS	Done	NA	Included in jacketed cavity FRS
38	Risk assessment	Done	NA	Included in jacketed cavity RA
39	TRS	Oct-17		Included in jacketed cavity TRS
40	Preliminary Design Review Documentation	Done	NA	Included in jacketed cavity FRS
41	3D Models	Done	Jun-20	Available - see EPDM
42	Engineering drawings	Done	Jun-20	Available - see EPDM
43	Procurement Readiness Review Documentation	Jul-17	Jun-20	Production drawings, production plan incl schedule, etc.
45	Final Design Review Documentation	NA	Jun-20	If separate from Jacketed cavity FDR (one for Prototype, one for Production)
46	Manufacturing Process Documents	Dec-17	Jun-20	From B.90 jacketing activities
47	QA Documentation and Travelers	Dec-17	Jun-20	From B.90 jacketing activities

Table 6: HB650

51	HB650 Tuner	TC: ED0001253		Same as LB650 Tuner
52		Prototype Phase	Final Design Phase	Remarks:
53	Risk assessment	Done	NA	Available - see EPDM
54	TRS	NA	Jun-20	
55	Preliminary Design Review Documentation	Done	NA	Available - see EPDM
56	3D Models	Done	Jun-20	Available - see EPDM
57	Engineering drawings	Done	Jun-20	Available - see EPDM
58	Procurement Readiness Review Documentation	NA	Jun-20	Production drawings, production plan incl schedule, etc.
59	Engineering Note(s)	NA	Jun-20	No official note written for prototype
60	Final Design Review Documentation	NA	Jun-20	Final FEA, response analysis, electromechanical controls info, etc. Final for the prototype and final for the production.
61	Manufacturing Process Documents	NA	Jun-20	
62	QA Documentation and Travelers	Dec-17	Jun-20	No travelers
65				
66	HB650 Coupler	TC: ED0001260		Same as LB650 Coupler
67		Prototype Phase	Final Design Phase	Remarks:
68	FRS	Done	NA	Available - see EPDM
69	Risk assessment	Done	NA	Available - see EPDM
70	TRS	Done	Jun-20	Available - see EPDM
71	Preliminary Design Review Documentation	Done	Jun-20	Available - see EPDM
72	3D Models	Done	Jun-20	
73	Engineering drawings	Done	Jun-20	
74	Procurement Readiness Review Documentation	Done	Jun-20	Production drawings, production plan incl schedule, etc.
75	Engineering Note(s)	TBD	Jun-20	Not typically written as for vacuum or pressure vessels
76	Final Design Review Documentation	Jun-18	Jun-20	Final RF Design, final mech design, final thermal/structural analysis, etc.
77	Manufacturing Process Documents	Jun-18	Jun-20	
78	QA Documentation and Travelers	Jun-18	Jun-20	
81				
82	HB650 Cryomodule	TC: ED0001255		
83		Prototype Phase	Final Design Phase	Remarks:
84	FRS	Done	NA	Available - see EPDM
85	Risk assessment	Mar-17	Mar-17	RA FNAL requirement only
86	TRS	Jun-18	Jun-20	
87	Preliminary Design Review Documentation	Jun-18	NA	Subsystem preliminary design review information including cold mass, string, CM assembly plan, instrumentation, etc.
88	3D Models	Jun-18	Jun-20	
89	Engineering drawings	Jun-18	Jun-20	
90	Procurement Readiness Review Documentation	Jun-18	Jun-20	DAE to participate in Fermilab review
91	Engineering Note(s)	Jun-18	Jun-20	
92	Final Design Review Documentation	Jun-18	Jun-20	Subsystem final design review information including cold mass, string, CM assembly plan, instrumentation, etc.
93	Manufacturing Process Documents	TBD	Jun-20	
94	QA Documentation and Travelers	TBD	Jun-20	
95	Interface Specification	Jun-18	Jun-20	Required at CM level system. Expected versions for preliminary design and at final design stages.
96	Operational Readiness Clearance	Dec-20	Dec-20	Required at CM operations level.
97				
98	HB650 Cavity Processing and Testing			
99		Prototype Phase	Final Design Phase	Remarks:
100	Processing documents & Travelers	Done	TBD	Initial material in Feb/March includes updated travelers after current round of cavity processing. Production recipe will come after full verification of process.

Table 6: HB650 (cont.)

	A	B	C	D
1	325 MHz SS RF Amplifier			
2				
3	SSRFA 7 kW	TC: ED0005428		
4		<i>Prototype Phase</i>	<i>Final Design Phase</i>	Remarks:
5	FRS	Done	NA	Available - see EPDM
6	Risk Assessment	Feb-17	NA	Available - see EPDM
7	TRS	NA	Done	Jointly developed. Includes acceptance and testing plan.
8	Preliminary Design Review	NA	NA	Fermilab responsible for conducting review, DAE to set dates
15	Final design review	NA	Aug-17	Fermilab responsible for conducting review, DAE to set dates
17	TIS	NA	Jul-17	
18	Safety review	NA	Aug-17	Part of the FDR
19	Operational readiness clearance	NA	Jun-19	Completed after delivery and installation at PIP2IT.
20				
21	SSRFA 20 kW	TC: ED0005429		Not a R&D Deliverable
22		<i>Prototype Phase</i>	<i>Final Design Phase</i>	Remarks:
23	FRS	Done	NA	Available - see EPDM
24	Risk Assessment	Oct-17	NA	
25	TRS	NA	Sep-18	
35	TIS	NA	Sep-18	
36	Safety review	NA	Jun-19	Part of the FDR

Table 7: 325 MHz SSRF Power Amplifiers

	A	B	C	D
1	650 MHz SS RF Amplifier			
2				
3	SSRFA 40 kW	TC: ED0005430		
4		<i>Prototype Phase</i>	<i>Final Design Phase</i>	Remarks:
5	FRS	Done	NA	Available - see EPDM
6	Risk assessment	Done	NA	Available - see EPDM
7	TRS	NA	Jul-17	Jointly developed. Includes acceptance and testing plan.
8	Preliminary Design Review	Jul-17	NA	Fermilab responsible for conducting review, DAE to set dates
15	Final design review	NA	Sep-17	Fermilab responsible for conducting review, DAE to set dates
17	TIS	NA	Jul-17	
18	Safety review	NA	Sep-17	Part of the FDR
19	Operational readiness clearance	NA	Apr-20	Completed after delivery and installation at HTS-2.
20	List of information needed from FNAL	NA	Jul-20	Completed after delivery and installation at HTS-2.
21				
22	SSRFA 70 kW	TC: ED0005431		Not an R&D Deliverable
23		<i>Prototype Phase</i>	<i>Final Design Phase</i>	Remarks:
24	FRS	Done	NA	Available - see EPDM
25	Risk assessment	Oct-17	NA	
26	TRS	NA	Sep-21	Jointly developed
34	Final design review	NA	Dec-21	Fermilab responsible for conducting review, DAE to set dates
37	Safety review	NA	Dec-21	Part of the FDR

Table 8: 650 MHz SSRF Power Amplifier

	A	B	C	D
1	RF Controls			
2				
3	RF Protection Interlocks (RFPI)	TC: ED0005432		
4		<i>Prototype Phase</i>	<i>Final Design Phase</i>	Remarks:
5	FRS	Jan-18	NA	Circulating for comment withing DAE
6	Risk assessment	Done	NA	Available - see EDMS
8	System Operation Procedure	TBD		Requirements covered in the FRS. Final document is jointly developed.
9	Preliminary Design Review	Done	NA	Initial PDR conducted, awaiting design mods in response.
10	TRS	Jan-18	Dec-19	Same as FRS. Circulating for comment within DAE. Final TRS developed after SSR1 operation at PIP2IT.
11	Technical Design Report	NA	Dec-19	Jointly developed after SSR1 testing complete
12	Final design review	NA	Jan-20	
14	TIS	Sep-17		
15	Safety review	NA	Dec-18	Final review prior to SSR1 operations
16	Operational readiness clearance		Dec-18	

Table 9: RFPI

		TC: ED0004194 ED0005046 ED0005027 ED0005044 ED0004508 ED0004509 ED0004510 ED0004513		
18	Low Level RF System (LLRF)			
19		Prototype Phase	Final Design Phase	Remarks:
20	FRS of Integrated LLRF System	Done	NA	Approved through Fermilab; awaiting DAE approval
22	FRS of Master Oscillator and precision Ref distribution system	Done	NA	Approved through Fermilab; awaiting DAE approval
23	FRS of SRF Resonance Control Chassis	Done	NA	Approved through Fermilab; awaiting DAE approval
24	FRS of FPGA board	Done	NA	Approved through Fermilab; awaiting DAE approval
25	FRS of 4 Channel Up Converter	Done	NA	Approved through Fermilab; awaiting DAE approval
26	FRS of 8 Channel Down Converter	Done	NA	Approved through Fermilab; awaiting DAE approval
27	FRS of ADC/DAC Mezzanine board	Done	NA	Approved through Fermilab; awaiting DAE approval
28	Risk Assessment of all sub-systems of LLRF	Done		Available - see EPDM
29	Supporting Documents of existing system at Fermilab - schematics, layout of up-converter, down-converter, Multi-function controller boards, VHDL code	Done		Available for previous design - see EPDM
30	Supporting Documents of existing system at Fermilab-Detailed technical notes on the firmware (VHDL/Qsys) code and software code and design documentation	TBD	NA	Source code for previous design made available. New source code under joint development
31	Supporting Documents of system under development -up-converter - schematics, layout and test results, down-converter - schematics, design notes Digitiser Board - schematics, des	TBD		Available for previous design - see EPDM
32	Supporting Documents of system under development -Detailed technical notes or design notes on the firmware (VHDL/Qsys), cavity control and resonance control algorithms	TBD		Available for previous design - see EPDM; balance under joint development
33	System Operation Procedure		Jun-19	Will develop following SSR1 operations
34	Preliminary Design Review	Feb-18	NA	Fermilab responsible for the review, DAE to define dates. PDRs complete for up/down converters. ADC in process.
35	Priliminay TRS of Integrated LLRF System	Feb-18	NA	Jointly developed
36	Priliminay TRS of Master Oscillator and precision Ref distribution system	Feb-18	NA	Jointly developed
37	Priliminay TRS of LLRF Field Control Chassis	Feb-18	NA	Jointly developed
38	Priliminay TRS of SRF Resonance Control Chassis	Feb-18	NA	Jointly developed
39	Priliminay TRS of FPGA board	Feb-18	NA	Jointly developed
40	Priliminay TRS of 4 Channel Up Converter	Feb-18	NA	Jointly developed
41	Priliminay TRS of 8 Channel Down Converter	Feb-18	NA	Jointly developed
42	Priliminay TRS of ADC/DAC Mezzanine board	Feb-18	NA	Jointly developed
43	Priliminay TRS of Temperature Control Chassis	Feb-18	NA	Jointly developed
44	Technical Design Report		Jun-19	Following SSR1 operational experience
45	Acceptance Test Procedure for subsystems	Receipt of prototype + 8 weeks		Acceptance criteria in TRS, testing procedure is stand-alone document
46	Final design review	NA	Jun-19	Following SSR1 operational experience
48	TIS	Sep-17		Coincident with RFPI
49	Safety review	May-17	Dec-18	Coincident with RFPI
50	Operational readiness clearance		Dec-18	Coincident with RFPI

Table 10: LLRF

	A	B	C	D
1	Magnets			
2				
3	MEBT Magnets	TC: ED0001275 (Q), 2725 (D)		
4		Prototype Phase	Final Design Phase	Remarks:
5	FRS	Done	NA	Available - see EPDM
6	Risk assessment	Done	NA	Available - see EPDM
7	TRS	Done	NA	Available - see EPDM
8	Preliminary Design Review	Done	NA	Available - see EPDM
15	Final design review	Done	NA	Available - see EPDM
16	Acceptance Test Procedure	Done	NA	Available - see EPDM
19	Safety review	Done	NA	Available - see EPDM
20	Operational readiness clearance	Done	NA	Available - see EPDM
21				
22	Warm magnets (Linac 650 MHz) - DAE Design (Prime Responsibility with DAE)	TC: ED0003415 (Q), 3416 (D)		
23		Prototype Phase	Final Design Phase	Remarks:
24	FRS	Done	NA	Available - see EPDM
25	Risk assessment	Done	NA	Available - see EPDM
26	TRS	Done	Oct-18	Available - see EPDM
27	Preliminary Design Review	Oct-17	NA	Fermilab responsible for conducting review, DAE to set dates
34	Final design review	NA	Dec-18	Fermilab responsible for conducting review, DAE provides the date
36	Acceptance Test Procedure	NA	Jun-19	
38	Safety review	NA	Dec-19	After magnets received
39	Operational readiness clearance	NA	Dec-19	
40				
41	SSR2 Focusing lens - DAE Design (Prime responsibility with DAE)	TC: ED0004177		
42		Prototype Phase	Final Design Phase	Remarks:
43	FRS	Done	NA	Available - see EPDM
44	Risk assessment	Done	NA	Available - see EPDM
45	TRS	Done	Jul-18	Available - see EPDM
46	Preliminary Design Review	Done	NA	Available - see EPDM
53	Final design review	NA	Dec-18	
54	Acceptance Test Procedure	NA	Jun-19	
57	Safety review	NA	Jun-19	
58	Operational readiness clearance	NA	Jun-19	

Table 11: Magnets

	A	B	C	D
1	Horizontal Test Stand			
2				
3	Horizontal Test Stand	EPDM: ED0001677		
4		Prototype Phase	Final Design Phase	Remarks:
5	FRS	Done	NA	Available - see EPDM
6	Risk assessment	Done	NA	Available - see EPDM
8	Preliminary Design Review	Done	NA	Available - see EPDM
9	Technical Design Report	Done	NA	Feedcan drawings released by Fermilab a year ago - see EPDM This serves as the TDR.
10	3D Model	Done	NA	Available - see EPDM
11	Engineering drawings	Done	NA	Available - see EPDM
13	Engineering calculations	Done	NA	Available - see EPDM
15	Final design (Proc Read) review	Done	NA	Available - see EPDM
17	Interface Specification	Done	NA	Interfaces between cryostat and other systems is Fermilab responsibility. Already defined in commissioning document or drawings - see EPDM
18	Acceptance Testing/Commissioning Plan	Jun-18	NA	Joint RRCAT/FNAL document

Table 12: HTS