12th Meeting of DR/BDS/DUMP group

Date: 2021/03/31 (Wed)

Attendees: Karsten Buesser, Philip Burrows, Ibon Bustinduy, Marco Calviani, Angeles Faus-Golfe, Andy Lankford,
Andrea Latina, Thomas Markiewicz, Shin Michizono, Toshiyuki Okugi, Ivan Podadera, Soren Prestemon,
David L. Rubin, Peter Sievers, Nobuhiro Terunuma, Glen White, Andrzej Wolski, Kaoru Yokoya, Mikhail Zobov

Topics: The TPD revision for DR/BDS/DUMP

13th Meeting of DR/BDS/DUMP group

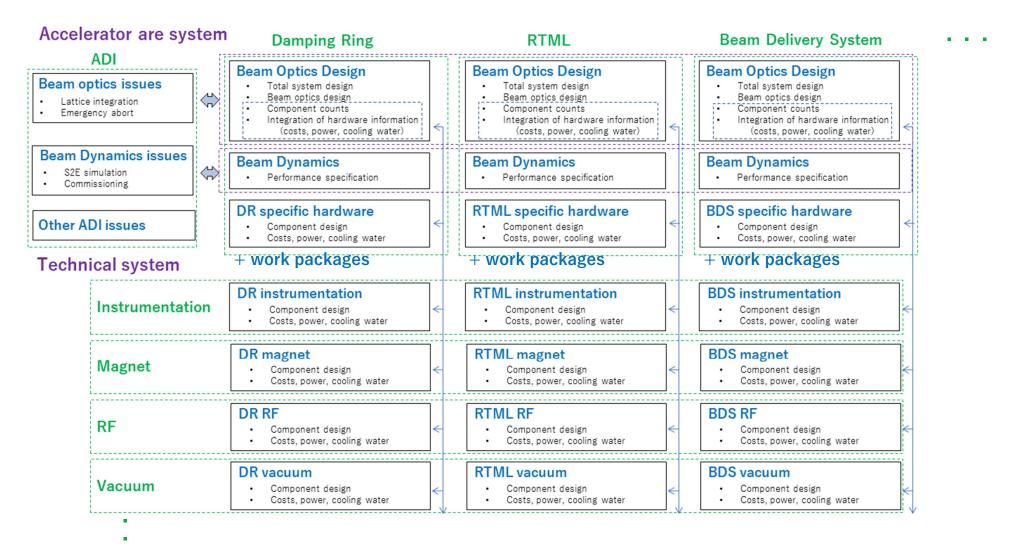
Date: 2021/04/14 (Wed)

Attendees were not recorded. (sorry)

Topics: WBS for DR/RTML/BDS area systems

(list up the to-do-lists for DR/RTML/BDS)

Simple WBS in Pre-Lab period (to write the ILC EDR)



Damping Ring

- List up all items for EDR related to DR
- Picked up the WP related items from the to-do-list of both area and technical systems and categorized.

DR area system

- 3WPs
- Remaining items
 of original area systems

Technical system

- Remaining items
 of original technical systems
- To be integrated the item of each technical category for all area systems

	Items	Deliverables	Related area and technical systems
Mark packages	DR cell design, based on present ILC optics (WP-12)	Beam optics design	DR(WP-12)
Work packages	DR cell design (further small emittancs) (WP-12)	Beam optics design	DR(WP-12)
	Dynamic aperture survey (WP-12)	Beam optics design; Performance specification	DR(WP-12)
	SC wiggler magnets (WP-12)	Component design; costing; power, cooling water	DR(WP-12)/SCmagnet
WP-12	Design of PM (WP-12)	Component design; costing; power, cooling water	DR(WP-12)/PMmagnet
***	PM prototyping (WP-12)	Performance specification	DR(WP-12)/PM magnet
	NC magnets (WP-12)	Component design; costing; power, cooling water	DR(WP-12)/Magnet
	Ion trapping and fast ion instability (WP-13)	Performance specification	DR(WP-13)
WP-13	Electron cloud instability (WP-13)	Performance specification	DR(WP-13)
	Fast FB system design (WP-13)	System design; costing	DR(WP-13)/Instrumentation
	Fast FB test (WP-13)	Performance specification	DR(WP-13)/Instrumentation
	Vacuum chambers to reduce SEY for positrin DR (WP-13)	Performance specification	DR(WP-13)/Vacuum (basic design was in TDR)
	System design of fast injection/extraction system (WP-14)	System design;	DR(WP-14)
WP-14	Fast kicker devices (WP-14)	Component design; costing;	DR(WP-14)
	Fast kicker power supplies (WP-14)	Component design; costing; power, cooling water estimation	DR(WP-14)
	System design of injection kicker for E-driven PS (WP-14)	System design;	DR(WP-14)
	Injection kicker device for E-driven PS (WP-14)	Component design; costing;	DR(WP-14)
	Injection kicker power supplies for E-driven PS (WP-14)	Component design: costing: power, cooling water estimation	DR(WP-14)/Source
	Items	Deliverables	Related area and technical systems
A roo systems	DR cell design, based on present ILC optics (WP-12)	Beam optics design	DR(WP-12)
Area system	DR cell design (further small emittancs) (WP-12)	Beam optics design	
	DR straight section optics design (for WP-14)	Beam optics design	DR
	System design of the beam diagnostics	Beam optics design	DR
Ontice decign and	ILC lattice integration	Beam optics design	ADI/DR
Optics design and	Contact part with ADI for the beam optics issues	Beam optics design	DR/ADI
	Integration of the hardware components in DR	Component counts; costing; power, cooling water estimation	DR/TechnicalSystems
system integration	Dynamic aperture survey (WP-12)	Beam optics design; Performance specification	DR(WP-12)
system mitegration	Small emittance tuning	Performance specification	DR
	Tolerance evaluation for each device	Performance specification	DR
	Ion trapping and fast ion instability (WP-13)	Performance specification	DR(WP-13)
Doom dunomics	Electron cloud instability (WP-13)	Performance specification	
Beam dynamics	Spece charge effects	Performance specification	DR DR
	Impedance driven instability	Performance specification	DR
and tuning	Tune shift by quadrupole wake for E-driven PS	Performance specification	DR/Source
and taring		Performance specification	DR/ADI
	Contact part with ADI for the beam dynamics and tuning System design of fast injection/extraction system (WP-14)	System design;	DR(WP-14)
Fast kicker	Fast kicker devices (WP-14) Fast kicker power supplies (WP-14)	Component design; costing;	
rasi kickei		Component design; costing; power, cooling water estimation	
	System design of injection kicker for E-driven PS (WP-14)	System design;	
	Injection kicker device for E-driven PS (WP-14)	Component design; costing;	DR(WP-14)
	intection kicker power supplies for E-driven P3 (WP-14)	Lomponent design; costing; power, cooling water estimation	DROWP-141/Source
	Items	Deliverables	Related area and technical systems
	Fast FB system design (WP-13)	System design; costing	DR(WP-13)/Instrumentation
Tachnical cyctam	Fast FB test (WP-13)	Performance specification	DR(WP-13)/Instrumentation
Technical system			
	Beam position monitors	costing	Instrumentation/DR
		costing costing	Instrumentation/DR
Instrumentation	Beam position monitors Beam current monitor Tune monitor		Instrumentation/DR Instrumentation/DR
	Beam position monitors Beam current monitor	costing	Instrumentation/DR
	Beam position monitors Beam current monitor Tune monitor	co sting co sting	Instrumentation/DR Instrumentation/DR
Instrumentation	Beam position monitors Beam current monitor Tune monitor Beam size/profile monitors	costing costing costing	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CFS/DR
Instrumentation	Beam position monitors Beam current monitor Tune monitor Beam suize/profile monitors Slow orbit FB	costing costing costing Component design; costing	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR
	Beam position monitors Beam current monitar Lune monitor Beam size/profile monitors Slow orbit FB Polatim teters	costing costing costing costing Component design; costing Component design; costing	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CFS/DR
Instrumentation	Beam position monitors Beam current monitors Iven monitors Beam size/profile monitors Slow orbit #B Polarimeters Cabling and monitor station	costing costing costing Costing Component design; costling Component design; costling Component design; costling Component counts; costling; power, coolling water estimation	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CF S/DR Instrumentation/CF S/DR
Instrumentation	Beam position monitors Beam current monitar Tune monitar Beam size/profile monitors Slew orbit FE Polarimeters Cabling and monitor station SC cavities, cryostal, the transfer	costing costing costing Costing Component design; costing Component design; costing Component costing: Component costing: power, cooling water estimation Component costing: costing:	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CFS/DR Instrumentation/CFS/DR SCRF/DR
Instrumentation Magnet	Beam position monitors Beam current monitar I une monitor Beam size/profile monitors Slow orbit FB Polarimeters Cabling and monitor station SC cavities, orgostal, the transfer RF source, waveguide	costing costing costing Component design; costing Component design; costing Component design; costing Component countx; costing; power, cooling water estimation Component design; costing Component design; costing	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CF S/DR Instrumentation/CF S/DR Instrumentation/CF S/DR INSTRUMENTATION INSTRUM
Instrumentation Magnet	Beam position monitors Beam current monitor The monitor Beam size/profile monitors Slow orbit RB Polosimeters Cabiling and monitor station SC cavities, cryostal, the transfer RF source, waveguide LLRF	costing costing costing Component design; costing;	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CF S/DR Instrumentation/CF S/DR Instrumentation/CF S/DR INSTRUMENTATION INSTRUM
Instrumentation	Beam position monitors Beam current monitar Tune monitor Beam size/profile monitors Slow orbit FB Polisim eters Cabling and monitor station SC cavoltes, opostal, the transfer RF source, waveguide LLRF SC wiggler magnets (WP-12)	costing costing costing costing Component design; costing; power, cooling water estimation Component design; costing; power, cooling water estimation Component design; costing; power, cooling water estimation	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CF S/DR Instrumentation/CF S/DR INSTRUMENTATION INSTRUMENTATION INSTRUMENTATION INSTRUMENTATION INSTRUMENTATION
Instrumentation Magnet	Beam position monitors Beam current monitor The monitor Beam size/profile monitors Slow orbit R5 Polarimeters Cabiling and monitor station SC eavities, cryostal, He transfer RF source, waveguide LLRF SC wingler magnets (WP-12) Cryostal, He transfer	costing costing costing costing Component design; costing Component design; costing Component design; costing Component counts; costing: power, cooling water estimation Component design; costing; power, cooling water estimation Component design; costing; power, cooling water estimation Component design; costing;	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DF Instrumentation/OFS/DR Instrumentation/OFS/DR INSCRP/DR ILLEF/DR LLEF/DR DR.WH-12/SCmagnet SCmagnet/DR
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Instrumentation Magnet RF	Beam position monitors Beam current monitor The monitor The monitor Beam size/profile monitors Slow other RB Polestmeters Cabling and monitor station SC-oxylide, crystat, the transfer RF source, waveguide LLRF SC-wiggler magnets (WP-12) Crystat, the transfer Power supplies, and cabling for SC magnet Design of PM (WP-12) PM protedying (WP-12) PM protedying (WP-12)	osting osting osting costing Component design; costing Component cesign; costing Component design; costing Component design; costing Component design; costing Component cesign; costing Component cesig	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CR Instrumentation/CF \$/DR Instrumentation/CF \$/DR INSTRIPT INS
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Instrumentation Magnet RF	Beam position monitors Beam current monitor The monitor Beam size/profile monitors Slew orbit RE Polarimeters Cabiling and monitor station SC cavities, cryostal, He transfer RF source, waveguide LLRP SC wingler magnets (WP-12) Cryostal, He transfer Power supplies, and cobiling for SC magnet Design of PM (WP-12) FM prototyping (WP-12) RC magnets (WP-12) Power supplies, and cobiling for NC magnet	costing costing costing costing Component design; costing Component design; costing Component counts; costing: Component counts; costing: Component design; costing Component design; costing; power, cooling water estimation Parformance specification Component design; costing; power, cooling water estimation Component design; costing; power, cooling water estimation Component design; costing; power, cooling water estimation	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CF \$/DR Instrumentat
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Instrumentation Magnet RF	Beam position monitors Beam current monitors The monitor The monitor Beam size/profile monitors Slow order F8 Polosimeters Cabling and monitor station SC cavities, cryostal, the transfer RF source, waveguide LLRP SC wageler magnets (WP-12) Cryostal, the transfer Power supplies, and cabling for SC magnet Design of PM (WP-12) PM protection (WP-12) No magnets (WP-12) PM protection (WP-12) No magnets (WP-12) Regular vacuum components (pomp etc.) Impedance calorisations Photon stopper from wigglers	o string costing costing costing costing costing costing costing Component design; costing Component design; costing Component covered	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CR Instrumentation/CR Instrumentation/CR INSTRIPT INS
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Instrumentation Magnet RF	Beam position monitors Beam current monitor The monitor Beam size/profile monitors Slew orbit FB Polarimeters Cabiling and monitor station SC cavities, cryostal, He transfer RF source, waveguide LLRP SC wingler magnets (WP-12) Cryostal, He transfer Fover supplies, and cobiling for SC magnet Design of PM (WP-12) RC magnets (WP-12) RC magnets (WP-12) RC magnets (WP-13) Regular vacuous design for NC magnet Magnet support Vacuum chambers to reduce SEY for position DR (WP-13) Regular vacuum components (pump etc.) Impedo ane colcivitions Photon support from wigglers Cooling water system and distribution Magnet purpor supply station Magnet power supply station	o string costing costing costing costing costing costing costing costing Component design; costing Component design; costing Component costing; costing; component costing; co	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CR Instrumentati
Instrumentation Magnet RF	Beam position monitors Beam current monitors Itone monitor Beam size/profile monitors Siew offile FB Polarimeters Cabling and monitor station Sic cavities, copastal, the transfer RF source, waveguine LLRF Sic wagger magnets (WF-12) Cryodal, the transfer Power supplies, and cabling for SC magnet Design of PM (WF-12) PM prototyping (WP-12) Not magnets (WP-12) PW cryodal the transfer Power supplies, and cabling for SC magnet Design of PM (WF-12) PW cryodal the transfer Regular vector (WP-12) Romanies (WP-13) Regular vector (WP-13) Reg	o string costing costing costing Component design; costing; power, cooling water estimation Component design; costing; power, cooling water estimation Component design; costing; power, cooling water estimation Performance specification Component design; costing; power, cooling water estimation System design; costing; power, cooling water estimation Performance specification Component counts; costing; cooling water estimation Performance aspecification Component counts; costing; cooling water estimation System design; costing; cooling water estimation System design; costing; cooling water estimation System design; costing; cooling water estimation System design	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CF S/DR Instrumentation/CF S/DR Instrumentation/CF S/DR INSTRUMENTATION INST
Instrumentation Magnet RF	Beam position monitors Beam current monitor The monitor Beam size/profile monitors Slew orbit FB Polarimeters Cabiling and monitor station SC cavities, cryostal, He transfer RF source, waveguide LLRP SC wingler magnets (WP-12) Cryostal, He transfer Fover supplies, and cobiling for SC magnet Design of PM (WP-12) RC magnets (WP-12) RC magnets (WP-12) RC magnets (WP-13) Regular vacuous design for NC magnet Magnet support Vacuum chambers to reduce SEY for position DR (WP-13) Regular vacuum components (pump etc.) Impedo ane colcivitions Photon support from wigglers Cooling water system and distribution Magnet purpor supply station Magnet power supply station	o string costing costing costing costing costing costing costing costing Component design; costing Component design; costing Component costing; costing; component costing; co	Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/DR Instrumentation/CR Instrumentati

Resource

of technical

preparation

Resource of EDR

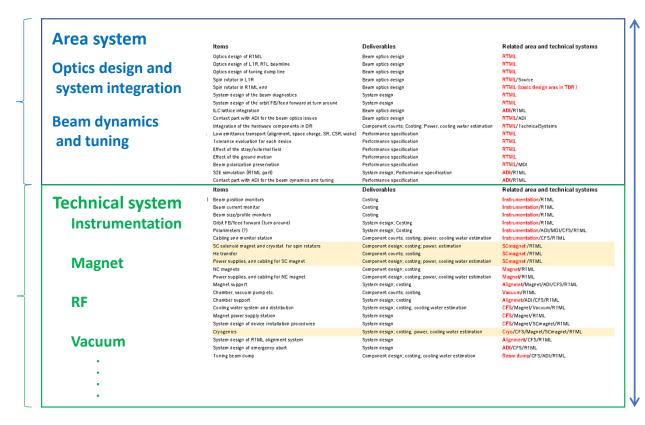
RTML

List up all items for EDR related to RTML

RTML area system

Technical system

 To be integrated the item of each technical category for all area systems



Resource of EDR

Beam Delivery System

- List up all items for EDR related to BDS
- Picked up the WP related items from the to-do-list of both area and technical systems and categorized.

BDS area system

- 2WPs
- MDI related items
- Remaining items
 of original area systems

Technical system

- Remaining items
 of original technical systems
- To be integrated the item of each technical category for all area systems

Work packages	Items	Deliverables	Related area and technical systems
Work packages	Optics design of final focus beam line (WP-15)	Beam optics design	BDS (WP-15)
	Correction of higher order optics aberration (WP-15) Beam tuning study with machine learning technique (WP-15)	Performance specification Performance specification	BDS (WP-15) BDS (WP-15)
14/D 4 E	ATF3 beam test (WP-15)	Performance specification	BDS (WP-15)
WP-15	Short range static wakefield effect (WP-15)	Performance specification	BDS (WP-15)
	Short range dynamic wakefield effect (WP-15)	Performance specification	BDS (WP-15)
	System desing of the intra-train orbit FB (WP-15)	Performance specification	BDS(WP-15)
	Cavity BPMs (WP-15)	Performance specification; Costing	BDS (WP-15)/Instrumentation
WP-16	IP intra-train FB (WP-15)	Performance specification; Costing	BDS (WP-15)/Instrumentation
	Upstream intra-train FB (WP-15)	Performance specification; Costing	BDS (WP-15)/Instrumentation
	Wakefield minimization for vacuum components (WP-15) Collimators (WP-15)	System design; Performance specification; Costing System design; Performance specification; Costing	BDS (WP-15)/Vaccom BDS (WP-15)/CFS
	QD0 package with anti-solenoid (WP-16)	System design; Performance specification; Costing Component design; Costing; Power estimation	BDS (WP-15)/CFS BDS (WP-16)/SCmagnet/MDI
	QF1 package (WP-16)	Component design; Costing; Power estimation	BDS (WP-16/SCmagnet/MDI
	QD0 vibration test (WP-16)	Performance specification	BDS (WP-16)/SCmagnet/MDI
	Polarimeters	Performance specification; Costing	BDS (MDI)/Instrumentation/ADI/MDI
MDI	Energy spectrometers	Performance specification; Costing	BDS (MDI)/Instrumentation/ADI/MDI
	Anti-DID (detector solemoid)	Component design	BDS (MDI)/Scmagnet/MDI
	System design of push-pull scheme	System design	BDS (M DI)/CFS/ADI/MDI
	System design of Packman	System design	BDS (MDI)/CFS/ADI/MDI
	rtems	Deliveracies	Related area and technical systems
	Optics design of final focus beam line (WP-15)	Beam optics design	
Area system	Optics design for QD0 package design (for WP-16)	Beam optics design	BDS/SC magnet/MDI
AIGO SYSTEIII	Optics design for QF1 package design (for WP-16)	Beam optics design	BDS/SC magnet/MDI
=	Optics design for Crab cavity (for WP-3)	Beam optics design	BDS/SCRF/MDI/ADI
	Optics design of beam diagnostic system	Beam optics design	BDS
Optics design and	Optics design of beam collimation system	Beam optics design	BDS
Optics design and	Optics design of mail beam dump line	Beam optics design	BDS
· ·	Optics design of tuning beam dump line	Beam optics design	BDS
system integration	System design of the beam diagnostics	System design	BDS
system integration	System design of Muon collimation ILC lattice integration	System design Beem optics design	BDS/MDI/ADI ADI/BDS
	ILC lattice integration Contact part with ADI for the beam optics issues	Beam optics design Beam optics design	ADI/BDS BDS/ADI
			BDS/TechnicalSystems
	Integration of the hardware components in DR L* and crossing angle	Component counts; Costing; Power, cooling water estimation System design	ADI/CFS/MDI/BDS
Beam dynamics	Correction of higher order optics aberration (WP-15)	Performance specification	BDS (WP.45)
Deam dynamics	Beam tuning study with machine learning technique (WP-15)	Performance specification	
1.0	Tolerance evaluation for each device	Performance specification	RDS
and tuning	Effect of the ground motion	Performance specification	BDS
und tuning	Long range static wakefield effect (resisitive wall)	Performance specification	BDS
	Vacuum chamber diameter and magnet bore design	Performance specification	BDS
	ATF3 beam test (WP-15)	Performance specification	
	Short range static wakefield effect (WP-15)	Performance specification	
	Short range dynamic wakefield effect (WP-15)	Performance specification	
	System desing of the intra-train orbit FB (WP-15)	Performance specification	
	Collimation and detector background evaluation (incl. Muon)	Performance specification	BDS/MDI/ADI
	Radiation loss evaluation in dump line	Performance specification; System design	BDS/ADI/CFS
	S2E simulation (BDS part)	Performance specification; System design	ADI/BDS
	Items	Deliverables	Related area and technical systems
	Cavity BPMs (WP-15)		BDS (WP-15) / Instrumentation
Technical system	IP intra-train FB (WP-15)	Performance specification; Costing Performance specification; Costing	
recinited system	Upstream intra-train FB (WP-15)	Performance specification; Costing	
and the second second	Beam current monitor	Costine	Instrumentation/BDS
Instrumentation			matrumentation/ 003
	Ream size (profile monitors (la sequire)		Instrumentation/RDS
instrumentation	Beam size/profile monitors (laserwire) Polarimeters	Performance specification; Costing Performance specification; Costing	Instrumentation/BDS BDS (MDI)/Instrumentation/ADI/MDI
instrumentation	Beam size/profile monitors (Is service) Polarimeters Energy spectrometers		
instrumentation	Polarimeters	Performance specification; Costing	
instrumentation	Polarimeters Energy spectrometers	Performance specification; Costing Performance specification; Costing	
	Polarimeters Energy socctometers Laser station for polarimeters and laser wire monitors Cabling and monitor station Crab cavities, reyestat (VPP-3)	Performance specification; Costing Performance specification; Costing System design; Costing; Power, cooling water estimation	BDS.M.DIV/instrumentation/ADI/MDI BDS.M.DIV/instrumentation/ADI/MDI Instrumentation/CFS/BDS/MDI Instrumentation/CFS/BDS SCRF.WP-3J/BDS
	Polarim eters Energy spectrometers Laser station for polarim eters and laser wire monitors Cabling and monitor station Crab cavities, crystat (WP-3) Crab cavity LLRF (WP-3)	Performance specification: Costing Performance specification: Costing System design; Costing: Pewc, cooling water estimation Component counts; Costing: Power, cooling water estimation Component design; Costing: Power est	BDS.MDIVInstrumentation/ADIVMDI BDS.MDIVInstrumentation/ADIVMDI Instrumentation/CFS/BDS/MDI Instrumentation/CFS/BDS SCHRWH-3VBDS SCHRWH-3VLUEF/BDS
Magnet	Polarine stars Energy social meters Laser station for polarine eters and laser wire monitors Cabing and monitor station Cas a context cryostat (CMP-3) Cas be ently LLFF (MP-3) He transfer for casb cavity	Performance specification. Costing. Performance specification Costing. System design; Costing: Power, cooling water estimation. Component counts: Costing: Power, cooling water estimation. Component costing: Costing: Power estimation. System design; Costing: System design; Costing:	BDS.M.DIC/Instrumentation/ADI/MDI BDS.M.DIC/Instrumentation/CFS/RDS/MDI Instrumentation/CFS/RDS/MDI Instrumentation/CFS/RDS SCRFQMP-34/KLIR/RDS SCRFQMP-34/KLIR/RDS SCRFQMP-34/KLIR/RDS
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Resource of technical preparation

Resource of EDR

Technical preparation document

Ver-5: 2021/Jam/26

Technical Preparation and Work Packages (WPs) during ILC Pre-lab

IDT-WG2

Engineering design document

Engineering design documentation

IDT-WG2

(Ver.2,2021-Jan-06)

Outline:

One of the main missions of the ILC Pre-lab on the engineering front is to complete an engineering design report (EDR), that is derived from the TDR published in 2013. The EDR will represent the "technical readiness" for the actual construction of the ILC and will also be expected to serve as a critical material to be evaluated in certain countries in the context of formal project approval. The EDR will include basic specifications and drawings for manufacturing and construction. Cost-estimate confirmation, scheduling, and preparation for mass production will also be included in this report.

Timeline:

1st year; Work on TDR-based cost-estimate confirmation that has been started by an international team centered at the Pre-lab

2nd year: Complete the cost-estimate confirmation based on progress in technical preparation plans and conduct an internal review in the latter half of the 2nd year. The review will also report on the progress of resolving the technical problems encountered during the preparation period.

3rd year: Conduct an external review and complete the scrutiny of costs and risks; complete the draft of Engineering Design Report (EDR).

4th year: Publish the EDR (in the first half of the year), report on the progress in resolving the technical problems encountered, and prepare for starting each large bid.

Items:

- Engineering design and documentation based on WBS
- Cost-estimate confirmation/update, tender, and purchase preparation
- Plans for mass production and transportation, QA.
- Schedule follow-up and construction schedule preparation
- Resource follow-up and planning

Expected FTE:

Contents (based on TDR Vols. 3-II)	Human Resources (FTE-yr)
Accelerator design	3
Main Linac and SCRF*	20
Sources	5
Damping ring	5
BDS	5
Beam dump	2
RTMI	2
Conventional facilities and siting	5
Control	3
Construction schedule, commissioning, and operations	3
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^{*} includes cryogenics, RF system (high-power and low-level RF)