EDR Strategy and Timeline
Cavities and Cryomodules

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Strategy in the EDR Phase

During the EDR Phase (next three years):

- Want to come to consensus on an ILC Cavity & Cryomodule design (best of the best)
  - **Fully engineered CM design that meets requirements**
  - **May not be the exact "final design" (depends on project start date)**
- Want to verify this design by passing it through a prescribed series of validation tests **(XFEL will validate its design)**
- Want to validate (to the extent possible) the assumptions of the ILC Value Estimate (updated cost at end of EDR)
- Do Not Want to shut off new ideas/approaches
  - **May be necessary to meet ILC requirements (TBD)**
- Do Not Want to lose any potential partners
  - **Need to respect the boundaries and plans of each region/institution**
- **Multiple branch points in this decision process**
- **Manage EDR phase in the face of some uncertainty**

Strategy in the EDR Phase (cont'd)

- Already have a cavity & cryomodule baseline design (based on Type III+, established in the RDR) however still need to verify the gradient and the yield of cavities
- Differences between Type IV and Type III+ still needs to be validated (quad in middle, choice of tuner…)
- Know that there are some changes that must be made due to ILC requirements (pipe size, quad parameters…)
- Initiatives exist for even more changes that could be beneficial (performance/cost/reliability)
  - **Cavity shape**
  - **He vessel material**
  - **Position of magnetic shields**
  - **New coupler and tuner designs**
  - **Instrumentation**
- **If changes are made still need to decide whether this results in a unified design or a plug compatible design**

Basic strategy of designing Cryomodule

Consideration of plug-compatible design
for cryomodule and cavity unit

H. Hayano, KEK

Lists Pros/Cons of Unified & Plug Compatible Designs

Cryomodule Compatibility

- Types of "compatibility"
  - **Exact part & assembly procedure match**
    - Use the same drawing set (same materials, tolerances, etc.)
    - Use the same assembly techniques
  - **Most parts match but allow some differences**
    - Manufacturing techniques could be different
    - Assembly procedures could be different
  - **Plug-in compatible (slot length & interconnect are the same)**
    - Performance based specification with interface points
    - Internal parts can be different
    - **Regions responsible for entire sections of Main Linac**
- As compatibility moves down the list
  - **Project risk and number of spares increases**
  - **Need for component & system testing increases**
- How to deal with different safety codes?

Fabrication Model

- Independent of which design the cryomodules are (identical, near-identical with common parts or plug compatible) still want to know the most probable fabrication model => won't know this for quite some time
- **Final ILC cost/reliability could depend on Fabrication Model**
  - CAUTION: In the "Value" world, Final ILC cost may not drive decisions
- Many possible Fabrication Models (just a few here)
  - **One Region produces all cryomodules (RDR Value Estimate)**
  - **Continue to use the three Region approach (1/3 split)**
  - **Three (or more) countries build cryomodules internal to their national boundaries and ship them to the ILC**
  - **Dressed cavities are built and tested "around the world" but cryomodules are assembled only at the ILC site => cold mass parts come from low bidder of a world-wide tender**
  - **Industry forms joint ventures (national, regional or world-wide) and creates the most efficient way to build cryomodules (like cars)**
  - **Many variants are possible => all have their issues**
- **Choice of Fabrication Model interacts with compatibility issue**
- **This Technical Group needs to guide the ILC to correct solution**

Key Questions

- Level of compatibility allowed?
  - **Complicated by the lack of a precise project start date**
    - "Fast track" => changes limited by R&D efforts available and ability to complete validation testing (people, time, and $)
    - More time => can develop new designs & perform validation tests
      - What about statistics?
  - **Need to understand the interaction of one component with another (e.g. cavity shape & RF systems)**
    - How "far reaching" are the changes?
    - Can you make components like dressed cavities interchangeable?
  - **What are the tradeoffs for allowing a different design**
    - Pros versus Cons => needs to be analyzed
      - Does participation depend on using "plug compatibility"?
      - Does Regional Industrialization produce different designs?
- **Question: If the machine is upgraded to 1 TeV at a later date won't the new cryomodules be different from the originals?**

Key Questions (cont'd)

- Fabrication model?
  - **Technical and political question => probably can only answer the technical part**
    - Try to understand what is the best technical solution for the project and what constitutes "mastering the technology" in a Region
      - Does one model give significantly better results (QC)?
      - Is final assembly a contentious point?
    - Would like to have statistics on intercontinental shipping of fully assembled cryomodules (very few opportunities)
  - **Several relevant examples of Fabrication Models**
    - Tevatron, Main Injector and HERA magnets
    - SNS cryomodules
    - LHC dipoles & quads (most recent)
    - XFEL cryomodule plans

Design Strategy – Use the XFEL Design Don't Allow Changes

- Accomplishments of TTF/FLASH give confidence to the validity of the Type III+ design (It Works!)
- Between now and the end of EDR phase Asia & America efforts in CM production will be limited
  - **STF & ILCTA (~ 6 to 8 CM at best => won't all be the same)**
- **XFEL will produce 101 CM using the TTF III+ design with industrial participation (better than any validation test)**
- **Do not want to move too far away from the XFEL experience (loss of continuity/shared experience)**
- Any resources going into an alternative design are resources that could have gone into perfecting the Type III+/IV design or creating a better fabrication expertise (Industrialization) in the Region (Opportunity Cost)

Design Strategy – Modify the XFEL Design Allow Changes

- ILC RDR design/cost estimate calls for a cavity gradient, yield and reduction in cost that has yet to be verified
  - **Need to verify assumptions (S0/S1 Goals) or change them or change the design**
- Regions may have very different "cost to fabricate" for a specific design => allowing variation could lower overall cost of the project
- Regions may have different industrial or funding constraints which lead to optimization around a slightly different design
  - **Regional Industrialization may require changes (IP Rights)**
  - **May need to show some intellectual contribution to the project to satisfy a funding agency (master technology not just production)**
- XFEL experience (with respect to cost and/or reliability) may uncover issues that force changes

Validation Survey

- Very important to define the criteria for validation of a new design before alternatives are completed
  - **# of parts fabricated and tested?**
  - **Hours of component test / simulated lifetime test?**
  - **Requirement to be tested in # of cryomodules?**
  - **Requirement for test with beam?**
- At the DESY Cavity Kickoff Meeting, I presented an Excel-based survey with these questions and acquired some data/results

Survey Results (abbreviated)

Validation Survey	NOTE: Vallidation tests occur after all R&D and prototype work is complete & design change is mature enough to be considered as change to baseline													
If you make a change in this →	Cavity Shape LL OR RE	Cavity Material Large Small Grain	Magnet Shield Location	Quad Design	Quad Position	BPM Design	He Vesssel SS vs. Ti	Tuner Design	Coupler Design	Pipe Size (dia)	Rad Shield Design	Support Design Transport fixture	Instrumentation	Align System
You validate the change by doing this ↓														
Can design change be made without testing? (Y/N)	N	N	N	N	N (few Y)	N	N	N	N	Y (few N)	Split	N	N	N
Number of components fabricated & tested?	24-30	30	10	1-3	3	3	24-30	10	24	1	1-3	1-3	1	1
Does design change require only component level testing? (Y/N) Component level testing equals Vert or Horiz testing or cycle test	N	Y (V&H)	N	N	N	N	Split (H)	N	N	N	Split	N	N	N
Hours of component level testing?		1000hrs		40hrs		500hrs	1000hrs	1000hrs	1000hrs			250 hrs	250 hrs	
Does design change require testing in cryomodules (without beam)? (Y/N)	Y	N	Y	Y	Y	Y	Y (few N)	Y	Y	Y	Y	Y	Y	Y
Number of cryomodules?	3		1	1	3	3	3	1-3	3	1	1	1-3	1-3	1
Does design change require testing in RF Unit/String test (with beam)? (Y/N)	Y	N	N	N	Split	Y	N	Split	Split	N	N	N	N (few y)	N
Hours of string testing?	1000hrs	0	0	0	1000hrs	1000hrs	0	1000hrs	500hrs	0	0	0	100hrs	0

Results from survey can be used to identify dependencies in design schedule

Cryomodule Design Schedule

From the KEK Cryomodule KOM

- This schedule looks at the cryomodule design process up until a "Ready for Large Scale Production" date
- It creates logical links between tasks and does not impose an "end date"
- Type V becomes ILC-1 (first ILC prototype)
- Think of this as a "tool to help make decisions", dates and dependencies can change
- Initial Criteria
  - **Include feedback from XFEL, STF, ILCTA into design process**
  - **Allow for a parallel ACD design effort**
  - **Down select to get the best overall design for ILC_1**
  - **Cavity shape decision should be as late as possible and be driven by measured performance (data from test systems)**
  - **Provide for CM Pre-series production (same time est. as XFEL)**

Critical Links

- Define the dates when test results are available
  - **Get schedules for XFEL, STF, ILCTA (Hans, Norihito, Harry)**
  - **These dates DRIVE the schedule (VERY IMPORTANT)**
    - **Building, installing & testing cryomodules takes time**
  - **Important to DEFINE level of tests needed (in a CM operating in a string or just a bench test) => How do you define reliability?**

Realistically:

- FLASH & XFEL will validate Type III+ design
- ILCTA will validate Type IV (low statistics)
- ACD design will be validated at STF-1 & STF-2 (low statistics)

- Type V (ILC_1) Design takes dependencies from
  - **Type IV Design Complete**
  - **Some portion of XFEL Pre-Series Complete**
  - **ILCTA Results Available**
  - **STF-1 Results Available**

Critical Links (Cont'd)

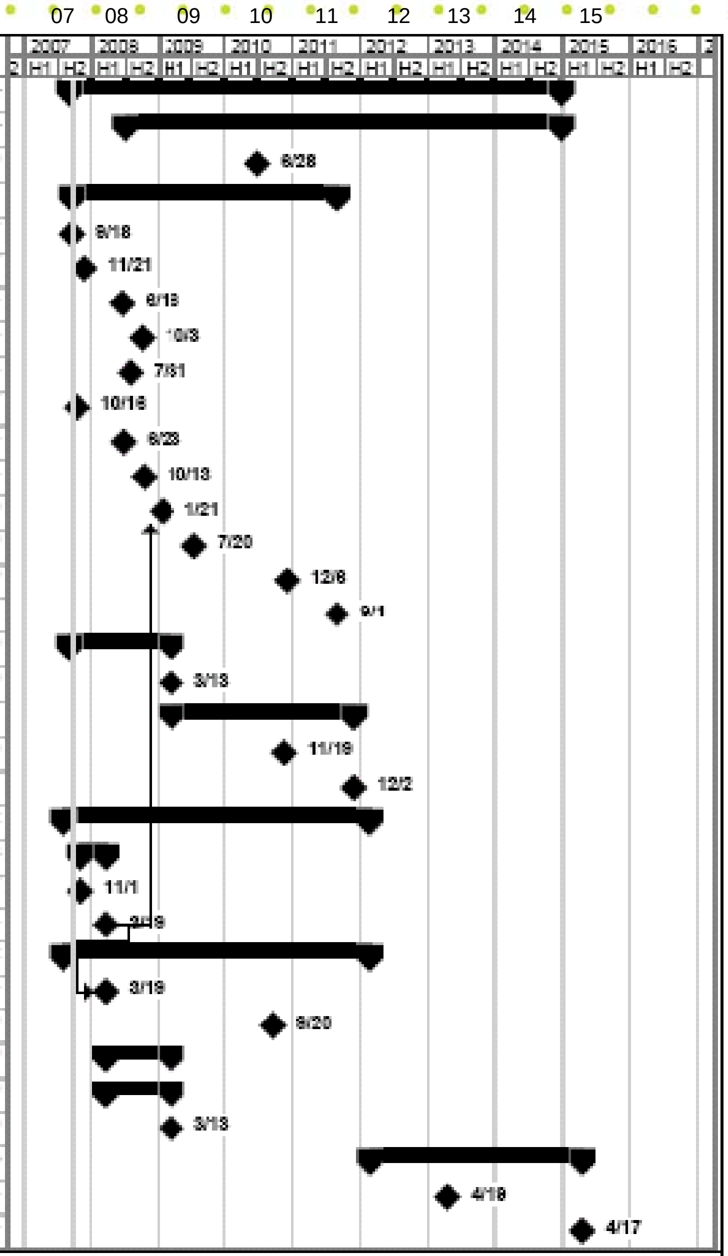
- Cavity Shape Decision
  - **Allow different shapes in CM design model (so decision can be as late as possible)**
  - **Make cavity shape decision when data available: XFEL Pre-Series complete + STF-2 Results available and ILCTA has a full Type IV+ RF Unit**
  - **DRIVES THE "READY DATE" VERY LATE!**
  - **(See later slide for an alternative)**
- Allow ACD Design to go on in parallel
  - **Use KEK STF schedule information for this part of schedule**
- **At the very end, move forward with only one design that incorporates best of all worlds**
  - **Changing this assumption changes the schedule end date**

Critical Links (Cont'd)

- Industrialization of the Type V design starts as soon as Type IV design is complete
- Pipe size decision & cryogenic design goes quickly
- Able to make decision on Large Grain/Small Grain independent of cavity shape
- If there was considerable "float in the schedule" allow that task more time => people are busy so things take longer
- Many tasks go in parallel meaning lots of people are needed and international participation is required
  - **Must get people to take responsibility for parts of the design and for delivering an evaluation for final decision on time**
    - **Evaluation = specification of parameters + quantification of all alternatives + criteria for validation + decision tree**

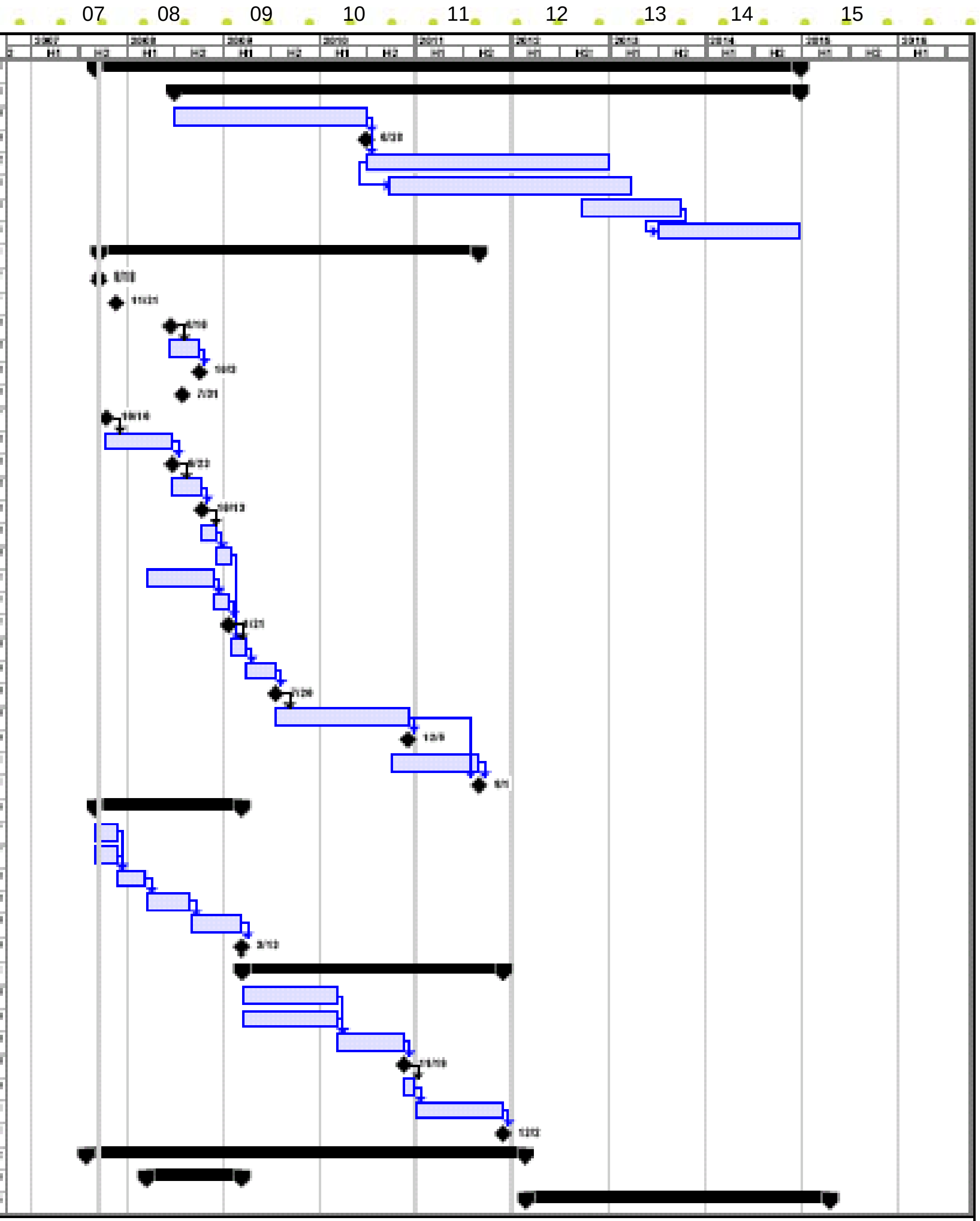
Milestone Dates

ID	Task Name	Duration	Start	Finish
1	Ongoing Cryomodule Production	86.6 mons	Mon 8/6/07	Fri 12/26/14
2	XFEL Schedule	84.7 mons	Tue 7/1/08	Fri 12/26/14
4	XFEL Pre-Series Results Available	0 mons	Mon 6/28/10	Mon 6/28/10
9	ILCTA Schedule	51.86 mons	Tue 9/18/07	Thu 9/1/11
10	Refrigerator #1 Operational	0 mons	Tue 9/18/07	Tue 9/18/07
11	CM1 (DESY kit) Complete	0 days	Wed 11/21/07	Wed 11/21/07
12	Cryo System Components Installed	0 mons	Mon 6/16/08	Mon 6/16/08
14	CM1 Tests Complete	0 mons	Fri 10/3/08	Fri 10/3/08
15	Refrigerator #2 Operational	0 mons	Thu 7/31/08	Thu 7/31/08
16	INFN Places Order for CM2 Cold Mass	0 mons	Tue 10/16/07	Tue 10/16/07
18	CM2 Cold Mass Parts Available	0 mons	Mon 6/23/08	Mon 6/23/08
20	CM2 Complete	0 mons	Mon 10/13/08	Mon 10/13/08
25	CM3 (Type IV) Complete	0 days	Wed 1/21/09	Wed 1/21/09
28	ILCTA Results Available	0 mons	Mon 7/20/09	Mon 7/20/09
30	ILCTA Running at Low Rep Rate	0 mons	Mon 12/6/10	Mon 12/6/10
32	ILC-like RF Unit Operations Begin	0 mons	Thu 9/1/11	Thu 9/1/11
33	STF-1 Schedule	20 mons	Mon 8/6/07	Fri 3/13/09
39	STF-1 Results Available	0 mons	Fri 3/13/09	Fri 3/13/09
40	STF-2 Schedule	36.6 mons	Mon 3/16/09	Fri 12/2/11
44	STF-2 CM Assembled (not tested)	0 mons	Fri 11/19/10	Fri 11/19/10
47	STF-2 Results Available	0 mons	Fri 12/2/11	Fri 12/2/11
48	BCD Cryomodule Design	68.86 mons	Wed 8/1/07	Fri 2/24/12
49	Type IV Design	6 mons	Thu 11/1/07	Wed 3/19/08
50	Initial Drafting Pkges Complete	0 mons	Thu 11/1/07	Thu 11/1/07
55	Type IV Design Complete	0 days	Wed 3/19/08	Wed 3/19/08
56	Type V (ILC_1) Design Decisions	68.86 mons	Wed 8/1/07	Fri 2/24/12
57	Begin Type V (ILC_1) Design	0 days	Wed 3/19/08	Wed 3/19/08
77	Type V (ILC_1) Design Complete (w/o Cav Shape)	0 days	Mon 9/20/10	Mon 9/20/10
78	ACD Cryomodule Design	13 mons	Mon 3/17/08	Fri 3/13/09
79	Type ACD Design	13 mons	Mon 3/17/08	Fri 3/13/09
81	Type ACD Design Complete	0 mons	Fri 3/13/09	Fri 3/13/09
82	ILC Final Design	41 mons	Mon 2/27/12	Fri 4/17/15
87	ILC_1 CM Accepted as new Baseline	0 mons	Fri 4/19/13	Fri 4/19/13
89	Ready for Large Scale Production of ILC CM	0 mons	Fri 4/17/15	Fri 4/17/15



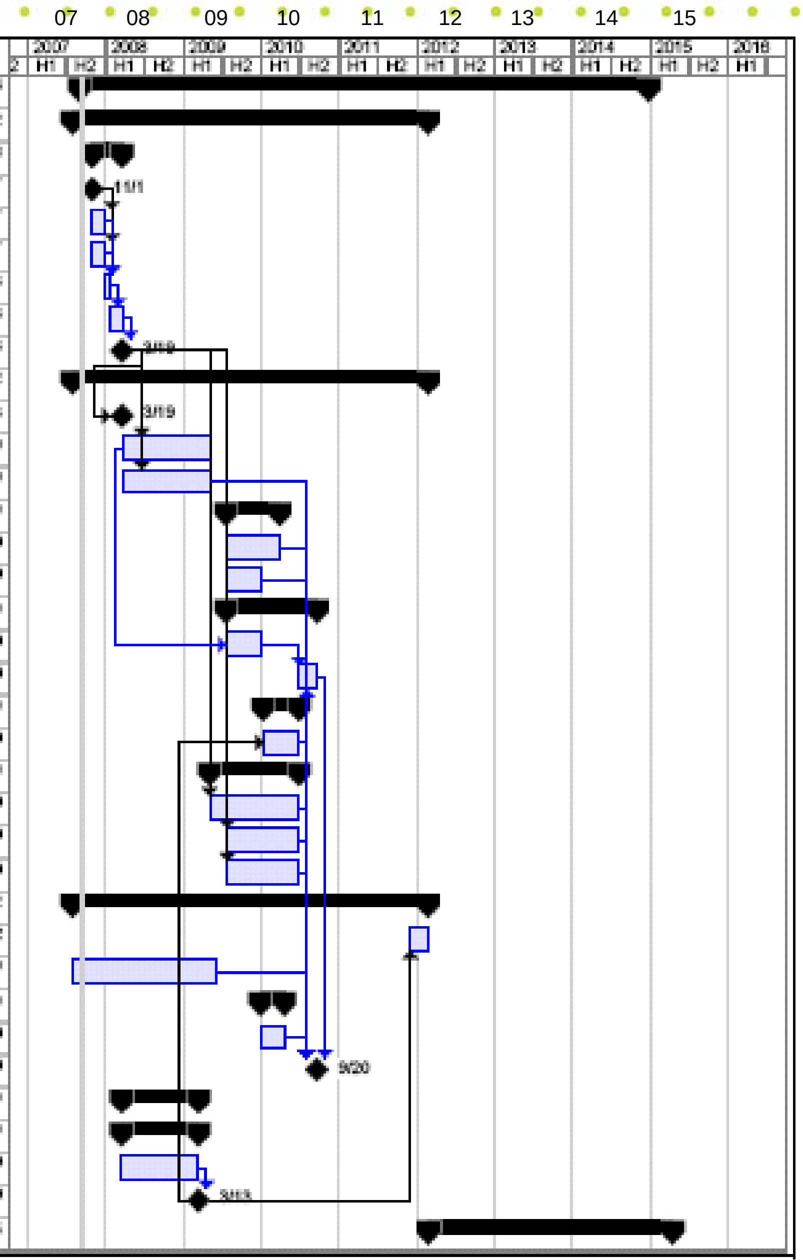
XFEL, ILCTA, STF

ID	Task Name	Duration	Start	Finish
1	**Ongoing Cryomodule Production**	95.5 mons	Mon 9/3/07	Fri 12/26/14
2	**XFEL Schedule**	89.7 mons	Tue 7/1/08	Fri 12/26/14
3	XFEL CM Tender & Pre-Series	104 wks	Tue 7/1/08	Mon 6/28/10
4	XFEL Pre-Series Results Available	0 mons	Mon 6/28/10	Mon 6/28/10
5	CM for XFEL Fabrication	130 wks	Tue 6/29/10	Mon 12/24/12
6	CM for XFEL Test	130 wks	Tue 9/28/10	Mon 3/25/13
7	XTL Installation	52 wks	Mon 10/1/12	Fri 9/27/13
8	Linac Cooldown & Commissioning	78 wks	Mon 7/1/13	Fri 12/26/14
9	**ILCTA Schedule**	51.85 mons	Tue 8/7/07	Thu 9/1/11
10	Refrigerator #1 Operational	0 mons	Tue 8/7/07	Tue 8/7/07
11	CM1 (DESY kit) Complete	0 days	Wed 11/21/07	Wed 11/21/07
12	Cryo System Components Installed	0 mons	Mon 6/16/08	Mon 6/16/08
13	Cryo/Full RF Test of CM1	4 mons	Mon 6/16/08	Fri 10/3/08
14	CM1 Tests Complete	0 mons	Fri 10/3/08	Fri 10/3/08
15	Refrigerator #2 Operational	0 mons	Thu 7/31/08	Thu 7/31/08
16	INFN Places Order for CM2 Cold Mass	0 mons	Tue 10/16/07	Tue 10/16/07
17	Produce CM2 Cold Mass Parts	8 mons	Tue 10/16/07	Mon 6/23/08
18	CM2 Cold Mass Parts Available	0 mons	Mon 6/23/08	Mon 6/23/08
19	CM2 (US Cav+INFN Cold Mass) Ass'y	4 mons	Tue 6/24/08	Mon 10/13/08
20	CM2 Complete	0 mons	Mon 10/13/08	Mon 10/13/08
21	Install CM2 into ILCTA	2 mons	Tue 10/14/08	Mon 12/8/08
22	Cryo/Full RF Test of CM1& CM2	2 mons	Tue 12/9/08	Mon 2/2/09
23	Produce CM3 Parts	8 mons	Thu 3/20/08	Wed 11/26/08
24	CM3 Ass'y	2 mons	Thu 11/27/08	Wed 1/21/09
25	CM3 (Type IV) Complete	0 days	Wed 1/21/09	Wed 1/21/09
26	Install CM3 into ILCTA	2 mons	Tue 2/3/09	Mon 3/30/09
27	Full RF Unit Test (reduced rep rate)	4 mons	Tue 3/31/09	Mon 7/20/09
28	ILCTA Results Available	0 mons	Mon 7/20/09	Mon 7/20/09
29	Replace RF Unit with ILC Prototypes	18 mons	Tue 7/21/09	Mon 12/6/10
30	ILCTA Running at Low Rep Rate	0 mons	Mon 12/6/10	Mon 12/6/10
31	Install & Commission New Refrigerator	12 mons	Fri 10/1/10	Thu 9/1/11
32	ILC-like RF Unit Operations Begin	0 mons	Thu 9/1/11	Thu 9/1/11
33	**STF-1 Schedule**	29 mons	Mon 9/3/07	Fri 3/13/09
34	Cooldown 1 BL Cavity CM	3 mons	Mon 9/3/07	Fri 11/23/07
35	Repair of LL Cavity CM	3 mons	Mon 9/3/07	Fri 11/23/07
36	Install 4 BL+2 LL Cavities in CM	4 mons	Mon 11/26/07	Fri 3/14/08
37	Cooldown 4 BL+2 LL Cavities in CM	6 mons	Mon 3/17/08	Fri 8/29/08
38	Additional R&D Cooldown	7 mons	Mon 9/1/08	Fri 3/13/09
39	STF-1 Results Available	0 mons	Fri 3/13/09	Fri 3/13/09
40	**STF-2 Schedule**	35.5 mons	Mon 3/16/09	Fri 12/2/11
41	Fabricate Cavities & CM Parts	13 mons	Mon 3/16/09	Fri 3/12/10
42	Fabricate & Process Cavities	13 mons	Mon 3/16/09	Fri 3/12/10
43	Assemble CM & Install in Tunnel	9 mons	Mon 3/15/10	Fri 11/19/10
44	STF-2 CM Assembled (not tested)	0 mons	Fri 11/19/10	Fri 11/19/10
45	High Pressure Gas Review	1.5 mons	Mon 11/22/10	Fri 12/31/10
46	Cooldown CM & Commissioning of STF-2	12 mons	Mon 1/3/11	Fri 12/2/11
47	STF-2 Results Available	0 mons	Fri 12/2/11	Fri 12/2/11
48	BCD Cryomodule Design	55.85 mons	Wed 8/1/07	Fri 2/24/12
78	ACD Cryomodule Design	13 mons	Mon 3/17/08	Fri 3/13/09
82	ILC Final Design	41 mons	Mon 2/27/12	Fri 4/17/15



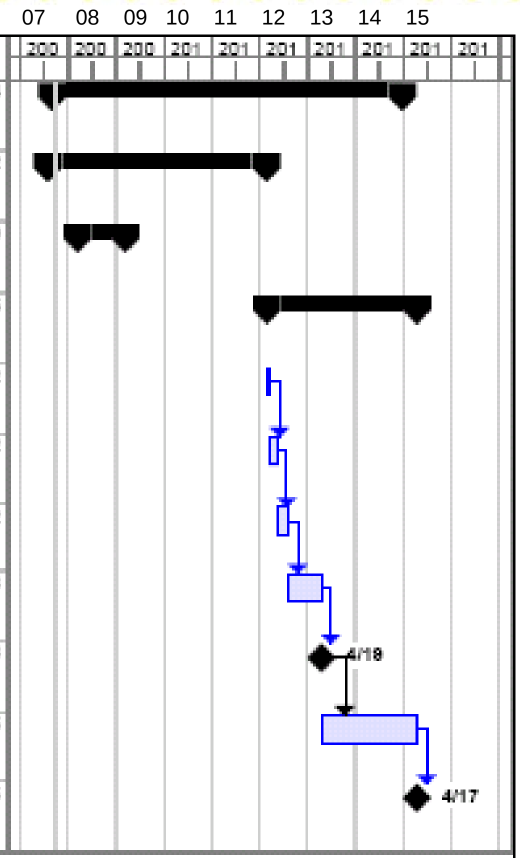
Design Work

ID	Task Name	Duration	Start	Finish
1	Ongoing Cryomodule Production	95.5 mons	Mon 9/3/07	Fri 12/26/14
48	BCD Cryomodule Design	59.65 mons	Wed 8/1/07	Fri 2/24/12
49	Type IV Design	5 mons	Thu 11/1/07	Wed 3/19/08
50	Initial Drafting Pkges Complete	0 mons	Thu 11/1/07	Thu 11/1/07
51	Bid & Select Vendors for Fabrication	2 mons	Thu 11/1/07	Wed 12/26/07
52	Finish Detail Drawings	2 mons	Thu 11/1/07	Wed 12/26/07
53	Final 3D Model Completed	1 mon	Thu 12/27/07	Wed 1/23/08
54	Final 2D Drawings Completed	2 mons	Thu 1/24/08	Wed 3/19/08
55	Type IV Design Complete	0 days	Wed 3/19/08	Wed 3/19/08
56	Type V (ILC_1) Design Decisions	59.65 mons	Wed 8/1/07	Fri 2/24/12
57	Begin Type V (ILC_1) Design	0 days	Wed 3/19/08	Wed 3/19/08
58	Industrialization & DFM of Type IV	15 mons	Thu 3/20/08	Wed 5/13/09
59	Pipe Sizes & Cooling Design	15 mons	Thu 3/20/08	Wed 5/13/09
60	Quad Magnet & BPM Design	9 mons	Tue 7/21/09	Mon 3/29/10
61	Quad Position & Design.	9 mons	Tue 7/21/09	Mon 3/29/10
62	BPM Decision (data - FLASH, ATF, ILCTA)	6 mons	Tue 7/21/09	Mon 1/4/10
63	Helium Vessel Design	15.25 mons	Tue 7/21/09	Mon 9/20/10
64	Ti versus SS Decision	6 mons	Tue 7/21/09	Mon 1/4/10
65	Incorporate Final Tuner	3 mons	Tue 6/29/10	Mon 9/20/10
66	Tuner Design	6 mons	Tue 1/12/10	Mon 6/28/10
67	Evaluate Blade, Ball Screw or Sliding Jack	6 mons	Tue 1/12/10	Mon 6/28/10
68	Coupler Design	15 mons	Tue 5/5/09	Mon 6/28/10
69	Evaluate KEK & Orsay Couplers + DFM	15 mons	Tue 5/5/09	Mon 6/28/10
70	Instrumentaion & Alignment Design	12 mons	Tue 7/28/09	Mon 6/28/10
71	Supports & Transportation Design	12 mons	Tue 7/28/09	Mon 6/28/10
72	Cavity Design	59.65 mons	Wed 8/1/07	Fri 2/24/12
73	Cavity Shape Decision	3 mons	Mon 12/5/11	Fri 2/24/12
74	Grain Size Decision	24 mons	Wed 8/1/07	Tue 6/2/09
75	Magnetic Shielding Design	4 mons	Tue 12/29/09	Mon 4/19/10
76	Inside/Outside Decision	4 mons	Tue 12/29/09	Mon 4/19/10
77	Type V (ILC_1) Design Complete (w/o Cav Sh	0 days	Mon 9/20/10	Mon 9/20/10
78	ACD Cryomodule Design	13 mons	Mon 3/17/08	Fri 3/13/09
79	Type ACD Design	13 mons	Mon 3/17/08	Fri 3/13/09
80	Complete Type ACD CM Design	13 mons	Mon 3/17/08	Fri 3/13/09
81	Type ACD Design Complete	0 mons	Fri 3/13/09	Fri 3/13/09
82	ILC Final Design	41 mons	Mon 2/27/12	Fri 4/17/15



End Game

ID	Task Name	Duration	Start	Finish
1	Ongoing Cryomodule Production	86.6 mons	Mon 8/6/07	Fri 12/26/14
48	BCD Cryomodule Design	68.86 mons	Wed 8/1/07	Fri 2/24/12
78	ACD Cryomodule Design	13 mons	Mon 3/17/08	Fri 3/13/09
82	ILC Final Design	41 mons	Mon 2/27/12	Fri 4/17/15
83	Review Existing Designs	1 mon	Mon 2/27/12	Fri 3/23/12
84	Finalize ILC Design Choices	2 mons	Mon 3/26/12	Fri 5/18/12
85	Complete Drawings for ILC_1 CM	3 mons	Mon 5/21/12	Fri 8/10/12
86	Build 3 exact prototypes of ILC_1 CM (international)	9 mons	Mon 8/13/12	Fri 4/19/13
87	ILC_1 CM Accepted as new Baseline	0 mons	Fri 4/19/13	Fri 4/19/13
88	ILC_1 CM Tender & Pre-Series	104 wks	Mon 4/22/13	Fri 4/17/15
89	Ready for Large Scale Production of ILC CM	0 mons	Fri 4/17/15	Fri 4/17/15



Results and Alternatives

- If you follow the dependencies as described:
- Milestones

ILC_1 CM Accepted as Baseline	**4/19/13**
Ready for Large Scale Production of ILC CM	**4/17/15**

- If you allow the dependencies change:
  - **Decide on a cavity shape after STF-1 results available + STF-2 CM built but not tested + ILCTA running (but NOT new refrigerator => low rep rate) + Type ACD design complete**
- Milestones

ILC_1 CM Accepted as Baseline	**4/23/12**
Ready for Large Scale Production of ILC CM	**4/21/14**

Work Package Strategy

- In addition to defining technical scope & resources required
- Work Packages should
  - **Review and document design requirements and create the list of key interface points (for plug compatibility)**
  - **Review baseline design against these requirements**
    - **Make changes and fill in the detailed design**
  - **Create the “decision/consequences table” for components and generate a list of which decisions need input from other sources**
  - **Specify the required validation tests (baseline & alternatives)**
  - **Create a schedule (timeline) for the proposed scope of work**
- **Essentially frame the problem in such a way as to make the answer (as to which things can be changed from the baseline) obvious to all**
  - If you don’t do this, consensus cannot be reached and efforts aimed at looking at alternatives may be wasted
  - Of course the conclusion is different if project start is delayed

Strategy Towards Other SRF Projects

- Facilities such as the DESY CTS, STF1 and ILCTA (pre-beam) offer the ability to individually test cryomodules in order to validate component changes
- Transition of TTF to FLASH (and eventually ILCTA to operate with beam) offers real beam test potential and operational experience for a limited number of cryomodules
- Projects such as XFEL (STF3, some ERLs, Project X) offer the ability to fabricate sufficient numbers of ILC-like cryomodules to test the production model, operate and build up real statistics
- **Need to embrace these opportunities and use them to validate the ILC choices and prepare Industry**
- **As long as these projects do not drive the ILC schedule later (ILC driven by other factors) => Win-Win situation**

Summary

- Cavity & cryomodule design effort would like to
  - **Arrive at a consensus design for an ILC cryomodule**
  - **Build on the anticipated success of XFEL project**
  - **Utilize the components that give the best chance for success**
- Due to uncertainty in project start date, current inability to meet ILC cavity requirements (gradient & yield) and a general influx of new ideas (cost reduction/reliability), EDR phase will face multiple decision paths in its design process
- Important to contain the design work within acceptable parameter space
- This process needs to be open and responsive to the requirements and plans of each Region
- **Need to decide will we have a <u>unified design</u> or a <u>plug compatible design</u>**

Summary (cont'd)

- Design changes (anything different than the XFEL design) must be validated
- Opportunities to test these changes (in cryomodules or with beam) will be limited in the EDR phase
- There is a general consensus on how extensive these validation tests need to be (survey results)
- Combination of feedback from test facilities, time to implement design changes, and validation testing requirements => results in a final ILC cryomodule design available after the EDR phase is complete
  - **If the design is Region dependent things change**