ILC Scenarios

I wish I had a crystal ball…

Karsten Buesser
FLC Retreat
04. December 2017

HELMHOLTZ GEMEINSCHAFT

DESY

European Action Plan

- Created on request by KEK
  - KEK made its own action plan in 2016
- Delegated by CERN to E-JADE leaders

- Try to assemble a plan of probable European contributions to the ILC in Japan

- No commitments
- Not approved by funding agencies

- But discussed in CERN Council in September
- To become public soon

September 21, 2017

ILC European Action Plan

Towards a European Contribution to the International Linear Collider

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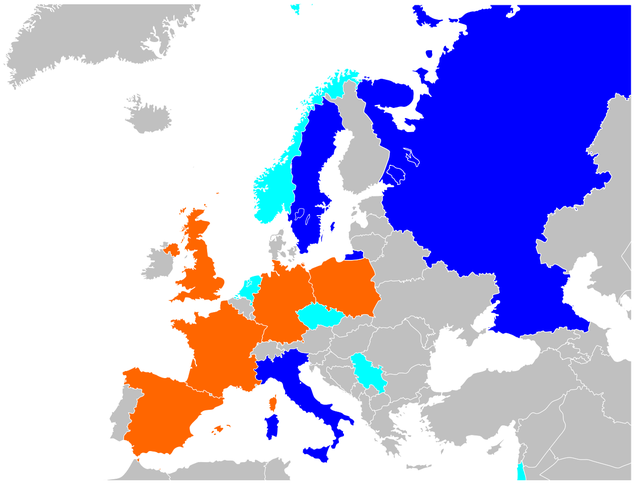
Content

Pre-Preparation Phase - Europe

- Machine:
  - Major activities are related to large ongoing projects in Europe:
    - XFEL, ESS
  - And to R&D facilities
    - ATF2, CLIC
- Detector R&D is strong in Europe



Item/topic	Brief description	CERN	France CEA	Germany DESY	Time line
SCRF	Cavity fabrication including forming and EBW technology,	✓			2017-18
	Cavity surface process: High-Q &–G with N-infusion to be demonstrated with statics, using High-G cavities available (# > 10) and fundamental surface research		✓	✓	2017-18
	Power input-coupler: plug compatible coupler with new ceramic window requiring no-coating	✓			2017-19
	Tuner: Cost-effective tuner w/ lever-arm tuner design	✓	✓		2017-19
	Cavity-string assembly: clean robotic-work for QA/QC.		✓		2017-19
Cryogenics	Design study: optimum layout, emergency/failure mode analysis, He inventory, and cryogenics safety management.	✓			2017-18
HLRF	Klystron: high-efficiency in both RF power and solenoid using HTS	✓			2017- (longer)
CFS	Civil engineering and layout optimization, including Tunnel Optimization Tool (TOT) development, and general safety management.	✓			2017-18
Beam dump	18 MW main beam dump: design study and R&D to seek for an optimum and reliable system including robotic work	✓			2017- (longer)
Positron source	Targetry simulation through undulator driven approach			✓	2017-19
Rad. safety	Radiation safety and control reflected to the tunnel/wall design	✓			2017 – (longer)

	CERN	DESY	Czech Republic	France	Germany	Israel	Netherlands	Norway	Poland	Serbia	Spain	UK
Vertexing	✓	✓	✓	✓	✓				✓		✓	✓
Tracking	✓	✓		✓	✓		✓				✓	✓
Calorimetry	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
MDI	✓	✓						✓				✓
System Integration	✓	✓		✓							✓	

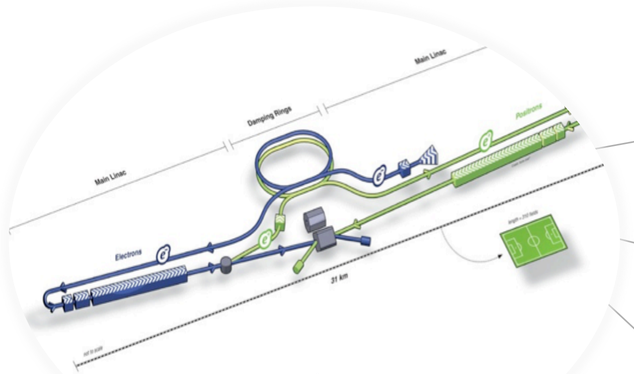
Preparation Phase 2019-2022

- The preparation phase in Europe will only start if:
  - Japan sends a „positive signal“
  - The European strategy ranks European participation in the ILC as a high-priority item
- Preparation phase focuses on preparation for construction and agreement on the definition of deliverables and their allocation to the regions
- In Europe:
  - Technical preparation of European deliverables for the construction phase
    - Final technical specs, final prototypes, finalisation of pre-series orders
    - Industry involvement
    - Knowledge transfer from XFEL construction to ILC
  - European design office at CERN
    - Satellite offices at other labs
  - Documentation based on XFEL experience (EDMS)
  - Negotiations about final European contributions, organisation of the project, governance

- During the preparation phase the ILC International Lab will be founded

Preparation Phase in Europe

Preparation Phase 2019-22: Organization and resources



ILC prep. phase project:

CERN coordination of European effort

R&D contracts

MoU annexes or similar (with MS and NMS collaborators)

Techn. Transfer agreements, EU projects.

Key activities in Europe	More details
SCRF activities	
	Cavity fabrication and preparation, Power Couplers, Automation of assembly, E-XFEL -> ILC
High efficiency klystron R&D	
Cryogenics system	LHC system similar in size to ILC
Accelerator Domain Issues	
	Positron source, Damping Rings, Beam Delivery Systems, Low emittance beam transport, Beam dumps, Positron source
Detector and Physics	
	Design optimization, MDI, Technical prototypes, TDRs, physics studies
Documentation system	Experience from E-XFEL
"Regional" Design office	Naturally at CERN, linking to other European National Labs

A European ILC project in the preparation phase 2019-22:

- Resources needed estimated to ~25 MCHF/year (material) and 60 FTE/year (personnel), ramping up from 2019
- Move towards more engineering personnel
- The organisational model above is used for existing studies at CERN, e.g. CLIC/HE-LHC/FCC

European ILC Design Office

- Most likely located at CERN with satellite offices at other places in Europe
- Tasks:
  - Dissemination of design experience from XFEL and CLIC (ans also LHC!) to ILC in Japan;
    - especially for SCRF, Cryogenics
  - Contributions to final ILC design in liaison with host design team in Japan and possible other international design efforts;
  - Involve special European expertise in other fields, e.g. BDS, MDI, positron source, beam instrumentation
    - define technical deliverables
  - Participation in the definition of the commissioning and running strategy based on XFEL and ATF2 experience

Construction Phase

- Organisational structure of ILC project not known at this time
- CERN could form the European hub for financial or in-kind contributions
  - possible through CERN's „geographical enlargement"
  - larger countries could form bi-lateral agreements with Japan, but smaller would probably use CERN
  - European Commission has formal agreements with CERN (e.g. support for European Strategy projects in FPs)
- In-kind contribution model is not known at this time
- European contributions would probably cluster on SCRF
  - XFEL experience
  - industrial involvement

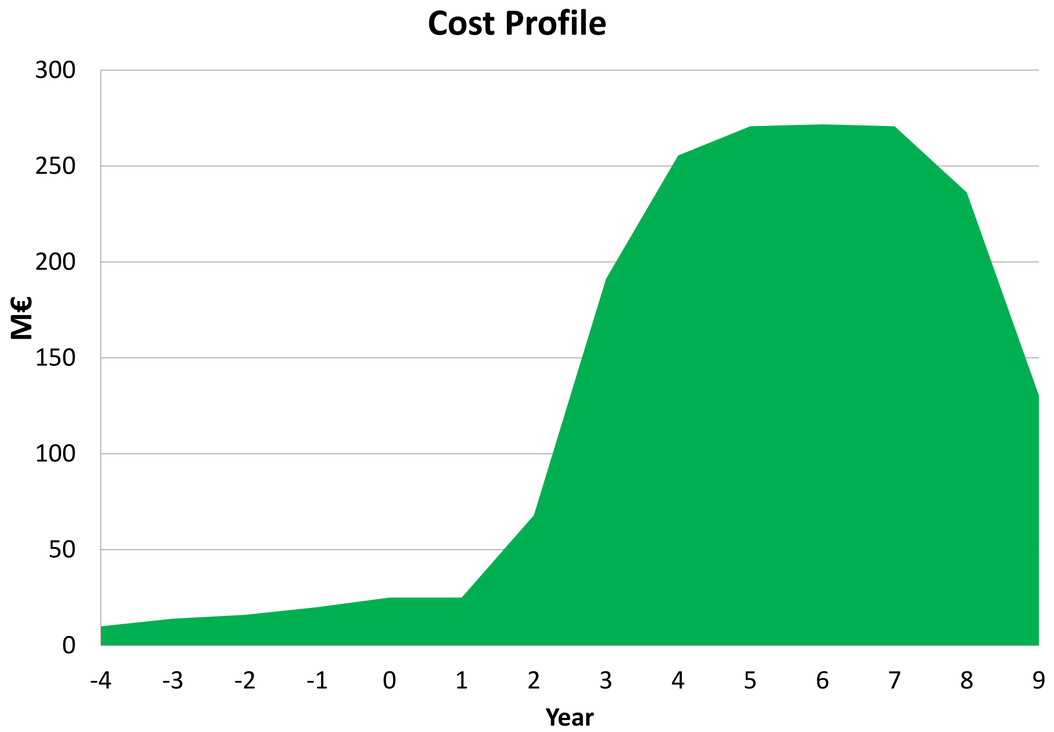
500 GeV	Total TDR IKC M€	Fraction of non-CFS construction costs 10% 500	20% 1010	33% 1680
SCRF priority	SRF modules (M€)	500	970	970
	Other (M€ / FTE-y)	0 / 0	40 / 92	710 / 1625
pro rata	SRF modules (M€)	320	600	970
	Other (M€ / FTE-y)	180 / 412	410 / 938	710 / 1625

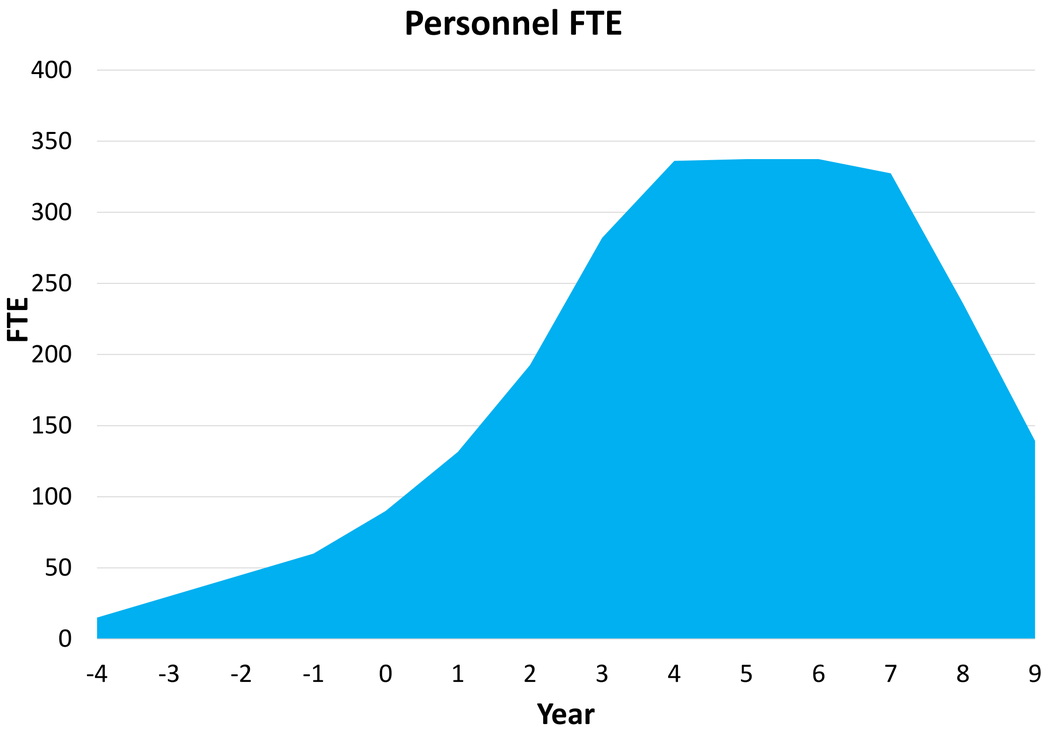
250 GeV	Total TDR IKC M€	10% 330	20% 650	33% 1090
SCRF priority	SRF modules (M€)	330	510	510
	Other (M€ / FTE-y)	0 / 0	140 / 336	580 / 1392
pro rata	SRF modules (M€)	170	320	510
	Other (M€ / FTE-y)	160 / 384	330 / 792	580 / 1392

- SCRF priority: 33% of the cryomodules come from Europe
  - Other cost reduced; in 10% case also SCRF reduced
- pro rata: everything scales with 33%

Cost Profiles

- From EAP
  - Pre-preparation phase: 2017-2018
  - Preparation phase: 2019-2022 (-4…-1)
  - Construction phase: starting 2023 (0…9)





Detectors

- A strong host lab basis is required (CERN/LHC experience)
- Less need for a central design team, but organisation in multi-lateral detector collaborations
- Central support with test beams and other facilities
- Deliverables for Preparation Phase:
  - Integration/MDI
    - Site-dependent design, transportation, facilities planning, etc.
    - Close collaboration with local experts
  - Concept design optimisation
    - Physics (at ILC250), cost, technological developments, etc.
    - Proto-collaboration work
  - Technical prototype tests
    - Feasibility of technologies and system design
    - Test-beam campaigns
  - Technical Design Report
    - Expected to be finalised towards the end of the preparation phase
    - In my eyes, this is very ambitious…
    - Don’t we need an international host lab first? And will there be another round of LoIs?

Scenarios

- All depends on a statement of the Japanese government that would push the ILC on the high-priority list of the European strategy
  - And that is strong enough to keep the ILC in the DESY strategy!
- What would qualify for that?
  - It clearly has to be more than „thanks for your interest, we will monitor the situation closely“
- What can be expected?
  - „Great project, we will do it and pay 70% upfront!“ will not happen
- The best we can hope for:
  - A clear statement indicating Japanese interest to host the ILC and carry a substantial fraction of the cost, accompanied by a public invitation to start negotiations.

- I think it is mandatory to have in addition a dedicated and large enough R&D budget in Japan
  - This (from Kitakami Times, 22.09.2017) is not enough:

> MEXT has added a request for 260 million yen for the 2018 fiscal year budget for "fundamental technology development" that would increase performance and shrink the physical size of the technology needed to make advanced particle colliders. Hon. Shionoya said, "If you attach a budget by calling it 'ILC Investigative Costs', it would show the international community that the Japanese government has taken a step forward." To which, Minister Hayashi was said to respond, "I will work to understand the situation, and study further."

Scenarios

- 1. ILC comes early
  - This corresponds to my „optimistic“ scenario
  - Requirement is a strong statement from Japan that has immediate impact on DESY strategy and is strong enough to put ILC high on the European list of priorities
  - My crystal ball is not good enough to estimate what could happen in the US - but this is important for the Japanese!
- 2. ILC is dead (for us)
  - A good hint would be the execution of the DESY strategy statement „take away ILC resources if no positive sign from Japan“
    - we could hide some R&D under generic „future project“ labels, but I fear that the drive will go
    - hard to get new students, fellows
- 3. ILC keeps to be in limbo
  - Example: some statement from Japan that is lukewarm enough to keep the ILC in the DESY strategy
    - Next milestone would be European strategy. If ILC does not score high, we are at point 2.
  - Or: strong Japanese statement, but international response is slow
    - I have the feeling that in Europe we would have a feeling of the political water temperature by the time of the European strategy. No idea about the US…
- My conclusion: we will know soon, if the Japanese signal (if there is one) is good enough. „ILC in Limbo“ would for us probably just take until the European strategy.

A Possible ILC Timeline - My Optimistic Scenario

- European Action Plan:
  - Pre-preparation phase: 2017-2018
  - Preparation phase: 2019-2022
  - Construction phase: 2023-2032
- My very personal optimistic view…

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
DESY	DESY Strategy	Participation in Detectors and Machine (?)									DESY Strategy?							
European Strategy	Discussions	Decision	Publication			Discussions	Decision	Publication			Discussions	Decision	Publication		Discussions	Decision	Publication	
US P5	???	Discussion	Decision	Publication	???													
Japanese Government	"Green Light"																	
	Local and International Negotiations							Supervision										
ILC International Lab				Foundation	Call for LoIs	LoI		TDR	Construction Supervision/Support									
ILC Machine/Project	Pre-Prep Phase	Preparatory Phase						Machine Construction									Commissioning	
																	Data Taking	
Detector Collaborations	Preparatory Phase/ R&D					LoI		TDRs									Commissioning	

Back to Realism…

Minister of MEXT Hayashi gives his opinion on the shortening of the ILC: “We will deliberate seriously”

TRANSLATED BY **AMANDA WAYAMA** | DECEMBER 1, 2017

The original article was published in the Iwate Nippo (November 18th edition). Read the original here.

At a press conference on November 17th, Minister of Education, Culture, Sports, Science and Technology Yoshimasa Hayashi said that he had received the news that (the initial length of) the ILC would be shortened. He stated that the Panel of Experts of MEXT would continue to debate the ILC taking this into account.

The International Committee of Future Accelerators has decided to support the realization of the ILC with an initial length of 20km, rather than the original 30km. Mr. Hayashi opined: “I heard that this will reduce the construction costs of over 1 trillion yen. However, this is still a project that requires a massive investment. It cannot be realized by just one country; international cooperation is crucial.”

In response to ICFA’s statement that it encourages Japan to realize the ILC in a timely fashion, Mr. Hayashi said, “The Panel of Experts of MEXT will look over the modified ILC plan, and will continue to seriously deliberate the project, including the results of experiments being done at European research facilities. We are also thinking of asking the Science Council of Japan to once again carefully consider the project.”