ILC – Global Overiew

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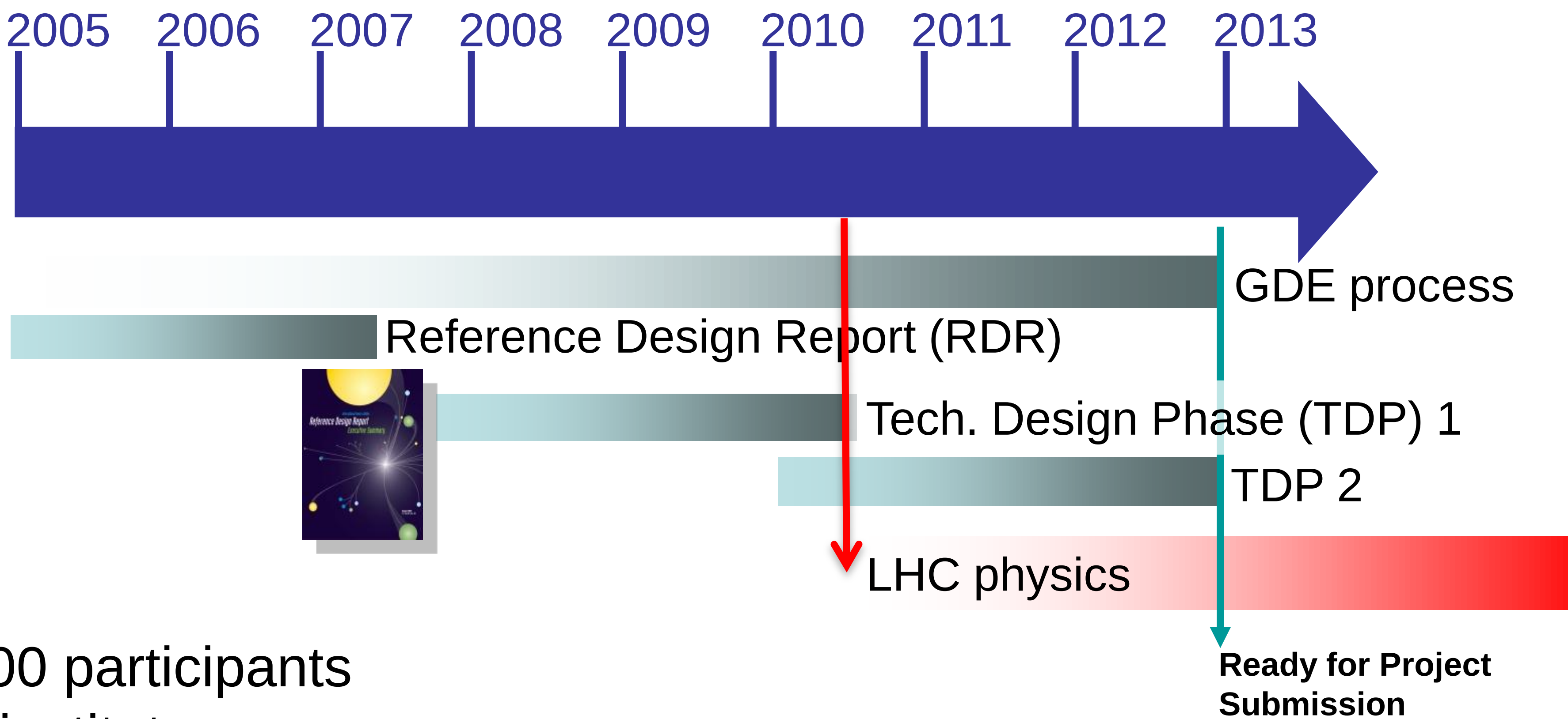
Plenary ECFA Frascati 2/07/10

Overview

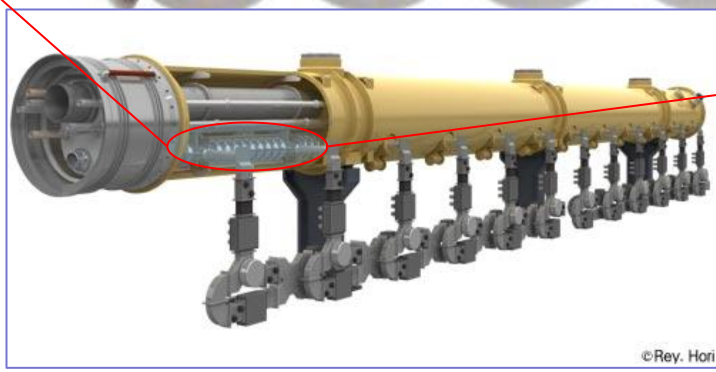
- Current status – progress towards rebaselining & cost containment.
- Realising the ILC as a project – Interim Governance report
- Summary & Outlook

GDE ILC Timeline



~100 participants
55 institutes
12 countries
3 regions

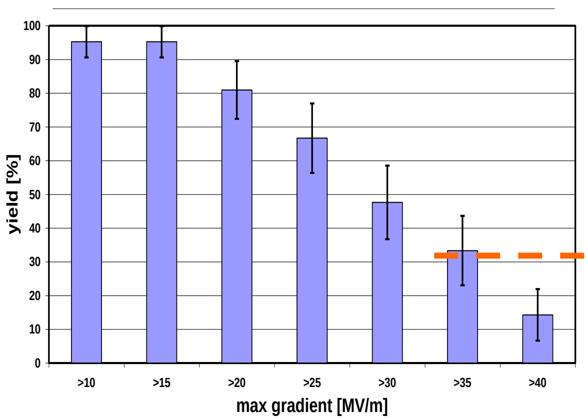
ILC's Workhorse - SCRF



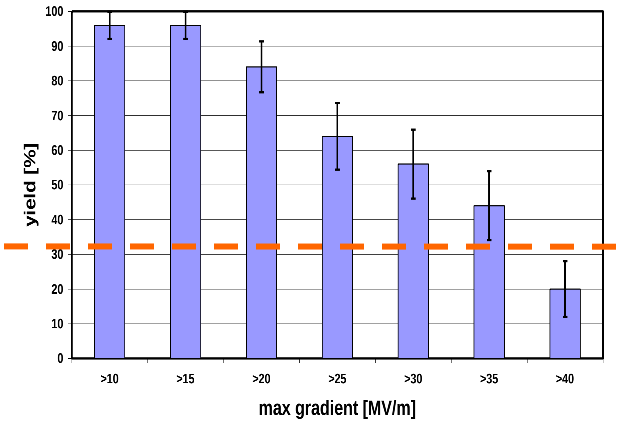
Parameter	Value
C.M. Energy	500 GeV
Peak luminosity	$2x10^{34}$ $cm^{-2}s^{-1}$
Beam Rep. rate	5 Hz
Pulse time duration	1 ms
Average beam current	9 mA (in pulse)
Av. field gradient	**31.5 MV/m**
# 9-cell cavity	**14,560**
# cryomodule	**1,680**
# RF units	**560**

Progress with gradient from industry

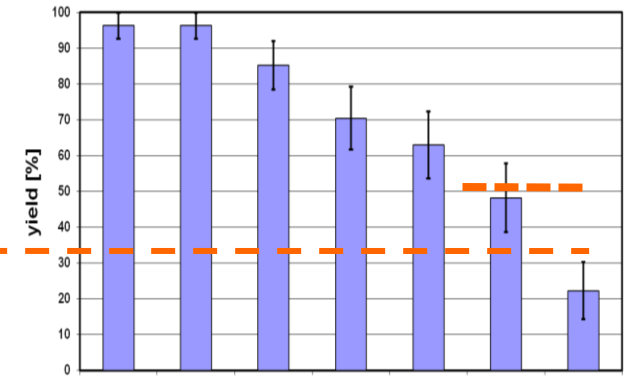
GDE: ~ 1.Oct.2009



AAP: ~ 6-7Jan.2010



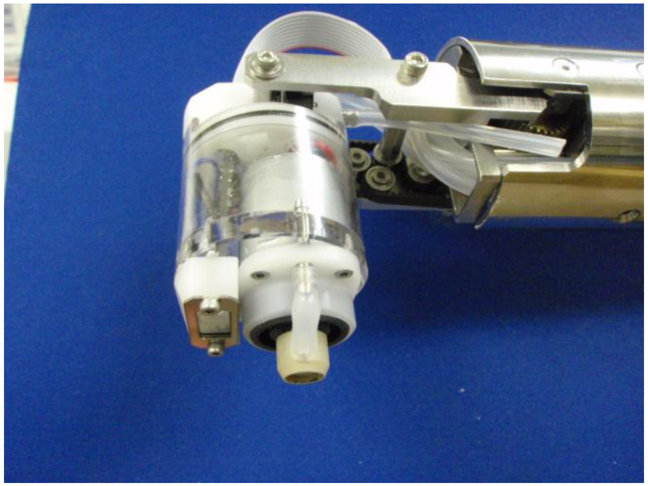
ILC-10: ~28 March, 2010

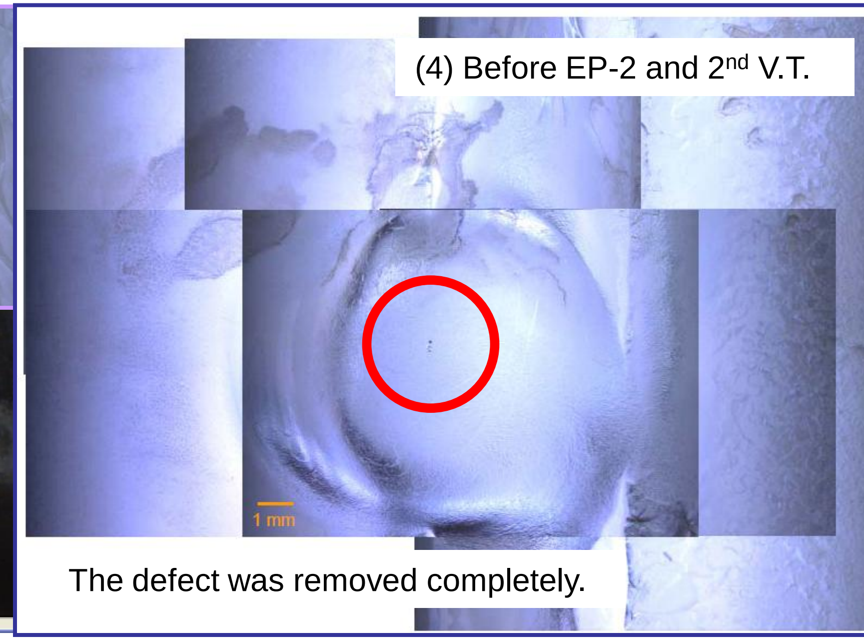


Integrated since 1st plot

Camille Ginsburg & DB Team:	Yield in percentage (%)			
Yield and statistical uncertainties:	>25 MV/m		>35 MV/m	
Reported, March 27, 2010:	1st pass	2nd pass	1st pass	2nd pass
ALCPG-Albuquerque 1.Oct.2009	63+-10	67+-10	23+-9	33+-10
AAP-Oxford 6.Jan.2010	63+-9	64+-10	27+-8	44+-10
ILC-10-Beijing 28.Mar.2010	66+-8	70+-9	28+-8	48+-10

Repairing cavities by grinding





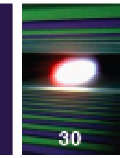
Labs	Method	Cavity name	Results
DESY	Local Grinding (KEK)	AC71	26MV/m (string???) -> 30 MV/m
FNAL	Local Grinding (KEK)	AES-03	20 MV/m (Bump, scratch) -> 34 MV/m
JLAB	Local Grinding (KEK)	JLAB LG-01	30 MV/m (Pit) -> will be tested.
KEK	Local Grinding(KEK)	MHI-08	16 MV/m (Pit) -> 27 MV/m

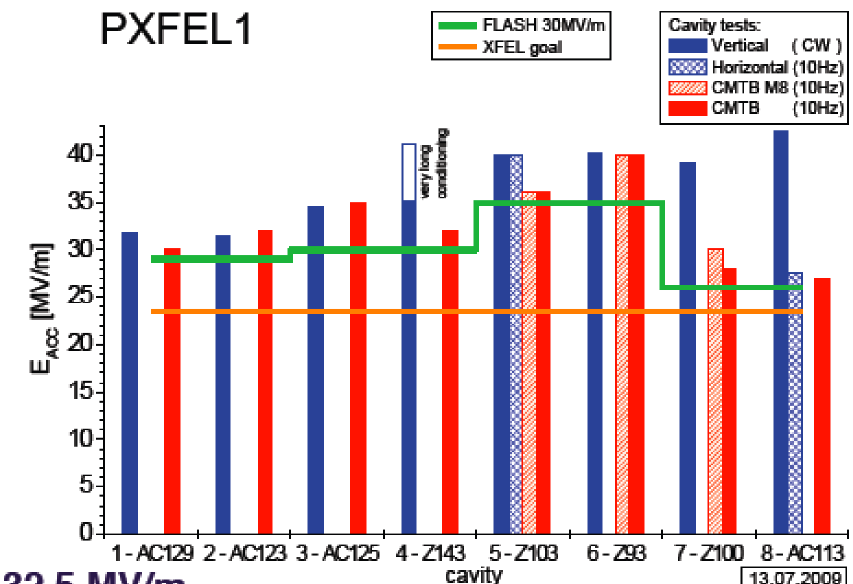
Progress at FLASH

The European XFEL

European XFEL

PXFEL1 - The *Chinese* Module at CMTB





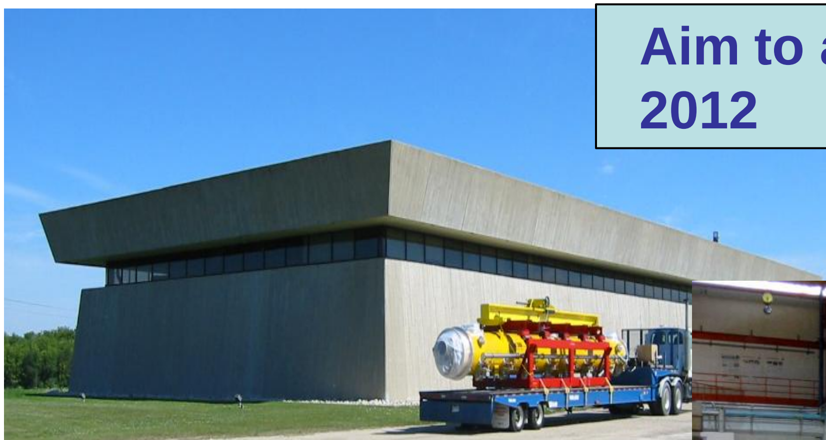
- The accelerator module PXFEL1 was conditioned and tested at the Cryo-Module Test Bench (CMTB).
- The average maximum gradient is **32.5 MV/m.**
- After string and module installation we have seen a **gradient reduction of only 5%.**
- PXFEL1 has been installed at FLASH and **can be operated** there with an average gradient of **30 MV/m.**
- The **XFEL waveguide distribution** is used.

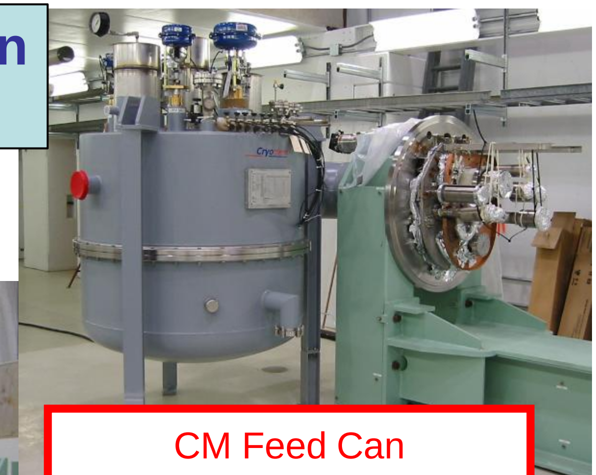
TTC Meeting, Fermilab, April 19/22, 2010
Hans Weise / DESY

HELMHOLTZ ASSOCIATION

Beam acceleration plans at FNAL

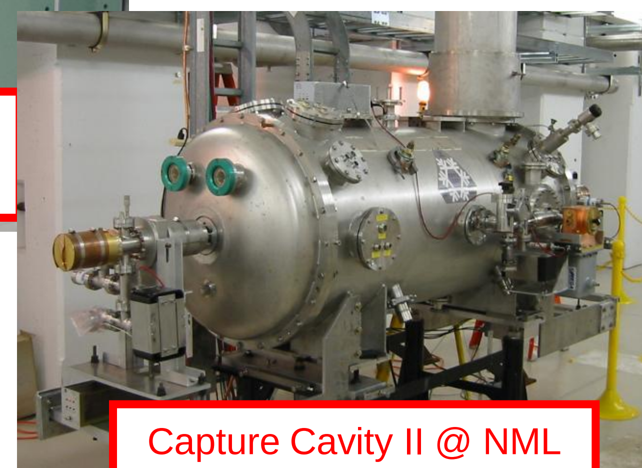
Aim to accelerate beam in 2012



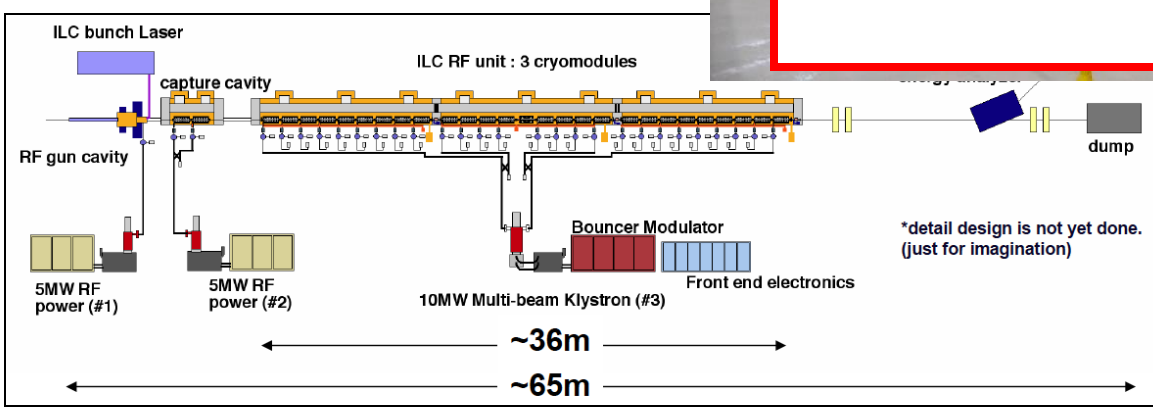


CM Feed Can

1st Cryomodule Test fit



Capture Cavity II @ NML

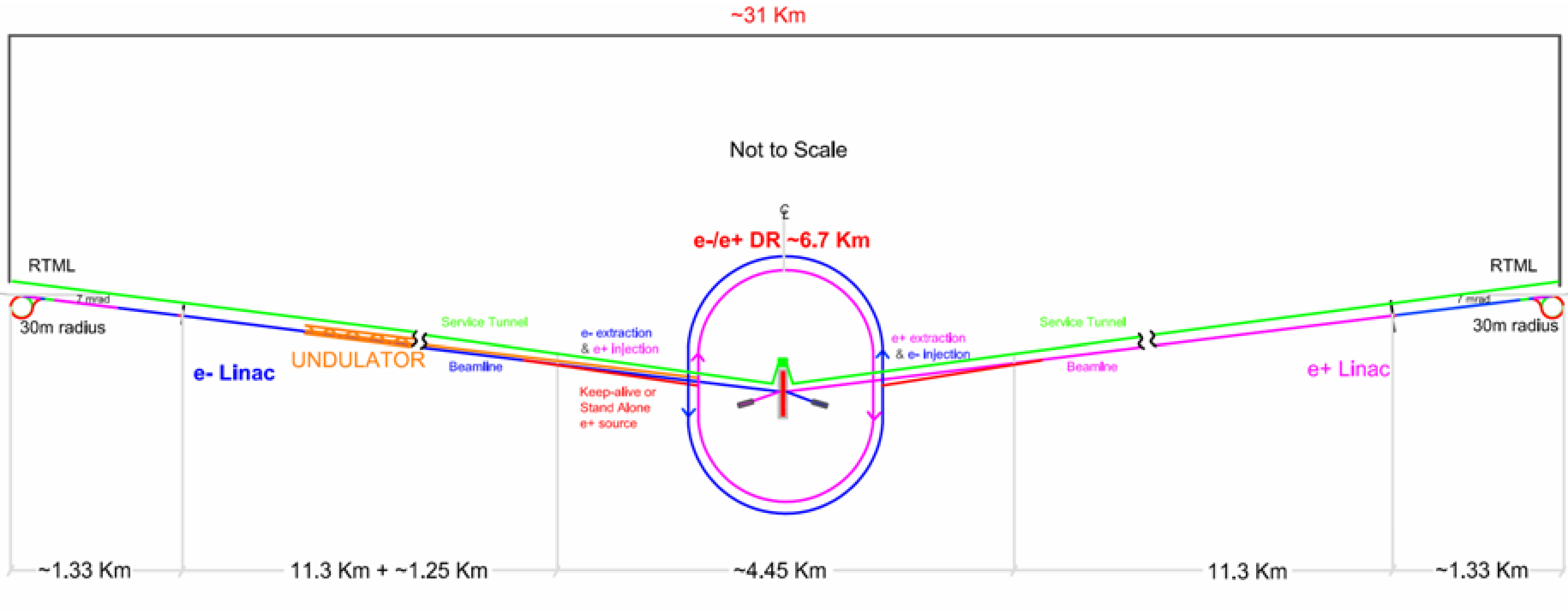


Global Plan for SCRF

Year	07	2008	2009	2010	2011	2012
Phase	TDP-1			TDP-2		
Cavity Gradient in v. test to reach 35 MV/m	→ Yield 50%			→ Yield 90%		
Cavity-string to reach 31.5 MV/m, with one-cryomodule		Global effort for string assembly and test (DESY, FNAL, INFN, KEK)				
System Test with beam acceleration		FLASH (DESY) , NML (FNAL) STF2 (KEK, test start in 2013)				
Preparation for Industrialization			Mass-Production Technology R&D			

Overall ILC Layout from RDR

1st Stage: 500 GeV; central DR et al. campus; 2 "push-pull" detectors in 14 mrad IR.



Schematic Layout of the 500 GeV Machine

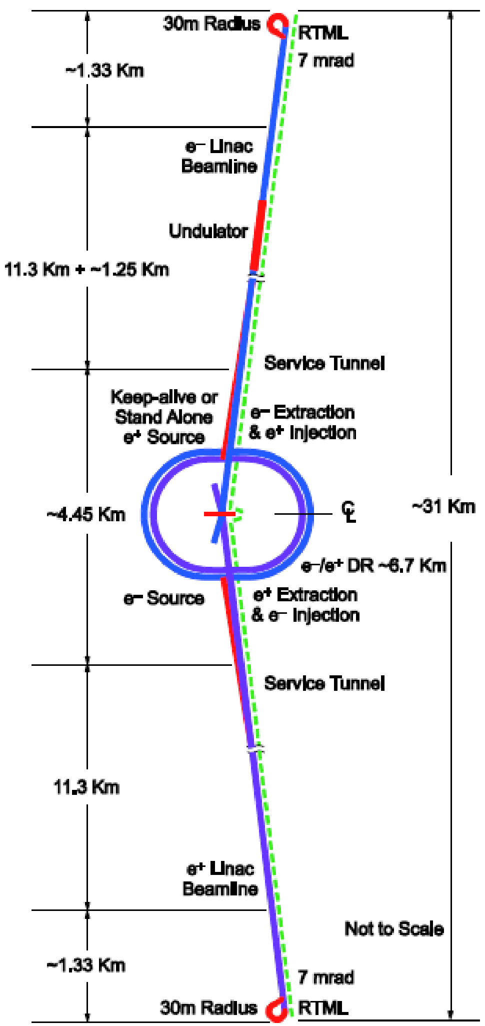
Cost estimate 6.62B ILCU (~$2007) + 14,100 Staff-years

New baseline rationale

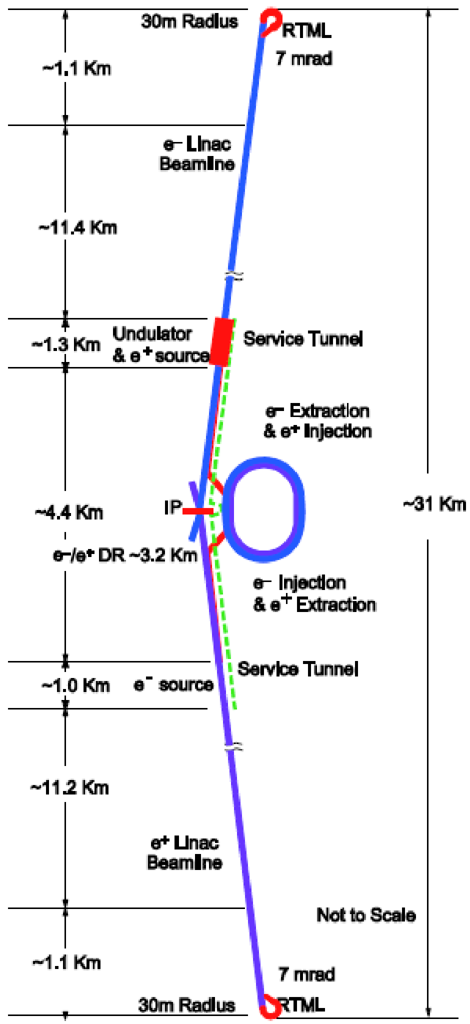
- **Timescale of ILC demands we continually update the technologies and design to be prepared to build the most forward-looking machine at the time of construction.**
- **Our next big milestone – the technical design (TDR) at end of 2012 should be as much as possible a “construction project ready” design with crucial R&D demonstrations complete and design optimised for performance to cost to risk.**
- **Cost containment vs RDR costs is a crucial element. (Must identify costs savings that will compensate cost growth)**

From RDR -> SB2009

RDR

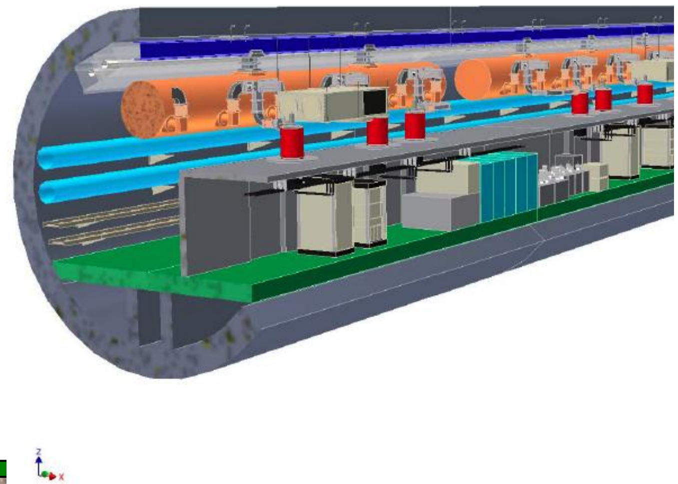


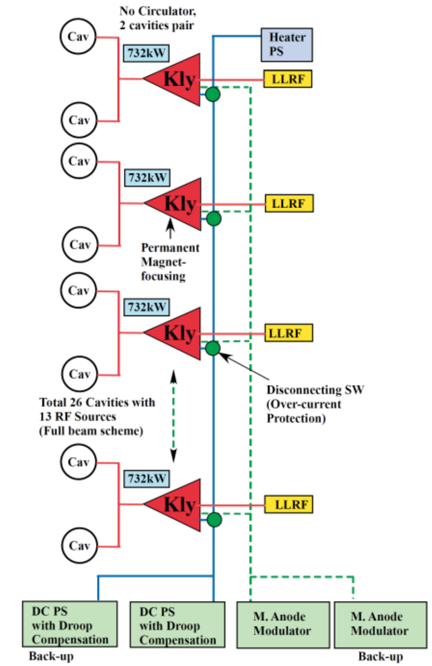
SB2009



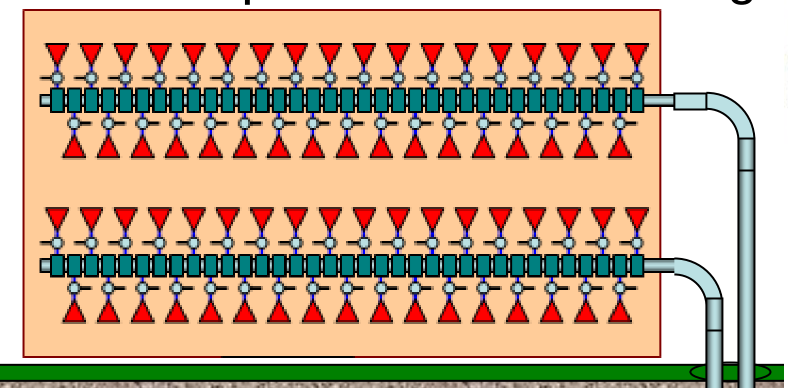
- **Single Tunnel for main linac**
- **Move positron source to end of linac**
- **Reduce number of bunches factor of two (lower power)**
- **Reduce size of damping rings (3.2km)**
- **Integrate central region**
- **Single stage bunch compressor**

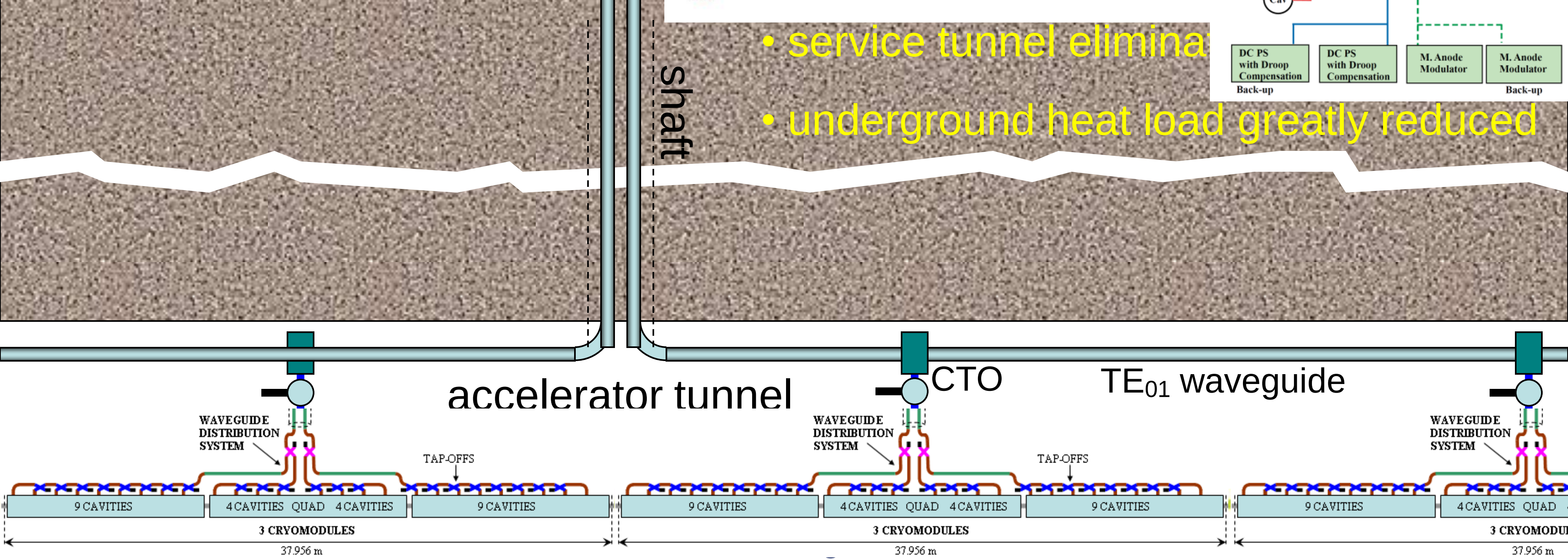
Single tunnel issues - RF





- service tunnel elimina[...]
- underground heat load greatly reduced





Luminosity loss at low E

	RDR			SB2009 w/o TF				SB2009 w TF			
CM Energy (GeV)	250	350	500	250.a	250.b	350	500	250.a	250.b	350	500
Ne- ($*10^{10}$)	2.05	2.05	2.05	2	2	2	2.05	2	2	2	2.05
Ne+ ($*10^{10}$)	2.05	2.05	2.05	1	2	2	2.05	1	2	2	2.05
nb	2625	2625	2625	1312	1312	1312	1312	1312	1312	1312	1312
Tsep (nsecs)	370	370	370	740	740	740	740	740	740	740	740
F (Hz)	5	5	5	5	2.5	5	5	5	2.5	5	5
γex ($*10^{-6}$)	10	10	10	10	10	10	10	10	10	10	10
γey ($*10^{-6}$)	4	4	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
βx	22	22	20	21	21	15	11	21	21	15	11
βy	0.5	0.5	0.4	0.48	0.48	0.48	0.48	0.2	0.2	0.2	0.2
σz (mm)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
σx eff ($*10^{-9}$ m)	948	802	639	927	927	662	474	927	927	662	474
σy eff ($*10^{-9}$ m)	10	8.1	5.7	9.5	9.5	7.4	5.8	6.4	6.4	5.0	3.8
L (10^{34} $cm^{-2}s^{-1}$)	0.75	1.2	2.0	0.2	0.22	0.7	1.5	0.25	0.27	1.0	2.0

Naively would expect low E to drop by factor 4 – factor 2 from rep. rate and factor 2 from low power - Travelling Focus makes it more like 3.

Can we regain this and/or minimise its effects? Go to 10Hz operation at low E.

Luminosity loss at low E

Requirements:

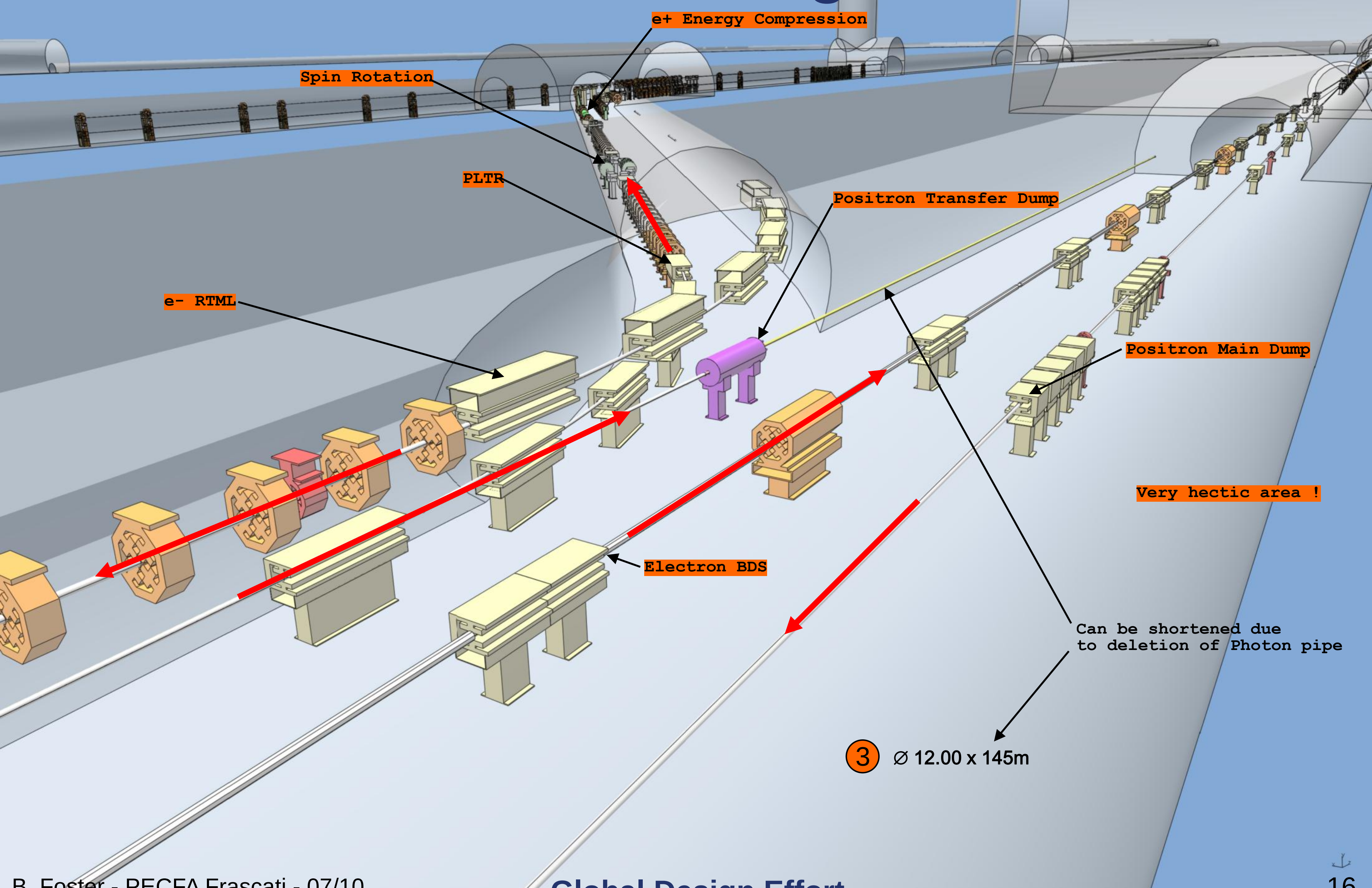
Design in travelling-focus hardware

Use shorter doublet for low E operation, or design dual-function

Damping ring: No. of cavities 8 -< 16
Wiggler field 1.6 -> 2.4 T
Wiggler period 0.4 -> 0.28m

E-source & injector – Double rep rate.
Optimistic that no show-stoppers; but costly?

Central Integration



ILC-CLIC collaboration

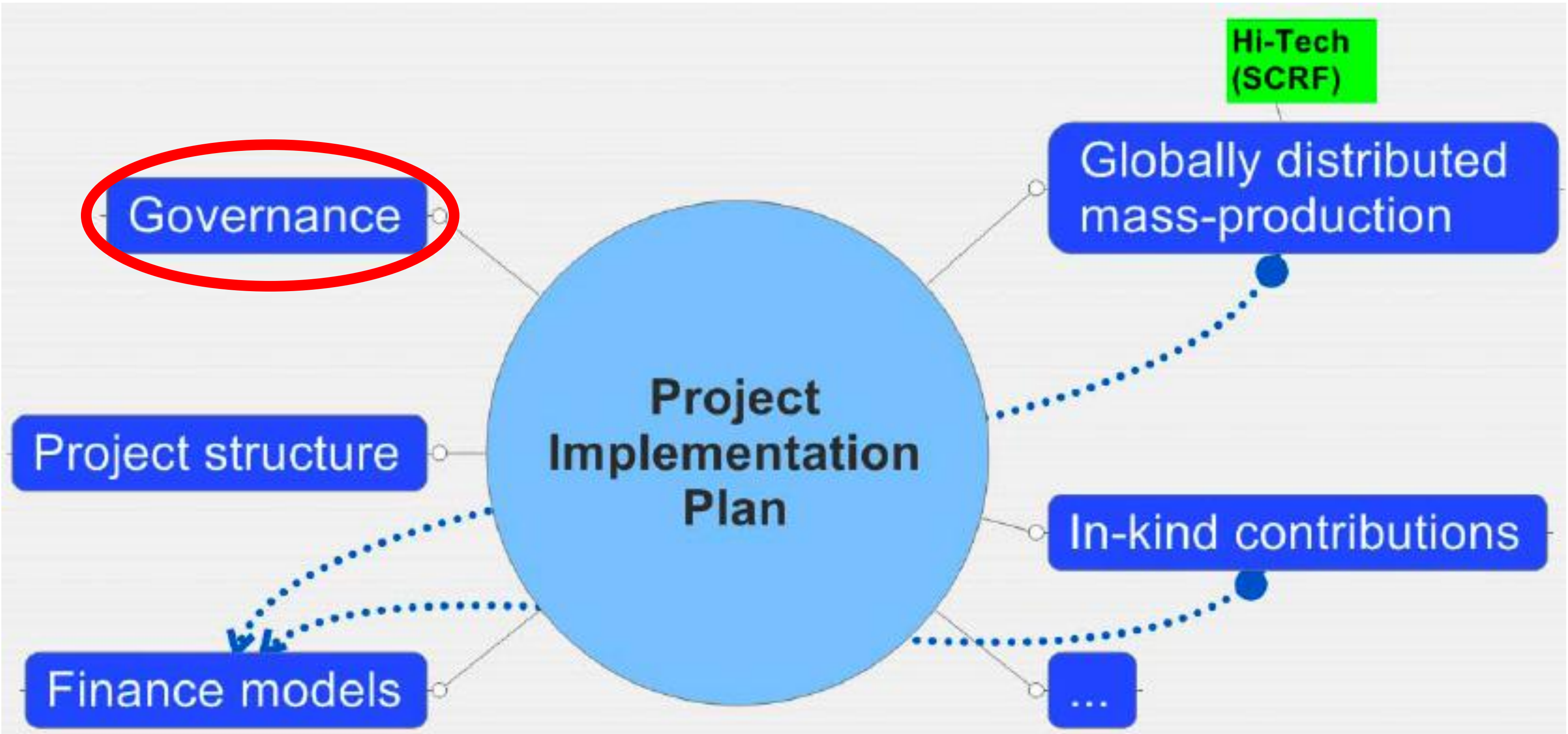
Seven technical WGs + “General Issues” WG

- **There is evidently a significant amount of activity involving the technical working groups. Most of this work would not be taking place without these initiatives.**

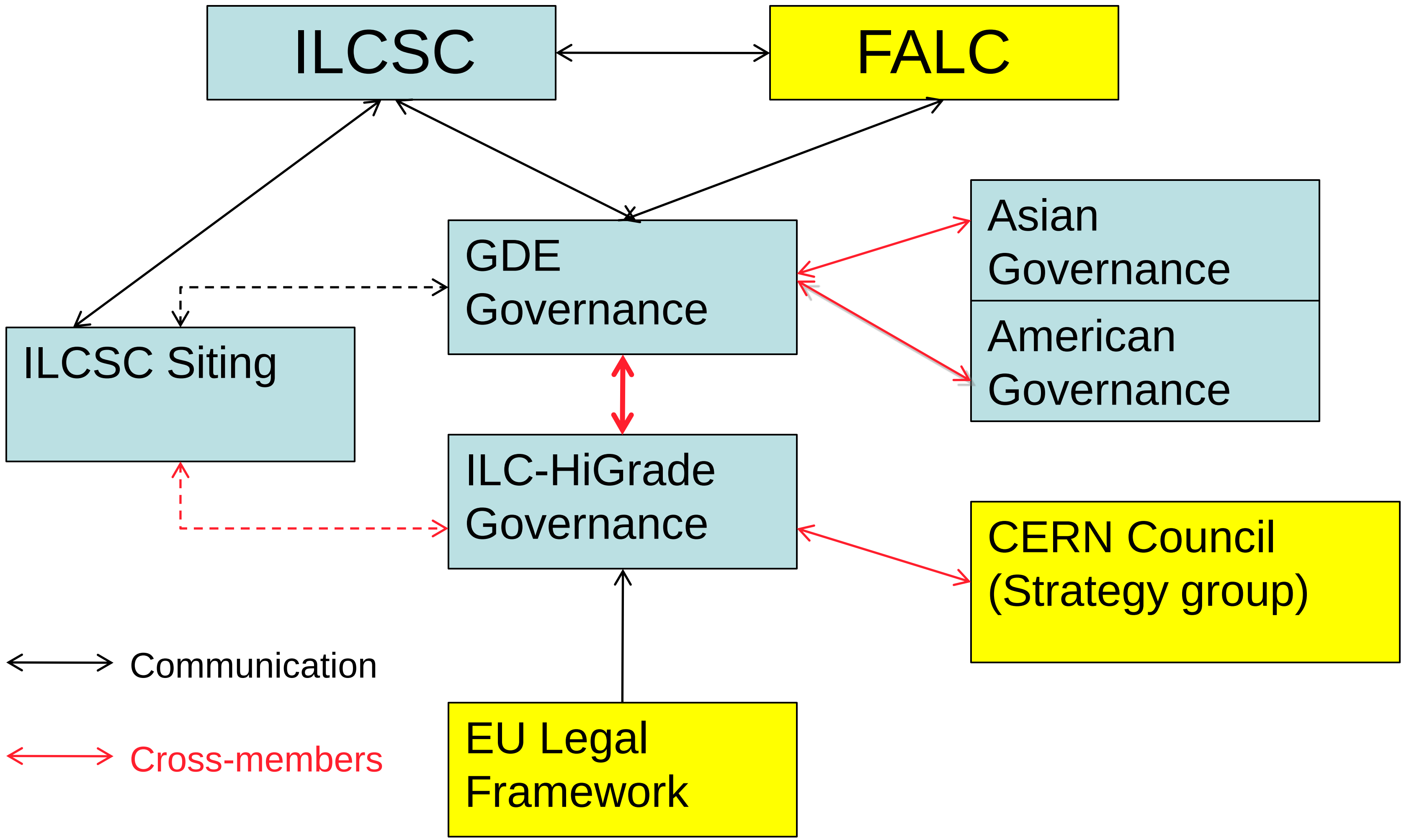
- **Anecdotally the process is viewed positively by the participants.**

- **Collaboration is strongly supported by the CERN and the GDE managements**

Making the ILC a reality



Governance Activity



Overview of Governance activity

Over last 18 months have gathered information from “cognate projects”. First we produced “1-page summaries” of the projects to gather together the important facts and the open questions or issues that each project raised.

This then led to discussions, further fact gathering etc.

Cognate projects include: ALMA, ESS, FAIR, ITER, SKA, XFEL.

We have also examined initiatives from Brussels, such as ERIC framework and whether they can be applied to our problems.

1-page summary - e.g. ALMA

Complex agreement – ALMA is not a legal entity.

Host (Chile – special position) + regional membership (Americas (=US/Canada (+ Taiwan!)), Europe (=ESO), Asia (=Japan – with link with Taiwan). No clear leading region; Japan joined late, leading to "de-descoping". All partners involved in ~ all aspects of project.

Each region carried out separate procurement for WBS items for which it took responsibility; Common fund does not exist. Total cost ~ $1.25 billion (2008$)

Host provides site only; present in Board but does not vote on many things. EU +Americas 50:50 before Japan; Japan then 25% of enlarged project => EU:Am:Asia 3/8:3/8:1/4

Project reports to ALMA Board which meets 3 times per year with extra telecons.

Issues

- ALMA's lack of legal standing is problem; staff employed by two different bodies;
- Procurement led to 3 different designs of antennae – although there are positive aspects of this (risk reduction) it is a problem;
- Partners joining (and leaving) not properly catered for;
- Management control weak – multiple paths of reporting to regional funding agencies;
- Council subordinate to regional interests and did not become robust;
- Ownership of assets, pensions fund etc. needed earlier clarification.

Pro Formas

In order to get information into a common format that facilitates comparison and deduction, have completed “pro-formas” for representative subset of projects. Pro-forma headings are:

- 1) Legal Status of project
- 2) Management Structure
- 3) Representation and voting structure in governing body
- 4) Duration of agreement
- 5) Attribution of in-kind contributions, value engineering etc
- 6) Running costs
- 7) Budgetary control

Example Pro Forma - ITER

1) Legal Status of project

ITER has a legal personality and as such can make contracts, licenses, legal proceedings and agreements. The ITER Organisation (IO) employs the core ITER organisation and project personnel. In addition to the IO there is a local Host Organisation operated by CEA which is responsible for the non-project related activities which are typically related to site support such as services to the site boundary, land, transport, telecommunications and other such things. There is also site support staff employed in medical, emergency services, cafeteria, and environmental activities.

An ITER Agreement consisting of 29 articles, common understandings and annexes supports ITER. These documents were generated and signed serially over a two-year period by all seven collaboration members. The agreements are quasi-legal in nature and cover such items as intellectual property, privileges and immunities, and the umbrella agreement. Common understandings cover more project related issues such as cost sharing, schedule, operations, procurement practices, and cost estimates. In addition the IO has some bilateral agreements such as one with CERN.

"The ITER Organization shall have international legal personality, including the capacity to conclude agreements with States and/or international organizations.

The ITER Organization shall have legal personality and enjoy, in the territories of the Members, the legal capacity it requires, including to:

a) conclude contracts;

b) acquire, hold and dispose of property;

c) obtain licenses; and

d) institute legal proceedings."

Decommissioning is by building up a fund during operation (presumably as an additional charge on top of full operations cost) which is then handed over to host state who then deal with any shortfall and decommission, issuing bulletins to member states as they progress.

In addition to the construction project the agreements cover operations and deactivation.

Recommendations

a) Legal Status

- ILC should be set up as an international treaty organization similar to ITER, taking advantage of zero VAT rating and similar privileges.

b) Management Structure

- ILC should have a strong Council as the ultimate governance body. Council delegates should be of sufficient standing to make decisions in a timely fashion. The ILC should have a Director General and a Directorate, proposed for Council ratification by the DG. The DG should have significant delegated authority from the Council, allowing him or her to act decisively without continual need to refer back to Council.

Recommendations

c) Representation and voting structure in governing body

- Each Council "member state" should have 2 official delegates and a maximum of 2 advisors. One of the two delegates should be a particle physicist. There should be the option, every few years, of Ministerial Council Meetings in which delegates are the relevant government minister.

- Council should decide questions not of a financial nature by simple majority; financial questions should be decided by a qualified majority voting decided by a majority of financial contributions plus a majority of individual member states.

Recommendations

d) Duration of ILC Agreement

- The ILC agreement should be fixed term – a construction period of ~9 years plus 20 years of operation; it should be extendable by agreement of Council in periods of 5 years. Withdrawal would not be allowed until a minimum of 10 years after the agreement comes into force and then only after 1 full year after notice of withdrawal.

Recommendations

e) Attribution of in-kind contributions, value engineering, etc.

- The ILC construction project should be based on a Work Breakdown Structure (WBS) system. In-kind contributions will be likely to form the majority of contributions to the project's infrastructure. An agreed register of WBS items should be set up and a committee constituted to consider bids for WBS items from member states. Value engineering should be used in defining the "value" of each WBS item. There should be an adequate Common Fund (of at least 20%) in order to give management enough flexibility. There should be no strict "juste retour".

Recommendations

f) Contingency

- If and when needed, the Council should have the authority to call on a central contingency budget with a maximum of 10% of the total project cost and to allocate it as appropriate. Increases in costs to produce a WBS item smaller than 25% or some other agreed ceiling in cash should be borne by the country with responsibility for that item; they are recommended to have appropriate internal contingency. It is important to avoid double counting between the central contingency and a country's internal contingency in arriving at the overall project costing. If costs for a WBS item increase beyond the agreed ceiling, the case could be referred to and considered by a standing Board and either referred back to the submitting country or referred to Council for release of central contingency, as appropriate.

Recommendations

f) Contingency (contd.)

- Exhaustion of the central contingency should lead to appropriate descoping of the project to be decided by management with Council's agreement.

g) Running costs & decommissioning

- Running costs should be evaluated at the time of setting up the organization and a suitable algorithm agreed to. A commonly chosen algorithm is that running costs should be distributed roughly proportional to capital contributions.
- Decommissioning should be the responsibility of the state that provided that WBS item; the Host State should have residual responsibility.

Timescales

1) FALC presentation – July 13th 2009

2) Albuquerque Sep 29 – Oct 3 – tentative conclusion on funding model – fractions per partner, size of common fund etc.

3) EC face-to-face ~ Jan. Oxford – conclusion on funding models, preliminary conclusion on governance model options

4) Beijing March/April 2010? – conclusion on governance model options

5) Write preliminary governance report and iterate May – June 2010

6) Present to and hope to get agreement from ICFA, ILCSC, PAC & FALC – June-July 2010.

→ We are here

7) Present at Paris ICHEP July 2010 – N.B. this is not a final report and no funding authority/government will be expected to sign off on it. Comments/criticisms etc however would be ***very*** welcome.

Summary and Outlook

- The ILC is a machine that could be built tomorrow – but it is expensive. Significant R&D is under way to produce savings & therefore contain cost while maintaining physics specs – much already achieved.
- Collaboration with CLIC is close and growing. We will build the best machine whenever - and wherever – political will and funding becomes available.
- We need to be ready with a credible project whenever exciting results at LHC arrive. Political framework needs to be discussed – encouraged by FALC reaction. Input from ECFA is very welcome.