BCD Overview
Process and Highlights

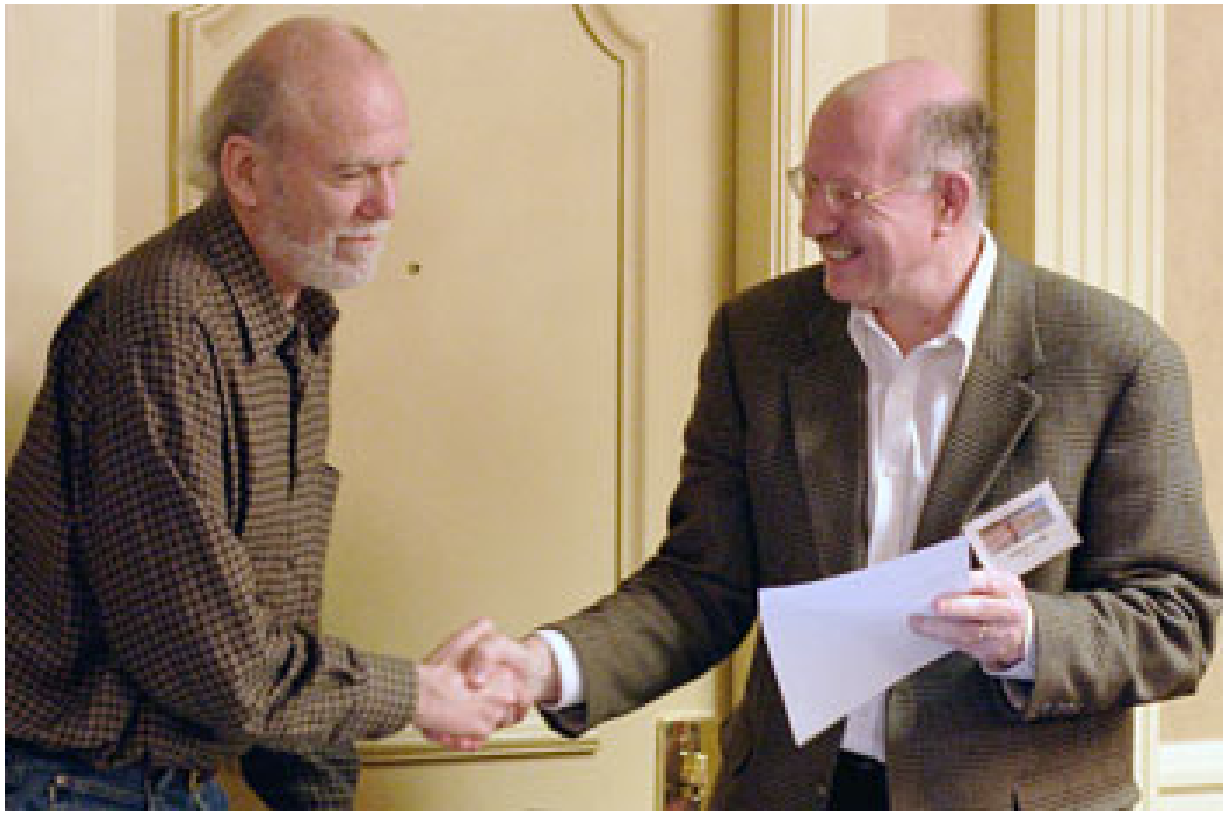
Barry Barish

GDE

Caltech

Global Design Effort (GDE)

- On March 18, 2005, during the opening of *LCWS05* workshop at Stanford University, I officially accepted the position of Director of the (yet to be formed) GDE



Creating the Global Design Effort

- First Decision: "Build a Globally Distributed Effort"
  - This allowed creating an "expert team" for the GDE
    - I consulted broadly for who should be recruited. First – The key people who must be in the GDE. Then, members to fill out the technical skills and expertise needed and regional balance
    - Almost all my offers to join the GDE were accepted
  - A **Big Advantage** of a "distributed" GDE
    - GDE is naturally integrated into the broader ILC R&D efforts in the major laboratories worldwide
  - A **Big Disadvantage** of a "distributed" GDE
    - The Communication issues and decision making are far more challenging. This is a continuing issue for us.
    - Strong emphasis on modern tools to mitigate – website design; EDMS system; telecon/videocon tools etc.

Global Design Effort

- The Mission of the GDE
  - Produce a design for the ILC that includes a detailed design concept, performance assessments, reliable international costing, an industrialization plan , siting analysis, as well as detector concepts and scope.
  - Coordinate worldwide prioritized proposal driven R & D efforts (to demonstrate and improve the performance, reduce the costs, attain the required reliability, etc.)

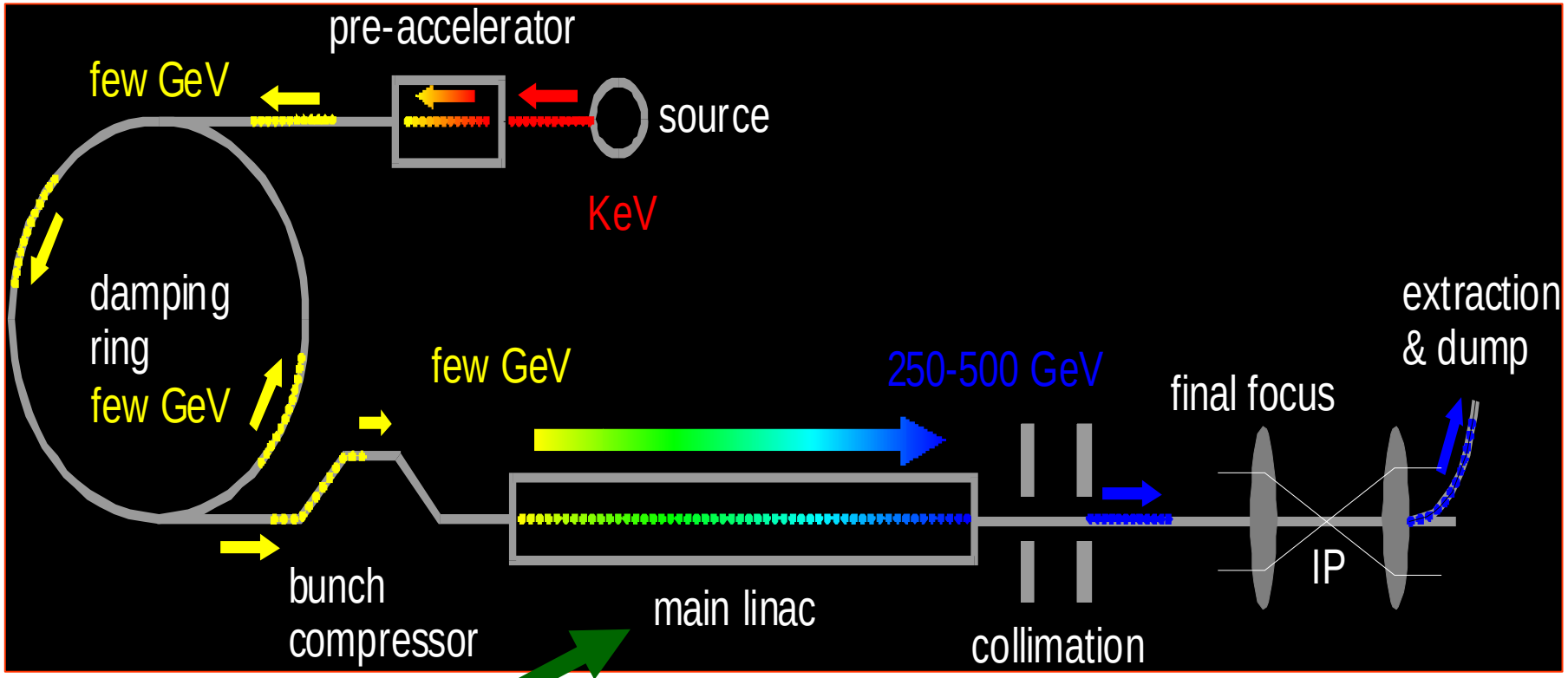
GDE Began at Snowmass

Snowmass
49 GDE members

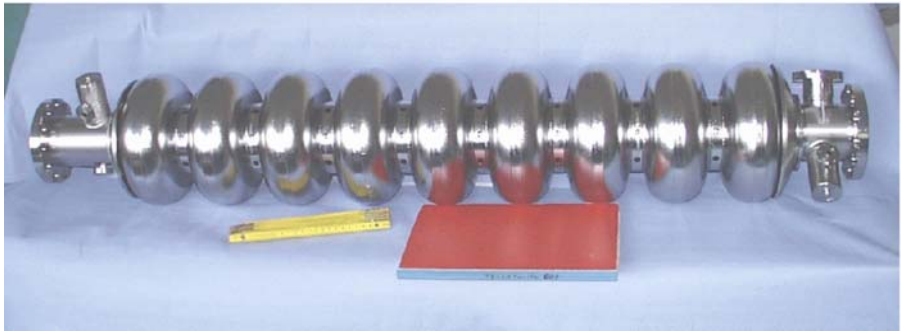
Present
GDE Membership
Americas 22
Europe 24
Asia 18

About 30 FTEs

Designing the ILC



Superconducting RF Main Linac



Barish - Snowmass Plenary Talk

GDE – Near Term Plan

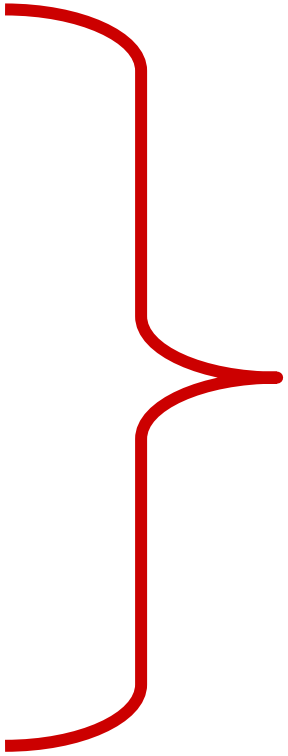
- Schedule
  - Begin - define Configuration (Snowmass Aug 05)
  - Baseline Configuration Document (end of 2005)

  - Baseline under Configuration Control (Jan 06)
  - Develop Reference Design (end of 2006)
  - Coordinate the supporting R&D program

- Three volumes -- 1) Reference Design Report; 2) Shorter glossy version for non-experts and policy makers ; 3) Detector Concept Report

GDE Structure and Organization

- Executive Committee for Baseline Configuration
  - **GDE Director**
    - Barish
  - **Regional Directors**
    - Dugan – Americas
    - Foster – Europe
    - Takasaki – Asia
  - **Accelerator Leaders**
    - Yokoya - Asia
    - Raubenheimer - Americas
    - Walker - Europe



GDE Executive Committee

- Responsible for top-level decisions for the Baseline Configuration Document (BCD) and RDR
  - **Public Minutes; Invited Guests; etc**

GDE Structure and Organization

- **GDE Groups**
  - **Design / Cost Engineers**
    - Shidara – Asia
    - Bialowons – Europe
    - Garbincius – Americas
  - **Conventional Facilities and Siting**
    - Baldy - Europe
    - Enomoto – Asia
    - Kuchler – Amercas
  - **Physics / Detectors (WWS chairs)**
    - Brau - Americas
    - Richard - Europe
    - Yamamoto - Asia
  - **Accelerator Experts (~50 GDE members)**

Guidance for Baseline Configuration

Baseline: **A forward looking configuration which we are reasonably confident can achieve the required performance *and* can be used to give a reasonably accurate cost estimate by mid-end 2006 in a "Reference Design Report."**

Alternates: Technologies or concepts, which may provide a significant cost reduction, improved performance (or both), but which will not be mature enough to used in baseline by end 2006

Alternatives will be part of the RDR, will form an important element in the R&D program and are the key to evolving the design

Baseline Configuration Document

- Our ‘Deliverable’ by the end of 2005

- A structured electronic document
  - Documentation (reports, drawings etc)
  - Technical specs.
  - Parameter tables
  - Revisions and Evolution through Change Control Process

http://www.linearcollider.org/wiki/doku.php?id=bcd:bcd_home

Baseline Configuration Document

- **ILC Configuration Main**

- **What's New**
- March 28, 2006 - RTML section has been updated (v.Mar.28 2006)
- March 23, 2006 - Missing figure in the “Number of Tunnels” section under the GDE White Papers has bee restored.
- March 16, 2006 - Conventional Facilities & Siting Section has been updated (v.Mar. 16 2006)
- March 3, 2006 - RTML and Parameters Sections have been updated (v.Mar.3 2006)

- **Change Configuration Communication**
- Change Configuration Procedure (v.0.5, Feb. 3, 2006)
- Archives of public communications regarding BCD Change Control.
- Change Configuration History

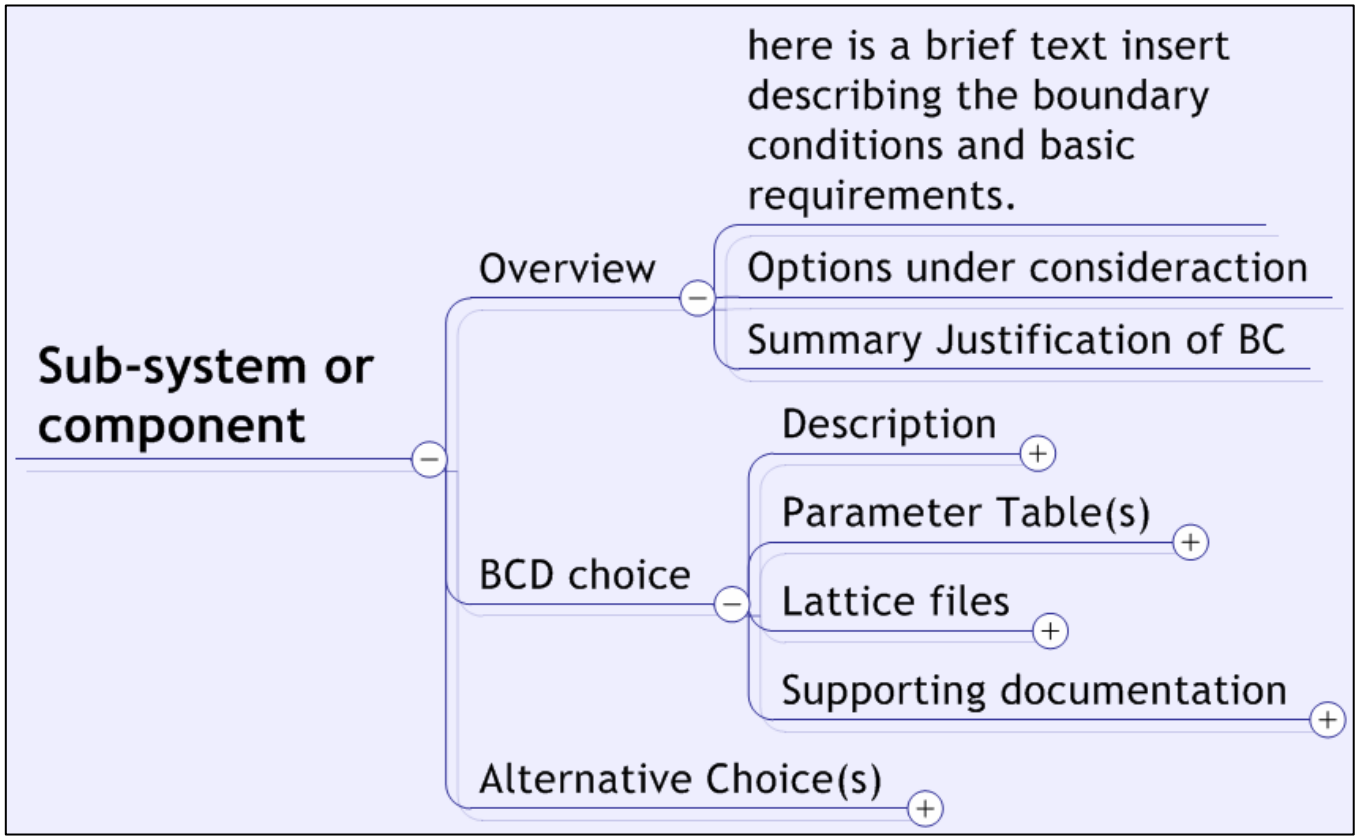
Baseline Configuration Document

- **Latest Official Version of BCD**
- **BCD in MSWord files:**

- **All-in-one-file**
  - Single PDF File (2582kB, Updated Mar.28, 2006)
  - Single MSWord File (5103kB, Updated Mar.28, 2006)

- **By Area Nodes:**
  - General Parameters (233kB, Updated Mar. 3, 2006)
  - Electron Source (296kB)
  - Positron Source (316kB)
  - Damping Rings (554kB, Updated Feb.27, 2006)
  - Ring to Main Linac (313kB, Updated Mar.28, 2006)
  - Main Linacs (455kB)
  - Beam Delivery (543kB)
  - TeV Upgrade Scenario (26kB)

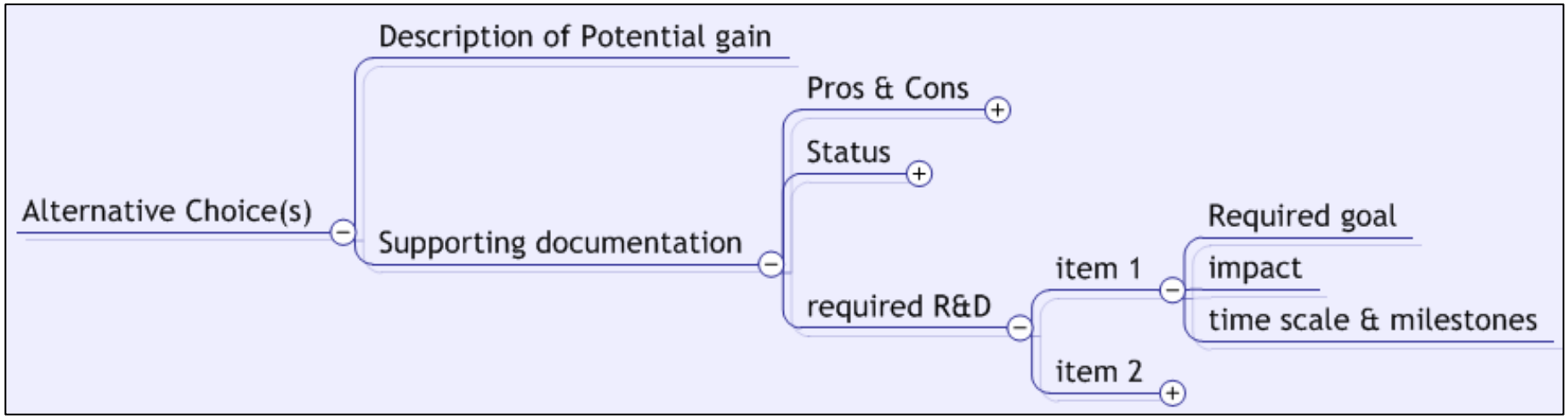
Structure of the BCD



Summary-like overview for those who want to understand the **choice** and the **why**

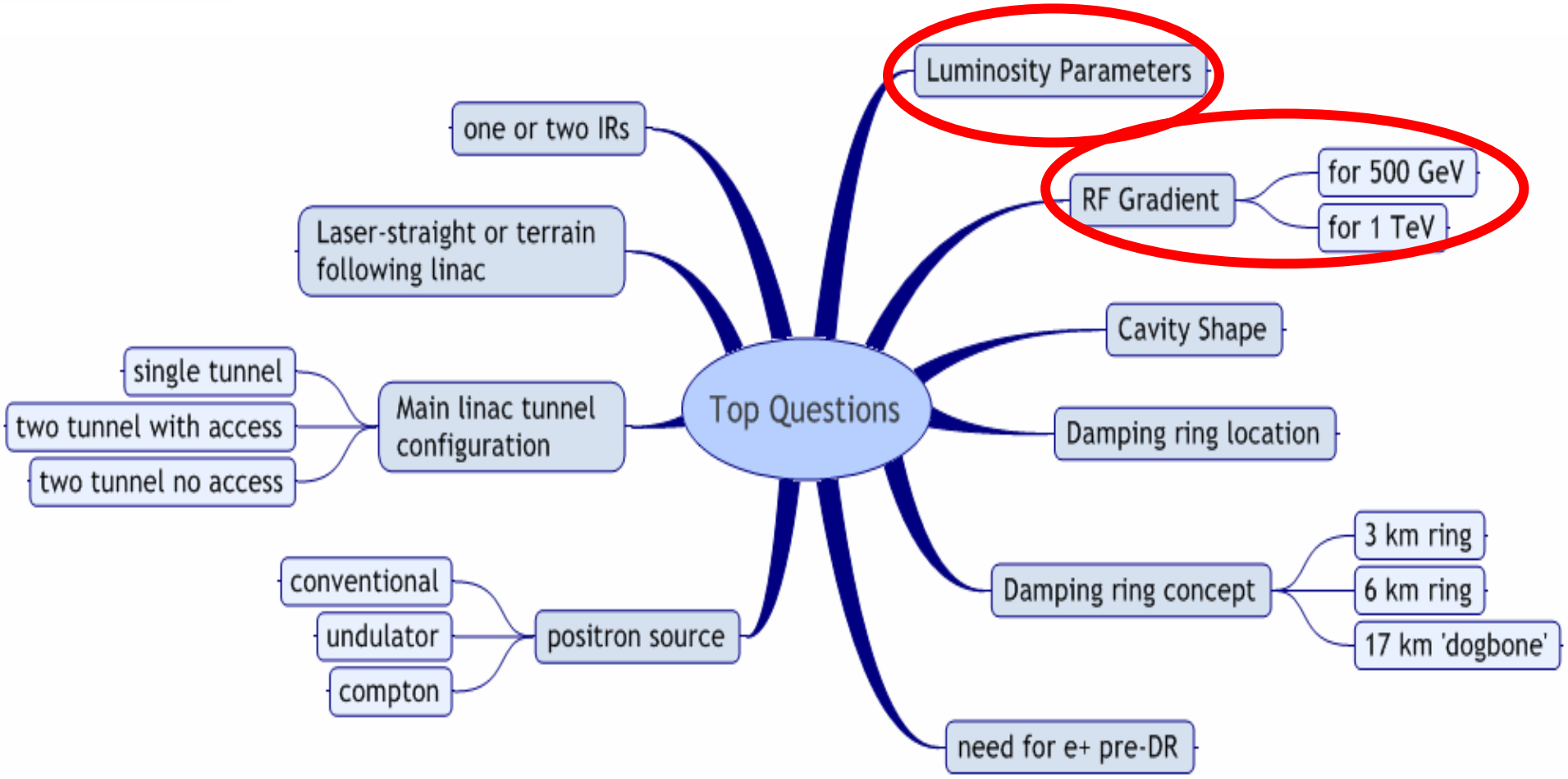
Technical documentation of the **baseline**, for engineers and acc. phys. making studies towards RDR

Alternatives Section(s)



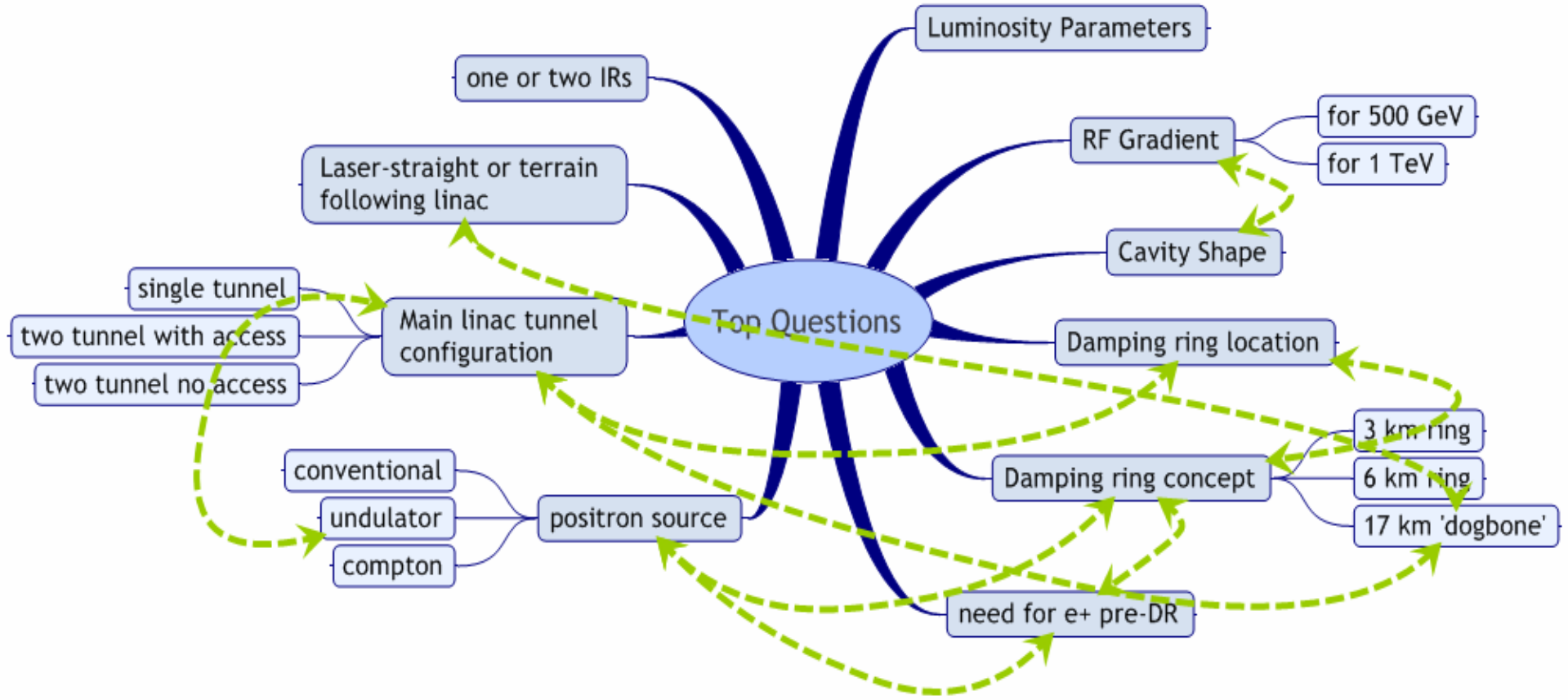
Note - **ACD is part of the BCD**

The Key Decisions



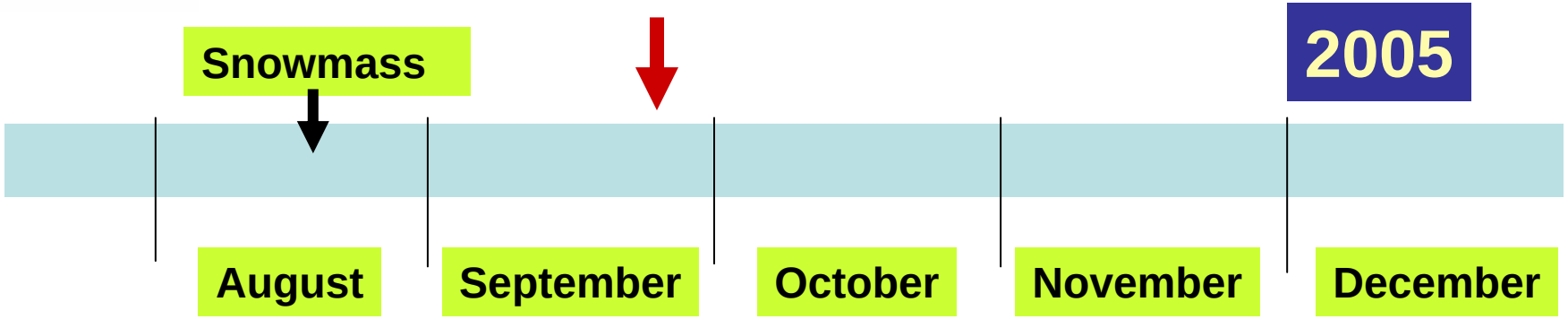
Critical choices: luminosity parameters & gradient

Making Choices – The Tradeoffs



Many decisions are interrelated and require input from several WG/GG groups

From Snowmass to a Baseline



WW/GG summaries

Response to list of 40+ decisions

All documented 'recommendations available on ILC Website (request community feedback)

Review by BCD EC

BCD Executive Committee:
Barish
Dugan, Foster, Takasaki
Raubenheimer, Yokoya, Walker

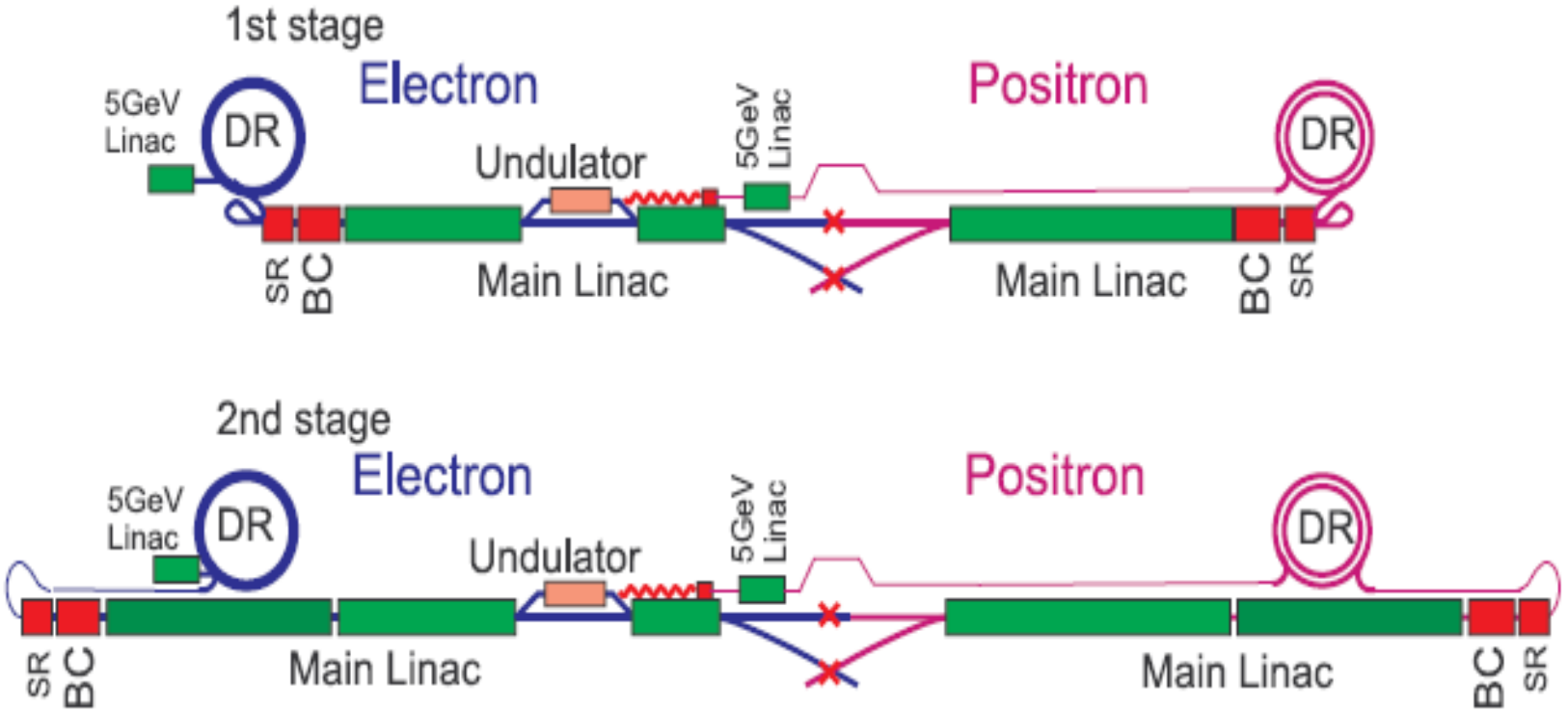
BCD EC publishes 'strawman' BCD

Public Review

Frascati GDE meeting

Baseline Configuration - Schematic

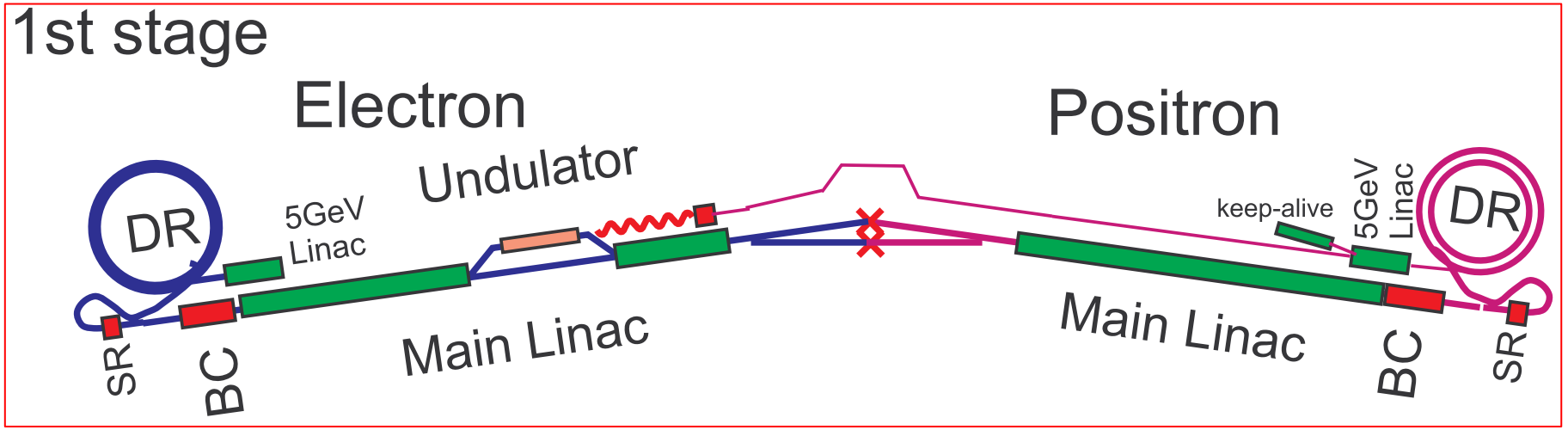
Dec 05



Tor Raubenheimer

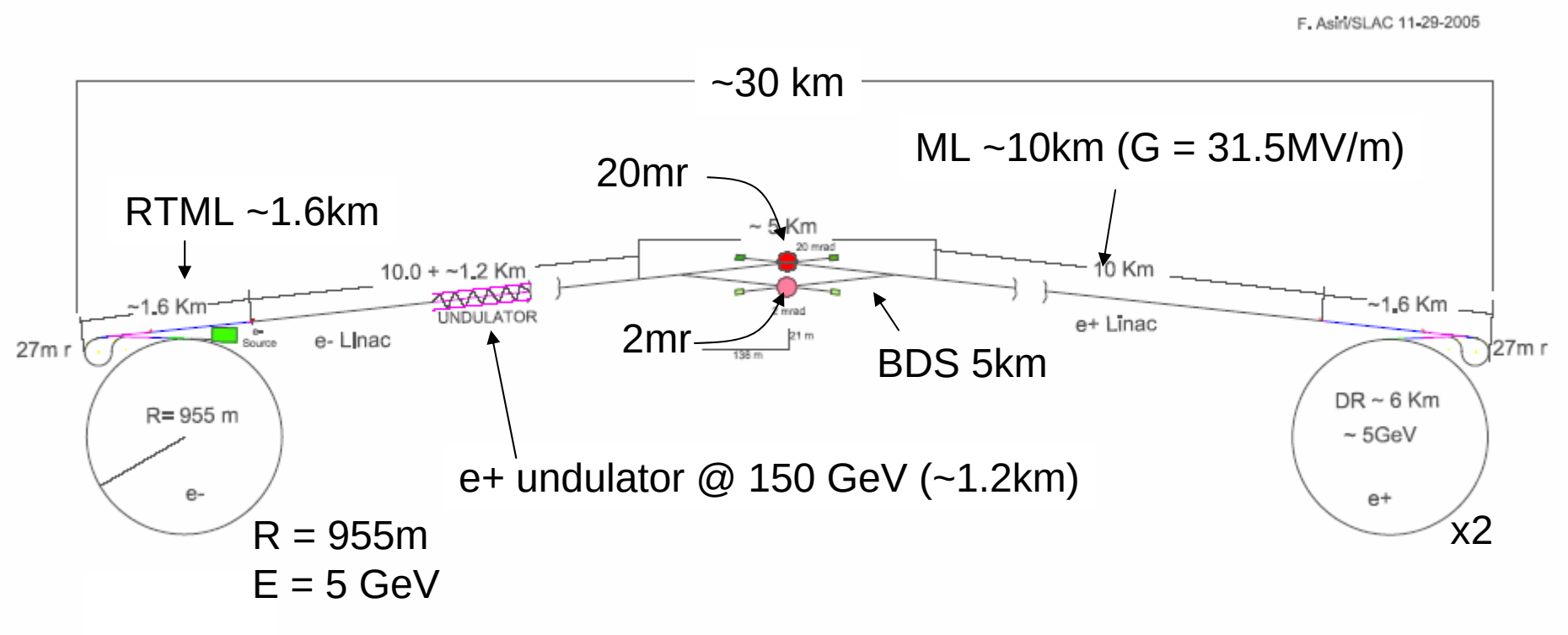
Baseline Configuration - Schematic

March 06



Tor Raubenheimer

The Baseline Machine (500GeV)

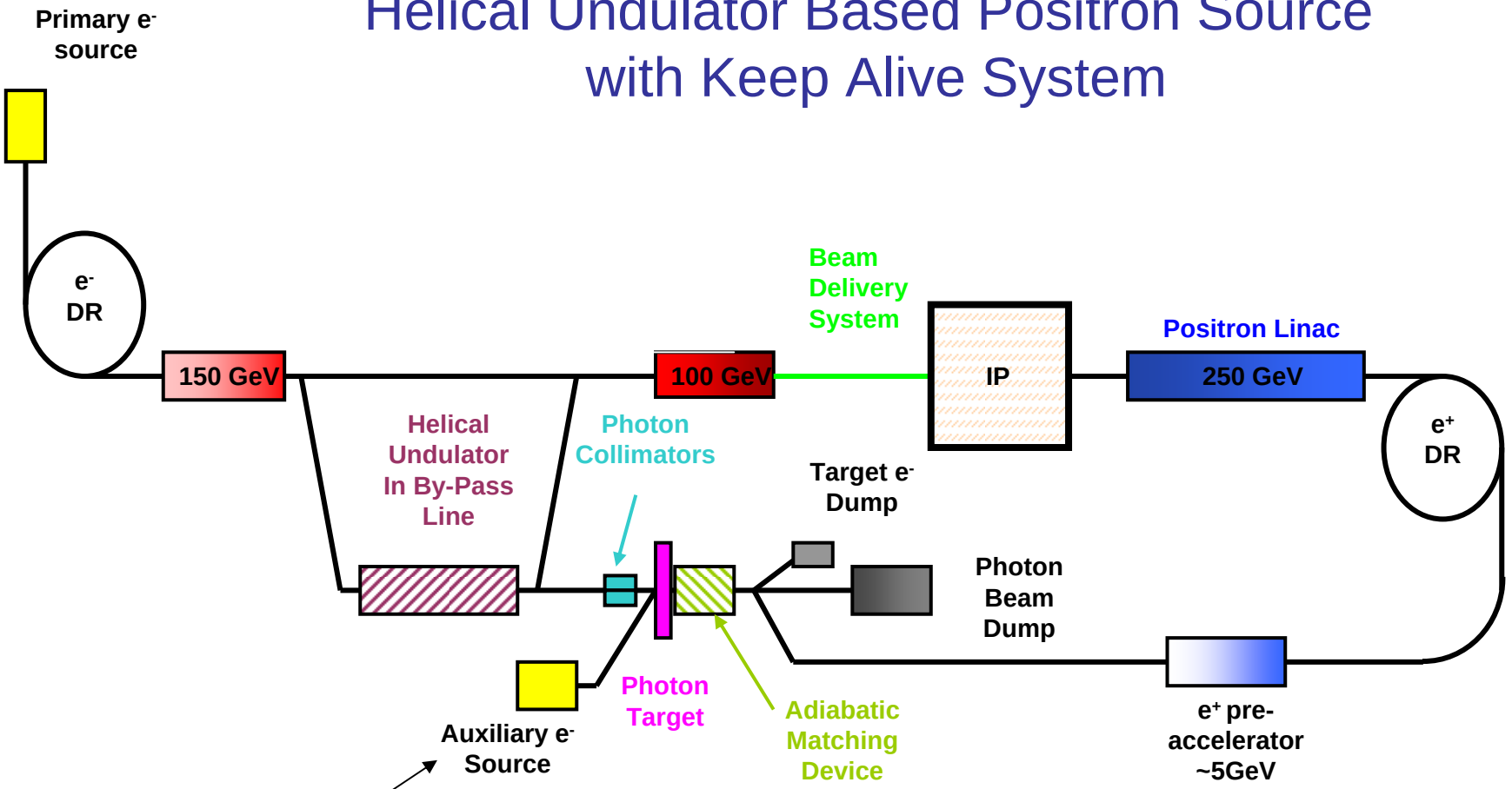


not to scale

Tor Raubenheimer

Positron Source

Helical Undulator Based Positron Source with Keep Alive System

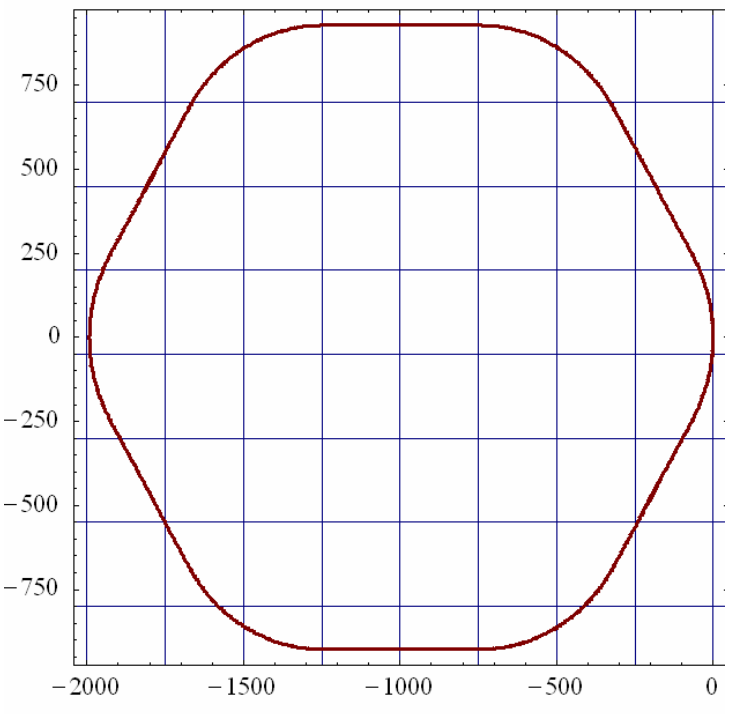


Keep Alive: This source would have all bunches filled to 10% of nominal intensity.

Tor Raubenheimer

Damping Rings

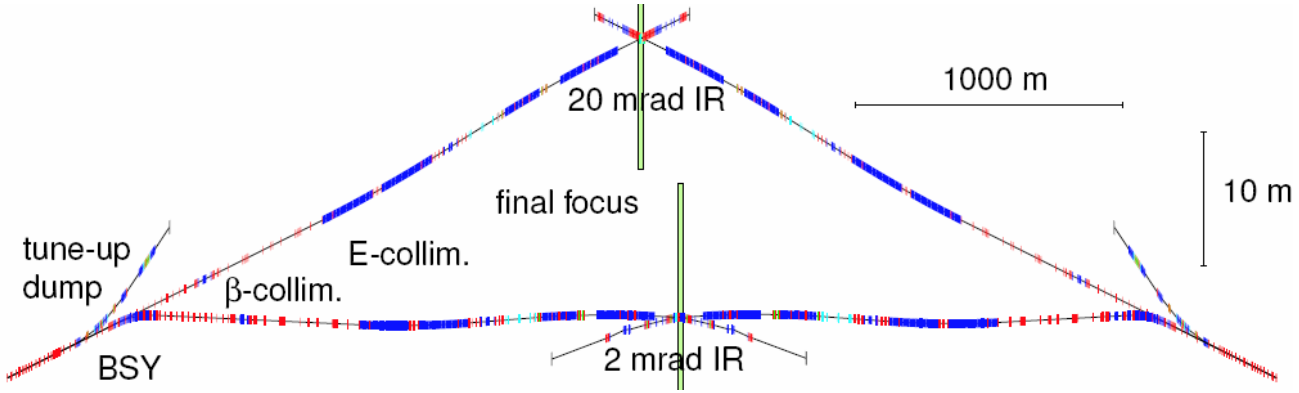
- **Positrons:**
  - Two rings of ~6 km circumference in a single tunnel.
  - Two rings are needed to reduce e-cloud effects unless significant progress can be made with mitigation techniques.
  - Preferred to 17 km dogbone due to:
    - **Space-charge effects**
    - **Acceptance**
    - **Tunnel layout (commissioning time, stray fields)**



- Electrons:
  - One 6 km ring.

Tor Raubenheimer

Beam Delivery System



- Baseline (supported, at the moment, by GDE exec)
  - **two BDSs, 20/2mrad, 2 detectors, 2 longitudinally separated IR halls**
- Alternative 1
  - **two BDSs, 20/2mrad, 2 detectors in single IR hall @ Z=0**
- Alternative 2
  - **single IR/BDS, collider hall long enough for two push-pull detectors**

Tor Raubenheimer

Parametric Approach

		min		nominal		max	
Bunch charge	N	1	-	2	-	2	$\times 10^{10}$
Number of bunches	n_b	1330	-	2820	-	**5640**	
Linac bunch interval	t_b	**154**	-	308	-	461	ns
Bunch length	σ_z	**150**	-	300	-	500	μm
Vert.emit.	$\gamma\epsilon_y^*$	**0.03**	-	0.04	-	0.08	mm·mrad
IP beta (500GeV)	β_x^*	**10**	-	21	-	21	mm
	β_y^*	**0.2**	-	0.4	-	0.4	mm
IP beta (1TeV)	β_x^*	**10**	-	30	-	30	mm
	β_y^*	**0.2**	-	0.3	-	0.6	mm

Tor Raubenheimer

SRF Cavity Gradient

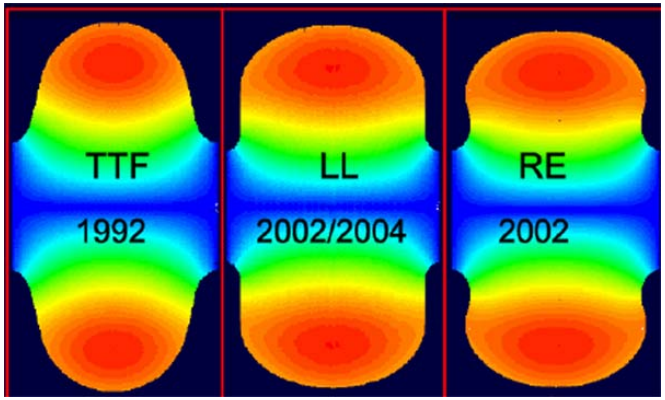
	Cavity type	Qualified gradient	Operational gradient	Length*	energy
		MV/m	MV/m	Km	GeV
initial	TESLA	35	31.5	10.6	250
upgrade	LL	40	36.0	+9.3	500

Total length of one 500 GeV linac ≈ 20km

* **assuming 75% fill factor**

Chris Adolphsen

Superconducting RF Cavities



Chemical Polish Electro Polish

Chris Adolphsen

RF Power: Baseline Klystrons

Thales

CPI

Toshiba

Specification:

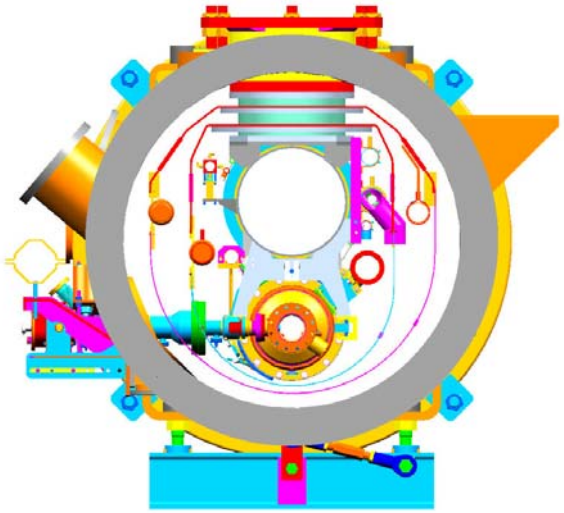
10MW MBK

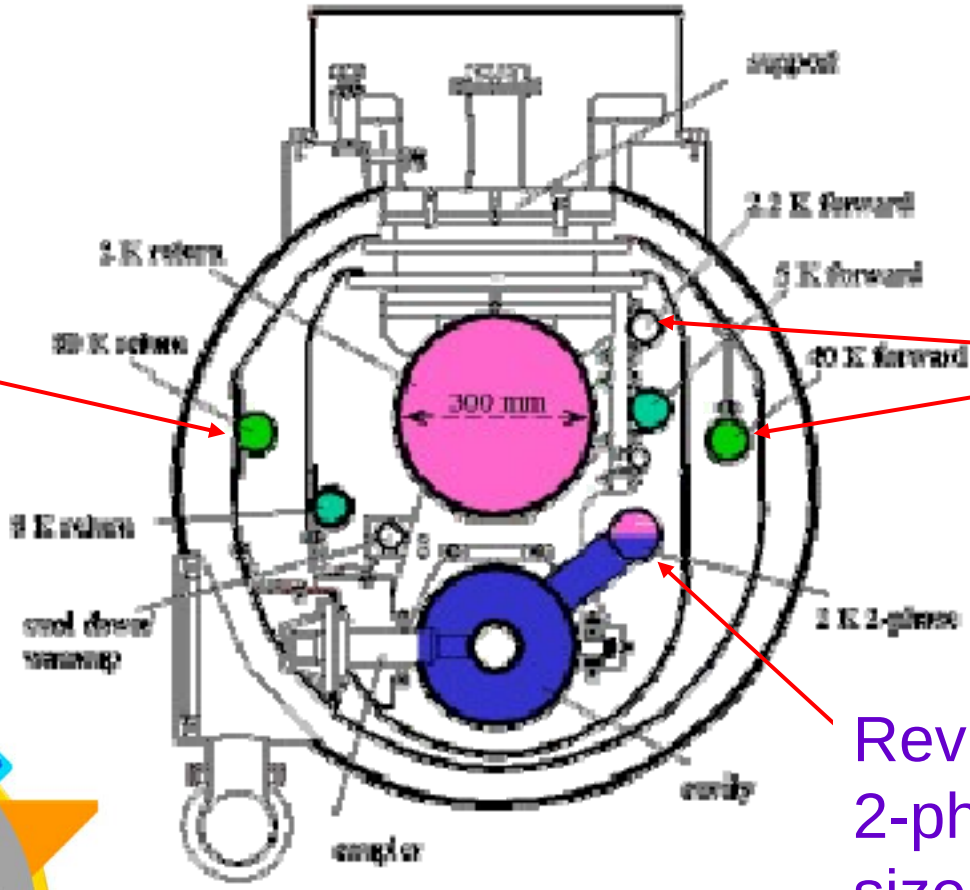
1.5ms pulse

65% efficiency

Chris Adolphsen

ILC Cryomodule





Increase diameter beyond X-FEL

Increase diameter beyond X-FEL

Review 2-phase pipe size and effect of slope

Chris Adolphsen

Siting and Conventional Facilities

- International team with representation from the three regions has been assembled

- The design is intimately tied to the features of the site
  - **1 tunnels or 2 tunnels?**
  - **Deep or shallow?**
  - **Laser straight linac or follow earth's curvature in segments?**

- GDE ILC Design is being done to **samples sites** in the three regions
  - **Criteria matrix has been used to understand siting and compare siting**
  - **Sample sites from all three regions.**

Vic Kuchler

ILC International Linear Collider
Office of the Global Design Effort
PO Box 500
Batavia, IL 60510
USA
630-840-8907

November 18, 2005

Dr. Gerry Dugan
Regional Director for the Americas

Dr. Brian Foster
Regional Director for Europe

Dr. Fumihiko Takasaki
Regional Director for Asia

Dear Regional Directors of the GDE

As you are well aware, the detailed technical design and implementation of the ILC will be intimately connected to the features of the site where it will be located. For that reason, it will be important to have real site information during the technical design effort in a couple years. However, at the present time, our design effort is conceptual and we have much less need for specific site information. Therefore, it would be premature to solicit actual site proposals at his time. .

More specifically, our needs during the reference design effort are to learn about the factors that are important in doing the siting and can help set site requirements. Secondly, it is important to develop an ILC reference design that is consistent with the features of real sites. For these reasons, I am requesting each regional director to produce information on one "sample" site in their region by this December 2005. Even though the final candidate sites are likely to be different sites, the information on these sample sites will help to insure that we produce a realistic reference design.

Let me assure you that the sample site information from the three regions will not be used to compare one site with another or to do any preliminary site selection, or in a way that will reveal those sites. Instead, we plan to study siting issues and to develop a reference design for a range of site conditions. We will not make public any detailed or individual site information and the chapter we produce on siting in the Reference Design Report will not discuss or compare individual sites.

Sincerely,

Barry C. Barish

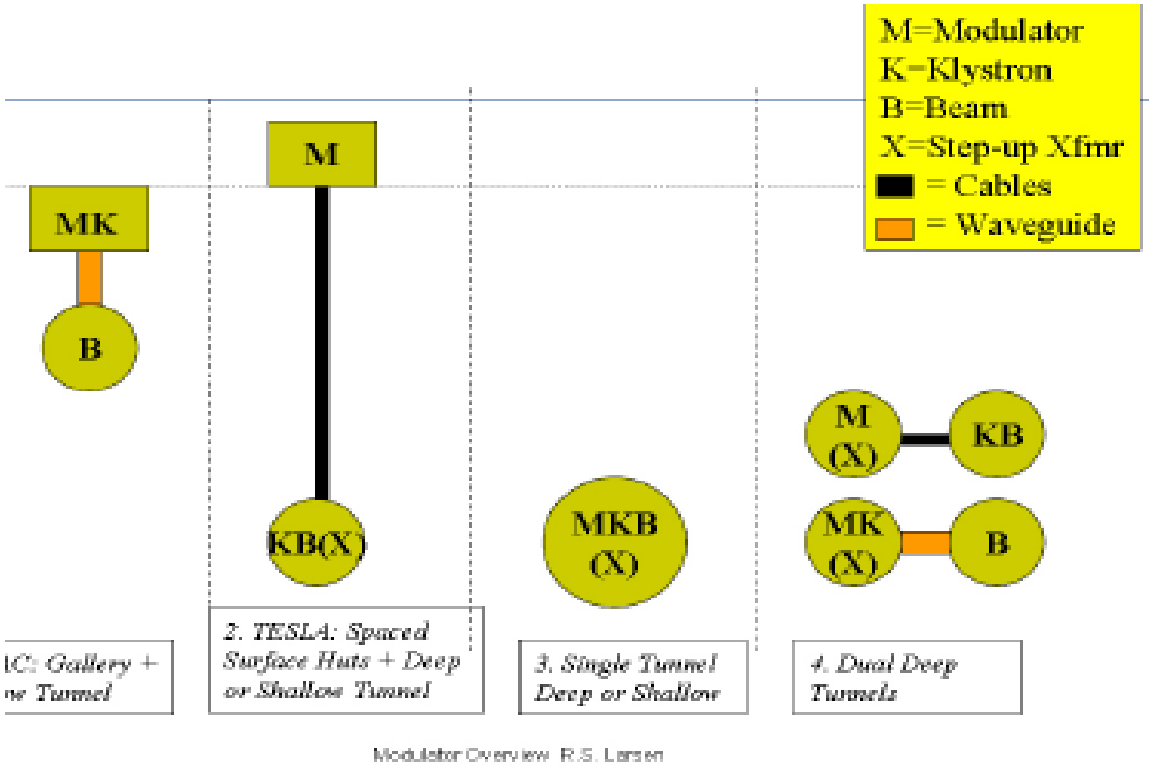
Barry C. Barish
Director, ILC Global Design Effort

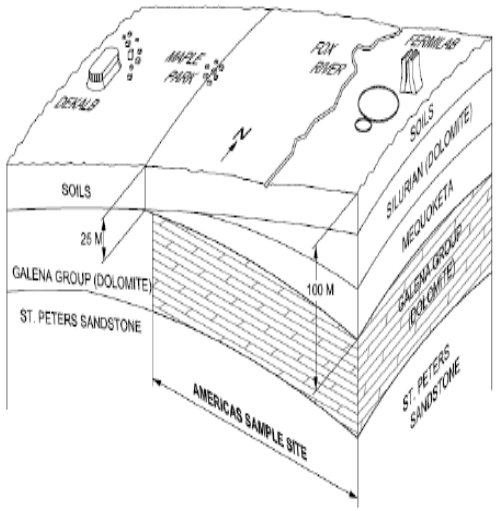
Request for Sample Site Information

To be used to study siting issues, in advance of a call for "expressions of interest" to host the ILC

Vic Kuchler

Possible Tunnel Configurations





Vic Kuchler

Change Control

- The BCD was put under change control, upon approval at Frascati
- All changes since have been coordinated through the CCB
  - **The first action of the CCB was to complete the BCD**
  - **An hierarchical system of requesting, evaluating and approving changes has been instituted and is working.**
  - **The BCD will evolve, and be consistent (or part) of the RDR when it is produced**

- CCB will evaluate R&D defined by the alternatives in the baseline to what needs to be demonstrated in these projects, in order to be considered for a CCB action to replace the baseline.

Nobu Toge

Conclusions -- BCD

- The baseline configuration for the ILC has been established and is document in the BCD (a 700+ page electronic document)
- We have put the BCD under configuration control and are evolving it now in a controlled manner
- The BCD also defines alternatives and the combination of the baseline and alternative will give good guidance for the ILC R&D program
- The BCD is now being used as the starting point and basis for the reference design / cost effort this year.