The International Linear Collider

Outline

How did we get here?
- Why e+ e-
- Technology choice
- Global Design Effort

Where are we?
- Reference design
- Cost Estimate

Where are we going?
- R&D
- Engineering Design Phase
- Regional Activities

Global Design Effort
Why $e^+e^-$ Collisions?

- elementary particles
- well-defined
  - energy,
  - angular momentum
- uses full COM energy
- produces particles democratically
- can mostly fully reconstruct events
ILC Physics Goals

- EWSB
  - Higgs
    - Mass (~50 MeV at 120 GeV)
    - Width
    - BRs (at the few% level)
    - Quantum Numbers (spin/parity)
    - Self-coupling
      - Strong coupling (virtual sensitivity to several TeV)
- SUSY particles
  - Strong on sleptons and neutralinos/charginos
- Extra dimensions
  - Sensitivity through virtual graviton
- Top
  - Mass measured to ~ 100 MeV (threshold scan)
  - Yukawa coupling
- W pairs
  - W mass
How do you know you have discovered the Higgs?

Measure the quantum numbers. The Higgs must have spin zero!

The linear collider will measure the spin of any Higgs it can produce by measuring the energy dependence from threshold.
New space-time dimensions can be mapped by studying the emission of gravitons into the extra dimensions, together with a photon or jets emitted into the normal dimensions.
After the SLC demonstrated the linear e+e- concept was viable in the late 80’s then technology development started aimed at a machine to be complimentary to the LHC.

Consensus (HEPAP, ECFA, ACFA) in 1999 that the next world accelerator should be a 500 Gev e+e- collider that would be upgradeable.

ICFA in 2001 requested the International Linear Collider Technical Review Committee to assess status; they conclude it can be built but with what technology (warm SLAC, KEK or cold DESY)?
ICFA sets up the ILC Steering Committee (2002) to ‘organise’ and the International Technology Recommendation Panel (2003) to ‘decide’. A major step toward a new international machine required uniting behind one technology, and then working toward a unified global design based on the recommended technology i.e. a global project:

- X-band (11 GHz) normal-conducting copper structures (GLC/NLC)
- L-band (1.3 GHz) superconducting niobium structures (TESLA)
The Recommendation - 2004

- We recommend that the linear collider be based on superconducting rf technology

- This recommendation is made with the understanding that we are recommending a technology, not a design. We expect the final design to be developed by a team drawn from the combined warm and cold linear collider communities, taking full advantage of the experience and expertise of both (from the Executive Summary).
After the technology recommendation: 

**The Global Design Effort**

**Mission**

1. 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.

2. Coordinate worldwide prioritized proposal driven R & D efforts (to demonstrate and improve the performance, reduce the costs, attain the required reliability, etc.)

This is the first truly global accelerator project
ILC Organization

Oversight: ILCSC / FALC

Global Design Effort (B. Barish director)
65 members equally from Americas, Asia, Europe

Americas Team
(M. Harrison)
R&D Board
(W. Willis)
Change Control Bd

Asian Team

European Team
Design/ Cost Bd

Participating institutions ~ 700 scientists and engineers worldwide

US Labs
Fermilab
SLAC
LBNL
ANL
Cornell
BNL
LLNL
TJNAF
LANL
LANL
ORNL
+universities
Create a baseline configuration for the machine:
– Document a concept for ILC machine with a complete layout, parameters, etc. defined by the end of 2005. This process continues much of the design work of the past decade, including the recent ILC workshops at KEK (Nov. 2004) and Snowmass (Aug. 2005).

Develop a reference design and cost estimate in 2006
ILC Parameters - physics driven input

- Luminosity $\Rightarrow \int Ldt = 500 \text{ fb}^{-1}$ in 4 years
- $E_{cm}$ adjustable from 200 – 500 GeV
- Ability to scan between 200 and 500 GeV
- Energy stability and precision below 0.1%
- Electron polarization of at least 80%

- The machine must be upgradeable to 1 TeV
- Positron Polarisation desireable as an upgrade
Starting Point for the GDE

Superconducting RF Main Linac
Towards a baseline: The Hard Questions

- Laser-straight or terrain following linac
- Main linac tunnel configuration
- one or two IRs

Luminosity Parameters
- RF Gradient
  - for 500 GeV
  - for 1 TeV
- Cavity Shape
- Damping ring location
- Damping ring concept
- 3 km ring
- 6 km ring
- 17 km 'dogbone'
- need for e+ pre-DR

- single tunnel
- two tunnel with access
- two tunnel no access
- conventional
  - undulator
  - Compton
- positron source

Global Design Effort
Technical Challenges

• Developing efficient high gradient superconducting RF systems
  – Requires efficient RF systems, capable of accelerating high power beams (~MW) with small beam spots (~nm).

• Achieving nm scale high-power beam spots
  – Requires generating high intensity beams of electrons and positrons
  – Damping the beams to ultra-low emittance in damping rings
  – Transporting the beams to the collision point without significant emittance growth or uncontrolled beam jitter
  – Cleanly dumping the used beams.
Global Design Effort

Costs v’s Gradient

\[ S \approx \frac{a_{\text{lin}}}{G} + b_{\text{cryo}} \frac{G^2}{Q_0} \]

35 MV/m is close to optimum

30 MV/m would give safety margin

C. Adolphsen (SLAC)  Gradient MV/m

Global Design Effort
Baseline to a RDR

Global Design Effort

2006
- Frascati
  - Freeze Configuration
  - Organize for RDR

2007
- Bangalore
  - Review Design/Cost Methodology
- Vancouver
  - Review Initial Design / Cost
- Valencia
  - Review Final Design / Cost RDR Document
- Beijing
  - Preliminary RDR Released

Design and Costing

RDR estimate slides from B. Barish BILCW07
Reference Design

- 11km SC linacs operating at 31.5 MV/m for 500 GeV
- Centralized injector
  - Circular damping rings for electrons and positrons
  - Undulator-based positron source
- Single IR with 14 mrad crossing angle
- Dual tunnel configuration for safety and availability

Not to Scale
ILC Parameters

• Overall parameters
  – 2e34 peak luminosity
  – 85% collider availability $\rightarrow$ 500 fb$^{-1}$ 1st four years
  – 9.0 mA average current during beam pulse
  – 0.95 ms beam pulse and 1.5 ms rf pulse length
  – 5 Hz operation and ~230 MW power consumption

• Beam parameter ranges defined for operability
  – 1000 to 6000 bunches
  – 1e10 to 2e10 per bunch
  – Beam power between 5 and 11 MW
  – Bunch length: 200 to 500 µm at IP
  – IP spots sizes: $\sigma_x \sim 350 – 620$ nm; $\sigma_y \sim 3.5 – 9.0$ nm
## ILC Beam Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nominal</th>
<th>Low N</th>
<th>Large Y</th>
<th>Low P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repetition rate frep (Hz)</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
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<tr>
<td>Number of particles per bunch N ($10^{10}$)</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Number of bunches per pulse nb</td>
<td>2625</td>
<td>5120</td>
<td>2625</td>
<td>1320</td>
</tr>
<tr>
<td>Bunch interval in the main linac (ns)</td>
<td>369.2</td>
<td>189.2</td>
<td>369.2</td>
<td>480</td>
</tr>
<tr>
<td>in units of RF buckets</td>
<td>480</td>
<td>246</td>
<td>480</td>
<td>624</td>
</tr>
<tr>
<td>Average current in the main linac (mA)</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>6.8</td>
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<tr>
<td>$\gamma^\varepsilon x$ at IP (mm-rad)</td>
<td>10</td>
<td>10</td>
<td>12</td>
<td>10</td>
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<tr>
<td>$\gamma^\varepsilon y$ at IP (mm-rad)</td>
<td>0.04</td>
<td>0.03</td>
<td>0.08</td>
<td>0.035</td>
</tr>
<tr>
<td>Beta function at IP $\beta x$ (mm)</td>
<td>20</td>
<td>11</td>
<td>11</td>
<td>11</td>
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<tr>
<td>Beta function at IP $\beta y$ (mm)</td>
<td>0.4</td>
<td>0.2</td>
<td>0.6</td>
<td>0.2</td>
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<tr>
<td>R.m.s. beam size at IP $\sigma x$ (nm)</td>
<td>639</td>
<td>474</td>
<td>474</td>
<td>474</td>
</tr>
<tr>
<td>R.m.s. beam size at IP $\sigma y$ (nm)</td>
<td>5.7</td>
<td>3.5</td>
<td>9.9</td>
<td>3.8</td>
</tr>
<tr>
<td>R.m.s. bunch length $\sigma z$ (nm)</td>
<td>300</td>
<td>200</td>
<td>500</td>
<td>200</td>
</tr>
<tr>
<td>Disruption parameter $D x$</td>
<td>0.17</td>
<td>0.11</td>
<td>0.52</td>
<td>0.21</td>
</tr>
<tr>
<td>Disruption parameter $D y$</td>
<td>19.4</td>
<td>14.6</td>
<td>24.9</td>
<td>26.1</td>
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<tr>
<td>Beamstrahlung parameter $Y ave$</td>
<td>0.048</td>
<td>0.05</td>
<td>0.038</td>
<td>0.097</td>
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<tr>
<td>Energy loss by beamstrahlung $\delta_B$</td>
<td>0.024</td>
<td>0.017</td>
<td>0.027</td>
<td>0.055</td>
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<tr>
<td>Number of beamstrahlung photons $n_Y$</td>
<td>1.32</td>
<td>0.91</td>
<td>1.77</td>
<td>1.72</td>
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<tr>
<td>Luminosity enhancement factor $H_D$</td>
<td>1.71</td>
<td>1.48</td>
<td>2.18</td>
<td>1.64</td>
</tr>
<tr>
<td>Geometric luminosity $L_{geo}$ $10^{34}$ cm$^{-2}$ s$^{-1}$</td>
<td>1.2</td>
<td>1.35</td>
<td>0.94</td>
<td>1.21</td>
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</tbody>
</table>
ILC Energy Upgrade Path

- Linac energy upgrade path based on empty tunnels hard to ‘sell’
  - Empty tunnels obvious cost reduction
- Lower initial gradient increases capital costs
- Baseline has tunnels for 500 GeV cms with a linac gradient of 31.5 MV/m
- Geometry of beam delivery system adequate for 1 TeV cms
  - Require extending linac tunnels past turn-around, adding transport lines, and moving turn-around → ~50 km site
ILC Availability Issues

- ILC is $\sim 10x$ larger than previous accelerators
- Aiming at an availability of $\sim 85\%$
- Predict very little integrated luminosity using standard accelerator MTBFs and MTTRs
  - **Stringent requirements on component and sub-system availability**
    - Improvements $\sim 10x$ on magnets, PS, kickers, etc
  - **Drives choices such as redundant power and particle sources and dual linac tunnels**
- Potential for significant impact on project cost
- Dual 140kV guns and dual polarized laser systems
- Single NC capture section with spare klystron
- Collimation and then SC linac @ 23 MV/m → 5 GeV
- Energy compressor and spin rotator before DR
Positron Source

- Undulator-based positron source
  - ~100 meter undulator with $K=1$; $\lambda = 1\text{cm}$; 6mm aperture
  - Easy upgrade to produce polarized positrons
- Undulator located at 150 GeV in electron linac
  - Eases operational issues when changing IP energy
- 10% keep alive source near pre-accelerator

Schematic not updated for centralized injector

Global Design Effort
**Positron Target**

- Large positron flux required
  - Large diameter Ti target wheel rotated at ~500 rpm
  - Limited lifetime due to radiation damage
    - Remote handling needed – hot cells located at surface
    - Immersion in 6~7T OMD field improves yield by ~50%
Damping Ring Requirements

- Compress 1 ms linac bunch train in to a “reasonable size” ring
  - Fast kicker (rise and fall time ~3ns)
- Damping of $\gamma \varepsilon_{x,y} = 10^{-2}$ m-rad positron beams to
  - ($\gamma \varepsilon_x$, $\gamma \varepsilon_y$) = (8 x $10^{-6}$, 2 x $10^{-8}$) m-rad
  - Low emittance, diagnostics
- Cycle time 0.2 sec (5 Hz rep rate) $\Rightarrow$ $\tau = 25$ ms
  - Damping wiggler (~200 meters of 1.6 T wiggler)
- ~2700 bunches, 2 x $10^{10}$ electrons or positrons per bunch, bunch length= 9 mm
  - Instabilities (classical, electron cloud, fast ion)
- Beam power > 200 kW
  - Injection efficiency, dynamic aperture
e⁻ footprint is identical, but beam circulates in opposite direction, and RF cavities are always upstream of the wiggler.
Role: beam transport, halo collimation, spin rotation, bunch compression, diagnostics, intermediate beam dumps
Main Linac Features

- Linacs roughly 11km in length with ~280 rf units
  - 13 GeV → 250 GeV
- Accelerating gradient 31.5 MV/m @ 9.0 mA
- Each rf unit consists of 3 cryomodules:
  - 2 modules with 9 SC cavities and one with 8 cavities; 8-cavity module has SC quadrupole/BPM
  - All modules are 12.65 meters in length
  - RF power source: Bouncer-type modulator with pulse transformer & 10 MW Multi-beam klystron
  - RF distribution system ~310kW per cavity
- Effective filling factor is ~67%
Conceptual ML Tunnel View

- Design based on two 4.5m tunnels
  - Active components in service tunnel for access (availability)
  - Personnel cross-over every 500 meters (safety)
RF Unit: The Main Linac Building Block

ILC RF Unit: 3 CM, klystron, modulator, LLRF

Linear RF Power distribution with circulator & stub or EH tuner for every cavity input

High power Att.

10MW Multi-beam Klystron, socket assembly

1:12 Pulse Trans

Bouncer Modulator

Front end electronics
Beam Delivery System

• Functional requirements:
  – Post-linac emittance and energy diagnostics
  – Coupling correction section
  – Halo collimation and Machine Protection
  – Tuning dump and fast extraction dump
  – Final focus system
    • IP beta functions of $\beta_x = 10\text{~to~}20 \text{ mm}$ and $\beta_y = 200\text{~to~}400 \text{ \mu m}$
  – Interaction region with 14 mrad crossing
    • IR hall large enough for two detectors in a push-pull mode
    • Surface buildings for detector assembly
  – Low loss extraction lines to main dumps (11 MW)
• Roughly 2.2 km per side
ILC Final Focus schematic
Sophistry worthy of Bill Clinton:

The ILC cost is not a well defined term; each nation has its own costing rules (include labor? contingency? overheads? R&D? escalation?) and materials and labor costs vary. Taking the estimate for the 500 GeV TESLA project of $3.1B€; add salaries, contingency, overheads, detectors to get ~ $10B in US terms:
RDR Cost Estimating

• “Value” Costing System: International costing for International Project
  – Provides basic agreed upon “value” costs
  – Provides estimate of “explicit” labor (man-hr)

• Based on a call for world-wide tender:
  lowest reasonable price for required quality

• Classes of items in cost estimate:
  – Site-Specific: separate estimate for each sample site
  – Conventional: global capability (single world estimate)
  – High Tech: cavities, cryomodules (regional estimates)
Cost Roll-ups

Area Systems

Technical Systems
- Vacuum systems
- Magnet systems
- Cryomodule
- Cavity Package
- RF Power
- Instrumentation
- Dumps and Collimators
- Accelerator Physics

Global Systems
- Commissioning, Operations & Reliability
- Control System
- Cryogenics
- CF&S
- Installation

<table>
<thead>
<tr>
<th></th>
<th>e-source</th>
<th>e+ source</th>
<th>damping rings</th>
<th>RTML</th>
<th>main linac</th>
<th>BDS</th>
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</table>
## Cost-Driven Design Changes

<table>
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<tr>
<th>Area</th>
<th>RDR MB</th>
<th>CCR</th>
<th>CCB</th>
<th>approx. Δ$</th>
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<tr>
<td><strong>BDS</strong></td>
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<tr>
<td>2×14mr IRs</td>
<td>supported</td>
<td>14</td>
<td>YES</td>
<td>~170 M$</td>
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<tr>
<td>Single IR with push-pull detector</td>
<td>supported</td>
<td>23</td>
<td>YES</td>
<td>~200 M$</td>
</tr>
<tr>
<td>Removal of 2nd muon wall</td>
<td>supported</td>
<td>16</td>
<td>YES</td>
<td>~40 M$</td>
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<tr>
<td><strong>ML</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal of service tunnel</td>
<td>rejected</td>
<td></td>
<td></td>
<td>~150 M$</td>
</tr>
<tr>
<td>RF unit modifications (24 → 26 cav/klys)</td>
<td>supported</td>
<td></td>
<td></td>
<td>~50 M$</td>
</tr>
<tr>
<td>Reduced static cryo overhead</td>
<td>supported</td>
<td>20</td>
<td>YES</td>
<td>~150 M$</td>
</tr>
<tr>
<td>Removal linac RF overhead</td>
<td>supported</td>
<td></td>
<td></td>
<td>~20 M$</td>
</tr>
<tr>
<td>Adoption of Marx modulator (alternate)</td>
<td>rejected</td>
<td></td>
<td></td>
<td>~180 M$</td>
</tr>
<tr>
<td><strong>RTML</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-stage bunch compressor</td>
<td>rejected</td>
<td></td>
<td></td>
<td>~80 M$</td>
</tr>
<tr>
<td>Miscellaneous cost reduction modifications</td>
<td>supported</td>
<td>19</td>
<td>YES</td>
<td>~150 M$</td>
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<tr>
<td><strong>Sources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional e+ source</td>
<td>rejected</td>
<td></td>
<td></td>
<td>&lt;100M$</td>
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<td>Single e+ target</td>
<td>supported</td>
<td></td>
<td></td>
<td>~30 M$</td>
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<td>e- source common pre-accelerator</td>
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<td>22</td>
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<td>~50 M$</td>
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<tr>
<td><strong>DR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Single e+ ring</td>
<td>supported</td>
<td>15</td>
<td>YES</td>
<td>~160 M$</td>
</tr>
<tr>
<td>Reduced RF in DR (6 → 9mm α)</td>
<td>supported</td>
<td></td>
<td></td>
<td>~40 M$</td>
</tr>
<tr>
<td>DR consolidated lattice (CFS)</td>
<td>supported</td>
<td></td>
<td></td>
<td>~50 M$</td>
</tr>
<tr>
<td><strong>General</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central injector complex</td>
<td>supported</td>
<td>18(19)</td>
<td>YES</td>
<td>~180 M$</td>
</tr>
</tbody>
</table>

Global Design Effort
RDR Design & “Value” Costs

The reference design was “frozen” as of 1-Dec-06 for the purpose of producing the RDR, including costs.

The RDR is a snapshot and the design will continue to evolve, due to results of the R&D, accelerator studies and value engineering.

The value estimate was reviewed twice, before the RDR release:
- 3 day “internal review” in Dec
- ILCSC MAC review in Jan

Summary

Total Value Cost

- 4.87B ILCU’s Shared
  - +
- 1.78B ILCU’s Site Specific
  - +
- 13.0K person-years
  - (“explicit” labor = 22.2 M person-hrs @ 1,700 hrs/yr)
  - 1 ILCU = $1 FY07
ILC Value – by Area Systems

Main Cost Driver

Conventional Facilities Components

VALUE - $M

Main Linac
DR
RTML
e+ Source
BDS
Common
Exp Hall
e- Source

Global Design Effort
ILC Value – Global & Technical Systems

Main Cost Driver

Value - $M

Installation counted mostly as explicit labor

Global Design Effort
Explicit Manpower
13 K person-yrs = 22 M person-hrs

* “management” includes overhead

Global Design Effort
This is where we are today

- **RDR is a complete design for the ILC**
  - Recent design changes to reduce cost
    ➔ mostly self-consistent

- **Draft Report presented to ICFA/ILCSC Feb 8**
  - Design reviewed by the ILC MAC
  - RDR cost review at Orsay May 23-25
  - Final release planned for mid-summer

- **The RDR provides a good basis for the Engineering Design phase**
Where are we going? - R&D and Engineering Design

- We have not yet demonstrated that we can routinely meet the cavity/cryomodule specifications for gradient and cavity yield -> R&D continues
- Value engineering still remains to be done in many areas
- Accelerator physics issues:
  - e+ Damping ring (e-cloud)
  - Beam delivery system: vibration
  - Positron production
  - Many technical details
- Machine Detector Interface & Push-Pull
- Detectors
“Our highest priority for investments toward the future is the ILC based on our present understanding of its potential for breakthrough science. We need to participate vigorously in the international R&D program for this machine as well as accomplish the preparatory work required if the U.S. is to bid to host this accelerator.”
Globally Integrated R&D Planning

ILC R&D Board: Andy Wolski, Tom Himel, Marc Ross, Eckhard Elsen, Terry Garvey, Bill Willis (chair), Hitoshi Hayano, Olivier Napoli, Chris Damerell, Lutz Lilje, Toshiyaso Higo, Hasan Padamsee

Herding cats: how do we organize the ILC so that all regions of the world feel that they are full partners and gain from participation?

Topics: Cavities, Cryomodules, System tests, Damping Rings, Beam Delivery system, Positron source via separate task forces

Initial recommendations presented (last week) to the MAC
(Will submit plan to FALC in July and ILCSC in Aug)
Cryomodule Assembly

- Bare Cavity Test (VTS)
- He Vessel Welding
- Couplers Test
- Tuners Test
- Test
- High Power Test (HTS)
- Dress Cavities
- BPM
- Magnet
- Cryostat parts
- Cavity String Assembly In Clean Room
- Cryomodule Test
- Module Assembly

Global Design Effort
Learning to make reliable Cavities

- Weld free cavity forming
- Chemical / electropolish
- Rinse, bake
- Intensive R&D; extensive test facilities
- Chemical Polish
- Electropolish
- DESY photos
- String test
- Cryomodule assembly
- Vertical / horizontal test
Learning how to prepare smooth, pure Nb surfaces to get the high gradient was a decade-long effort. One recent advance uses electropolishing as well as (rather than?) chemical polishing for smooth surface. (Alternate cavity shapes have reached >50 MV/m.) But the process is not under good control. One still worries about field emission from surface imperfections giving large dark current.
Accelerator Module Operational Gradients

Operational Gradient [MV/m]

Module Number

1 2 3 4 5 6 7

ILC

XFEL

Global Design Effort

M7 preliminary

ILC MAC Meeting FNAL
26.4.2007

Global Design Effort
Detector development under the WWS - Detector outline document in 2006 and a Detector Concept document released concurrent with the RDR

Global Design Effort
## Detector Concepts

<table>
<thead>
<tr>
<th>Tracking</th>
<th>ECal Inner Radius</th>
<th>Solenoid</th>
<th>EM Cal</th>
<th>Hadron Cal</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiD</td>
<td>silicon 1.27 m</td>
<td>5 Tesla</td>
<td>Si/W</td>
<td>Digital (RPC..)</td>
<td>Had cal inside coil</td>
</tr>
<tr>
<td>LCD</td>
<td>TPC gaseous 1.68 m</td>
<td>4 Tesla</td>
<td>Si/W</td>
<td>Digital or Analog</td>
<td>Had cal inside coil</td>
</tr>
<tr>
<td>GLD</td>
<td>TPC gaseous 2.1 m</td>
<td>3 Tesla</td>
<td>W/ Scin.</td>
<td>Pb/ Scin.</td>
<td>Had cal inside coil</td>
</tr>
<tr>
<td>4th</td>
<td>TPC gaseous</td>
<td>crystal</td>
<td>Compensating fiber</td>
<td>Double Solenoid (open mu)</td>
<td></td>
</tr>
</tbody>
</table>
Machine-Detector Interface

- Single IR push-pull compatible design
The DOE has articulated its interest in hosting the ILC in the US at a site near Fermilab.

The EPP2010 report made a strong recommendation for the on-shore ILC as a way for the US physics community to maintain globally shared leadership.

To make a bid to host credible and successful, there are several needs:

1. **demonstrated that the industrial capability for the large scale, big expense components exists in this country**
2. **The test facilities needed at our laboratories or universities for conducting R&D on cavity production procedures and surface preparation techniques**
3. **The evaluation of specific site candidates with respect to geology, environmental and safety concerns, site infrastructure, and land acquisition will be required.**
4. **Test facilities for R&D on other (non SCRF) topics not covered by GDE initiatives or by other nations may be needed**
Regional Interest R&D - Ozaki Committee

• Regional interest R&D must be strong contributor to ILC GDE R&D program.
• At the same time, it should support the development and/or preservation of the ILC critical technologies in the US.
  – An important, if not essential, requirement to host the ILC is to have expertise in key areas of ILC technology

1. Support enhancement of technical capabilities and infrastructure for SRF, in particular, by intensive R&D that is focused on the demonstration of GDE S0 goal, and prepare laboratory infrastructure and industrial participation toward S1, and possibly S2 in the future.
2. Support R&D in certain technical areas that are not necessarily “very high” in GDE priority, but are important to the ILC, unique in the US, and are in danger of extinction due to lack of funding. For example:
   • Polarized electron source
   • Marx Modulator
   • Sheet beam klystron
   • Final Focus SC magnets

3. Support the geotechnical and other evaluation and the development of conceptual machine layout at the US candidate site that is not covered by GDE. Also regional outreach.
ILC Timeline

2005  2006  2007  2008  2009  2010

Global Design Effort

Baseline configuration

Reference Design

Engineering Design

ILC R&D Program

Expression of Interest to Host

International Mgmt

LHC Results – off ramp
For the EDR Phase:

The GDE will create:

- a Project Management structure (with a Project Management team)
- an ILC WBS structure
- an EDMS structure
- adopt more formal EVMS software
- a definition of what the EDR is together with a timeline

• The agencies have also asked for the first glimmer of formal international co-operation - an EDR phase MoU
Future Detector Activities

DETECTOR ROADMAP PROPOSAL
UNDER DISCUSSION (not yet implemented)

• 2008 – Conceptual Design Reports received by Intl Det Adv Gp
  Panel characterizes positive aspects and criticizes weaknesses
  Guides community to the definition of two detectors for
  EDR preparation
  Collaborations formed to develop EDRs

• 2009-2011 – Development of two technical designs,
  produce first technical design report for the overall detectors,
  which will be followed by additional volumes
  (detailed technical reports on subsystems)

Presented by WWS at ILCSC meeting in Valencia, Nov 11, 2006
Will be taken up again in Beijing at ILCSC meeting in February
Americas Region Funding FY08

For FY08 (presidential) funding:

- ILC R&D $60M
- SRF Infrastructure $23M

- Fermilab $45M
- SLAC $20M
- Everything/everybody else ~ $18M

~ 200 FTE’s

Similar efforts in the other two regions though less explicit
Summary

• The ILC is still in a relatively early phase as a construction project (~CD-1 for the DOE cognoscenti) however significant progress in the last two years

• We have a (basically) functioning global (virtual) laboratory - the GDE

• The Reference Design & associated cost estimate provides a strong basis for the next phase

• We still need R&D on the SRF linac components (and other areas)

• Pondering how to proceed with the engineering phase 2008 -> 2010