



CLIC 09 WORKSHOP
Working Group 5 - Technical Systems

ILC REBASELINE

***ILC CONVENTIONAL FACILITIES
AND SITING GROUP***

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Overview

- *Review of Conventional Facilities Milestones*
- *Main Linac Tunnel Configuration Comparison*
- *Update on Accelerator Design and Integration (AD&I) Effort*
- *Life Safety and Egress*



CFS Responsibilities and Milestones

- *The ILC R&D Plan Provides Milestones for CFS to Review Regarding Specific Aspects of the Reference Design to be Reviewed with Respect to Value Engineering for the RDR Design*
- *The Accelerator Design and Integration Effort Is a Separate Overall Review of Alternatives to the Original RDR Design*
- *As a Result of the AD&I Process (Eliminating the Twin Tunnel Scheme in Favor of a Single Tunnel Design) Life Safety and Egress is Also Being Reviewed as Part of the AD&I Process*



CFS R&D Plan Milestone Status

- **Process Water Value Engineering**
 - **Completed**
- **Alternative Tunnel Configuration**
 - **Preliminary Work was Completed by Hanson Engineering in July 2009**
 - **2-Day Workshop was Held at Fermilab on Aug 3-4, 2009 to Review Progress and Begin to Develop Cost Estimates**
 - **A Second 2-Day Workshop was Held at FNAL to Internally Review the Final Configuration Analysis and Cost Estimates on August 24-25, 2009 at Fermilab**

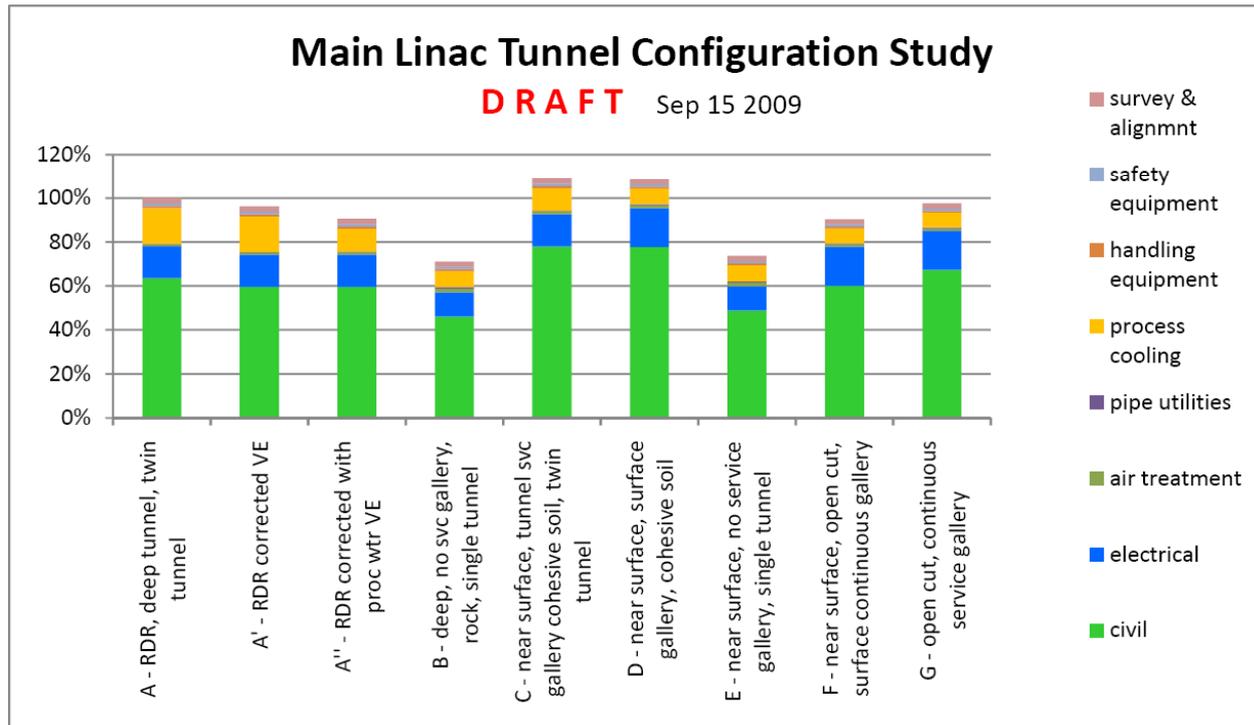


CFS R&D Plan Milestone Status

- **Life Safety and Egress Global Document**
 - **Hughes and Associates has Reviewed the Alternative Tunnel Configurations and has Developed Life Safety and Egress Plans for Each Alternative**
 - **CLIC Document Is Complete**
 - **XFEL Document has been Translated into English**
 - **LHC Document is being Developed**
 - **Asian Document has been Completed**
 - **All Individual Documents will be Compiled into a Single Comprehensive Document with an Executive Summary Which will Describe Commonalities and Distinctions in the Various Reports The Executive Summary will be Added to Complete the Document Prior to the AAP Review in January, 2010**
- **Surface Building Criteria Review**
 - **Not Scheduled for Completion Until July, 2010**

Main Linac Tunnel Configurations

- **Tunnel Cross Sections are Complete**
- **Detailed Cost Estimates Based on the Americas Region Criteria for Each Alternative are Complete**





AD&I Progress to Date

- *The First Collaboration Wide ILC Accelerator Design and Integration Meeting was Held at DESY on May 27-29*
- *The First Conventional Facilities and Siting (CFS) Group Meeting was Held at SLAC on July 20-21*
- *A Second Meeting is Planned at the Daresbury Laboratory, UK on September 3-4*
- *The ALCPG 09 Meeting, Held in Albuquerque NM on Sept 28 – Oct 2, Also Devoted a Considerable Portion of the Agenda to the AD&I Effort*
- *The Final Collaboration Wide AD&I Meeting will be Held at DESY on Dec 2-3*
- *The AD&I Effort will Culminate in a Proposed Revised ILC Baseline Layout that will be Presented for Review to the ILC Accelerator Advisory Panel at Oxford on Jan 6-8*

SB 2009 Working Assumptions (WA)

The Project Management proposes the following top-level WA for SB2009 as a focus for the initial discussions (incremental to the RDR baseline):

1. A Main Linac length consistent with an optimal choice of average accelerating gradient (currently 31.5 MV/m, to be re-evaluated)
2. Single-tunnel solution for the Main Linacs and RTML, with two possible variants for the HLRF
 - a. Klystron cluster scheme
 - b. DRFS scheme
3. Undulator-based e+ source located at the end of the electron Main Linac (250 GeV)
4. Reduced parameter set (with respect to the RDR) with $n_b = 1312$ and a 2ms RF pulse.
5. ~3.2 km circumference damping rings at 5 GeV, 6 mm bunch length.
6. Single-stage bunch compressor with a compression factor of 20.
7. Integration of the e+ and e- sources into a common “central region beam tunnel”, together with the BDS.



Progress on AD&I Central Region Layout

- *While All Area Systems were Affected by Some of the Alternate Suggestions, Each Suggestion had a Definite Impact on the Conventional Facilities Layout*
- *New Criteria Regarding the Various Area System Design Changes was Needed from Each Area System in Order to Develop an Integrated Machine Layout*
- *The Weekly CFS Meeting has been Used for Direct Discussion with Area System Representatives to Finalize Area System Criteria and Layout Requirements*
- *Initial 2D Drawings are Being Prepared at FNAL with Consultant Support and will be Used as the Basis for the Revised Baseline Proposal*
- *2D Drawings Consist of Overall Layouts, Larger and More Detailed Drawings of Specific Areas and Cross Sections Taken at Various Points to Analyze Beamline Locations and Conflicts*
- *3D Layout Drawings are Beginning to be Prepared at CERN with Efforts at FNAL and KEK to Follow*



SB 2009 CFA WA Status

- ***WA 1 – Dependent on Technical Decision***
- ***WA 2a & 2b***
 - ***Americas Region - Klystron Cluster is Complete, DRFS Still to be Completed. Tunnel Diameter Still needs Optimization***
 - ***European Region - Both Schemes are Being Worked on by Amberg Consulting***
 - ***Asian Region - Both Schemes have been Investigated. Cost estimates Need to be Updated***
- ***WA 3 – Undulator-Based e+ Source has been Incorporated into the New CFS Machine Layout***
- ***WA 4 – Low Power Option is Reflected in the New Area System Criteria and CFS Machine Layout***
- ***WA 5 – 3.2 km Damping Ring has been Incorporated into the New CFS Machine Layout***
- ***WA 6 – Single Stage Bunch Compressor has been Incorporated into the RTML and New CFS Machine Layout***
- ***WA 7 – Coordination of the Central Region Beam Layouts are Being Developed and will be Incorporated into the New CFS Machine Layout. Specific Lattice Information is Still Needed***



Current Status of Codes and Regulations

- ***There are No Codes that Directly Address Underground Accelerator Complexes***
- ***Most Initial Approaches Review Experience with Traffic Tunnels and Their Associated Guidelines and Regulations for Designs***
- ***Most Recognized Codes Evolve Over Time and are Revised, Based in Part, in Response to Fire and/or Catastrophic Failures***
- ***But Traffic Tunnel Requirements are Based on Fuel Loads that Far Exceed Those Found in Actual Accelerator Installations (i.e. Gasoline, Diesel Fuel, Oil, etc.)***



Current Regional Laboratory Approaches

- *Most Laboratories Rely on Examples from Previous Projects to Develop Initial Criteria for Life Safety and Egress Design for a New Project*
- *This Initial Criteria is Then Supplemented by Consultant Review, Local Underground Codes where Available and Applicable as well as Regulations/Guidelines from Funding and Project Oversight Organizations*
- *While Most Regions do have Regulations that Directly Control Traffic Tunnel Design, in the Americas Region Two Distinct Codes have been Developed*
 - *NFPA 130-2007, Standard for Fixed Guideway Transit Systems*
 - *NFPA 520-2005, Standard for Subterranean Spaces*
- *It Should be Noted that All Codes are Subject to Interpretation*



Current Regional Designs

- Life Safety and Egress Issues and RF System Selection are Two of the Major Drivers of Main Linac Tunnel Diameter*
- All Three Sample Sites have Developed a Life Safety and Egress Design for the Main Linac Single Tunnel Alternative Based on Their Local Experience and Applicable Regional Regulations*
- All Three Regions have Reviewed both RF Alternatives and Selected the More Appropriate Alternative to Develop Their Regional Main Linac Tunnel Diameter*
- A Global Safety Document is Currently Being Developed that will Gather Information from All Current Accelerator Projects, Including ILC, XFEL, CLIC, LHC and Project X, for Use as a Supporting Reference to any Current or Future Accelerator Design Project*

Asian and European Design Approaches

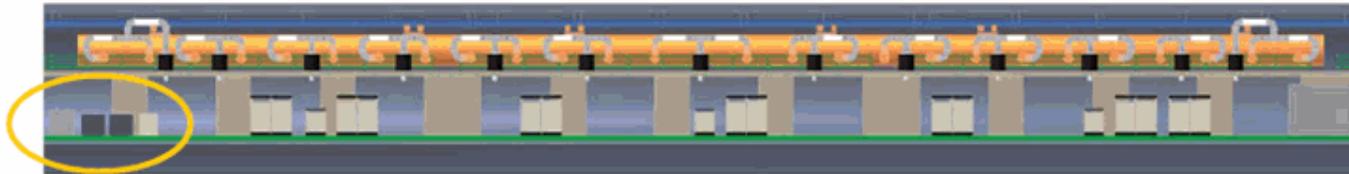
- *Main Linac Single Tunnel is Divided into 500 m Long Segments (i.e. Compartmentalization)*
- *Firewall and Fire Doors Separate Adjacent Segments*
- *Ducted Transverse Ventilation is Used for Fresh Air Supply and Return and Smoke Control and Exhaust*
- *The European Region Uses the Klystron Cluster RF System*
- *The Asian Region Uses the Distributed RF System*
- *Both Regions Currently Utilize a 5.2 m Main Linac Tunnel Diameter*

Americas Design Approach

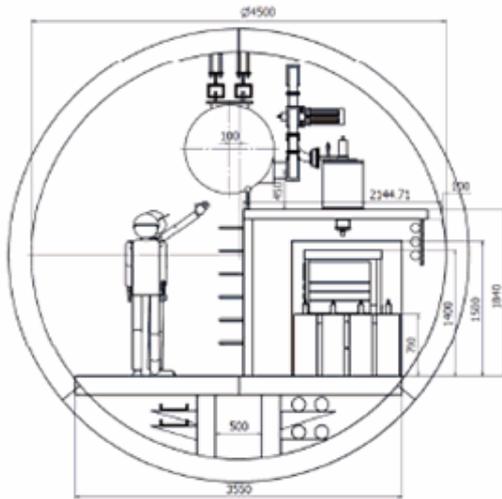
- *Based on NFPA 520, the Main Linac Single Tunnel Must be Divided into “Building” Space (i.e. Functional or Operation Space) and “Common” Space (i.e. Space Used Only for Exit Travel to the Surface)*
- *A 2 hr Firewall and 1-1/2 hr Fire Doors Must be Used to Separate the Two Spaces*
- *Alcoves are Also Required in the Common Space to Limit the Distance to an Exit or Area of Refuge to 610 m*
- *The Americas Region Currently Utilizes the Klystron Cluster RF System and a 5.0 m Main Linac Tunnel Diameter*

Asian Region Tunnel Design

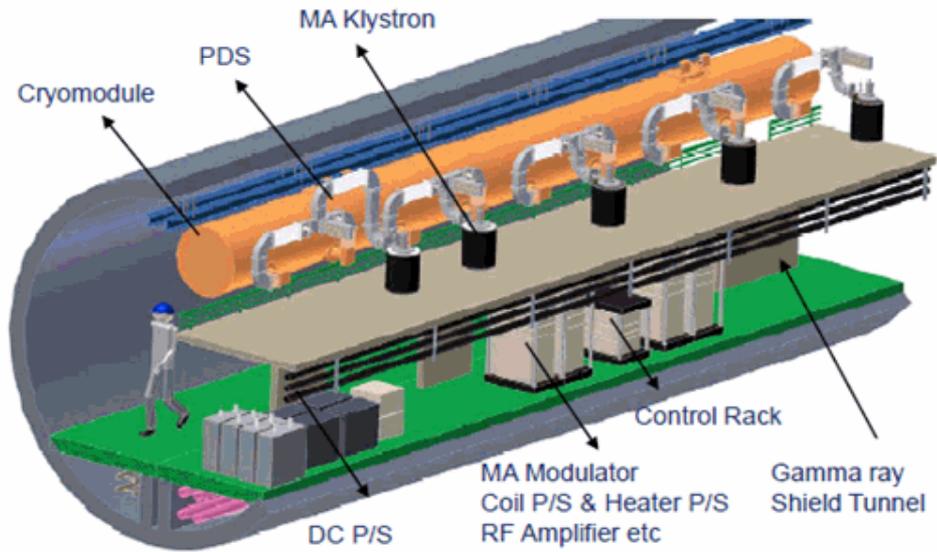
Sketch of 3-Cryo-odule unit



6.6kV In & Rectifier Transformer
Capacitor Bank, Bouncer

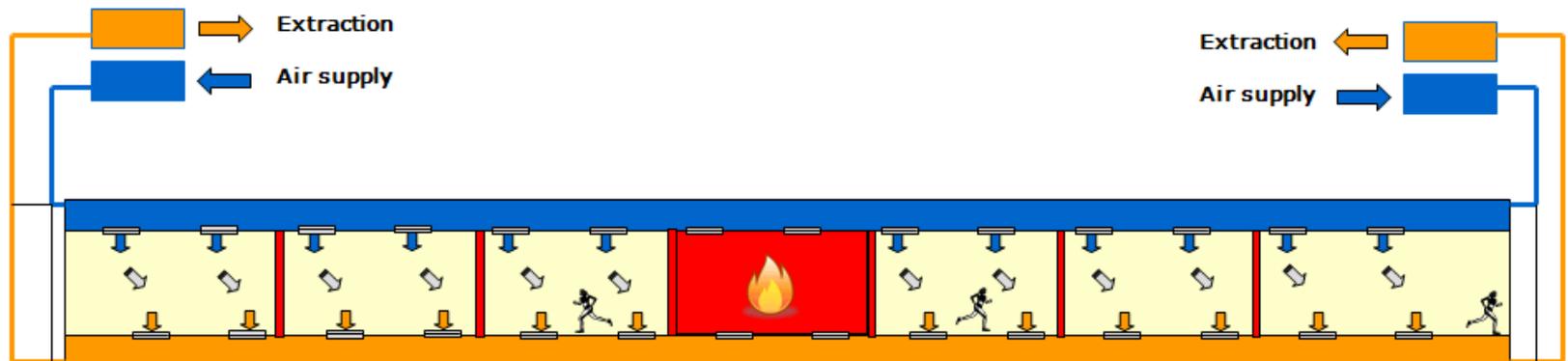


Cross Section



European Tunnel Compartmentalization

Safety considerations

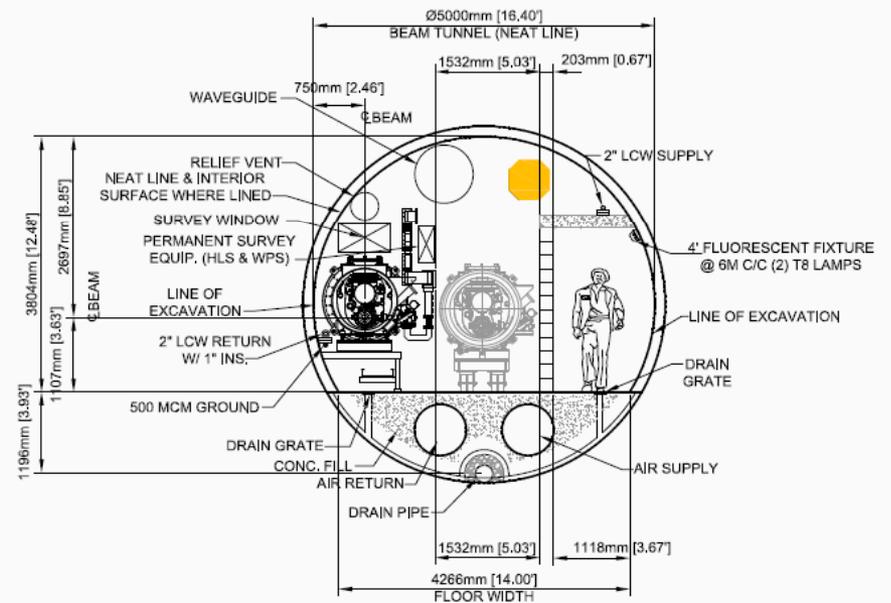
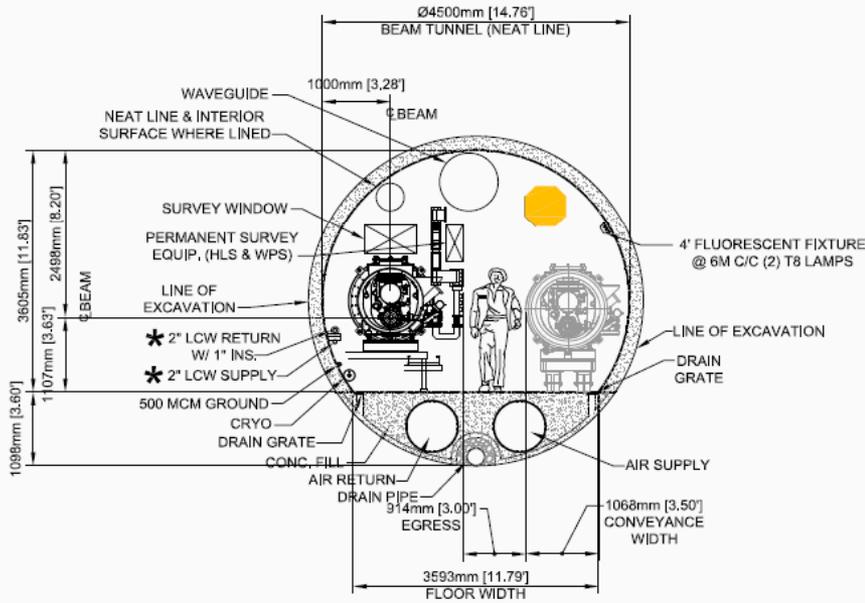


SHAFT
POINT

- Control of the pressure from both ends of a sector.
- Control of the pressure (overpressure or underpressure in each area).
- Fire detection per sector compatible to fire fighting via water mist.



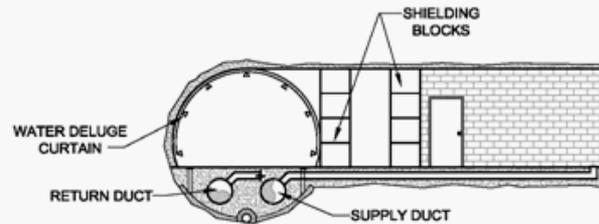
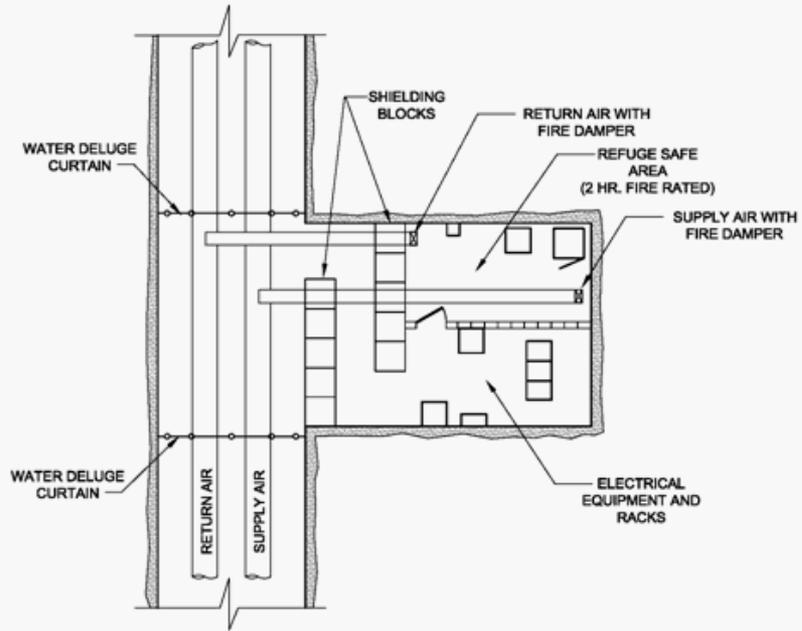
Americas Region RDR and AD&I





Americas Areas of Refuge

Area of Refuge





Life Safety and Egress Summary

- ***Each Region has Developed a Sample Site Solution that Satisfies Local Life Safety and Egress Requirements Using Both Identified RF System Alternatives***
- ***The Development of a Single, Cost Optimized, Uniform Design for All Three Regions is Simple not Possible***
 - ***Different Geology***
 - ***Different Tunnel, Shaft and Cavern Construction Means and Methods***
 - ***Different Approaches to Life Safety and Egress***
 - ***Preference of RF System***
- ***Using the Regional Sample Site Approach for the ILC CFS Design Appears to be a Sensible Model for the Development of the TDR***
- ***The Final Life Safety and Egress Design for the ILC Cannot be Completed Until a Specific Site is Chosen and an Approving Authority has been Established***



Summary

- *The CFS Group is Making Good Progress on R&D Plan Milestones and AD&I Efforts*
- *The AD&I Baseline Proposal will be Completed and Reviewed at the Oxford Meeting in Jan 2010*
- *The CLIC/ILC Collaboration Efforts have Fundamentally Contributed to the Efforts for the ILC RDR Alternative Review Process as well as the Efforts to Develop an Alternative Baseline Proposal and the Eventual Baseline Design for the ILC Technical Design Report Due to be Developed in 2012*