Review of CLIC-ILC collaboration on technical subjects

(accelerators)

and ways to improve the collaboration

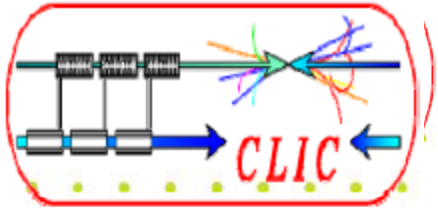
Jean-Pierre Delahaye,

Marc Ross

Nick Walker

Akira Yamamoto

Subjects with strong synergy
Working Groups & Conveners



		CLIC	ILC
1	Civil Engineering & Conventional Facilities	C.Hauviller, J.Osborne.	J.Osborne, V.Kuchler
2	Cost & Schedule	K.Foraz, G. Riddone, P. Lebrun	J.Carwardine, P.Garbincius, T.Shidara
3	Beam Delivery System (BDS) & Machine Detector Interface (MDI)	D.Schulte, R.Tomas Garcia, Lau Gatignon	B.Parker, A.Seryi
4	Positron Generation (new)	L.Rinolfi	J.Clarke
5	Damping Rings (new)	Y.Papaphilipou	M.Palmer
6	Beam Dynamics	D.Schulte	A.Latina, K.Kubo, N.Walker
7	Physics & Detectors	L.Linssen, D.Schlatter	F.Richard, S.Yamada

Overview:

Top 2 WG: CES/CFS & C/S

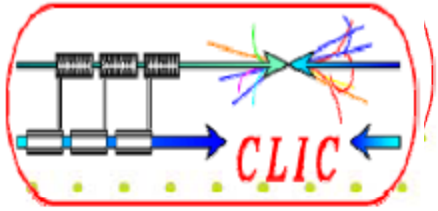
- CLIC CES / ILC CFS
  - Events, activities, mandate, concerns
- Cost / Schedule
  - Mandates
  - Tools
  - Risk analysis
  - Schedule
  - Issues
  - Plans
  - Links

Four Accel WG:

- e+
  - Events, activities, mandate, concerns
- BDS/MDI
  - …
- DR
  - …
- Beam Dynamics

Conclusions and Recommendations

Outline of CLIC-ILC Activities



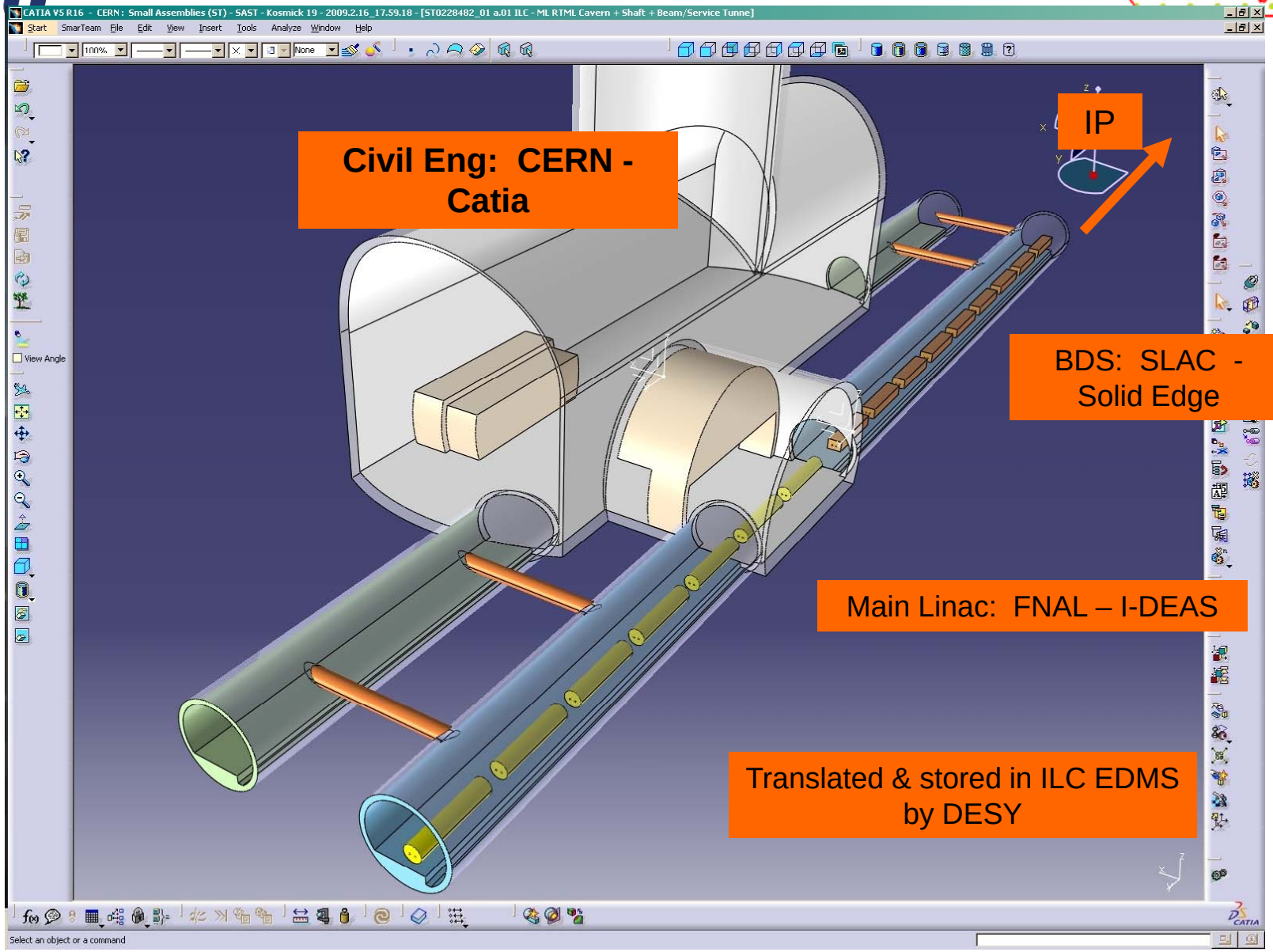
Conventional Facilities: ILC-CFS & CLIC-CES

- ***also cooperative activities with XFEL and Project X***
- 3 D Modeling for Civil Engineering & Installation
- Transportation & Installation of Equipment
- Cooling and Ventilation
- Interaction Region Design
- Joint Safety Document
- Cost Estimating methodology

Cost & Schedule WG:

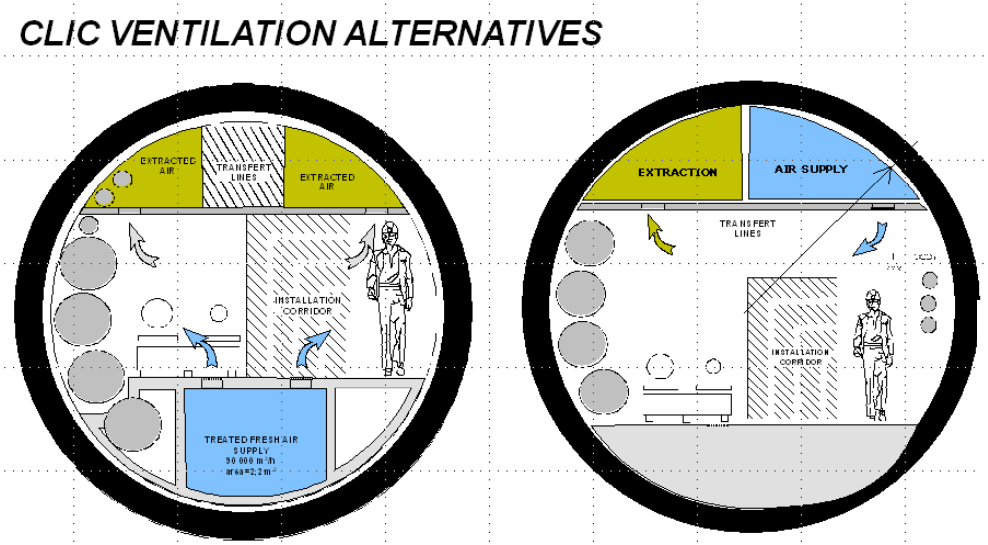
- **Goal: compare cost estimates by the end of *2010* using similar methods and metrics**
- Gave ILC RDR cost estimate & backup info for BDS to CLIC
- Cost Templates & Tools - similarities & differences
- Common Risk Document
- Common Scheduling Methods
- Common Conventional Magnet Estimating Methods

ILC 3d modelling – CES/CFS



CLIC-ILC-DESY Cooperation

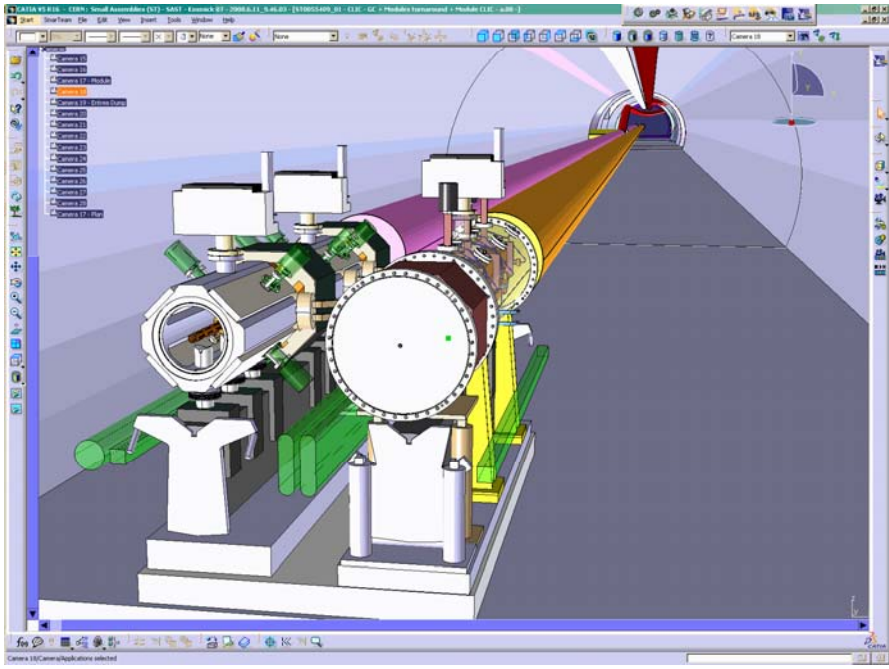
CES/CFS: Tunnel Configuration Cooling, Ventilation, Installation



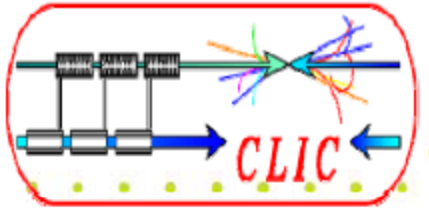
Layouts developed for CLIC & ILC are mutually assisting design process for both projects

Common study on the
single tunnel layout and the safety issue

CLIC 3d layouts for turnaround regions

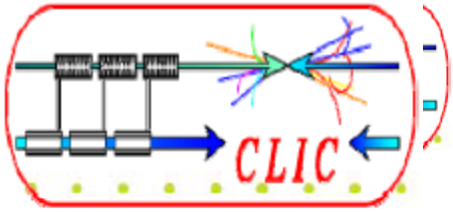


Draft CLIC-ILC Cost &Schedule Working Group Mandate – May08

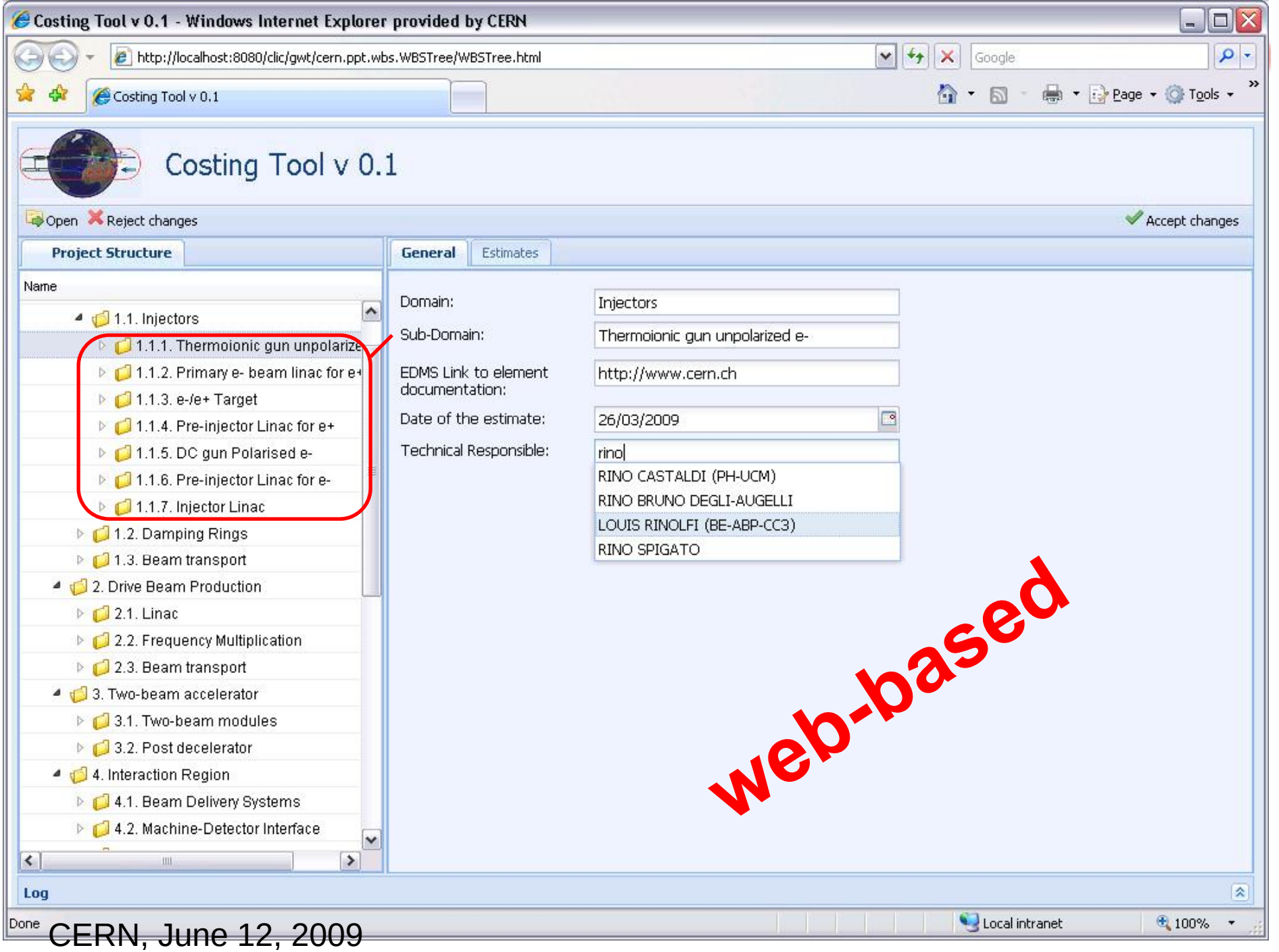


- Compare the **assumptions and methodology** adopted by both projects in matter of cost.
- Establish **functionalities for cost data analysis**:
  - Parametric cost models to define variation of costs as a function of the main parameters
  - Risk/uncertainty assessment.
- **Compare costs for certain items** (to be defined with the agreement of management) to better understand the difference subsystem by subsystem between the two technologies
- Develop ***common approaches*** to traceability, requirements, cost estimates, and the bases of estimates.
- Compare the basic **assumptions and baseline units for schedule**.

Cost Estimating Tools & Methods

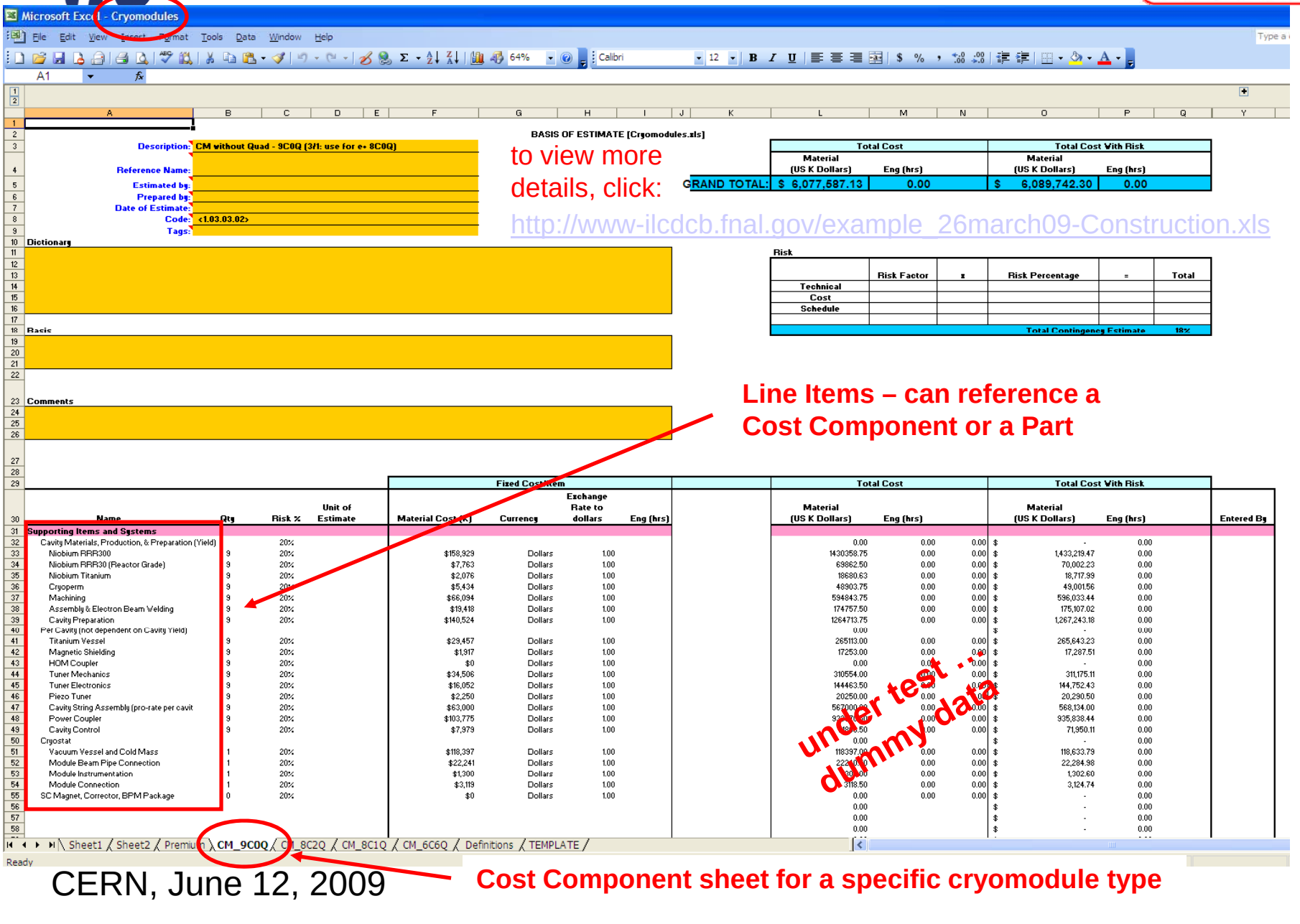


- ILC – using Triad Project Management, Inc.
  - Developing ILC Cost Estimating Tool (ICET)
    - WBS- linked Excel Cost Estimating Modules (CEMs)
    - mySQL DataBase => Reports
    - Store CEMs and Reports in ILC EDMS at DESY
- Differences with CLIC approach:
  - CLIC has 3 TeV & 500 GeV estimates under each item
  - ILC does not include any scheduling information
    - Triad believes this is better done in scheduling tool such as MS Project or Primavera which link back to ICET CEMs
  - Under a given item's cost data, CLIC includes:
    - industrialization and tendering, procurement, reception, installation, and commissioning
    - ILC includes these as separate items


Costing Tool v 0.1 - Windows Internet Explorer provided by CERN
http://localhost:8080/clic/gwt/cern.ppt.wbs.WBSTree/WBSTree.html
Costing Tool v 0.1
Costing Tool v 0.1
Open
Reject changes
Accept changes
Project Structure
General
Estimates
Name
1.1. Injectors
1.1.1. Thermoionic gun unpolarize
1.1.2. Primary e- beam linac for e+
1.1.3. e-/e+ Target
1.1.4. Pre-injector Linac for e+
1.1.5. DC gun Polarised e-
1.1.6. Pre-injector Linac for e-
1.1.7. Injector Linac
1.2. Damping Rings
1.3. Beam transport
2. Drive Beam Production
2.1. Linac
2.2. Frequency Multiplication
2.3. Beam transport
3. Two-beam accelerator
3.1. Two-beam modules
3.2. Post decelerator
4. Interaction Region
4.1. Beam Delivery Systems
4.2. Machine-Detector Interface
Domain:
Injectors
Sub-Domain:
Thermoionic gun unpolarized e-
EDMS Link to element documentation:
http://www.cern.ch
Date of the estimate:
26/03/2009
Technical Responsible:
rino
RINO CASTALDI (PH-UCM)
RINO BRUNO DEGLI-AUGELLI
LOUIS RINOLFI (BE-ABP-CC3)
RINO SPIGATO
Log
Done
Local intranet
100%

web-based

ICET Cost Estimate Module example



Microsoft Excel - Cryomodules

File Edit View Insert Format Tools Data Window Help

BASIS OF ESTIMATE [Cryomodules.xls]

Description:	CM without Quad - 9C0Q (3/1: use for e+ 8C0Q)
Reference Name:	
Estimated by:	
Prepared by:	
Date of Estimate:	
Code:	<1.03.03.02>
Tags:	

Dictionary

Basis

Comments

to view more details, click:

http://www-ilcdcb.fnal.gov/example_26march09-Construction.xls

	Total Cost		Total Cost With Risk	
	Material (US K Dollars)	Eng (hrs)	Material (US K Dollars)	Eng (hrs)
GRAND TOTAL:	$ 6,077,587.13	0.00	$ 6,089,742.30	0.00

Risk

	Risk Factor	x	Risk Percentage	=	Total
Technical					
Cost					
Schedule					
			Total Contingency Estimate		18%

Line Items – can reference a Cost Component or a Part

Name	Qty	Risk %	Unit of Estimate	Fixed Cost Item: Material Cost (K)	Currency	Exchange Rate to dollars	Eng (hrs)	Total Cost: Material (US K Dollars)	Eng (hrs)		Total Cost With Risk: Material (US K Dollars)	Eng (hrs)	Entered By
Supporting Items and Systems													
Cavity Materials, Production, & Preparation (Yield)		20%						0.00	0.00	0.00	$ -	0.00	
Niobium RRR300	9	20%		$158,929	Dollars	1.00		1430358.75	0.00	0.00	$ 1,433,219.47	0.00	
Niobium RRR30 (Reactor Grade)	9	20%		$7,763	Dollars	1.00		69862.50	0.00	0.00	$ 70,002.23	0.00	
Niobium Titanium	9	20%		$2,076	Dollars	1.00		18680.63	0.00	0.00	$ 18,717.99	0.00	
Cryoperm	9	20%		$5,434	Dollars	1.00		48903.75	0.00	0.00	$ 49,001.56	0.00	
Machining	9	20%		$66,094	Dollars	1.00		594843.75	0.00	0.00	$ 596,033.44	0.00	
Assembly & Electron Beam Welding	9	20%		$19,418	Dollars	1.00		174757.50	0.00	0.00	$ 175,107.02	0.00	
Cavity Preparation	9	20%		$140,524	Dollars	1.00		1264713.75	0.00	0.00	$ 1,267,243.18	0.00	
Per Cavity (not dependent on Cavity Yield)								0.00			$ -	0.00	
Titanium Vessel	9	20%		$29,457	Dollars	1.00		265113.00	0.00	0.00	$ 265,643.23	0.00	
Magnetic Shielding	9	20%		$1,917	Dollars	1.00		17253.00	0.00	0.00	$ 17,287.51	0.00	
HOM Coupler	9	20%		$0	Dollars	1.00		0.00	0.00	0.00	$ -	0.00	
Tuner Mechanics	9	20%		$34,506	Dollars	1.00		310554.00	0.00	0.00	$ 311,175.11	0.00	
Tuner Electronics	9	20%		$16,052	Dollars	1.00		144463.50	0.00	0.00	$ 144,752.43	0.00	
Piezo Tuner	9	20%		$2,250	Dollars	1.00		20250.00	0.00	0.00	$ 20,290.50	0.00	
Cavity String Assembly (pro-rate per cavit	9	20%		$63,000	Dollars	1.00		567000.00	0.00	0.00	$ 568,134.00	0.00	
Power Coupler	9	20%		$103,775	Dollars	1.00		933975.00	0.00	0.00	$ 935,838.44	0.00	
Cavity Control	9	20%		$7,979	Dollars	1.00		71813.50	0.00	0.00	$ 71,950.11	0.00	
Cryostat								0.00			$ -	0.00	
Vacuum Vessel and Cold Mass	1	20%		$118,397	Dollars	1.00		118397.00	0.00	0.00	$ 118,633.79	0.00	
Module Beam Pipe Connection	1	20%		$22,241	Dollars	1.00		22241.00	0.00	0.00	$ 22,284.98	0.00	
Module Instrumentation	1	20%		$1,300	Dollars	1.00		1300.00	0.00	0.00	$ 1,302.60	0.00	
Module Connection	1	20%		$3,119	Dollars	1.00		3118.50	0.00	0.00	$ 3,124.74	0.00	
SC Magnet, Corrector, BPM Package	0	20%		$0	Dollars	1.00		0.00	0.00	0.00	$ -	0.00	
								0.00			$ -	0.00	
								0.00			$ -	0.00	
								0.00			$ -	0.00	

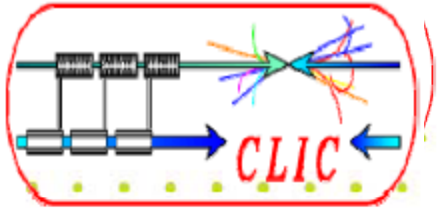
under test ... dummy data

Sheet1 / Sheet2 / Premium / CM_9C0Q / CM_8C2Q / CM_8C1Q / CM_6C6Q / Definitions / TEMPLATE /

Ready

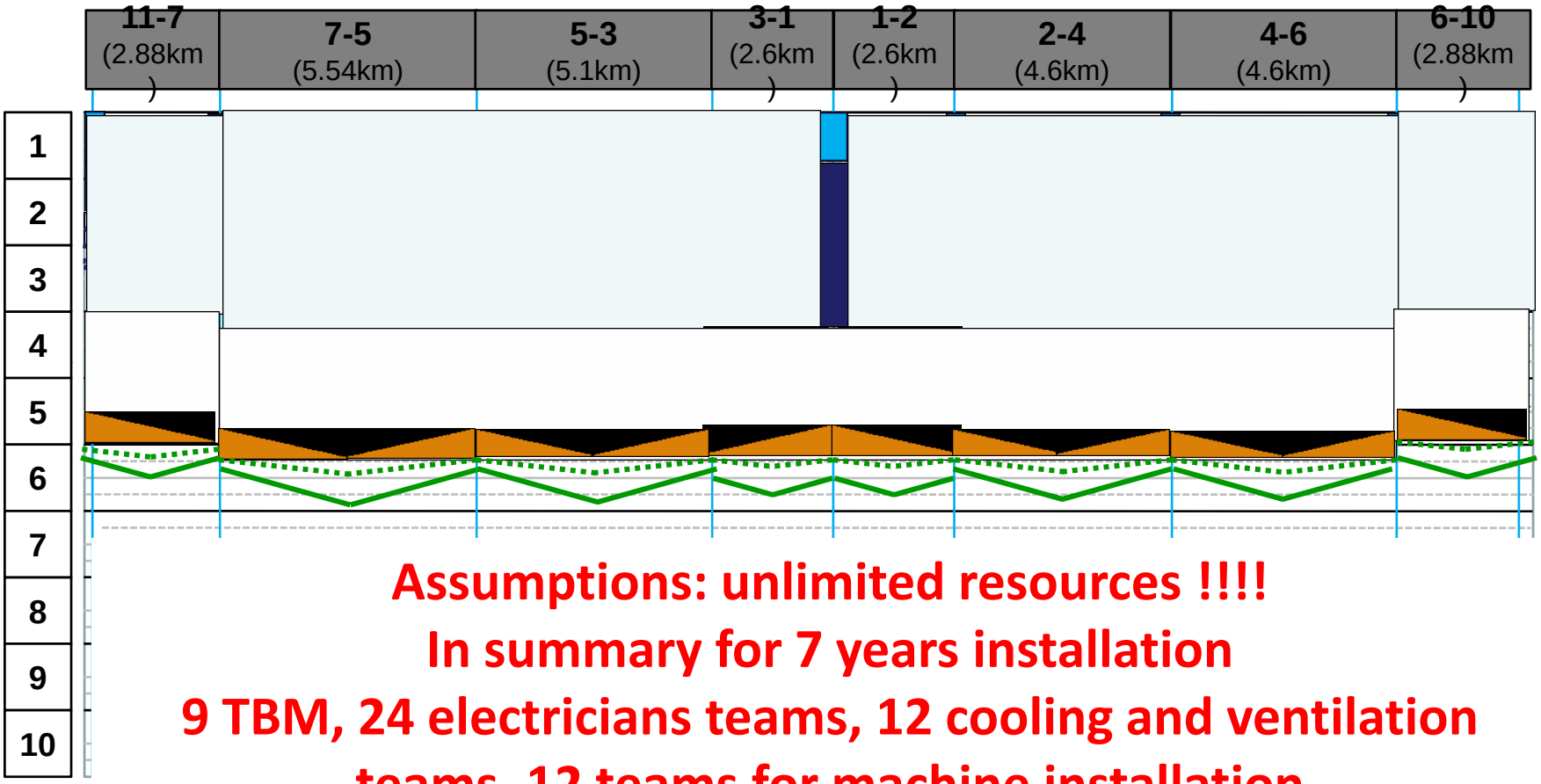
Cost Component sheet for a specific cryomodule type

Common Scheduling Methodology MS Project => Primavera



- Martin Gastal (CERN) did construction schedule in ILC RDR
- Katy Foraz (CERN) applied LEP-LHC experience & Amberg underground construction - added more details + installation
- Assumed unlimited resources (technically limited)
  - 9 TBMs – 120 m/wk excavation, 400 m/wk outfitting
  - # crews: 24 electrician, 12 cool & ventilate, 12 installation
  - all components available for installation when scheduled
- ***6 years*** - groundbreaking to installation complete
- more realistic manpower, e.g. ½ install crews => *8.5 years*
- ***How can commissioning vs. construction be optimized?***

ILC - Machine installation



Assumptions: unlimited resources !!!!

In summary for 7 years installation

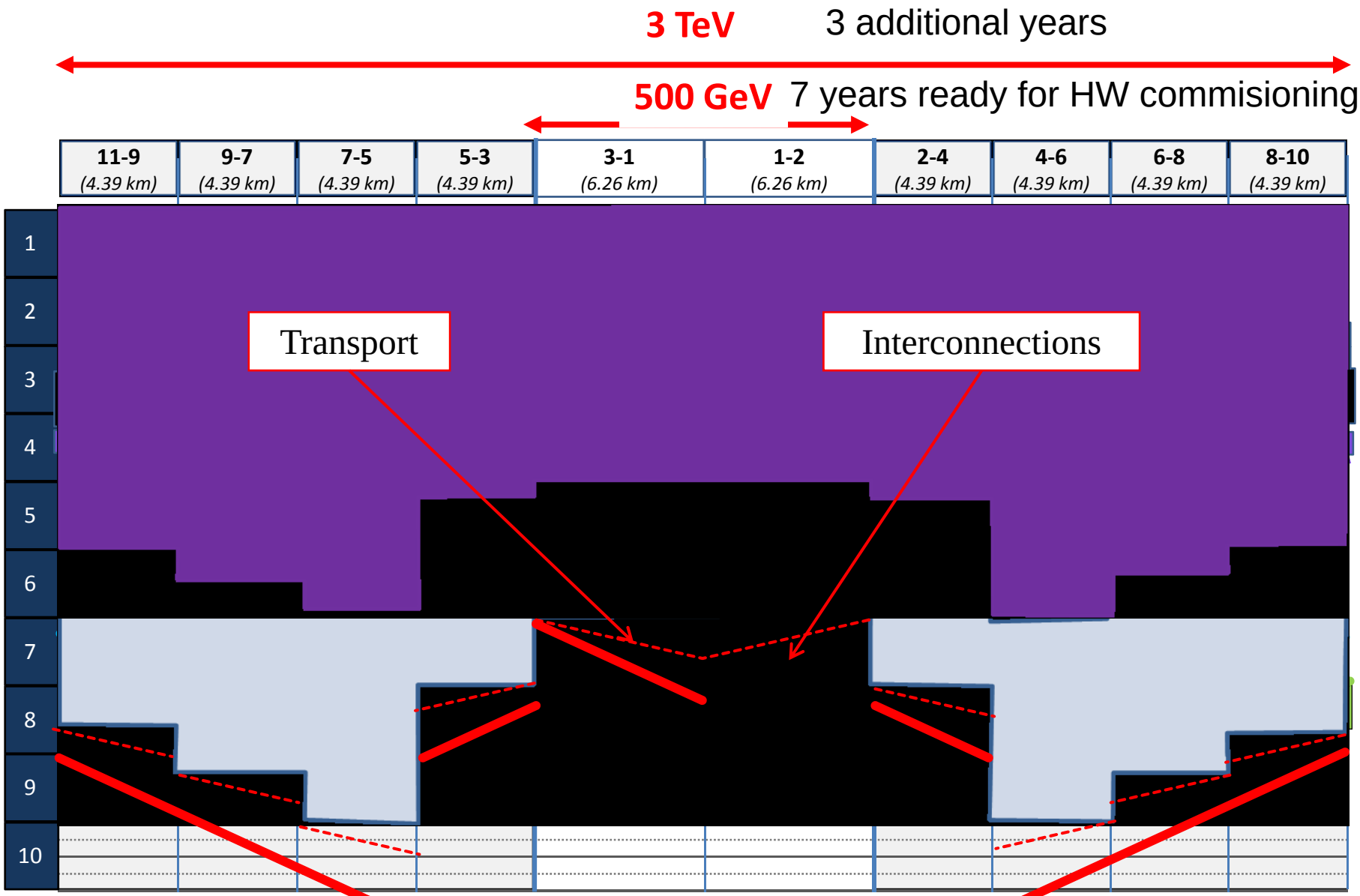
9 TBM, 24 electricians teams, 12 cooling and ventilation teams, 12 teams for machine installation

Support installation and alignment (250m/wk)

Machine inst.: transport and interconnections (progress rate to be confirmed 100m/wk)

maybe more realistic: 4 TBM, 8 elec, 4 hvac, 2 mach inst => 8.5 yrs

CLIC Machine installation



2 TBMs, 2 teams of each kind in parallel in e+ and e- tunnels

our common plans - *11/08*:

- *√* CLIC-ILC Cost & Schedule Working Group WEBEX Meetings
  1400 GMT - 2nd Thursday of each month
- *√* Keep work towards cost estimate mutually transparent
- *√* Profit by synergies
- *√* Understand and communicate unavoidable differences in the methodologies used for the two projects
- *√* Construction & installation schedules for CLIC & ILC w same methodology – 6/09
- Common ILC/CLIC notes (for mid '09)
  - Tunnel safety underground compliance
    defer to: Fabio Corsenego - ILC-CFS and CLIC-CES groups
  - Standardization methods to estimate cost of warm magnets including cabling and power supplies – Braun & Garbincius gathering materials, but international magnet fabrication experts ***– are just not available! - defer***
  - Description of cost risk assessment – Lebrun, Riddone, Lehner, Garbincius
    reviewed other applications, started outlining this mgt – outline soon!

Listing of ongoing activities

Undulator-based source

Develop Geant4 model of collimator, target, capture optics, and capture RF assembly (with CI)
Positron target tests at CI
Optimise parameters wrt yield, polarisation (with ANL)

Compton source

Design of the Compton ring (with NSC KIPT)
Optical stacking cavity (with LAL and KEK)
Stacking simulations (at CERN)

"ILC/CLIC e^+ generation" working group

Lithium lens capture

Evaluate suitability for Undulator and Compton schemes (with KEK, BIPN and Cornell)

Conventional sources (Conventional targets and hybrid targets)

Simulations (Geant4) to optimize the unpolarized e+ yield with hybrid targets (with LAL)
Simulations (FLUKA) to optimize the beam energy deposition in targets (with Ankara Uni.)
Tests of e+ target at ATF and KEKB

Electron source

Tracking studies (with SLAC)
Preliminary HV tests for the DC gun at JLAB and SLAC
Implementation of the polarized e- source to produce the nominal charge at SLAC

Mandate of the e+ working group

The ILC study considers the Undulator option as the base line while the Compton schemes are alternative options. The CLIC study considers the Compton schemes as the base line while the Undulator is an alternative option. Additionally, both projects are interested in the development of conventional sources (ILC as an auxiliary source and CLIC as an alternative baseline).

The working group should:

- Develop the synergy between the ILC and CLIC e^+ studies.
- Evaluate the common technical issues related to both options for the production of polarized positrons.
- Prioritize R&D.
- Review the existing technical and tests facilities where further tests could be performed.
- Evaluate where cost savings could be obtained.
- Promote common meetings and workshops.

http://clic-study.web.cern.ch/CLIC-Study/CLIC_ILC_Collab_Mtg/ILC_CLIC_e+_working_grou

On-going activities

- Collimation review: performance, wakefields and secondary particles
- Final Focus system review: new optics, optimization and tuning performance
- ATF2 ultra-low beta: Optics design, optimization and tuning performance (new CERN PhD student)
- Post-collision line: background to the detector

Ongoing Activities

-- Ongoing visit of Alain Herve to SLAC to work on push-pull design, detector motion system and shielding system, which is a common issue with CLIC; It is planned to have also colleagues from DESY and FNAL to come to SLAC, to join the work on push-pull IR;

-- plan to have working meeting at SLAC for beam dump, which can be considered a common activity with CLIC.

-- CLIC colleagues evaluating longer L* design and studying FFS tolerances, an optimized design need to be done;

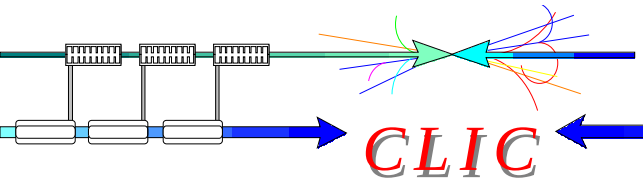
-- low beta optics for ATF2 further investigated, together with large aperture SC FD for ATF2;

The major focus of report on ALCPG and CLIC09 will be IR design progress.

Current – Future Events

- Mini-Workshop on the CesrTA Electron Cloud R&D Program for Linear Collider Damping Rings (CTA09), June 25-26 2009, Cornell
  - Discussion on current and future experimental studies of common interest in Cesr-TA (e^--cloud, low-emittance stabilization)
  - Extending the collaboration in other subjects
- 2009 Linear Collider Workshop of the Americas, September 29-October 3 2009, Albuquerque, New Mexico
  - Session on damping rings
- CLIC workshop 2009
  - Session on damping rings
- Discussions for a CLIC-ILC damping rings' workshop beginning 2010

ILC/CLIC DR working group



On-going activities

- e^--cloud
  - Cesr-TA vacuum chamber sent to CERN, coated with a-C and returned to Cornell
    - Beam measurements (SEY, PEY) expected end of July
  - Simulation work using CERN codes for electron cloud built-up (ECLOUD) and instability dynamics (HEADTAIL)
- Stabilization
  - Mostly connected to LINAC activities but experimental methods and diagnostics (BBQ) useful for damping ring studies
- Wigglers
  - Discussions for installing super-conducting wiggler prototypes (e.g. the one built and currently measured at BINP) in Cesr-TA, ATF
- IntraBeam Scattering
  - Discussions for triggering IBS dominated beam conditions in Cesr-TA for experimental work

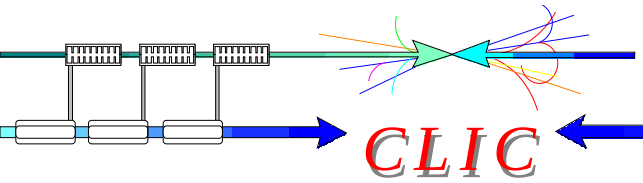
Mandate

ILC/CLIC DR working group

CLIC

- Develop synergies and collaborate in beam dynamics and technical issues of common interest in damping ring design
- Use common research approaches and studies when possible including numerical tools
- Take advantage of existing test facilities or storage rings and participate in a common experimental program
- Trigger communication, establish links between the two communities, share knowledge and document common work

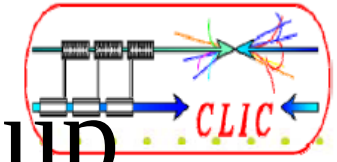
- Original mandate kept
- ILC and CLIC damping ring designs differ as driven from different main linac RF systems, **BUT**, majority of damping ring issues are generic
- Work more actively especially in experimental facilities (Cesr-TA)



Issues and concerns

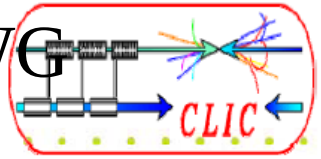
- Workload for both ILC and CLIC damping ring activities does not much available manpower
- R&D experimental program of Cesr-TA extremely demanding for the 2-years' allocated time-scale
  - Necessary to be extended to accommodate further experimental studies interesting for both CLIC and ILC

Damping Ring Working Group



- Also formed in November 08
- Strong RD focus (Palmer)
  - Steady progress; alpha carbon chambers shipped from Cern to Cornell; simulation team started
  - Other topics weaker, but expect leverage-low emittance tuning, fast ion
- No regular meetings, but three face-face meetings planned:
  - CTA09 (late June at Cornell)
  - DR09 - at ALCPG
  - Late Jan 2010
- TDP2 / CDR design work also has strong overlap - resources needed to engage

Some Ongoing Studies – Beam Dynamics WG



- CLIC main linac has strong wakefield and dispersive effects
  - Excellent benchmarking case
  - Complements previous benchmarking on ILC linac
  - CLIC case presented in ILC beam dynamics meeting
  - Waiting for results
- Machine modelling
  - Pre-alignment and survey
    - Full model studies performend for ILC and CLIC, potential of synergy (common data format?) to be explored
    - Work on solenoid field impact for CLIC has potential synergy with ILC
- PLACET is developed in common effort with contributions from both sides
  - Used for ILC RTML
  - E.g. our halo generation modules are being extended to cover ILC like cavities
  - Benchmarking with ELEGANT
- Discussion of RTML rational and performance for ILC and CLIC (started at CLIC08)
  - Currently functional CLIC RTML design is being made
  - Comparison of system design, identification of common issues and differences, e.g. presentation in ILC meeting
  - An important common problem are stray fields
    - Address by common data collection and measurements

Summary

- 1) Expanding the mandates of the working groups, including a general review of the success (or lack of success) of each over the last year and the plans for the meetings this fall. *We may choose to recommend the consideration or adoption of specific tasks.* It may prove useful to adopt more a formal management approach on key issues
  - discuss the general scope of the planned effort and the available resources – esp. Cost & Schedule
  - propose a prioritization process so that – if we wished to have a more inclusive mandate – there would be some direction and some mechanism for developing one.

Summary (2)

- 2) Expanding the number of working groups, including groups which are not strictly balanced.
- 5 possible additional WGs:
  - Beam instrumentation,
  - Alignment & Stability,
  - Machine Protection system,
  - Klystrons (L band) & Modulators with long pulses and high efficiency,
  - Operational & reliability issues.