



(Interim) Report from the Civil Facilities & Siting Kick Off Meetings

**ILC@DESY General Project Meeting
Deutsches Elektronen-Synchrotron DESY
Hamburg · September 7, 2007**

Wilhelm Bialowons · DESY & GDE

Based on "CFS-EU Summary" by Marc Ross, CFS KOM, September 3 to 5, 2007 and other talks



Outline

- Introduction
 - [RDR: Finished August 15, 2007](#)
 - International Cost Review at Orsay end of May
 - Engineering Design Phase
 - EDR Kick Off Meetings (KOM)
- CFS US Kick Off Meeting August 22 to 24, '07
 - [Agenda in InDiCo \(confId=1850\)](#)
- CFS EU Kick Off Meeting September 3 to 5, '07
 - [Agenda in InDiCo \(confId=1852\)](#)
- CFS As Kick Off Meeting September 10 & 11, '07
 - [Agenda in InDiCo \(confId=1853\)](#)
- Value Engineering
- Alternative Designs
- Safety
- Summary



ILC Reference Design Report

~700 Contributors from 84 Institutes

ILC-REPORT-2007-01
 AAI-PUB-2007-002
 CHEP A07-001 (CHEP/KNU)
 CLNS 07/1991
 Cockcroft-07-04
 DESY 07-046
 FERMILAB-TM-2382-AD-CD-DO-E-FESS-TD
 JAI-2007-001
 JINR Dubna E9-2007-39
 JLAB-R-2007-01
 KEK Report 2007-1
 LNF-07/9(NT)
 SLAC-R-857

INTERNATIONAL LINEAR COLLIDER

REFERENCE DESIGN REPORT

2007

APRIL, 2007

LIST OF CONTRIBUTORS

3:00pm, May 4, 2007

Geordi Aaron⁰¹, David Adey⁰⁸, Chris Adolphsen⁰³, Ilya Agapov²⁸, Jung-Kwon Ahn⁰⁶,
 Mitsuo Akemoto²⁴, Maria del Carmen Akiba²⁷, Michael Albrecht²⁹, David Alesini⁰⁹,
 Jim Alexander¹⁸, Wade Allison⁰¹, John Amann⁰⁹, Shozo Anami²⁴, Terry Anderson²¹,
 Michael Anerella¹, Deepa Angul-Kalini^{12,6}, Sergej Antipov², Claire Antoine²³,
 Rob Appleby^{12,70}, Sakae Araki²⁴, Tag Arkan²³, Ned Arnold², Ray Arzouf⁰³,
 Xavier Artru²⁸, Alexander Arystov²⁴, Fred Asst⁰⁹, David B. Angustin²³, Derek Baas⁴²,
 Nigel Baddams¹¹, Ian R. Bailey^{12,70}, N. I. Balalykin²⁸, Jean-Luc Barbry¹¹, Maurice Ball²¹,
 Philip Bambede²⁷, Synchroni Ban²⁴, Karl Baner⁰⁹, Bakul Banerjee²³, Someno Barbarotti²⁰,
 Desmond P. Barber^{18,12,70}, D. Yu. Bardin⁰⁹, Barry Barish⁰³, Roger Barlow^{12,70},
 Maury Barone^{21,22}, Yuri Batygin⁰⁹, D. Eilwyn Bayzham⁰, Carl Beard^{12,6}, Leo Bellarini²¹,
 Paul Bellomo⁰⁹, Lynn D. Benson⁰⁹, Martin Berndt⁰⁹, Simona Bettini⁰⁹,
 Vinod Bhargava⁰⁹, Marica Biagini⁰⁹, Wilfried Biskamp¹⁸, Thomas Bisher⁰⁵,
 John Bierwagen⁰⁵, Alison Birch^{12,6}, Victoria Blackmore⁰¹, Grahame Blair⁰⁸,
 Christian Bock²¹, Courtlandt Bohn⁰⁹, V. I. Boiko²⁸, Edward N. Bondaruk⁰⁴,
 Roberto Boni⁰⁸, Stewart Boogers²⁸, Gary Boorman²⁸, Alessio Bosisio²⁸, Pierre Boulard⁸,
 Angelo Bosotti²⁷, Gordon Bowden⁰⁹, Gary Bower⁰⁹, Axel Brachmann⁰⁹,
 Tom W. Bradshaw², Hans Peter Bräuer¹, James Braun⁰⁹, Steve Bricker⁴⁵,
 Craig Brookby⁴¹, Timothy A. Brooks², James H. Brownell¹⁷, Melanie Bruchan⁸,
 Heiner Brueck¹⁸, Amanda J. Brummitt¹, Yu. A. Bugayev⁰⁹, Karsten Bussler¹⁸,
 Eugene Bulyak⁴⁹, Adriana Bungau^{12,70}, Craig Burkhardt⁰⁹, Philip Burrows⁰⁹,
 Graeme Burt¹², David Burton^{12,20}, Yunhai Cai⁰⁹, Orelia Capatina¹¹, Ruben Carrazzo²¹,
 F. Stephen Carr², Harry F. Carter²¹, John Carver⁰⁹, John Carwardine², Richard Cassel⁰⁹,
 Giorgio Cavallari⁸, Brian Chao²⁷, Hubert Chabal²⁷, Stéphane Chef⁸, Chipping Chen⁴⁴,
 Jian Cheng²¹, M. Chiovallini²⁸, William Chouh²⁷, Jun-tyuk Choi²¹, Glenn Christian²⁴,
 Mike Church²¹, Gundagi Gowati²⁸, Christine Clarke²¹, Don G. Clarke⁸,
 James A. Clarke^{12,6}, Elizabeth Clements^{21,20}, Paul Coe⁴¹, John Cogan⁰⁹, Chris Coapstin⁰⁹,
 Ed Cook⁴¹, Peter Cooley^{12,70}, Laura Corner²¹, Clay Covein⁰⁹, Curtis Crawford¹⁸,
 James A. Crittenden¹⁸, Hamid Dabiri Khah⁴¹, Olivier Dacou²⁷, Chris Dameroff¹,
 Michael Danilov²², Ken P. Davies⁰⁸, Antonio de Lira⁰⁹, Stefano De Santis⁰⁹,
 Laurence Dawson⁰⁹, Jean-Pierre Delahaye¹¹, Nicholas Delerue⁰¹, Olivier Dellierriere⁰⁸,
 Yu. N. Denisov²⁸, Christopher J. Dennis²⁷, Guillaume Devaux⁸, Amos Dexter¹²,
 Sushir Dier⁴¹, Ralph Dillan²⁸, George Doucas⁴¹, Robert Downing²⁷, Eric Doyle⁰⁹,
 Alessandro Drago²⁸, Alex Dragt²⁷, Alexandr Drushlin²¹, Gerald Dugan¹⁸,
 Viktor Duginov²⁸, Helen Edwards²¹, Heiko Ehrlichmann¹⁸, Michael Ehrlichman²⁸,
 Peder Eliasson¹¹, George Edwood^{12,6}, Eckhard Elsen¹⁸, Louis Emery², Kazuhiro Enomoto²⁴,
 Kunioei Enoki²⁴, Atsushi Enomoto²⁴, Fabien Estienne⁰⁹, Roger Erickson⁰⁹, Karen Faust⁰⁹,
 Alberto Fasso⁰⁹, John Felber²⁴, John Ferguson¹¹, J. Luis Fernandez-Hernandez^{12,6},
 Ted Fieguth⁰⁹, Mike D. Fittos², Mike Foley²¹, Richard Ford²¹, Brian Foster⁰¹,
 Horst Friedman², Josef Frisch⁰⁹, Joel Fuster², Masafumi Fukuda²⁴, Shigeki Fukuda²⁴,
 Yoshihito Funahashi²⁴, Warren Funk²², Kazuro Furukawa²⁴, Fumio Furuta²⁴,
 Karsten Gadow¹⁸, Wei Gai², Fred Gannaway²¹, Jie Gao²¹, Peter Garbancius²¹,
 Luis Garcia-Tabares¹⁸, Terry Garvey²⁷, Edward Garwin⁰⁹, Martin Gata¹¹, Lixin Ge⁰⁹,
 Zhaohao Gong²¹, Scott Gerbick², Rod Gerig², Lawrence Gibbons¹⁵, Allan Gillespie²,

ii ILC-Reference Design Report

<http://www.linearcollider.org>



What's RDR

- (International) Conceptual design report
- With first-stage (reliable) cost (value & labor) estimation
- Engineering details not yet contained
- Not all based on the present technology
 - Forward-looking
 - R&D needed
- History
 - BCD (Baseline Configuration Document) published in December 2005 at Frascati meeting
 - Rules for cost estimation established in March 2006 at Bangalore meeting
 - First cost compilation in July 2006 at Vancouver meeting
Cost reduction effort started
 - RDR draft published in February 2007 at Beijing meeting
 - **RDR finished: Final Version delivered to ILCSC on August 15, 2007**



Total ILC Value and Explicit Manpower

- Total ILC Value Cost **ILCU* 6.62 B**

ILCU 4.79 B shared + **ILCU 1.83 B** <site specific>#

plus **14.2 k** person-years Explicit Manpower

= **24.2 M** person-hours

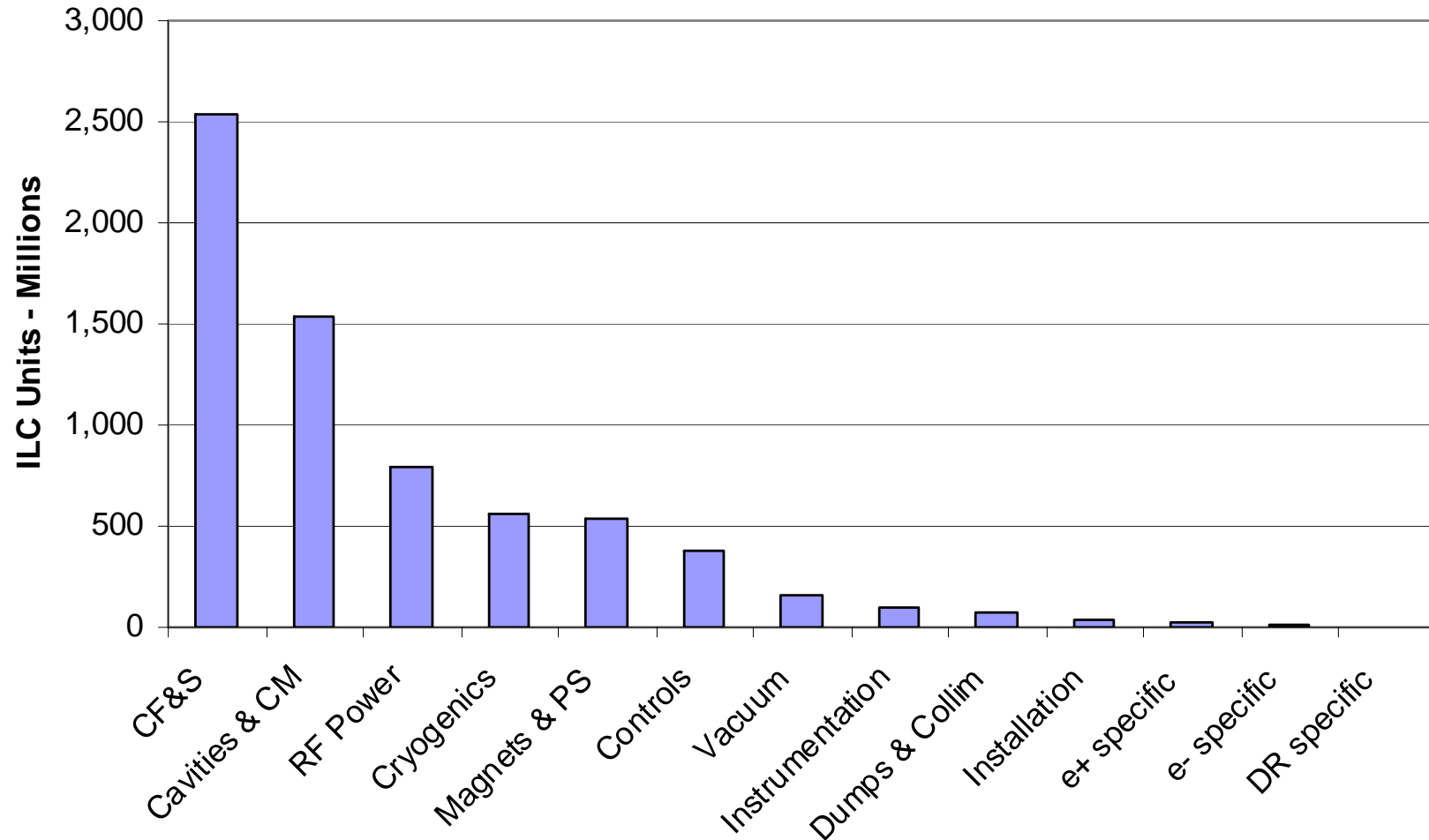
@ 1,700 person-hr/person-yr

*ILCU(nit) = \$ (January 2, 2007)

#<site specific> = average of the three site specific costs



ILC Value – by Technical Systems





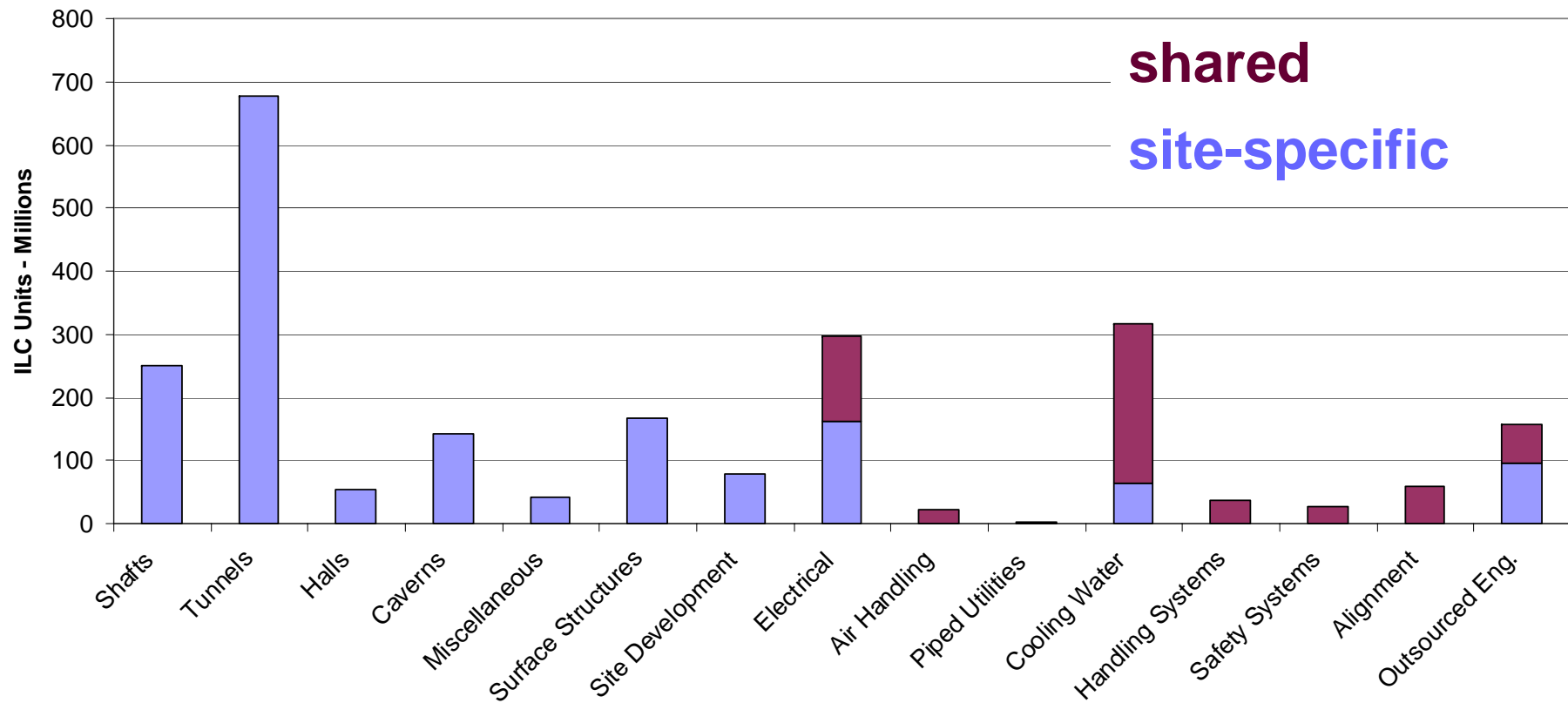
Conventional Facilities

ILCU(nit) = \$ (January 2, 2007)

	total	civil only
Asia	ILCU 2.25 B	1.38 B
Americas	ILCU 2.54 B	1.65 B
Europe	ILCU 2.49 B	1.61 B



Conventional Facilities





ILC Cost Reviews

- Internal Review of the Cryomodule cost
- Internal Cost Review at SLAC with the participation of an External Review Panel on December 14 to 16, 2006
 - *“Methodology is an appropriate basis” for ILC costing*
- Machine Advisory Committee Review at Daresbury on January 10 to 12, 2007
 - *“... performance driven baseline configuration was successfully converted into a cost conscious design.”*
- DOE Briefing on January 17, 2007
- FALC Meeting at London on January 22, 2007
- **International Cost Review at Orsay on May 23 to 25**



International Cost Review of the ILC

- The Committee believes that the GDE is doing an excellent job of designing the ILC under the conditions that currently exist. The costing methodology is as good as can be done at the present time. For more accuracy on some items, further R&D and a designated site location for the ILC is needed.
- ... the Committee concentrated on **two major cost drivers: the Main Linac and Conventional Facilities**, which together comprise 70% of the ILC cost, ...
- ... sees further **possible cost savings** based on expected R&D results and further optimization of the following areas: the Main Linac, RF system, Damping Ring layout, **tunnel diameters, the number and size of vertical access shafts, tunnel water cooling parameters** ...
- ... **a shallow site should be costed for comparison.**
- The methodology for the Main Linac design is the best that can be done at present.
- Lengthening the construction period could allow cost reductions.



The GDE Plan and Schedule

2005

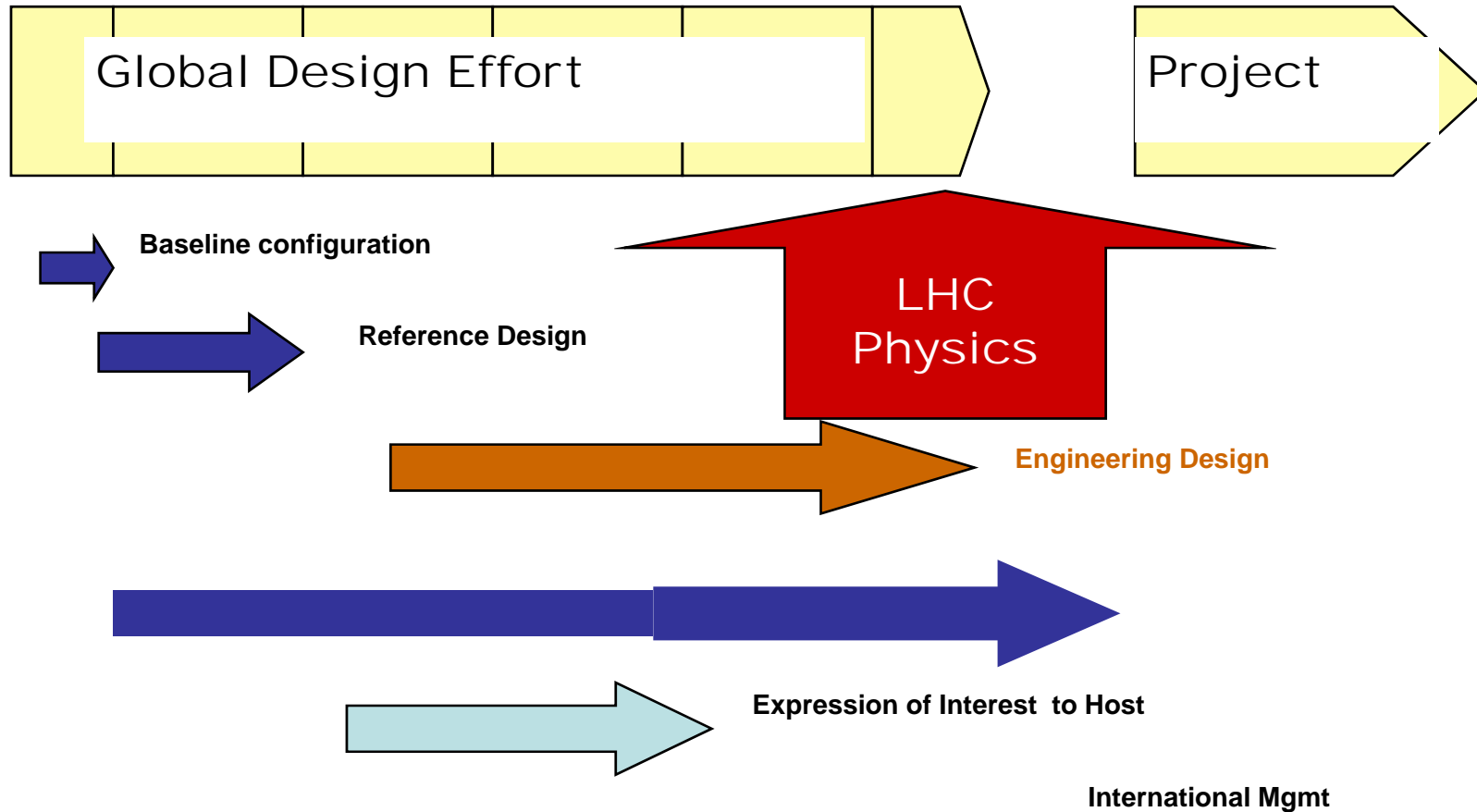
2006

2007

2008

2009

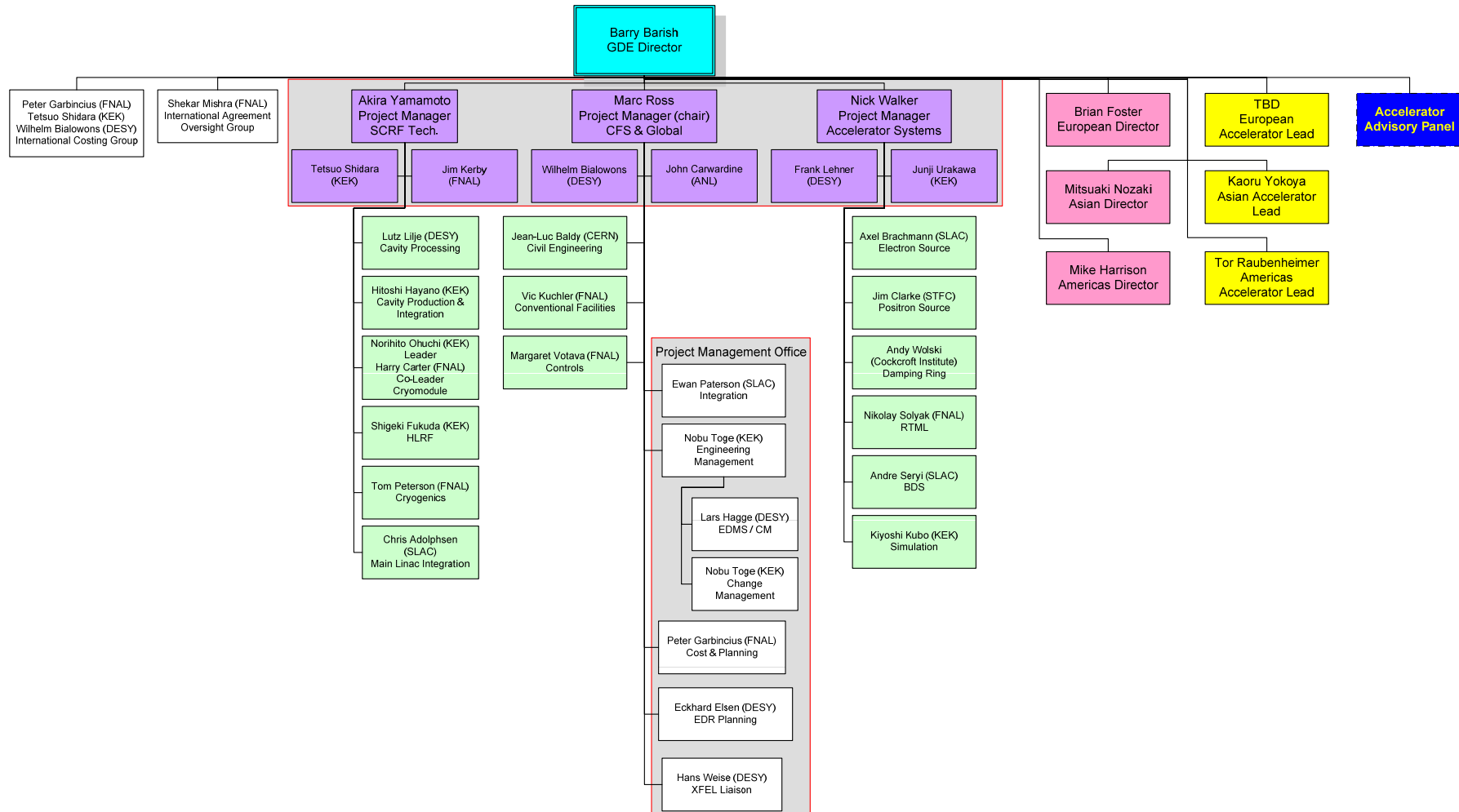
2010





GDE EDR Organisation Chart

GDE ILC Engineering Design Phase Project





Schedule GDE Kick Off Meetings

#	Topic / host reg.	Start Date	Primary Host
1	Controls - (US)	Montag, 20. August 2007	John Carwardine
2	CFS - (US)	Mittwoch, 22. August 2007	Vic Kuchler
3	RTML (US)	Montag, 27. August 2007	P. Tenenbaum
4	CFS- EU	Montag, 3. September 2007	J-L Baldy
5	CFS (AS)	Montag, 10. September 2007	Atsushi Enomoto
6	CM - (AS)	Donnerstag, 13. September 2007	Hitoshi Hayano
7	Cav - (EU)	Mittwoch, 19. September 2007	Lutz Lilje
8	e- -(US)	Montag, 24. September 2007	Axel Brachmann
9	ML - (US)	Mittwoch, 26. September 2007	Chris Adolphsen
10	HLRF (US)	Montag, 1. Oktober 2007	Ray Larsen
11	e+ - (EU)	Montag, 8. Oktober 2007	Jim Clarke
12	BDS-(US/EU)	Donnerstag, 11. Oktober 2007	Andrei Seryi
*****		Montag, 22. Oktober 2007	ILC Meeting Fermilab
13	DR - (EU)	Montag, 5. November 2007	Andy Wolski



CFS Kick Off Meetings

- CFS US Kick Off Meeting August 22 to 24, '07
 - [Agenda in InDiCo \(confId=1850\)](#)
 - Tom Lackowski, Value Engineering
 - [The Value-Society](#)
 - Decreasing Costs
 - Improving Quality
 - Saving Time ...
- CFS EU Kick Off Meeting September 3 to 5, '07
 - [Agenda in InDiCo \(confId=1852\)](#)
 - Ghislain Roy, Licensing Procedure for LHC
 - John Andrew Osborn, The ILC Experimental Area
 - Eva-Maria Gröniger-Voss, CERN as an Intergovernmental Organization



CFS EU Kick Off Meeting

- 3 CFS EDR Kick Off meetings.
- Each one has a focus on
 - Regional issues,
 - Issues special to the group - special experience or institutional expertise, and
 - Carry over from previous meetings or discussions.
- At the Fermilab GDE meeting there will be a 1 hour CFS closing plenary presentation.
 - Summaries of the Kick Off meetings
 - And a plan for the EDR.
 - An outline of needed criteria and who is responsible for providing it by when.



CFS EU Kick Off Meeting

- The presentation should also include plans for (the) key CFS deliverables:
 1. An integrated inter-regional plan - with schedules for regional and global activities,
 2. Plans for specific value engineering exercises –
 - to be highlighted in the PM presentation,
 3. Strategic discussion of a model site selection process and
 4. A plan for the development and publication of a alternate site format design.



CFS EU Kick Off Meeting

- Of course a key focus of the CFS-EU meeting is the LHC experience.
 - Environmental process,
 - Safety approvals (esp. single tunnel egress),
 - Civil engineering,
 - Overall ‘lessons learned’ are topics which should be included in our discussions.



4 Functional WBS and WP Descriptions, EDR Phase 1

1/2

A -Final Criteria Development and Design						
x.x.1	Work Package 1 - Civil Works specific to the Americas Regions sample site					
	x.x.1.1	Civil Engineering				
			x.x.1.1.1	Develop Final Criteria		
			x.x.1.1.2	Design and calculations		
			x.x.1.1.3	Cost estimates		
			x.x.1.1.4	Time Schedules		
			x.x.1.1.5	EDR writing		
x.x.2	Work Package 2 - Civil Works specific to the Asian Region sample site					
	x.x.2.1	Civil Engineering				
x.x.3	Work Package 3 - Civil Works specific to the European Region sample site					
	x.x.3.1	Civil Engineering				
x.x.4	Work Package 4 - Electrical Engineering (all three sample sites)					
	x.x.4.1	Electrical Engineering specific to the Americas Region sample site				
	x.x.4.2	Electrical Engineering specific to the Asian Region sample site				
	x.x.4.3	Electrical Engineering specific to the European Region sample site				
	x.x.4.4	Electrical Engineering common to all three sample sites				
x.x.5	Work Package 5 - Air Treatment Equipment (all three sample sites)					
x.x.6	Work Package 6 - Process cooling water and Piped Utilities (all three sample sites)					
x.x.7	Work Package 7 - Handling equipment (all three sample sites)					
x.x.8	Work Package 8 - Safety equipment (all three sample sites)					
x.x.9	Work Package 9 - Survey and Alignment (all three sample sites)					



4 Functional WBS and WP Descriptions, EDR Phase 1

2/2

B - Costs estimates, cost reduction Time schedules and Value Engineering	
x.x.10	Work Package 10 - CFS cost estimates, time schedules, value Engineering Reviews and EDR final writing
x.x.10.1	Total CFS cost estimate (from WP 1 to 9)
	x.x.10.1.1 Americas Region sample site
	x.x.10.1.2 Asian Region sample site
	x.x.10.1.3 European Region sample site
x.x.10.2	Overall Time schedules (from WP 1 TO 9)
	x.x.10.2.1 Americas Region sample site
	x.x.10.2.2 Asian Region sample site
	x.x.10.2.3 European Region sample site
x.x.10.3	Review and possible cost reductions
	x.x.10.3.1 Cut and cover / near surface alternatives
	x.x.10.3.2 Verify Tunnel costs
	x.x.10.3.3 Review tunnel diameter requirements
	x.x.10.3.4 Review Shaft Requirements (number and size)
	x.x.10.3.5 Review Process Water Requirements
	x.x.10.3.6 Review Air Handling Requirements
	x.x.10.3.7 Review Electrical Requirements
	x.x.10.3.8 Review Life Safety Solutions for one and two tunnels
	x.x.10.3.9 Construction schedules for cost advantages
x.x.10.4	EDR phase 1 final writing (from WP 1 to 9)
C - Regional Interest Efforts	
x.x.11	Work Package 11 - Site selection process
	x.x.11.1 Pre-selection process
	x.x.11.2 Call for bids documents preparation and launching
	x.x.11.3 Interaction with bidders
	x.x.11.4 Evaluation of bids
	x.x.11.5 Proposal for selection of the final site



Proposed Alternative Site Work Packages

- WBS for the alternate site format development. Propose 3 work packages. **Coordinator?**
- WP deliverables need to be developed
 - Example – surface radiation exposure levels for shallow tunnel

12. Development of the baseline machine with a different, perhaps improved linac profile.

- CFS AM meeting.
- 4 fold approach given by Tracy Lundin (5th is baseline).
- One of these is a review of the single tunnel.
 - RDR may contain enough information for development of this



Proposed Alt. Site WPs

13. 'Brown Field' (i.e. Hanford) site that has the simplest construction.

- Term indicates open space, low use site – probably not agricultural or urban residential land
- What is the deliverable?
 - White paper analysis of the comparative costs.
- Dubna deliverable?

14. Additional (independent) regional developments



Safety

- For example:
- Near surface geometry:
 - What is the impact of berm (=soil) thickness on the Cut&Cover cost?
 - How and who ?
- Egress
 - Development of life safety strategy
 - ILC project can adopt, for EDR, the CERN approach is practical.
 - Use all available input,
 - Formulate 'our own' rules
 - Examine consistency
 - CERN Convention.
- Others?
- How to define this process in terms of WP & WP coordinator?



'Value Engineering'

- A process that crosses internal organization boundaries
 - A kind of 'integration activity'
- Need to define for the ILC as a whole
 - 'brainstorming' is the most time consuming part
 - Basis of innovation that is mandated
 - Intended to shift focus from traditional responses
- Assessment of less tangible cost is a key part
 - Requires development of specific / alternate models



Planning

- How much effort will be required for the above?
 - In addition to plans we have (from this year)
- When?
- General schedule:
 - WP matrix for ILC – due in November
 - CFS plans – WBS/ WP's
 - With examples(?) for outside use
 - Full WBS for March (Tohoku)



Summary and Outlook

- Engineering design issues still remain.
 - The next document will contain much more technical detail:
Engineering Design Report due 2010.
 - Currently work packages for Engineering are being set up.
- The Civil Facilities and Siting Kick Off Meetings in the Americas and Europe are just over.
- The Asian Meeting will be next week at KEK.
- In my personal opinion it will be a long and stony way to reduce the CFS cost, which will be essential, by Value Engineering and Value Management.
- An alternative shallow site investigation is needed in Europe (DESY and Dubna)
- The PM must write a draft convention (with rules, codes etc.)