Report on activities in the GDE

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PECFA Meeting
CERN 30/11/07

Overview

- ILC parameters and overview of ILC RDR design
- Progress since last PECFA
  - **definition and staffing of EDR Phase**
- European situation and EU projects
- Summary and future prospects

ILC Parameters

- **E_{cm} adjustable from 200 – 500 GeV**
- **Luminosity $\int L dt$ = 500 fb^{-1} in 4 years**

  (corresponds to $2*10^{34}$ cm^{-2} s^{-1})
- **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**

ILC Reference Design Report

~700 Contributors from 84 Institutes

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

LIST OF CONTRIBUTORS

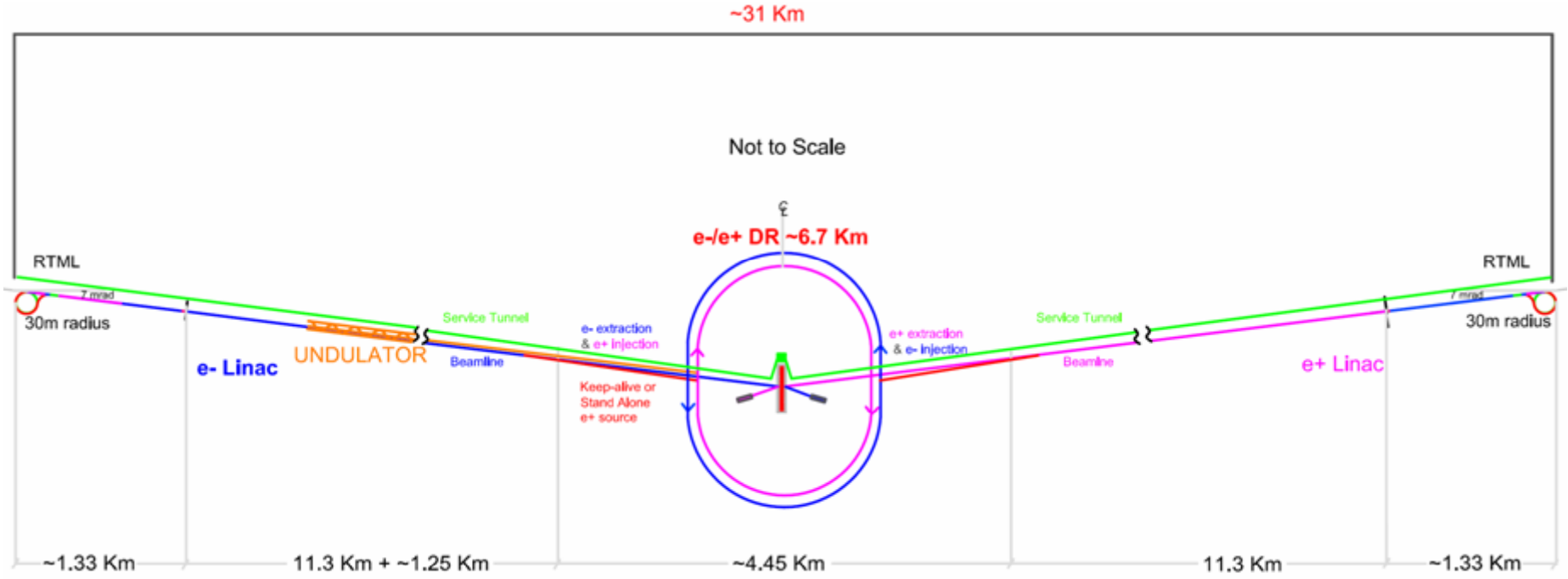
3:00pm, May 4, 2007

ii ILC-Reference Design Report

The RDR is not a full engineering design - it is conceptual; some aspects require R&D. Forms reliable basis for detailed engineering design & costing.

Overall Layout

1st Stage: 500 GeV; central DR et al. campus; 2 “push-pull” detectors in 14 mrad IR.



Schematic Layout of the 500 GeV Machine

ILC COST

Summary

RDR "Value" Costs

Total Value Cost (FY07)

4.80 B ILC Units Shared

+

1.82 B Units Site Specific

+

14.1 K person-years

("explicit" labor = 24.0 M person-hrs @ 1,700 hrs/yr)

1 ILC Unit = $ 1 (2007)

Σ Value = 6.62 B ILC Units

The reference design was "frozen" on 1-12-06 for RDR production, including costs.

Important to realise this is a snapshot; design will continue to evolve, due to R&D, accelerator studies & value engineering.

The value costs have already been reviewed many times; all reviews have been very positive and generally consider there is scope for further cost reductions.

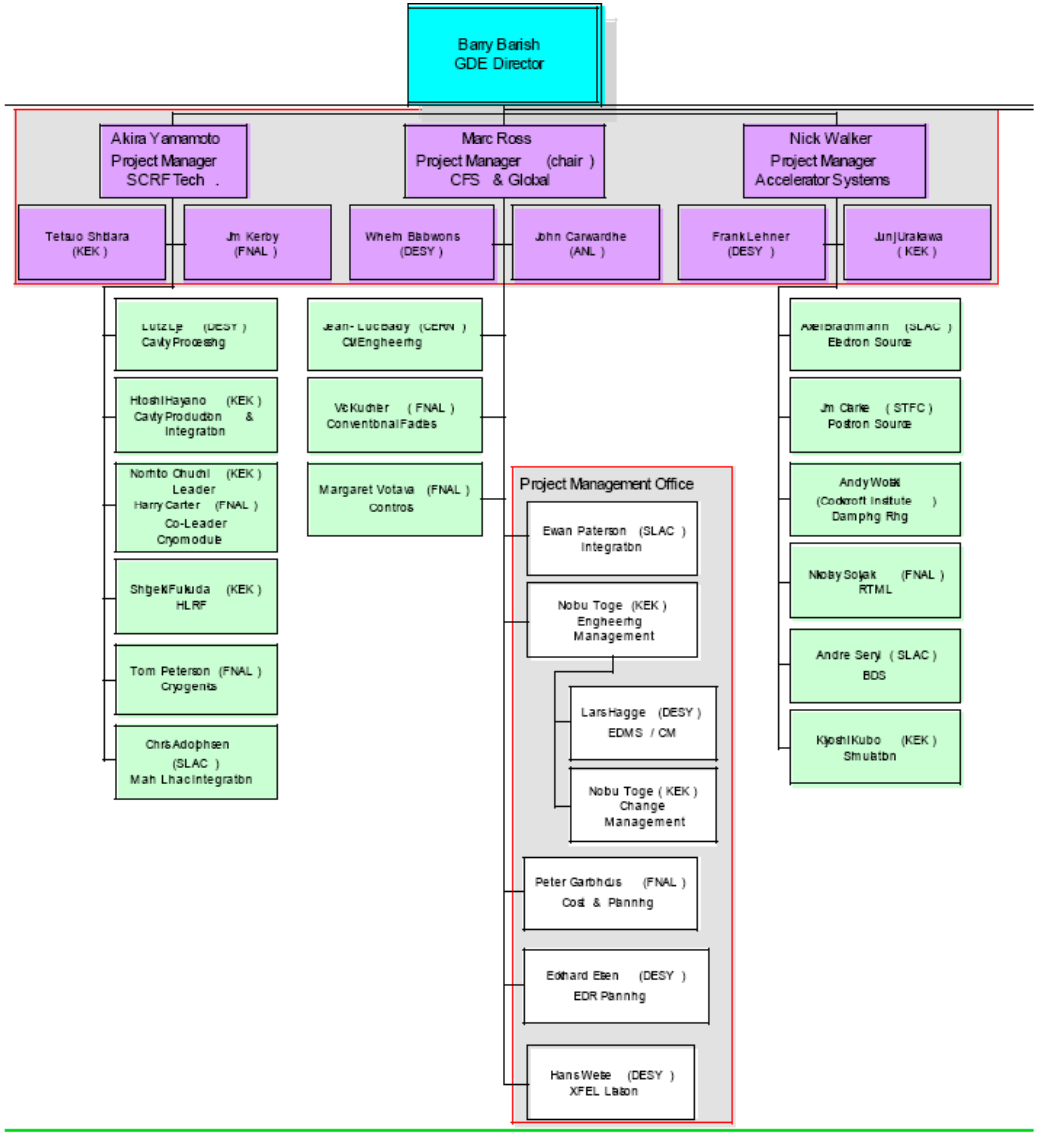
EDR phase

- The period since the formal publication of the RDR in August has been one of intensive internal reorganisation and preparation for the EDR phase.

- Major development has been the installation and staffing of the Project Management Office, led by M.Ross (Fermilab) (Chair), N. Walker (DESY) & A. Yamamoto (KEK).

- All positions in project office now essentially complete.

EDR phase management structure



EDR phase - technical areas

- The EDR phase R&D will be divided into 15 technical areas:

	Technical Area		
	1. Superconducting RF Technology	2. Conventional Facilities & Siting and Global Systems	3. Accelerator Systems
Technical Area Groups	1.1 Cavity Processing	2.1 Civil Engineering and Services	3.1 Electron Source
	1.2 Cavity Production and Integration	2.2 Conventional Facilities Process Management	3.2 Positron Source
	1.3 Cryomodules	2.3 Controls	3.3 Damping Ring
	1.4 Cryogenics		3.4 Ring To Main Linac
	1.5 High Level RF		3.5 Beam Delivery Systems
	1.6 Main Linac Integration		3.6 Simulations

Yamamoto Ross Walker

EDR phase - SCRF

- SCRF is most crucial R&D area - milestones:

High-gradient cavity performance at 35 MV/m with the specified production yield.	2010
ILC-like Cryomodule design, including optimization for: **- thermal balance and cryogenics operation;** **- beam dynamics (component orientation and alignment)**	2010
Operation of Cryomodules in all three regions	2010

EDR phase - SCRF

- Numbers of cavities available for test as function of FY in three regions:

Americas	FY06 (actual)	FY07 (actual)	FY08	FY09	FY10	TOTAL ED-P	FY11	FY12
Cavity orders - qualified vendors	8	12	18	40	40	108	40	40
Total 'process and test' cycles		40	60	90	115	276	120	120
Asia	**FY06 (actual)**	**FY07 (actual)**	**FY08**	**FY09**	**FY10**		**FY11**	**FY12**
Cavity orders	8	7	15	25	15	59	39	39
Total 'process and test' cycles		21	45	75	45	152	117	117
Europe	**2004-08 (actual)**	**2007 (actual)**	**2008**	**2009**	**2010**		**2011**	**2012**
Cavity orders	60			838		898		
Total 'process and test' cycles		14	15	30	100	109	354	354
Global totals								
Global totals - cavity fabrication	76	19	33	903	55	1065	79	79
Global totals - cavity tests	**0**	**75**	**120**	**195**	**260**	**538**	**591**	**591**

EDR phase - facilities

- Test facilities available or proposed for EDR era

Test Facility	Acronym	Purpose	Host Lab	Operation start	Organized through:
Accelerator Test Facility	ATF	Damping Ring	KEK	1997	ATF Collaboration
Beam Delivery Test Facility	ATF2	Beam Delivery	KEK	2008	ATF Collaboration
Superconducting RF Test Facility	STF	Main linac	KEK	2008	KEK
TESLA Test Facility/ Free Electron Laser Hamburg	TTF / FLASH	Main linac	DESY	1997	TESLA Collaboration, DESY
End Station A	ILC-SLACESA	Machine Š Detector Interface	SLAC	2006	SLAC
ILC Test Accelerator	ILCTA-NML	Main Linac	FNAL	2008	Fermilab
Cornell Test Accelerator	CESR-TA	Damping Ring	Cornell	2008	Cornell

EDR phase - facilities

- Test facility deliverables and milestones

Test Facility	Deliverable	Date
ATF	Generation of 1 pm-rad low emittance beam	2009
ATF2	35 nm beam size; 2 nm rms beam stability	2010
STF	RF Unit demonstration	2011
FLASH	Full 10mA, 1 GeV, high-repetition rate operation	2008
ILC-SLACESA	Energy spectrometer, energy spread and collimator tests	2008
ILCTA-NML	RF Unit demonstration	2012
CESR-TA	Electron cloud mitigation tests	2010

EDR phase - resources

- Estimated resources available - SCRF

Region	Country	Total SRFT	Cavities	Cryomodule	HLRF	Cryogenics	ML Integ.
Americas	Canada						
	US	310	126	47	88	6	43
Europe	EU (CERN, ESRF)	5				1	4
	France	100	100				
	Germany	67	37	8		8	14
	Italy	48	38	8		1	1
	Poland	6	6				
	Russia						
	Spain	3		3			
	Sweden						
	Switzerland						
	UK	6	4				2
Asia	China	32	12	8	8	4	
	India	36	24	12			
	Japan	72	45	6	11	4	5
	Korea	3	2	0	1		
Total SRFT		687	394	92	108	24	70

Region	Country	Total SRFT	Cavities	Cryomodule	HLRF	Cryogenics	ML Integ.	
Americas	Canada							
	US	35015	20117	5538	8805	84	472	k$
Europe	EU (CERN, ESRF)	129					129	k€
	France	10058	10058					k€
	Germany	2161	2009				152	k€
	Italy	1342	1182	160				k€
	Poland	30	30					k€
	Russia							k$
	Spain	9		9				k€
	Sweden							k€
	Switzerland							k€
	UK	496.5	425				71.5	k€
Asia	China	0						
	India	2460	1560	900				
	Japan	44.38	22.25	4.62	4.52	1.8	11.19	OY
	Korea	0						
Total SRFT								

- LH - person-years - RH M&S

EDR phase - participants

- Institutions with interest in Accelerator Systems work packages

Electron Source		
Americas	USA	SLAC, FNAL, Jlab
Asia	Japan	Hiroshima U, KEK, Nagoya U
Positron Source		
Americas	USA	ANL, BNL, Cornell, FNAL, LLNL, SLAC
Asia	Japan	Hiroshima U, KEK
Europe	France	Orsay
	Germany	DESY
	UK	Daresbury, Liverpool U., Durham U., Manchester U., RHUL
	Ukraine	KIPT
Damping Ring		
Americas	USA	ANL, Cornell U., FNAL, LBNL, SLAC
Asia	China	IHEP
	Japan	KEK
	Korea	KNU
Europe	Germany	DESY
	Italy	INFN
	UK	Cockcroft Inst.
RTML		
Americas	Canada	UBC
	USA	Cornell U., FNAL
Asia	China	IHEP
	Japan	KEK
	Korea	KNU
Europe	Germany	DESY
	Russia	Efremov, JINR
	UK	? (tbc)

EDR phase - participants

- Institutions with interest in Accelerator Systems work packages

BDS		
Americas	Canada	UBC
	USA	BNL, Colorado U., FNAL, Iowa U., Jlab, LANL, LLNL, LBNL, MSU, Notre Dame U., SLAC, Wisonsin U., Yale U.
Asia	China	IHEP
	India	BARC, RRCAT
	Japan	KEK, Kyoto U., Tohoku U., Tokyo U.
	Korea	KNU, PAL
Europe		CERN
	France	LAL/Orsay, LAPP, Saclay
	Germany	DESY
	Russia	BINP, JINR, Moscow U.
	Spain	IFIC
	UK	Abertay U., Birmingham U., Cockcroft Inst., Cambridge U., Dundee U., IPPP Durham, Lancaster U., Liverpool U., Manchester U., Oxford U., RHUL, UCL
	Ukraine	KIPT
Simulation		
Americas	USA	Cornell U., FNAL, SLAC
Asia	India	BARC, RRCAT
	Japan	KEK
	Korea	KNU
Europe		CERN
	France	LAL/Orsay
	Germany	DESY
	UK	Cockcroft Inst., IPPP Durham, Liverpool U., Manchester U., Oxford U., RHUL

EDR phase - WP definition

- Workpackage definition - example cryomodule.

ID	title	description
1.3.1.	Standardization	Establish basic design parameters, plug compatible interface conditions, and high-pressure gas code (regulation) issues,
1.3.2.	Cooling pipe configuration	Calculation of pressure drops, definition of the maximum pressure, cooling procedure, new piping on the module transverse cross section.
1.3.3.	5-K shield	Calculation of thermal-balance with or w/o 5 K-shield Trade-off with cryogenics operation cost.
1.3.4.	Quadrupole Assembly	Quadrupole location, support, installation procedure, alignment, vibration, current leads,
1.3.5.	Assembly Process	Study of Assembly procedure, fixtures, facilities, Study of inter-connect procedure,
1.3.6.	Engineering design with CAD	Systematic engineering design using 2D/3D CAD, R&D for technically critical components such as Ti-SUS junction, vacuum components, etc.
1.3.7.	Systematic performance evaluation	Establish performance test contents, and procedure
1.3.8.	Transportation	Seek transportable cryomodule (region to region) Investigate transportation down to the tunnel through vertical shaft, with inclination (to save shaft size).
1.3.9.	Cost/Industrialization	Cost estimate based on BCD, and Industrialization effort (mass production and reducing the cost)

EDR phase - report

- All of these details currently being finalised.
- Report will be submitted to FALC resources group on Wednesday for discussion there and at subsequent FALC meeting in Vancouver.

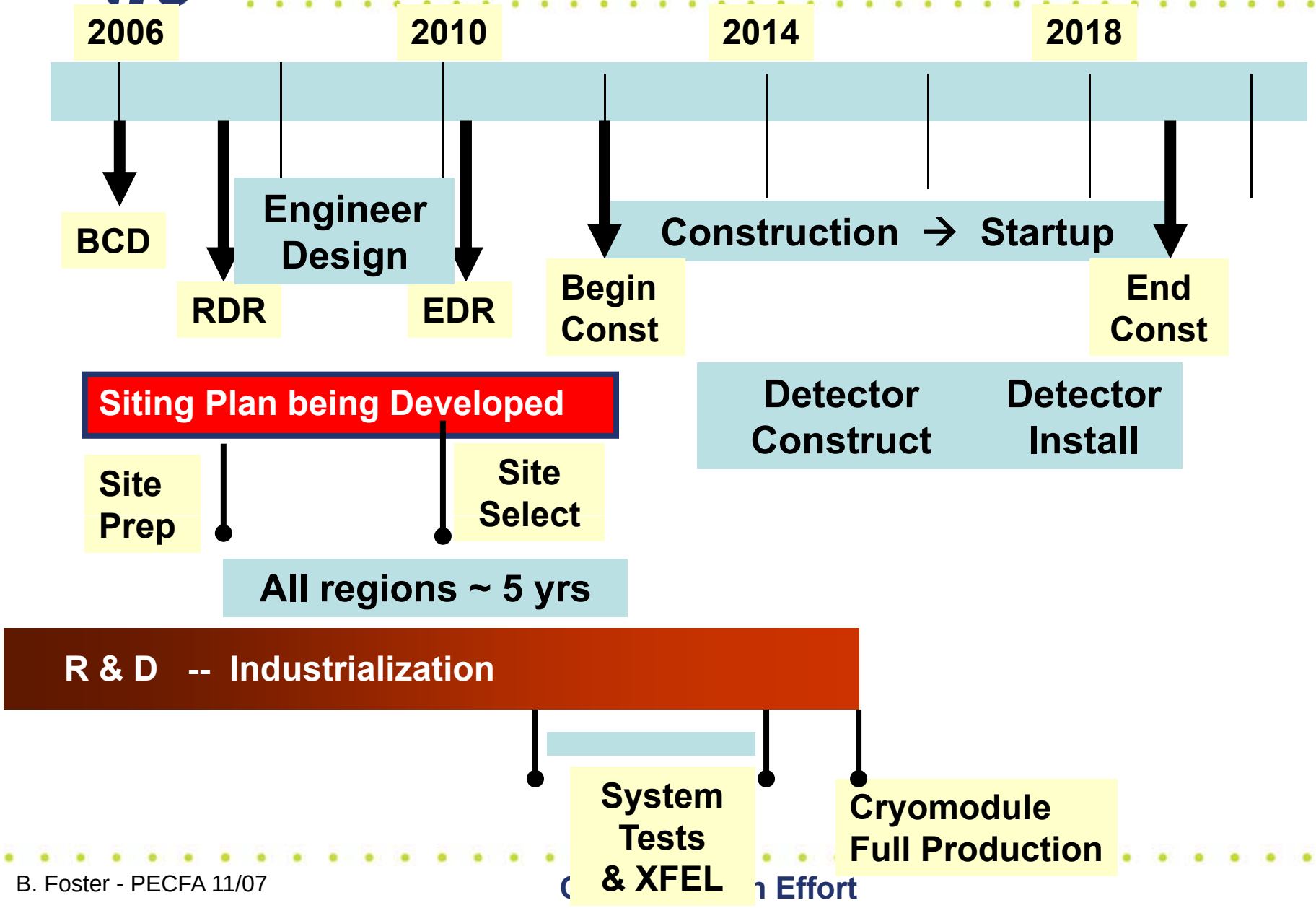
A New GDE

- Previous GDE was small and idiosyncratic. Some members were rather inactive; some very important high-profile jobs being done by non-members.

- GDE now reformed and reconstituted on basis of membership for all working more than 30% FTE - or with high-level responsibilities.

- New list exists - currently 480 GDE members worldwide.

Technically driven timeline



Global developments

- CCAST meeting in Beijing at start November:
  - **Mostly Asian attendance, lively technical sessions and reports on world developments, B. Barish and BF also there . We met Chinese politicians and responsible for pp in Chinese ministry over dinner . Great interest in ILC involvement.**

- Next ILC “general” meeting in Sendai Japan in March. Subsequent meeting in Europe is split: GDE will meet in Dubna and directly afterwards WWS will meet in Warsaw.

Global developments

- R. Orbach talked at Fermilab meeting in October.
  - **great that he takes time to come to talk to us. He is always very supportive in his remarks.**
  - **he has domestic troubles**
  - **we now have to stick to rules of CD0, CD1 in DoE speak**
  - **US budget looks likely to be flat for next few years.**

European situation

- FP7 calls:
  - **“Preparatory phase” is intended for projects on the ESFRI Road map; scheme is meant to take mature projects over the final threshold to construction. ILC is eligible since it is on the European particle physics roadmap, which was assimilated into the ESFRI roadmap. The EU Commission ruled that only 2 projects were sufficiently advanced to be eligible for PP funding: the LHC upgrade, and ILC.**

European situation

- Goals:
  - **“Political”: prepare sites within Europe (including Russia) and explore with governments mechanisms for site proposal and selection; develop models for governance of an ILC laboratory - FALC Chair is a member of collaboration; develop outreach materials and strategies in many EU languages.**
  - **“Technical”: make 24 cavities integrated into ILC R&D programme; close interaction and synergy with XFEL facilities to build and test high-performance cavities and modules and to develop EU industrial capacity to produce substantial fraction of the ILC SC modules.**

European situation

- Status:
  - **Approved @5 MEuro level in the summer**
  - **E. Elsen opened contract negotiations in early September - as usual pp blazed the trail with all sorts of FP7 procedures, new software - which of course did not work - new funding rules etc. Along the way, HiGrade caused all Oxford's FP7 project budgets to be recalled and rewritten.**
  - **Final details and budget submitted on 21.11.07. Awaiting Commission approval.**

European situation

- In the nation states:
  - **Germany continues to be major contributor to ILC, mostly in form of synergies with XFEL.**
  - **UK also continues to make important contributions but disquieting rumours on serious financial crisis in STFC**
  - **Hoping for increased French involvement now France approved for XFEL; Spanish effort also continuing.**
  - **Smaller but important work in a variety of other European countries.**

Summary and Outlook

- Final RDR published in August and presented to ILCSC
  - represents enormous effort over last 18 months.
- EDR phase now underway. Great progress in getting structure together and populating positions. WPs should be allocated soon.
- As usual, positive and negative developments over different regions.

- Momentum being maintained and great progress continue.