EDR Planning, Cost Review and Technical Risk Analysis

A status report

Nick Walker

ILC@DESY Project Meeting
11.05.2005

Global Design Effort

Content

- Status of EDR Planning
- Goals and Programme for Orsay RDR International Cost Review (23-25th May)
- Technical Risk Assessment

EDR Planning Update

- Project Manager ‘negotiations’ continue
  - **But we are very close**

- GDE structure being revised
  - **Work Package structure**
  - **Definition of high-level milestones during EDR phase**
  - **(including R&D milestones defined by S0,1,2…)**

- Task force evaluating WP and management structures

EDR Planning Task Force

Will report at LCWS/ILC2007

- Membership:
  - **Bob Kephart** **FNAL**
  - **Lutz Lilje** **DESY**
  - **Hitoshi Hayano** **KEK**
  - **Ewan Paterson** **SLAC**
  - **Marc Ross** **FNAL** ***chair***
  - **Nobu Toge** **KEK**
  - **(European #2)** **??** ***still missing!!***
  - **+ GDE EC**
    - Barish, Foster, Harrison, Nozaki, Raubenheimer, Walker, Yokoya

EDR Planning: Process

- For EDR Phase, need to define:
  - **High-level goals and milestones**
  - **Work packages**
  - **Responsible groups (people!)**
  - **Management structure**
- Gain input from community
  - **Critical: RDR Area, Technical and Global System leaders.**
  - **R&D groups (RDB, S0,1,2… etc)**
  - **Laboratories, institutes, Universities etc.**
- Getting the input:
  - **Ross has canvas input via email**
  - **Weekly EDR planning TF meetings (WebEx)**
  - **Lab/institute visits (SLAC, FNAL, DESY, KEK, Cockcroft…)**
- Important goals for Workshop

LCWS/ILC2007 Goals

- review current status of global ILC R&D and future plans, including GDE Global R&D Board recommendations, for both the baseline configuration as well as the supported alternative designs;
- review and plan activities in and around Test Facilities (both existing and proposed);
- identify and prioritise critical engineering milestones for EDR phase (cost driven), which are consistent and integrated with the critical R&D milestones;
- promote and improve collaboration between groups working on ILC related R&D:
  - **To encourage a broader participation from active groups around the world;**
  - **To attract new researchers to the field;**
- define the scope of the EDR and consolidate EDR planning:
  - **Review general project structure and possible 'Work Package' (WP) structures;**
  - **Refine proposed schedule, milestones, deliverables etc.;**
  - **Begin process of WP allocation.**

LCWS/ILC2007 Goals

EDR planning relevant

- review current status of global ILC R&D and future plans, including GDE Global R&D Board recommendations, for both the baseline configuration as well as the supported alternative designs;
- review and plan activities in and around Test Facilities (both existing and proposed);
- identify and prioritise critical engineering milestones for EDR phase (cost driven), which are consistent and integrated with the critical R&D milestones;
- promote and improve collaboration between groups working on ILC related R&D:
  - **To encourage a broader participation from active groups around the world;**
  - **To attract new researchers to the field;**
- define the scope of the EDR and consolidate EDR planning:
  - **Review general project structure and possible 'Work Package' (WP) structures;**
  - **Refine proposed schedule, milestones, deliverables etc.;**
  - **Begin process of WP allocation.**

Orsay Cost Review

- Last critical milestone for RDR process
  - **“The RDR is dead – long live the EDR!”**
- International Committee put together by
  - **Funding Agencies for Large Colliders (FALC)**
  - **ILC Steering Committee (ILCSC)**
- Single ‘international’ review initiated/requested by GDE
  - **We wrote the charge**
  - **We set the programme**

Membership

- Sergio Bertolucci (Frascati) Sergio.Bertolucci@lnf.infn.it
- Jia-er Chen (Peking University) chenje@pku.edu.cn
- Mark de Jong (Canadian Light Source) Mark.deJong@lightsource.ca
- Lyn Evans (CERN) Lyn.Evans@cern.ch (**Chair)**
- Norbert Holtkamp (ITER) norbert.holtkamp@iter.org
- S. S. Kapoor (BARC) kss@barc.gov.in
- G. S. Lee (National Fusion Research Center, Korea) gslee@nfrc.re.kr
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- Ex-officio
  - **Shin-ichi Kurokawa (KEK) shin-ichi.kurokawa@kek.jp**
  - **Ferdinand Willeke (DESY) ferdinand.willeke@desy.de**
- Secretary
  - **Roy Rubinstein (Fermilab) royr@fnal.gov**

Charge to IRC

Charge for the Review of the Preliminary Cost Estimate of the ILC Global Design Effort Reference Design Report

The ILC Global Design Effort (GDE), under the direction of Prof. Barry Barish, was established by ICFA in May 2005. The GDE is purposefully constituted as a tri-regional design team whose goal is to produce by 2009 an Engineering Design Report (EDR) which will contain a detailed, engineering-based design and cost for the ILC.

The initial step towards the EDR is to establish a Reference Design Report (RDR) which will define a self-consistent set of ILC design parameters and associated implementation scope. The RDR will also contain an initial estimate of cost at the 20% level which will be mostly parametric in nature. This initial cost estimate will be at sufficient detail to permit a) trend analysis for cost reduction/optimization and b) give guidance for the R&D and industrialization that must accompany the engineering design process of the EDR.

Consistent with the suggestion of the GDE Director, an international team should be convened prior to completion of the RDR to review those aspects of the RDR cost estimate that strongly influence the EDR. Given the intermediate nature of the RDR estimate as discussed above, it would seem premature to review in detail every aspect of an ILC cost estimate. Rather this review team should:

- review cost trends and relative costs of sub-systems. Comment on their relevance to potential changes to be incorporated into the EDR, and to the R&D program in support of the EDR.
- review the methodology used in the estimate to ensure that it is appropriate for establishing an accurate EDR cost assessment. Evaluate that the method and format of estimation can serve the needs of regional authorities as they develop plans for potential involvement as partners in the ILC.

Charge to ICR

- review cost trends and relative costs of sub-systems. Comment on their relevance to potential changes to be incorporated into the EDR, and to the R&D program in support of the EDR.

Programme Day 1

Wednesday 23 May 2007

top

08:30	Executive Session (30')	
09:00	Introduction (1h00')	Barry Barish (*GDE*)
10:00	Reference Design Report (1h00') - includes technical machine description & cost optimization	Kaoru Yokoya (*KEK*)
11:00	coffee	
11:30	Costing Methodology (1h00')	Peter Garbincius (*FNAL*)
12:30	lunch	
13:30	Main Linac (1h00') - include discussion of gradient and impact on total ILC cost	Chris Adolphsen (*SLAC*)
14:30	Cavities, Cryomodules, and RF Power (1h00')	Wilhelm Bialowons (*DESY*)
15:30	coffee	
16:00	Conventional Facilities - introduction (1h00')	Jean-Luc Baldy (*CERN*)
17:00	Beam Delivery System design - introduction (30')	Andrei Seryi (*SLAC*)
17:30	Executive Session (1h30')	

Programme Day 2

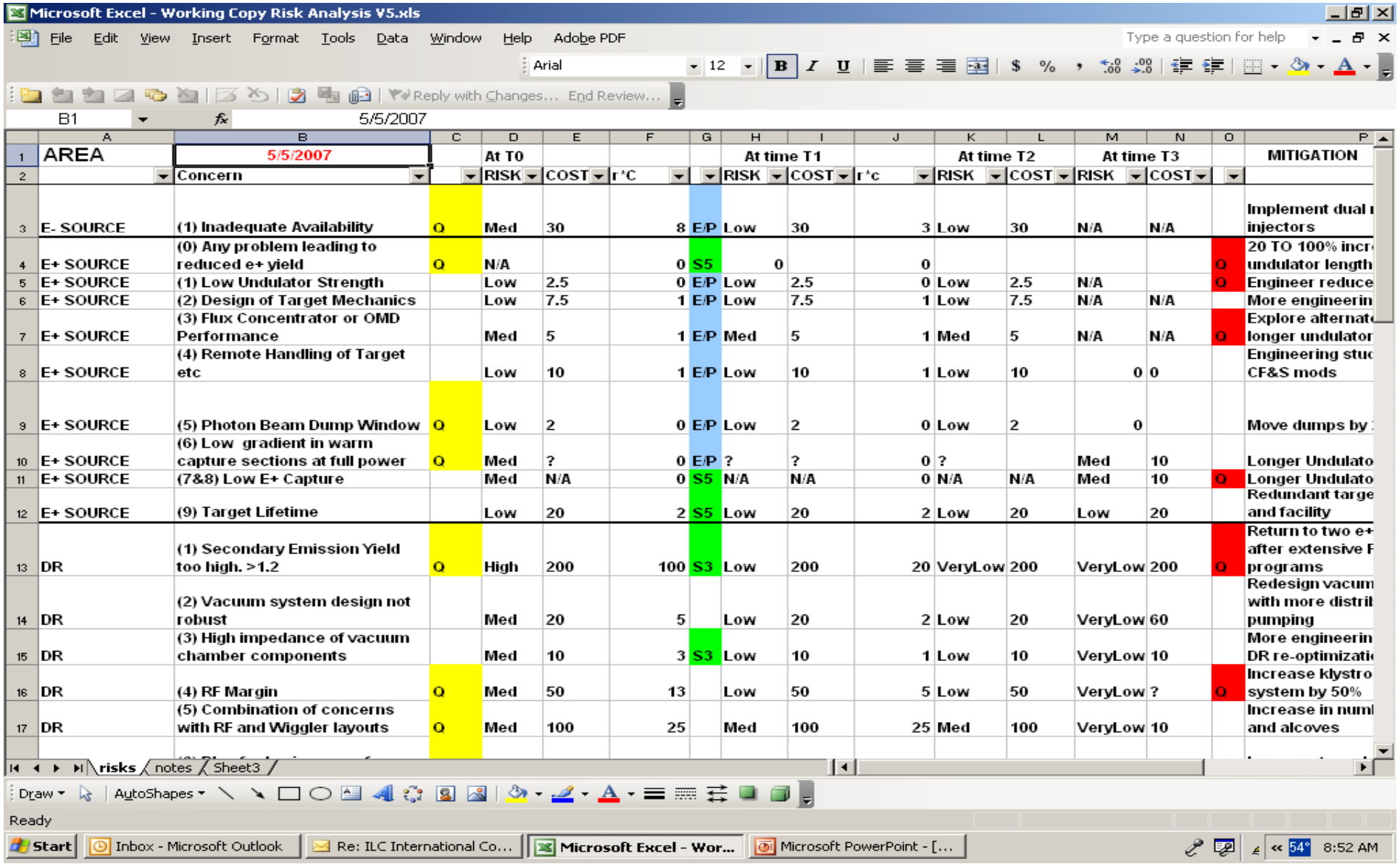
Two ‘breakout’ parallel sessions

AM	**Main linac and associated systems** (Cavities, Cryomodules, RF power, gradient choice etc.)	**Management and Planning #1** (Detail of manpower estimates; methodology; **uncertainty in value estimate**)
PM	**CF&S, DR, BDS**	**Management and Planning #2** R&D plans **Technical risk assessment** Plans & Engineering design

Technical Risk Assessment

- Current Value estimate is based on assumptions that key R&D and engineering programmes will be successful:
  - **accelerating gradient (shorter linac)**
  - **electron cloud (single e+ ring)**
- If one or more of this critical R&D/engineering fail, what is the *risk* (cost impact)
- Very closely related to RDBs S0,1,2… work
  - **R&D priority list is a subset of Technical Risk assessment**

EXCEL tool (E.Paterson)



Microsoft Excel - Working Copy Risk Analysis V5.xls

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B1 5/5/2007

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	AREA	5/5/2007		At T0				At time T1			At time T2		At time T3			MITIGATION
2		Concern		RISK	COST	r*C		RISK	COST	r*c	RISK	COST	RISK	COST		
3	E- SOURCE	(1) Inadequate Availability	Q	Med	30	8	E/P	Low	30	3	Low	30	N/A	N/A		Implement dual i injectors
4	E+ SOURCE	(0) Any problem leading to reduced e+ yield	Q	N/A		0	S5	0		0					Q	20 TO 100% incr undulator length
5	E+ SOURCE	(1) Low Undulator Strength		Low	2.5	0	E/P	Low	2.5	0	Low	2.5	N/A		Q	Engineer reduce
6	E+ SOURCE	(2) Design of Target Mechanics		Low	7.5	1	E/P	Low	7.5	1	Low	7.5	N/A	N/A		More engineerin
7	E+ SOURCE	(3) Flux Concentrator or OMD Performance		Med	5	1	E/P	Med	5	1	Med	5	N/A	N/A	Q	Explore alternat longer undulator
8	E+ SOURCE	(4) Remote Handling of Target etc		Low	10	1	E/P	Low	10	1	Low	10	0	0		Engineering stud CF&S mods
9	E+ SOURCE	(5) Photon Beam Dump Window	Q	Low	2	0	E/P	Low	2	0	Low	2	0			Move dumps by
10	E+ SOURCE	(6) Low gradient in warm capture sections at full power	Q	Med	?	0	E/P	?	?	0	?		Med	10		Longer Undulato
11	E+ SOURCE	(7&8) Low E+ Capture		Med	N/A	0	S5	N/A	N/A	0	N/A	N/A	Med	10	Q	Longer Undulato
12	E+ SOURCE	(9) Target Lifetime		Low	20	2	S5	Low	20	2	Low	20	Low	20		Redundant targe and facility
13	DR	(1) Secondary Emission Yield too high. >1.2	Q	High	200	100	S3	Low	200	20	VeryLow	200	VeryLow	200	Q	Return to two e+ after extensive R programs
14	DR	(2) Vacuum system design not robust		Med	20	5		Low	20	2	Low	20	VeryLow	60		Redesign vacum with more distril pumping
15	DR	(3) High impedance of vacuum chamber components		Med	10	3	S3	Low	10	1	Low	10	VeryLow	10		More engineerin DR re-optimizati
16	DR	(4) RF Margin	Q	Med	50	13		Low	50	5	Low	50	VeryLow	?	Q	Increase klystro system by 50%
17	DR	(5) Combination of concerns with RF and Wiggler layouts	Q	Med	100	25		Med	100	25	Med	100	VeryLow	10		Increase in numl and alcoves

risks notes Sheet3

Draw AutoShapes

Ready

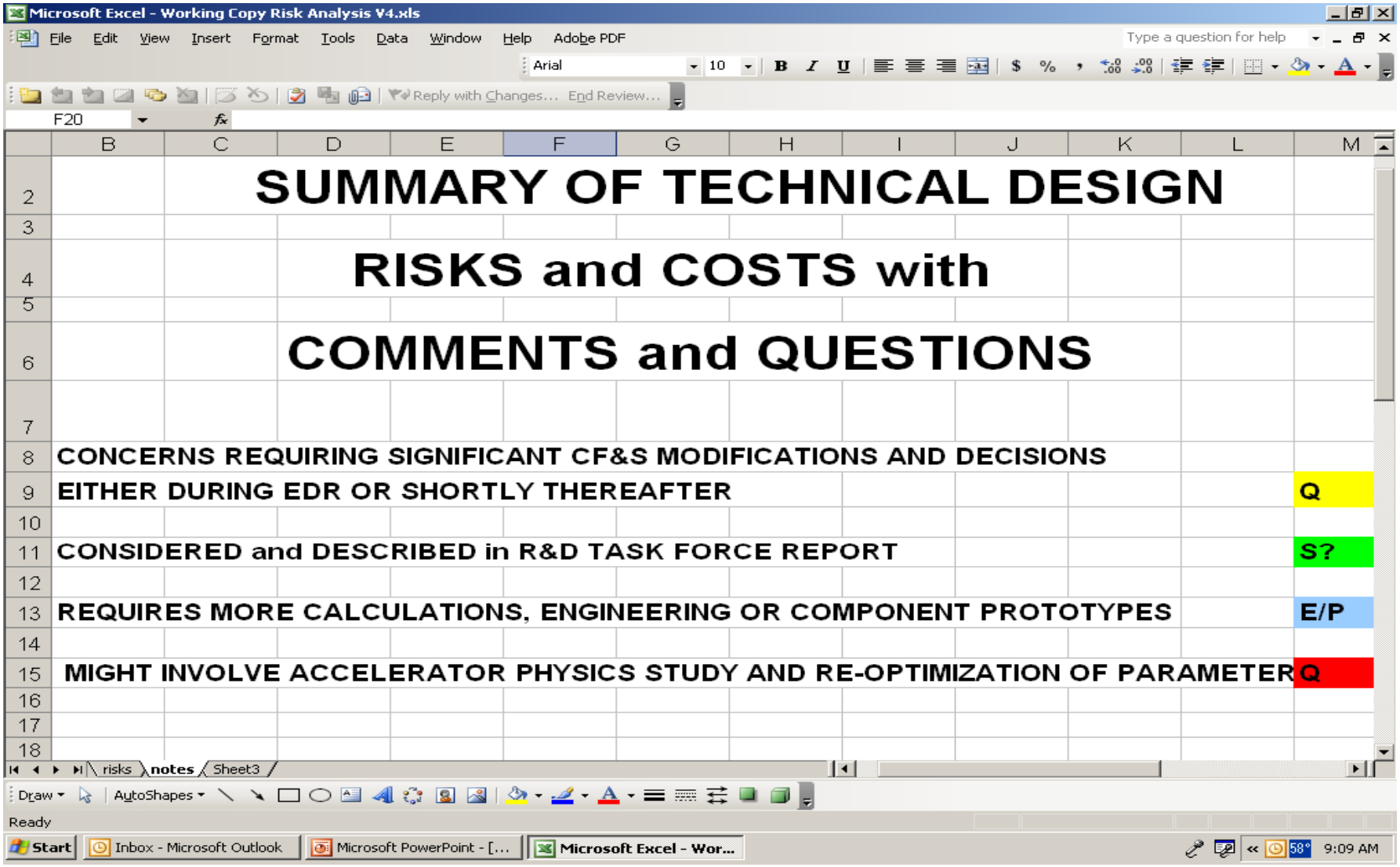
Start | Inbox - Microsoft Outlook | Re: ILC International Co... | Microsoft Excel - Wor... | Microsoft PowerPoint - [... | 8:52 AM

DEFINITIONS

These are part of the Excel Package

DEFINITIONS USED IN SPREADSHEET	
CONCERNS are the topics of concern for technical or design risk listed by area system, and using ILCDoc categories.	
TIMES	Are the decision points to address concerns. These may be determined by the impact on other systems and earlier than the time late to order components required for mitigating the concern. These are
	T0 is where we are today at the beginning of the EDR
	T1 is during or at the completion of the EDR
	T2 is during or at the completion of the proposal process, end of R&D and beginning of the bidding process.
	T3 is any time during the construction and commissioning process and before official project completion.
COST	The estimated cost of mitigation at T1,T2,T3. Does not imply that all necessary R&D is or must be completed by that time.
	For example one might decide to leave space for a component which is still under development.
	Units are M ILCU's
MITIGATION	A brief statement of the design change require for mitigating the concern.
COMMENTS and NOTES	Should include references to the more complete analysis of the concerns through mitigation that are prepared by area and global systems. Notes highlight any major impacts on other systems.
	There should be a reference to the detailed report from the area managers, etc, which will be in a section in ILCDoc?"
RISK	the definition of the risk levels is given in the table below.
risk %	

Definitions and Color Codes



RESULT of Top Ten SORT

Microsoft Excel - Working Copy Risk Analysis V5.xls

	A	B	C	D	E	F	G	H	I	O	P
1	AREA	5/5/2007		At T0				At time T1			MITIGATION
2		Concern		RISK	COST	r*C		RISK	COST		
13	Linac	(3) Design Gradient	Q	Med	600	150	S1	Med	600		Continuing R&D program
16	DR	(1) Secondary Emission Yield too high. >1.2	Q	High	200	100	S3	Low	200	Q	Return to two e+ ring design after extensive R&D programs
17	BDS	(10) Performance of FF Optics		Med	200	50	S4	Low	200	Q	Continuing studies at ATF2
28	DR	(5) Combination of concerns with RF and Wiggler layouts	Q	Med	100	25		Med	100		Increase in number of shafts and alcoves
32	RTML	(9) Bunch Compressor Phase Stability		Med	60	15		Low	60	Q	Measurements and ILC Parameter Optimisation
34	Linac	(5) Cryogenic Load Capacity		Med	60	15	S1	Med	60		Measurements on string tests?
39	DR	(4) RF Margin	Q	Med	50	13		Low	50	Q	Increase klystron/cavity system by 50%
40	BDS	(2) Beam Halo too large	Q	Med	50	13	S4	Med	50	Q	Install longer muon or magnetized walls
41	BDS	(3) Prompt Push Pull Operation		High	50	25	E/P	Med	50		Detail engineering
43	BDS	(4) Adequacy of Beam Dumps windows, shielding etc	Q	Med	50	13	E/P	Med	50		Longer tunnels, more shielding etc
47	BDS	(6) Collimation Performance	Q	Med	50	13		Low	50		Measurements and studies
54											
56											

Initial Conclusion from TRA

- We have a relatively conservative machine
- No ‘high-risk’ items that are not expected to be mitigated during EDR phase
  - **(warning: new problems may appear!)**
- risk×cost factors typically few % TPC
  - **Not tens of % or factors of 2!!**
- Useful tool which we will continue to develop