



TeV Upgrade Study

Nick Walker

AD&I WebEx Meeting

01.04.11

Brief summary of ALCPG'11 discussions.



ALCPG'11 References

Sunday 20.03

GDE plenary session on ultra-high gradient R&D

<http://ilcagenda.linearcollider.org/sessionDisplay.py?sessionId=2&confId=4572#20110320>

16:00	Cavity surface and material research <i>Erb Memorial Union</i>	COOLEY, Lance	16:00 - 16:25
	Cavity shape and configuration <i>Erb Memorial Union</i>	SAITO, Kenji	16:25 - 16:50
17:00	Cavity process and the general R&D plan/proposals <i>Erb Memorial Union</i>	GENG, Rongli	16:50 - 17:15
	Optimum ML cavity performance: gradient, Q0, and other ML parameters <i>Erb Memorial Union</i>	ADOLPHSEN, Chris	17:15 - 17:30

Monday 21.03

Joint plenary session on TeV upgrade

<http://ilcagenda.linearcollider.org/sessionDisplay.py?sessionId=0&confId=4572#20110321>

14:00	Linear Collider Physics at 1 TeV <i>Ballroom, Erb Memorial Union</i>	DAWSON, Sally	13:30 - 14:10
	Collider Upgrade Issues @ 1TeV <i>Ballroom, Erb Memorial Union</i>	WALKER, Nicholas	14:10 - 14:50
15:00	Detector Upgrade Issues for 1 TeV <i>Ballroom, Erb Memorial Union</i>	SIMON, Frank et al.	14:50 - 15:30

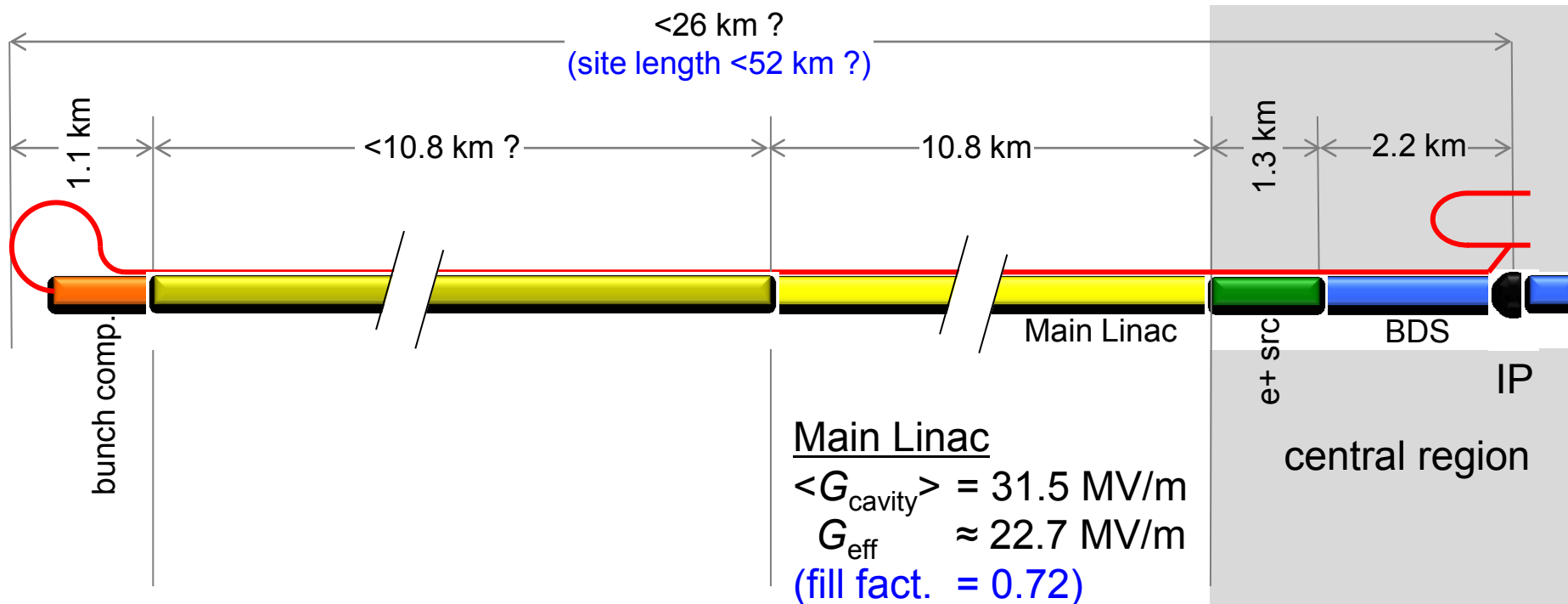


Why (now)?

- **ILCSC Parameters subcommittee report:**
 - “An initial center-of-mass (cms) energy up to 500 GeV with the ability to upgrade to 1 TeV”
 - Upgrade has always been part of ILC “requirements”
- **RDR: superficial treatment**
 - site length and available power as part of siting requirements.
 - BDS and main dump layout
 - *No parameter set or detail information!*
- **Cavity R&D progress**
 - Knowledge base and industrial capacity for baseline tech. now well established
 - Promising forward looking R&D results indicate promise of even-higher gradients (\rightarrow 60 MV/m)
 - Post-TDP R&D
- **LHC results**
 - Physics landscape changing almost weekly!
 - ILC design (scope) must be flexible in 2013
- **Note: 200-500 GeV still primary TDR focus**
 - TeV study will be only conceptual

Must do
more for
TDR

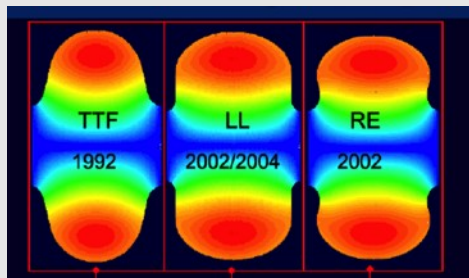
From 500 to 1000 GeV



Snowmass 2005 baseline
recommendation for TeV upgrade:

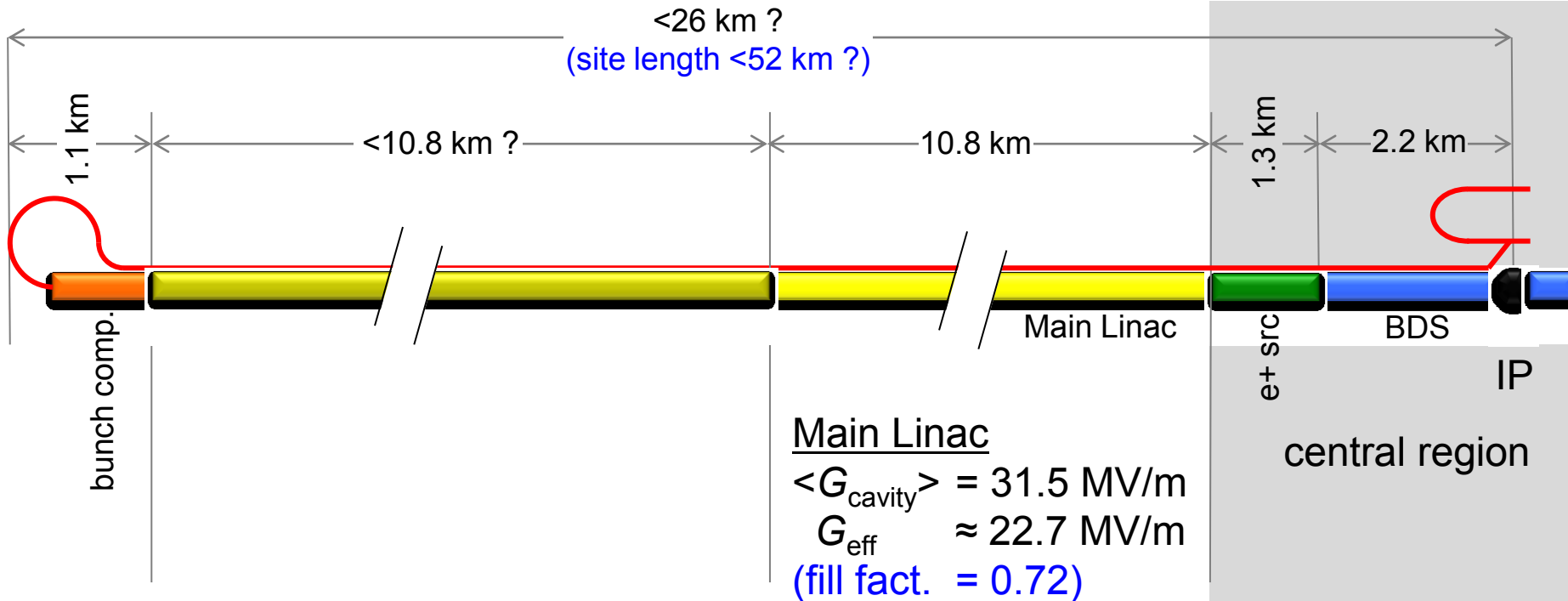
$$G_{\text{cavity}} = 36\text{ MV/m} \quad \Rightarrow \quad 9.6\text{ km}$$

$$(\text{VT} \geq 40\text{ MV/m})$$



Based on use of
 low-loss or re-entrant cavity
 shapes

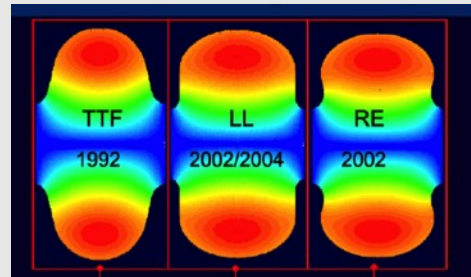
From 500 to 1000 GeV



Sn
rec
G
(V

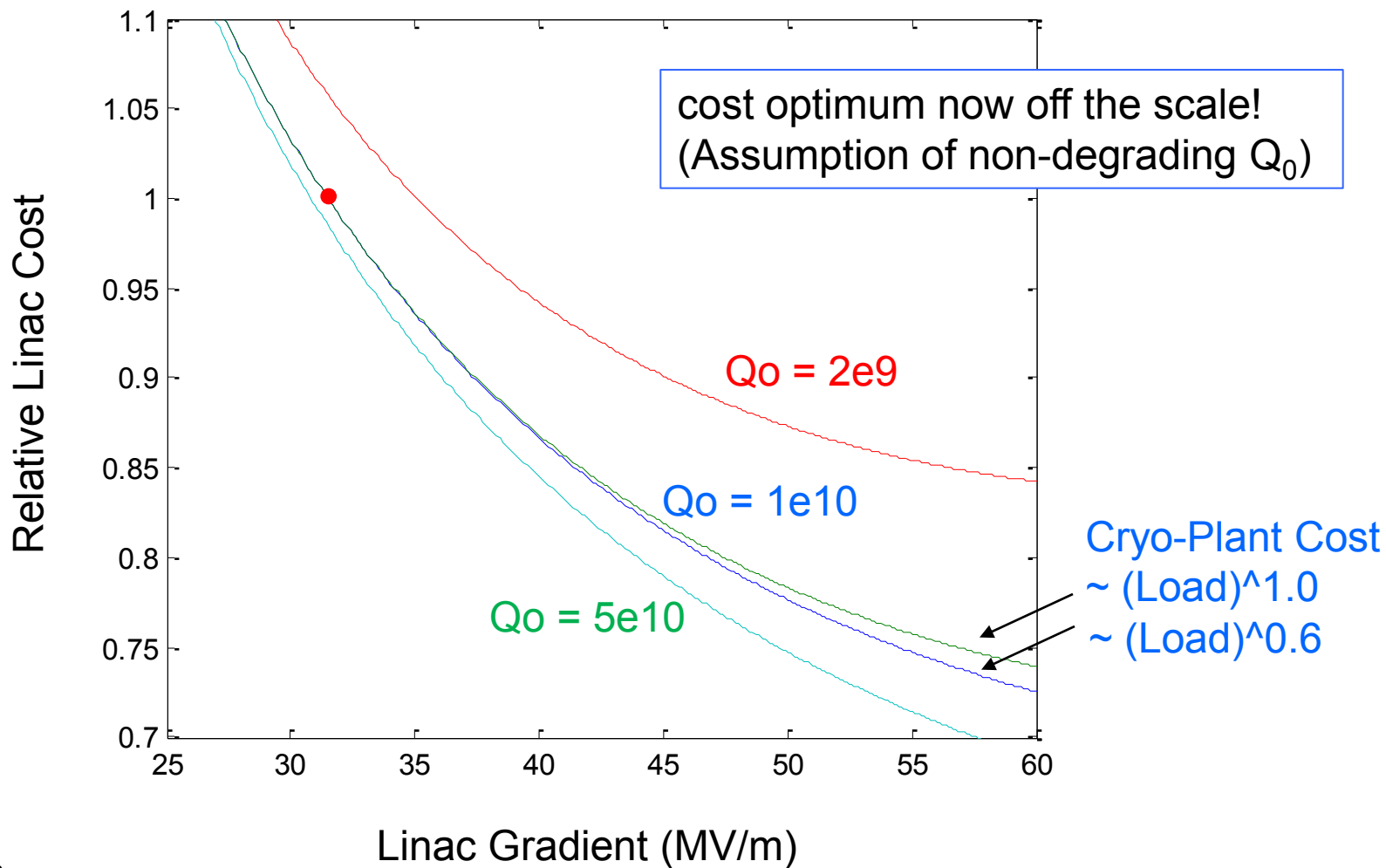
**2011 Update:
40-60 MV/m ??**

grade:
9.6 km



Based on use of low-loss or re-entrant cavity shapes

Cost Scaling

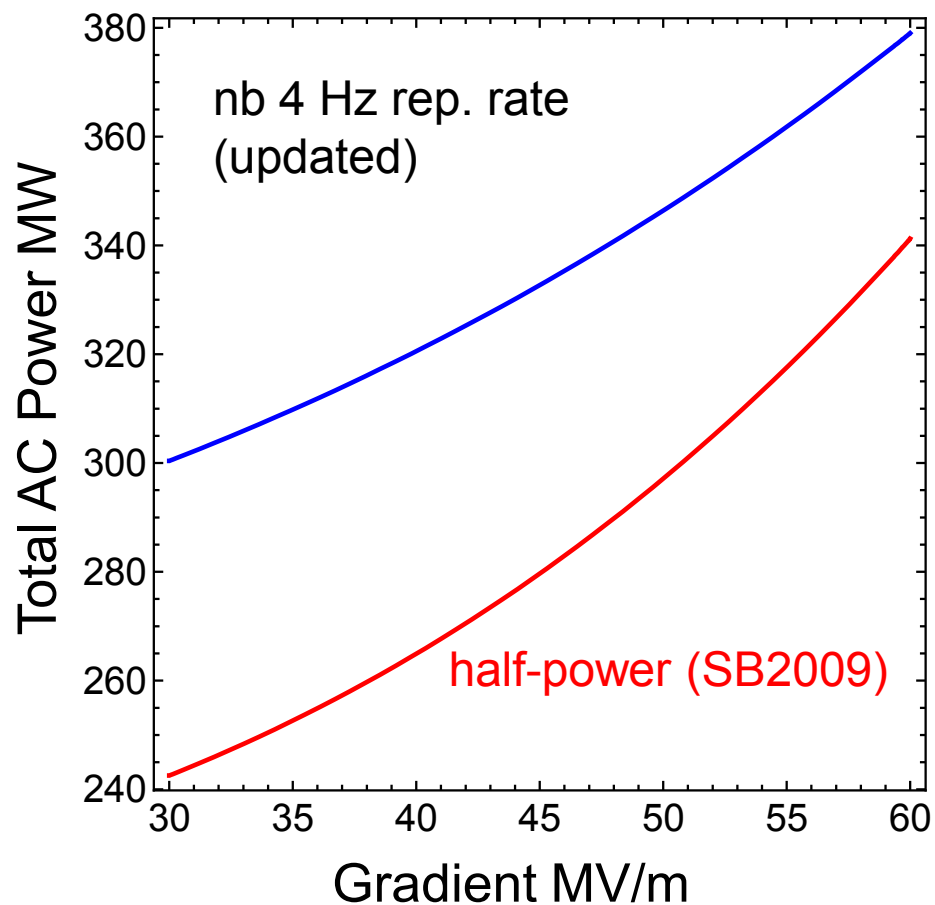
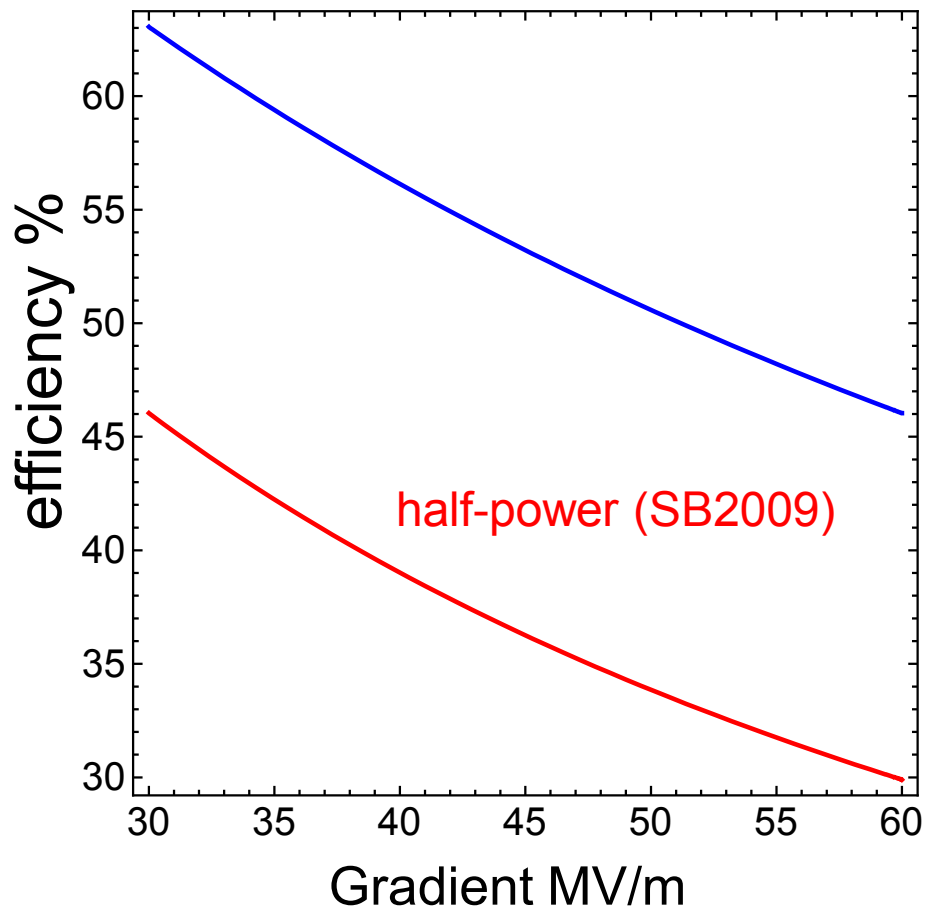


C. Adolphsen

<http://ilcagenda.linearcollider.org/sessionDisplay.py?sessionId=2&confId=4572#20110320>



Efficiency and Power



Simple scaling – needs more detailed analysis



1 TeV Tentative Parameters

Collision rate	f_{rep}	4 Hz
Number of bunches	n_b	2625
Bunch population	N_b	2×10^{10}
Bunch separation	Δt_b	356 ns
Pulse current	I_{beam}	9.0 mA
RMS bunch length	σ_z	0.3 mm
RMS energy spread (e-, e+)	$\Delta p/p$	0.105, 0.038
Polarisation (e-, e+)	P_{\cdot}	80, 22 %
Emittance (linac exit)	$\gamma \epsilon_{x,y}$	10, 0.035 μm
IP beta function	$\beta_{x,y}^*$	30, 0.3 mm
IP RMS beam size	$\sigma_{x,y}^*$	554, 3.3 nm
Vertical disruption parameter	D_y	19.2
Luminosity	L	$2.70 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$
Fraction of luminosity in top 1%	$L_{0.01}/L$	63.5 %
Average energy loss	δE_{BS}	4.9 %
Number of pairs per bunch crossing	N_{pairs}	169
Total pair energy per bunch crossing	E_{pairs}	1084 TeV

Current “official” parameter set in EDMS*.

Should still be considered tentative, pending review and further study.

Understanding (and updating) these parameters is our job for the next ~6 months.

negotiation!

* EDMS Doc ID: D*925325

http://ilc-edmsdirect.desy.de/ilc-edmsdirect/file.jsp?edmsid=*925325&fileClass=ExcelShtX



The TDR Upgrade Study

- **Begins this workshop (next slide)**
- **Limited resources means only a very conceptual study**
 - design parameters
 - scaling of 500GeV designs
 - Working assumptions on ML technology
- **SCRF Tech. will define forward looking R&D**
 - beyond 2012
 - upgrade scenarios can be ‘aggressively optimistic’ at this stage.
- **An AD&I activity – including physics & detector**
- **Proposal to produce a White Paper by early 2012**
 - Will eventually be part of TDR
- **Primary editors (tentative – needs discussion):**
 - 3 PMs
 - 1 Integration
 - 1 Parameters
 - 3 reps from physics and detectors (2 detectors + theory)
 - 1 cost & schedule

Note that 500GeV remains our primary focus for the TDR

Expected to drive the study and write the White Paper



Next Steps

- **Each TAG needs to produce a comprehensive list of issues/questions**
 - Report back AD&I meeting 25.05.2011 (two months)
- **Formation of the White Paper task force**
 - hopefully in next few weeks
- **Early initial review of top-level parameter(s)**
 - working assumptions for remainder of studies
 - Also by 25.02.2011
- **Identification of key studies and deadlines for reports**
 - integrated into monthly AD&I meetings
- **Outline of white paper and writing assignments**