

Status of the DCR Detector Chapter

Detector Concept Report for the ILC

Part I

Detector Concept Report

Version Built November 7, 2006

Editors: T. Behnke
C. Damerell
J. Jaros
A. Miyamoto

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7 November 2006

What's the DCR?

- Companion document to GDE's Reference Design Report (RDR) which outlines baseline and costs for the ILC machine.
- DCR has three pieces: Physics (50p)+Detector(150p)+Executive Summary
- DODs (Detector Outline Documents) provide much of the material for the Detector DCR
- WWS-OC oversees writing the DCR
 - Overall Editorial Board
 - Brau, Richard, Yamamoto
 - Physics Case for ILC Editors
 - J. Lykken, M. Oreglia, K. Moenig, A. Djouadi, S. Yamashita, Y. Okada
 - ILC Detectors and Costs Editors
 - A. Miyamoto, T. Behnke, J. Jaros, C. Damerell

More about the DCR

- The RDR and DCR are due at the end of 2006
- The DCR must make a compelling case for ILC physics and detectors

- The Detector DCR will

*make the case that detectors can do the ILC physics
show that detector designs are within reach
note that advances in detector technology are needed
show the progress on detector R&D
ballpark detector cost
argue for 2 detectors*

- Spirit of the DCR
***cooperative among concepts,
not a vs b vs c vs d vs...
supported by the international ILC detector community***

DCR History (short course)

- WWS-OC requested Detector Outline Documents from the Concept Studies as input for the newly formed R&D Panel. It planned a subsequent document, the DCR, to make the general ILC Detector/Physics case.
- First vision of Detector and Physics DCRs presented at Bangalore LCWS2006. Physics and Detector Editors met and coordinated documents.
- Detector DCR goals and outline presented at Vancouver VLCWS06. Coordination with RDR began.
- Editors invited authors, detailed chapter outlines, and began writing.
- Rough drafts prepared for Valencia ILCWS06. Discussion of costs and next steps to take place there.

The Outline of the DCR

A. Miyamoto's Talk
VLCWS06

-
1. General Introduction
 2. Challenges for Detector Design and Technology
 3. Introduction to the Detector Concepts
 4. MDI Issues
 5. Subsystem Designs and Technologies
 6. Sub-Detector Performance
 7. Integrated Physics Performance
 8. Why We need 2 Detectors
 9. Detector Costs
 10. Future Options
 11. Next Step
 12. Conclusion

Rough Drafts Available ✓

1. General Introduction
2. Challenges for Detector Design and Technology ✓
3. Introduction to the Detector Concepts ✓
4. MDI Issues ✓
5. Subsystem Designs and Technologies
6. Sub-Detector Performance ✓
7. Integrated Physics Performance
8. Why We need 2 Detectors ✓
9. Detector Costs
10. Future Options ✓
11. Next Step
12. Conclusion

Chapter by Chapter Status

1. General Introduction

- 3-5 pages, by Editors
- The Challenge of ILC Physics for Detectors
- Goals of the Document
- Organization of the DCR

Chapter by Chapter Status

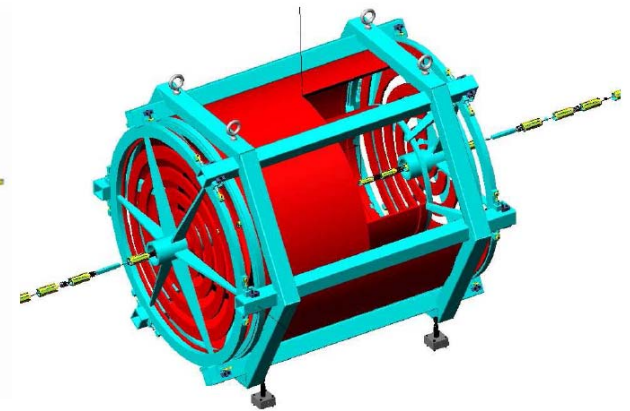
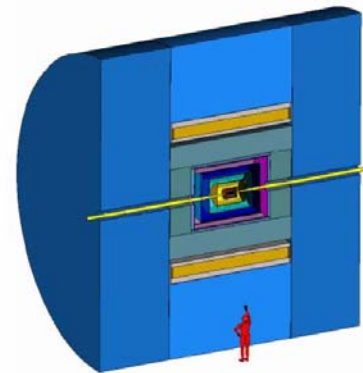
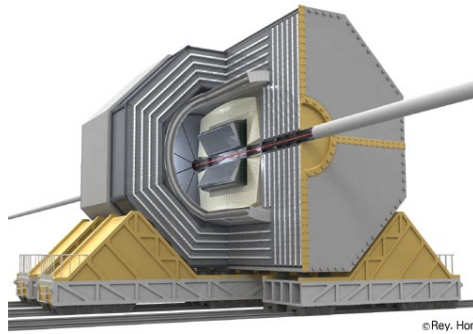
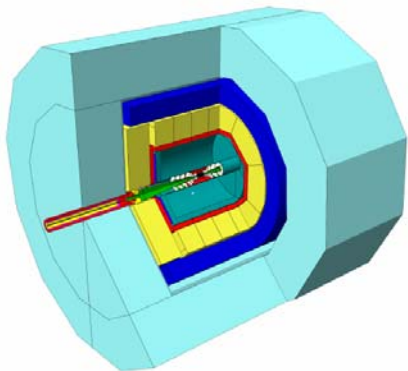
√ 2. Challenges for Detector Design/Technology

- 10-15 pages, by T. Barklow, K. Fujii, W. Lohrman, H. Videau + Editors
- **Cal Jet Mass Resolution** must resolve W, Z, and H; Hermeticity needed for SUSY studies; good lepton ID crucial.
Pushing to $30\%/ \sqrt{E}$ resolution worth 40% more luminosity, added physics reach, sensitivity to the unexpected.
- **Tracker** needs fully efficient pattern recognition over full Ω , minimal material for PFA and lepton ID.
 $\Delta p/p^2 < 5 \times 10^{-5}$ improves Higgs recoil mass determination, SUSY mass determinations, and direct measurements of E_{cm} .
- **VXD Impact Parameter Resolution** $\Delta\delta \sim 5 \oplus 10/p \sin^{3/2} \theta$ [μm] needed for precision Higgs BR measurements and quark charge determination.
Boosting readout speed to survive ILC backgrounds essential.
- **Beamcal** must be extremely rad hard, fast, highly segmented, and fully efficient for high energy electrons.

Chapter by Chapter Status

√ 3. Introduction to Detector Concepts

- ~5 pages/concept, by Concept Coordinators + Editors
- Motivation, rationale, and overview of designs for LDC, GLD, SiD, and 4th
- Progress on system integration and R&D
- Concepts provide a forum for MDI issues before GDE



November 7, 2006
Valencia

Status Detector DCR

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Chapter by Chapter Status

✓ 4. MDI Issues

- 10-15 pages by MDI Panel + Editors
- Interaction Region Layout
 - 14 mr crossing angle solution
 - Masking and Luminosity Measurement
 - “Anti-Detector Integrated Dipole”
 - Polarimetry and Energy Spectrometry
- Backgrounds and their Impact on Detectors
 - Beamstrahlung induced (pairs, gammas, neutrons)
 - Synchrotron radiation
 - Muons from beam collimation
- Detector Integration
 - Surface Assembly
 - Installation and Access
 - Push-Pull?

Chapter by Chapter Status

5. Subsystem Designs and Technologies

- 10-15 pages, by R&D Panel plus experts (Damerell, Eckerlin, Frey, Weerts, Lohrman) + editors
- Subsystem designs, status of R&D, additional work required
- Covers the major subsystems
 - Beamcal
 - Vertex Detector
 - Tracking TPC/Si Hybrid
 - Si Monolithic
 - Ecal
 - Hcal
 - Solenoid
 - Muon System
 - LEP
 - Electronics and DAQ

Chapter by Chapter Status

√ 6. Sub-Detector Performance

- 10-15 pages by Concept Representatives + Editors
- Philosophy: Sample full simulation performance studies from the Concepts. Demonstrate performance goals are reached.
- Performance Studies
 - Material budgets
 - Tracker: Pattern Recognition, Momentum Resolution, Ω
 - Calorimeter Single Particle Response vs Energy
 - PFA Algorithms and Results at the Z and Higher Energies *
 - VXD Impact Parameter Resolution, b/c tagging, quark Q *
 - Muon ID Efficiency and Purity
 - Beamcal Electron ID Efficiency vs Beam Parameters *

* More Full Simulation Needed

Chapter by Chapter Status

7. Integrated Physics Performance

- ~10 pages by Analysis Experts + Editors
- Original Philosophy: Physics analysis utilizing full MC. Confirm earlier fast MC studies!
- **We need new results here at Valencia!**
- Backup Plan: Describe Status of full simulation studies, show preliminary results.

Chapter by Chapter Status

√ 8. Why We Need 2 Detectors

- 3-5 pages by 2IR Task Force + Editors
- What 2 Detectors Give ILC
 - maximum scientific opportunity
 - essential cross-checks and scientific redundancy
 - complementarity
 - competition
 - efficiency, reliability, and insurance
 - ...as shown by history

Chapter by Chapter Status

9. Detector Costs

- ~5 pages by WWS Costing Panel + WWS-OC
- Methodology and GDE Costing Philosophy Described
- Based on cost estimates from Detector Concepts
- Discussions at Valencia -> “Representative Cost”

Chapter by Chapter Status

✓ 10. Future Options

- 5-10 pages by K. Moenig, J. Gronberg + Editors
- Philosophy: Detectors and IRs are optimized for e+e- physics, but can be modified in the future if LC 500 or LHC results provide motivation.
- Physics and Detectors for Giga Z
- Physics and Detectors for Gamma-Gamma

Chapter by Chapter Status

11. Next Steps

- 3 pages by WWS-OC + Editors
- Continuing/Expanding Detector R&D
- Detector Design Optimization
- Roadmap to TDR
 - CDR?
 - Selecting Detectors for ILC?
 - Preparation of TDRs?

Missing Pieces

- Introduction and Conclusions...
...will come post Valencia
- Subsystem Designs and Technologies
...under construction, ready soon.
- Integrated Physics Performance...
...depends on input **at** Valencia. We are still hoping for examples of benchmark analyses based on full MC
- Detector Costs...
...depends on meeting of the concepts **at** Valencia and WWS OC strategy for generating a “representative” cost
- Next Steps...
...depends on how ILCSC views the detector roadmap **at** Valencia
- Executive Summary...
... awaiting DCR rough draft! Will come post Valencia.

Detector DCR Wiki

(thanks Akiya)



dcrdet:dcrdet_home ILC WIKI

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DCR - Detector Chapter

DCR Detector Section page

Proposed outline

- Introduction
- Challenges for Detector Design and Technology
- Introduction to the Detector Concepts
- MDI Issues
- Subsystem Designs and Technologies
- Subsystem Performance
- Integrated Physics Performance
- Why we need 2 IRs and 2 Detectors
- Detector Costs
- Future Options
- Next Step
- Conclusion

Editors

- ties.behnke@desy.de
- C.J.S.Damerell@rl.ac.uk
- john@slac.stanford.edu

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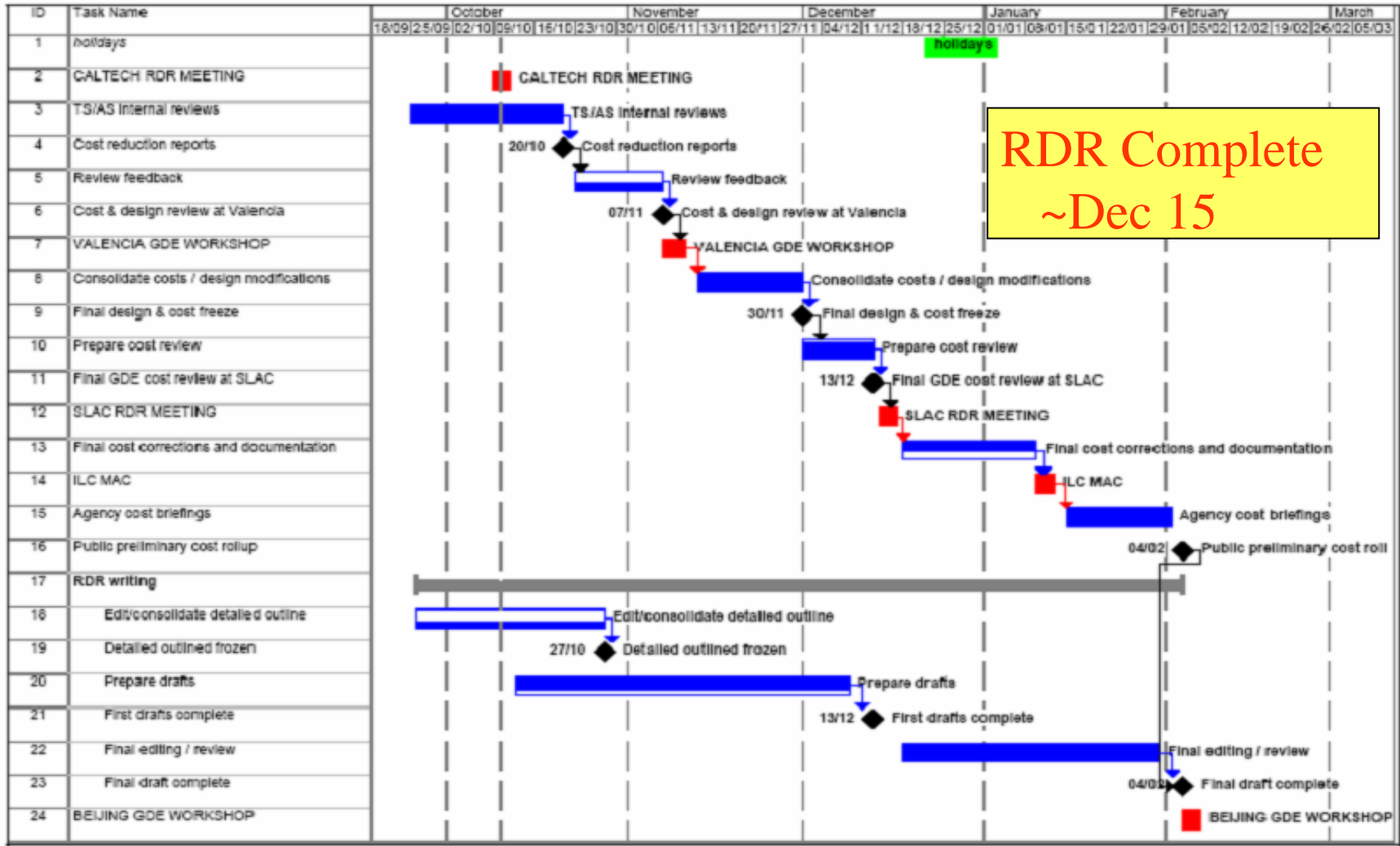
- DCR - Detector Chapter
- DCR Detector Section page
- Proposed outline
- Editors
- Presentations

Rough Drafts Available Now!
(thanks Ties)

Caveat: Drafts are evolving rapidly. It's too early for comments.

http://www.linearcollider.org/wiki/doku.php?id=dcrdet:dcrdet_home

Schedule is Driven by RDR



Finishing the DCR

- Refine/Edit Rough Drafts
 - Add Missing Pieces
 - Complete Draft DCR
 - Solicit Comments/Final Edits
 - DCR Complete
- Thru November
- Early December
- Thru December
- End December

Signing the DCR

- The ILC Physics/Detector Community will be invited to sign the completed document upon its completion.
- Register on indico.desy.de
<https://indico.desy.de/conferenceDisplay.py?confId=146>
- Set the Author list by ACFA Beijing ILCWS
- Go public at Beijing

DCR Status in Sum

- Good Start for Valencia
- Lots to do while we're here: costs, next steps, integrated physics performance,...
- But miles to go before we sleep.