

WWS Detector R&D

Report from the WWS R&D panel

H. Weerts
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For the WWS R&D panel:

*J-C. Brient, C.J.S. Damerell (chair), R. Frey, HongJoo Kim,
W. Lohmann, D. Peterson, Y. Sugimoto, T. Takeshita, H. Weerts*

WWS ILC Detector R&D--outline

- ❑ WWS Detector R&D Panel and charge
- ❑ Addendum to charge, and action plan from Panel
- ❑ Input from detector R&D groups
- ❑ The report and findings
- ❑ Missing Topics
- ❑ Longer term plans
- ❑ Conclusions

ILC Detector R&D Panel and charge

- 9 members appointed shortly before LCWS 2005 by WWS-OC, 3 from each region:

- Jean-Claude Brient (Ecole Polytechnique, France)
- Chris Damerell (RAL, UK) chair
- Ray Frey (U Oregon, USA)
- HongJoo Kim (Kyonpook National U, Korea)
- Wolfgang Lohmann (DESY-Zeuthen, Germany)
- Dan Peterson (Cornell U, USA)
- Yasuhiro Sugimoto (KEK, Japan)
- Tohru Takeshita (Shinsu U, Japan)
- Harry Weerts (Argonne Nat. Lab., USA)

- Our website:

<https://wiki.lepp.cornell.edu/wws/bin/view/Projects/WebHome>

Thanks to Cornell & Dan Peterson
Great service for ILC community

Charge for WWS LC Detector R&D Panel 13th Jan 2005

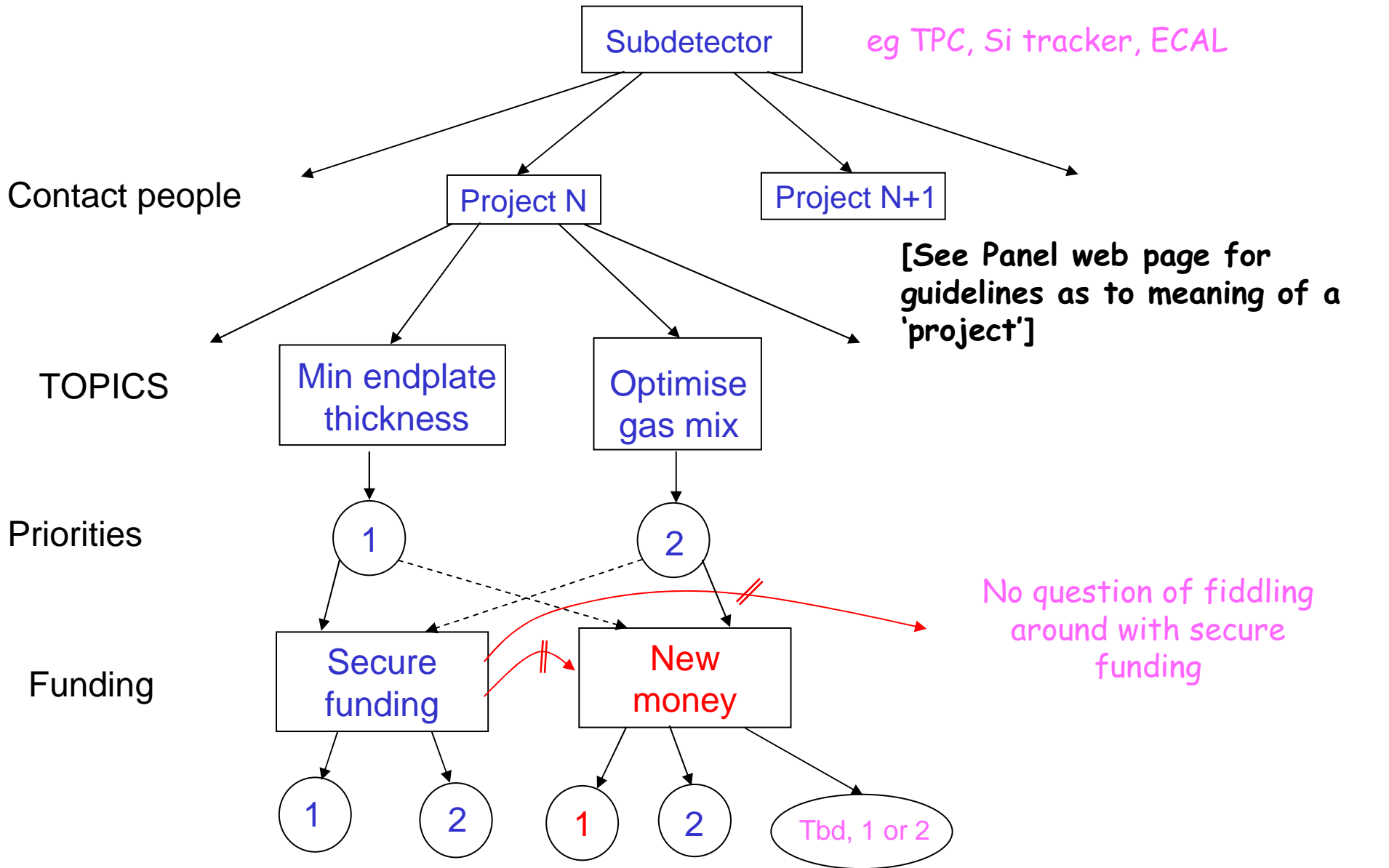
1. Create and maintain a register of ongoing R&D programs relevant for LC experiments, which should include R&D goals and schedules, names of participating institutions and their responsibilities, relevant publications, level of support, and web-links to current work. The R&D programs should include not only those required for the proposed detector concepts, but also those needed for measurements of luminosity, energy, and polarization (LEP) and those associated with the masking system, possible beam EMI, and other areas which may overlap with MDI. The registration of such MDI projects should be performed jointly with the MDI panel. Maintain a central web repository for this information, and update it regularly.
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5. Continue these activities, and whatever further activities are judged important to prepare needed R&D for LC detectors, until a global lab assumes these responsibilities

Addendum to charge, and action plan from Panel

- Addendum to our charge, given to us by ILCSC on 27th September (following meeting with Barry Barish et al on 18th August in Snowmass):
- 'At the request of the chair of the ILCSC,
Produce a written report by the end of 2005 which **identifies and prioritises the topics and areas of detector R&D which need immediate support**. Inputs to this should be collected both from the detector concept teams and from all the detector R&D collaborations and groups interested, via their contact persons with the Detector R&D Panel. **Individual proposals should not be identified**. This report will initially be submitted to the WWS-OC, and then passed to the ILCSC.'
- Could lead to increased funding for detector R&D in some regions as early as 2006
- Given this timescale, we needed to move fast ...

- ❑ Action plan, unanimously agreed by our Panel on 11th October:
- ❑ A **topic** is typically a body of work within *a subdetector*,
eg the minimisation of endplate thickness within *the TPC subdetector*
- ❑ **Priority 1:** Results needed urgently for proof of principle, to significantly enhance physics capability and/or reduce costs. Results needed in order to prepare LOI at end of 2008 (or as late as 2010 for lower-cost detector systems, such as BEAMCAL, LUMICAL, vertex detector)
- ❑ **Priority 2:** Essential R&D, but not a potential showstopper, so results post-LOI will be OK. Or, R&D with goals on a longer timescale than ILC startup, eg for upgrade to 1 TeV
- ❑ Some Priority 2 items will eventually evaporate, for subdetector options which aren't incorporated in an approved overall detector (e.g. at least 8/10 of vertex detector technology options)
- ❑ To first order, our Panel is simply collecting assessments from our wise contact people. If we have doubts about priorities suggested or sums estimated, we will resolve our differences in discussion with them.

Example



Our job: Publish needs for each *Priority 1* topic

Input from detector R&D groups

- ❑ Dan Peterson and colleagues at Cornell U have set up and maintained an **excellent** website for the R&D reports
- ❑ Since LCWS2005, Panel has worked via e-mail, phone calls and personal contacts, to establish **one contact person per detector collaboration (or per group, if preferred by the groups)**, and to help that person complete the register for their project
- ❑ Response rate was slow till end of Snowmass, because we had 'no carrots and no sticks'
- ❑ *This has changed with the Addendum to our charge. Groups have at last recognised the disadvantages of being left out ...*
- ❑ **Several projects were added in November.....**

Funding Inquiry Form has been sent to all our contact people (~40 at Snowmass, now ~70)

- ❑ Asked them to define topics as:
 - Priority 1
 - Priority 2

- ❑ For their Priority 1 work only, asked about level of 'established' support for next 3 years (alternatively, support in 2005) broken down as:
 - 'Equipment' (meaning all non-staff costs) in \$ or €
 - Academics
 - Students
 - Support staff } in FTEs

- ❑ Asked about additional support needed (2006-2008 or 2006-2010) to achieve their Priority 1 goals

- ❑ Requested a separate form for each *funding country* - NOT funding agency! (with EU considered to be a separate country)

- ❑ *Panel members then spoke to (almost) all our contact people by phone*

- ❑ We introduced 'escape clauses' for multinationals, those unable to guess their budget for next year, those with problems separating academics and support staff, people with rivals on our Panel, etc. *All our contact people were satisfied, we hope*

- ❑ Deadline for return of completed forms, and for input of Research Statements to our web page, was 25th November 2005, one week after ECFA workshop in Vienna.

Example of Web pages

Register of Detector R&D Projects

- WWS Detector R&D Panel -

- [Home](#)
- [Contact Instruction](#)
- [LEP/MDI](#)
- [VTX](#)
- [TRACK-Si](#)
- [TRACK-GAS](#)
- [CAL](#)
- [MUON](#)
- [PID](#)
- [DAQ](#)
- [SOLENOID](#)
- [GLD](#)
- [LDC](#)
- [SiD](#)
- [CHANGE PASSWORD](#)

Project Links: Calorimetry (ECAL, HCAL, forward)

Individual Projects

- Annecy le Vieux (LAPP), University of Oregon, SLAC
(incomplete) [Conceptual Design for a Si/W Electromagnetic calorimeter](#)
- Argonne National Laboratory, Boston University, University of Chicago, Fermilab, IHEP Protvino, University of Iowa (affiliated with CALICE)
[Digital Hadron Calorimeter with RPCs](#)
- Birmingham U., Cambridge U., LPC-Clermont, LPSC-Grenoble, Kangnung NU., London Imp. Coll., London Univ. Coll., London RHUL, Manchester U., Orsay LA Palaiseau LLR, Palaiseau PICM, IP-Prague, Moscow State U., Rutherford RAL, Seoul Yonsei U., Suwon Sungkyunkwan U. (affiliated with CALICE)
(incomplete) [Highly segmented electromagnetic calorimeter](#)
- University of Colorado at Boulder
(incomplete) [Offset Tile Calorimetry R&D](#)
- DESY-Zeuthen
(incomplete) [R&D for the TESLA-Detector: Instrumentation of the very forward region](#)
- Fermilab
(incomplete) [Optimization of the ILC calorimeter for jet-jet mass resolution](#)
- The University of Iowa
(incomplete) [Establishing a Particle Flow Algorithm with the SiD Calorimeter for ILC](#)
- University of Kansas
[Investigation of ECAL Concepts Designed for Particle Flow](#)
- KEK, Kobe, Konan, Niigata, Shinshu, Tsukuba, Kyungpook, Seoul, Sunkyunkwan, Mindano, JINR
(incomplete) [GLD-CAL](#)

- [Home](#)
- [Contact Instruction](#)
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- [SiD](#)
- [CHANGE PASSWORD](#)

(incomplete, missing: funding)

Project: GLD-CAL

Contact: Kiyotomo Kawagoe (Kobe University, Japan) [mail](#)

System: Calorimetry

Assisting Panel Member: Tohru Takeshita

Participating Institutions: - ([participating individuals](#))

- KEK
- Kobe University
- Konan University
- Niigata University
- Shinshu University
- Tsukuba University
- Kyungpook National University
- Seoul National University
- Sunkyunkwan University
- Mindano State University
- JINR

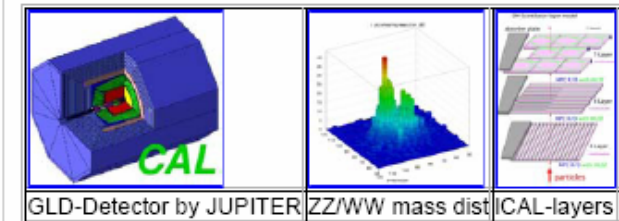
Detector Concept Affiliation: GLD

web page : <http://ppwww.phys.sci.kobe-u.ac.jp/~kawagoe/gldcal/>

recent presentations/publications:

- Miyata, presentation at Stanford, March 2005: [pdf](#)

publicity graphics



[Research Statement](#)

[Funding](#)

Layout of the ILC Detector R&D Panel Report, completed ~ 6th January 2006:

❑ Executive Summary

❑ Detector Systems introductions

- LEP (Ray Frey, ...)
- Vertexing (Chris Damerell, ...)
- Tracking - gaseous (Dan Peterson, ...)
- Tracking - silicon (Harry Weerts, ...)
- Calorimetry (Wolfgang Lohmann, ...)
- Muon tracking (Harry Weerts, ...)
- PID (Chris Damerell, ...)
- DAQ (Chris Damerell, ...)
- Electromagnetic Interference (Chris Damerell, ...)
- Solenoid (Harry Weerts, ...)

plus 1 page per project: information including 'Research Statement' contributed by each contact person to the Panel website

❑ Current funding levels and urgent needs for future

- To be presented by topic and by country, not by project. Report lists the projects that have identified their needs. Those that have **not**, are under the heading:

[No information provided; assumed to have no requirements for future support]

❑ Contact people were sent the draft report in December. Those who provided nothing were given a couple of days to provide input, if they wished to

❑ By this means, tried for a full response from the community

The report

Provides list of priority 1 R&D topics

ILC Detector Research and Development Status Report and Urgent Requirements for Funding

5th DRAFT 3rd January 2006

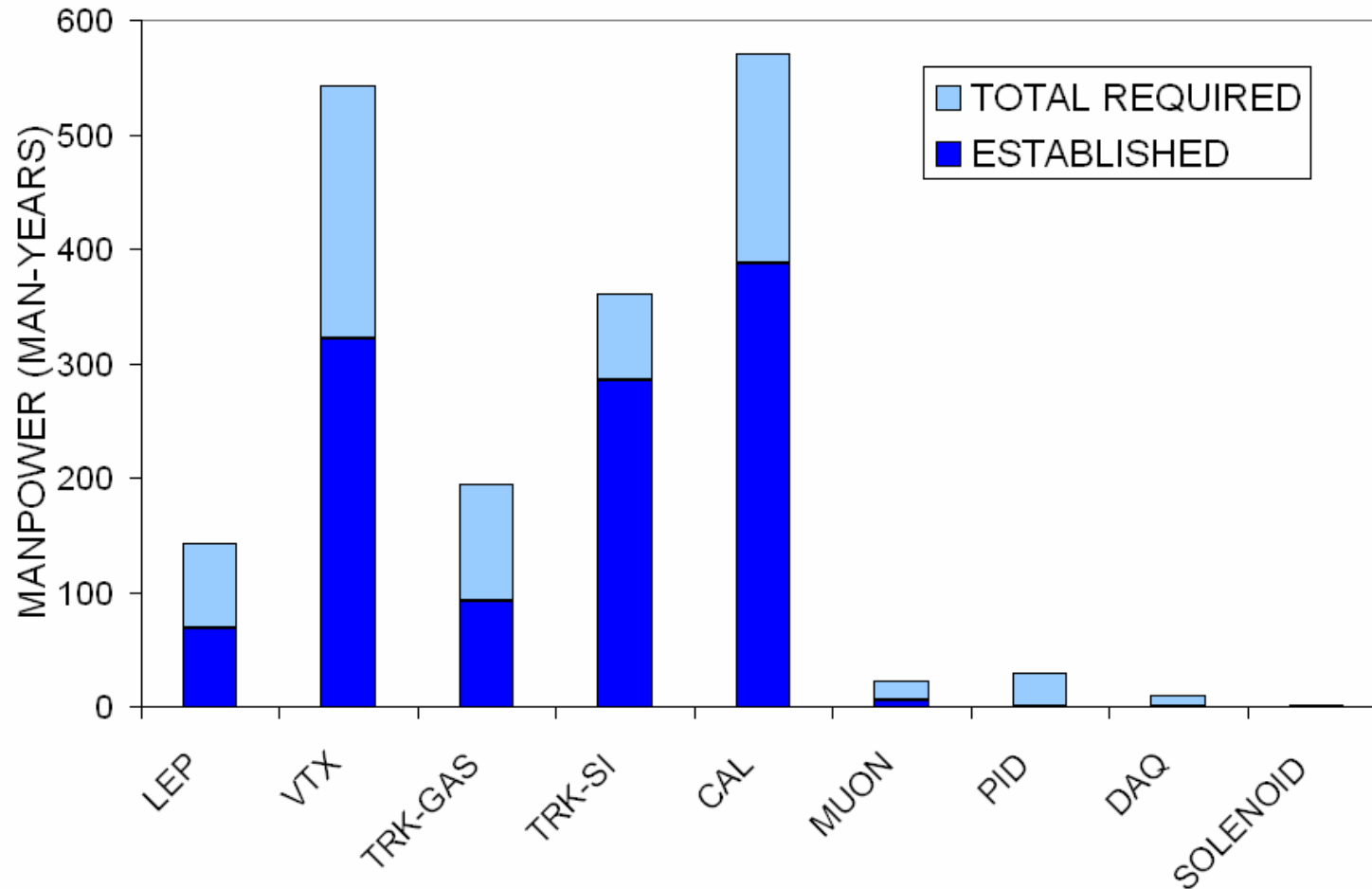
Editors: J-C Brient¹³, CJS Damerell⁴², R Frey³⁹, HongJoo Kim²⁷, W Lohmann¹², D Peterson¹¹, Y Sugimoto²⁵, T Takeshita⁴⁵, H Weerts²

Contributors: L Andricek³⁶, M Barbi⁴¹, M Battaglia²⁹, T Bergauer⁵¹, G Bonvicini⁵², S Boogert⁴⁹, D Bortoletto⁴⁰, J Brau³⁹, J-C Brient¹³, D Chakraborty³⁷, P Checchia¹⁹, D Christian¹⁴, P Colas⁶, W Cooper¹⁴, P Dauncey¹⁶, M Demarteau¹⁴, M Dixit⁴, Z Dolezal⁸, G Eckerlin¹², R Frey³⁹, J Goldstein⁴², J Hauptman²¹, M Hildreth³⁸, P Karchin⁵², D Karlen⁵⁰, Y Karyotakis²⁸, K Kawagoe²⁶, R Lipton¹⁴, J List¹², W Lohmann¹², U Mallik²⁰, T Maruyama⁴⁴, K Moffeit⁴⁴, U Nauenberg⁹, T Nelson⁴⁴, H Niemiec¹, Y Onel²⁰, A Para¹⁴, H Park²⁷, R Partridge³, D Peterson¹⁰, M Piccolo¹⁸, J Repond², K Riles³⁴, A Savoy-Navarro³⁰, L Sawyer³¹, D Schulte⁷, B Schumm³², F Sefkow¹², R Settles³⁵, D Su⁴⁴, Y Sugimoto²⁵, A Sugiyama⁴³, E von Toerne²⁴, E Torrence³⁹, G Varner¹⁵, I Vila⁵, S Wagner⁹, A White⁴⁶, R Wigmans⁴⁷, G Wilson²³, R Wilson¹⁰, M Winter²², H Yamamoto⁴⁸, F Zomer¹⁷

1	AGH, U Science and Technology, Poland	28	LAPP Annecy, France
2	Argonne National Lab, USA	29	Lawrence Berkeley Natl Lab, USA
3	Brown U, USA	30	LPNHE, U Paris 6, France
4	Carleton U, Canada	31	Louisiana Tech U, USA
5	Instituto Fisica de Cantabria, Spain	32	U California Santa Cruz, USA
6	CEA/DAPNIA Saclay, France	33	U Michigan, USA
7	CEBN, Switzerland	34	Michigan State U, USA

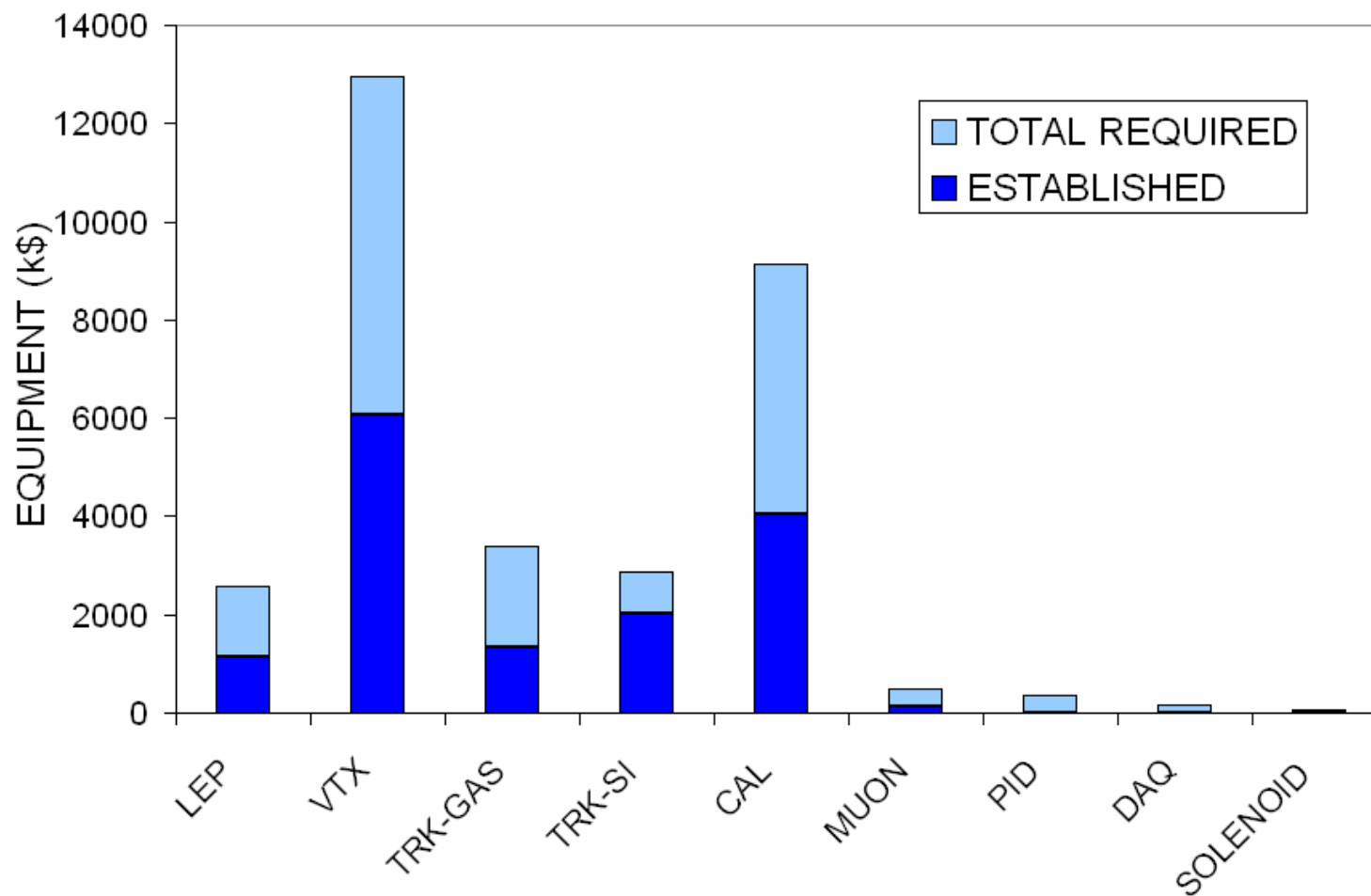
66 pages

Resources: manpower by subsystem

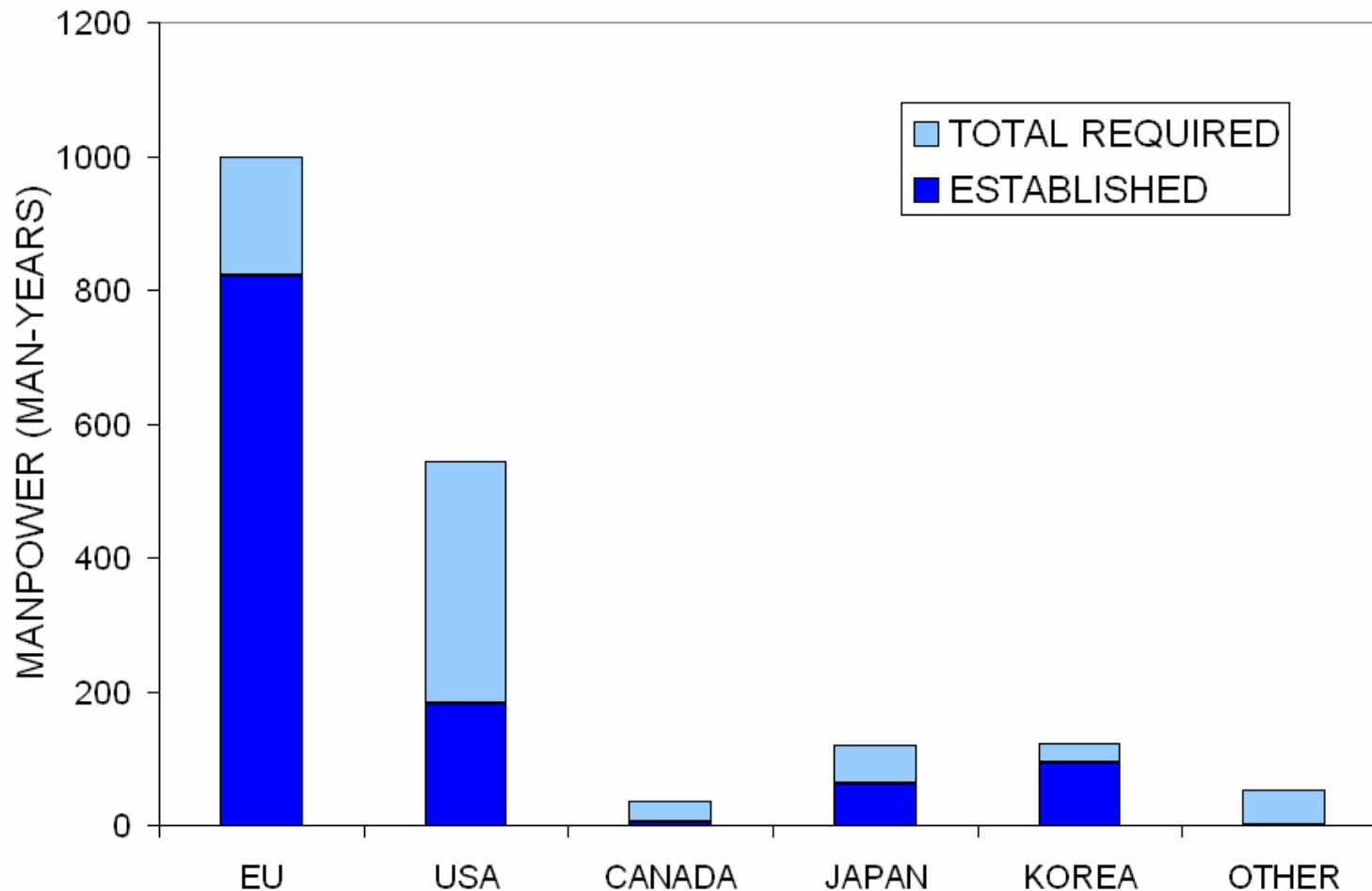


Urgent R&D support levels over the next 3-5 years, by subdetector type. 'Established' levels are what people think they will be able to get under current conditions, and 'total required' are what they would need to establish proof-of-principle for their project.

Resources: Equipment funds by subsystem



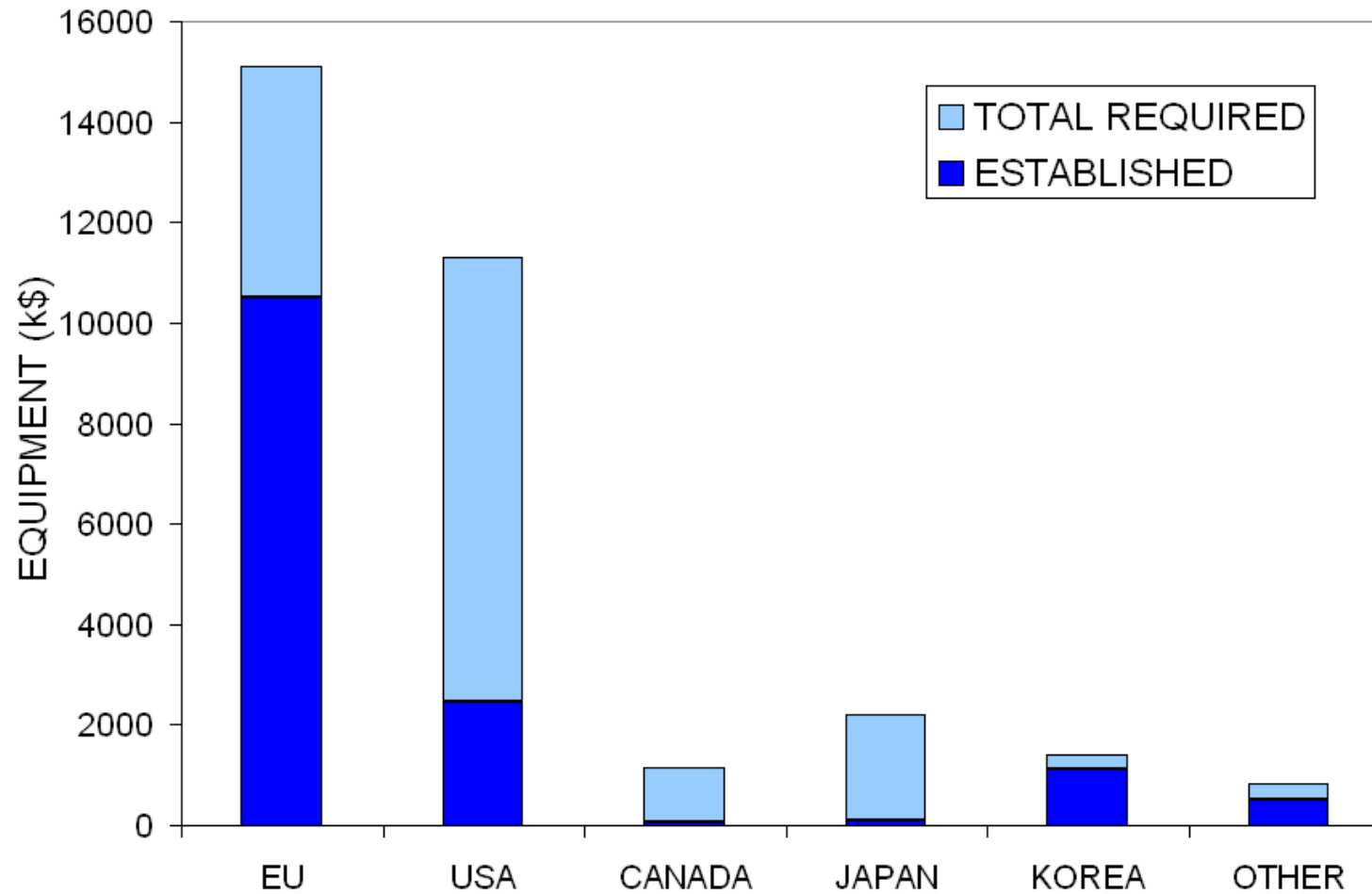
Resources: manpower by region



Urgent R&D support levels over the next 3-5 years, by region. 'Established' levels are what people think they will be able to get under current conditions, and 'total required' are what they would need to establish proof-of-principle for their project.

Resources: equipment funds by region

H.Weerts



Funding summary from report

Overall, the **established** equipment funds world-wide for the next 3-5 years are estimated to amount to approximately **\$15M**, and the established manpower to **1160 man-years**. The R&D groups **estimate** that they will **need** approximately **\$32M** and **1870 man-years** if they are to achieve their urgent goals.

If we **simplify the manpower** to be predominantly postdocs **at \$50k p.a.**, and simplify the **time period** to be **4 years** for all projects, this amounts to **established support world-wide of \$18.2M p.a.**, *a requested increment of \$13.2M p.a., making a total request of \$31.4M p.a. of which $\frac{3}{4}$ is manpower.*

This overall growth by nearly a factor two seems appropriate as the world of particle physics moves towards its biggest ever project.

'Missing' Topics chapter

- ❑ Example 1: Particle ID could be important, given the possible use for heavy quark sign-selection. Advanced DIRC options.
- ❑ Example 2: Given the less than perfect record of LEP detectors and SLD for forward tracking, excellent performance in this region should not be taken for granted ... See talk by Klaus Monig yesterday
- ❑ PFA has been advertised for ILC since LCWS 1991, and jet energy resolution of $30\%/\sqrt{E_{\text{jet}}}$ has been suggested since Snowmass 1996
Isn't it about time it was demonstrated? -- there is progress, but slow
- ❑ 'System integration' - inner electronics, cables, connectors, cooling, etc is unfashionable but **could be decisive** between subdetector options. Often has considerable impact on final performance. (C. Damerell point)
- ❑ Are there others who have been discouraged by lack of support, from pursuing potentially important R&D studies for ILC?

Longer term plans

- ❑ An initial discussion between a few R&D Panel members, all WWS-OC chairmen, and Barry Barish for GDE took place on Aug 18th at Snowmass
- ❑ Suggestion was considered of evolving to a second phase, where our panel would be replaced by a committee under the GDE. Now there is an overall GDE R&D panel, for accelerators & detectors. C. Damerell member of this panel. → Next talk by W.Willis
- ❑ Future of current WWS R&D panel not totally clear; being discussed
- ❑ Need to keep WEB site up to date, so it remains useful
- ❑ Panel may also advice groups on direction for R&D, given global knowledge

Conclusions

- ❑ The urgent tasks of the Detector R&D Panel was to
 - Create a list of ongoing and anticipated detector R&D topics and make this available to community
 - Establish the current levels of support worldwide by subdetector and by region
 - Quantify needed resources, for Priority 1 goals to be realised in time

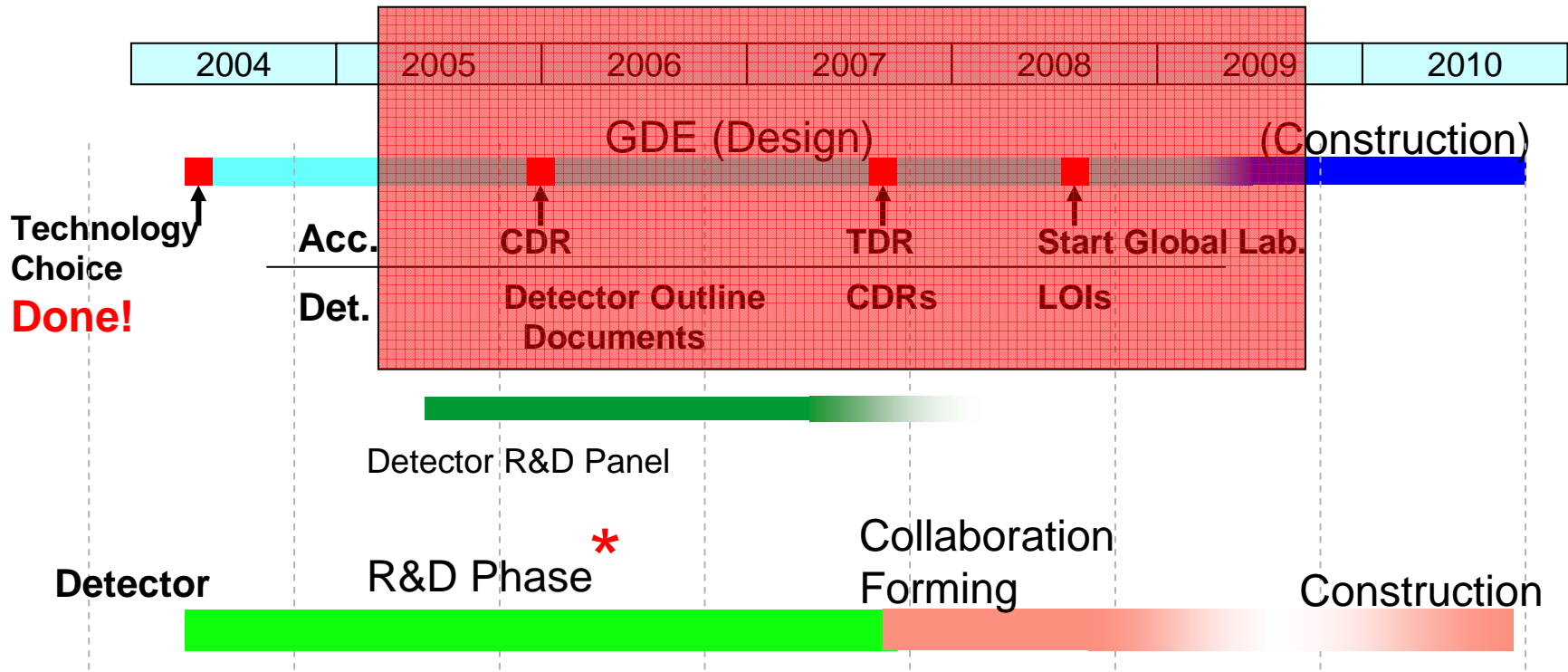
- ❑ This was accomplished by the end of 2005

- ❑ There are dangers, the most extreme expressed to our Panel being that the 'haves' could be reduced to the level of the 'have-nots', because of priorities and recommendations. Main reason for no direct priorities from report.

- ❑ Need mechanism/structure to be advocate for and stimulate the expanded worldwide programme that everyone in the ILC detector community knows to be urgently needed.

THE END

"Window for Detector R&D"

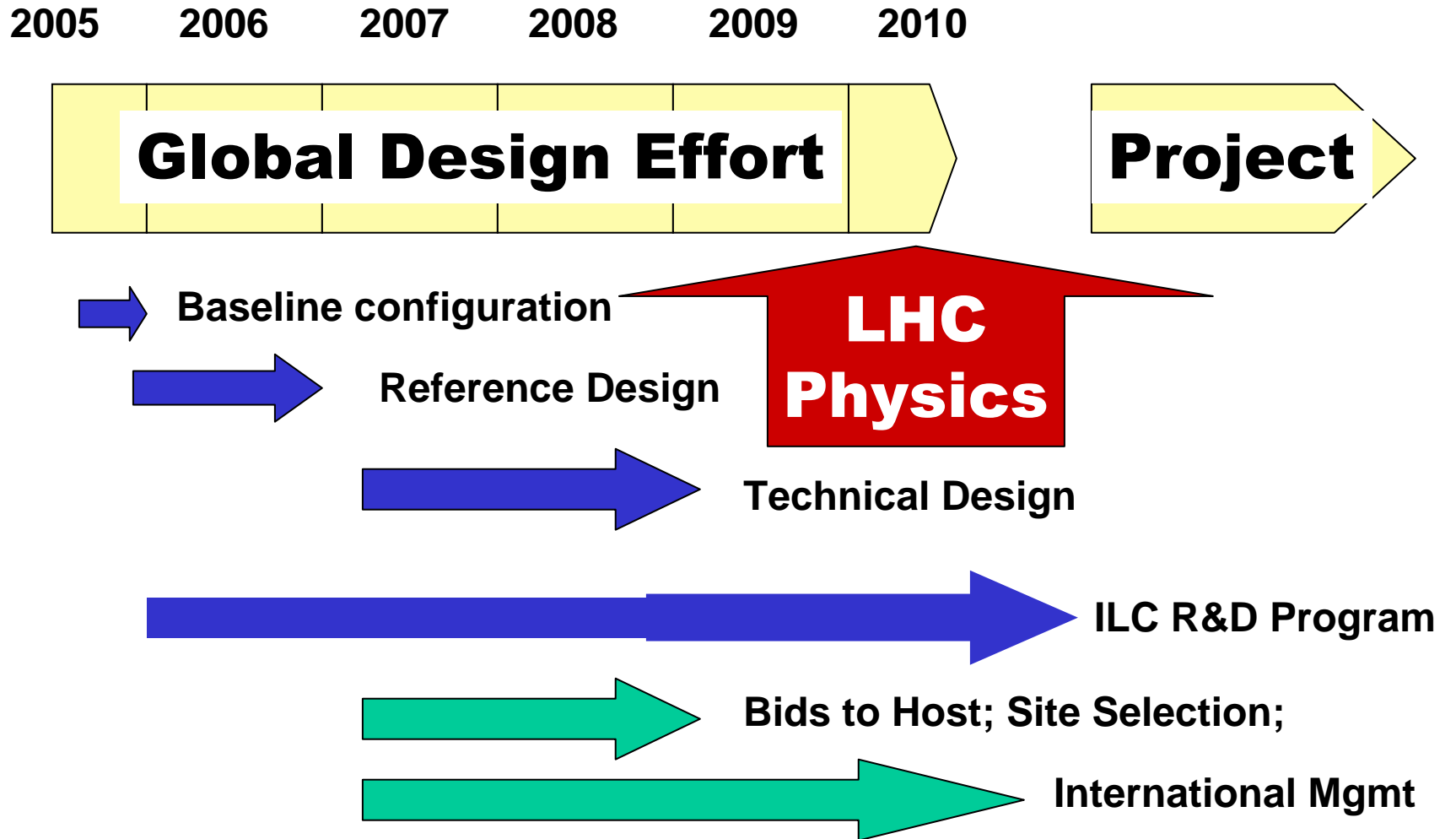


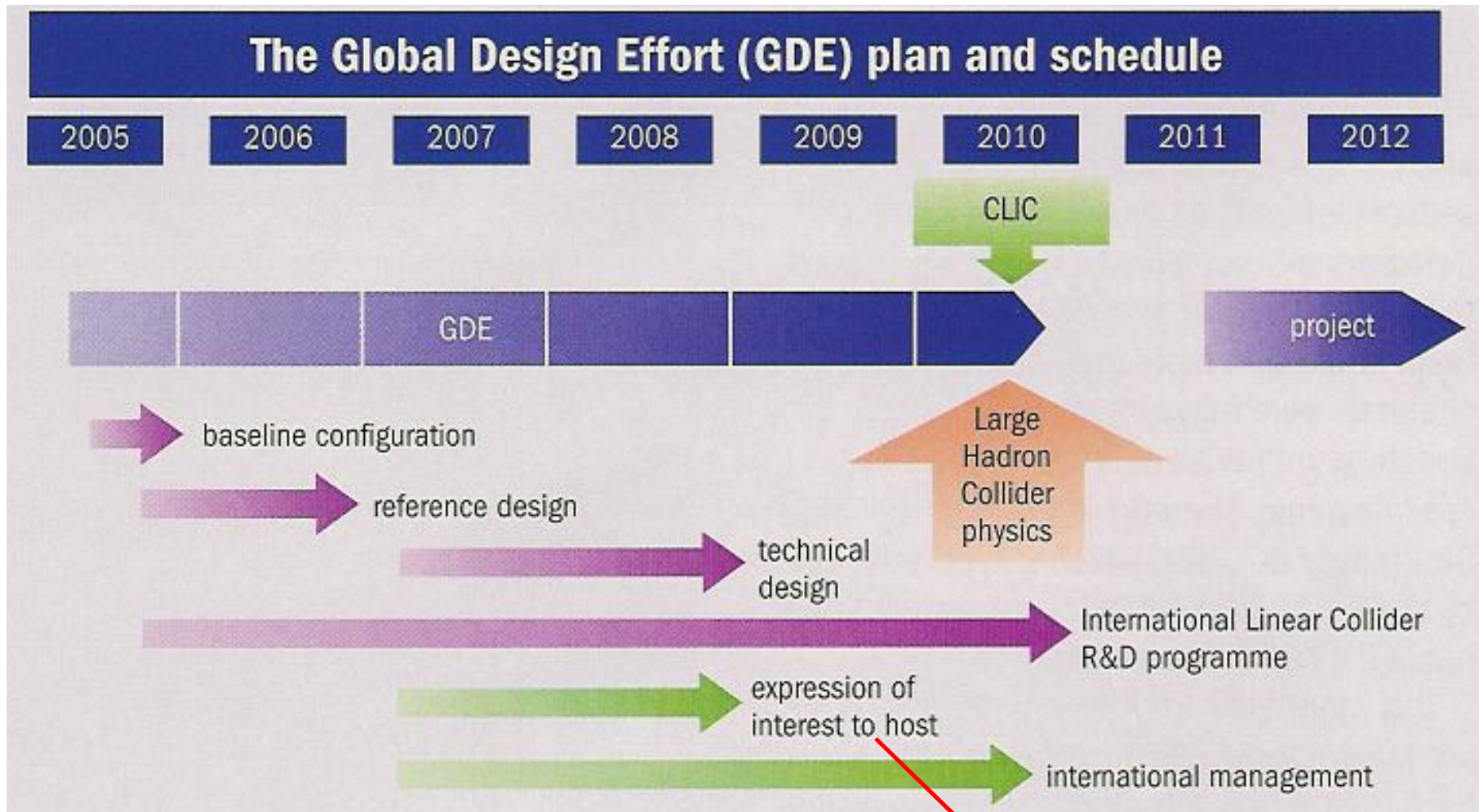
Plans from Snowmass:

- Documents: Accelerator BCD (Baseline Configuration Document) end 2005
- Detector R&D Panel Report end 2005
- 3 (or 4?) DODs March 2006
- DCR (Detector Concept Report) end 2006

* In practice, detector R&D will extend much later, being continued within the approved collaboration(s)

The GDE Plan and Schedule





CERN Courier November 2005

formerly: 'Bids to host; site selection'