Worldwide Study on Physics/Detector for the Future Linear Collider

The name is too long, so I will abbreviate it as WWSPD

(not a widely accepted shorthand)

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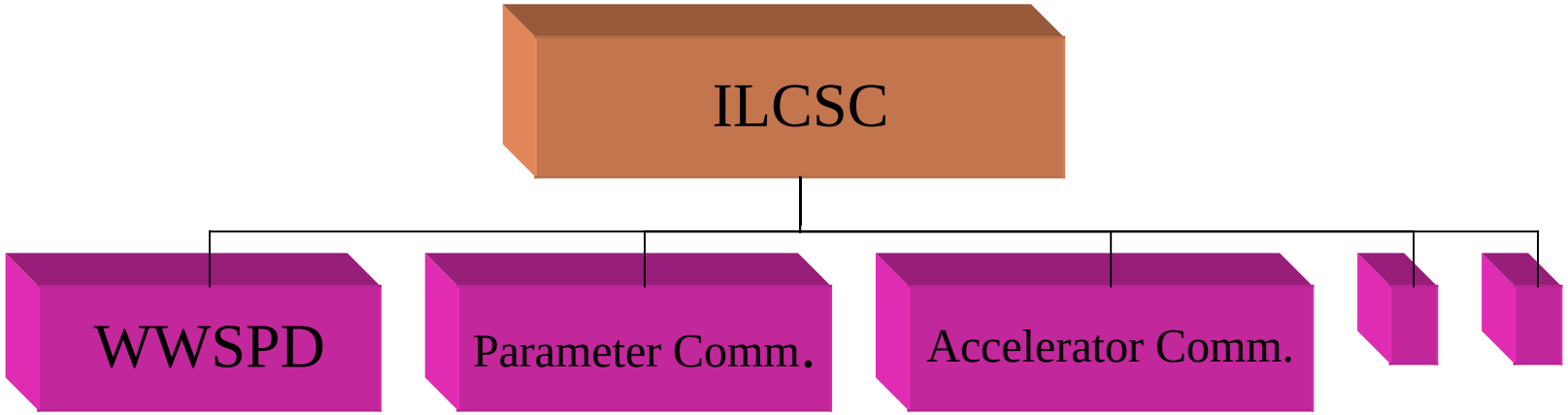
ACFA LCWS, Mumbai, December 2003

History of WWSPD

- Created in 1998 at Vancouver ICHEP.
- Integrated into ILCSC in 2003
  as the physics and detector subcommittee.



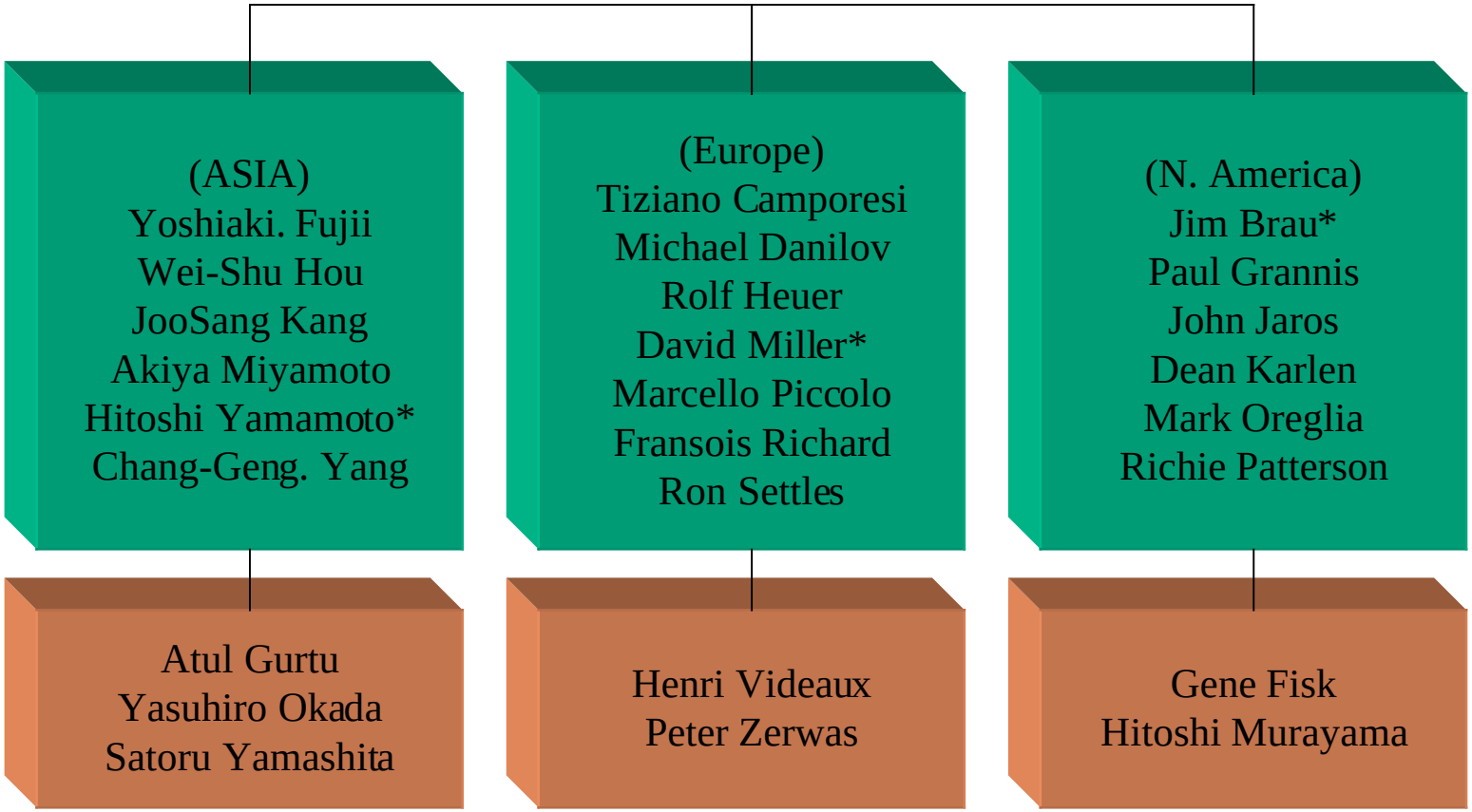
http://blueox.uoregon.edu/~lc/wws

Tasks of WWSPD

- Coordinate the regional studies :
  - ACFA study (Asian)
  - ALCPG study (North American)
  - ECFA study (European)
- Organize the international linear collider workshops (LCWS) as the core of its program committee.
- Create work groups/committees as needed to promote international coordination.
  - Detector R&D review committee
  - Working group for the global detector network (GDN)
  - LHC/LC study group
  - Consensus document (justification of LC)
  - Test beam coordination

WWSPD Committee Members

* co-chairs



Additional members for LCWS program comm.

Detector R&D Review

- Chair : R. Heuer.
- Charge :
  - Define required LC detector performances,
  - Review currently active detector R&D's worldwide and identify missing items.
- A report released in summer 2002.
  (http://blueox.uoregon.edu/~lc/randd.html)
- Web site for each subdetector system to keep up with the progresses.
- Subdetector phone/net meeting attached to LCWS suggested (next slide)
- Its charge is now being re-evaluated.

Detector Performances

- In order to take advantage of the LC environment, the detector performances required be much better than those of LHC.
- The lepton recoil mass resolution of the Higgs search (quite possibly the most important analysis at LC) :
  - Mode : e+e- -> ZH, Z-> l+l-
  - Requires momentum resolution ~10 times better than LHC.
- Jet 4-momentum reconstruction for W, Z masses etc.
  - PFA (Particle flow algorithm),
    or sometimes called EFA (energy flow algorithm)
  - Very high granurality required for calorimeters.
  - Charm tagging for H->cc. Requires a super vertexing with pixel size ~ 25 μm.

International R&D Review Meetings

- Phone/net meeting for each subdetector
  Comprehensive summary/review of the given subdetector.
- Started this year (2003)
  Attached to regional LCWS (one day before etc.)
  - January 8, UT Arlington - vertex/interm.tracker
  - March 31, Amsterdam - tracker/muon
  - November 12, Monpellier - calorimeter
  - December 14, Mumbai - vertex
- After Paris LCWS, they will be integrated into regional LCWS (current plan: not worldwide LCWS).

GDN (Global Detector Network)

- Led by G. Mnich, V. Vrba, R. VanKooten, M. Hildreth (and K. Fujii now)
- The goal is to help physicists off-site make significant contributions to detector construction/operation.
  (Partly to justify the money paid by non-host countries)
- A real work started at a satellite mini workshop at IEEE Oregon in October 2003.
- Ideas :
  - Several shift-taking stations globally, more or less copies of each other. The one on-site is just one of them.
  - At a given time, one shift-taking station is in charge of running the experiment.
  - Any access is through the active shift-taking station.
  - Impacts detector designs. (Detector monitoring by net)

LHC/LC Study Group

- Led by Rohini Godbole, Frank Paige, Georg Weiglein.
- Collaboration of LHC and LC communities
  (~200 physicists)
- Complementarity of LHC and LC is now established.
- Quantify the interface of LHC and LC.
- Presentations of results:
  e.g. Weiglein's talk at EPS 03, Aachen and other talks.
- See also :
  http://www.ippp.dur.ac.uk/~georg/lhclc

LHC and LC

Critical questions :

If LHC and LC are to run concurrently,

(but LC starting 5-8 years later),

- What is the advantage over running sequentially?
  Mutual cross feeding : does it justify the expeditious funding of both LHC and LC?
- Is there any scenario where LC becomes not worth the cost?
  e.g. if nothing new found at LHC?
  - 5σ discovery at design luminosity :
    1 year LHC vs 1 day for LC, namely
    LC can detect much smallr Higgs couplings.
    But does it change our view of nature?

Linear Collider Consensus Document

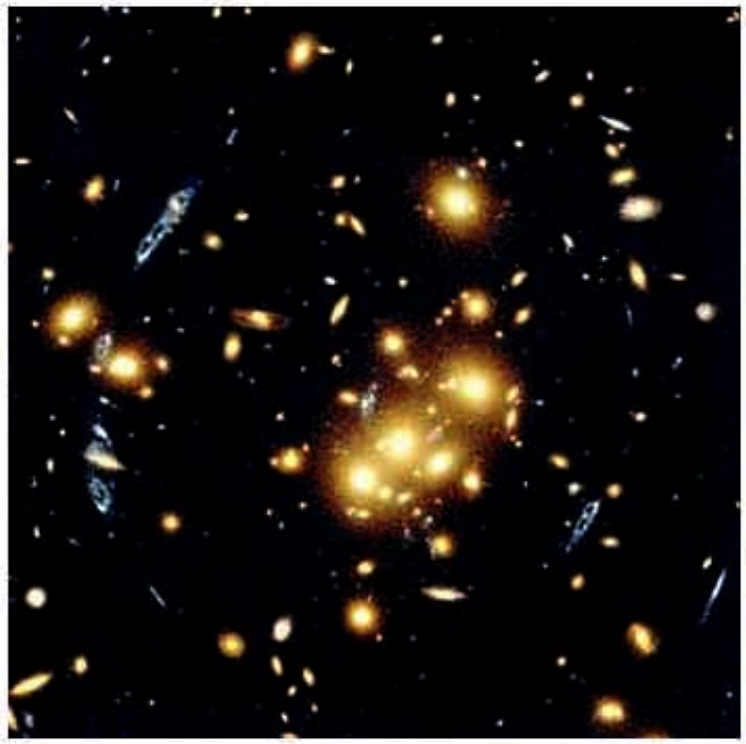
- Justification of LC concisely stated - to educate ourselves and people outside of our field.
- **Located at : http://sbhep1.physics.sunysb.edu/~grannis/wwlc_report.html**
- ~1300 people have signed.
- For Asian part, the authors of the roadmap report to be asked to sign. A mailing list is being prepared and the requests will go out soon (within a week or so).
- If you do not receive the request, please let us know. (yhitoshi@awa.tohoku.ac.jp)

Cosmological Connection

It is now known that

- Ordinary matter 5%
  Big-bang baryogenesis
- Dark matter 25%
  Gravitational lensing
- Dark energy 75%
  Acceleration of expansion

Confirmed by CMB Temperature Isotropy (WMAP)



Gravitational lensing (Hubble)

Cosmology and LC

- Baryogenesis
  - SM CPV known to be insufficient
  - CPV in new physics needed; what is it?
- Dark Matter
  - SUSY LSP is a perfect candidate
  - Axion?
- Dark energy
  - ????
- Particle composition depends on the detail of theory (Precise measurements of couplings critical) > LC
- We have created `cosmology ginger group' (Paris LCWS)
  - Interact with all relevant sessions and address cosmological issues.

Some Issues Discussed at WWSPD

- Shall we integrate worldwide LCWS and regional LCWS?
  - No.
    - Regional LCWS have been instrumental in promoting physics and detector studies.
    - In particular, they have been effective for pushing ahead **detector R&D's** in Europe for years and recently in North America (Asia?).
- Forming of collaboration(s)
  - Physicists are more productive when left to do what they want to do - not now.
  - Possible scenario :
    - Realignment of R&D's upon the technology decision.
    - Forming of collaboration(s) when LC host is decided.

- How many collaborations will there be?
  - One or two generic detectors.
  - One gamma-gamma detector.
  - Else?
- What is certain is :
  - They are entirely international, and
  - Best available technology worldwide will be taken advantage of.
- The ‘G/JLC’ detector, ‘SD’ and ‘LD’ of North America, and the ‘Tesla’ detector :
  - Nothing but working paradigms.
  - Real models are to emerge as collaborations are formed.

Recent and Future LCWS's

- Cornell 7/13-16 2003 ALCPG
- Monpellier 11/13-16 2003 ECFA
- Mumbai 12/15-17 2003 ACFA
- SLAC 1/7-10 2004 ALCPG
- Paris 4/19-23 2004 WW
- Victoria 7/28-31 2004 ALCPG
- Durham 9/1-4 2004 ECFA
- spring 2005 ECFA ?
- spring 2005 ALCPG ?
- spring 2005 WW ?
- gamma-gamma submeeting at Photon 2005, Warsaw 8/29-9/8 2005