NLC - The Next Linear Collider Project

Photon Collider

Jeff Gronberg/LLNL
For the γγ working groups
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Warm and Cold $\gamma\gamma$ technology work is on hold

- Photon collider technologies for both warm and cold accelerators
  - Warm technology based on MERCURY laser is being developed at LLNL
    - Final laser is under construction
  - Cold technology using recirculating cavity being designed at DESY / MBI
  - Both are waiting for technology decision
- Looking for R&D issues common to both for work before the technology decision
Detector groups need to evaluate the effect of higher $\gamma\gamma$ backgrounds

- Additional tracks from $\gamma\gamma \rightarrow$ hadrons will affect occupancies and reconstruction
  - Cold v. Warm
    - Cold time structure allows readout of a single crossing
    - Warm time structure requires fast readout to minimize number of crossings
  - Extraction line aperture requires rad-hard silicon
    - Technology exists

Charged tracks
3.7 tracks/crossing
($|\cos \Theta| < 0.9$)

Neutral showers
5.5 showers/crossing
($|\cos \Theta| < 0.9$)
Higgs physics studies

- IWSLC Jeju panel determined that $\gamma\gamma$ is an important capability to retain for the LC
  - Higgs
    - SM light Higgs $\rightarrow$ bb, W+W- and $\gamma\gamma$ done
    - SUSY Heavy H$^0$, A$^0$ $\rightarrow$ bb done
    - SUSY Heavy H$^+$ $\rightarrow$ $\tau\nu$ done
  - CP determination of Higgs with linear polarization
    - Expanding study to SUSY models with explicit CP violation in the Higgs sector
- Extending analyses to Higgs $\rightarrow$ ZZ, Z$\gamma$
  - Pandora-pythia with H $\rightarrow$ ZZ and Z$\gamma$ cross sections
  - Including $\gamma\gamma$ $\rightarrow$ $\gamma\gamma$, ZZ, Z$\gamma$ backgrounds in pandora
- Impact of MSSM on the SM light Higgs Analysis
  - The ratio of MSSM / SM of $\sigma(\gamma\gamma\rightarrow h) \times$ BR(h $\rightarrow$ bb) still yields a good measurement over most of $M_A$, $\tan(\beta)$ space.
- NMSSM with extra CP+ and CP- Higgs
  - Light h $\rightarrow$ aa $\rightarrow$ bbbb checked, where LHC sees a hint, $\gamma\gamma$ can make a mass measurement.
  - h $\rightarrow$ aa $\rightarrow$ $\tau\tau\tau\tau$, observable with good CP info
- Complex MSSM model
  - h $\rightarrow$ aa $\rightarrow$ bbbb, $\tau\tau\tau\tau$ done, visible at $\gamma\gamma$
  - h$_1$ $\rightarrow$ bb complementaty to h$_1$ $\rightarrow$ $\gamma\gamma$ at LHC
- Littlest Higgs hep/ph-0302188
  - Partial widths of loop decays $\Gamma(h\rightarrow gg)$ versus $\Gamma(h\rightarrow \gamma\gamma)$ probe the model parameters. Greatest sensitivity with $\gamma\gamma$ data and complementarity to LHC.
- Radion-Higgs Mixing hep/ph-0304245
  - Will be observable at $\gamma\gamma$
  - Combining information with LHC probes anomalous couplings in this model.
For LCWS / Victoria / Technology decision

- Photon Collider Technology
  - Waiting for the technology decision before beginning prototyping
  - MERCURY laser
    - Single head test are done
    - Final laser will be at full power by Victoria

- Photon Collider Detector
  - Background simulation is ready
    - Agreement between Europe/US on level
  - Detector groups need to evaluate the effect on reconstruction

- Photon Collider Physics
  - SM Higgs, SUSY Heavy Higgs, Higgs CP analysis mature
  - Susy sparticle, Extra-dimensions, non-SM Higgs, lepton number violation ongoing