SiD Benchmarks for the LOI

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Compulsory LOI Benchmarking List

At a Dec 7 meeting between Sakue Yamada and representatives of SiD, ILD, 4th Concept, and the WWS, it was agreed that the following reactions will be used for LOI Physics Benchmarking:

1. $e^+e^- \to Zh, \to \ell^+\ell^- X, l = e, \mu;\ m_h = 120$ GeV at $\sqrt{s}$=0.25 TeV
2. $e^+e^- \to Zh, Z \to q\bar{q}, \nu\bar{\nu};\ h \to c\bar{c}, \mu^+\mu^-;\quad m_h = 120$ GeV at $\sqrt{s}$=0.25 TeV
3. $e^+e^- \to \tau^+\tau^-$, at $\sqrt{s}$=0.5 TeV
4. $e^+e^- \to t\bar{t}$ at $\sqrt{s}$=0.5 TeV
5. $e^+e^- \to \tilde{\chi}_1^+\tilde{\chi}_1^-/\tilde{\chi}_2^0\tilde{\chi}_2^0 \to W^+W^-\ \tilde{\chi}_1^0\tilde{\chi}_1^0$ / $ZZ\tilde{\chi}_1^0\tilde{\chi}_1^0$ at $\sqrt{s}$=0.5 TeV

N.B.: The physics observables that are to be measured have not yet been determined.

Compulsory LOI Benchmark Observables - SiD Proposal

1. $e^+e^- \to Zh, \to \ell^+\ell^- X$, $l = e, \mu$; $m_h = 120$ GeV at $\sqrt{s}$=0.25 TeV

   M_h & $\sigma(e^+e^- \to Zh)$

2. $e^+e^- \to Zh$, $Z \to q\bar{q}, \nu\bar{\nu}$; $h \to c\bar{c}$, $\mu^+\mu^-$; $m_h = 120$ GeV at $\sqrt{s}$=0.25 TeV

   BR($h \to c\bar{c}$) & BR($h \to \mu^+\mu^-$)

3. $e^+e^- \to \tau^+\tau^-$, at $\sqrt{s}$=0.5 TeV

   Identification efficiency and purity for $\tau^- \to \pi^-\nu_\tau$, $\rho^-\nu_\tau$

4. $e^+e^- \to t\bar{t}$ at $\sqrt{s}$=0.5 TeV

   $\sigma(e^+e^- \to t\bar{t})$ & M_t (as defined in tree-level event generator such as WHIZARD)

5. $e^+e^- \to \tilde{\chi}_1^+\tilde{\chi}_1^-/\tilde{\chi}_2^0\tilde{\chi}_2^0 \to W^+W^-\tilde{\chi}_1^0\tilde{\chi}_1^0$ / $ZZ\tilde{\chi}_1^0\tilde{\chi}_1^0$ at $\sqrt{s}$=0.5 TeV

   $M_{\tilde{\chi}_1^+}$, $M_{\tilde{\chi}_2^0}$, $\sigma(e^+e^- \to \tilde{\chi}_1^+\tilde{\chi}_1^-)$, $\sigma(e^+e^- \to \tilde{\chi}_2^0\tilde{\chi}_2^0)$

Additional SiD Benchmarking Studies for LOI

6. $e^+e^- \to c\bar{c}, b\bar{b}$, at $\sqrt{s}$=0.5 TeV;

   $A_{FB}^{LR}(c)$ & $A_{FB}^{LR}(b)$

7. $e^+e^- \to Zhh$, $m_h = 120$ GeV at $\sqrt{s}$=0.5 TeV;

   g_{hhh}

8. $e^+e^- \to \tilde{\tau}_1\tilde{\tau}_1$, at Point 3 at $\sqrt{s}$=0.5 TeV;

   $M_{\tilde{\tau}_1}$ $\sigma(e^+e^- \to \tilde{\tau}_1\tilde{\tau}_1)$

9. $e^+e^- \to \tilde{t}_1\tilde{t}_1^* \to c\bar{c}\tilde{\chi}_1^0\tilde{\chi}_1^0$, $m_{\tilde{t}_1} = 120$ GeV, $m_{\tilde{\chi}_1^0} = 100$ GeV, at $\sqrt{s}$=0.5 TeV

   $M_{\tilde{t}_1}$, $\sigma(e^+e^- \to \tilde{t}_1\tilde{t}_1^*)$, $\cos\theta_{\tilde{t}}$

10. $e^+e^- \to \tilde{b}_1\tilde{b}_1^* \to b\bar{b}\tilde{\chi}_1^0\tilde{\chi}_1^0$, at $\sqrt{s}$=0.5 TeV

    $M_{\tilde{b}_1}$, $\sigma(e^+e^- \to \tilde{b}_1\tilde{b}_1^*)$

11. $e^+e^- \to \mu^+\mu^-$, at $\sqrt{s}$=0.5 TeV

    Luminosity Weighted $\sqrt{s}$

Manpower

1. $e^+e^- \to Zh, \to \ell^+\ell^- X$, $l - e, \mu$; $m_h - 120$ GeV at $\sqrt{s}$–0.25 TeV	SLAC
2. $e^+e^- \to Zh$, $Z \to q\bar{q}, \nu\bar{\nu}$; $h \to c\bar{c}$, $\mu^+\mu^-$; $m_h = 120$ GeV at $\sqrt{s}$=0.25 TeV	Michigan/RAL/Bristol
3. $e^+e^- \to \tau^+\tau^-$, at $\sqrt{s}$=0.5 TeV	RAL ? Oregon?
4. $e^+e^- \to t\bar{t}$ at $\sqrt{s}$=0.5 TeV	Oxford ?
5. $e^+e^- \to \tilde{\chi}_1^+\tilde{\chi}_1^-/\tilde{\chi}_2^0\tilde{\chi}_2^0 \to W^+W^-\tilde{\chi}_1^0\tilde{\chi}_1^0$ / $ZZ\tilde{\chi}_1^0\tilde{\chi}_1^0$ at $\sqrt{s}$=0.5 TeV	SLAC ?
6. $e^+e^- \to c\bar{c}, b\bar{b}$, at $\sqrt{s}$=0.5 TeV;	Oxford
7. $e^+e^- \to Zhh$, $m_h = 120$ GeV at $\sqrt{s}$=0.5 TeV;	Oxford / SLAC
8. $e^+e^- \to \tilde{\tau}_1\tilde{\tau}_1$, at Point 3 at $\sqrt{s}$=0.5 TeV;	Texas A&M/Colorado
9. $e^+e^- \to \tilde{t}_1\tilde{t}_1^* \to c\bar{c}\tilde{\chi}_1^0\tilde{\chi}_1^0$, $m_{\tilde{t}_1} = 120$ GeV, $m_{\tilde{\chi}_1^0} = 100$ GeV, at $\sqrt{s}$=0.5 TeV	Fermilab
10. $e^+e^- \to \tilde{b}_1\tilde{b}_1^* \to b\bar{b}\tilde{\chi}_1^0\tilde{\chi}_1^0$, at $\sqrt{s}$=0.5 TeV	Oxford
11. $e^+e^- \to \mu^+\mu^-$, at $\sqrt{s}$=0.5 TeV	SLAC ? Fermilab?

Near Term Plans

- Submit SiD proposal for compulsory observables to WWS Software Panel today
- Complete benchmarking LOI planning spreadsheet this week
- Make some modifications to Ecm=500 GeV SM data set and begin production of Ecm=250 GeV SM data set starting Jan. 7, 2008