

PAC report

Yasuhiro Sugimoto

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PAC meeting

- Web page
 - <http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=5843>
- Physics and detector session on Dec. 14th
- Tim Barklow presented SiD analysis quite in detail, while I presented ILD results very briefly

My presentation for benchmark analysis

LOI benchmark

ECM (GeV)	Observable	Precision	Comments	Post LOI analysis
250	$\sigma(e^+e^- \rightarrow Zh)$	2.5%	Model independent	
	m_h	32 MeV	Model independent	
	m_h	27 MeV	Model dependent	
250	$\text{Br}(h \rightarrow bb)$	2.7%	Includes 2.5% of $\sigma(Zh)$	2.7%*
	$\text{Br}(h \rightarrow cc)$	12%		7.3%*
	$\text{Br}(h \rightarrow gg)$	29%		8.9%*
	$\text{Br}(h \rightarrow \tau\tau)$			4.9%
	$\text{Br}(h \rightarrow WW^*)$			8.6%
500	$\sigma(e^+e^- \rightarrow \chi_1^+\chi_1^-)$	0.6%	From kinematical edges Two masses (LSP and χ_1^+/χ_2^0) are fitted simultaneously	
	$\sigma(e^+e^- \rightarrow \chi_2^0\chi_2^0)$	2.1%		
	$m(\chi_1^+)$	2.4 GeV		
	$m(\chi_2^0)$	0.9 GeV		
	$m(\chi_1^0)$	0.8 GeV		

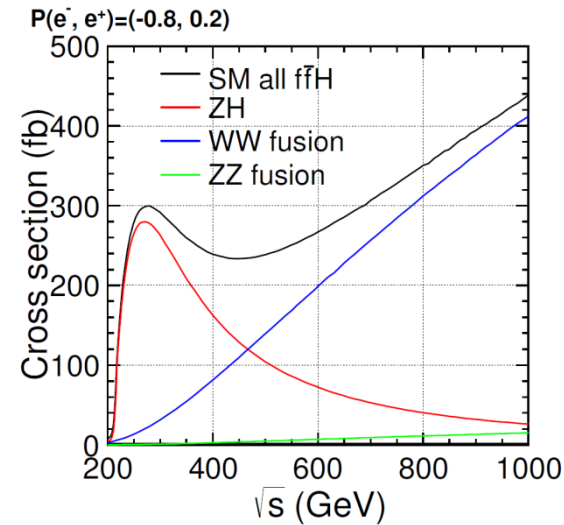
* <http://arxiv.org/abs/arXiv:1207.0300>
H.Ono, Akiya Miyamoto

LOI benchmark

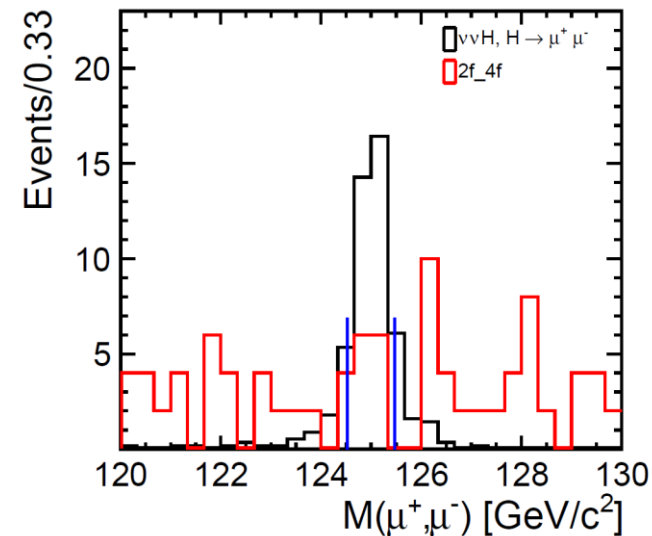
ECM (GeV)	Observable	Precision	Comments
500	$\sigma(e^+e^- \rightarrow \tau\tau)$	0.29%	$\theta_{\tau\tau} > 178^\circ$
	A_{FB}^τ	0.0025	$\theta_{\tau\tau} > 178^\circ$
	P_τ	0.007	Excluding $a_{1\nu}$
500	$\sigma(e^+e^- \rightarrow tt)$	0.4%	(bqq)(bqq) only
	m_t	40 MeV	Fully hadronic only
	m_t	30 MeV	+ semi-hadronic
	Γ_t	27 MeV	Fully hadronic only
	Γ_t	22 MeV	+ semi-hadronic
	A_{FB}	0.0079	Fully hadronic only
500	$\sigma(e^+e^- \rightarrow \mu_L^+ \mu_L^-)$	2.5%	SPS1a' (smuon)
	$m(\mu_L)$	0.5 GeV	
500	$m(\tau_1)$	$0.1 \text{ GeV} \oplus 1.3 \sigma_{LSP}$	SPS1a' (stau)
1000	α_4	$-1.4 < \alpha_4 < 1.1$	Strong EWSB in WW scattering
	α_5	$-0.9 < \alpha_5 < 0.8$	

1TeV benchmark

- $e^+e^- \rightarrow \nu\nu h$
 - Higgs production cross section is larger than 250 GeV
 - Luminosity is larger than 250 GeV
 - Higgs $\rightarrow \mu\mu$ channel can be measured

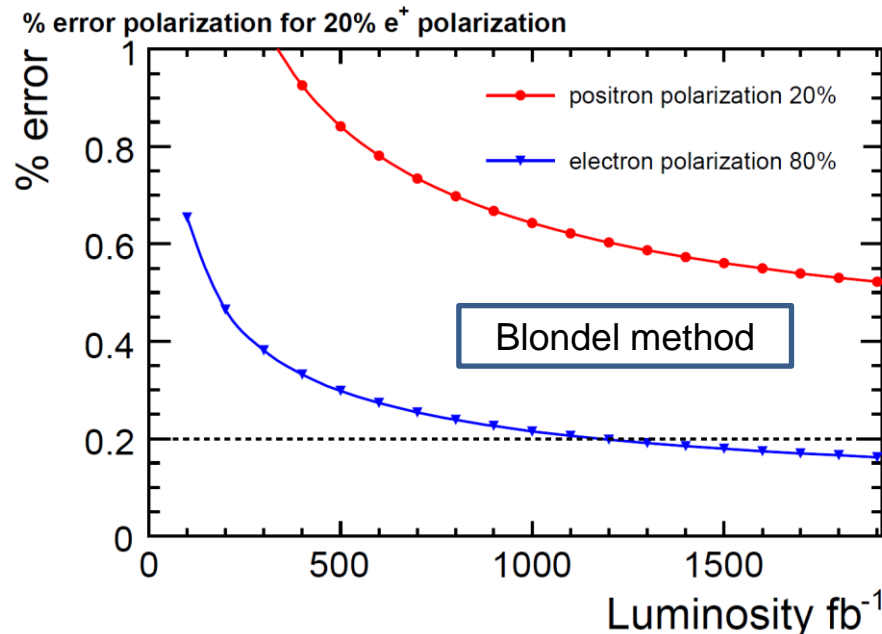


Decay mode	σBr accuracy (500fb ⁻¹ , -0.8,+0.2)	Comments
bb	0.4%	
cc	5%	
gg	4%	
WW*	3%	Fully hadronic mode only
$\mu\mu$??	



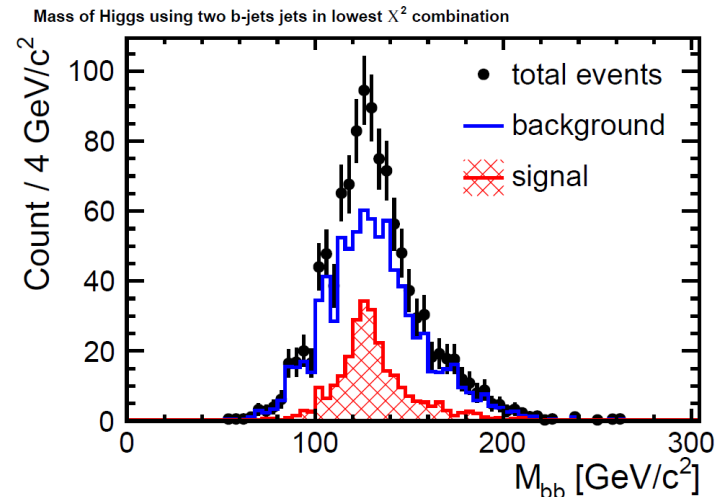
1TeV benchmark

- $e^+ e^- \rightarrow W^+ W^-$
 - Precise measurement of beam polarization
 - Two methods
 - Modified Blondel scheme: (+,+),(+,-),(-,+),(-,-) data required
 - Angular distribution of $W \rightarrow$ Analysis not finished yet



1TeV benchmark

- $e^+ e^- \rightarrow t t h$
 - Fully hadronic mode (8 jets, no isolated lepton) and semi-leptonic mode (6 jets + 1 isolated lepton) were used
 - Main background: $t\bar{t}b\bar{b}$, $t\bar{t}Z$, and $t\bar{t}$
 - Multivariable analysis technique is effective to reduce the background
 - Preliminary result on accuracy of top Yukawa coupling with 500fb^{-1} (+0.8,-0.2) and 500fb^{-1} (-0.8,+0.2)
 - 7.0% for semi-leptonic mode
 - 6.5% for hadronic mode
 - **4.8% for combined data**

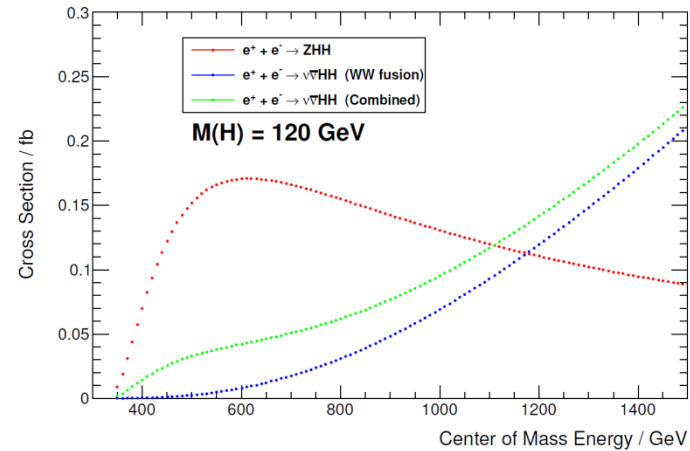
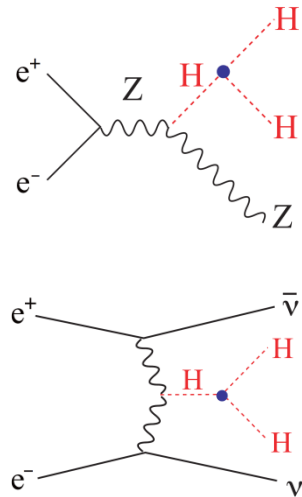


LOI-DBD common benchmark

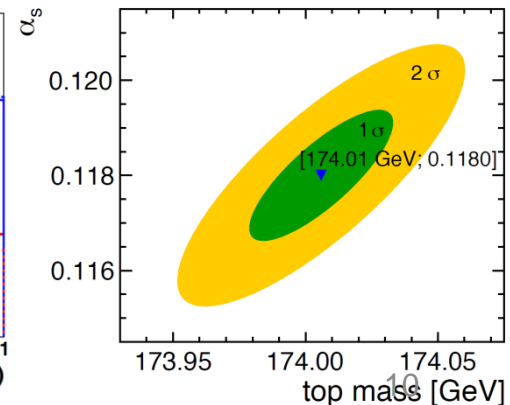
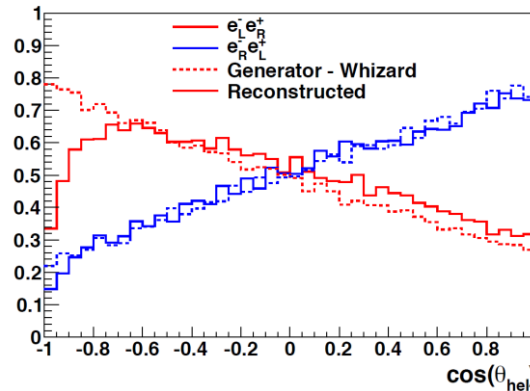
- We used $e^+e^- \rightarrow t t$ channel for the comparison between LOI and DBD analysis @500 GeV
- Forward-backward asymmetry is determined by hadronic decay mode
- Vertex charge determination is needed \rightarrow good benchmark for vertex detector/finding
- Results with 500fb^{-1} , $P(e^-, e^+) = (-0.8, +0.3)$:
 - $A_{\text{FB}}^t = \text{Coming soon}$ (DBD)
 - $A_{\text{FB}}^t = 0.334 \pm 0.0079$ (LOI)

Other physics processes

- Higgs self coupling
 - Zhh final state at 500 GeV
 - 27% accuracy in Zhh cross section = 44% accuracy in λ with $2ab^{-1}$
 - $\nu\nu hh$ final state at 1TeV
 - 17% accuracy in λ with $2ab^{-1}$ (Fast simulation)
 - Full simulation study on going



- Further $t\bar{t}$ study
 - A_{FB}^t by semi-leptonic decay mode
 - 1% measurement can be done
 - A_{hel}^t (helicity asymmetry) measurement
 - $t\bar{t}$ at threshold: measurement of m_t and α_s



Discussion at PAC

SUSY mass

- There is large difference of the accuracy of SUSY masses between SiD and ILD in LOIs
- We discussed this issue and we understand the reason
- We still have to discuss how to present it in DBD → Tim will contact Jenny to discuss it

Higgs branching ratio at 1TeV

- SiD knows the unbelievable accuracy in Higgs branching ratio at 1TeV is wrong
- They will re-evaluate the accuracy

Beam polarization

- SiD and ILD should use same luminosity for each polarization combination

	L (-80%,+20%)	L (+80%,-20%)	SiD	ILD
tth	1000 fb ⁻¹	0	4.1%	NA
	500 fb ⁻¹	500 fb ⁻¹	4.6%	4.8%
WW	500 fb ⁻¹	500 fb ⁻¹	0.17% (e-)	In progress
vvh	1000 fb ⁻¹		In progress	?
	500 fb ⁻¹	(500 fb ⁻¹)		Results shown

- If possible, we should give the results of both cases (1ab⁻¹ with preferable polarization and 500fb⁻¹ each)
 → Gives a guideline for running plan at 1TeV

BR summary table

- IDAG suggested to make one table which summarizes precision of branching ratios of all accessible decay channels by ILC
- The table would be placed either in the Physics volume or in the introduction chapter of DBD
- Michael Peskin and Keisuke Fujii will discuss how to make it

All summary table

- In PEB meeting yesterday, Sakue-san mentioned that the directorate is considering to make a table summarizing all of the physics analysis results, and put it in the summary chapter

Summary

- We still have a lot of things to do
 - Finalize 1 TeV benchmark study and fix the results through internal review by middle of January (before SiD WS 16-18 Jan. 2013?)
 - Revise the description on LOI benchmark analysis to include post-LOI analysis
 - Discuss and coordinate with SiD to make the whole DBD self-consistent
 - Collaborate with RD and physics common task group to make summary tables