LINEAR COLLIDER COLLABORATION

Simulation, Reconstruction & Detector Optimization Efforts

Manqi, RUAN

IHEP, Beijing/LLR, Palaiseau

For the Speakers & Conveners of Sim-Det Opt Group

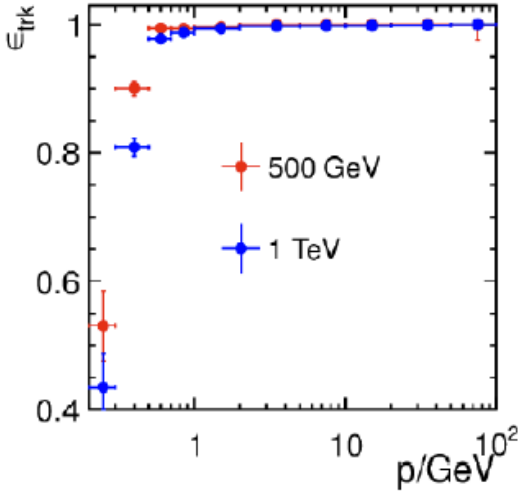
14 talks

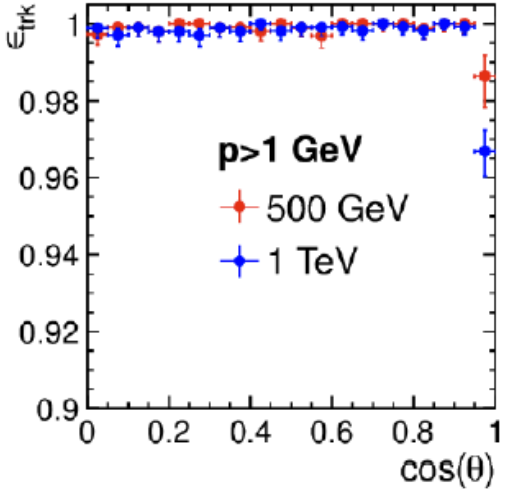
Id	Date	Duration	Type	Title	Presenter
60	2013-Nov-12 09:00	00h20'		Common generator tools	MIYAMOTO, Akiya
61	2013-Nov-12 09:20	00h20'		lcsim status and future	GRAF, Norman
62	2013-Nov-12 09:40	00h20'		iLCSoft status and future	GAEDE, Frank
63		00h20'		Sttudy of tracking and flavour tagging with Fine Pixel CCD vertex detector	Mr. MORI, Tatsuya
64	2013-Nov-12 11:00	00h20'		Reconstruction method of scintillator strip ECAL	KOTERA, Katsushige
65	2013-Nov-12 11:40	00h20'		Comparison of performance among three types of ILD ECAL on tau pair reconstuction	OGAWA, Tomohisa
66	2013-Nov-12 11:20	00h20'		Simulation Study of the Hybrid ECAL for ILD	UENO, Hiraku
67	2013-Nov-12 12:00	00h20'		Optimization of ILD ECAL dimensions	TRAN, Trong Hieu
68	2013-Nov-12 16:40	00h30'		Pandora PFA with SiW and ScW ECAL models (Fuse presentation)	Dr. MARSHALL, John
69	2013-Nov-12 16:00	00h20'		Clustering algorithm for the Forward Calorimeters	SAILER, Andre
70	2013-Nov-12 16:20	00h20'		Overlay removal with a MVA approach	Dr. TIAN, Junping
71	2013-Nov-14 11:00	00h20'		Feasibility of a minimum bias analysis of ee-->ZH-->qq+X at 250 GeV	Mr. HADDAD, Yacine
72	2013-Nov-14 11:20	00h20'		Precise Higgs mass measurement using pi0 reconstruction	VAN DOREN, Brian
73	2013-Nov-12 10:00	00h20'		ILCDirac status and future	Dr. GREFE, Christian
74	2013-Nov-14 11:40	00h20'		BelleII software and computing	HARA, Takanori

Software oriented: 5
Detector performance analysis oriented: 9

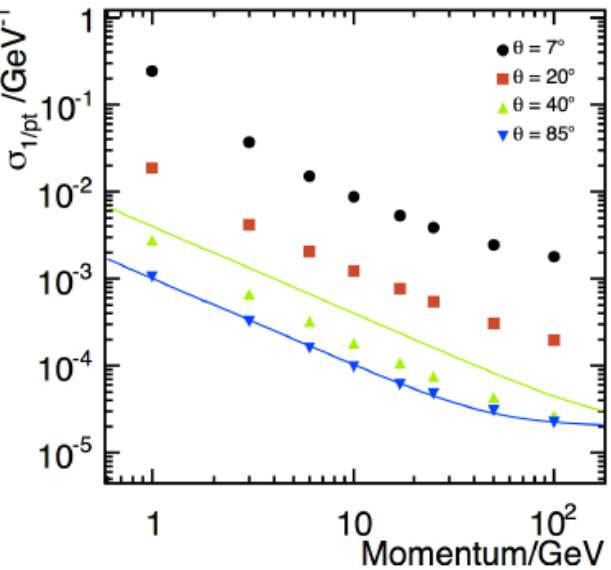
Softwares

iLCSoft reconstruction performance

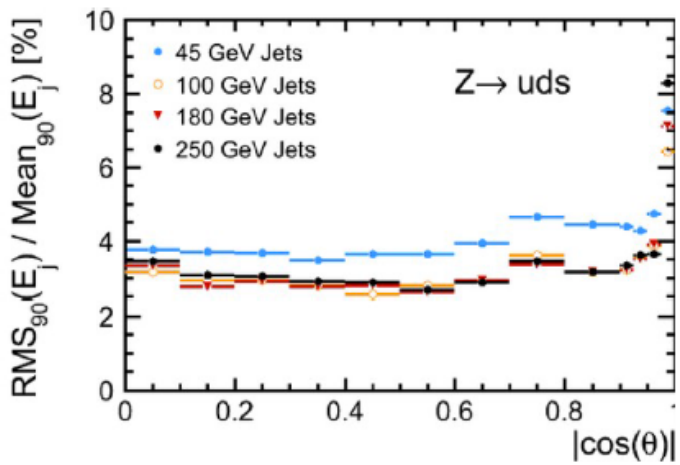


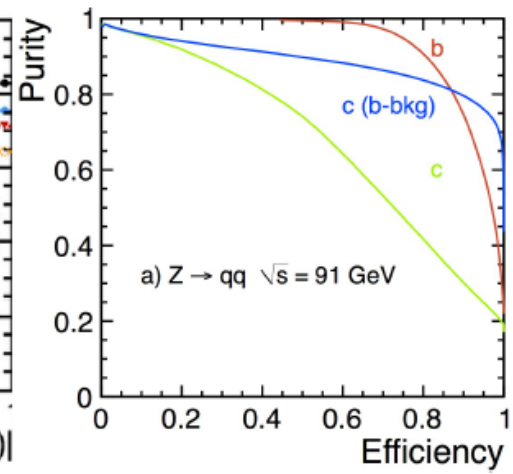


some examples of the software (*and detector*) performance for ILD with current iLCSoft tools



- the simulation and reconstruction tools in iLCSoft have reached a considerable level of maturity
- used to demonstrate that the design goals for ILD detector performance are met



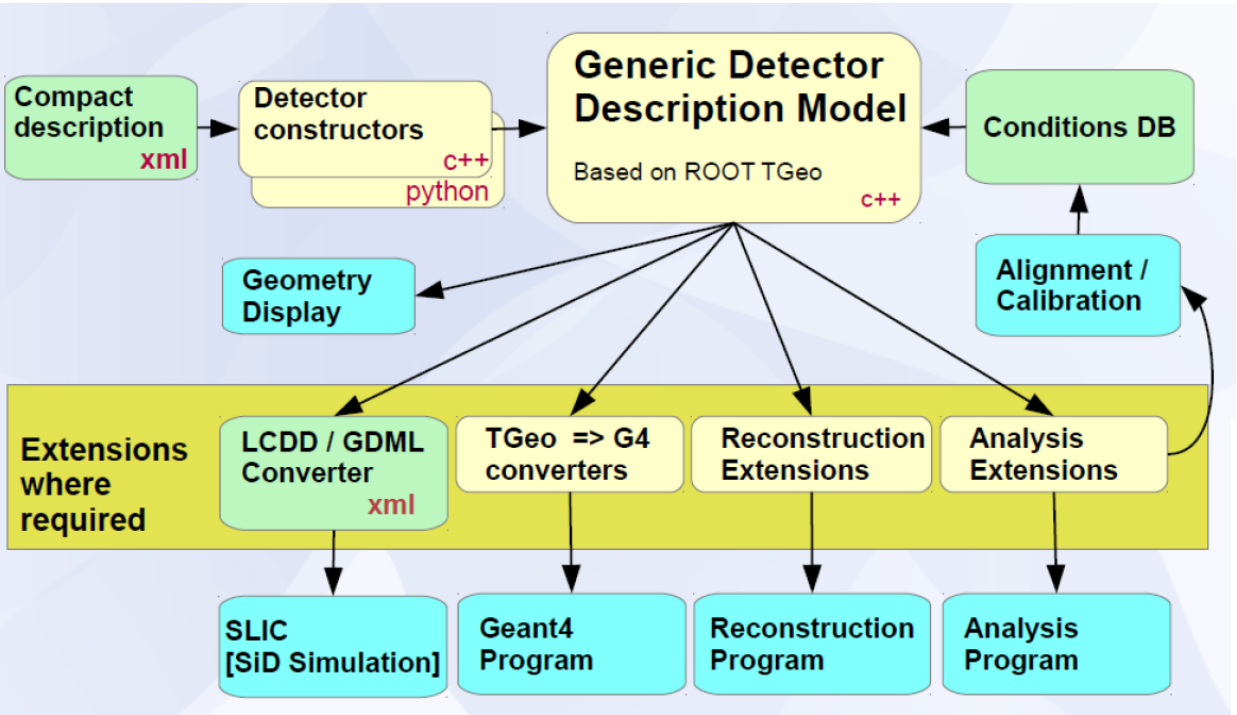


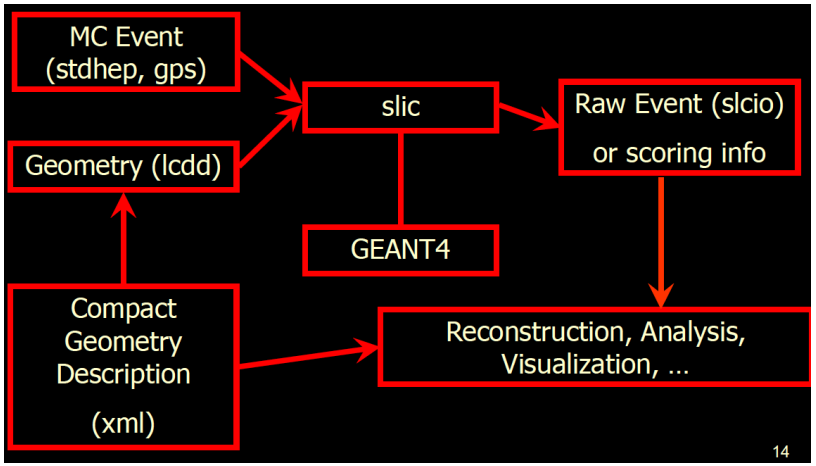
Frank Gaede, LCWS2013, Tokyo, Nov 11-15, 2013

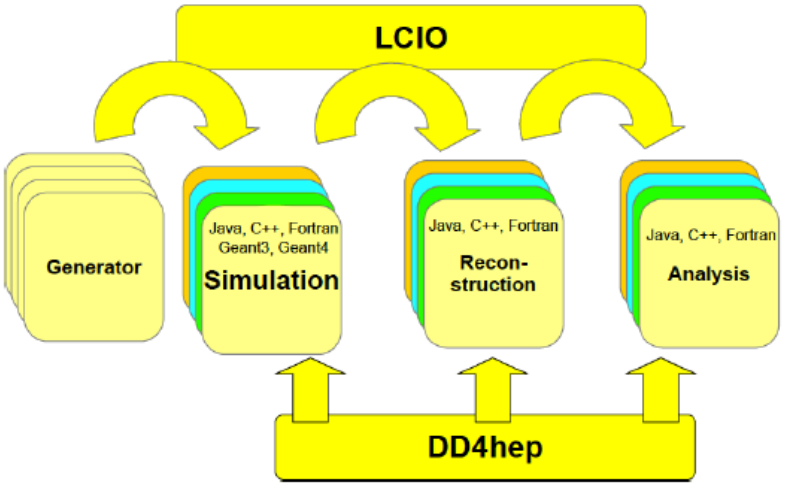
Frank Gaede (DESY)

9

DD4Hep: Generic geometry framework







As well as many other developments:

Goal: realism, commonality, flexibility

Frank Gaede (DESY) & Norman Graf (SLAC)

Generator Samples

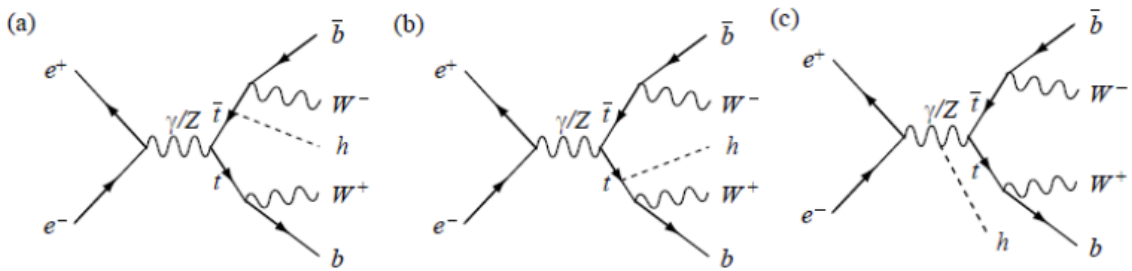


Figure 2.2.1: Feynman diagrams for the $e^+e^- \to t\bar{t}h$ process.

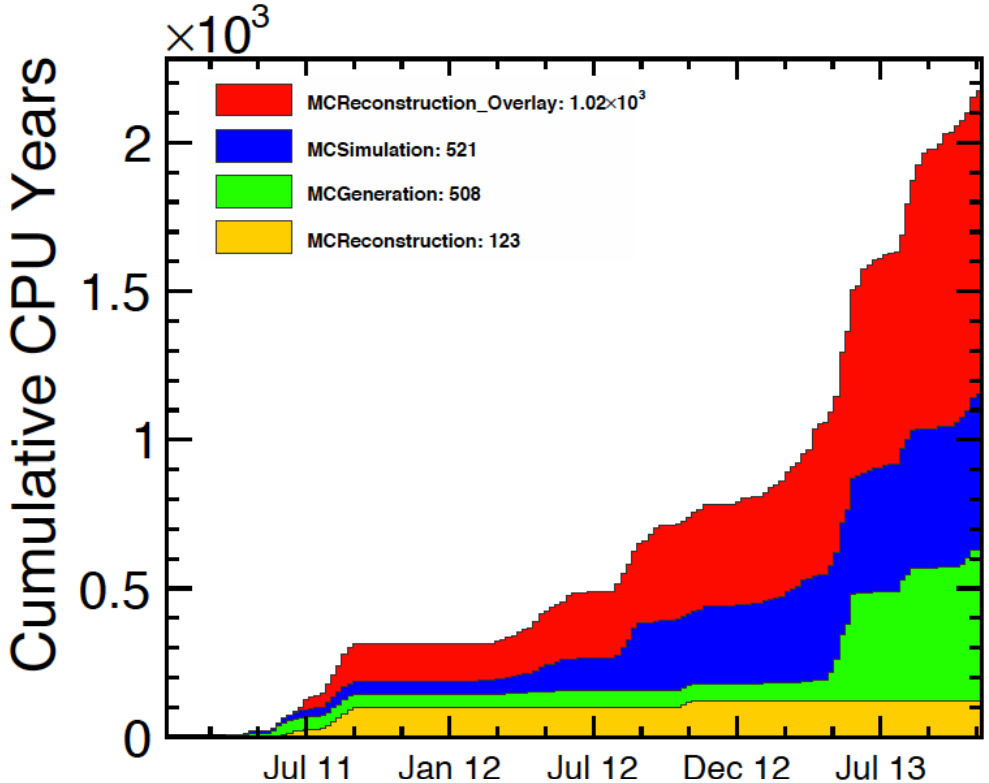
250 GeV	350 GeV
$e^+e^- \to 2f, 4f, f\bar{f}\,h$	$e^+e^- \to 2f, 4f, 6f, f\bar{f}\,h$
$e^+\gamma/\gamma e^- \to 1f, 3f$	$e^+\gamma/\gamma e^- \to 1f, 3f, 5f$
$\gamma\gamma \to 2f$, *mini-jet, low_pt*	$\gamma\gamma \to 2f$, *4f*, *mini-jet, low_pt*
eepairs	*eepairs*
	$e^+e^- \to t\bar{t}$ *(w. thresh. effect by Physsim)*

- $e^\pm$ fully polarized. 1 ab^{-1} except high σ processes
- ffh files were sub-divided depending on the Higgs decay mode
- ~ 1 G events, 6k files (except low_pt hadrons and eepairs)
- Files are on ILC VO GRID (LCG & DIRAC catalog)

- Common generator tools and samples are important for
  - consistent studies
  - minimize unnecessary duplicated efforts
- Needs for common generator tools and samples will continue for physics and optimization studies in future
- Several generator issues have been identified during the DBD era. We hope to be able to solve them in coming months.
  - Current main focus : Whizard 1.95 to Whizard 2.x.
  - Other generators (QED generator, for example) would be necessary eventually
- Participation of many users are important for these activities.

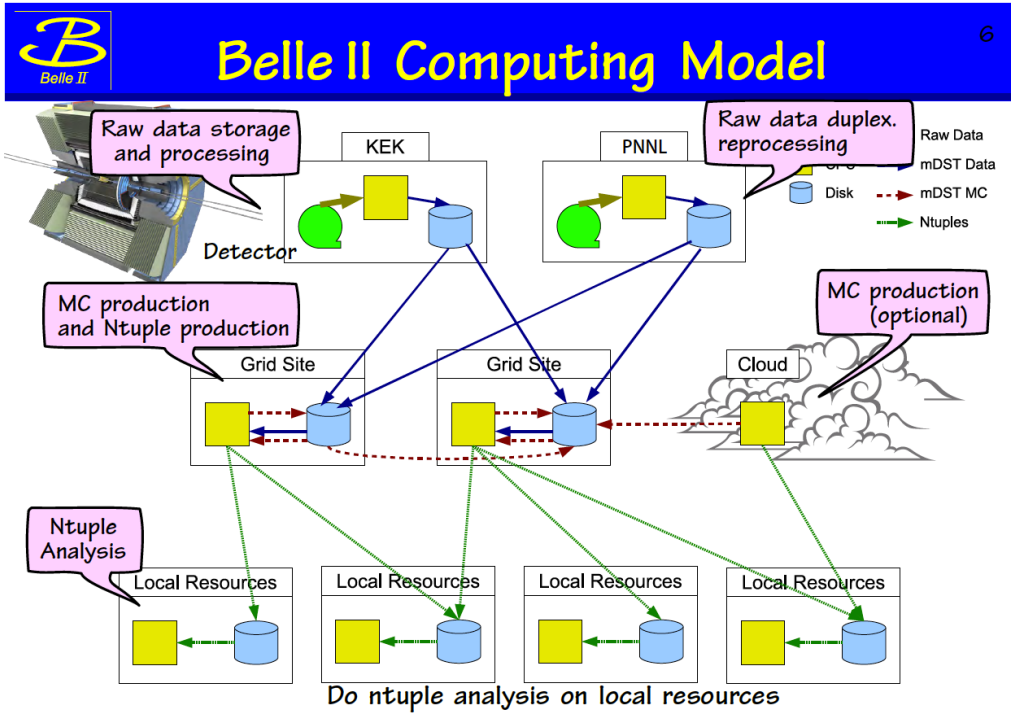
Akiya miyamoto (KEK)

Dirac: grid tools



ILCDIRAC is stable!

- Mailing lists:
  - Registration: `ilcdirac-register@cern.ch`
  - Questions: `ilcdirac-support@cern.ch`



There are similarities between Belle II and ILC
+ software concepts
+ DIRAC

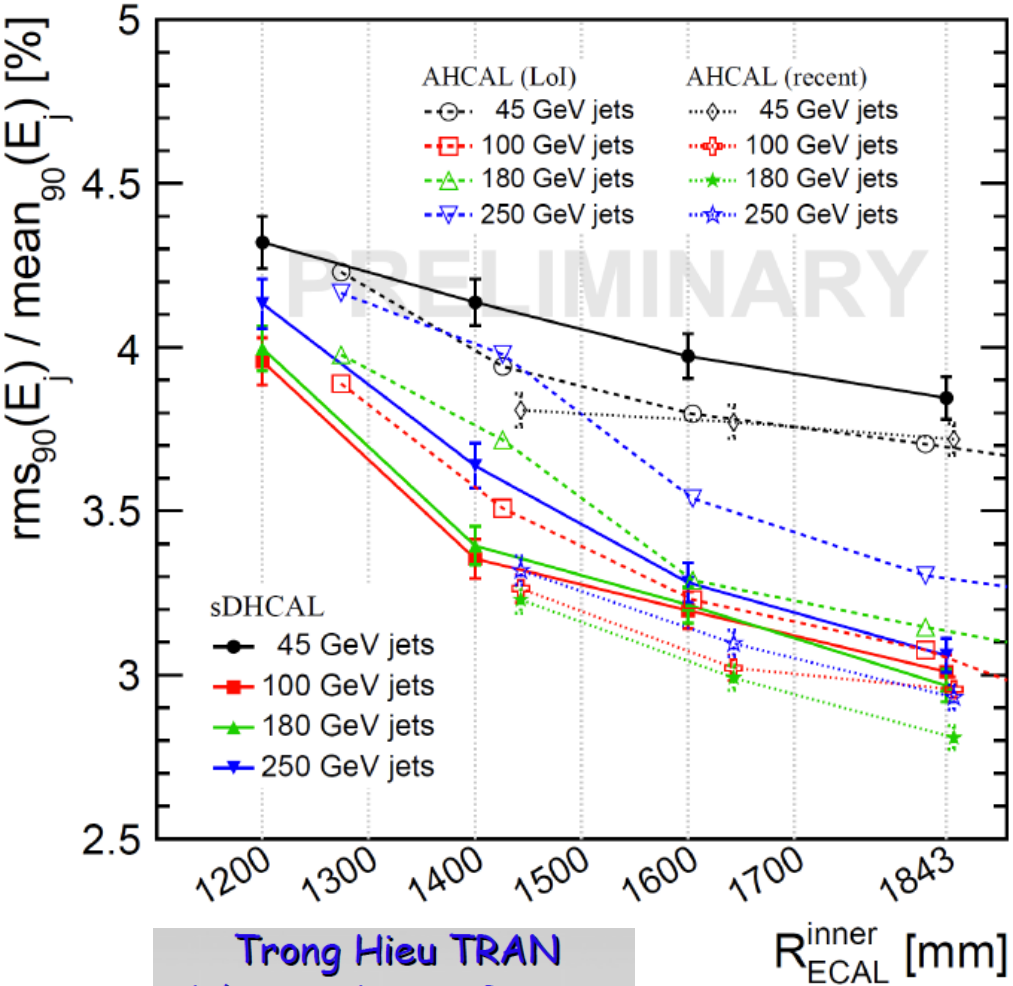
some chances to work together?

Christian Grefe*, Stéphane Poss*, André Sailer*

Takanori Hara (KEK)

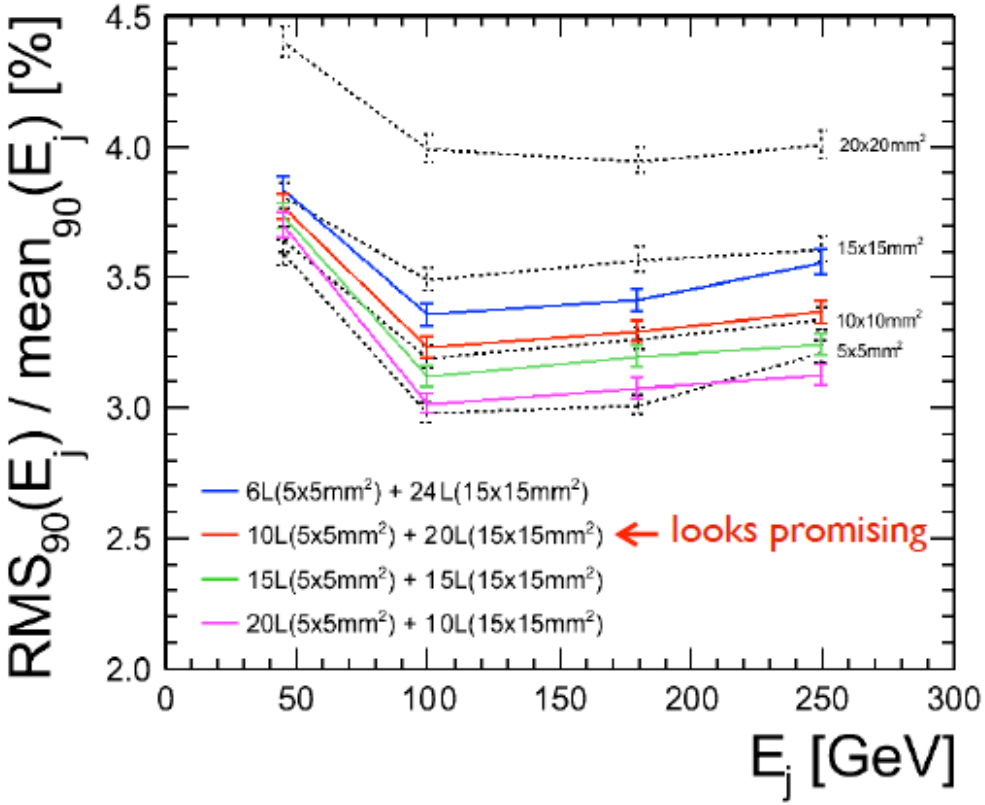
Detector Performance Study

Changing radius, cell size, longitudinal configuration, thickness...



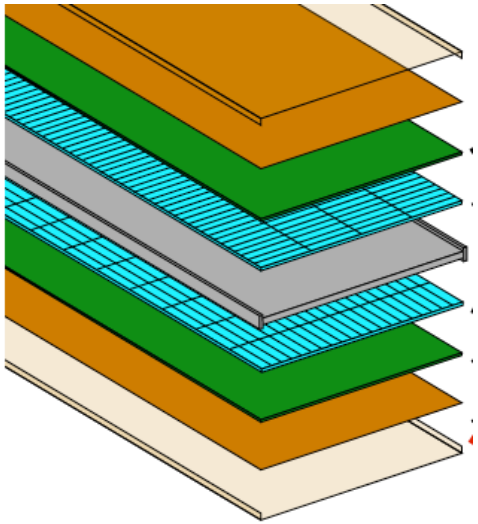
Trong Hieu TRAN
Laboratoire Leprince-Ringuet,
Ecole polytechnique, CNRS/IN2P3

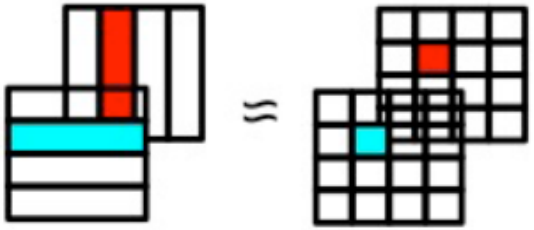
J. S. Marshall, University of Cambridge

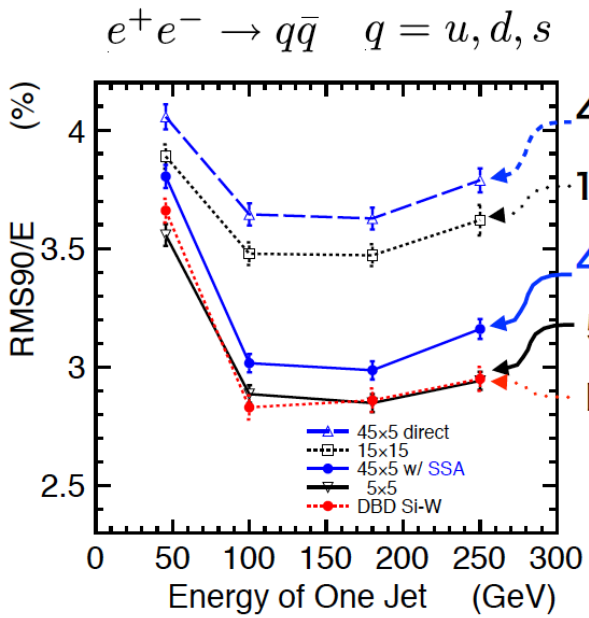


Foreseen:
A full parametrization of Jet energy resolution on detector geometrical parameters

Scintillator Strips ECAL & SSA







45 x 5 mm² strip ScECAL w/o SSA

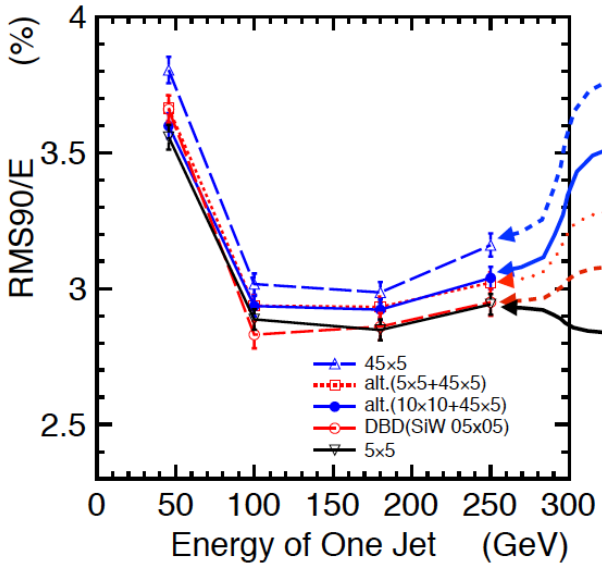
15 x 15 mm² tile ScECAL

45 x 5 mm² strip ScECAL w SSA

5 x 5 mm² tile ScECAL

DBD results (Si-W ECAL)

SSA works well,
leave ~0.2% difference from
5 x 5 mm² tile ScECAL and
DBD results



45 x 5 mm² ScECAL w SSA

Alt.10x10 ScECAL w/ SSA

Alt.5x5 ScECAL w/ SSA

DBD result (SiW ECAL)

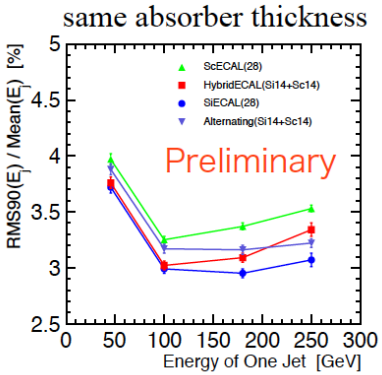
5 x 5 mm² tile ScECAL

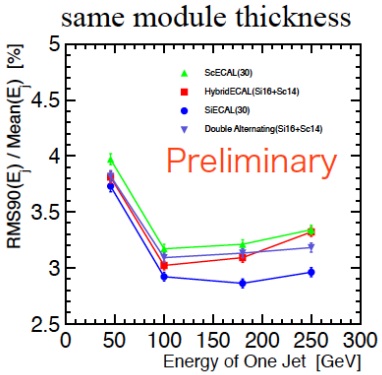
Effect on Alt.15x15 is small, then it was removed from this plot to clearly show Alt.10x10 result.

K. Kotera,
Shinshu University

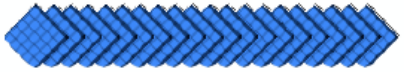
Tau/Jet at different ECAL

Hiraku Ueno (Kyushu University)


same absorber thickness


same module thickness

- Si ECAL



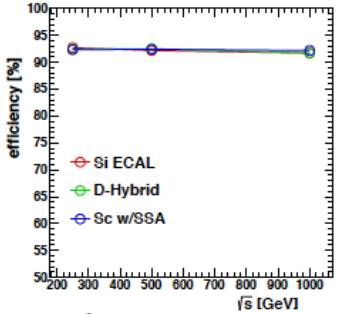
- Sci ECAL w/ SSA

- DoubleLayer Hybrid

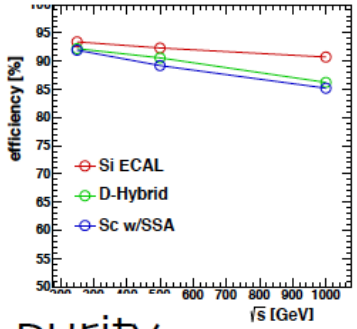
LCWS13
12 / 11 / 2013 @ Tokyo
Tomohisa Ogawa
Shinshu-Univ.

e-mode

efficiency

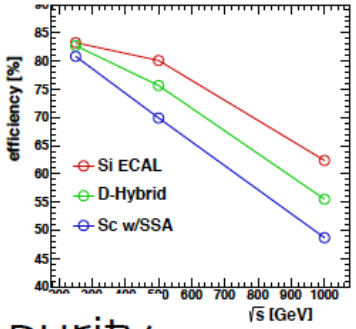


purity

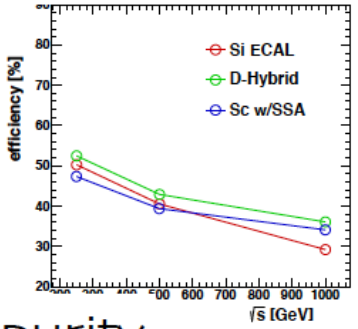


pi-mode

efficiency

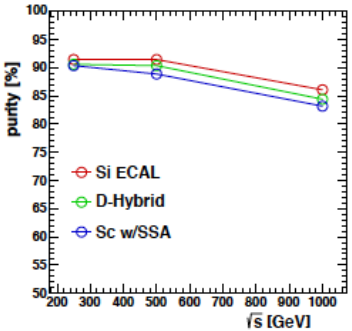


purity

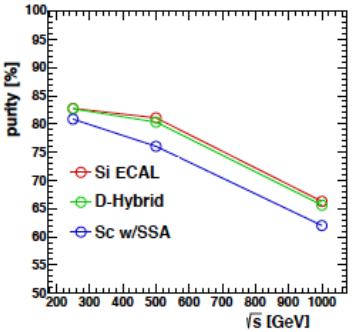


rho-mode

efficiency

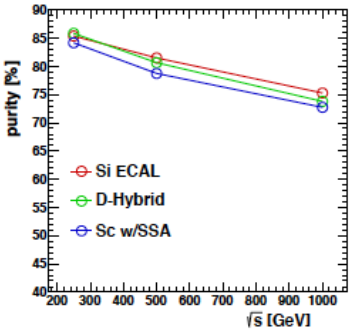


purity

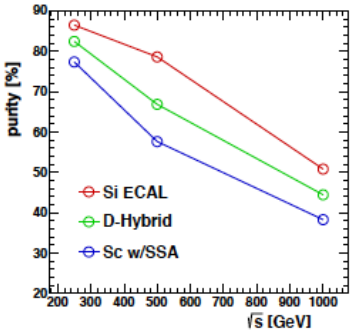


a1-mode

efficiency

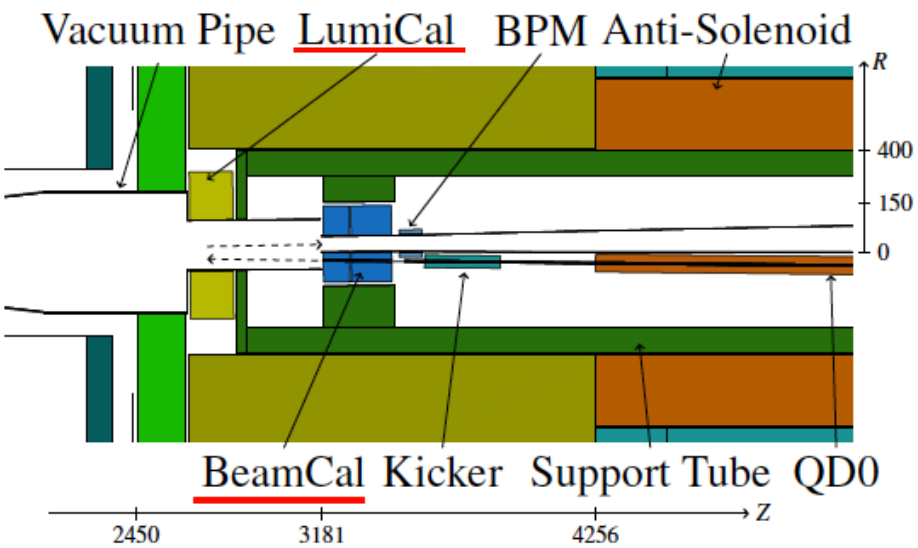


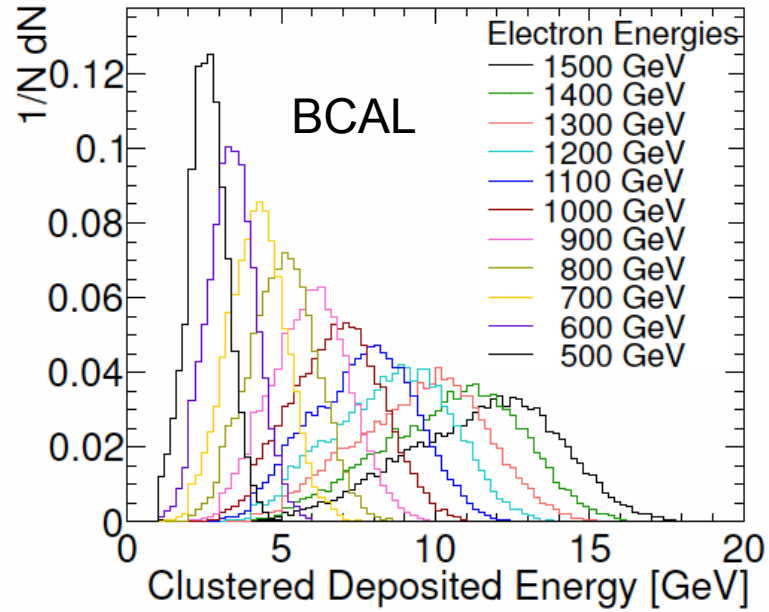
purity

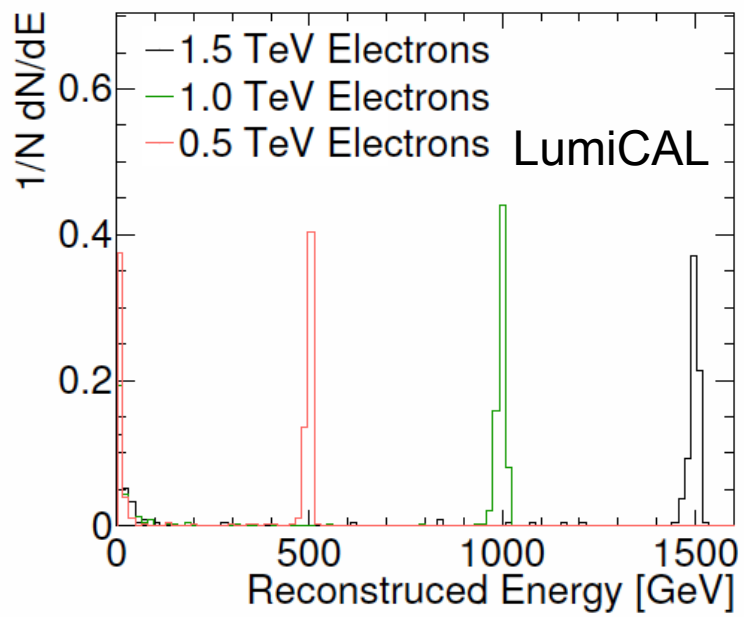


Reconstruction at Forward Calorimeter

- To flag photon converting event: tag forward electron/positrons in Beam Cal & LumiCal

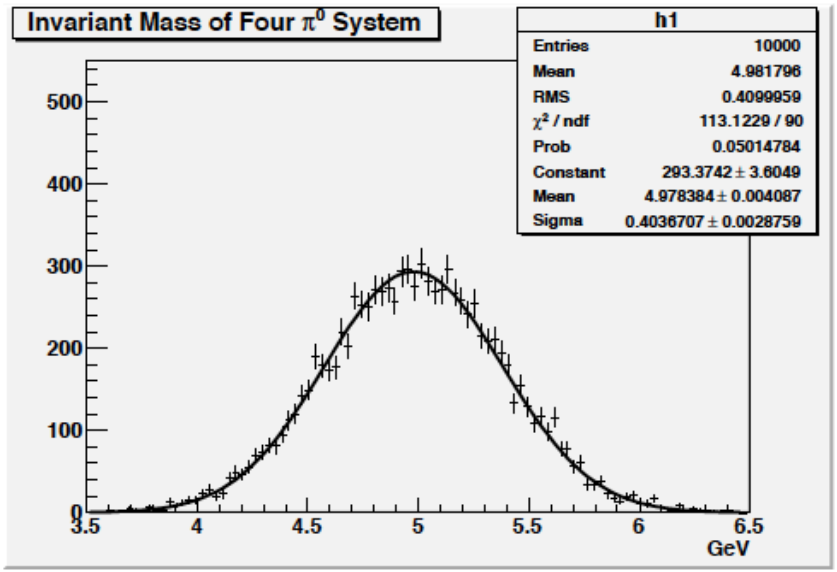


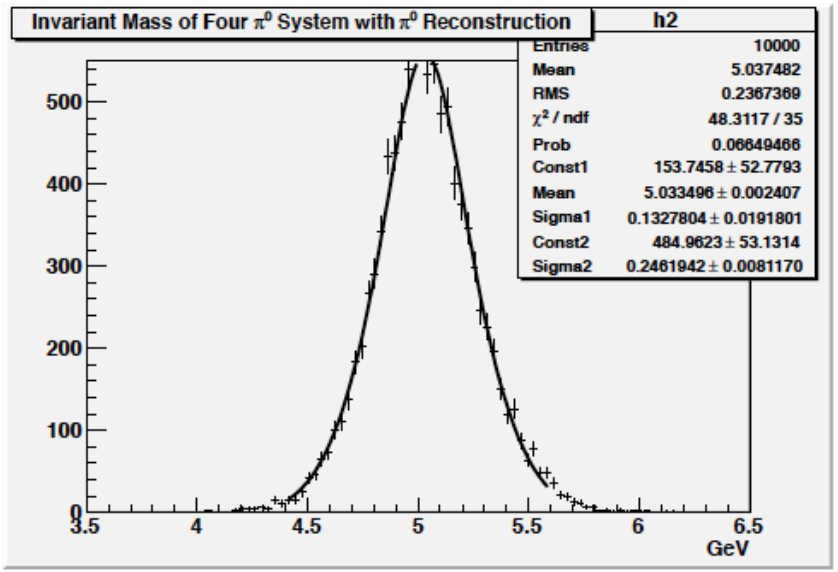




André Sailer
on Behalf of the FCal Collaboration
and the CLIC Detector and Physics Study

Pion-0 reconstruction

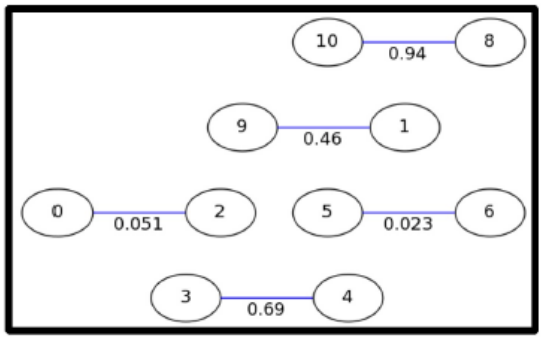




Intermediate Particle (π^0) Reconstruction

L = 1 ab^{-1}

Method	σ_{M_H} (MeV)
Double-Gaussian	± 5.5
Variance Weighted	± 4.32
χ^2 Minimum π^0 Reco	± 3.78
Log-likelihood π^0 Reco	± 3.66

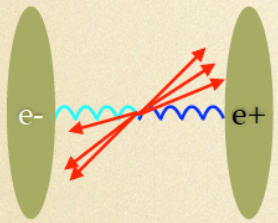


In full simulation 92 GeV $Z^0 \to q\bar{q}$, 75 - 80% of π^0 energy is correctly recovered

Brian van Doren

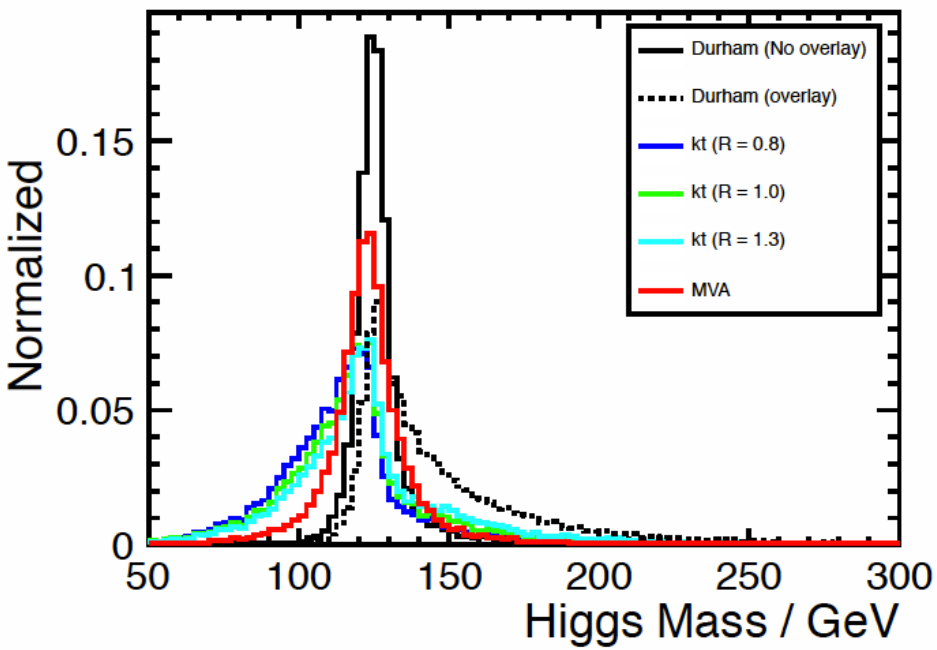
Department of Physics and Astronomy
University of Kansas

MVA method to remove beam beam background

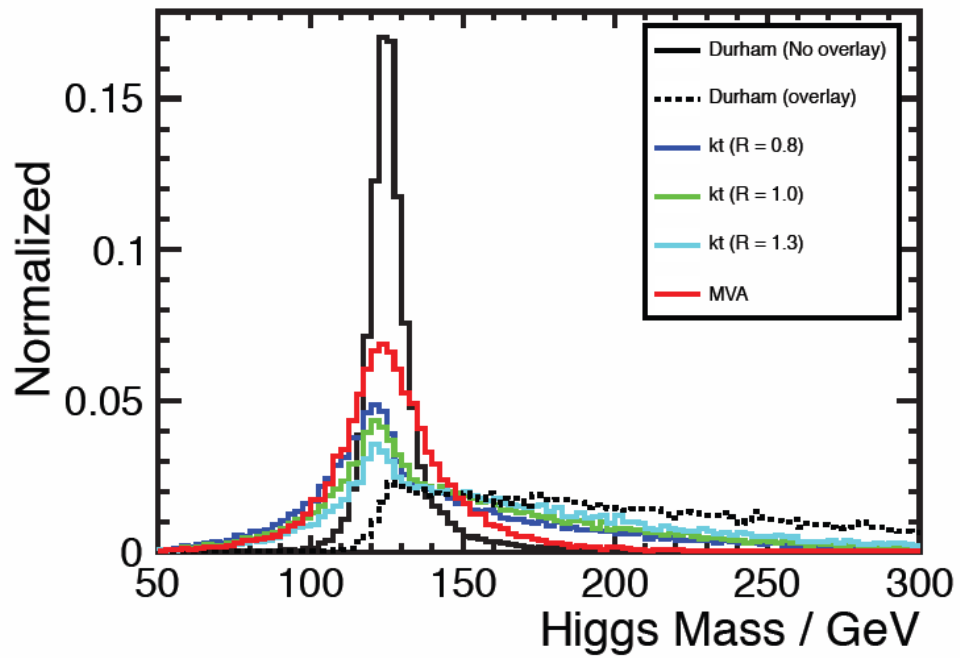


<N> = 0.4 @ 250 GeV
1.7 @ 500 GeV @ ILC
4.1 @ 1 TeV

Ecm (GeV)	Old#	# used for ILD Production	New# (correct)
250	0.33	0.20	0.25
350	0.54	0.33	0.40
500	1.7	1.7	1.2
1000	4.1	4.1	2.7

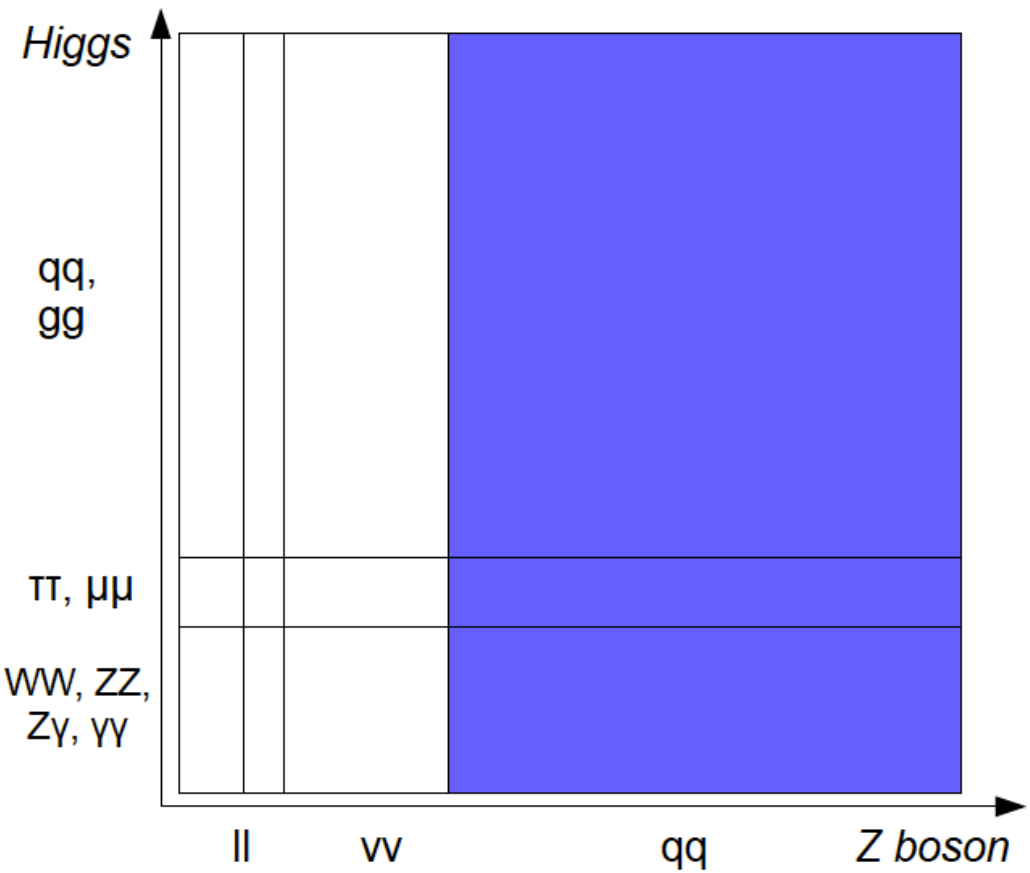


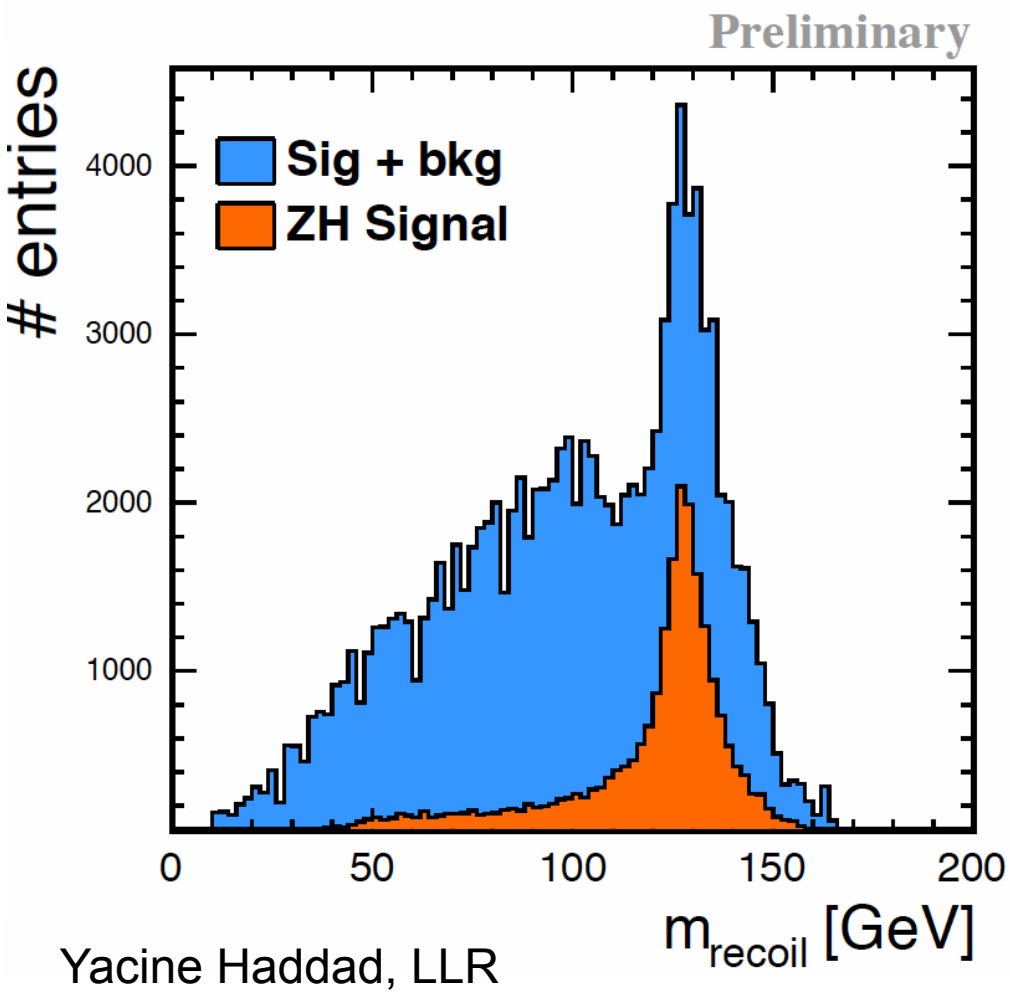
$e^+ + e^- \to \nu\bar{\nu}H \to \nu\bar{\nu}(WW^*) \to \nu\bar{\nu}qqqq$ @ 500 GeV



$e^+ + e^- \to \nu\bar{\nu}H \to \nu\bar{\nu}(WW^*) \to \nu\bar{\nu}qqqq$ @ 1 TeV

Model independent analysis of Higgs though ZH (Z→qq) event





Yacine Haddad, LLR

See also the analysis of Mark Thomson & Taikan Suhera

Summary

- ILC Softwares are stable & mature, fulfills the ILC physics requirement
  - Many developments on going: general, realism & flexible
- Huge simulation-analysis efforts, toward
  - A better understanding of the Detector/realism physics environments
  - Better reconstruction algorithms
  - **Optimized detector design**
  - **Better physics output**