Report from Physics WG

July 20, 2016

The Goals of Physics Coordination

1) to make compelling physics case for ILC that can convince decision makers that ILC is worth the investment,
2) and to optimize ILD so as to realize (1)

The Roles of the Physics Coordination

a) make a task list and set mile stones and timeline

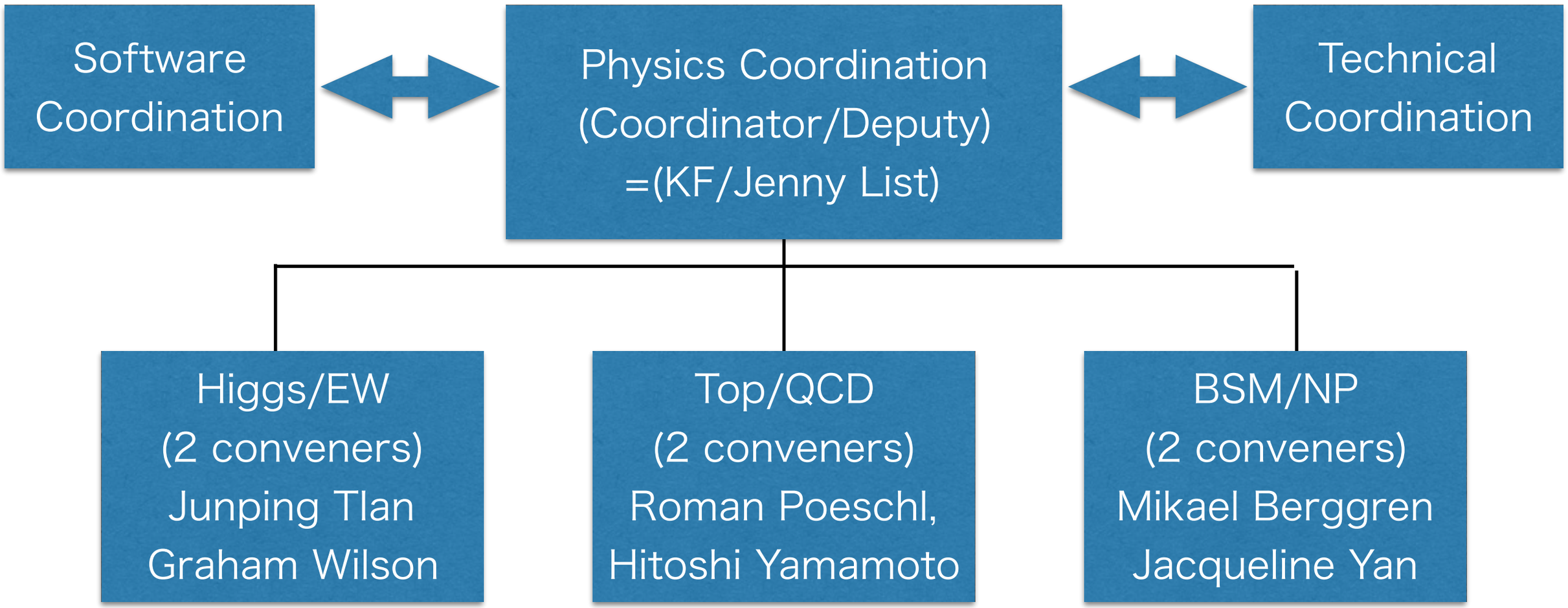
b) organize working groups / collaborate with other parts of ILD (in particular for detector optimization) as well as with the LCC physics WG.

c) monitor and, if needed, guide/help their progress

d) communicate the achievements to appropriate targets as needed,

e) thereby positively influencing decision makers, while contributing to international and regional strategy discussions.

Organigram



The structure and the members of the physics coordination team have been approved by IA.

We may add more subgroups or task forces as needed in future.

Action Items

1. Mailing lists:

Conveners' ML:

primarily for WG conveners, coordinator, and deputy:

ild-physics-conveners@desy.de created by Jenny

Use this mailing list also to send talk request.

Subgroup mailing lists:

ild-physics-bsm@desy.de	created by Mikael
ild-physics-top@desy.de	created by Roman
ild-physics-higgs@desy.de	created by Graham

mainly for communication among **active** people, not so much for every interested ILD member to stay informed.

Action Items (Continued)

2. List of activities:

WG conveners are compiling on-going/planned analyses.
Higgs/EW, BSM: list almost complete. Based on the list, we will

1. check if each benchmark process is properly worked on (who does what? → web page) and
2. enforce the analysis teams if needed, while
3. cultivating new/young people for new analyses
   → Web page as an entry point

Overlaps between WGs:

Higgs CP from ttH => Higgs/EW, but keeps close contact with top group
ee -> bb => top/QCD (same person as ee->tt)
ee -> other ff => Higgs/EW (interpretation in/with BSM)
Higgs -> inv => Higgs/EW (interpretation in/with BSM)
direct production of non-SM-Higgses => BSM
t -> ch (exotic top decays) => top/QCD

BSM group takes care of
- simulation studies for **direct production of new particles**
- specific BSM interpretations of analyses done in other WGs
  in collaboration with the LCC Physics WG / other theory colleagues

Higgs/EW

ongoing Higgs/EW analyses

topic	comment	contact	institute
Higgs mass	H—>bb	A.Ebrahimi	DESY
Higgs CP	H—>τ τ	D.Jeans	U. Tokyo
Higgs CP	ttH	T.Ogawa	KEK
anomalous HVV couplings	ZH, ννH	T.Ogawa	KEK
Higgs self-coupling	HH—>bbbb	C.Duerig	DESY
Higgs self-coupling	HH—>bbWW*	M.Kurata	U. Tokyo
Higgs self-coupling	systematics	J.Tian	U. Tokyo
Higgs BRs	H—>bb/cc/gg	H.Ono	NDU
Higgs BRs	H—>μ μ	S.Kawada	DESY
Higgs BRs	H—>WW*—>4q	M.Panduravic	Vinca
Higgs BRs	H—>invisible	A.Ishikawa/Y.Kato	U. Tokyo
W mass	threshold / direct	G.Wilson	U. Kansas
W mass	single W	K.Cotera	DESY
Z-pole running	ILC Parameters	G.Wilson	U. Kansas

BSM/New Particles

Ongoing studies in this group

Manpower welcome in both untouched and ongoing studies

analysis main person		topic	sqrt(s) [GeV]	detector sim	Status/ comments
Hale Sert, Yorgos Voutsinas	DESY	Light Higgsinos, dM <= 1 GeV	500	SGV/ FullSim	Paper published (Hale Sert) Eur.Phys.J. C73 (2013) no.12, 2660 Yorgos working on reconstruction of low momentum particles
Jacqueline Yan Tomohiko Tanabe	Tokyo/ KEK	Radiative Natural SUSY dM = 15-20 GeV	500	FullSim	Ongoing Input for Suvi's theoretical studies
Tomohiko Tanabe/ Moritz Habermehl	Tokyo/ DESY	WIMPs	350 / 500	FullSim	Ongoing Include systematics
Mikael Berggren	DESY	Sleptons, reco and disc. reach	500/ ...	SGV	Paper published in Eur.Phys.J. C76 (2016) no.4, 183 Moving towards FullSim and other channels than sleptons
Madalina Chera	DESY	SUSY Point 5 chi->Z/ W->qq	500	FullSim & SGV	ongoing

Top@LC2016

Top/QCD

- Top workshop: 6/7/2016 – 8/7/2016 at KEK
  Indico: https://agenda.linearcollider.org/event/7020/overview

- 41 registered participants
  Theorists, experimentalists from both LHC and LC world
  => Group of ~50-60 persons are working worldwide for top at the LC
  Nice example for (regular) overarching effort

- Excellent presentations, lot's of room for discussion

- Introduction (Public session)
  - Welcome to KEK (DG of KEK)
  - Status of ILC (Y. Okada
  - Keynote by Michael Peskin on role of top quark for BSM searches

- Hot News Top@LC2017 will be organized at CERN

1. The WS covers essentially all the current activities regarding top quark physics.
2. Contacts by Jenny (and Frank) with Stefan Kluthe on future measurements of alphas at ILC (maybe including low energy data)
3. b-quark production will be part of top/QCD working group (e.g. Initial studies at LAL)

Action Items (Continued)

3. Followup of the ICFA letter:

Plan for the followup of the ICFA letter

1. Decide analyses to include (figures and tables?)
2. Set up analysis teams (who does what?)

Write the backup documents (svn/regular meetings)

Work with LCC physics WG, but ILD will be the engine for this task.

Comment on the LCC Physics WG activities

1. ILC brochure (almost finalized)
2. X750 note (now available from arXiv:1607.03829

ILC-NOTE-2016-067
July, 2016

Implications of the 750 GeV $\gamma\gamma$ Resonance as a Case Study for the International Linear Collider

LCC Physics Working Group

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ABSTRACT

If the $\gamma\gamma$ resonance at 750 GeV suggested by 2015 LHC data turns out to be a real effect, what are the implications for the physics case and upgrade path of the International Linear Collider? Whether or not the resonance is confirmed, this question provides an interesting case study testing the robustness of the ILC physics case. In this note, we address this question with two points: (1) Almost all models proposed for the new 750 GeV particle require additional new particles with electroweak couplings. The key elements of the 500 GeV ILC physics program—precision measurements of the Higgs boson, the top quark, and 4-fermion interactions—will powerfully discriminate among these models. This information will be important in conjunction with new LHC data, or alone, if the new particles accompanying the 750 GeV resonance are beyond the mass reach of the LHC. (2) Over a longer term, the energy upgrade of the ILC to 1 TeV already discussed in the ILC TDR will enable experiments in $\gamma\gamma$ and e^+e^- collisions to directly produce and study the 750 GeV particle from these unique initial states.

In this note X750 is called Φ

Action Items (Continued)

4. WG Meetings:

(~Bi-weekly) **Wednesday Parallel Subgroup Meetings** to be organized by subgroup conveners interleaved with the main bi-weekly software/analysis meeting series. One is expected to choose the meeting of his/her interest.

BSM and Higgs/EW will start setting up WG meetings.
Top/QCD, to be discussed during top@LC2016 WS at KEK.

Main idea is to on one hand create a forum for more topical discussion among the active people and on the other hand then have only more mature analyses presented in the ILD-wide analysis/optimisation meeting.

Main series of Bi-weekly Wednesday Software/Analysis Meetings

Short status reports from each subgroup of soft/phys + a couple of longer reports from subgroups with significant developments to focus on (by default rotate among the three subgroups in the case of physics WG). Everybody in ILD is encouraged to attend this series of meetings to get general idea about what is going on.

Physics focus schedule

July 27: Higgs/EW
Aug 10: BSM
Aug 24: top/QCD
Sep 7: Higgs/EW

Clarification:

Software talks (organised by Frank&Akiya) will come in addition, as well as the overall software and physics coordination updates in the beginning of each meeting.