Promoting ILC in Snowmass Studies

J. List,
ILD General Meeting
September 1, 2020

Snowmass

- general overview on the Snowmass process c.f. talk by Graham in May ILD meeting
- US strategy process relies on “community study”
- (US) physicists are encouraged to do studies about future colliders themselves
- Energy Frontier Monte-Carlo Task Force organizes
  - publicly available samples
  - access to software
  - support
  - tutorials
- **huge opportunity to (re-)grow an ILC community in the US**
- **vital for a continuation (or even strengthening) of the political support for ILC from the US**

=> That’s why the global ILC community, including many people from ILD, make the outreach to the US community a priority!

Overview of Activities

- LCC Physics WG & friends, aka ILC Snowmass Task Force:
  "ILC Study Question" Document
- assigned "ILC contact persons" to each relevant Energy Frontier working group:
  - follow meetings & give ILC input to discussions
  - organize talks & alert experts on specific topics
- ILC Snowmass TF & LCC Software WG:
  - provide **easy to use** software
  - large-scale data sets
  - examples
  - and tutorials!

ILC Study Questions for Snowmass 2021

Keisuke Fujii (KEK, Tsukuba), Christophe Grojean (DESY and Humboldt U., Berlin), Michael E. Peskin (SLAC), Tim Barklow (SLAC), Yuanning Gao (Peking U.) Show All(34)
Jul 7, 2020

47 pages
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DOI: 10.3204/PUBDB-2020-02708
Report number: DESY 20-122, DESY-20-122, KEK Preprint 2020-8, IFIC/20-34, LCTP-20-14 SLAC-PUB-17543, LCTP-20-14 SLAC-PUB-17543
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pdf cite 1 citation

What does “easy to use” mean?

- our “normal” analysis workflow:
  - start off from DST (i.e. “raw” PandoraPFOs, Vertices etc)
  - then run `Marlin` job to do analysis-specific high-level reconstruction:
    - isolated lepton / photon finding
    - flavour tagging
    - jet clustering
    - calculation of event shape variables
    - particle ID
    - kinematic fitting
    - …
    - root tree writing
  - only then move to ``Marlin`-free” root / jas / python / … analysis
- lower the threshold by
  - running ``a generic” high-level reconstruction centrally
  - dropping many collections, e.g. tracks, clusters etc
  - **resulting LCIO files are called “miniDST” and (as any LCIO file) can be directly read in root**
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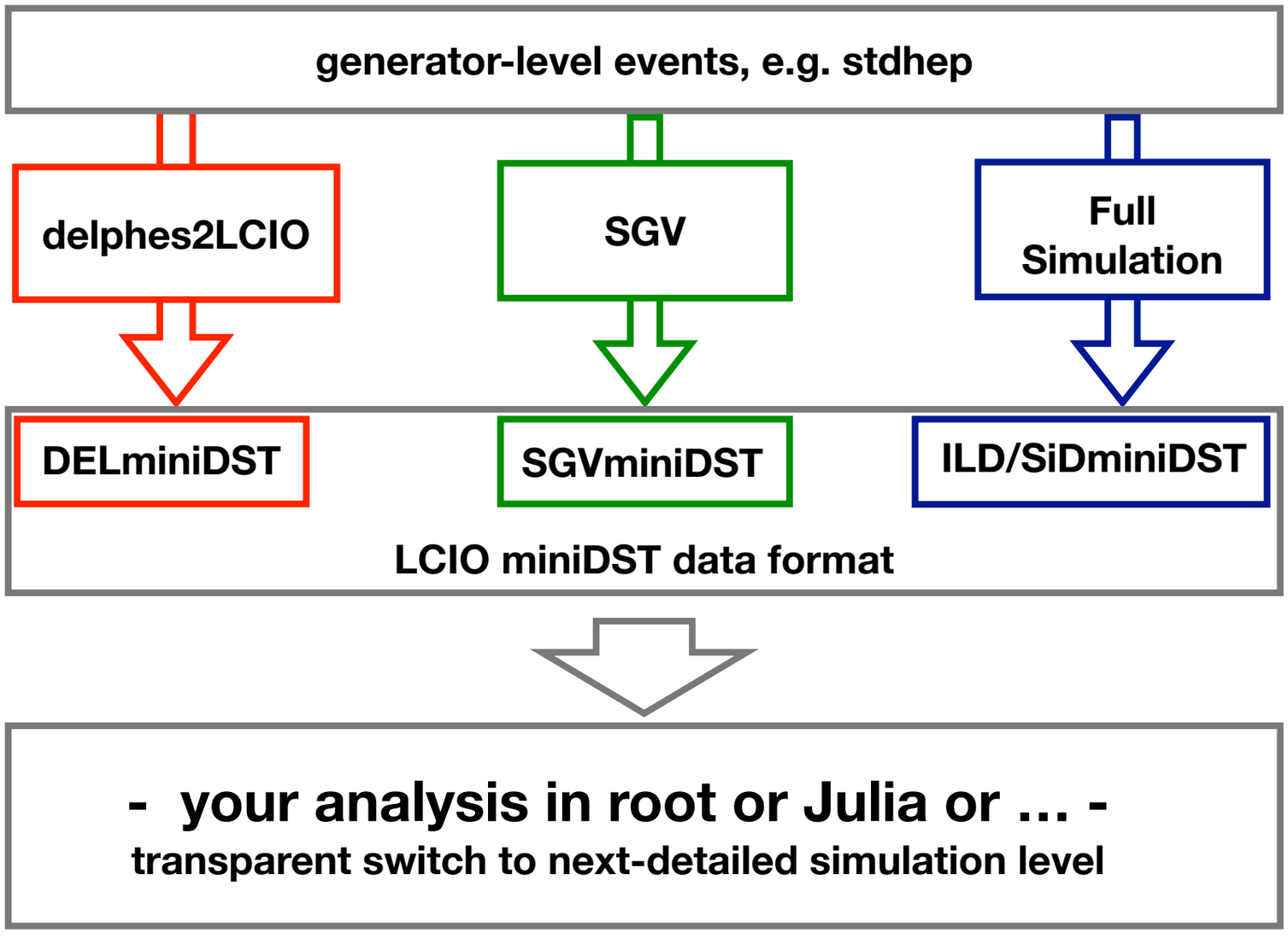
lots of expertise in here!

Three flavours of miniDST



analysis programmed against miniDST can switch transparently between different levels of detail!

Data samples

- Thanks to Michael Peskin and JoAnne Hewett, we got 50 TB at SLAC for ILC data samples for Snowmass (accessible via grid-tools and http / wget)
- **stdhep files of DBD** production, all ECM
  => have already been copied to SLAC
  => offered for “free” usage for Snowmass (cite “ILC Study Question” document)
- **DELPHESminiDSTs** of DBD stdhep files
  => based on generic ILC detector Delphes card by Filip Zarnecki (c.f. talk June 30)
  => will be produced by Chris Potter (U.Oregon)
  => offered for “free” usage Snowmass (cite “ILC Study Question” document)
- **SGVminiDSTs** of new Whizard2 samples ECM = 250 GeV
  => based on ILD in SGV (c.f. talk by Mikael Berggren June 30)
  => 20k of 2f / 4f / Higgs to be released during this week
  => full size samples as full production proceeds
- **ILDminiDSTs** of DBD samples, ECM > 250 GeV
  => 20k of 250 GeV μμH and μμqq (non-Higgs) used for tutorial
  => parasitically whenever not harming our own 250 GeV production!

A generic e^+e^- detector Delphes Card?

- proposal from Snowmass Energy Frontier conveners
- **joint response from ILD & SiD**
- discussion meeting with representatives from each project
- conclusion (so far):
  - circular and linear e+e- colliders differ too much in beam parameters and detectors to make a common Delphes card meaningful
  - (some) FCCee and CEPC detectors will investigate the possibility for a joint card (IDEA probably not ;-))
  - ILC generic card can probably be used for CLIC380, but not for the higher energy stages, where effect of overlay (removal) needs to be modeled

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Note to the Snowmass conveners on the energy frontier

SiD and ILD Spokespeople, August 24, 2020

Simulation tools for studies for Snowmass 2020

ILD and SiD very much welcome the effort by the Snowmass 2020 conveners, to collect/ provide / develop a suite of software tools which will make it easy for people to contribute to the Snowmass studies.

Over the last months intense discussions in the community have taken place, and have resulted in a loose agreement how ILD and SiD can best support this effort. A common detector description and performance parametrization has been developed by ILD and SiD, which has been verified by both groups as being adequate for the two detectors.

ILD and SiD would like to stress again that reliable results, in particular, for precision analyses, rely on the availability of fully simulated events, and should not be done using fast simulation tools like DELPHES. Because of this and to ease the access to fully simulated events, a mini-DST data format has been developed for the Snowmass 2020 effort and beyond. This data format is available for selected fully simulated events, and can also be written from DELPHES or other fast simulation suites. People are cordially invited to use this format if they later would like to look at full simulation events. Nevertheless we acknowledge DELPHES as the most widespread tool for fast simulation particular in the LHC community and the common DELPHES cards developed for ILD and SiD together serve as a good starting point for many studies, and deliver reasonable performance estimation.

Extending this model of a common set of fast simulation tools to other colliders, in particular, to FCC-ee or CEPC, seems rather difficult. There are significant differences in the detectors, in their acceptance, and their performance and also the energy regime they have been designed for. These need to be reflected in the DELPHES fast simulation, and make it virtually impossible to operate with one common set of detector description.

Cooperation between these different groups by e.g sharing of codes is possible on the more technical level, for example, on the methods a particular detector performance is parameterized, etc. Here similar solution should be sought as much as possible and feasible .

In addition we encourage all groups to agree on a common set of benchmark plots, which demonstrate the underlying detector performance, and to make these plots available together with the relevant card sets e.g. from DELPHES. These plots could be impact parameter resolution, momentum resolution, as a function of p_T and of cos(Θ), energy resolution for single electrons and pions, and the jet energy, but also high-level quantities like charged hadron ID and b- and c-tagging performance. Such plots will certainly help to establish a common understanding of the performance of the different options.

Documentation, documentation….

general entry-page for ILC in Snowmass context:
http://ilcsnowmass.org

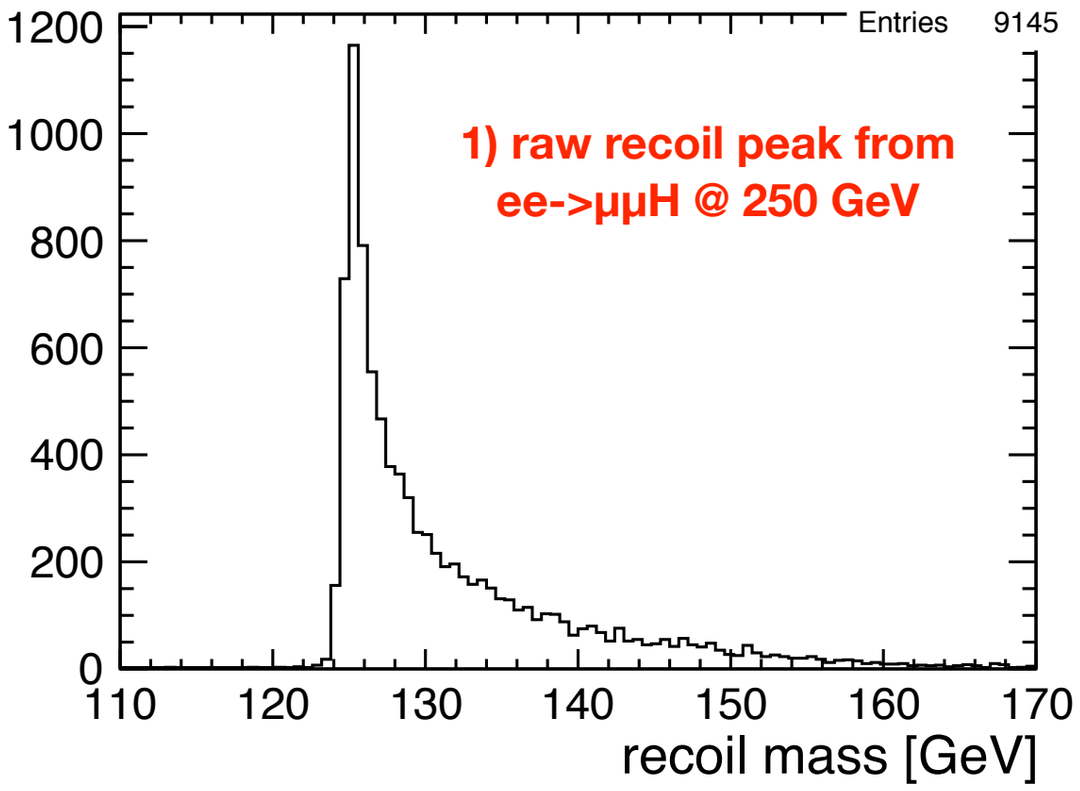
- find there links to more detailed information on
  - all the tools
  - data sets
  - examples

discussed in this talk

Tutorials

- the crew: C. Potter, J. Strube, F. Gaede, R.Ete, D.Jeans, N.Graf, JL
- a first tutorial happend last Friday: https://indico.fnal.gov/event/45031/
- 66 registrations, ~50 actual participants
- general introduction by Chris
- followed by hands-on parts:
  - install LCIO and create Higgs recoil peak based on ILDminiDST examples with root (JL)
  - Higgs recoil peak as Jupyter notebook (Jan)

Tutorial Steps



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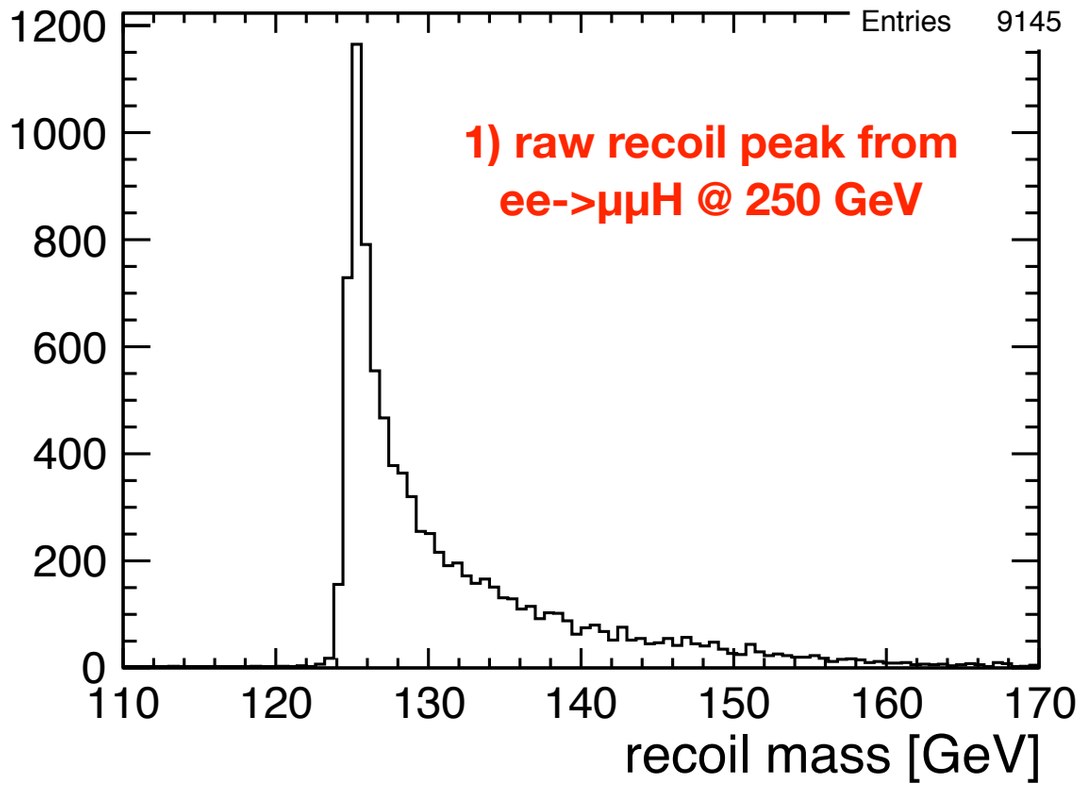
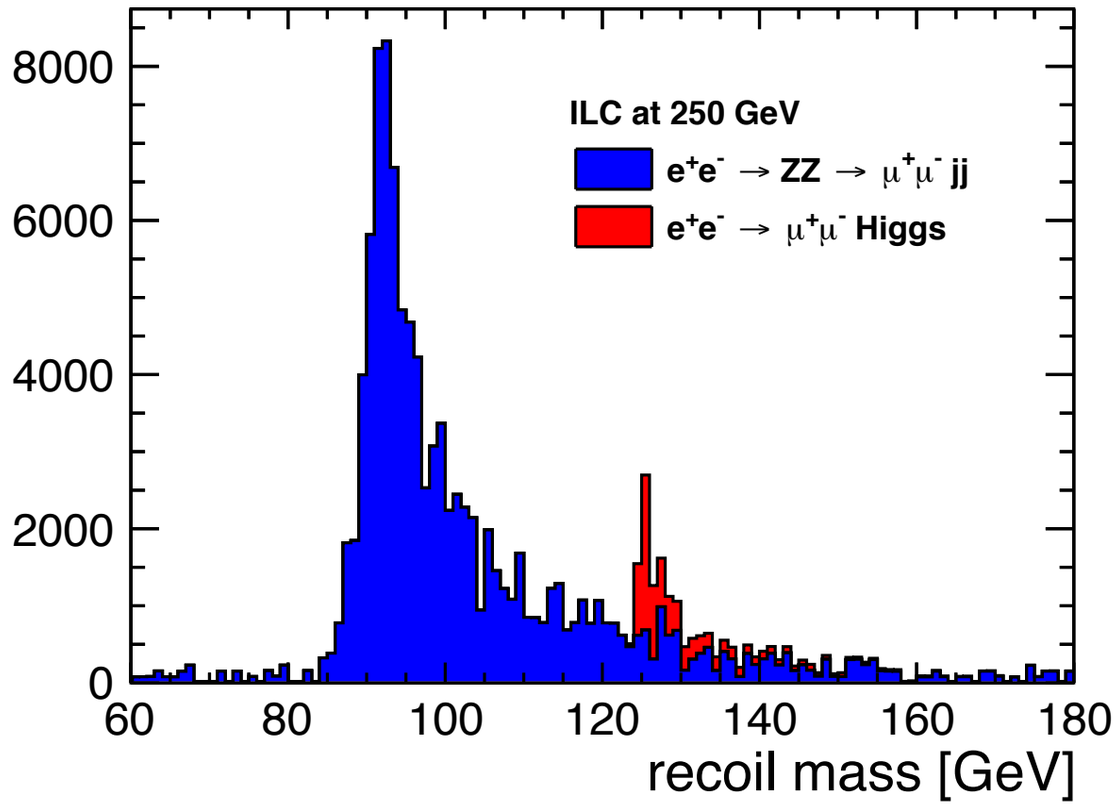


1) raw recoil peak from ee->μμH @ 250 GeV



2) luminosity and polarisation weighted recoil peak from ee->μμH and ee->μμqq @ 250 GeV

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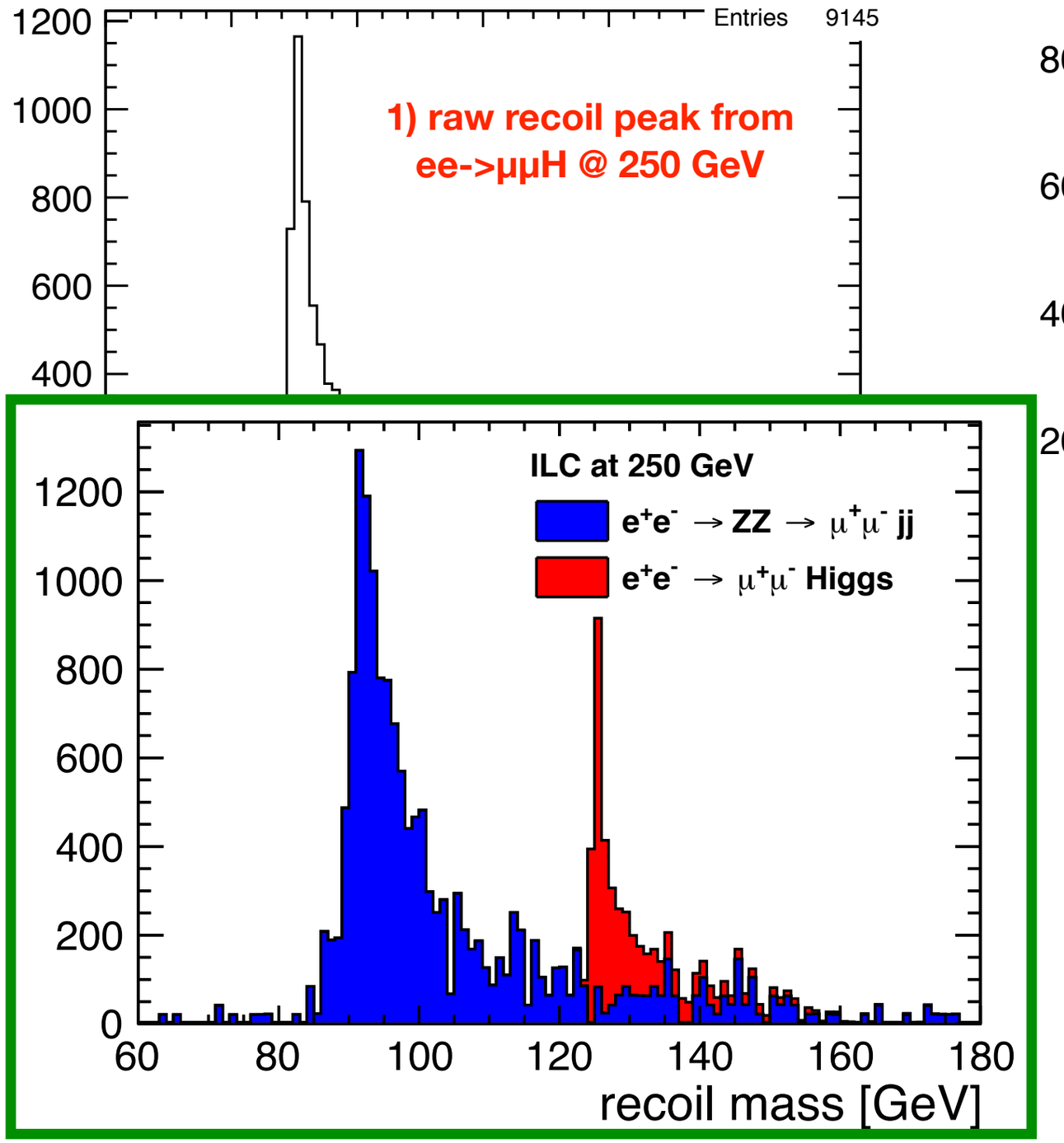

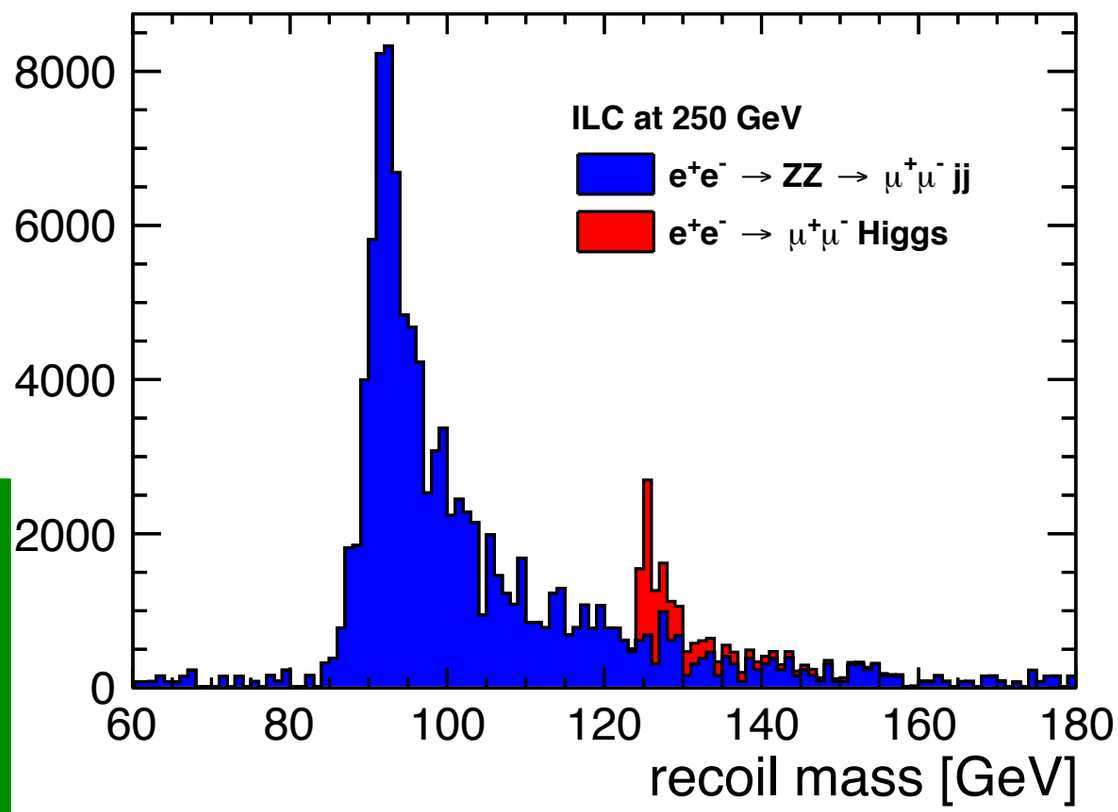

2) luminosity and polarisation weighted recoil peak from ee->μμH and ee->μμqq @ 250 GeV

3) excercise: apply cut on b-likeliness of jets

More Tutorials

- many ideas, comprising
  - repeat (improved version of) last Friday's tutorial
  - Whizard
  - delphes2lcio
  - DD4HEP / simulate your detector idea
  - Marlin / how-to contribute to reconstruction
  - tutorial showing a real analysis step-by-step
  - [your idea? -> contact us!]
  - …

=> need to get together in the next days among the tutorial team and with Snowmass MC TF to decide on next steps

Conclusions

- **Snowmass is a HUGE chance for the ILC: essential to keep-up / re-inforce US pressure**
- **it is also a HUGE chance for ILD:**
  - **miniDST is a perfect entry point for newcomers**
    - from summer / bachelor student to professor :-)
  - **tutorial material is (of course!) also available to us**
    - **attracting new ILD (guest) members**
- **we still need your help:**
  - **test receipes**
  - **write more examples**
  - **answer questions (e.g. on Snowmass Slack)**
  - **contribute to content of tutorials e.g. e^+e^- analysis dos & don'ts / best practice examples / …**

Many, many thanks to all who contributed and will contribute!