

Systematics at the LC ILD systematic WG

Marcel Vos, IFIC (UVEG/CSIC) Valencia

Graham Wilson, U. Kansas

Taikan Suehara, Kyushu U.

Systematics...

Most of our physics case is based on sophisticated prospect studies in full simulation

Often, the uncertainty quoted is statistical only

(which you could have gotten on the back of an envelope)

This may be fine... or not...

You have to judge for your analysis what can be safely ignored and what must be taken into account

Identifying the susceptibilities of your analysis, you can redesign it to become more robust

Example: top quark mass from threshold scan

stat. error:

< 30 MeV (can be reduced further by assuming more lumi)

exp. syst. error:

several sources considered, a few are similar size as stat error

main systematics in current world average (modelling, JES) not considered

theory error:

~10-50 MeV in $1S \rightarrow \overline{MS}$ transition, depending on how you feel about α_s

Systematics working group

Analysis teams should make sure they are syst-proof

- check susceptibility to systematic uncertainties
(redesign analysis if needed/possible)
- look at LEP and SLC legacy
- contact your favorite theorist

Systematics WG to help here

- Collect information
- Identify major missing items
- Coordinate work on in-situ constraints
- Define prescriptions for analysis teams

How well do we know the machine?

Integrated luminosity: 0.1 %

Source: JINST 2 (2007) P09001

Contact: MDI?

Polarization: 0.1 % (electron), 0.35% (positron)

Source: LC-REP-2013-009

Contact: Jenny List

Beam energy: 10^{-4} , or better still from $\mu\mu\gamma$

Graham

Luminosity spectrum + uncertainty

Source: arXiv:1309.0372

Contact: André Sailer, Jacqueline Yan

How well do we know the Monte Carlo?

Very precise measurements on complex final states may be limited by the accuracy of the generator used to correct the result

- fiducial measurements may overcome this?
- hard to estimate (typically compare generator A and B)

Define alternative WHIZARD setups together with authors?

How well do we know the physics?

- Estimate theory error
- Parametric uncertainty from α_s , W, Z, H, t quark masses

Numbers (or guesses) exist for most

Not for all: I have not managed to get a prospect for α_s

How well do we know ILD?

Acceptance has uncertainty from selection cuts,
b-tagging, energy scale of reconstructed objects
- MC modelling probably OK to few %, not at required level

Need contacts: b-tagging, jets, leptons

How much can we learn in situ?

- Ultimate precision often driven by data-driven constraints
- We need to study control samples ($Z \rightarrow b\bar{b}$)

This is the area where your contribution is most needed. Please, sign up.

Systematics: detector effects

- | Energy scales
 - | Tracks
 - Jets (by flavor and other conditions)
- Efficiencies and purities
 - Lepton ID
 - Flavor tagging

Accuracy of 'basic parameters' (above) should be investigated in common. Application to individual analyzes should be done by analyzers.

Status and plans

- No work yet
 - except very rough estimation of flavor tagging
 - appeared on Higgs White Paper of snowmass
 - (0.x% for b- and c-tagging purities)
 - At least we plan to do
 - Jet energy scale
 - (Better) flavor tagging
- based on MC analysis on control samples
- More working force (horse) needed!

Way forward

Proposal: new group to collect “prescriptions” for major systematics. Collect in one central document. Wiki page?

Please, sign up as the contact expert for one of the systematics I discussed (or the ones I missed).