Systematics at the LC

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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 to within an error of several 10s of % using 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:

~100 MeV in 1S → $\overline{\text{MS}}$ transition

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: take into account relevant luminosity spectrum + uncertainty

Source: arXiv:1309.0372

Contact: André Sailer?

How well do we know the generator?

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 (scale variations)
  - *Careful... returning to top mass example we cited 100 MeV until http://arxiv.org/pdf/1502.01030.pdf came out*
- Parametric uncertainty from α_s, W, Z, H, t quark masses

Numbers (or guesses) exist

Collect in one central document?

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.

Way forward

Analysis teams should make sure they cover their backs

→ check susceptibility to systematic uncertainties

(redesign analysis if needed/possible)

→ look at LEP and SLC legacy

→ contact your favorite theorist

Proposal: new group to collect “prescriptions” on ILD (internal) page for major systematics

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