EF03: EW Physics: Heavy flavor and top quark physics

- April – August 31, 2020: Letter of interest: ~ 1 page
- April – July 31, 2021, Contributed Papers

- Topics
- Manpower
- Coordinated effort

- Twiiki: http://twiki.ihep.ac.cn/twiki/view/CMS/Snowmass
- Today's agenda

Monday, 13 July 2020

20:00 - 20:05	Intro *5'*	
20:05 - 20:20	top FCNC (1) *15'* Speaker: Cen Zhang	
20:20 - 20:35	CKM phi_s measurement, Bs->JPsi phi *15'* Speaker: Mingrui Zhao (China Institute of Atomic Energy)	

Content of the group

- Top
  - Precision studies of top-quark properties (mass, couplings)
  - High-precision predictions for top-quark observables
  - New production modes and rare decays of top quarks
  - Top quark identification at future facilities
  - …
- Bottom, and Charm
  - Precision probes of pQCD and heavy-quark factorization
  - W+c/Z+b production
  - EW production
  - …

informations

- EF03 biweekly meeting, Thursdays1pm EDT(1AM Beijing time)
  - 28 May: https://indico.fnal.gov/event/43491/
  - 11 June: https://indico.fnal.gov/event/43738/
  - 25 June: https://indico.fnal.gov/event/44043
  - Next: 16 July: https://indico.fnal.gov/event/44297

Limits on Precision Top Mass Measurements at HLLHC and Prospects for the 4top Process
Speaker: Stephen Wimpenny (University of California - Riverside)
Snowmass EF03 Ki...

Dark Matter and Heavy Flavors at Colliders
Speaker: Alexander Moreno Briceño (Antonio Nariño University)
DM-HFaC.pdf

Top Quark Spin Correlations at the HL-LHC & constraining new physics
Speaker: Andreas Jung (Fermilab)
snowmass_aj_0528...

ILC: EFT fit for top and bottom EW couplings
Speakers: Gauthier Durieux (Technion Haifa), Martin Perello (IFIC Valencia), Roman Poeschl (LAL Orsay)
meeting_snowmass...

Optimizing top-quark threshold scan using genetic algorithm ¶
Speakers: Aleksander Filip Zarnecki (University of Warsaw), Kacper Nowak (University of Warsaw)
kn_prezentacja_sno...

new ideas for top quark mass measurements
Speaker: Kaustubh Agashe (University of Maryland)
B-hadron_CMS.pdf

Top mass prospects at e+e- colliders
Speakers: Esteban Fullana (IFIC-Valencia (CSIC-UV)), Frank Simon (Max-Planck-Institute for Physics)
TopMassEECollider...

Heavy quark studies other than top at Linear Colliders
Speaker: Roman Poeschl (LAL Orsay)
talk280520.pdf

ttW modeling
Speaker: Maria Moreno Llácer (IFIC, Valencia, Spain)

Novel constraints on EFT in the top sector
Speakers: Alexander Grohsjean (Deutsches Elektronen-Synchrotron), James Keaveney (DESY)
EFT_Top_prospects...

+专题:
Top physics at a linear collider
Top physics at HL-LHC and HE-LHC
ESG decision toward FCC on top physics

Existing Notes and comments

- Notes and Comments:

  https://docs.google.com/document/d/17aPp9XpJAImmPlnPNtgV21rG2zEiFS2IHkO-ooC4rcQ/edit

  - **Top-quark mass measurement（e+e- threshold scan)**
  - ~~**Top-quark production processes**~~
  - ~~**Top-quark properties(other than mass, ex: spin correlation)**~~
  - **EFT interpretation**
  - **Heavy quark studies other than the top quark**

Mass measurements at e+e- colliders:

Frank Simon, Esteban Fullana Torregrossa
(CLIC,ILC,FCC-ee)

Future Studies

Ideas & Opportunities

- Threshold studies - standard total cross-section studies already very complete, personally planning an updated summary of results for CLIC, ILC, FCCee) - ideas beyond:
- additional observables at the threshold: asymmetries (AFB, maybe also LR with polarisation), kinematic observables, ... -
- Study of the evolution of signal efficiency and background rejection in the threshold region with event generators - at the moment the studies use constant numbers

Unfolding with measured luminosity spectrum. More generally

- Explore possibilities to combine threshold and above-threshold measurements, possibly breaking degeneracies of αs, yt
- Further development of mass measurements in the continuum, connection to theory to establish the best precision in theoretically well-defined mass schemes

Includes systematics in kinematic reconstruction

Identify the best strategy to measure the top quark width (threshold, continuum)

Roman Poeschl: **Linear colliders**

● Future e+e- machines are more than Higgs factories

• ee->qq (here b and c) processes will reach the per-mill precision

• These processes are important to establish full patterns of electroweak couplings that may lead to discoveries

• Note also that in some current models Higgs couplings will be agnostic to new physics

• Marcel and Gauthier will also address issues like contact terms

• Precision on Z-Pole as input to search for new physics at higher energies (see backup)

• This may imply complementarity between linear and circular colliders if one can afford two machines

• Detector optimisation to be studied (and to be brought in phase with the detector optimisation at higher energies)

• One may exchange several times a vertex detector but not a calorimeter

● Main challenge at future machines will be the control of systematic errors • Experimentally

• Vertex charge and particle ID

• PFO for final state jets

• Theoretically (not discussed)

• Need at least NLO electroweak predictions (and MC programs) for correct interpretation of results

Doreen: MCs including NLO EW corrections for 2->2f (f=bb,cc,tt) production will be a dedicated topic in this TG

Our possible contributions

CepC CDR

11 Physics Performance with Benchmark Processes

11.1 Higgs boson physics
- 11.1.1 Higgs boson production and decay
- 11.1.2 Higgs boson tagging
- 11.1.3 Measurements of $\sigma(ZH)$ and the Higgs boson mass
- 11.1.4 Analyses of the individual Higgs boson decay modes
- 11.1.5 Combination of the individual analyses
- 11.1.6 Higgs boson width
- 11.1.7 Higgs boson coupling measurements
- 11.1.8 The Higgs boson self-coupling
- 11.1.9 Higgs boson and top-quark couplings
- 11.1.10 Tests of Higgs boson spin/CP
- 11.1.11 Summary

11.2 W and Z boson physics
- 11.2.1 Z pole measurements
- 11.2.2 Measurement of the W boson mass
- 11.2.3 Oblique parameters

Interested Topics

EF03.1	Rare B decay channel study, e.g. b->sll, b->c l nu and so on	
EF03.2	Z and Higgs flavor violating decay	
EF03.3	Tau in the Jet: Bc->Tauv	
EF03.4	Lepton in the Jet: B/C meson Leptonic decay	
EF03.5	Pi-0: Z->tautau, Br(tau->X)	
EF03.6	MET at Jet: leptonic decay of Heavy Flavor Mesons, Bs->Phi+vv	
EF03.7	CKM phi_s measurement, Bs->JPsi phi	Mingrui Zhao
EF03.8	ttbar threshold scan	
EF03.9	ttbar top-EW couplings, EFT interpretation	
EF03.10	top FCNC	Peiwen Wu