

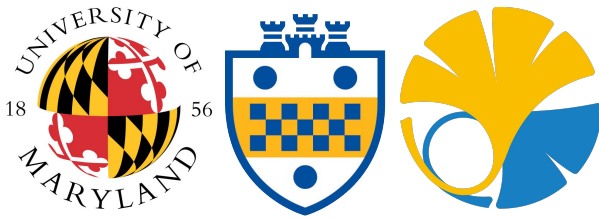


# EF04 Topical Group Meeting

A. Belloni - University of Maryland

A. Freitas - University of Pittsburgh

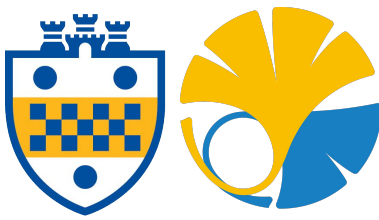
J. Tian - University of Tokyo



# Group Mandate

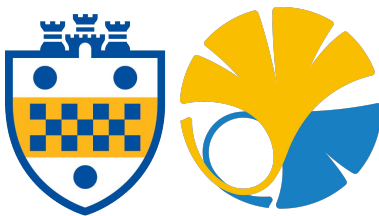
The dominant theme of topics covered in this topical group is constraining new physics by performing precision fits of standard model (SM) observables. The ingredients of the fit are electroweak observables, which are a direct component of the mandate of this group, and Higgs and top observables, which establish a tight link between this group and other EF topical groups (in particular, EF01, EF03, and EF05).

The mandate of this group includes the study of multi-boson signatures, and vector-boson fusion and scattering processes. Constraints to the SM are obtained within the EFT framework, and specific SM-extension models that are of particular relevance to electroweak precision physics. This group also investigates the impact of correlations among experimental and theoretical uncertainties, and discusses state-of-the-art theoretical modeling of EW and QCD uncertainties, and their combination.



# The Big Questions

- What is the scale of NP that can be probed with precision measurements?
- What is the value of new colliders? What is the motivation to do physics there?
  - Future colliders are presented in stages: why and how are these stages necessary?
- How can theoretical precision match the experimental precision?
  - What kind of precision do we need to achieve to overcome degeneracies?
- What are the correlations among experimental observables and theoretical models?
- What are the needs of theory and MC tools?
- What are the new analysis strategies?
- Ultimate goal is global fit of SM parameters, and evaluation of SMEFT constraints
  - Overall coherence of EFT interpretations



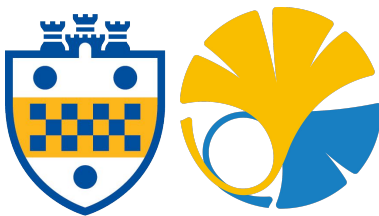
# Feedback from community

- Requests for EF background MC samples
  - <https://docs.google.com/forms/d/e/1FAIpQLScFNHgbXMoqtp1TGJO1KjvPdiA22ZvW-NuhTD1bBr9ZpRG0Dw/viewform>
  - So far, only one request submitted among all EF groups. It is possibly an indication that the situation is great (it is so easy to produce MC that no one needs centrally produced samples), but please make your MC requests, if any, as soon as possible
- Draft EF04 group report
  - [https://drive.google.com/file/d/1jNvoj5LxX47DHfeZ1DE\\_BgBqMaceAKEA/view](https://drive.google.com/file/d/1jNvoj5LxX47DHfeZ1DE_BgBqMaceAKEA/view)
  - Please let us know if you wish to add anything to the list of key questions, or other sections of the document



# Snowmass Timeline

- [DPF meeting](#) just concluded (July 12-14)
  - Community meeting with Funding Agencies (Tuesday 13th, 12:30pm)
  - Reports on Snowmass process presented at DPF Townhall (Wednesday 14th, 12:30)
- EF Workshop in first week of September (August 30 -- September 3)
  - Finalizing the schedule, expect plenary talks to draw a picture of the current situation, parallel session with combinations of topical groups, open-discussion sessions
- Major milestone for TG report: deadline to submit papers is March 15, 2022
  - We would like to receive notifications about essential results earlier (~January) to help their inclusion in the topical group report
  - Preparation and review of topical group report will follow, leading toward the Energy Frontier report (right before the July 2022 meeting in Seattle), and the final Snowmass report

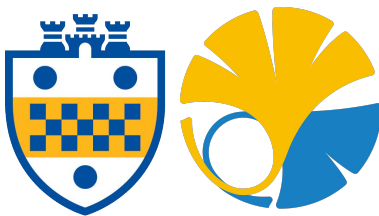


# Organizational Matters

- Communication
  - Slack: [ef04-ewk\\_constraints](#)
  - Mailing list: [SNOWMASS-EF-04-EWK\\_CONSTRAINTS \[at\] FNAL.GOV](#)
    - Send email to [listserv \[at\] fnal.gov](#) with empty subject and one line:  
[SUBSCRIBE SNOWMASS-EF-04-EWK\\_CONSTRAINTS FIRSTNAME LASTNAME](#)
  - Indico meetings: <https://indico.fnal.gov/category/1138/>
    - Link to “export to scheduling tools” in the top-right of the page
- Bi-weekly community meeting
  - Friday 10am EDT



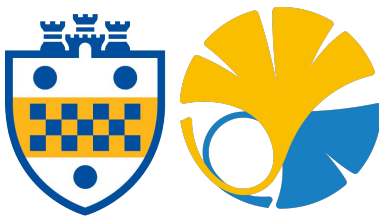
# Extra Material



# Analysis Topics (1)

- Multi-boson final states:  $VV$ ,  $VVV$ 
  - Inclusive and fiducial cross sections; differential cross sections
  - Limits to anomalous TGC and QGC (EFT framework)
- Vector-boson fusion and scattering
  - Electroweak production of vector bosons
  - Scattering amplitude polarization
  - Theoretical validity of EFT framework
- Measurement of  $W$  mass and  $A_{FB}$  at hadron colliders
  - Input from QCD (e.g. PDFs)
- QED and QCD corrections
  - Investigate state of the art of combination of corrections, and effect on global fits
    - ISR, IFI, FSR
  - MC tools





# Analysis Topics (2)

- Global fit of electroweak parameters
  - Global fits to SM:  $m_W$ ,  $m_Z$ ,  $\Gamma_W$ ,  $\Gamma_Z$ ,  $A_{LR}^f$  ( $f=e/\mu/\tau/b/c$ ),  $A_{FB}$ ,  $\alpha_{EW}$ ,  $\sigma_{had}$ , ...
    - Inputs from Higgs (mass), top (mass), QCD ( $\alpha_s$ )
  - Theoretical calculations and uncertainties (NNLO and beyond)
- Global fit in SMEFT
  - Formalism: T/QGCs + EWPOs + Higgs Obsv + Top-quark Obsv; LO & NLO
    - Input observables from Higgs (EF01) and top (EF03)
    - Provide fit results on Higgs coupling precisions (collaboration with EF01)
  - Correlations among experimental uncertainties
    - Roles of EWPOs & Top couplings on Higgs couplings
  - Oblique parameters S, T, U; new physics scales inferred from EFT operators
  - Evaluate reach of future colliders