Summary of Physics Discussions

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Future Colliders

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Higgs Physics:

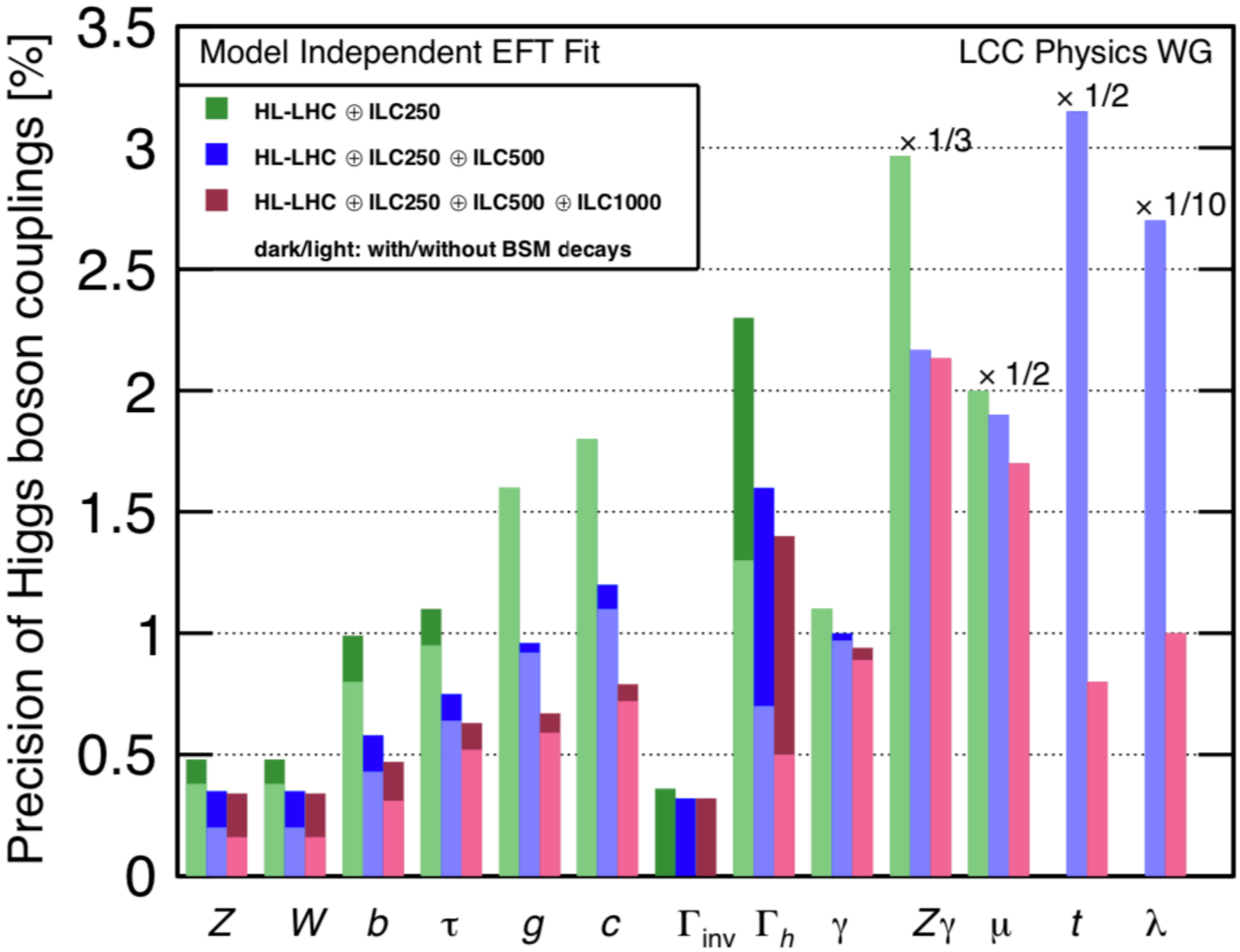
In this room, we believe that Higgs is problem #1. We need to enunciate that and make it a major theme at Snowmass.

Goals for Higgs precision:

1% errors in SM Higgs couplings
10% error in the Higgs self-coupling

These are interesting goals with respect to specific models. Our challenge is to defend these estimates using a “model-agnostic” point of view.

ILC projected precision (all proposals have similar results)



ILC, arXiv:1908.11299

new focus items:

Higgs size (Higgs self-energy)
requires precise absolute normalization of the W, Z couplings

2nd generation couplings
$y_f < 3\times$ SM gives new information beyond LHC
μ will be done at LHC; e+e- adds c, s
search for flavor-changing Higgs decays below 1%

CP violation in Higgs decay (e.g. in $H \to \tau^+\tau^-$)

exotic decays (through the “Higgs portal”)

Two important goals

top Yukawa to ~1% ; self-coupling to 10%

require CM energies above 500 GeV. Doable at 1 TeV.
How much energy is enough? Do we have this flexibility in C^3?

High energy e+e- :

Today, there are few specific motivations for a much higher energy collider:

heavy dark matter candidates (Higgsino WIMP)
Higgs self-coupling

But, we know that we will want this in the future;
need to develop technologies to make this possible after the Higgs factory.

Discoveries in precision Higgs or in other areas
(e.g., g-2, B anomalies) may require such a facility.

3 TeV is an inflection point in the technology.

We can reach 3 TeV with CLIC, C^3. Beyond this, a new technology is needed

plasma acceleration, W-band, muon collider

It is interesting to study a 3 TeV C^3, but ideally this collider should be built with an extendable technology.

For e+e-, need solutions for beamstrahlung
(short bunches, γγ collider)
and for the beam delivery system (plasma lenses)

There is a more detailed summary of the physics discussions on the Google doc. Please mark this up in preparation for the physics section of our Snowmass paper.