Precision Working Group Update

GAMBIT XVI

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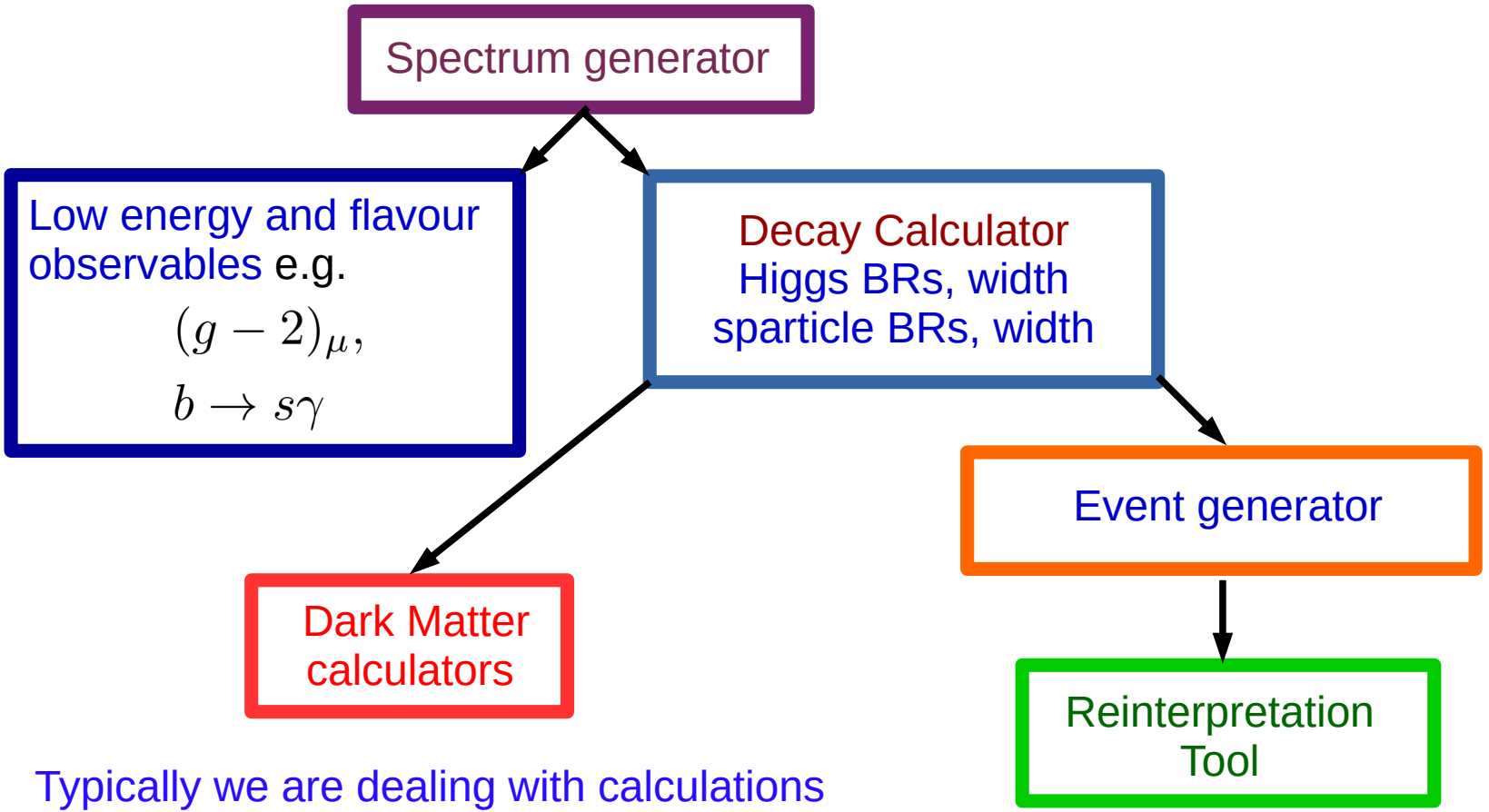
What is the Precision WG?

Handles (precision) theory calculations not directly related to flavour, collider or dark matter.

We are responsible for the following “Bits” of GAMBIT.

- SpecBit – Provides the mass spectrum and couplings, spectrum generator backends, vacuum stability calculations
- DecayBit – Provides decay tables, backends decay calculators
- PrecisionBit – precision calculations and likelihoods (e.g. muon g-2, EWPO, W-mass..)

Typical Tool Chain



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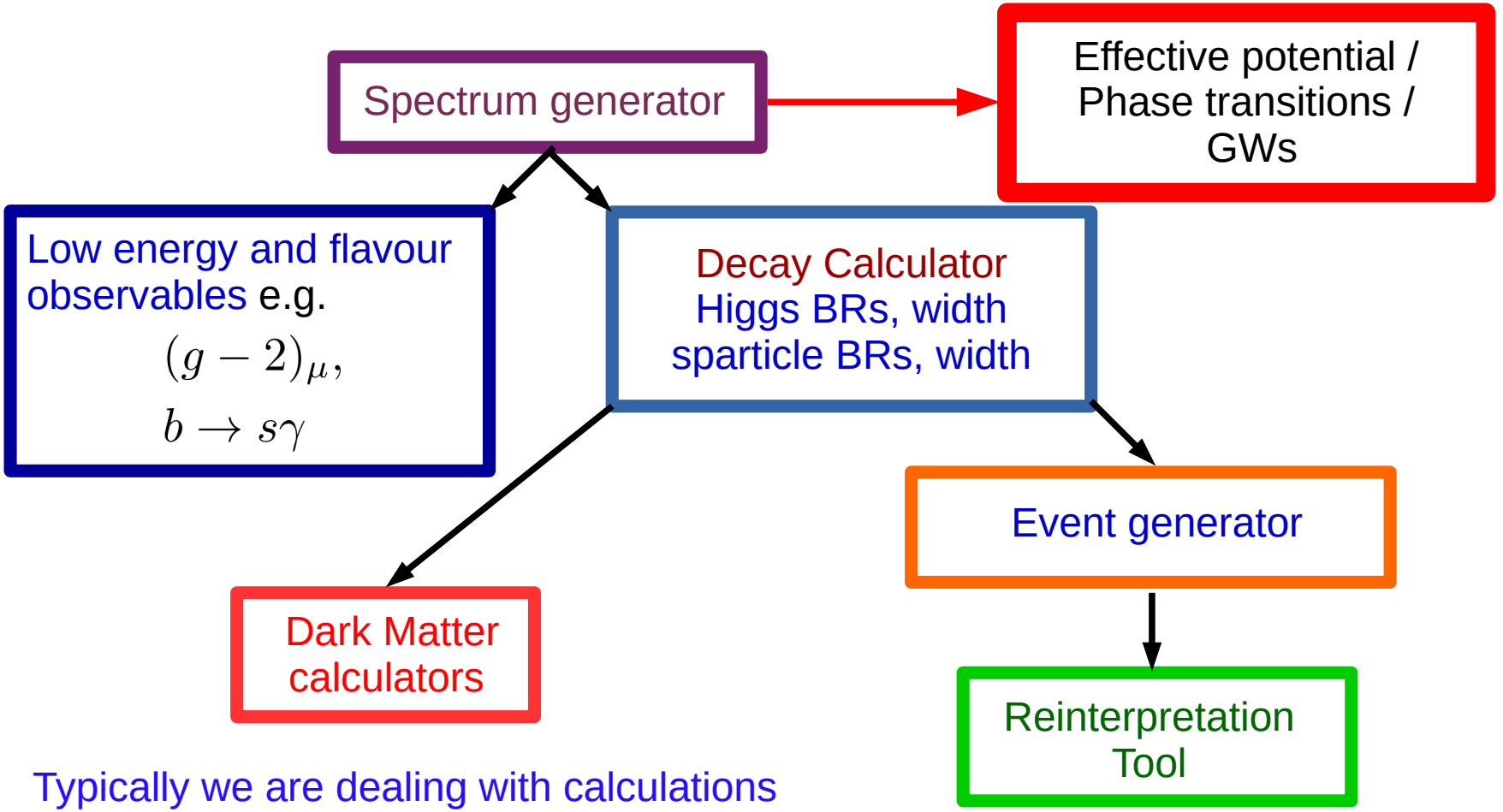

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- The likelihoods for these have been updated so that we offer the PDG 2024 fit that excludes the CDF measurement
- An alternative for explaining the CDF measurement alone, taken from 2204.03796

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- There are also S,T and U fits for averages with CDF MW, but I think these don’t make sense for fitting BSM, so we didn’t add these
- Should also add 2 parameter versions at least for CDF MW since some models cannot get a big U parameter.

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Note structure is we have

Capability: muon_gm2_SM with
module functions gm2_SM_WhitePaper, gm2_SM_BMW

Capability: muon_gm2_Exp with
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Muon g-2 AND oblique parameter updates currently in THDM_development

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```
+  fh_real DeltaAlphaTop = DeltaAlfaTopAlfa(MT*MT, MZ*MZ);

+  fh_real local_invAlfa0_default = 137.035999084;
+  invAlfaMZ = invAlfaMZ + DeltaAlphaTop + local_invAlfa0_default*.007127;
```

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FeynHiggs W mass

GAMBIT SLHA

```
24  8.036605006108935e+01   # W+
```

FeynHiggs standalone Output:

```
3     8.03660439E+01   # MWMSSM
4     8.03606076E+01   # MWSM
```

FeynHiggs Higgs mass

GAMBIT print out from inside FeynHiggs

Feynhiggs HiggsCorr sucks, MH1 = 113.63295702563185
Feynhiggs HiggsCorr sucks, MH2 = 719.70778286848440

GAMBIT SLHA

25 1.136331317357052e+02 # h0_1
35 7.197049371425107e+02

FeynHiggs standalone Output:

25 1.13632983E+02 # Mh0
35 7.19704738E+02 # MHH

FeynHiggs internal Output:

Feynhiggs HiggsCorr sucks, MH1 = 113.63280862628933
Feynhiggs HiggsCorr sucks, MH2 = 719.70758392871858

Update: FeynHiggs updating / debugging - summary

- Needs to be done with care due to problems unconvered by Alyshah Ladhu in her masters project
- Held up by bug in MW calculation
- Bug is now fixed via hacky solution, with patch to feynhiggs
- MW and Higgs masses now matching benchmark test
- Still to do:
  - put patch in our build system or find smarter way to do this.
  - Test in MW and MH in broader scan

Most of this was done in january/february, then slowed due to other things

Need for this maybe went down as CDF MW less interesting now

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- RGE running of spectrum will be removed
- Instead RGE running done a specific module function that fulfills running CAPABILITY
- Only some spectrum generators will fulfill this capability (as before)

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- FlexibleSUSY BOSSed 

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Sounds almost ready, but...

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- But grants, admin, jobs and then summer travel got in the way…
- Need to regroup, but:
  - Tomas is leaving
  - I have been trying to get replaced as convenor for many meetings...

  And I may be leaving soon as well actually

Members

Peter Athron
Eliel Camargo
Tomas Gonzalo
Anders Kvellestad
Christopher Chang
Cristian Sierra

Adeil Jueid
Roberto Ruiz
Wei Su
Martin White
Yongcheng Wu
Pengxuan Zhu

Did I miss anyone out?

Historically very few active members at any given time

Currently we have expressions of interest from a number of people...

but translating that into activity remains a challenge.

Past members

Pat Scott
Ben Farmer
James McKay
Csaba Balazs
Douglas Jacob

We could have a very big personel problem as I may also have to step down soon

Anyone who wants to be more involved in this group is welcome,

Please do get in touch and let us know

People interested in convening now

or in the future are also very welcome!

Personel/activity crisis

Possible solustions

- Approach and recruit more experts on EW precision corrections
  I tried to push this a few times but it got derailed various times
- Merge with Flavour WG?
- Physics projects that drive development, MSSM MW was serving that purpose...
- Actually get specbit redesign finished…

Physics projects

- S,T & U or full EW Global fits
- MSSM MW targetting global (now less intersting in my view)
- SMEFT project
- Phase Transitions, Graviational Waves and EWBG

  (also related to Dark/CosmoBit and the new GravBit)
- Vevacious and CMSSM (stalled) Some fundamental questions/obstacles

The END