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2HDM+pseudoscalar
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Oleg Brandt's talk summarized the studies done within ATLAS on various signatures, and presented a first proposal for a parameter scan for mono-Higgs signatures. Talks by Kevin Sung and Benedikt Meier from CMS covered the DM +tt and mono-Higgs signatures respectively.

##Status of UFO

1) Jet+MET: ok
2) HF+MET: working at LO, NLO being worked on
3) Z+MET: ok in the interesting phase space
4) H+MET: ok, CMS finds differences in the results with MG versions < 2.3.3

##Computational overhead

(ATLAS) 2D scan with 50 points of 10k events each takes 1 day on 500 cores

##Parameter scans

The model has 14 parameters to start with, with 7 fixed by symmetry, EW precision, Higgs properties, and 7 free parameters.
 - 4 parameters have an effect on the MET shape (scalars/pseudoscalar masses, couplings)
 - 3 parameters are only affecting the xsec only (tan(beta), although with some limited shape change(CMS) DM mass and Yukawa).
At LO diagrams are symmetric with respect to the exchange of mediator a/A, so scans should consider this. There was a suggestion to go only to sinTheta=1/sqrt(2) to span the parameter space, as for sinTheta larger than 1/2. (45 degrees) then the two pseudoscalars swap.

##Signatures

Jet+MET
- not dominating sensitivity, so parameter grid should be driven by resonant (other) signatures (H+MET etc)

DM+HF
- this is the most sensitive signature for tanBeta<0.5/high mA. However, if tanBeta<0.3 perturbativity becomes a problem.
- it is important to quantify difference 4 vs 5 flavor scheme (see next talk also)
- CMS studied the kinematic dependence on sinTheta, MET hardens.
 - in case of destructive interference when masses are equal, no problem seen in CMS

- compared the simplified model from DMF: the kinematics is the same when mMed=mA, for mA > ma and couplings = 1
- the competitiveness of bb signatures is a Yukawa sector-dependent statement (the result will apply to a specific 2HDM only, if tanBeta is very high)

tt/bb/tautau resonances
- this is an extension of the model used in searches already
- interference can be interesting, and worth planning for broader search with more masses and couplings as benchmarks

W+MET
- since the xsec is very small, the UFO is not ready yet
- open question: change in kinematics and xsec with u/d type couplings?

Z+MET(had)
- ATLAS tested the acceptance of the resolved vs merged analysis, with selection motivated by PLB763(2016)251 in order to motivate parameter scans
- Next steps: investigate

###H+MET
- interesting signature, with possible resonant enhancement, dependence of the kinematics on sinTheta
- ATLAS and CMS find similar results in terms of width and kinematics, consistent with the paper
  - m(a)=m(A)-m(h) is a transition point for the kinematics.
  - need to avoid Mh>2Ma to get a sensible Higgs width (as shown in the paper)
  - the width becomes very large for sinTheta>0.5 for m_a=50, from the additional decay channels
- ATLAS has a proposal for a grid based on kinematic changes and motivated by sensitivity with current searches, starting from benchmark point 3 in the paper.
  - sinTheta=0.35. The cross-section is smaller, but the MET spectrum is harder.
  - mass of heavy scalar = MH = MA + 100 GeV, again for harder MET spectrum
  - scan in pseudoscalar and DM mass
- A 3D scan would be too computationally extensive
- CMS investigated the impact of the triangle (where A is produced resonantly) vs box diagram, and found results consistent with the paper
- Next steps: worth studying H->gammagamma decays where one can probe slightly lower MET region with a larger cross-section, as this was a motivation for the choice of the paper benchmark points

General Q&A:

What does one miss by restricting to the exact alignment limit?
The original idea is not to go too far from it, to avoid constraints (heavy Higgs decaying invisibly, EW precision constraints, model-dependence). However, VBF signatures would become possible.

##Next steps

- Evaluate the grid proposal from ATLAS mono-Higgs
- Prepare an equivalent grid for mono-Z (and other) signatures

t-channel models
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Maria Giulia Ratti presented the studies from the ATLAS monojet analysis on the t-channel model, which evades dijet constraints and has interesting kinematic constraints. This extends the DMF work that was only at parton level. The samples are generated depending on the number of mediators, following suggestion on 1402.2205 (split samples). The effect of changing the matching scale is stable within 30%, and a Jacobian peak is visible when the qg->qChiChi diagram dominates. The talk raised a question on the cross-section for the various split samples that is being followed up with A. DiFranzo.

DM+HF NLO
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Yoav Afik presented cross-section LO/NLO studies from the ATLAS DM+tt/bb, starting from the DMF recommendations. For DM+tt, different scales at LO/NLO give different k-factors, with NLO x-section 30% larger than LO. DM+bbar is more complicated because of the 4-flavor scheme (where K. Mawatari added the b quark mass). The kinematics does not show appreciable differences. In this case the NLO x-section is 30% lower than the LO+matching 1-jet cross-section. This can lead to different interpretations between the two collaborations, and those present agreed to have the results for the k-factors from LO to NLO cross-checked within the same phase space and kinematic cuts at generator level between the two collaborations.