

Constraints On New Theories Using Rivet

David Yallup

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HUGE development of tools for automated calculations of LHC physics, success depends on the toolchain!



THE DATA

- **Rivet(+HepData)**, plugin directly on generator output to replicate analysis definition
- Experimentally validated plugins, no question of ambiguity on acceptance

Logo pending...

THE MODELS

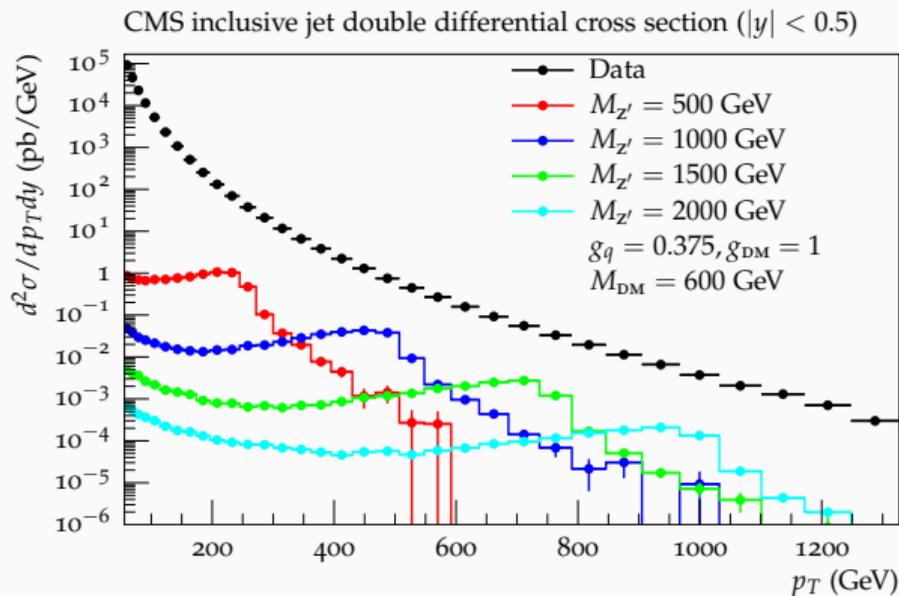
- **Feynrules**, de facto language to describe new physics Lagrangians
- **Herwig7** (MG,Sherpa etc.) Generate full LHC simulations of these events



THE LIMITS

- **Contur**, Analysis framework plugin directly to Rivet output. Analyse deviations from data

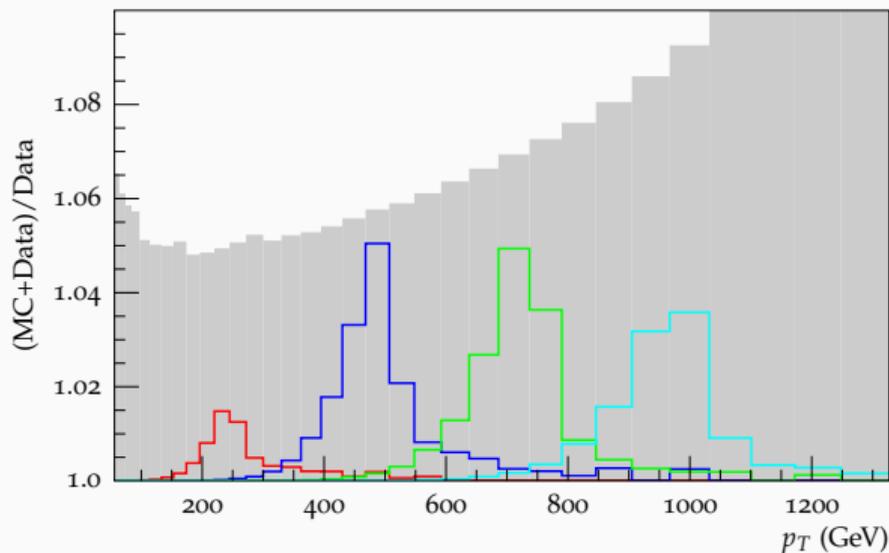
Contur - A Jetty Example Back to data



BSM vs data cross section comparison for 1D parameter scan

- Again, Inclusive Jets @ 7TeV CMS, [1406.0324](#)
- This time apply analysis definition to BSM model, scan in 1 parameter dimension, $M_{Z'}$
- BSM produces shapes with distinguishable kinematics, lead jet $p_T \approx M_{Z'}/2$
- Stack reveals bump hunting idea

Contur - A Jetty Example Back to data

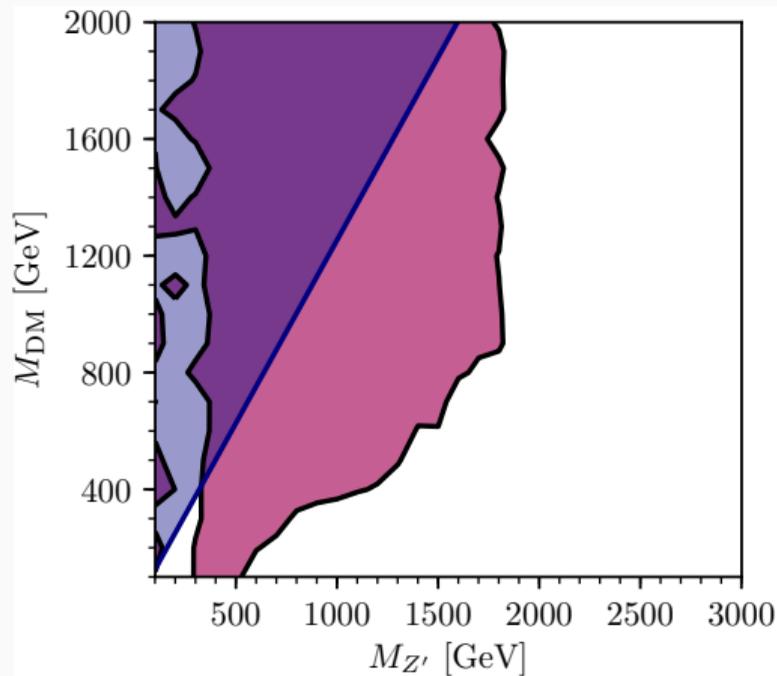


(BSM + data)/data cross section comparison for 1D parameter scan

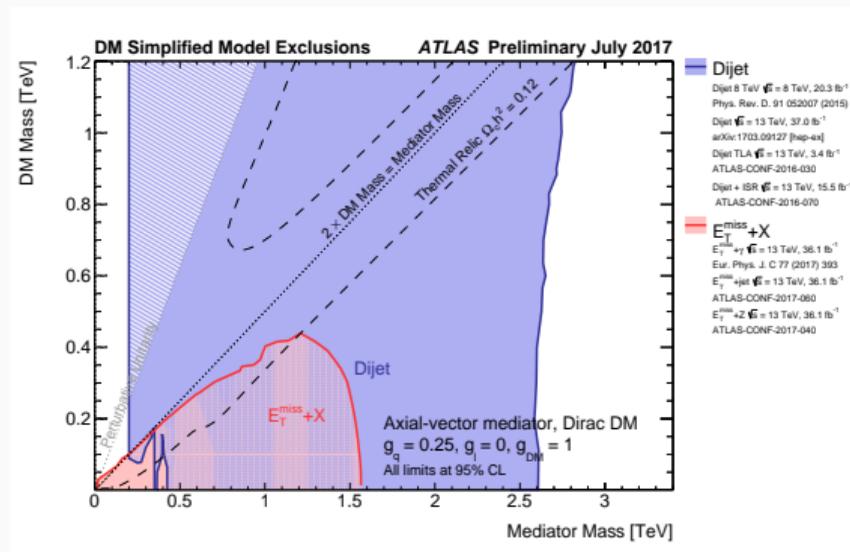
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Contur - A Jetty Example

One of the simplest SM extensions, often discussed for the context of Dark Matter searches, [LHCDCMWG - 1603.04156](#)



95% CL contour (pink), for a simplified dark matter model.
Theoretical bound from perturbative unitarity (blue)



The procedure gives comparable results to the official searches, differences are understood

- Current code base is purely python, repository available through HepForge, no formal release yet
 - Still some question of generalising more "bespoke" parts of toolchain flow, provided steering should be generator independant
- Continual updating of Rivet inputs already arriving, well positioned on this pipeline. **Make the most of what we can out of the current array of analyses, how do we feedback more information here?**
 - Still some feedback to the experiments to what we provide, currently run independently of theory predictions. A lot of time goes into these from the experiments, this would be useful.
 - Correlation information where available, how do we store this in hepdata, how do we pull this automatically through to rivet in a stable defined way
- Plan continual improvement of Contur code, more sophisticated/interactable Likelihood machinery

Summary, 2 main challenges:

- **Challenge: Internal machinery** - Increasing power will largely come from increasing the information propagated to the particle level measurements. This needs agreement from the experiment/HepData pipeline
- **Challenge: Public release** - In terms of usage as a pheno tool the current setup gives good mileage and interesting results (see Les Houches 2017 proceedings). This effects adoption in the pheno community.