

MCnet CEDAR

Intro, overview, status from yesterday...



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What is CEDAR?

“Combined EScience Data Analysis Resource”: collects the not-directly-MC-development bits of MCnet — including “user” connections to MC from experiment and theory.

(The name and original direction from a UK e-science grant pre-dating MCnet: Created Rivet, HepForge and the modern HepData)

Currently two main active areas:

- **Rivet:** MC event analysis toolkit and code library, for experimental analysis preservation
to complement HepData & for prototyping/pheno
- **Contur:** BSM limit-setter based on Rivet’s analysis collection

Also, smaller/periodic efforts on **Professor**, **YODA**, **TopFitter**, **LHAPDF**, **HepMC**, ...



Rivet status

Biggest recent added functionality: *Detector-effect “smearing” machinery* for non-unfolded BSM searches. Searches are a big new prospect for Rivet: lots of potential for impact and expansion



Christmas release of v2.6.0

- added some bells & whistles: now able to use an ordered chain of smearing projections on particles, and jet resolution functions improved. But really needs *users*, particularly the experiments. *Paper possibility: validation/comparison of Rivet wrt other fast-sims and BSM recasting tools. LH began effort with MadAnalysis5; others welcome; contact Andy*
- also in the 2.6 series: the Particle class \Rightarrow better definitions of W, Z, dressed leptons

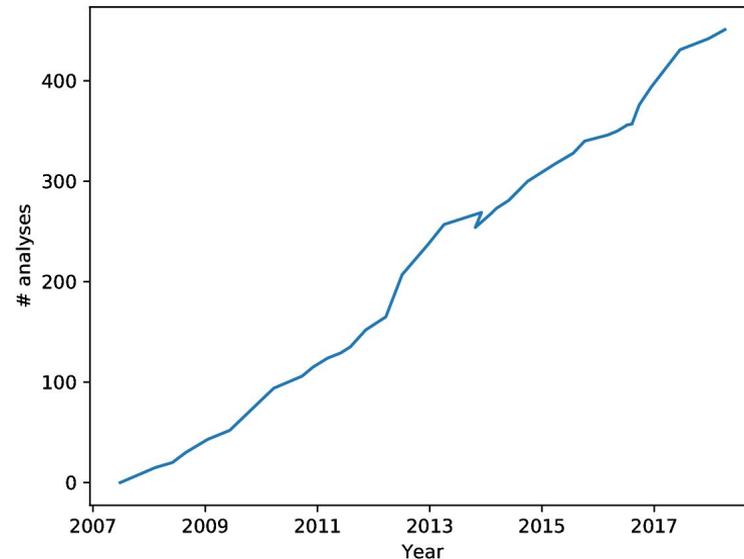
Rivet status (2)

Other v2.6 improvements:

- better build/merging of contributed analyses
 - could decouple analysis releases from core?
- zipped data I/O

Experimental submission rate has slowed recently:

- much of last steep rise was BSM mainly from AB
- ATLAS, CMS, LHCb all have varying degrees of delivery problems, but all using Rivet and contributing
- ALICE = development branch for extra functionality (next slides)
- Broken data sync with [HepData](#) is a worry...



Rivet next steps

Multiweights: proper use of event weights. *Will release something after Argyll workshop, even if not final*

MadGraph5_aMC@NLO integration: actually quite hard to run Rivet on MG5aMC events, otherwise, and could be a game-changer for BSM uptake

Dependencies: MCUtils? FastJet contrib? Minimiser for e.g. “topness” variable...

Thread safety: Holger porting FNAL fixes for v2.6, will enable use in BSM global fits

HepData: regular HD sync was broken, and need BSM standards \Rightarrow *super-important. MCnet convene a meeting on HepData development? (P Skands)*

Next developer + community meeting: Argyll, Scotland, May 21-24. Fully booked!

Rivet next steps (2)

Lots of activity around **heavy ions**

Some special requirements, many around two (or more) pass running:

- Ratios of different runs with different beams (also used in pp ATLAS/CMS)
- Event categorisation based on properties of the run calculated during the run
- Input of initial “calibration” info from previous runs
- Application of theory fits/extrapolations to measurement to make interpretation plots (e.g. total yield) [In YODA?]

Needs re-entrant *finalise* stage, multiweighting of events (see previous) and more.

Opportunity to be of use and to influence a new community with new challenges. Aim for release with progress on top priority items after **HI workshop (August?)** **Contact Christian Bierlich**

Contur status

Primary goal of Rivet is to provide like-for-like comparisons between particle-level measurements (archived in HepData) and full (ie final-state particle, ie precision event-generator) predictions.

- Differential cross sections
- Complex final state variables
- Intricate fiducial phase space

Contur is a post-processing stage, using the power of these comparisons to constrain (and maybe eventually find) new physics.

Key application for LHC and upgrades: ***this is the zone we are in now.***

arXiv:1606.05296

Contur status (2)

Currently:

- All data are consistent with SM
- So assume data *are* SM, look for “wiggle room” left by experimental uncertainties
- Not able to use correlations or theory uncertainties properly

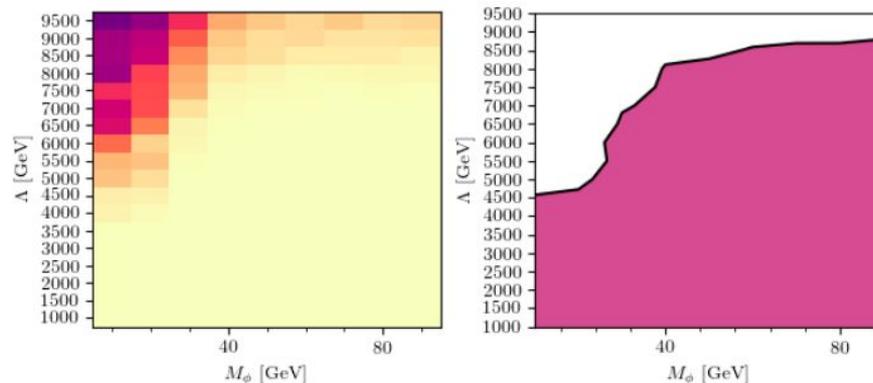
Near future:

- Include SM predictions and uncertainties
- Choice of different statistical treatments, use correlations where available

Recent results in Les Houches 2017 BSM proceedings [arXiv:1803.10379](https://arxiv.org/abs/1803.10379)

Heatmaps for CP-odd Light Scalar Model

Heatmap and contour for all available data (measurements from 7, 8 and 13 TeV runs in Rivet as of 21/9/2017)



Other projects

Professor — MC tuning/interpolation. Holger Schulz now project lead at FNAL

- BSM focus from devs; tuning continues! Stats paper promised when AB has time!

TopFitter — BSM EFT package, using Rivet and Professor on Top data. New fits in pipeline.

YODA — statistics package for Rivet and more: so many plans, so little time!

LHAPDF — standard LHC access to PDF fits. Dima Konstantinov now helping: big thanks!

- Several productive improvement routes: better/faster interpolation would save major LHC experiment CPU expense, support PDFs for virtual photons...
- No effort available for development at present: shortie projects welcome

HepMC — the standard LHC event record

- Version 3 has many MCnet contributions. Migration from v2 and some API issues need work, but *very* little available effort to move things forwards...

Resources

Many CEDAR projects have big personpower problems

Rivet's historic core team have largely had good career success: fellowships, academic posts, external jobs...

... all of which reduce (Rivet) research time! Gaps have not been filled by new RAs: also due to ITN rule changes

Result is schedule slips (cf. every-3-months Rivet plan, slow implementation and uptake of BSM features, and the multiweight-handling plan is around 5 years old!)

Academic system undervalues work on “community tools”. We need a concrete plan to incentivise new developers and experimentalist engagement. (e.g. Qualification tasks).
Discuss!



Summary

CEDAR is an important part of MCnet's engagement with the experimental and pheno communities

Loose conglomeration of several projects, of small to medium size, far more ideas than we have people to implement. A great way to get started in MCnet work, or as a component of MC theory PhDs.

Activity in analysis preservation, recasting, statistics and MC functional parametrisation, MC tuning, PDFs, and more. Developments boost impact of MCnet generator projects.

Resource problems: need to find ways (more (co-)publications, career benefits, other rewards?) to incentivise shortie & PhD students to join MCnet projects, and experimentalists (or theorists working with them?) to use & submit Rivet analysis codes & data.

