



MANCHESTER  
1824

The University  
of Manchester



# Proposal for an MCnet “living resource”

Michael H Seymour

13<sup>th</sup> MCnet meeting

Göttingen April 4<sup>th</sup> – 6<sup>th</sup> 2016

# MCnet RTN (2007–2010)



## 2.6.1 Milestones

**Year 4:** Completion of a systematic review of the results of the network's event generators after tuning, their commonalities and differences and detailed comparison with the early LHC data. Submission for publication in a peer-reviewed journal.

# MCnet RTN (2007–2010)



## 2.6.1 Milestones

**Year 4:** Completion of a systematic review of the results of the network's event generators after tuning, their commonalities and differences and detailed comparison with the early LHC data. Submission for publication in a peer-reviewed journal.

Physics Reports 504 (2011) 145–233



ELSEVIER

Contents lists available at ScienceDirect

## Physics Reports

journal homepage: [www.elsevier.com/locate/physrep](http://www.elsevier.com/locate/physrep)



## General-purpose event generators for LHC physics

Andy Buckley<sup>a</sup>, Jonathan Butterworth<sup>b</sup>, Stefan Gieseke<sup>c</sup>, David Grellscheid<sup>d</sup>, Stefan Höche<sup>e</sup>, Hendrik Hoeth<sup>d</sup>, Frank Krauss<sup>d</sup>, Leif Lönnblad<sup>f,g</sup>, Emily Nurse<sup>b</sup>, Peter Richardson<sup>d</sup>, Steffen Schumann<sup>h</sup>, Michael H. Seymour<sup>i</sup>, Torbjörn Sjöstrand<sup>f</sup>, Peter Skands<sup>g</sup>, Bryan Webber<sup>j,\*</sup>

<sup>a</sup> PPE Group, School of Physics & Astronomy, University of Edinburgh, EH25 9PN, UK

<sup>b</sup> Department of Physics & Astronomy, University College London, WC1E 6BT, UK

<sup>c</sup> Institute for Theoretical Physics, Karlsruhe Institute of Technology, D-76128 Karlsruhe, Germany

<sup>d</sup> Institute for Particle Physics Phenomenology, Durham University, DH1 3LE, UK

<sup>e</sup> SLAC National Accelerator Laboratory, Menlo Park, CA 94025, USA

<sup>f</sup> Department of Astronomy and Theoretical Physics, Lund University, Sweden

<sup>g</sup> PH Department, TH Unit, CERN, CH-1211 Geneva 23, Switzerland

<sup>h</sup> Institute for Theoretical Physics, University of Heidelberg, 69120 Heidelberg, Germany

<sup>i</sup> School of Physics and Astronomy, University of Manchester, M13 9PL, UK

<sup>j</sup> Cavendish Laboratory, J.J. Thomson Avenue, Cambridge CB3 0HE, UK

# MCnet RTN (2007–2010)



- 15 authors,  $\leq 1$  month each
- + dedicated 3-day meeting for final editing

# MCnetITN (2013–2016)



## B.4.4.2 Deliverables

- a web-based ‘living review’ of Monte Carlo physics and event generator results.

As part of our previous network, we wrote an extensive review of event generator physics. We will extend this further by producing an interactive and ‘living’ resource in which the physics points are demonstrated by online applications, for example with the possibility to make distributions using various modified parton shower algorithms, and in which comparison plots are automatically updated as new data sets, new event generator versions, or even new event generators, are released. This activity will naturally involve all our projects.

## MCnetITN (2013–2016)



MCplots

mcplots.cern.ch

Daily Mass Readings UK Apple Amazon eBay Yahoo! MEP maths Tutorial database Kiran Ostrolenk The ALAN TU...ition 2016

## Menu

- Front Page
- LHC@home / Test4Theory
- Generator Versions
- Generator Validation
- Tuning Validation
- Update History
- User Manual and Reference

### Analysis filter:

→ Beam: **pp/ppbar** ee

→ Analysis:

## Z (Drell-Yan)

- $1/\sigma d\sigma(Z)/d\phi^*_\eta$
- $d\sigma(Z)/dpTZ$
- $1/\sigma d\sigma(Z)/dpTZ$

## W

- Charge asymmetry vs  $\eta$
- $d\sigma(\text{jet})/dpT$
- Jet multiplicity

# mcplots.cern.ch

December 2015 - [P. Skands](#), I. Charalimpidis, A. Karneyeu, D. Konstantinov, M. Mangano, L. Mijovic, S. Prestel

**Reference:** Eur Phys J C74 (2014) 1 ([arXiv:1306.3436](#))

*New!* donate your unused CPU cycles to mcplots, via the [Test4Theory project](#) (based on [LHC@home](#)).

← Select beam, process, and observable

**Navigate these pages** by using the menu to the left. The default for each topic is a comparison of a small number of models to available data, but look for links at the top of each page for comparisons with more tunes/generators. Scroll down each page to see plots at other collider energies. To choose specific generator version(s), use the [Generator Versions](#) link towards the top of the menu (the default is to just display the most recent ones). More plots will be added, as new tunes become available, and as the available data increases.

**Note:** For a description in layman's terms, and/or to find out how to donate your unused CPU cycles to help generate more statistics for mcplots see the [Test4Theory project](#), the first volunteer cloud computing project to be based on [Virtual Machines](#) via the [LHC@home](#) platform.

---

## MCPLOTS

**MCPLOTS is intended** as a simple browsable repository of MC (Monte Carlo) plots comparing High Energy

Go to "http://lhcbathome.web.cern.ch/projects/test4theory"

# MCnetITN (2013–2016)



MCplots
Reader
+

mcplots.cern.ch/?query=plots,ppppbar,winclusive,njets
Daily Mass Readings UK
Apple
Amazon
eBay
Yahoo!
MEP maths
Tutorial database
Kiran Ostrolenk
The ALAN TU...ition 2016

→ Update History

→ User Manual and Reference

**Analysis filter:**

→ Beam: **pp/ppbar** ee

→ Analysis:

**Z (Drell-Yan)**

→  $1/\sigma d\sigma(Z)/d\phi_\eta^*$

→  $d\sigma(Z)/dpTZ$

→  $1/\sigma d\sigma(Z)/dpTZ$

**W**

→ Charge asymmetry vs  $\eta$

→  $d\sigma(\text{jet})/dpT$

→ **Jet multiplicity**

**Top (MC only)**

→  $\Delta\phi$  (ttbar)

→  $\Delta y$  (ttbar)

→  $|\Delta y|$  (ttbar)

→ M (ttbar)

→ pT (ttbar)

→ Cross sections

→  $y$  (ttbar)

→ Asymmetry

→ Individual tops

pp @ 7000 GeV

ATLAS (electron channel)

ATLAS (muon channel)

Ratio to ATLAS

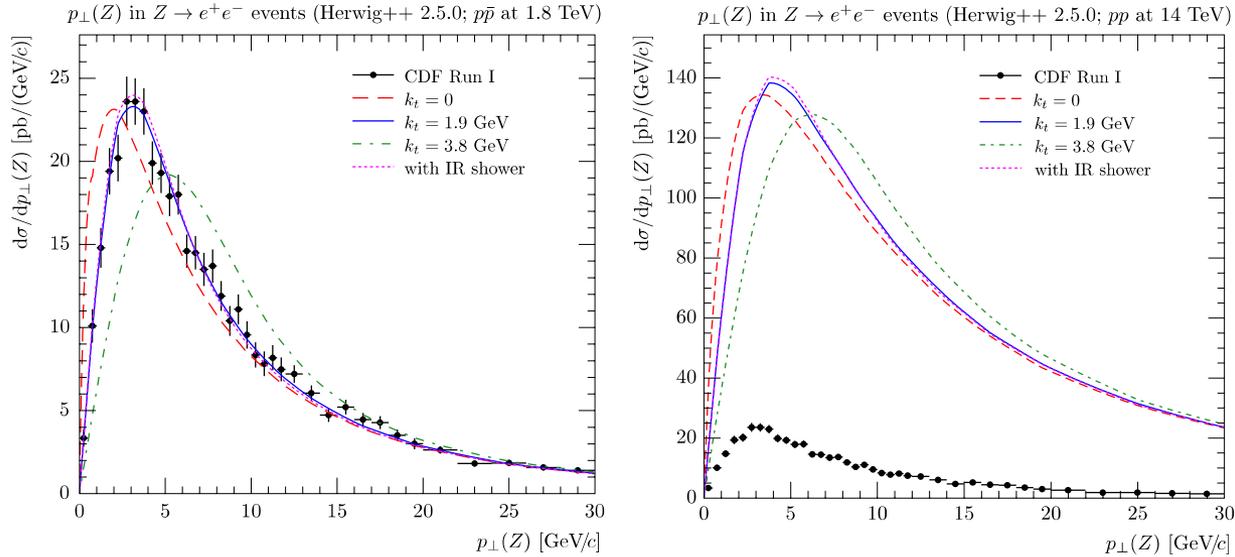
Ratio to ATLAS

# MCnetITN (2013–2016)



172

A. Buckley et al. / Physics Reports 504 (2011) 145–233



**Fig. 7.** The low- $p_{\perp}$  peak of the  $p_{\perp}$  distribution of lepton pairs in Drell-Yan events at the Tevatron, compared to CDF data [96]. A Monte Carlo model (Herwig++) is shown with four different choices for the “primordial  $k_{\perp}$ ”. (a)  $p\bar{p}$  at 1.8 TeV (b)  $pp$  at 14 TeV.

models, the expectation is that this should generate a more realistic process and collision energy dependence of the effective primordial  $k_{\perp}$ .

A secondary modelling issue, relevant to the MPI models discussed in the next subsection, is how much primordial  $k_{\perp}$  is assigned to partons initiating multiple-parton interactions, and how the associated recoil effects are distributed among those initiators and the remnant. Typically, MPI initiators are only assigned a primordial  $k_{\perp}$  of the order of Fermi motion, although this is a model-dependent statement that may of course change, as models improve.

Empirically, the most important distribution for constraining the magnitude of this effect is the  $p_{\perp}$  distribution of lepton pairs in Drell-Yan events. The peak of this distribution is extremely sensitive to infrared effects. In Fig. 7(a), we compare the distribution measured by the CDF experiment [96] to a Monte Carlo model (Herwig++) with four different primordial- $k_{\perp}$  settings: 0 GeV (off), 1.9 GeV (the default in Herwig++), 3.8 GeV (twice the default), and the IR-augmented shower model [95]. To illustrate how these predictions scale with collider centre-of-mass energy, keeping the  $Q^2$  of the hard interaction fixed, we also include a plot showing the  $p_{\perp}$  of Drell-Yan pairs in  $pp$  collisions at 14 TeV in Fig. 7(b); the distributions becomes broader, but the peak position stays relatively constant. A comparison of different generators on this distribution can be found in Fig. 18 in the comparisons section of the review (Section 18).

# MCnetITN (2013–2016)



- Can we reuse text of review with “live” figures provided by MCPLOTS ?
  - constantly updated with latest version and default parameters
  - configurable by reader for non-standard settings/parameters
    - cached for future readers
- Who can do this?
- Do we need a dedicated meeting?
  - If so, we have resources to fund it, but where and when?

# MCnetITN3 (2017–2020)?

## 2.3.1 Dissemination of the research results

The interactive tutorials of our Annual Schools can also be seen as part of our dissemination strategy, which have a significant impact on the students at the school and, through them, their research groups. In the new network, we will develop this further to have a much wider and more lasting impact on the whole community, by **restructuring our tutorials into interactive online courses, dynamically linked with the online review**. This will enable any PhD student in High Energy Physics and related subjects around the world to quickly get started using our generators, and learn the underlying physics. Thus we will leave a legacy not only of our research output but also our training output.

