

# Report from the 8<sup>th</sup> International Conference on Physics Opportunities at an ElecTron-Ion-Collider

POETIC Workshop Series

MCEGs for future ep and eA facilities

Markus Diefenthaler

Jefferson Lab

The poster for the 8th International Conference on Physics Opportunities at an ElecTron-Ion-Collider (POETIC 8) features a dark blue background with a white silhouette of a city skyline, including a prominent church spire. The title 'POETIC 8' is written in large, white, spaced-out capital letters at the top. Below it, the conference details are listed in white text. The local organizing committee and international advisory committee members are listed in smaller white text. The Jefferson Lab logo is visible in the bottom right corner.

**P O E T I C 8**

8th International Conference on Physics Opportunities at an ElecTron-Ion-Collider

**19-23 March 2018, University of Regensburg**

**Local Organizing Committee:**

- Gunnar Bali
- Vladimir Braun
- Falk Bruckmann
- Sara Collins
- Andreas Schäfer (chair)
- Stefan Solbrig

**International Advisory Committee**

- Nestor Armesto (Univ. de Santiago de Compostela, Spain)
- Elke Aschenauer (BNL, USA)
- Daniel Boer (University of Groningen, Netherlands)

# POETIC Workshop Series

## Primary goal

- following the efforts of the [INT-10-3](#) program
- continue advancing the field of EIC physics

<b>POETIC 8</b>	<b>March 19-23 2018</b>	<b>University of Regensburg</b>	<b>Regensburg, Germany</b>	<b>78</b>
<a href="#"><u>POETIC 7</u></a>	November 14-18 2016	Temple University	Philadelphia, PA	87
<a href="#"><u>POETIC 6</u></a>	September 7-11 2015	Ecole Polytechnique	Palaiseau, France	128
<a href="#"><u>POETIC 5</u></a>	September 22-26 2014	Yale University	New Haven, CT	n/a
<a href="#"><u>POETIC 4</u></a>	September 2-5 2013	University of Jyväskylä	Jyväskylä, Finland	31
<a href="#"><u>POETIC 2013</u></a>	March 4-8 2013	Universidad Técnica Federico Santa María	Valparaíso, Chile	31
<a href="#"><u>POETIC 2012</u></a>	August 20-22 2012	Indiana University	Bloomington, IN	51
<a href="#"><u>Exploring QCD Frontiers 2012</u></a>	January 30 - February 3 2012	Stellenbosch Institute for Advanced Study	Stellenbosch, South Africa	40

# POETIC-8 Satellite Workshop on Monte Carlo Event Generators

## MCEGs for future ep and eA facilities

March 22-23 2018

### Organizers:

- **EIC:**
  - E.C. Aschenauer (BNL)
  - M. Diefenthaler (JLab)
- **MCnet:**
  - S. Plätzer (Vienna)
  - S. Prestel (FNAL)

### Feedback

*"I really learned a lot."*

*"The organization was great. I learned something interesting from basically every talk."*

# Introduction



## Future $ep/eA$ experiments

Matthew Wing (UCL / DESY)

- Introduction
- Current  $ep$  and  $eA$  results
- Possible future colliders
  - Electron-ion collider (EIC)
  - Large hadron-electron collider (LHeC) and future circular collider hadron-electron (FCC-he) collider
  - Very high energy electron-proton (VHEeP) collider
  - Issues and needs for Monte Carlos
- Summary and outlook

POETIC-8, MCEG Workshop — 22–23 March 2018, University of Regensburg

Introduction  
Perturbative Precision  
Non-perturbative modelling



LUND  
UNIVERSITY



General Purpose

## Event Generators

Overview and Status

Leif Lönnblad

Department of Astronomy  
and Theoretical Physics  
Lund University

POETIC-8' 2018-03-22



Event Generators

1

Leif Lönnblad

Lund University

- MCEG not about tuning but about physics
- multi-leg NLO matching with parton showers
- ready to work on  $ep/eA$

# General-purpose event generators (Sherpa missing)

## Herwig 7

Stefan Gieseke

*Institut für Theoretische Physik  
KIT*

MCEGs for future ep and eA colliders  
Regensburg, 22–23 Mar 2018



Stefan Gieseke · MCEGs for future ep and eA colliders · Regensburg · 22–23 Mar 2018

1/23

- huge potential for DIS simulations
- first DIS implementation

## ep in Pythia 8

POETIC-8 Satellite Workshop on Monte Carlo Event  
Generators

Ilkka Helenius

March 23rd, 2018

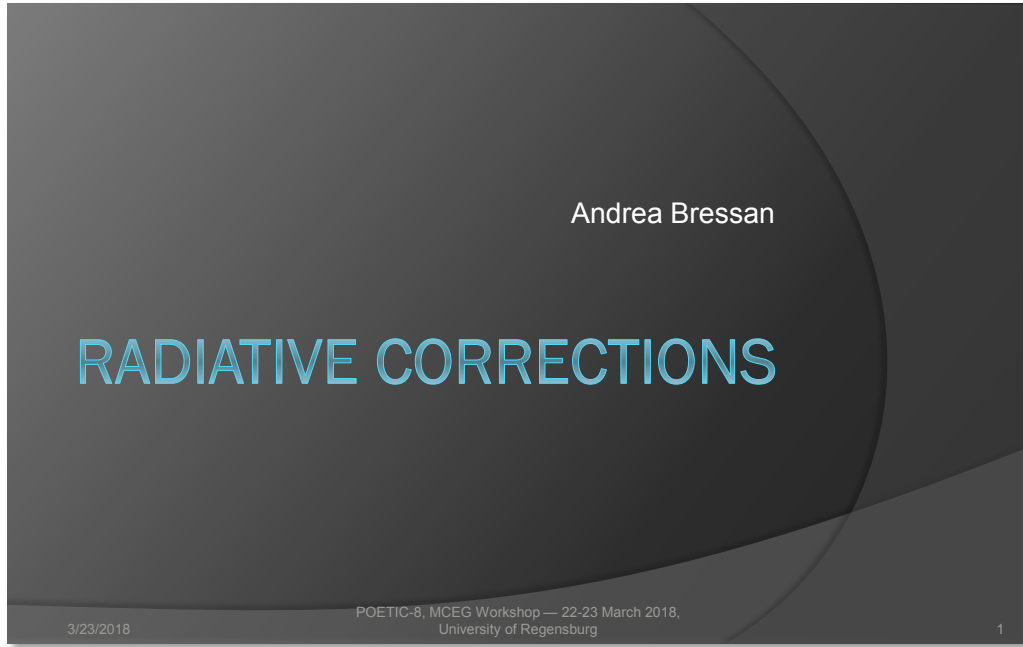
Tübingen University  
Institute for Theoretical Physics



EBERHARD KARLS  
UNIVERSITÄT  
TÜBINGEN



- DIS
- photoproduction
- hard diffractive photoproduction



- ESC project on radiative correction library

A presentation slide with a white background. At the top, there are three logos: on the left, the Max-Planck-Institut für Physik (Werner-Heisenberg-Institut) logo with a green stylized plant and the text '[1]'; in the center, a photograph of a historic town with a large cathedral and a bridge over a river; on the right, the same Max-Planck-Institut für Physik logo with the text '[1]'. Below the logos, there are two more logos: on the left, the CERN logo with the text '[2]', and on the right, the Lp3 logo with the text '[3]'. In the center, there is a blue rounded rectangle containing the text 'HERA data preservation | DIS data for MCEG'. Below this, the text 'Fabian Klimpel<sup>1,2</sup>, Frank Krauss<sup>3</sup>, Andrii Verbytskyi<sup>1</sup> (+SHERPA team)' is displayed. At the bottom, the text 'POETIC, Regensburg, 19-23 März 2018' is shown. In the bottom right corner, the text '1 / 33' is visible.

- make DIS analysis available (RIVET)
- include DIS data in standard tunes
- Sherpa DIS comparisons

# Novel QCD phenomena

## TMDs from parton branching and parton showers in MC event generators

Hannes Jung (DESY)

in collaboration with

A. Bermudez-Martinez, F. Hautmann, A. Lelek, V. Radescu, R. Zlebcik  
M. Bury, A. van Hameren, K. Kutak, S. Sapeta, M. Serino

- Why TMDs are needed
  - TMDs for hadron-hadron collisions
- New developments
  - parton branching algorithm to solve evolution equations
    - benchmark tests
    - advantages for integrated PDFs
  - determination of TMD densities at NLO with xFitter
- Application to DY production
- Application to TMD parton showers

H. Jung, MDs from parton branching and parton showers in MC event generators, POETIC2018 MC satellite WS, Regensburg, March 22, 2018 1

- unintegrated PDFs
- include TMD factorization and evolution

arTeMiDe

Alexey A. Vladimirov

Institut für Theoretische Physik  
Universität Regensburg

MCEGs for future ep and eA facilities  
Regensburg  
March 22, 2018



A. Vladimirov

arTeMiDe

March 22, 2018

1 / 14

- TMD distributions
- TMD evolution
- TMD cross-sections

eA: interesting prospect

$\gamma^*A$  pA, AA

DIPSY and Angantyr: Towards eA exclusive final states

Christian Bierlich  
bierlich@thep.lu.se

Lund University / University of Copenhagen

Mar 22, 2018  
MCEG for eA Workshop



Christian Bierlich (Lund/NBI)

DIPSY and Angantyr

Mar 22, Regensburg

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**BeAGLE:**  
Benchmark eA Generator for LEptoproduction  
hard interaction + nuclear response

Mark D. Baker\*  
MDBPADS Consulting

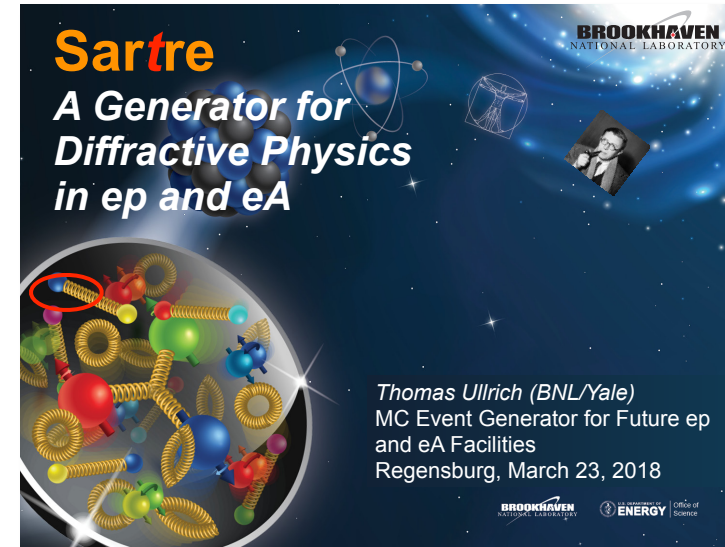
E.C. Aschenauer, J.H. Lee  
Brookhaven National Laboratory

L. Zheng  
China Univ. Of Geosciences (Wuhan)

22 March 2018



\* Contact: [mdbaker@mdbpads.com](mailto:mdbaker@mdbpads.com) (@bnl.gov, @jlab.org)



collaborate with  
BeAGLE

Lessons from MCEG at small-x for p+p/A,  
A+A : sampling nuclei for EIC

Prithwish Tribedy



Monte Carlo Satellite workshop of the POETIC-8

March 22-23, 2018, University of Regensburg, Germany



CGC + Pythia6



# Discussion on MCEG R&D

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- **MCEG R&D** requires *easy access to data*
- data := detailed analysis description / analysis + analysis results
- **HEP**: existing workflow for MCEG R&D using tools such as Rivet and Professor
- **Workshop discussion:**
  - What would be needed from HEP analysis tools to leverage them for NP as well?
  - How could we make the HERA data available?

# Summary

- **POETIC:**
  - incubator for ideas
- **MCEG for future ep and eA facilities**
  - collaboration with MCnet
  - write-up on requirements
  - 2019 workshop



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