

## Summary of Relevant Experience

### PD Dr Hannes Jung

Deutsches Elektronen Synchrotron (DESY)

Notkestr 85, 22603 Hamburg, Germany

E-mail: [hannes.jung@desy.de](mailto:hannes.jung@desy.de);

URL: [www.desy.de/~jung](http://www.desy.de/~jung)

### Physics Analysis

- 2016 – now      Convener of Physics Analysis group “Standard Model Physics with Jets” group in CMS
- 2013 – 2015    Convener of Monte Carlo group “Physics Comparison and Generator Tunes” group in CMS
- 2010 – 2011    Convener of "Forward Physics Analysis" group in CMS
- 2010 – now      Data analysis in CMS:
  - Measurement of inclusive jets at large  $p_t$
  - Measurement of azimuthal correlations  $\Delta\phi$  in high  $p_t$  dijet events
  - Measurement of heavy flavored jets (b-jets and top-jets)
  - Measurement of forward energy flow
  - Measurement of forward jet cross section
- 2000 – 2010    Data analysis in H1:
  - Measurement of  $D^*$  cross section
  - Measurement of underlying event and multiparton interaction in  $\gamma p$  and DIS
  - Measurement of forward jet cross sections
- since 2015      Supervision of PhD theses in the Standard Model area in CMS
- 2008 – 2015    Supervision of PhD theses in forward physics in CMS
- 2004 – 2010    Supervision of diploma and PhD theses in heavy quark production at H1.
- 2003 – 2005    Convener of the physics working group “Diffraction” in H1.
- 2002            Supervision of the analysis of *forward jet* events at H1.
- 2000 – 2001    Analysis of mini-jet events to study the parton dynamics at small  $x$  in non-diffractive and diffractive deep inelastic scattering.
- 1996 – 2000    Analysis of diffractive di-jet production at HERA
  - Analysis of di-jet events in deep inelastic scattering and resolved virtual photons, including measurement of the di-jet rate and azimuthal asymmetries.
- 1994 – 1996    Analysis of deep inelastic diffractive events at H1
  - Measurement of the diffractive contribution to the proton structure function  $F_2$  and analysis of di-jet events in deep inelastic diffractive scattering.
- 1991 – 1993    Convener of the physics working group “Heavy Flavors” at H1.
- 1988 – 1993    Studies for energy calibration of the H1 LAr calorimeter during data taking with  $ep \rightarrow e' J/\psi X$  and  $ep \rightarrow e' p' l^+ l^-$ 
  - Studies for the measurement of the gluon density at HERA and LEP-LHC using  $J/\psi$  photo-production
  - Analysis of  $J/\psi$  events at H1 (HERA)
- 1984 – 1987    Analysis of *single photon* events at CELLO (PhD thesis)

## Phenomenology

- 2013 – Development of a scheme to solve the coupled evolution equations (DGLAP and CCFM) with a Monte Carlo method and determination of the (unintegrated) Transverse Momentum Dependent (TMD) parton densities
- 2008 – Extension of the CASCADE Monte Carlo generator to include processes relevant for LHC, like forward jets, Drell-Yan and Higgs production
- 2008 – 2009 Chair and Convener of the Monte Carlo group in the analysis center of the Helmholtz Alliance “Physics at the Terascale”
- 2004 – 2008 Chair of the HERA-LHC workshop and contributions to studies concerning a better understanding and measurements of the unintegrated gluon density.
- 2002 – 2003 Studies of non-leading corrections to the CCFM evolution equation. New sets of unintegrated gluon densities were obtained from precision fits to the structure function  $F_2$  as measured by the H1 and ZEUS collaborations.  
First attempts to calculate Higgs production at LHC energies in the  $k_t$ -factorization approach using the CCFM unintegrated gluon densities.
- 2001 – 2002 Extension of the Monte Carlo generator CASCADE to describe also  $p\bar{p}$  processes. In the framework of  $k_t$ -factorization supplemented with the CCFM evolution equation,  $b\bar{b}$  at the Tevatron and also partially at HERA can be consistently described
- 1999 – 2002 Close collaboration with B. Andersson, G. Gustafson and L. Lönnblad (Department of Theoretical Physics, Lund, Sweden) for a better understanding of the different approaches to implement the CCFM equation into Monte Carlo generators. A *Lund Small x* workshop was organized in march 2001.  
Together with colleagues from Moscow studies for a deeper understanding of the  $k_t$  factorization approach (supported from the Royal Academy of Science, Sweden)
- 1999 – 2001 Intensive studies for a consistent implementation of NLO calculations into the Monte Carlo generator RAPGAP in collaboration with J. Collins, Penn State University. For the first time the  $\mathcal{O}(\alpha_s)$  processes are combined via a special subtraction scheme with *initial* and *final* state parton showers, making the standard  $p_t$ -cut obsolete.
- 1998 – 2001 Intensive studies of the CCFM evolution equation for a theoretically well based description of small  $x$  hadronic final state properties. A unique solution of the CCFM equation which allows to describe the inclusive structure function  $F_2$  and the forward jet cross sections simultaneously was obtained.  
Development of a new hadron level Monte Carlo program CASCADE, which includes consistently the CCFM evolution equation
- 1998 – 1999 Initiative for a workshop on *Monte Carlo Generators for HERA physics* with the aim to develop a better theoretical basis as well as a consistent implementation of  $\mathcal{O}(\alpha_s)$  and  $\mathcal{O}(\alpha_s^2)$  processes into Monte Carlo event generators.
- 1996 – 2000 Extension of the RAPGAP Monte Carlo generator into a general multi-purpose program, including also the simulation of non-diffractive processes. Implementation of the concept of resolved photons in DIS was implemented for a very good description of most phenomena not described by other standard DIS Monte Carlos making RAPGAP one of the most frequently used event generators by the H1 and ZEUS experiments, for diffraction, for jet analyzes and for heavy flavor production as well.  
Continuous dialog with experimentalists from both H1 and ZEUS experiments on ongoing analyzes and the interpretation of the measurements.
- 1994 – 1996 Development of the new Monte Carlo generator RAPGAP for events with large rapidity gaps in deep inelastic  $ep$  scattering as the first event generator fully suitable for deep inelastic diffraction and is extensively used in the analyzes of deep inelastic diffraction by the H1 and ZEUS experiments at HERA.
- 1988 – 1993 Development of the new Monte Carlo generator EPJPSI for  $J/\psi$  production in  $\gamma p$ ,  $ep$ ,  $\mu p$  and  $pp$  collisions including all production mechanisms at high energies.  
Improvement of the model for inelastic  $J/\psi$  photo-production using relativistic corrections  
Uniform description of elastic, diffractive and inelastic  $J/\psi$  photo-production.

## Detector Development and Hardware

- 2007 – 2008 Initiator for participation of the DESY group in the CMS CASTOR calorimeter for forward jets and small  $x$  physics, participation in CASTOR test beam measurements
- 1992 – 2007 Shift leader duties in the H1 experiment
- 1992 Run Coordinator of the H1 experiment
- 1988 – 1993 Construction of a wheel of the electro-magnetic lead - LAr calorimeter for H1 including treatment of glueing read-out boards on lead  
Final installation of the LAr calorimeter and putting it into operation  
Maintenance of the high voltage system of the LAr calorimeter during data taking and on-call expert
- 1984 – 1987 Scientific maintenance (electronics, trigger, read-out and calibration) of the liquid argon calorimeter at the CELLO experiment at PETRA, DESY (Hamburg).  
Development and installation of a calorimeter trigger with very low energy threshold for detecting “single photon” events with the CELLO detector.
- 1982 – 1983 Construction and test of a system of multi-wire-proportional chambers for the EMC experiment.

## Chair/Convener of Workshops since 1995

- 2016 Organizing and Program Committee of the Resummation, Evolution, Factorization (REF) workshop in Antwerp
- 2015 Chair of the Resummation, Evolution, Factorization (REF) workshop at DESY
- 2015 Chair of the Monte Carlo school of Terascale Alliance
- 2014 Initiator and co-chair of the Resummation, Evolution, Factorization (REF) workshop in Antwerp
- 2012 Chair of the workshop MPI@LHC
- 2011 Chair of the workshop MPI@LHC
- 2009 Chair of Monte Carlo school of Terascale Alliance
- 2008 Chair of Monte Carlo school of Terascale Alliance
- 2008 Chair of the workshop "International Symposium on multiparton dynamics" ISMD08
- 2007 Chair of the workshop "Elastic and diffractive scattering - forward physics and QCD"
- 2003 – 2008 Initiator and chair of the workshop "HERA and the LHC"
- 2003 – 2006 Convener of the physics working group "Diffraction" in H1.
- April 2002 Coordinator of the working group "Diffraction", DIS 2002, Cracow, April 2002.
- March 2001 Chair and coordinator of the "Lund Small  $x$  workshop"
- 2000 Convener of the working group "QCD and Simulation" at the THERA workshop (combination of TESLA with HERA).
- 1999 – 2001 Chair and coordinator of a project on *Small  $x$  phenomenology* involving physicists from Russia and the Lund theory group. This project is financed and supported by the Royal Swedish Academy of Science.
- 1998 – 1999 Initiator and chair of the workshop *Monte Carlo Generators for HERA physics* and editor of the proceedings.
- 1995 – 1996 Convener of the working group on *Diffractive Hard Scattering* at the workshop on Future Physics at HERA.
- 1991 – 1993 Convener of the physics working group *Heavy Flavors* at H1.
- April 1995 Convener of the working group on *Proton and Photon Structure and Diffractive Interactions* at the workshop on *Deep Inelastic Scattering and QCD*, Paris, April 1995.

## Supervision of doctoral theses

- 25 2016 – Armando Bermudez Martinez  
2016 – Daniela Dominguez Damiani
- 2015 – Patrick Connor
- 2015 – Aleksandra Lelek
- 2015 – Juan Manuel Grados Luyando
- 2011 – 2014 S. Dooling (Hamburg U.)  
*Differential Cross Section Measurement of Drell-Yan Production and associated Jets with the CMS Experiment at the LHC*
- 2011 – 2014 P. Gunnellini (Hamburg U. and Antwerp U.)  
*Study of double parton scattering using four-jet scenarios in proton-proton collisions at  $\sqrt{s}=7$  TeV with the CMS experiment at the Large Hadron Collider*
- 2010 – 2014 P. Cipriano (Hamburg U.)  
*Forward - Central Jet Correlations in pp Collisions at CMS*
- 2009 – 2013 A. Grebenyuk (Hamburg U.)  
*Analysis of charged particles in HI*
- 2008 – 2016 M. von den Driesch (Hamburg U.)  
*On parton showers and multi parton interactions*
- 2008 – 2011 N. Sen (Hamburg U.)  
*Measurement of the Energy Flow at Large Pseudorapidities at the Large Hadron Collider using the Compact Muon Solenoid*
- 2007 – 2010 T. Toll (Hamburg U.)  
*MC@NLO for Heavy Flavor Photoproduction at HERA*
- 2006 – 2010 Z. Staykova (Hamburg U.)  
*Measurement of  $D^*$  mesons with two jets in photoproduction with the HI detector at HERA*
- 2006 – 2009 M. Deak (Hamburg U.)  
*Transversal momentum of the electroweak gauge boson and forward jets in high energy factorization at the LHC*
- 2005 – 2011 A. Cholewa (Hamburg U.)  
*Measurement of charm cross section at low  $Q^2$  in HI*
- 2005 – 2009 Ll. Marti (Hamburg U.)  
*Multiple Parton Interactions in Photoproduction at HERA/HI*
- 2004 – 2008 S. Vinokurova (Hamburg U.)  
*Diffraction Photoproduction of Charm at HERA*
- 2004 – 2005 G. Flucke (Hamburg U.)  
*Photoproduction of  $D^*$  Mesons and  $D^*$  Mesons Associated with Jets at HERA*
- 2003 – 2007 M. Hansson (Lund)  
*Determination of the unintegrated gluon density at HERA*
- 2002 – 2007 A. Knutsson (Lund)  
*Study of parton dynamics at small  $x$  at HERA*
- 1998 – 2001 M. Davidsson (Lund)  
*Jet production and parton dynamics in deep inelastic scattering*
- 1996 – 2000 M. Lindström (Lund)  
*Measurement of azimuthal asymmetries in the hadronic final state of deep inelastic scattering at HERA*
- 1996 – 2003 M. Karlsson (Lund)  
*Jet reconstruction and its application in studies of parton dynamics*
- 1995 – 1997 B. Laforge (Saclay)  
*Etude des evenements a di-Jets dans la diffusion profondement inelastique avec large intervalle de rapidite dans l'experience HI aupres de l'accelerateur HERA*

1992 – 1995 D. Krücker (Aachen)

*Modelle für die elastische  $J/\psi$ -Produktion bei HERA*

## Supervision of diploma theses

- 2008 – 2009 F. von Samson-Himmelstjerna (FU Berlin)  
*Determination of parton density functions using Monte Carlo event generators*
- 2005 Z. Staykova (Sofia U.)  
*Simulations of DIS events containing a charm quark at HERA*
- 2004 – 2005 A. Cholewa (Hannover U.)  
*Transverse Momentum of Gluons in ep scattering at HERA*
- 2004 – 2005 L. Marti (Hamburg U.)  
*Investigation of heavy Quark and Multiple Interactions at HERA*
- 2002 – 2003 M. Hansson (Lund)  
*The Unintegrated Gluon Density in the Photon and Heavy Quark Production*
- 2001 – 2002 A. Knutsson (Lund)  
*Forward jet production in events with large rapidity gaps at HERA*
- 1999 – 2000 S. Schilling (Heidelberg)  
*Implementation of BGF-processes in Monte Carlo generators for electron proton scattering*
- 1995 – 1996 M. Karlsson (Lund)  
*An investigation of the parton momentum distribution in diffractive exchange using high  $p_t$  dijets*
- 1991 – 1993 G. Ihorst (Aachen)  
*Trigger und Datenanalyse von  $J/\psi \rightarrow e^+e^-$  Ereignissen im H1 - Detektor bei HERA*
- 1989 – 1991 O. Overbeck (Aachen)  
*Untersuchungen zur Bestimmung der Gluonstrukturfunktion des Protons*
- 1989 – 1991 J. Staeck (Aachen)  
*Kalibration von Schauerzählern für den HERA H1 – Detektor mittels Pion-Teilchenstrahlen*
- 1989 – 1991 M. Wielers (Aachen)  
*Heavy Flavor production in ep collisions: a comparison between different MC event generator*
- 1989 – 1991 T. Jansen (Aachen)  
*Trigger für  $J/\psi$  Ereignisse beim H1 - Detektor*

## Supervisor Experience

- 2009 – 2015    Lecture Course: QCD and Monte Carlos, University Antwerp
- 2009            Lecture Course: QCD and Monte Carlos, DESY and University Hamburg
- 2008/2009    Lecture Course: QCD and Monte Carlos, University Antwerp
- 2005 – 2007    Lecture Course : QCD and collider physics, DESY Hamburg
- 2005 – 2014    Summerstudent lectures on Monte Carlo simulations, DESY Hamburg
- 2000 – 2001    Course in High Energy Physics and Cosmology at Lund University
- 1998            Lecture course in High Energy Physics at Lund University
- 1993            Seminars on “electron - positron and electron - proton interactions” at Hamburg University
- 1988 – 1993    Student seminars in high energy physics at Aachen University (RWTH)
- Courses in experimental physics at Aachen University
- since 1988    Supervision of diploma and PhD theses at Aachen University (FRG),  
                  at Saclay (France), at Lund University and at Hamburg University.