

Where it all began ...

HERA AND THE LHC

A workshop on the implications of HERA for LHC physics

March 2004 - Jan 2005

Parton density functions
Multijet final states and energy flow
Heavy quark
Diffraction
Monte Carlo tools

Startup meeting
March 26-28 2004
CERN, Geneva

Final Meeting
Jan 2005
DESY, Hamburg

Organizing Committee:
G. Altarelli (CERN), J. Blümlein (DESY),
M. Botje (NIKHEF), J. Butterworth (UCL),
A. De Roeck (CERN) (chair),
H. Jung (Lund/DESY) (chair),
M. Mangano (CERN), A. Morsch (CERN),
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R. Yoshida (ANL)

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A. Wagner (DESY), S. Yoshida (ANL),
P. Zerwas (DESY)

www.cern.ch/~heralhc
www.desy.de/~heralhc

heralhc.workshop@cern.ch
heralhc.workshop@desy.de

HERA AND THE LHC

A workshop on the implications of HERA for LHC physics

6-9 June 2005
CERN, Geneva

Parton density functions
Multijet final states and energy flow
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P. Janji (CERN), R. Klanner (DESY),
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HERA AND THE LHC

2nd workshop on the implications of HERA for LHC physics

6-9 June 2006
CERN, Geneva

Parton density functions
Multijet final states and energy flow
Heavy quarks
Diffraction
Monte Carlo tools

Organizing Committee:
G. Altarelli (CERN), J. Blümlein (DESY),
M. Botje (NIKHEF), J. Butterworth (UCL),
A. De Roeck (CERN) (chair), K. Eggert (CERN),
E. Gallo (INFN), H. Jung (DESY) (chair),
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Highlights of 1st workshop !!!

“...The mechanic, who wishes to do his work well, must first sharpen his tools ...”

—Chapter 15, “The Analects” attributed to Confucius, translated by James Legge. (from X. Zu at DIS05)

... and where we are now ...

HERA AND THE LHC

3rd workshop on the implications of HERA for LHC physics



12-16 March 2007
DESY Hamburg



Parton density functions

Multijet final states
and energy flow

Heavy quarks

Diffraction

Monte Carlo tools

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O. Schneider (EPFL), C. Vallee (CPPM)

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J. Bartels (Hamburg), M. Della Negra (CERN),
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HERA AND THE LHC

4th workshop on the implications of HERA for LHC physics



26-30 May 2008
CERN



Parton density functions

Multijet final states
and energy flow

Heavy quarks

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Organising Committee:

G. Altarelli (CERN), J. Blümlein (DESY),
M. Botje (NIKHEF), J. Butterworth (UCL),
A. DeRoeck (CERN) (chair), K. Eggert (CERN),
T. Haas (DESY), H. Jung (DESY) (chair),
M. Klein (DESY), M. Mangano (CERN),
A. Morsch (CERN), G. Polesello (INFN),
O. Schneider (EPFL), C. Vallee (CPPM)

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www.desy.de/~heralhc

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Where are we now ?

- 4th HERA-LHC workshop marks the end of an era:
running HERA machine - before LHC starts data taking
- A lot has been achieved:
 - To encourage and stimulate transfer of knowledge between the HERA and LHC communities and establish an ongoing interaction.

Where are we now ?

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startup meeting:	26-27	March	2005	CERN (~ 250-300 participants)
2nd meeting:	6 - 9	June	2006	CERN (~150 participants)
3rd meeting:	12-16	March	2007	DESY (~160 participants)
4th meeting:	26-30	May	2008	CERN (~190 participants)

Where are we now ?

- 4th HERA-LHC workshop marks the end of an era:
running HERA machine - before LHC starts data taking
- A lot has been achieved:
 - To encourage and stimulate transfer of knowledge between the HERA and LHC communities and establish an ongoing interaction.
 - To increase the quantitative understanding of the implication of HERA measurements on LHC physics.
 - To encourage and stimulate theory and phenomenological efforts.
 - To examine and improve theoretical and experimental tools.

Well done ... !!!!!

Where are we now ?

- 4th HERA-LHC workshop marks the end of an era:
running HERA machine - before LHC starts data taking
- A lot has been achieved:
 - To encourage and stimulate transfer of knowledge between the HERA and LHC communities and establish an ongoing interaction.
 - To increase the quantitative understanding of the implication of HERA measurements on LHC physics.
 - To encourage and stimulate theory and phenomenological efforts.
 - To examine and improve theoretical and experimental tools.
 - To identify and prioritize those measurements to be made at HERA which have an impact on the physics reach of the LHC.



Can HERA still do something ?

- Many of precision HERA results are expected in next 1-2 years
 - F_2, α_s are being prepared, F_L coming soon
 - combined pdf fits etc
- active and lively discussion at DIS08 on future measurements at HERA
 - many old and new ideas for additional measurements, for example:
 - of pdfs of different quark flavours to uPDFs
 - from hadronization parameters (via tracks, multiplicities, particle spectra, energy flows) over underlying events to properties of jets (R- dep of jet xsections)

Jets, G. Salam (p. 26)
└ Closing

Conclusions

Unlocking the power of jets at LHC means going beyond stale discussions of whether we really need IRC safe algorithms.



For each IRC unsafe alg., there's a good safe alternative
HERA offers a good example in its approach to jets

The questions we face on jets cover LHC's whole dynamic range:



From ~ 1 GeV to multi-TeV
The scales mix: UE with pileup with EW with TeV
Understanding of low scales, substructure \leftrightarrow HERA

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 - from hadronization parameters (via tracks, multiplicities, particle spectra, energy flows) over underlying events to properties of jets (R- dep of jet xsections)
 - of fragmentation functions also for charm
 - is hadronisation universal ?
 - direct gluon determination with heavy quarks
 - diffraction, saturation and survival probabilities
 - jets and underlying events also in diffraction (R-dep)
 - and many more
 - summary of old and new ideas for measurements will be put on web page !!!!
- for completion of program, getting most out from HERA, DESY support is granted !!!

Future ...

- 4th HERA and the LHC workshop marks end of an era ...
- summarize achievements, progress and open issues with proceedings
- Questions (obvious....) for proceedings:
 - do we have the necessary tools for the LHC start?
 - pdfs, jets, HQ, diff, MCs ?
 - where are areas, which need urgent further work ?
 - where are areas, where progress can be made in the next 1-2 years ?
 - what has been achieved compared to 2006, what is still missing ?

Future ...

- 4th HERA and the LHC workshop marks end of an era ...
- summarize achievements, progress and open issues with proceedings
- Proceedings: online and printed as common DESY-CERN report
 - Consistent and common report per working group
 - with subsections covering different areas
 - WG conveners produce skeleton and contact people to contribute
 - no individual contributions !!!
 - 100 pages per WG
 - deadline for 1st draft of WG report: 1 Sept 2008
 - final version deadline: 15 Sept 2008
 - style file as for 2006 proceedings, will be available from web page
 - print proceedings in October 2008

Future workshops ?

- present type of HERA and the LHC workshops comes to an end
- **BUT** keep momentum and good collaboration **alive** ...
- several interesting, new & challenging options for the future:
 - specialised working groups, like **PDF4LHC etc**
 - or
 - extended workshop "**QCD at the TeV scale** "
including HERA, TeVatron and RHIC
 - or
 - extend workshop character, build real working groups
 - or
 - etc ...
- options will be discussed with conveners, org and advisory board
- **PLEASE**, give input and try to influence to outcome of the discussion,
decision together with publication of **proceedings in Nov 2008**

Thanks

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- Have a good and safe trip back home