ISMD2021

Closing remarks

16 July 2021

https://indico.cern.ch/e/ismd2021

@ismdconf

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In conclusion…

Thanks for joining ISMD2021

We hope you all enjoyed it, and saw interesting things outside your own day-to-day specialisation

All talks are also recorded and available as “material” via Indico

This has been an experiment for us (in many ways!)

It wouldn’t have worked without the participation of speakers, conveners, international advisors, and our sponsors and technical support

We’ve learned some useful lessons for future installments…

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Statistics

Some stats

- 132 abstracts → 60 talks, 14 flash talks, 48 posters/pre-rec talks
- Eventual total of 225 registrations! (normally closer to 100-120)
  - 89: Europe
  - 43: North America (all US)
  - 31: South Asia
  - 25: East Asia
  - 14: Central Asia
  - 7: Middle East
  - 6: Africa 5: Central & South America
- Breakdown of contribution types
  - 45/130 heavy-ion abstracts: nice balance between HEP/HI/both/other ✔
  - Approx 50/50 “theory” vs “experiment” ✔

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Poster prize

Poster sessions prize

- Thank you to all poster & pre-rec presenters — some fantastic work
- The poster prize of 400 CHF + publication APC in Universe, sponsored by MDPI, goes to…

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Runners-up

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Poster Competition

RUNNER-UP

Sukanya Sinha, University of Witwatersrand

"Exploring jet substructure in semi-visible jets"

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Poster Competition

RUNNER-UP

Kadir Utku Can, University of Adelaide

"Compton amplitude and the nucleon structure functions on the lattice via the Feynman-Hellmann theorem"

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Poster Competition

RUNNER-UP

Elena Kokoulina, JINR

"Collective phenomena in pp interactions with high multiplicity"

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Poster Competition

RUNNER-UP

Giuseppe Callea, University of Glasgow

"Colouring the Higgs Boson"

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Poster Competition

FIRST PRIZE

Eimear Conroy, University of Oxford

"The impact of ATLAS V+jet measurements on PDF fits"

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The impact of ATLAS V+jet measurements on PDF fits[1]

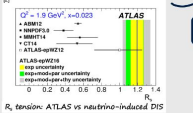
Eimear Conroy on behalf of the *ATLAS* collaboration
eimear.conroy@physics.ox.ac.uk

1. The motivations

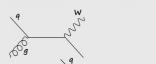
Quark flavour: Fit strange sea directly

$R_s = \frac{s+\bar{s}}{\bar{u}+\bar{d}}$

Sensitive to gluon @ leading order in QCD



R_s tension: ATLAS vs neutrino-induced DIS



$(\bar{d}-\bar{u})$ @ high x

E866[3] → > 0

ATLASepWZ16[2] → Compatible with 0, slightly negative

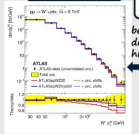
HERA data + inclusive ATLAS W/Z data @ 7 TeV[2]

Jets → V boson data: Higher x, Q^2 reach

2. The datasets

$d\sigma/dp_T^W$ spectrum

W+ jets 8 TeV[4]



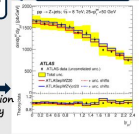
Adding V+jet data to PDF fit …

better data description @ high p_T

normalization change only

$d\sigma/dp_T^{jet}d|y^{jet}|$ spectra

Z+ jets 8 TeV[5]



kfactors: NLO QCD predictions → NNLO & LO EW predictions → NLO

HERA + W inclusive 7TeV + Z inclusive 7TeV + W+jets 8TeV + Z+jets 8TeV = ATLASep WZVjet20

cross-section measurements

DIS predictions: NNLO in QCD

NNLO QCD analysis performed with xFitter[6] framework + MINUIT[7]

3. The technicalities[1]

Parameterisation

Scales

Q_0^2 = 1.9 GeV^2 starting scale evolved with DGLAP

Q_{min}^2 =10 GeV^2 (avoid region with poor HERA χ^2)

General form: $xf(x) = Ax^B(1-x)^C(1+Dx+Ex^2)e^{\frac{F}{x}}$ (if needed) (extra gluon term: $-A'_g x^{B'_g}(1-x)^{C'_g}$)

Constrained by:

- Momentum sum rule
- Number sum rule
- $\bar{u} = \bar{d}$ as x → 0

HERAPDF2.0[8] + E_{uv}, D_g = 16 free parameters

Chi-square definition

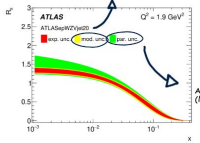
Partial term

$$\chi^2 = \sum_{i,k}\left(D_i - T_i\left(1-\sum_j \gamma_{ij}b_j\right)\right)C^{-1}_{stat,ik}\left(D_i - T_p\left(1-\sum_j \gamma_{kj}b_j\right)\right) + \sum_j b_j^2 + \sum_j \log\frac{\delta^2_{j,uncor}T_j^2 + \delta^2_{j,stat}D_jT_j}{\delta^2_{j,uncor}D_j^2 + \delta^2_{j,stat}D_j^2}$$

Correlated term — Log penalty (bias correction)

D_i Data point T_i Theory prediction $\delta_{uncor(stat)}$ Uncorrelated statistical (systematic) uncertainties on D γ_{ij} Correlated systematic uncertainties b_j Nuisance parameters C^{-1}_{stat} Statistical correlation matrix

Vary theoretical assumptions: Q^2_{min}, Q^2_{Cr}, heavy quark masses, alpha$_s$ etc.



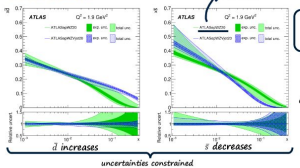
Uncertainties

- Experimental
- Model
- Parameterisation

Add extra D, E, F parameters (low-x sea), relax constraints

4. The results[1]

Identical fit without V+jets data

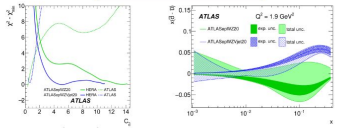


uncertainties constrained

V+jet data in fit → at high x…

HERA constrains sum

$(\bar{d}-\bar{u})$ at high x…



ATLAS preference for large $\bar{d}$ (C_F small) … …→ $(\bar{d}-\bar{u}) > 0$

R_S

Tension remains with global fits but reduced vs previous ATLAS fits

Includes ATLAS inclusive W, Z data

References
[1] ATLAS Collaboration, CERN-EP-2020-237, arXiv: 2101.05095 (accepted by JHEP)
[2] ATLAS Collaboration, Eur. Phys. J. C 77 (2017) 367, arXiv: 1612.03016 [hep-ex]
[3] FNAL E866/NuSea Collaboration, Phys. Rev. D 64 (2001) 052002, arXiv: hep-ex/0103030
[4] ATLAS Collaboration, JHEP 05 (2018) 077, arXiv: 1711.03296 [hep-ex]
[5] ATLAS Collaboration, Eur. Phys. J. C 79 (2019) 847, arXiv: 1907.06728 [hep-ex]
[6] S. Alekhin et al., Eur. Phys. J. C 75, 304 (2015) 304, arXiv: 1410.4412 [hep-ph]
[7] F. James and M. Roos, Comput. Phys. Commun. 10 (1975) 343
[8] H1, ZEUS Collaborations, Eur. Phys. J. C 75, 580 (2015), arXiv: 1506.06042

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Articles and proceedings

Proceedings

- We will operate optional, peer-reviewed proceedings open to all presenters — plenary, flash, poster, pre-rec — via open-access SciPost Proceedings
- More details by follow-up emails

SciPost

Universe special-edition option

- 26/39 poll interest in a special edition.
- Not ISMD-specific, but if interested contact S. Chekanov & Z. Sullivan

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Next year…

ISMD2022, Pitlochry, Scotland

- Nominal dates: 25-29 July 2022
- Fingers firmly crossed re. Covid developments
- 1 hour from Edinburgh or Glasgow
- Full days: more time for discussion, proper breaktimes!
- Excursions to Loch Tummel, Falls of Bruar

Lessons learned

- Significant virtual-participation element, to build on wider participation this year

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Thank you, and see you in 2022