

# Baryon anticorrelations and the Pauli principle in Pythia

Felipe J. Llanes-Estrada

Univ. Complutense de Madrid  
with Noe Demazure (ENS Lyon) and Víctor González Sebastián (Wayne State U.)

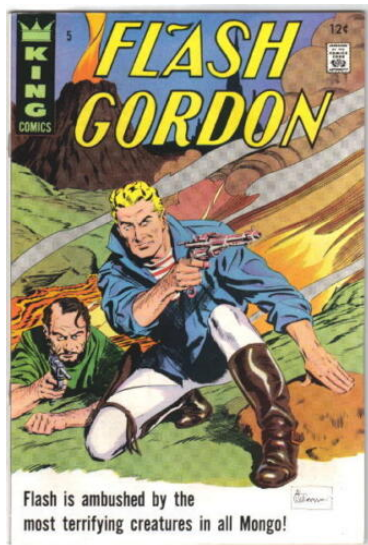
Presented in Seville, on November 9th 2022, to the  
International Conference on the Structure of Baryons



**Baryons 2022**

7-11 November, Sevilla

# So what is a “Flash talk” anyway?



# So what is a “Flash talk” anyway?



It's a talk where conclusions go up in the next slide...

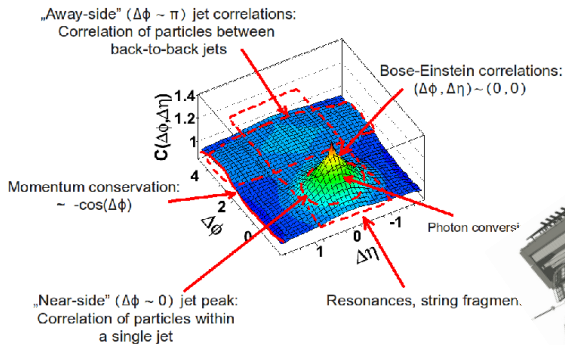
# So what is a “Flash talk” anyway?



It's a talk where conclusions go up in the next slide...

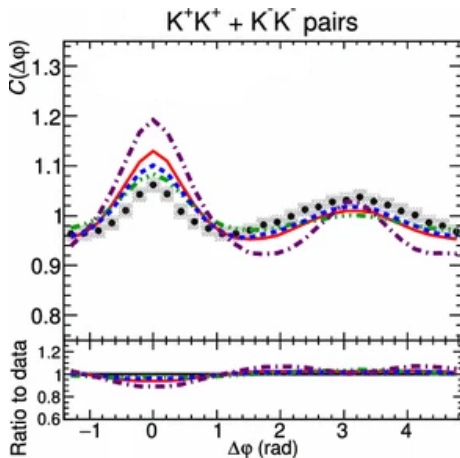
You're out of luck

# Pair correlations in hadron collisions



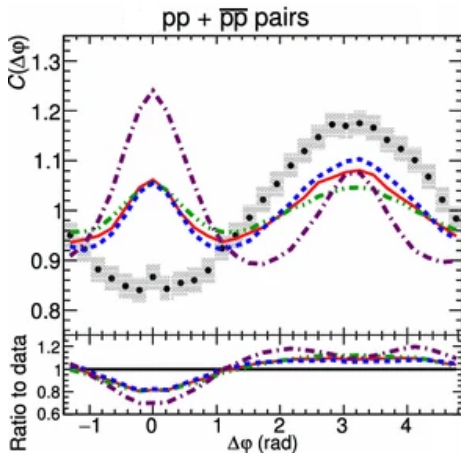
Nucl.Phys.A 926 (2014) 205-212; ALICE-PHO-SKE-2017-002-17

# Projecting out the rapidity dependence



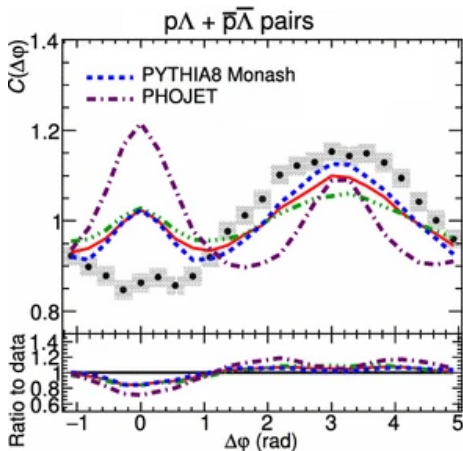
ALICE coll. Eur. Phys. J. C 77, no.8, 569 (2017), EPJ Web Conf. 171 (2018) 19003

# Gross (qualitative) Monte Carlo/experiment disagreement !



ALICE coll. Eur. Phys. J. C 77, no.8, 569 (2017), EPJ Web Conf. 171 (2018) 19003

# Anticorrelation also there for (distinguishable) $p\Lambda$



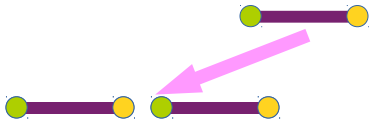
ALICE coll. Eur. Phys. J. C 77, 569 (2017), EPJ Web Conf. 171 (2018) 19003



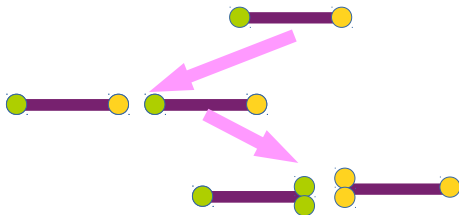
# This work: put the Pythia Monte Carlo apart

- Read about it in e-Print: [2210.02358 \[hep-ph\]](https://arxiv.org/abs/2210.02358)

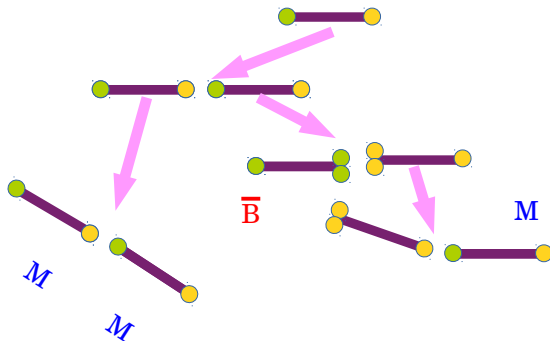
# String fragmentation in Pythia



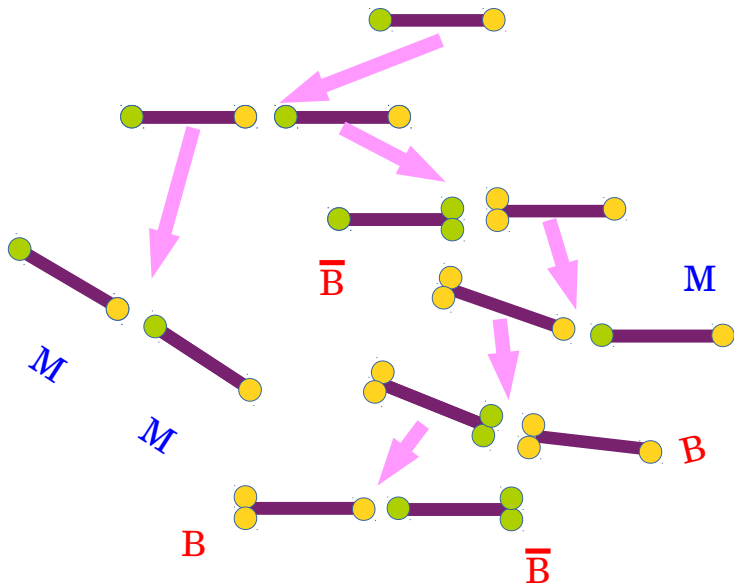
# String fragmentation in Pythia



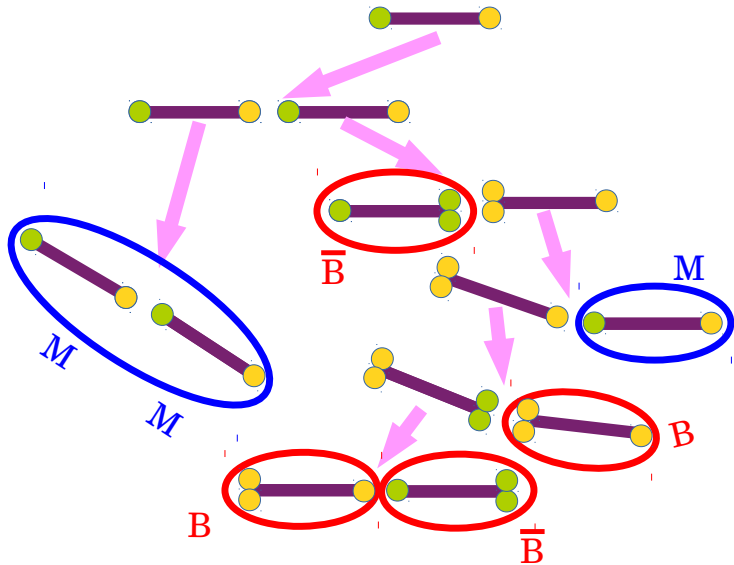
# String fragmentation in Pythia



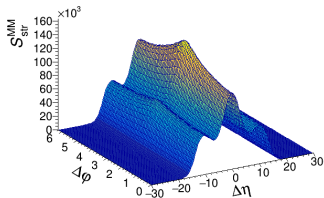
# String fragmentation in Pythia



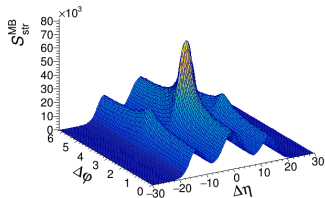
# String fragmentation in Pythia



# String-string correlations: marginal forward peak



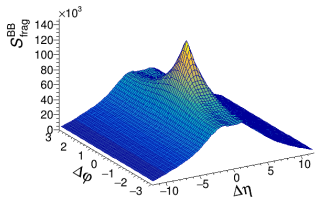
Two  $B = 0$  strings



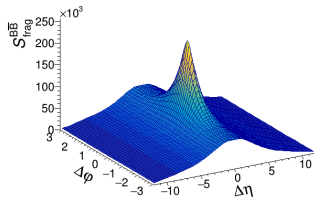
One  $B = 0$  and one  $B = 1$  strings

Maybe...

# Two baryons from the same string: clear forward peak



Baryon-baryon



Baryon-antibaryon

Got it!



## Two modifications to PYTHIA 8 code

- “One baryon policy”: each string can at most produce one baryon

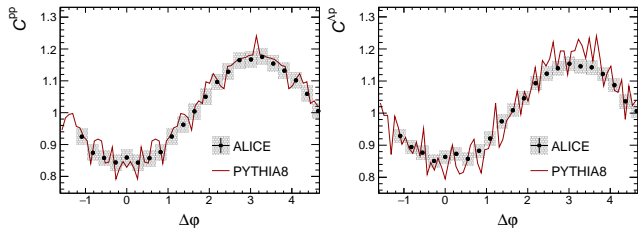
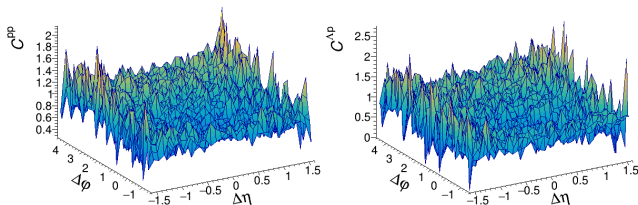
It eliminates the positive correlation,  
but depresses the total  $B$  number too much

# Two modifications to PYTHIA 8 code

- “Always baryon policy”: every string must produce one baryon

Baryons remain anticorrelated,  
and now their abundance is ok

# Spread baryon production brings Monte Carlo into agreement with ALICE data



$pp$

$p\Lambda$

- Need to separate baryon production vertices in Monte Carlo simulators
- Implementing the Pauli principle at the quark level could be a start

# Funding acknowledgments

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824093; grants MICINN: PID2019-108655GB-I00, PID2019-106080GB-C21, PID2019-106080GB-C22 (Spain); UCM research group 910309 and the IPARCOS institute.

