

Investigating diffractive processes with ALICE

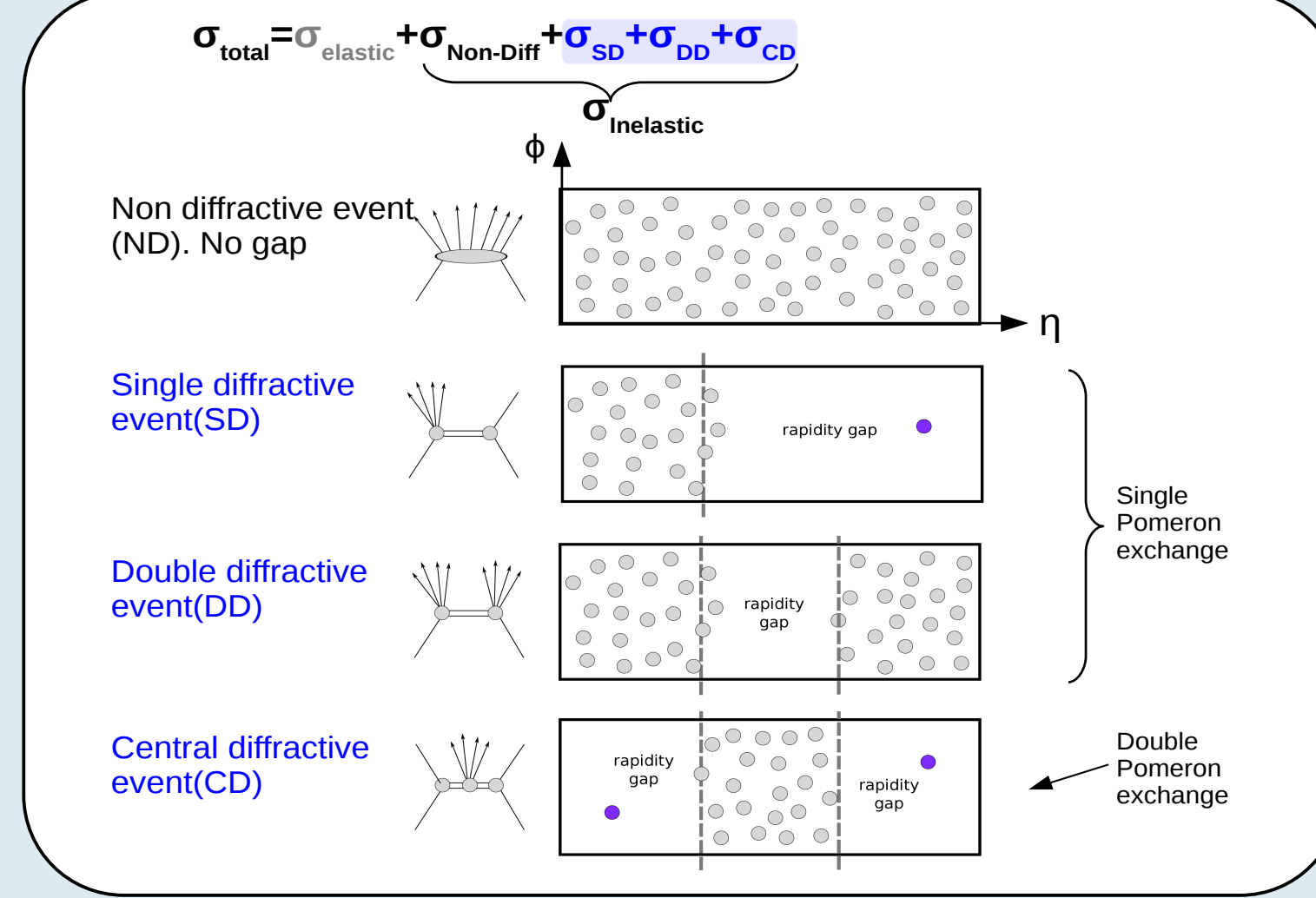
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In DIFFRACTIVE EVENTS there is no color exchange between the colliding protons. Instead, a colorless particle with the quantum numbers of the vacuum, the POMERON, is exchanged. Such an exchange generates rapidity gaps in the distribution of tracks.

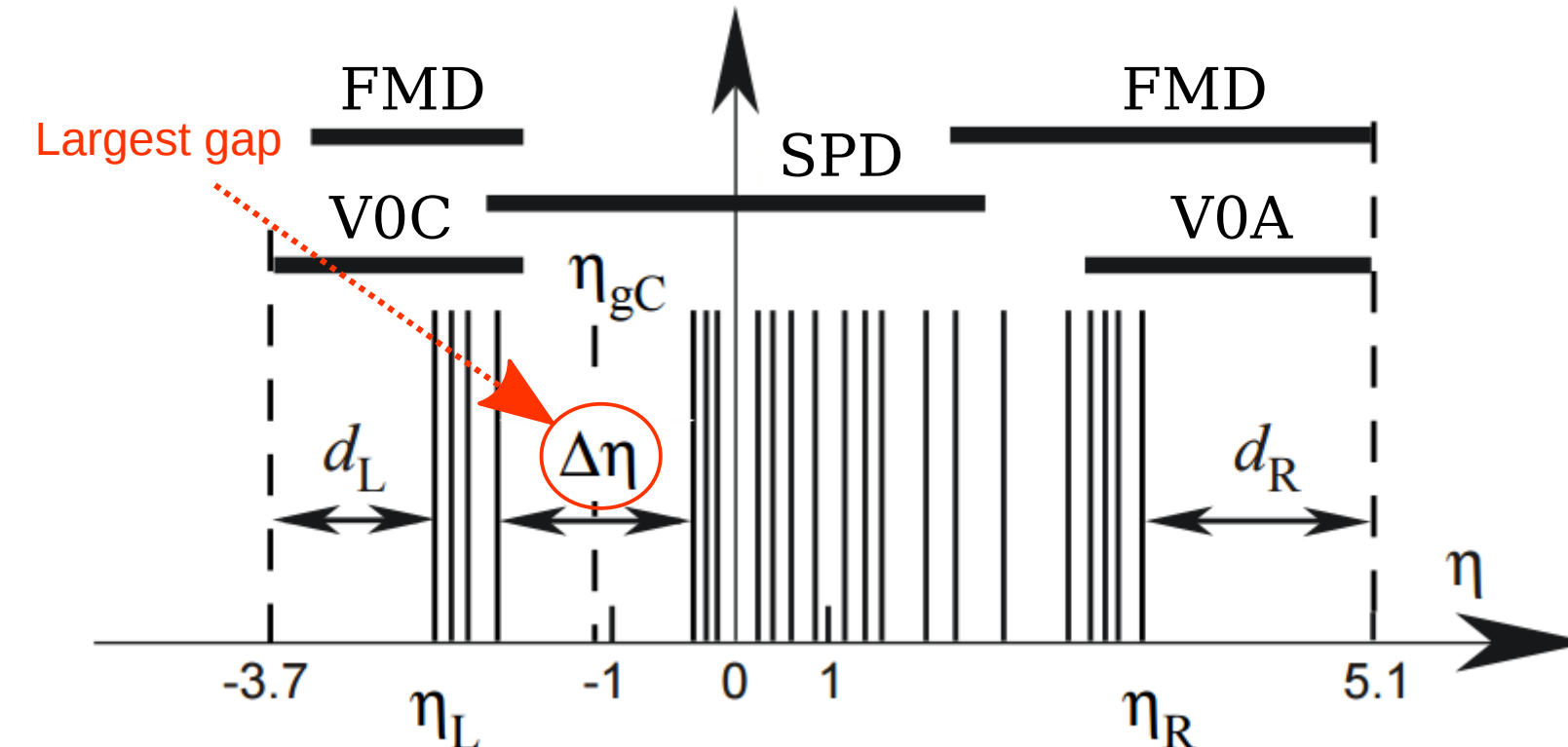


Classification procedure:

Events are classified into 3 categories [1]:

- 1-arm-L** → SD-L (left or $\eta < 0$)
- 1-arm-R** → SD-R (right or $\eta > 0$)
- 2-arm** → DD and ND events

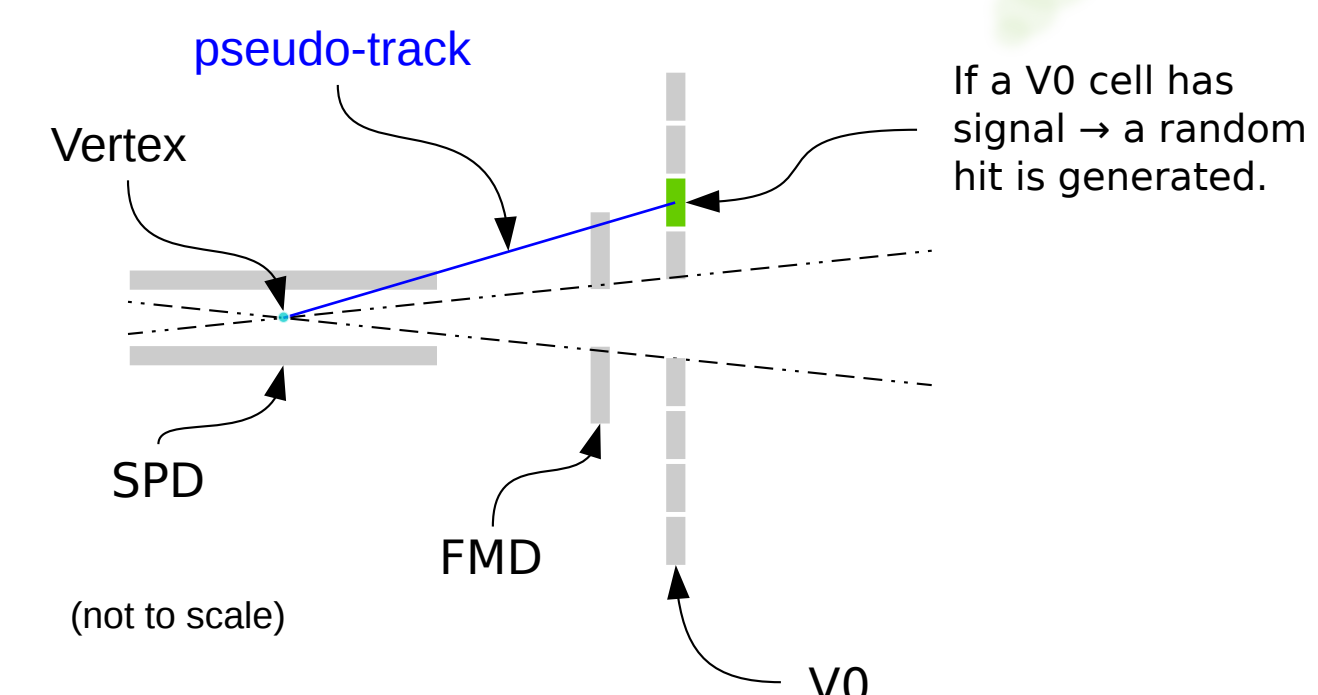
DD: 2-arm and $\Delta\eta > 3$



Pseudo-tracks:

track → pseudo-track

Association of the reconstructed vertex with a hit in SPD, FMD or V0. In 10% of cases there is no reconstructed vertex → A random vertex is generated from measured vertex distribution



One-track event:

All events satisfying the condition $(\eta_R - \eta_L) < 0.5$ and having all pseudo-tracks within 45° in ϕ . (small fraction of events, resolution set by V0)

$$\text{Let: } \eta_c = 1/2(\eta_L + \eta_R)$$

- If $\eta_c < 0$ → 1-arm-L
- If $\eta_c > 0$ → 1-arm-R

Multi-track event:

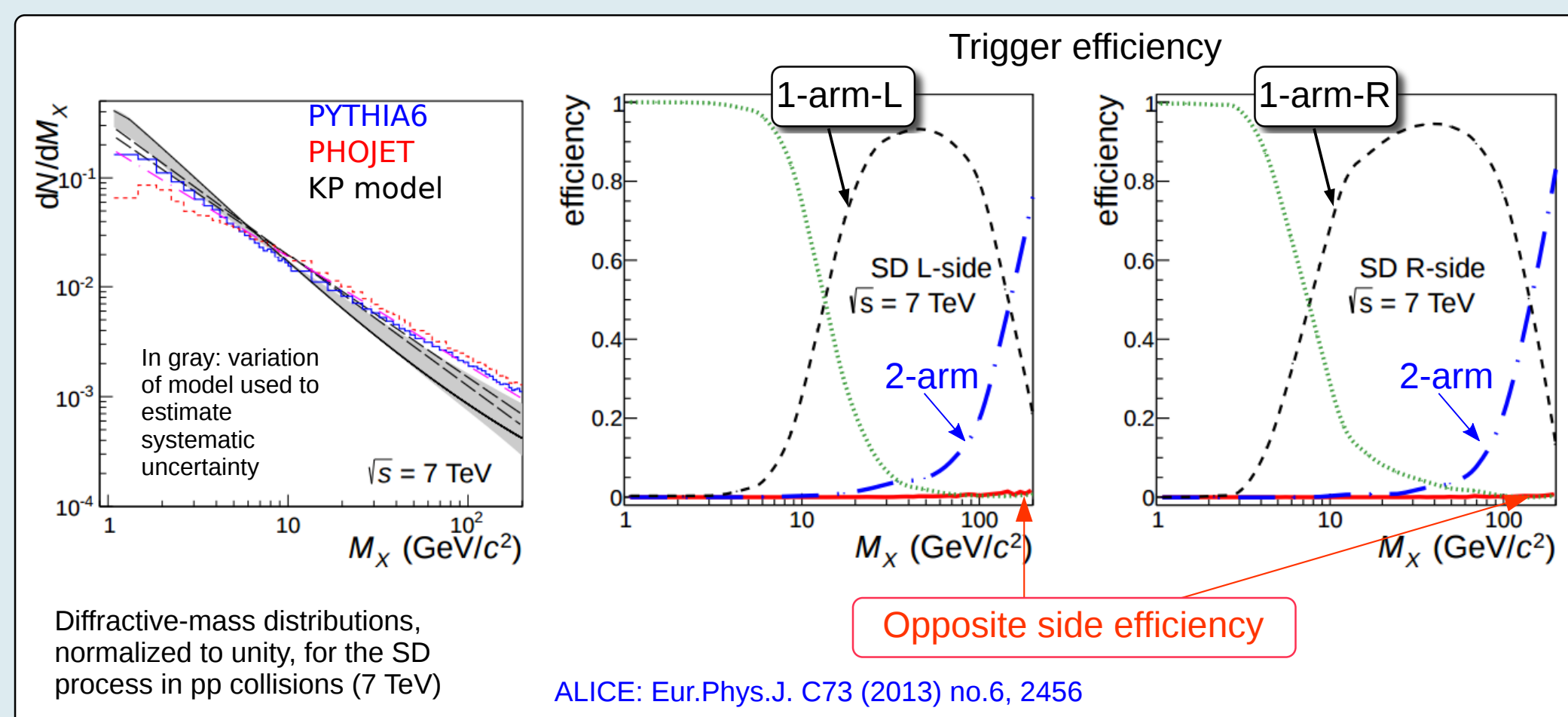
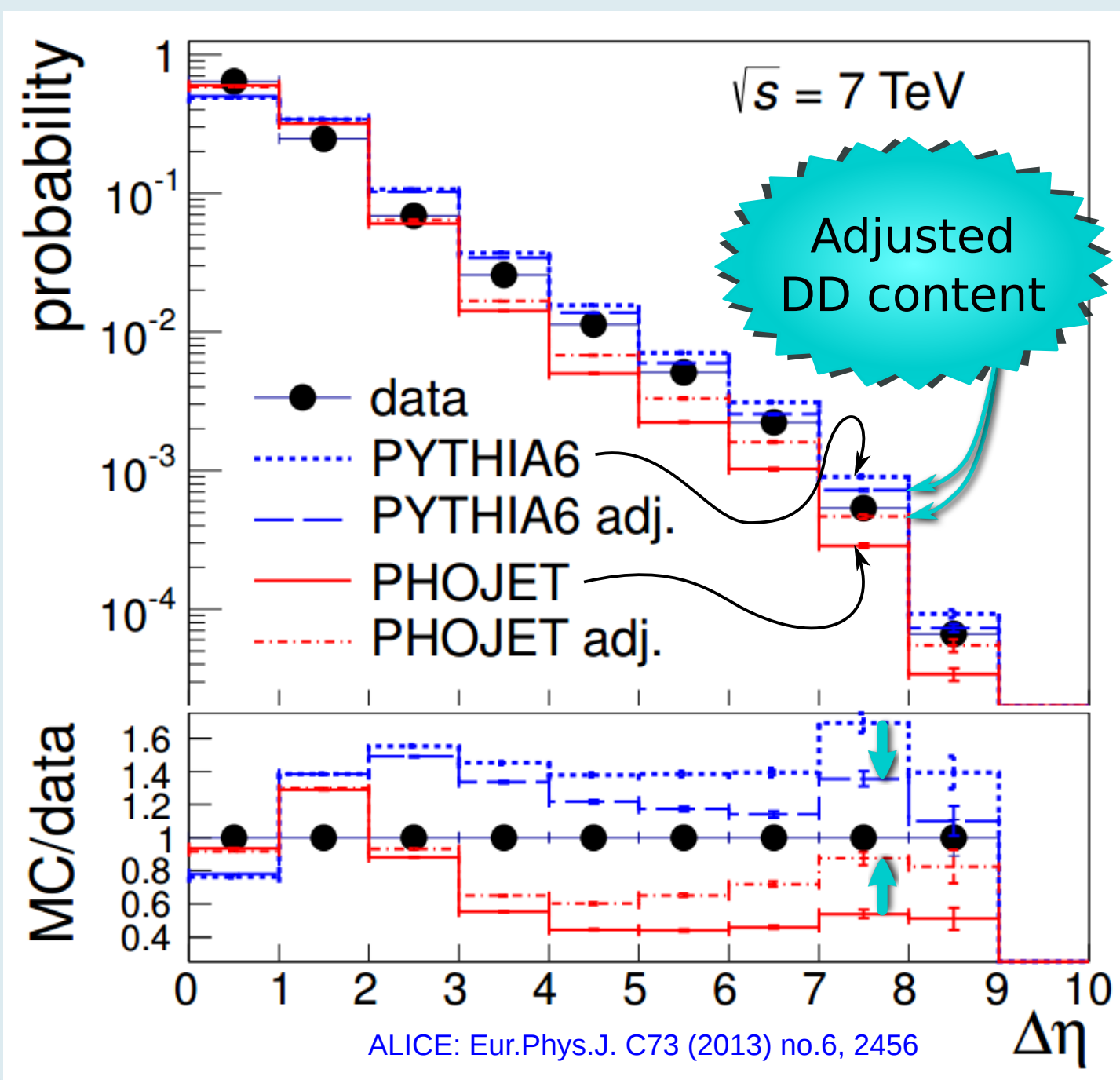
If $\Delta\eta$ is larger than d_R and d_L → 2-arm
If $-1 < \eta < 1$ for all pseudo-tracks → 2-arm
else,
If $\eta_c < 1$ → 1-arm-L
If $\eta_c > 1$ → 1-arm-R

Any remaining events → 2-arm

Diffractive in Run I

The diffractive mass (M_x) distribution of single diffraction in PYTHIA6 and PHOJET was modified to use the M_x distributions from a model [2] by Kaidalov-Poghosyan.

The Monte Carlo double diffractive fraction (DD) is adjusted until the distribution of the largest gap in



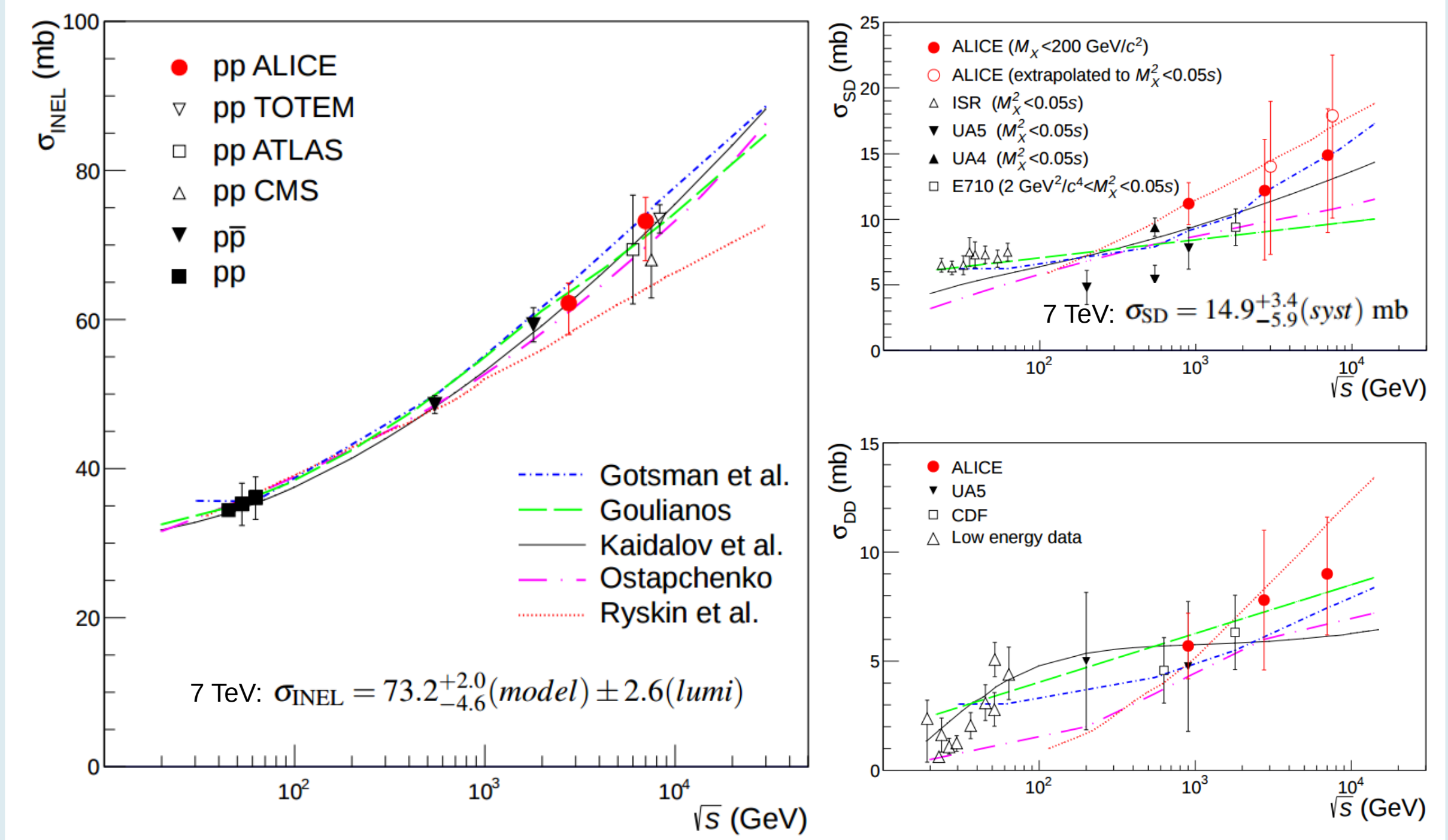
2-arm events brackets the data (PYTHIA6 from above and PHOJET from below).

Then, the estimated efficiency of 1-arm and 2-arm triggers (which depends on the DD fraction) is updated.

With these updated efficiencies and knowing the observed ratio of 1-arm to 2-arm events the fraction of SD to INEL events can be calculated.

The largest gap distribution from MC depends slightly on the SD fraction, so a few iterations are needed to reach final values.

Diffractive in Run I: Results

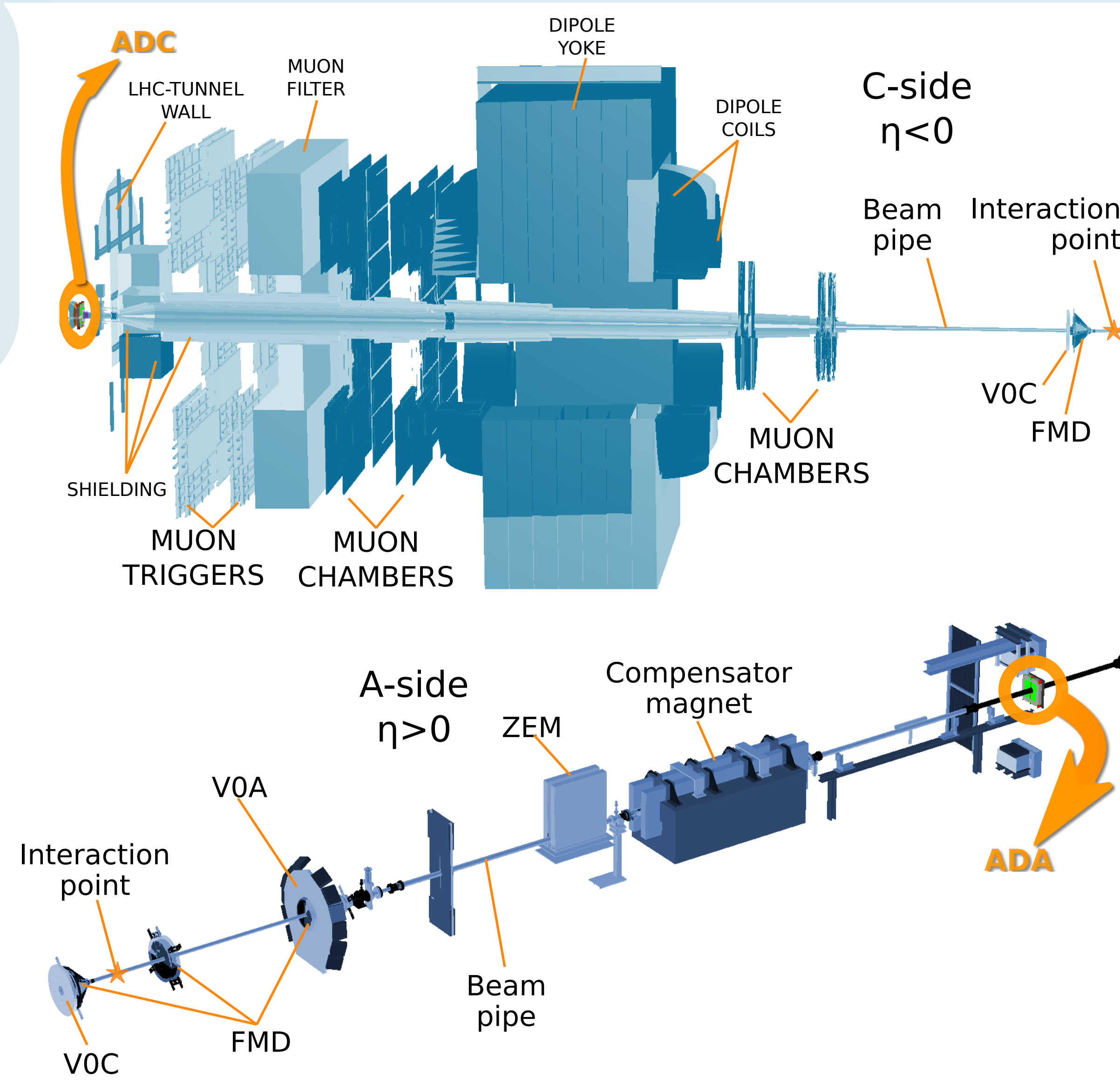


"The ALICE inelastic cross section result at $\sqrt{s} = 7$ TeV is consistent with those from ATLAS, CMS, and TOTEM"

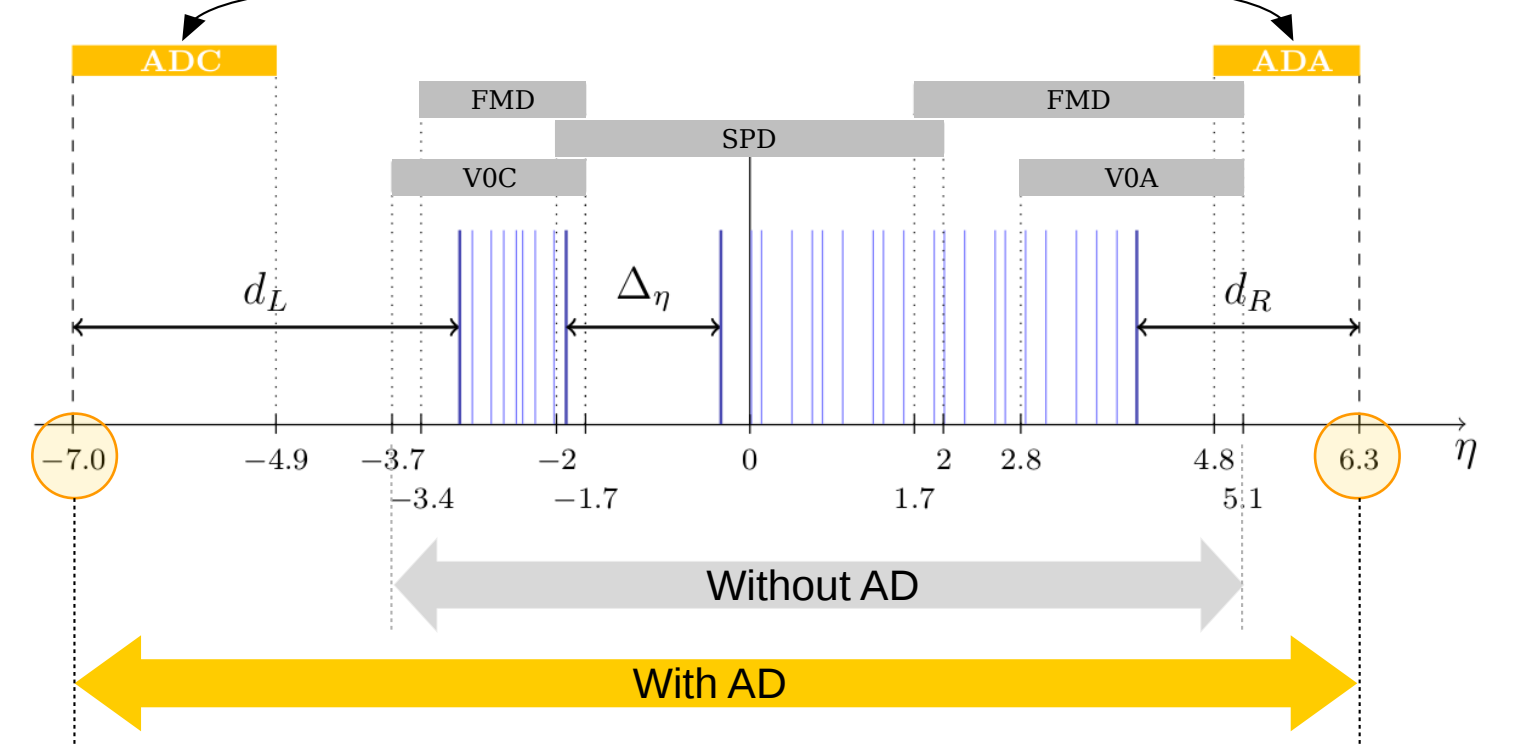
ALICE: Eur.Phys.J. C73 (2013) no.6, 2456

Run II: AD detector

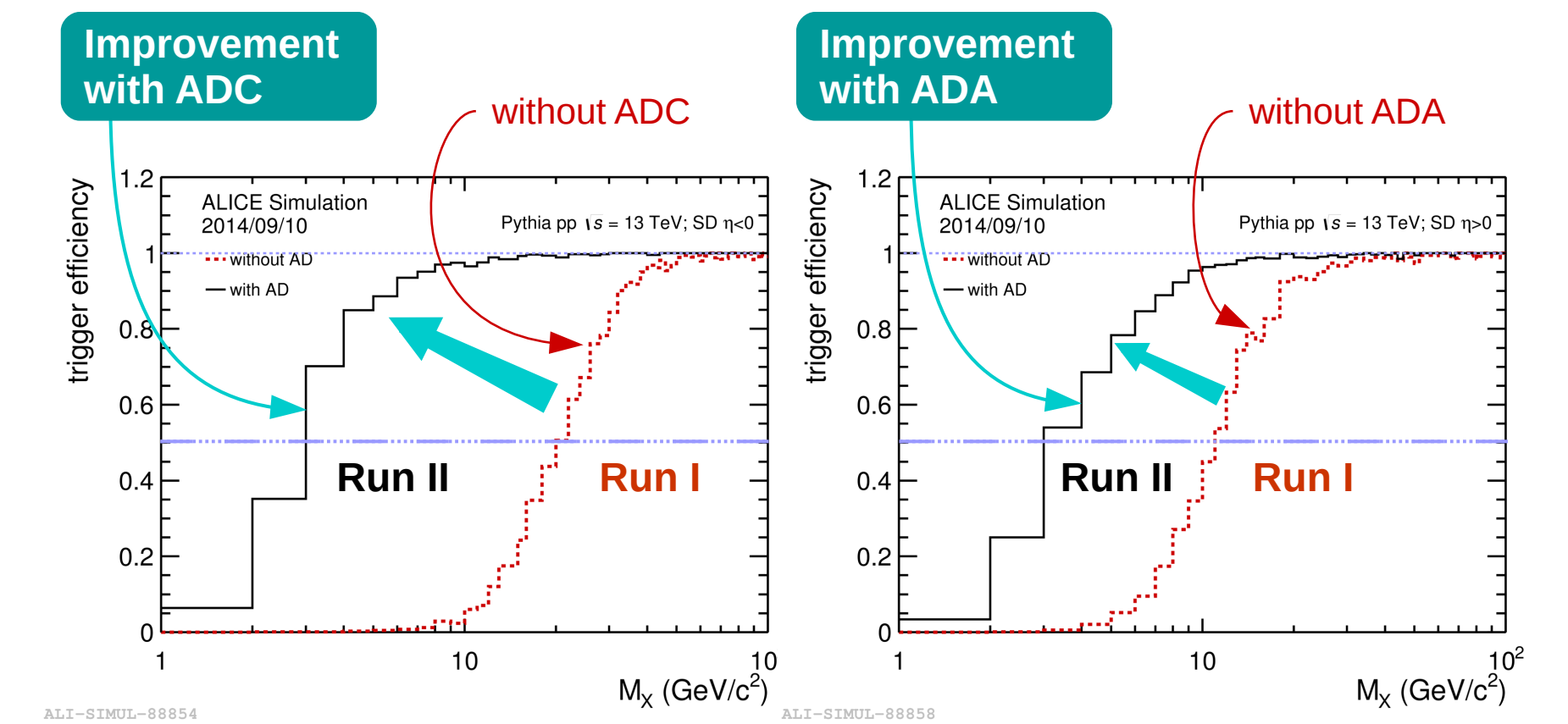
The AD detector consists of two stations each with 4 sectors containing 2 layers of scintillator tiles read out by wavelength-shifting bars and optical fibers. PMT's convert light into a current pulse which is pre amplified by a PASA and then processed by 2 CIU's and 1 CCIU.



ADA and ADC extend the pseudorapidity coverage of ALICE



AD improves trigger efficiency for diffractive events at low diffracted masses



Run II: $MB_{0R} = V0C + SPD + V0A$

Run II: $MB_{0R} = ADC + V0C + SPD + V0A + ADA$

References

- [1] B. Abelev et al. (ALICE Collaboration) "Measurement of inelastic, single- and double-diffraction cross sections in proton-proton collisions at the LHC with ALICE". In: Eur. Phys. J. C73.6 (2013), p. 2456. DOI: 10.1140/epjc/s10052-013-2456-0. arXiv: 1208.4968 [hep-ex].
- [2] A.B. Kaidalov, M.G. Poghosyan, "Description of soft diffraction in the framework of reggeon calculus: Predictions for LHC". In: Proceedings of the 13th International Conference on Elastic and Diffractive Scattering ("Blois Workshop"), ed. by M. Deile, D. d'Enterria, A. De Roeck, CERN, 2009 (DESY, Hamburg, 2010). arXiv:0909.5156 [hep-ph]