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Measurement of the hypertriton relative branching ratio with ALICE

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Hypernuclei are nuclei containing both nucleons and hyperons. Studying
their properties provides essential insights into the hyperon–nucleon interaction —a key component of the strong force that remains poorly understood. The lightest known hypernucleus is the hypertriton ($^3_\Lambda$H). In recent years, ALICE has performed the most precise measurements of the $^3_\Lambda$H lifetime and binding energy through the reconstruction of its two-body decay channel $^3_\Lambda\mathrm{H} \rightarrow {}^3\mathrm{He} + \pi^-$. However, the three-body decay $^3_\Lambda\mathrm{H} \rightarrow \mathrm{d} + \mathrm{p} + \pi^-$ has not yet been measuredby ALICE. This channel is crucial for providing additional constraints on the $^3_\Lambda$H properties, particularly through the determination of the relative branching ratio between the two- and three-body decay modes:
$\mathrm{R}_3 = \frac{\Gamma(^3_\Lambda\mathrm{H}\rightarrow{}^3\mathrm{He}+\pi^-)}{\Gamma(^3_\Lambda\mathrm{H}\rightarrow{}^3\mathrm{He}+\pi^-)+\Gamma(^3_\Lambda\mathrm{H}\rightarrow\mathrm{d}+\mathrm{p}+\pi^-)}$

The R_3 is directly connected to both the internal structure and the spin of the $^3_\Lambda$H. Previous determinations of R_3 suffer from large experimental uncertainties,underscoring the need for more precise measurements. In this talk, the first ALICE measurement of the hypertriton three-body decay and the determination of R_3 are presented. The analysis exploits the largest pp dataset ever collected by ALICE at the LHC, and introduces novel techniques to suppress and model the combinatorial background. The obtained results are compared with existing measurements and discussed in the context of theoretical predictions, providing new insight into the hypertriton spin and the hyperon–nucleon interaction.

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