Studying rare decays and improving EvtGen

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Simulation with: John Back, Michal Kreps, Giacomo Morgante (MRes) Thomas Latham, Peter Skands

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MONASH University

Studies of rare decays

Studies of $B^+_{(c)} \to \mu^+\mu^-\pi^+$ decays offer various ways to search for (or put constraints on) possible non-SM contributions

Vector $\to \ell\ell$ decays

EPJ C82 (2022) 459

- Search for $D^{*0} \to \mu\mu$ in $B^+ \to \mu^+\mu^-\pi^+$ decays

  EPJ C83 (2023) 666 $\mathcal{B}(D^{*0} \to \mu^+\mu^-) < 2.6\,(3.4) \times 10^{-8}$ at 90 (95)% CL

- Search for $B^{*0}_{(s)} \to \mu^+\mu^-$ in $B^+_c \to \mu^+\mu^-\pi^+$ decays

B^+_c annihilation

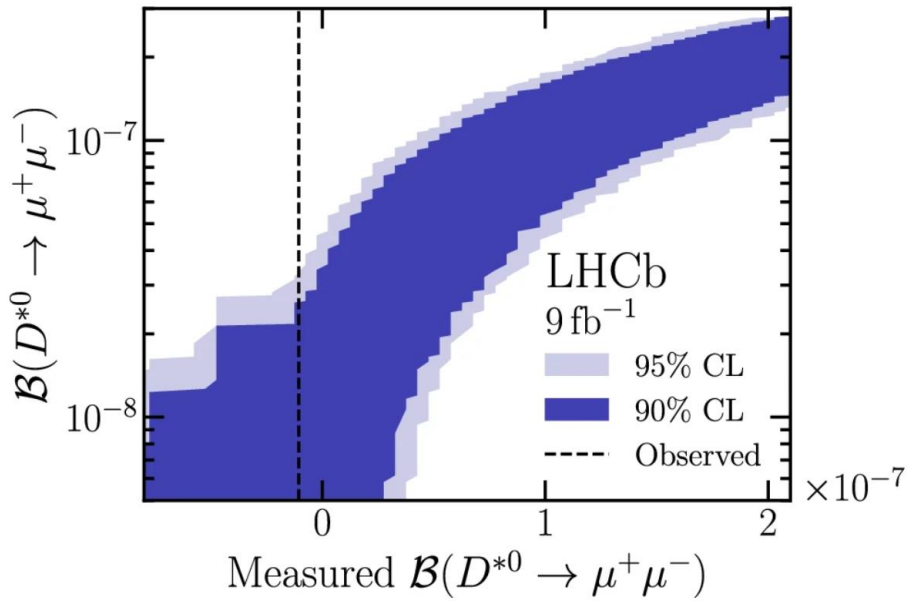
- Search for nonresonant $B^+_c \to \mu^+\mu^-\pi^+$ decays and update of $\mathcal{B}(B^+_c \to \psi(2S)\pi^+)/\mathcal{B}(B^+_c \to J/\psi\pi^+)$

  (to be submitted soon)

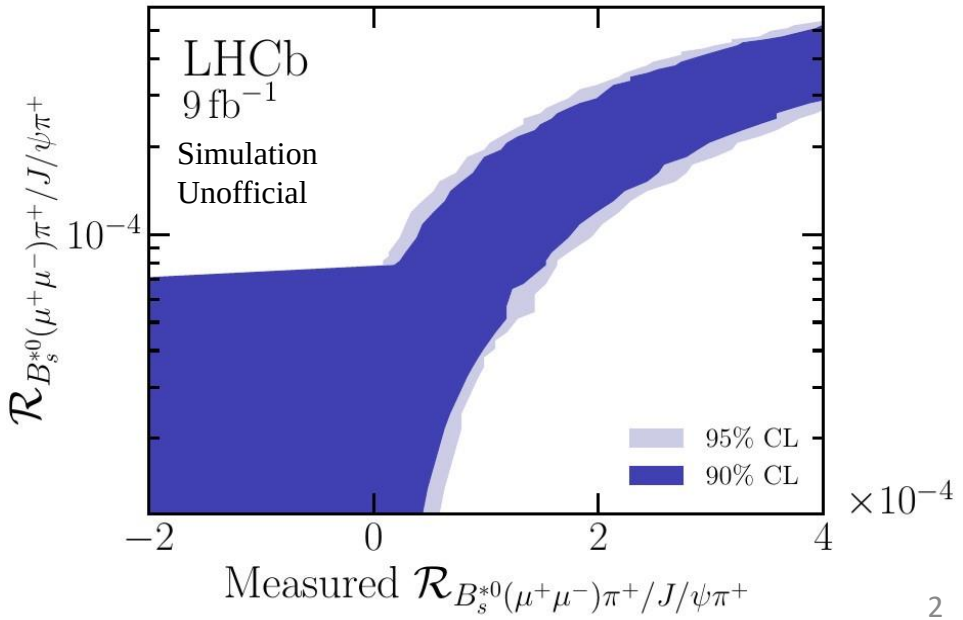
$b \to d\ell\ell$ transition

- Differential $\mathcal{B}$ and CP analysis of $B^+ \to \mu^+\mu^-\pi^+$
- Angular analysis of $B^+ \to \mu^+\mu^-\pi^+$

Search for $D^{*0} \to \mu^+\mu^-$ decays



Search for $B^{*0}_{(s)} \to \mu^+\mu^-$ decays



Improving EvtGen

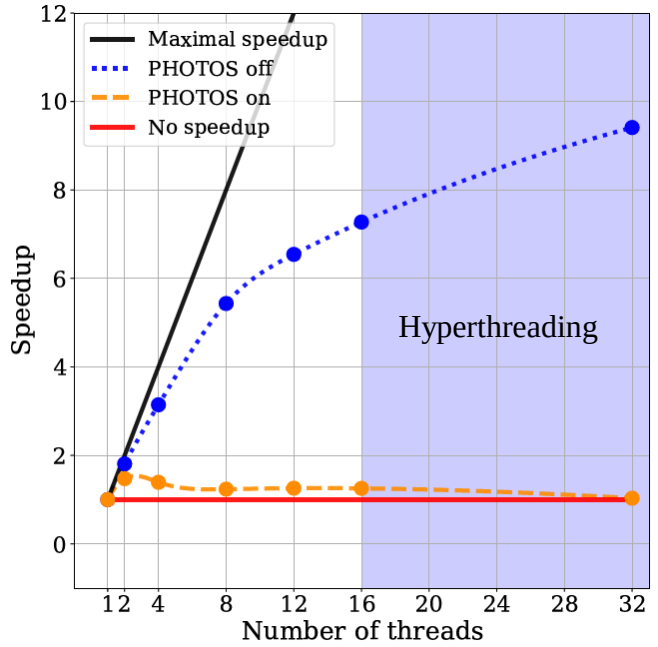
EvtGen generator is essential for simulation of heavy-flavor hadron decays

Developments and validation towards thread safety

- Implementation of common testing framework
- Repairing existing decay models
- Source code modernisation

Exploring alternatives for limiting external dependencies (TAUOLA, PHOTOS)

- Alternative for τ simulation (Pythia HME)
- Alternatives for final-state radiation simulation (Sherpa, Vincia FSR)



$J/\psi \to e^+e^-$