

CFT Hadronic Multi-Body I

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RA2 Cross-Functional Teams

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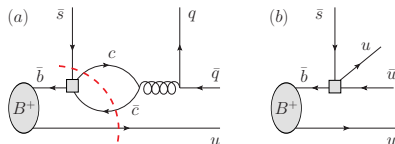


RA2-1: B decays with multi-hadron final states (Hanhart, Kubis, Mannel)

RA2-18: Beyond the Standard Model effects in tree-level B decays (Albrecht, Lenz)

Heuser, Reyes-Torrecilla, Hanhart, BK, Magalhães, Mannel, Peláez, PRL 136 (2026) 111901

- **LHCb**: CP asymmetries in $B^\pm \rightarrow h_1^+ h_2^- h_3^\pm$ ($h_i \in \{\pi, K\}$) \leftrightarrow role of **resonances**
- **Goal**: disentangle strong and weak phases
- First step: $B^\pm \rightarrow K^\pm \pi^+ \pi^-$ at **small $\pi^+ \pi^-$ invariant masses** ($\leq 1 \text{ GeV}^2$)

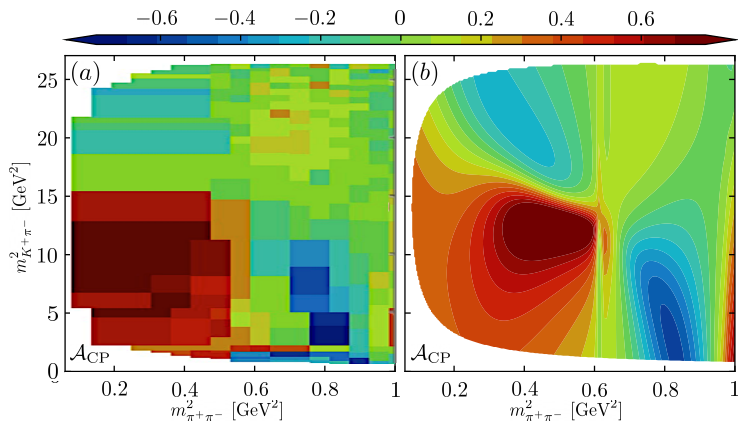


- **Eff. weak Hamiltonian** $H_{\text{eff}} = \frac{G_F}{\sqrt{2}} \left(|V_{cb}^* V_{cs}| (\bar{b}c)(\bar{c}s) + e^{i\gamma} |V_{ub}^* V_{us}| (\bar{b}u)(\bar{u}s) \right)$
- Final-state rescatt.: **Omnès** functions $\Omega_i(s) = \exp \left\{ \frac{s}{\pi} \int_{4M_\pi^2}^{\infty} \frac{ds'}{s'} \frac{\delta_i(s')}{s' - s} \right\}$

$$\mathcal{A}^\pm(s, t) = \sum_i f_i(s, t) P_i(s) \Omega_i(s) (\hat{A}_i + e^{\pm i\gamma} \hat{B}_i)$$

RA2-1: Result: CP asymmetry over Dalitz plot

- fit projections only, reconstruct Dalitz plot:



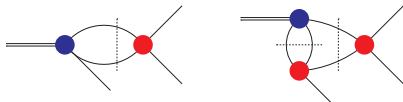
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RA2-1: CP violation in $B \rightarrow K\pi\pi$: work in progress

- **CP asymmetries in Dalitz plots** can be understood in terms of $\pi\pi$ rescattering
- Generalize
 - to other Dalitz plot sides: small $K\pi$ invariant masses
 - to the corners: include soft-pion theorems
 - to other final states $B^\pm \rightarrow \pi^\pm \pi^+ \pi^-$
 - to coupled channels $B \rightarrow \pi^\pm (\pi^+ \pi^- \leftrightarrow \bar{K}K)$
- **Open questions:**
 - Understand matching to **short-distance operators**
 - Beyond the **spectator approximation**: Khuri–Treiman formalism (\leftrightarrow RA1)

Thomas Mannel
work in progress

+ Yaxuan Huang



work in progress by Thanos Kotarelas & Miriam Penners

- Elucidate role of **charm loops**

→ Christoph Hanhart