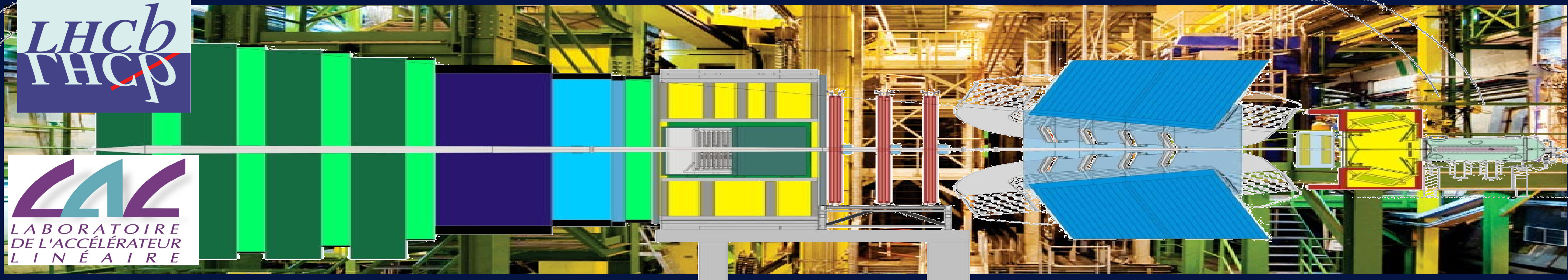

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LABORATOIRE DE L'ACCÉLÉRATEUR LINÉAIRE

Measurement of the γ angle from tree decays at LHCb

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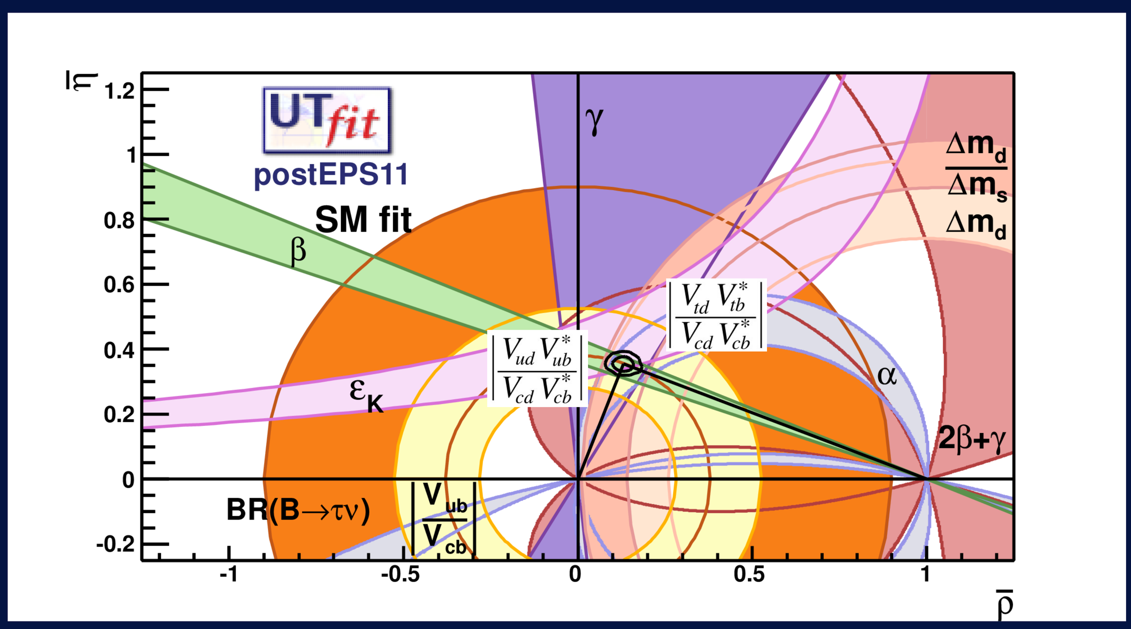
On behalf of the LHCb collaboration



$$\gamma = \arg\left(-\frac{V_{ud}V_{ub}^*}{V_{cd}V_{cb}^*}\right)$$

$$V_{\mathrm{CKM}} = \begin{pmatrix} V_{ud} & V_{us} & V_{ub} \\ V_{cd} & V_{cs} & V_{cb} \\ V_{td} & V_{ts} & V_{tb} \end{pmatrix}$$

CKM unitary matrix

$$V_{ud}V_{ub}^* + V_{cd}V_{cb}^* + V_{td}V_{tb}^* = 0$$

$\gamma_{\text{direct measurements}} = (76 \pm 11)^\circ$

$\gamma_{\text{global fit}} = (69 \pm 3)^\circ$

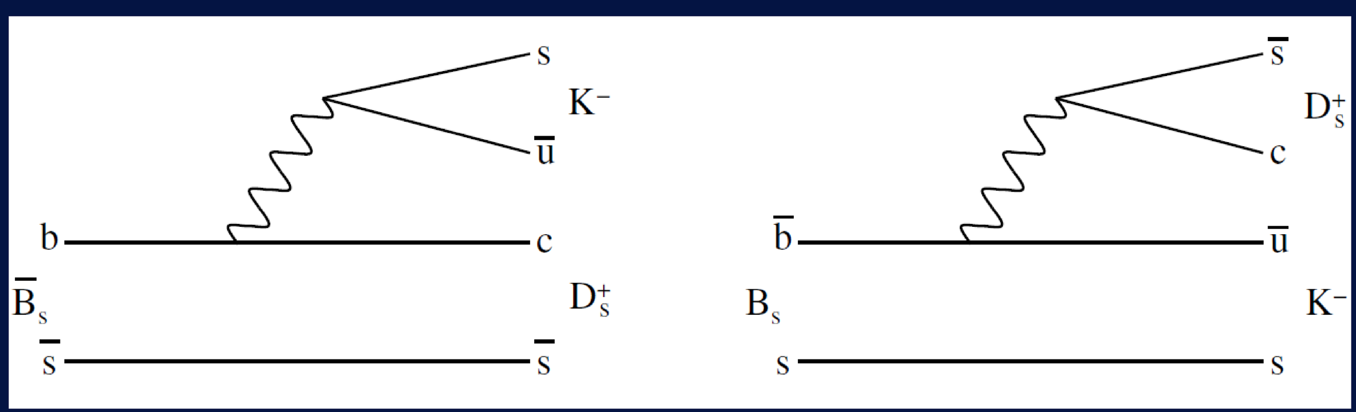
→ improvement on the precision in direct measurements needed

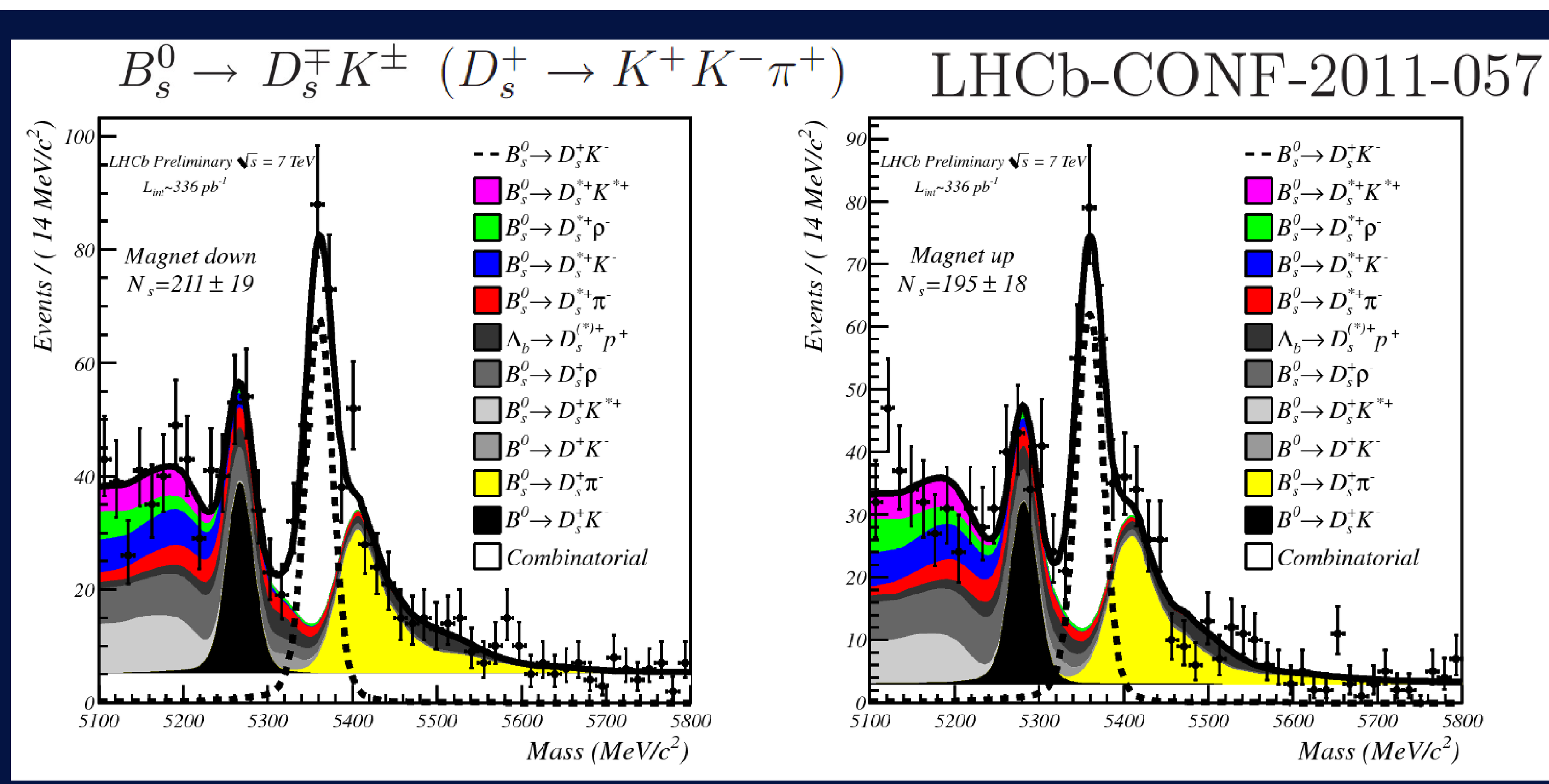
- γ from tree or loop diagrams.
  - Tree diagrams are not sensitive to New Physics contributions (SM candles).
- γ from trees:
  - Time dependent / integrated measurements.
  - Interference between $b \to u$ (V_{ub}) and $b \to c$ (V_{cb}) transitions.
- Combined expected sensitivity at LHCb: ~ 2º for 10 fb^{-1} from $\sqrt{s}$ = 14 TeV collisions.
- With the first LHCb data: observation of several key decay modes and early measurements of parameters.

Time-dependent measurements:

Interference between the direct decay and the decay after mixing (both accessing the same final state).

$B_s^0 \to D_s K$ and $B^0 \to D\pi$



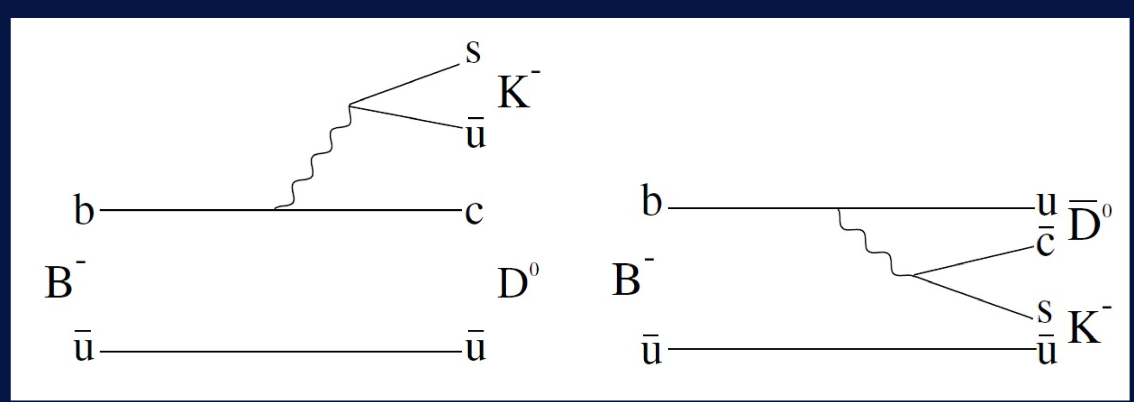


$$\mathcal{B}(B_s^0 \to D_s^{\mp}K^{\pm}) = (1.97 \pm 0.18\,(\mathrm{stat.})\,^{+0.19}_{-0.20}\,(\mathrm{syst.})\,^{+0.11}_{-0.10}\,(f_s/f_d)) \times 10^{-4}$$

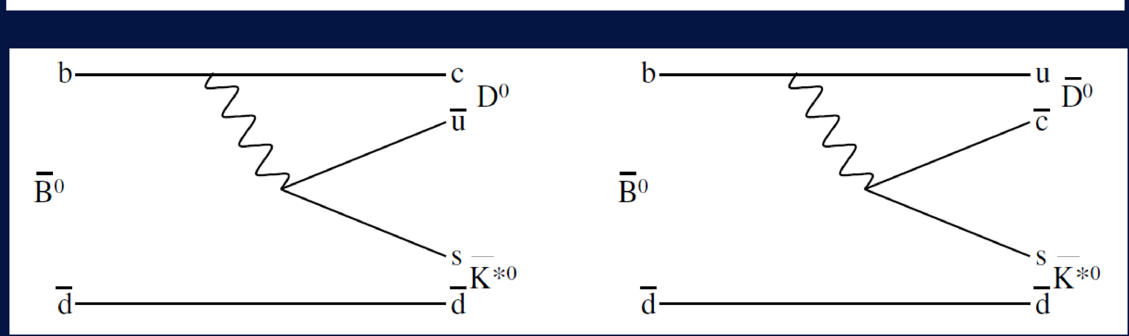
Time-integrated measurements:

Self-tagging modes, interference between decays to the same final products by different intermediate states.

$B^- \to \overset{(-)}{D^0} K^-$ (large *BR* but small interference)



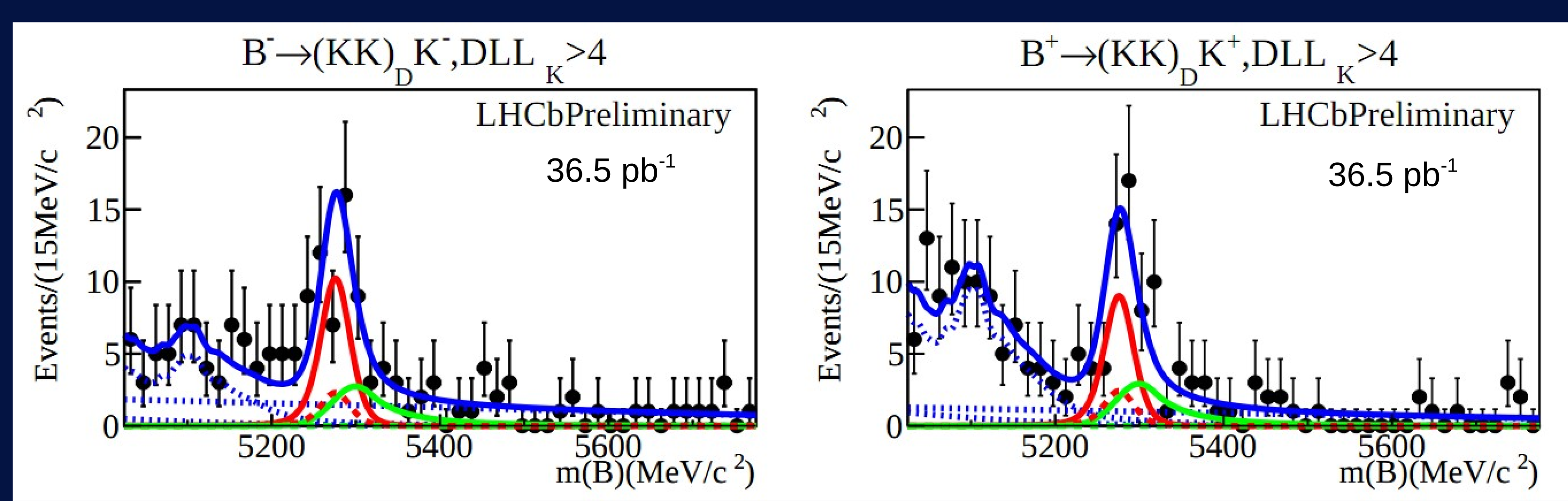
$B^0 \to \overset{(-)}{D^0} K^{*0}$ (small *BR* but large interference)



GLW method: $\overset{(-)}{D^0} \to K^+K^-, \pi^+\pi^-$ (CP eigenstates)

$$A_\pm = \frac{\Gamma(B^-\to D_\pm K^-) - \Gamma(B^+\to D_\pm K^+)}{\Gamma(B^-\to D_\pm K^-) + \Gamma(B^+\to D_\pm K^+)} = \frac{\pm 2r_B \sin\delta_B \sin\gamma}{1 + r_B^2 \pm 2r_B\cos\delta_B\cos\gamma}$$

$$R_\pm = 2\frac{\Gamma(B^-\to D_\pm K^-) + \Gamma(B^+\to D_\pm K^+)}{\Gamma(B^-\to D^0 K^-) + \Gamma(B^+\to D^0 K^+)} = 1 + r_B^2 \pm 2r_B\cos\delta_B\cos\gamma$$



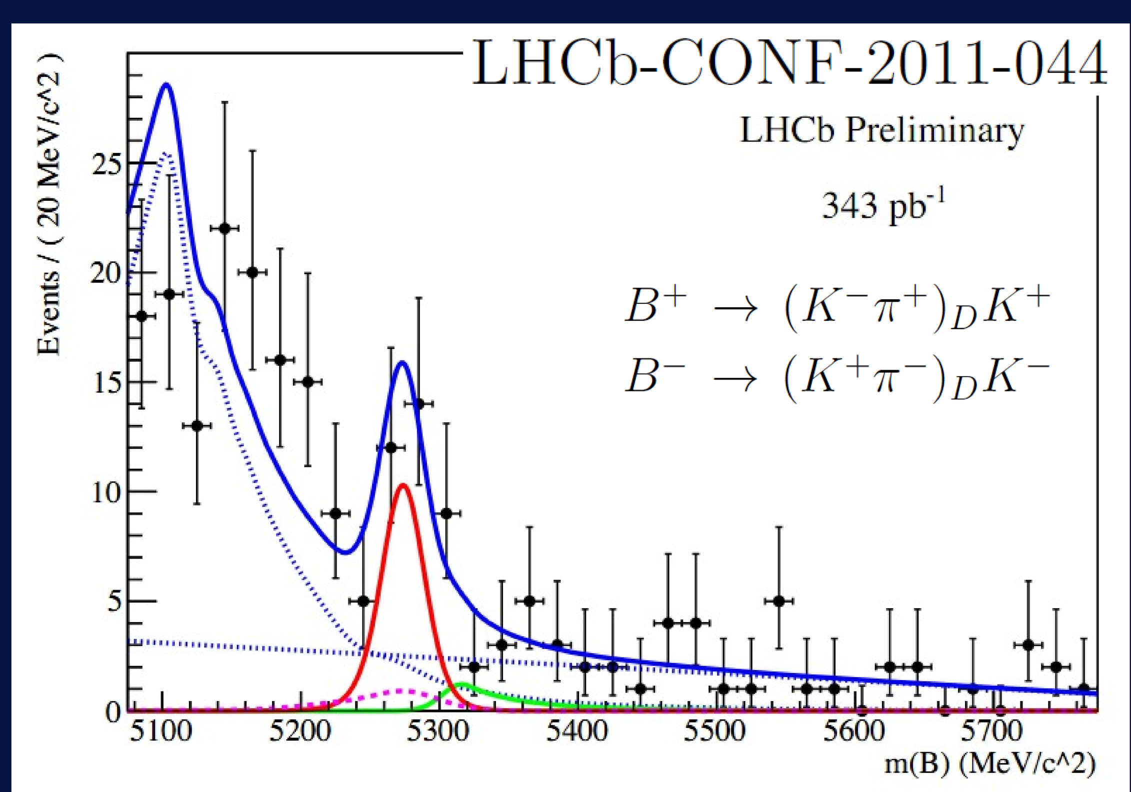
$$R_{CP+} = 1.48 \pm 0.31(stat.) \pm 0.12(syst.)$$
$$A_{CP+} = 0.07 \pm 0.18(stat.) \pm 0.07(syst.)$$

LHCb-CONF-2011-031

ADS method: $\overset{(-)}{D^0} \to K\pi$ (flavour specific final state)

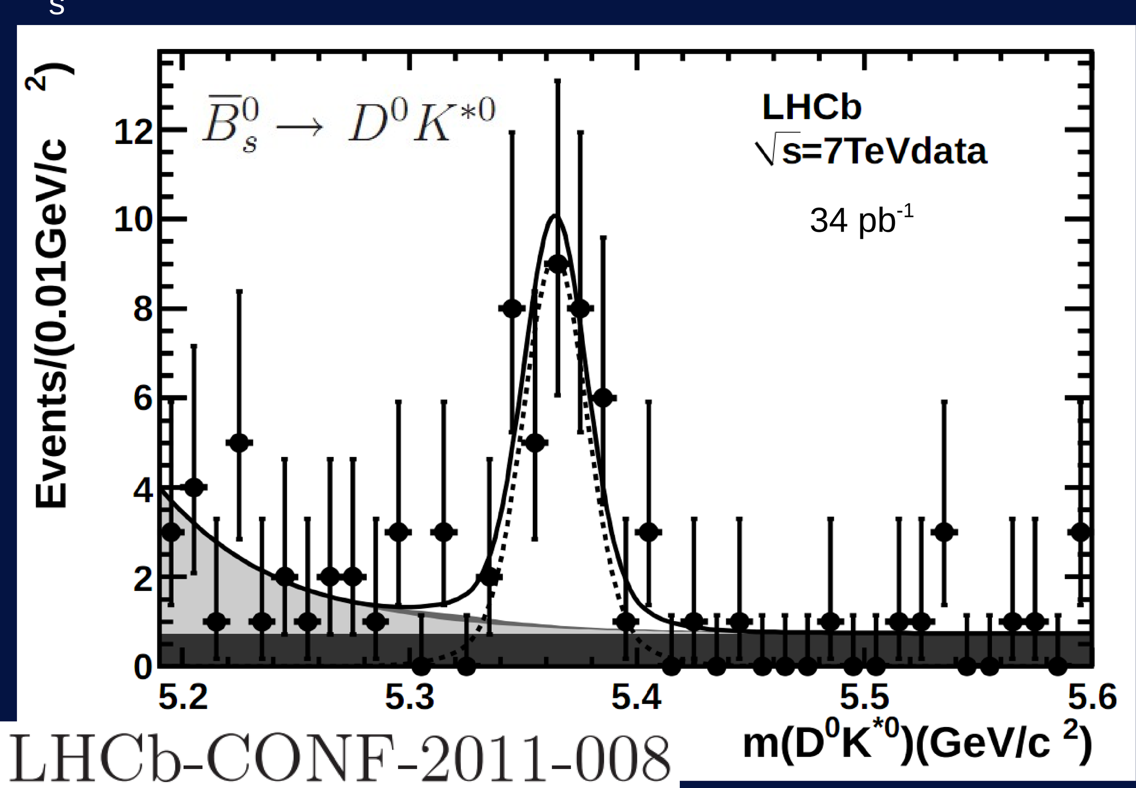
$$A_{\mathrm{ADS}} = \frac{\Gamma(B^-\to D(K^+\pi^-)K^-) - \Gamma(B^+\to D(K^-\pi^+)K^+)}{\Gamma(B^-\to D(K^+\pi^-)K^-) + \Gamma(B^+\to D(K^-\pi^+)K^+)} = \frac{2r_B r_D \sin(\delta_B + \delta_{K\pi})\sin\gamma}{r_B^2 + r_D^2 + 2r_B r_D\cos(\delta_B + \delta_{K\pi})\cos\gamma}$$

$$R_{\mathrm{ADS}} = \frac{\Gamma(B^-\to D(K^+\pi^-)K^-) + \Gamma(B^+\to D(K^-\pi^+)K^+)}{\Gamma(B^-\to D(K^-\pi^+)K^-) + \Gamma(B^+\to D(K^+\pi^-)K^+)} = r_B^2 + r_D^2 + 2r_B r_D\cos(\delta_B + \delta_{K\pi})\cos\gamma$$



$$R_{ADS} = (1.66 \pm 0.39 \pm 0.24) \times 10^{-2}$$
$$A_{ADS} = -0.39 \pm 0.17 \pm 0.02$$

Background study for the $B^0 \to \overset{(-)}{D^0} K^{*0}$ mode: $B_s^0 \to \overline{D^0} K^{*0}$ *BR* measurement.



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$$\frac{\mathcal{B}(\overline{B}_s^0 \to D^0 K^{*0})}{\mathcal{B}(\overline{B}^0 \to D^0 \rho^0)} = 1.61 \pm 0.37 \pm 0.16 \pm 0.20$$

HCP2011: Hadron Collider Physics Symposium, 14-18 November 2011, Paris (France)