Radiative decay $K\pi\gamma$: mass fit

Valentin Rabant

Université Clermont Auvergne

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1. Parametrization and modelling of signal and backgrounds

2. MC parametrization results
   - Signal
   - Peaking backgrounds
   - Partially reconstructed backgrounds

3. Mass fit and amplitude analysis results
   - Mass fit on $K\pi\gamma$ data
   - Amplitude analysis
     - $K\pi$ mass projection
     - $K\pi$ helicity projection

Global idea for the fit

Shapes to obtain :

- Signal + peaking bkgs (global shape)
- Partially reconstructed bkgs
- Combinatorial bkg

Signal + peaking bkgs shape

2 different methods :

- From MC samples with expected yields : ${}_s\mathcal{W}eights$ 1
- Global asymmetric Crystal-Ball with signal tails : ${}_s\mathcal{W}eights$ 2

Path followed :

$$
{}_{s}\mathcal{W}eights
$$

$$
\downarrow
$$

$$
\text{Amplitude analysis in } (m_{K\pi}; \theta_H) \text{ plane}
$$

$$
\downarrow
$$

$$
\text{Fitted yields}
$$

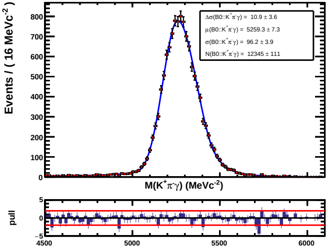
Next step : redo $K\pi\gamma$ mass fit on data with those fitted yields

Results

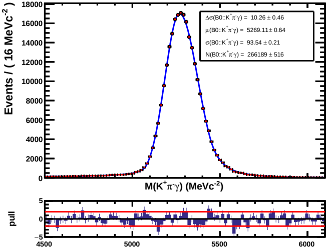
Fit conducted by run

Signal shape : asymmetric Crystal-Ball

- MC samples method : μ^{sig} and $\sigma^{sig}_{L,R}$ free parameters
- global CB method : all free except left tail $(\alpha_L,\ n_L)$

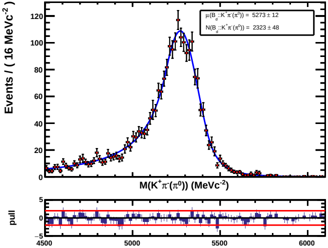


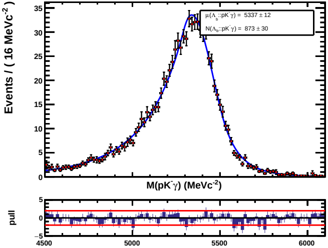
Run 1 signal shape



Run 2 signal shape

Some results from MC :

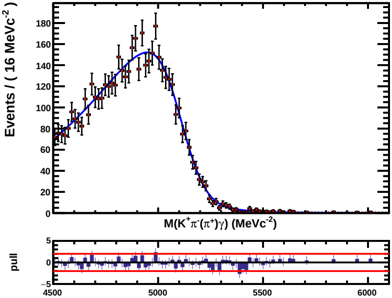




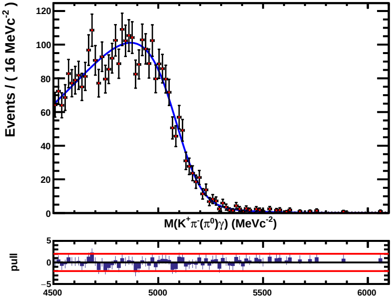
Parametrization of peaking bkgs :

$$\begin{cases} \mu_{CF_i} = \mu^{sig} + (\mu_{CF_i}^{MC} - \mu^{sig,MC}) = \mu^{sig} + \Delta\mu_{CF_i} \\ \sigma_{CF_i} = \sigma_{CF_i}^{MC} \end{cases}$$

MC samples used :



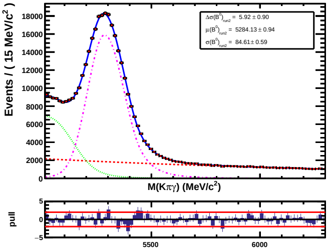
$B^+ \to K^+\pi^-\pi^+\gamma$ sample

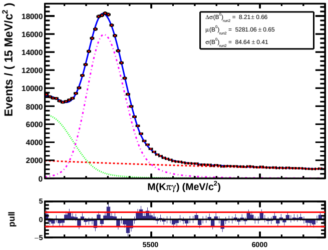


$B^0 \to K^+\pi^-\pi^0\gamma$ sample

Mass fit on the data

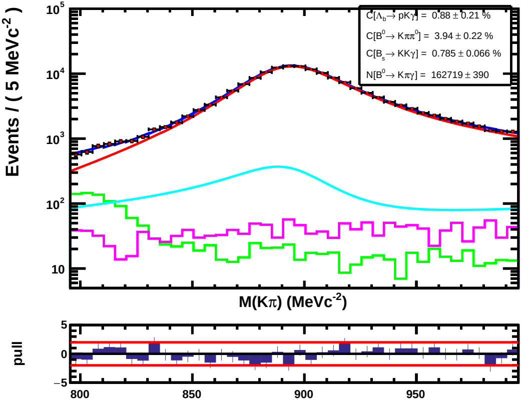
Global CB method (left) and weighted PDFs for peaking bkgs (right) :





$\longrightarrow$ gives ${}_s\mathcal{W}$*eights* used in amplitude analysis

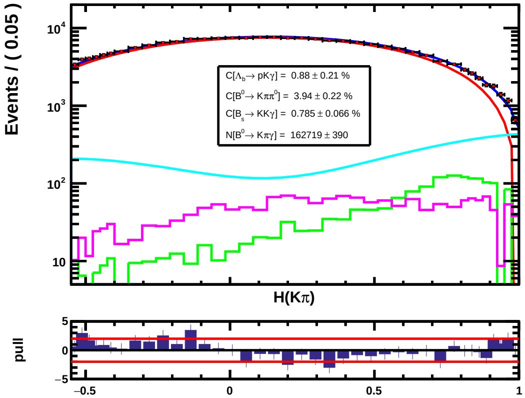
Preliminary results : mass projection



Global (run 1&run 2) mass projection

- $K\pi\pi^0$ only considered in $K^{*0}(892)$ region (cf.contamination)

Helicity projection



Global helicity cosine projection

- $\sin^2 H$ dependency for $KK\gamma, pK\gamma$
- $\cos^2 H$ dependency for $K\pi\pi^0$: well discriminated because vector-pseudoscalar final state

Comparison MC/amplitude analysis

Comparison between MC and amplitude analysis for contaminations :

Contamination (in %)	MC	Amplitude analysis
$\mathcal{C}(\Lambda_b \to pK\gamma)_{,\text{run2}}$	$0,54 \pm 0,13$	$0,75 \pm 0,21$
$\mathcal{C}(B_s^0 \to KK\gamma)_{\text{run2}}$	$0,69 \pm 0,15$	$0,75 \pm 0,07$
$\mathcal{C}(B^0 \to K\pi\pi^0)_{\text{run2}}$	$1,10 \pm 0,19$	$4,03 \pm 0,24$

- As expected : higher contaminations for run 1
- Afterwards : coherent to rely on MC efficiencies

NB : $K\pi\pi^0$ significantly different because only considered spin-1 K^{*0}, while spin-0 K^{*0} (and non-resonant) are dominant (but not considered here)

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Conclusion

In the following :

- still to obtain amplitude analysis for the MC method
- begin the work on $\pi\pi\gamma$ (study of the backgrounds...)