Further studies on the IPCHI2 fit

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Ω_c^0 *lifetime measurement meeting*

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MC samples used in this study

- 2016 MC samples

EventType	Decay mode	$\tau(b)$	$\tau(c)$
12165031	$B^+ \to \bar{D}^0(\to K^+K^-\pi^+\pi^-)\pi^+$	1.638 ps	0.410 ps
16265034	$\Omega_b^- \to \Omega_c^0(\to pK^-K^-\pi^+)\pi^-$	$1.1^{+0.5}_{-0.4}$ ps	0.069 ps

- Stripping
  - `B2D0PiD2HHHHBeauty2CharmLine`
  - `Omegab2Omegac0PiOmegac02PKKPiBeauty2CharmLine`

Fit procedure

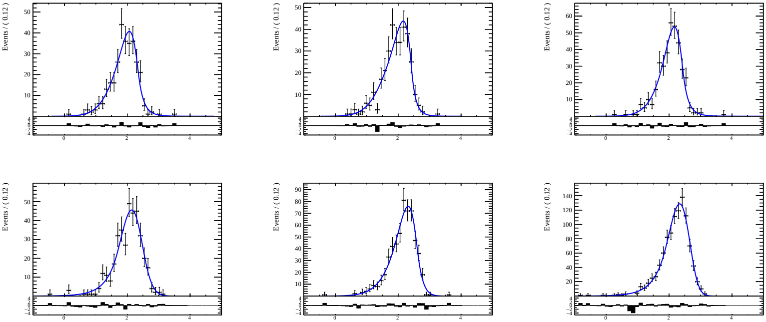
- Calculate decay time w.r.t. PV

$$t = \frac{\vec{p} \cdot \vec{r}}{p^2} \times m$$

- Decay-time bins are partially overlapped with the signal mode
  - [0.57, 0.63, 0.69, 0.75, 0.81, 0.9, 1.05, 2.0, 3.0, 5.0, 10.0] ps
- Fit to log(IPCHI2) with the Bukin function with all parameters free

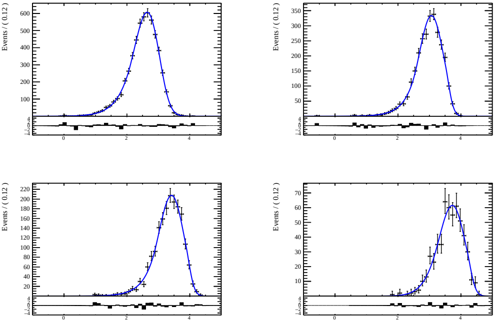
Fit results of D^0

- Bin 0 to 5



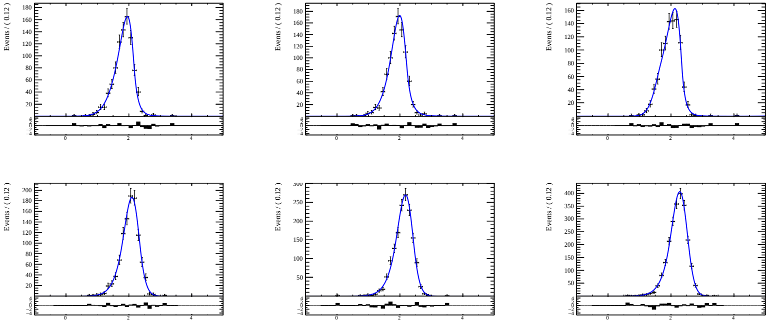
Fit results of D^0

- Bin 6 to 10



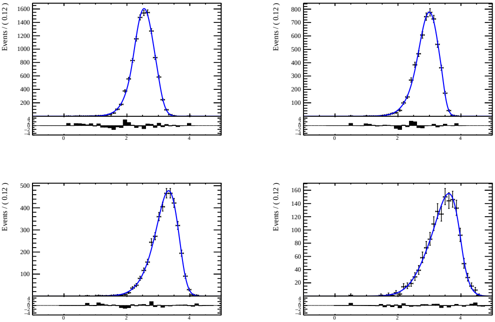
Fit results of Ω_c^0

- Bin 0 to 5



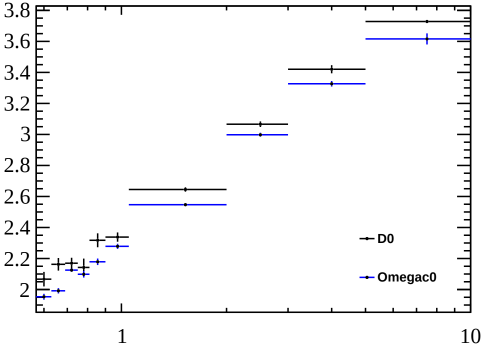
Fit results of Ω_c^0

- Bin 6 to 10



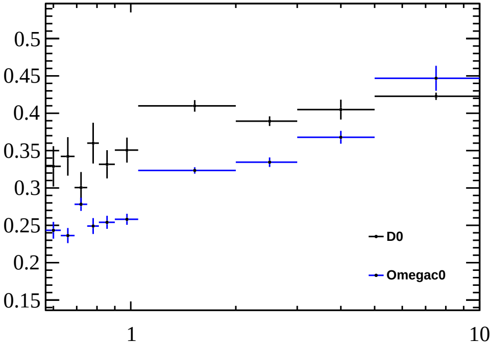
Fit results in decay-time bins

- μ
- Increase with decay-time bins
- $\mu(D^0)$ larger than $\mu(\Omega_c^0)$ may be due to the larger lifetime of B^+



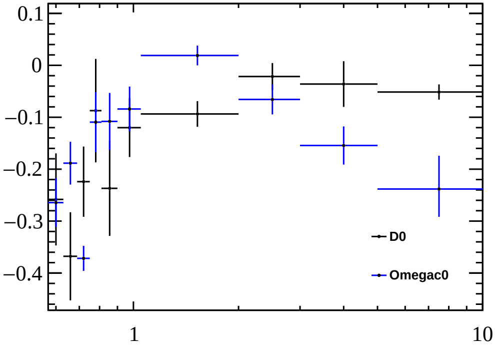
Fit results in decay-time bins

- σ
- Increase with decay-time bins slightly



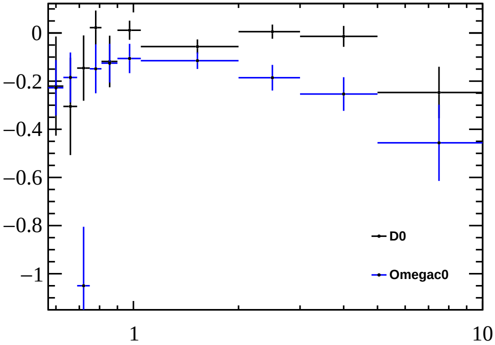
Fit results in decay-time bins

- ξ
- The asymmetry tends to decrease for large decay-time bins



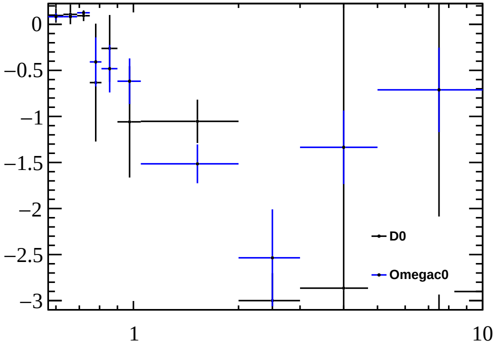
Fit results in decay-time bins

- ρ_1
- Non-linear feature for ρ



Fit results in decay-time bins

- ρ_2
- Non-linear feature for ρ



Backup

$\log \chi^2_{IP}$ modelling

- Bukin function, a modified Novosibirsk function with extended tail parameters

$$\mathcal{P}(x;\mu,\sigma,\xi,\rho_1,\rho_2)=\begin{cases}\exp\left\{\frac{(x-x_1)\xi\sqrt{\xi^2+1}\sqrt{2\ln 2}}{\sigma\left(\sqrt{\xi^2+1}-\xi\right)^2\ln\left(\sqrt{\xi^2+1}+\xi\right)}+\rho_1\left(\frac{x-x_1}{\mu-x_1}\right)^2-\ln 2\right\} & x\leq x_1,\\ \exp\left\{-\left[\frac{\ln\left(1+2\xi\sqrt{\xi^2+1}\frac{x-\mu}{\sigma\sqrt{2\ln 2}}\right)}{\ln\left(1+2\xi^2-2\xi\sqrt{\xi^2+1}\right)}\right]^2\times\ln 2\right\} & x_1<x<x_2,\\ \exp\left\{\frac{(x-x_2)\xi\sqrt{\xi^2+1}\sqrt{2\ln 2}}{\sigma\left(\sqrt{\xi^2+1}-\xi\right)^2\ln\left(\sqrt{\xi^2+1}+\xi\right)}+\rho_2\left(\frac{x-x_2}{\mu-x_2}\right)^2-\ln 2\right\} & x\geq x_2.\end{cases}$$

where

$$x_1=\mu+\sigma\sqrt{2\ln 2}\left(\frac{\xi}{\sqrt{\xi^2+1}}-1\right)$$

$$x_2=\mu+\sigma\sqrt{2\ln 2}\left(\frac{\xi}{\sqrt{\xi^2+1}}+1\right)$$

Illustration of Bukin functions

- Influence of asymetry and tail parameters with $\mu = 0, \sigma = 1, \rho_1 = 0$