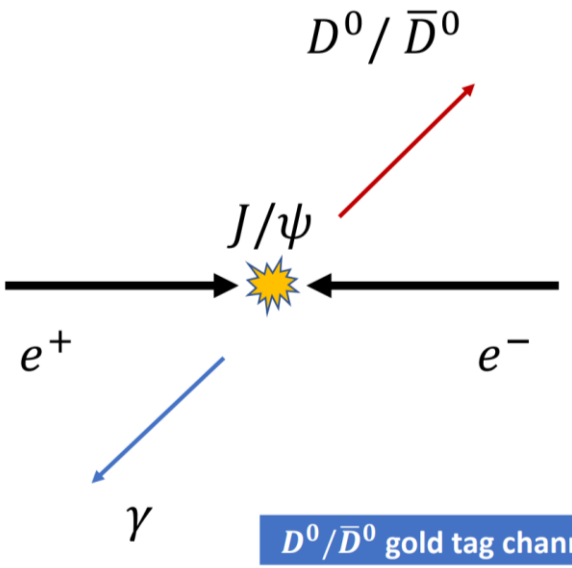
Question

- Angular distribution with different generators, which is important to evaluate the systematic uncertainties from signal model

Signal MC	PHSP	$J/\psi \to \gamma D^0/\bar{D}^0$	$D^0 \to K^-\pi^+$+c.c.	2×10^5
			$D^0 \to K^-\pi^+\pi^0$+c.c.	2×10^5
			$D^0 \to K^-\pi^+\pi^+\pi^-$ +c.c.	2×10^5



$D^0/\bar{D}^0$ gold tag channel
$D^0 \to K^-\pi^+$+c.c.
$D^0 \to K^-\pi^+\pi^0$+c.c.
$D^0 \to K^-\pi^+\pi^+\pi^-$+c.c.

electromagnetic transitions $J/\psi \to Pl^+l^-$

$$|T|^2 = 16\pi^2\alpha^2 \frac{|f_{\psi P}(q^2)|^2}{q^4}\left[8(p\cdot q)^2 m_l^2 - 8p^2q^2m_l^2 - 2p^2q^4 - 8(k_1\cdot p)(k_2\cdot p)q^2 + 4(p\cdot q)^2q^2\right], \quad (3)$$

where m_l is the lepton mass; $q = k_1 + k_2$, and p, k_1 and k_2 are 4-momenta of particles P, l^+ and l^-, respectively.

The angular distribution of the differential decay width can be obtained as

$$\frac{d\Gamma(\psi \to Pl^+l^-)}{dq^2} = \frac{1}{3}\frac{\alpha^2}{256\pi^3 m_\psi^3}\frac{|f_{\psi P}(q^2)|^2}{q^2}\left(1 - \frac{4m_l^2}{q^2}\right)^{1/2}\left[(m_\psi^2 - m_P^2 + q^2)^2 - 4m_\psi^2 q^2\right]^{3/2} \times$$
$$\int d\Omega_3 d\Omega_1^* \left[\left(1 + \frac{4m_l^2}{q^2}\right) + \left(1 - \frac{4m_l^2}{q^2}\right)\cos^2\theta_1^*\right], \quad (4)$$

For the corresponding radiative decay of $\psi \to P\gamma$, the decay width can be obtained as :

$$\Gamma(\psi \to P\gamma) = \frac{1}{3}\frac{\alpha(m_\psi^2 - m_P^2)^3}{8m_\psi^3}|f_{\psi P}(0)|^2. \quad (6)$$

FCNC transition $c \to u\gamma$

C. The amplitude

Using the above Lagrangians and form factor decomposition of Eqs. (2), (7), (9), the final amplitude for $B_c \to B_u^* \gamma$ containing SD and LD contributions can be expressed as

$$A[B_c(p) \to B_u^*(p', \epsilon')\gamma(q, \epsilon)] = i\epsilon_\mu^{*\prime}\epsilon_\nu^*[A_{PV}(p^\mu p^\nu - g^{\mu\nu} p \cdot q) + iA_{PC}\epsilon^{\mu\nu\alpha\beta} p'_\alpha p_\beta], \quad (10)$$

$$\Gamma = \frac{1}{4\pi}\left(\frac{m_{B_c}^2 - m_{B_u^*}^2}{2m_{B_c}}\right)^3 (|A_{PV}|^2 + |A_{PC}|^2).$$