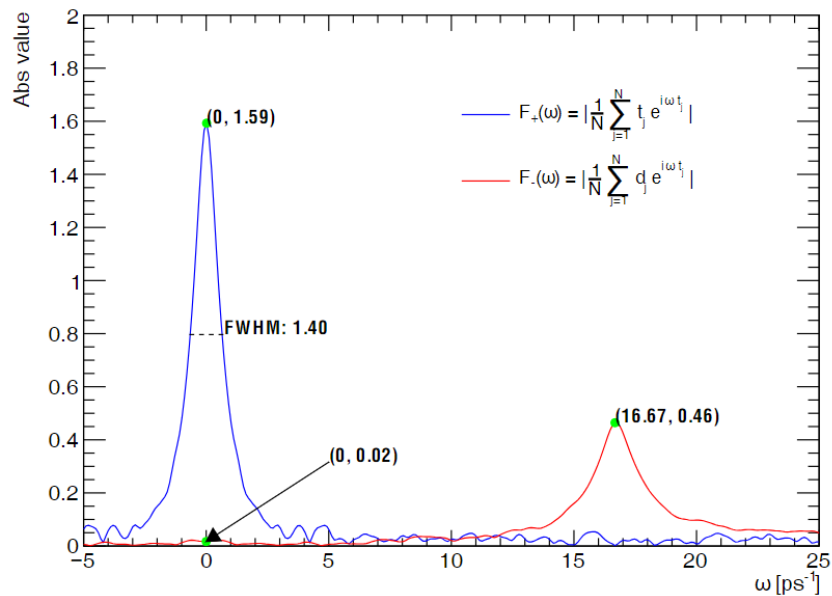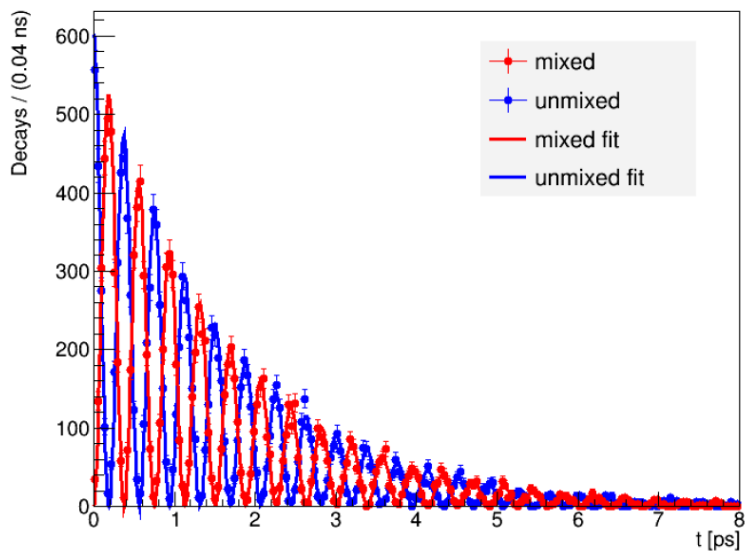# B_s^0 mixing in Whizard

Bs decay time distribution in Whizard3
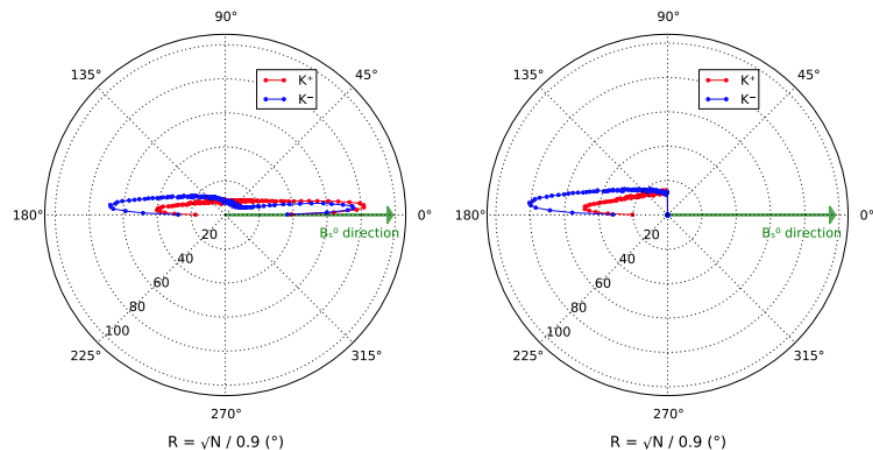
B_s^0 leading SSK tagging

- The angular distribution of the leading SSK is visually analyzed in a polar coordinate system, with the radius defined as the square root of events in each bin to ensure that the area is proportional to the total events.

- To improve tagging efficiency, focus is shifted to the same side region, excluding the opposite side where positive and negative charge kaons have similar leading chances.
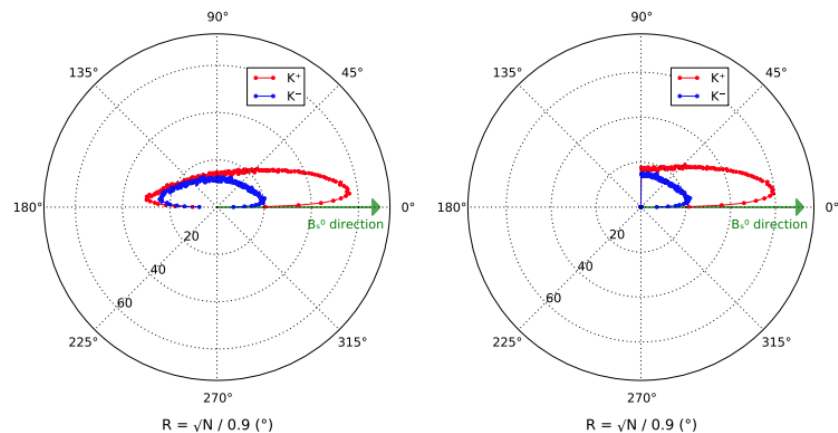
Figure 11. Angular distribution of the leading SSK in the region $(0°, 180°)$ on the left, and angular distribution of the leading SSK in the region $(0°, 90°)$ on the right.

B_s^0 leading OSK tagging

- Similarly, to improve OSK tagging efficiency, the focus is shifted to the opposite side region, excluding the same side where positive and negative charge kaons have similar leading chances.

Figure 12. Angular distribution of the leading OSK in the region $(0°, 180°)$ on the left, and angular distribution of the leading OSK in the region $(90°, 180°)$ on the right.

Results of tagging from leading SSK and OSK

Table 6. Results of tagging from leading SSK and OSK.

Methods	ϵ_{tag}	ω	ϵ_{eff}
Leading SSK (%)	57.45	19.96	20.73
Leading OSK (%)	72.41	31.36	10.06
Combined (%)	72.12	21.39	23.60

Idea

$$cos(a) = \frac{\mathbf{p}_K \cdot \mathbf{p}_B}{|\mathbf{p}_K| \cdot |\mathbf{p}_B|}$$

$$r = \frac{E_K}{E_B}$$

$$P(K_i) = \frac{f_{dep}(a_{K_i}, r_{K_i})}{f_{ind}(a_{K_i}, r_{K_i})}$$

For Bs0 and SSK:

$$P(K_i) = \frac{f_+(a_{K_i}, r_{K_i})}{f_-(a_{K_i}, r_{K_i})}$$
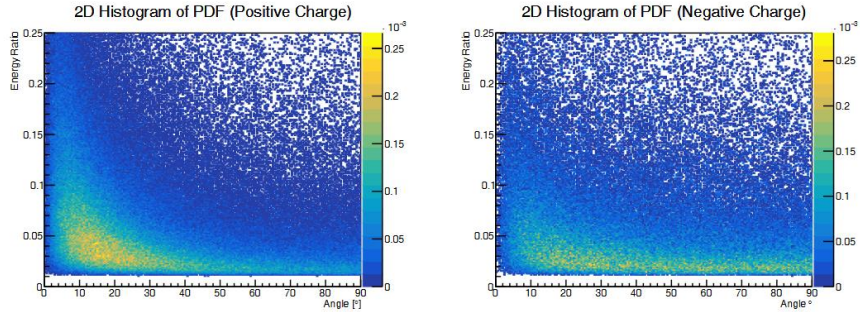
2D PDF SSK

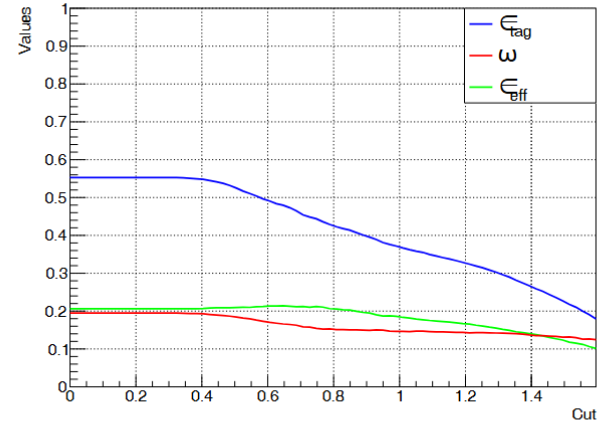**Figure 13**. 2D PDF histograms of different charges for B_s^0 and SSK

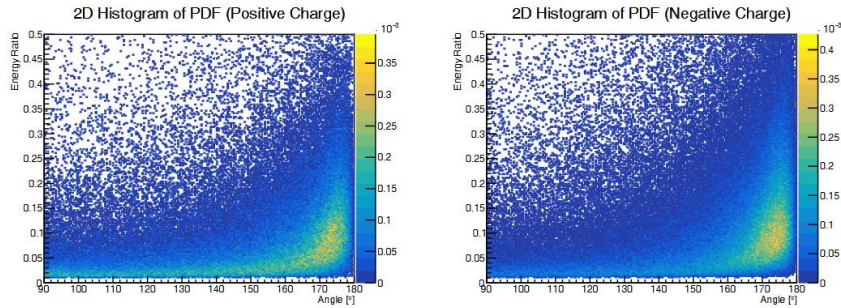**Figure 14**. The efficiencies of tagging SSK vary along the cut of P.

2D PDF OSK

Figure 15. 2D PDF histograms of different charges for B_s^0 and OSK

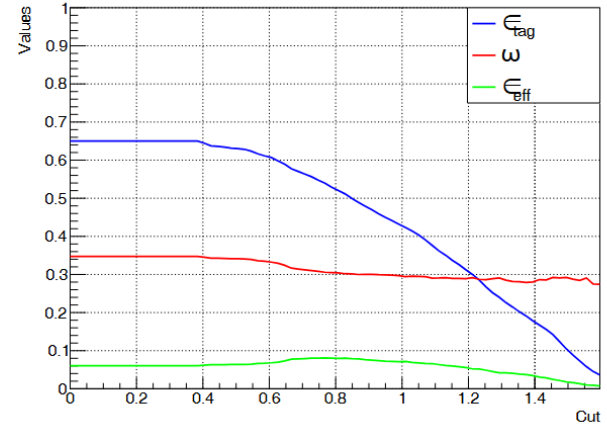**Figure 16**. The efficiencies of tagging OSK vary along the cut of P.

Results of tagging from 2D PDF

Table 6. Results of tagging from leading SSK and OSK.

Methods	ϵ_{tag}	ω	ϵ_{eff}
Leading SSK (%)	57.45	19.96	20.73
Leading OSK (%)	72.41	31.36	10.06
Combined (%)	72.12	21.39	23.60

Table 7. Best results of tagging with 2D PDF from SSK and OSK.

Methods	ϵ_{tag}	ω	ϵ_{eff}
2D PDF SSK (%)	44.38	15.45	21.19
2D PDF OSK (%)	53.95	30.58	8.14
Combined (%)	65.63	20.52	22.82

Plots of B2DK mixing and decay