

Interferences in $B \rightarrow \rho\rho$

R. Manfredi, Y. Nakazawa, R. Okubo, J. Skorupa

Belle II Physics Week
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Interferences in $B \rightarrow \rho\rho$

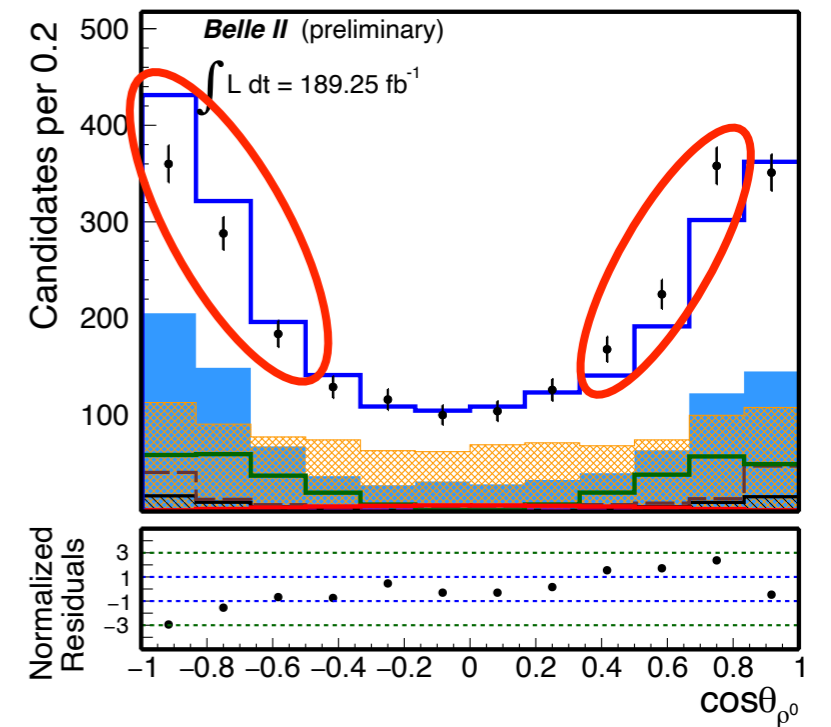
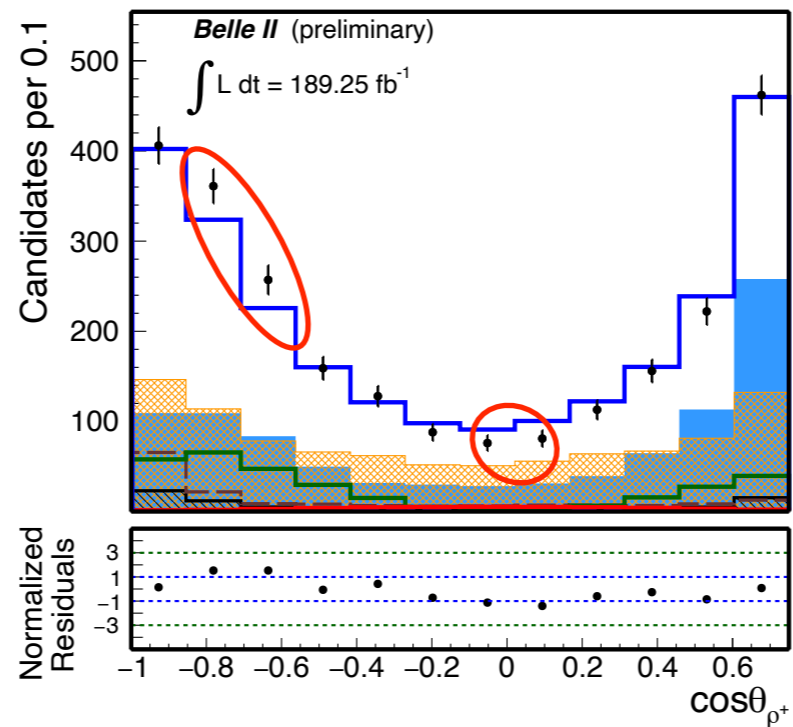
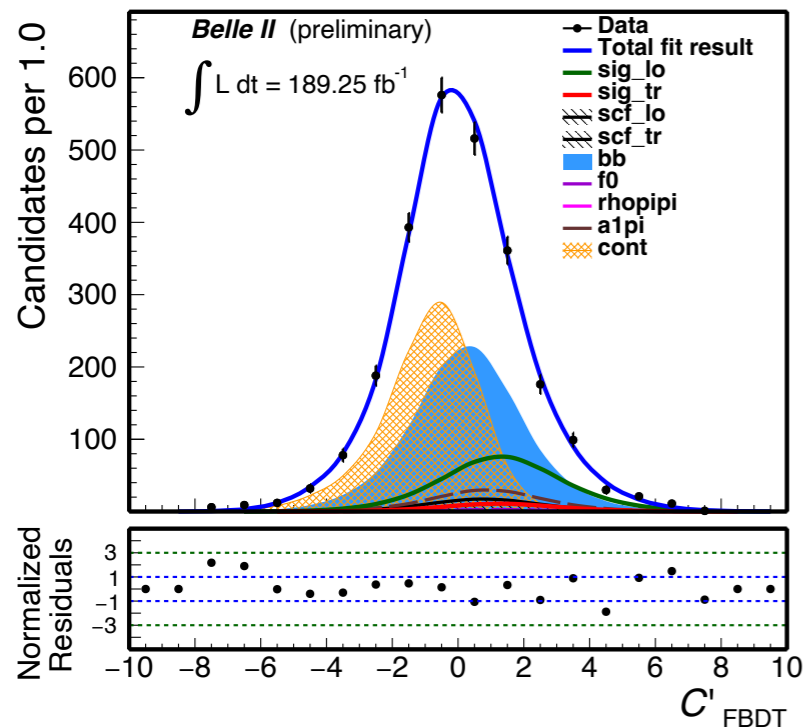
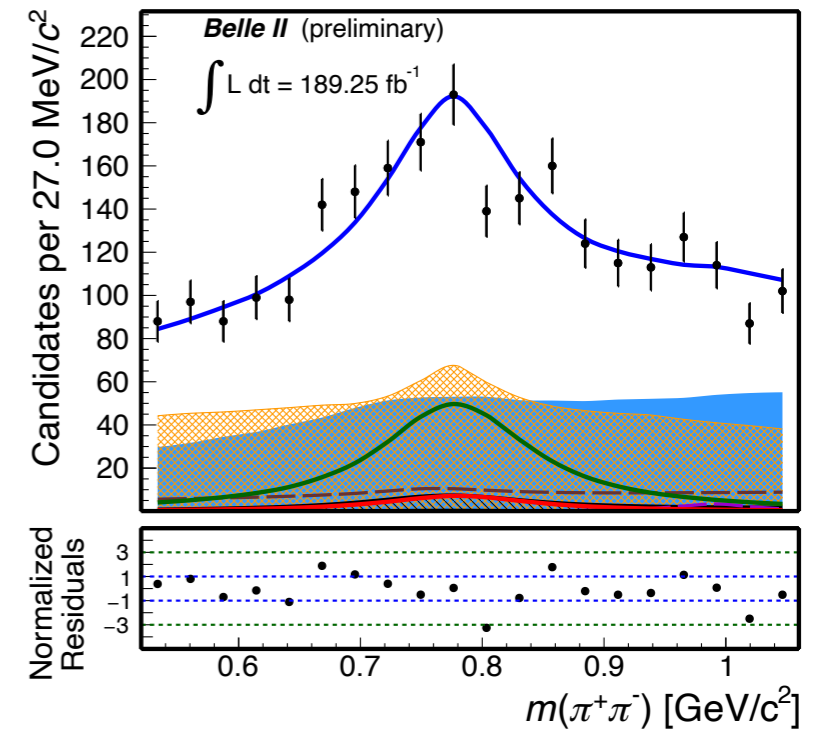
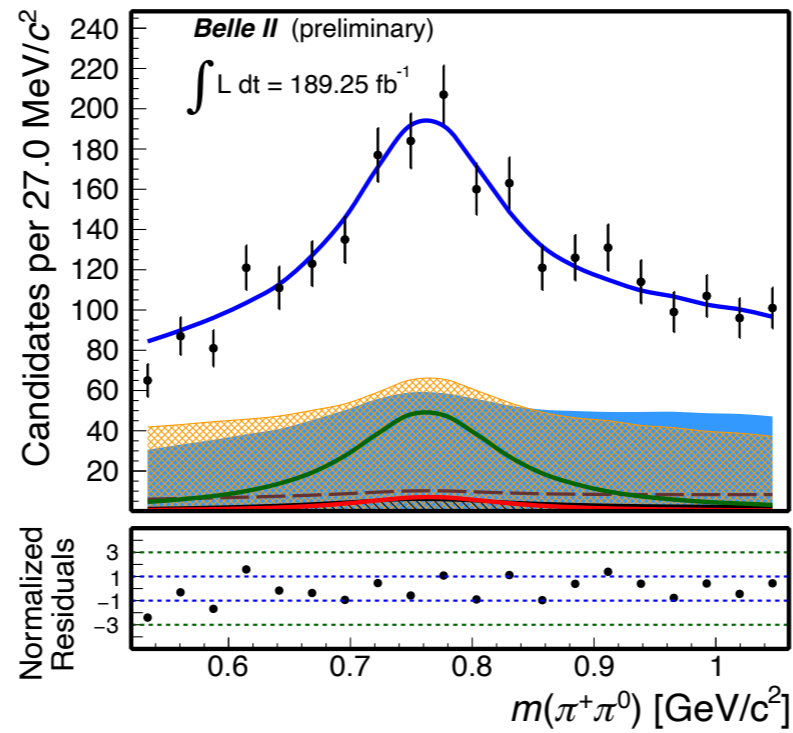
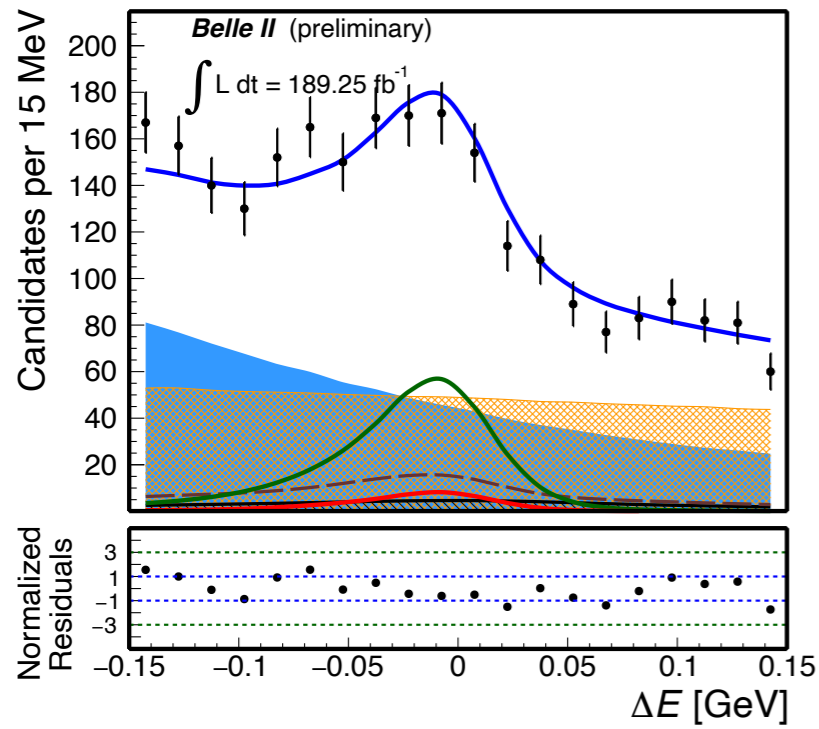
R. Manfredi, J. Skorupa, S. Wallner

Belle II Physics Week
November 3, 2023



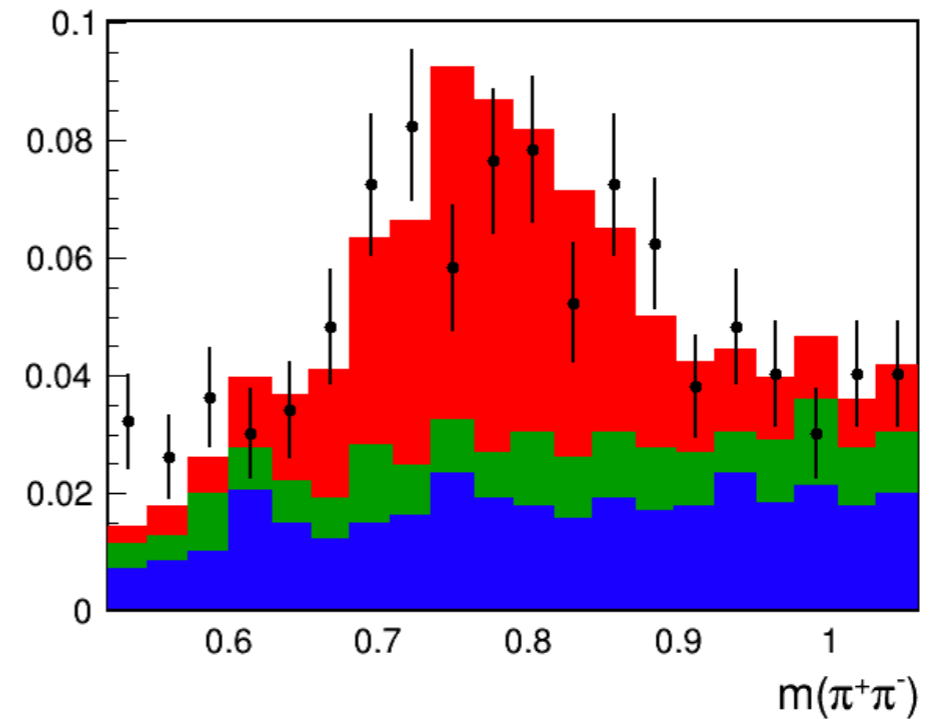
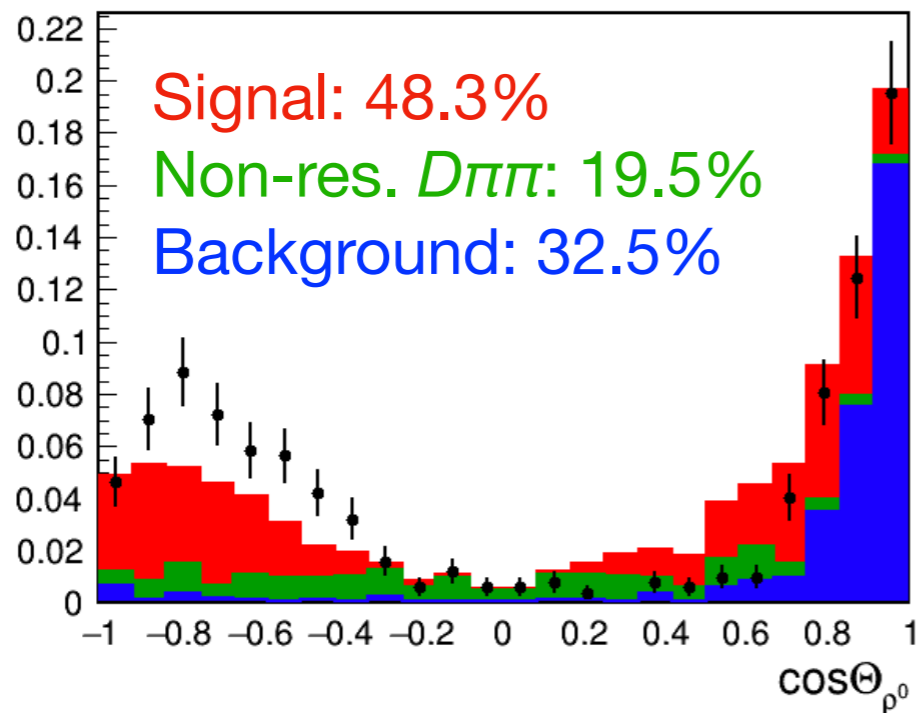
The issue

Background mismodeling corrected with off-res and sideband data.



Check in ρ^0

Reconstruct $B^0 \rightarrow D^0(\rightarrow K^-\pi^+)\rho^0(\rightarrow \pi^+\pi^-)$ and restrict in ΔE -Mbc.
 Sample composition spoiled by irreducible backgrounds.



LHCb Dalitz analysis
 measures interferences
 neglected in Belle II MC.
 Difficult to get any
 correction factor from
 here for the $\rho^+\rho^0$ case.

	A_0	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9
A_0	16.51	0.00	0.00	0.00	0.00	-0.06	2.37	-1.45	-0.10	0.01
A_1	-	36.15	-0.84	4.20	2.10	0.00	-5.39	-1.88	-2.81	-0.90
A_2	-	-	0.50	-0.01	0.00	0.00	0.00	0.01	-0.01	0.00
A_3	-	-	-	2.16	-0.43	0.00	-0.15	-1.14	0.73	-0.04
A_4	-	-	-	-	0.83	0.00	-1.49	-0.99	-1.12	-0.24
A_5	-	-	-	-	-	9.88	-2.03	-0.73	-1.50	-0.35
A_6	-	-	-	-	-	-	9.22	0.00	-0.01	0.00
A_7	-	-	-	-	-	-	-	9.27	0.01	0.00
A_8	-	-	-	-	-	-	-	-	28.13	0.00
A_9	-	-	-	-	-	-	-	-	-	1.58

Interference could be the cause of helicity angle mismodelings.

What can we do?

Amplitude analysis: should be a solution, but technical difficulties would imply rethinking of all the timelines.



Look at LCHb $B_s \rightarrow \phi\phi$: calculate correction factors to apply to each of the amplitudes. Still uncertain on how to do that and the impact. [[arXiv:1907.10003](https://arxiv.org/abs/1907.10003)]



Any good ideas from this physics week...



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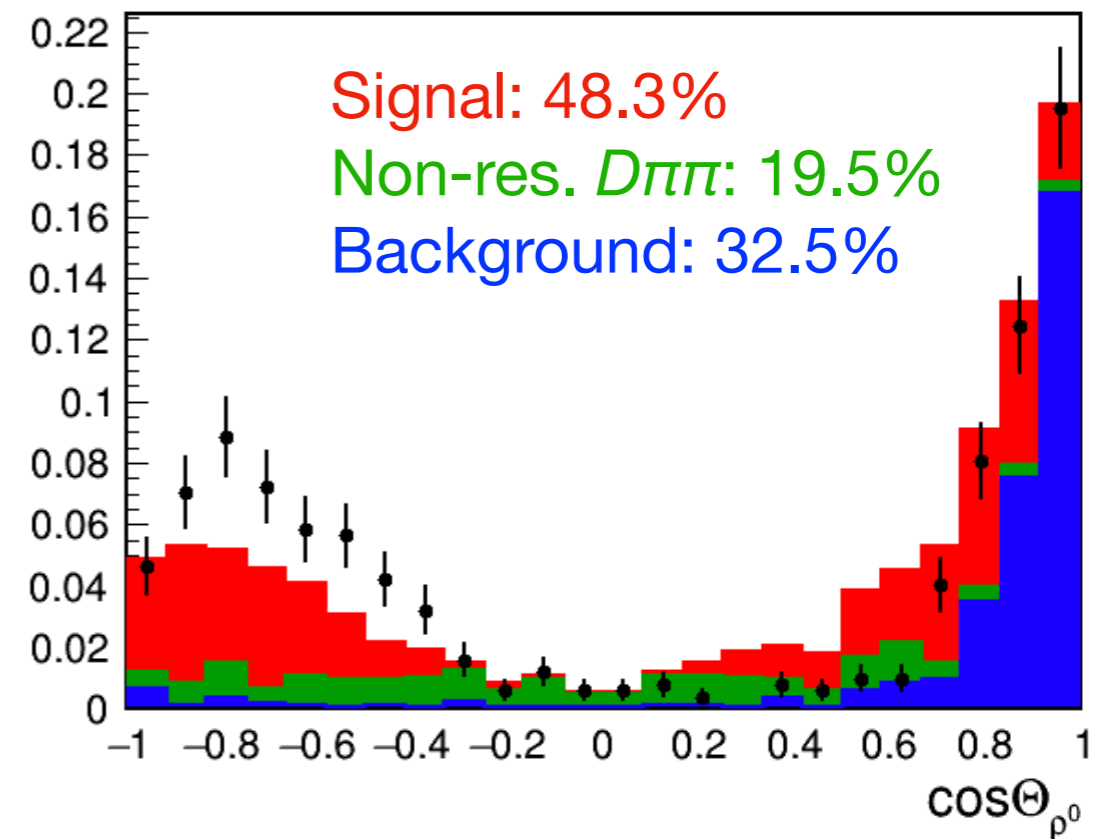
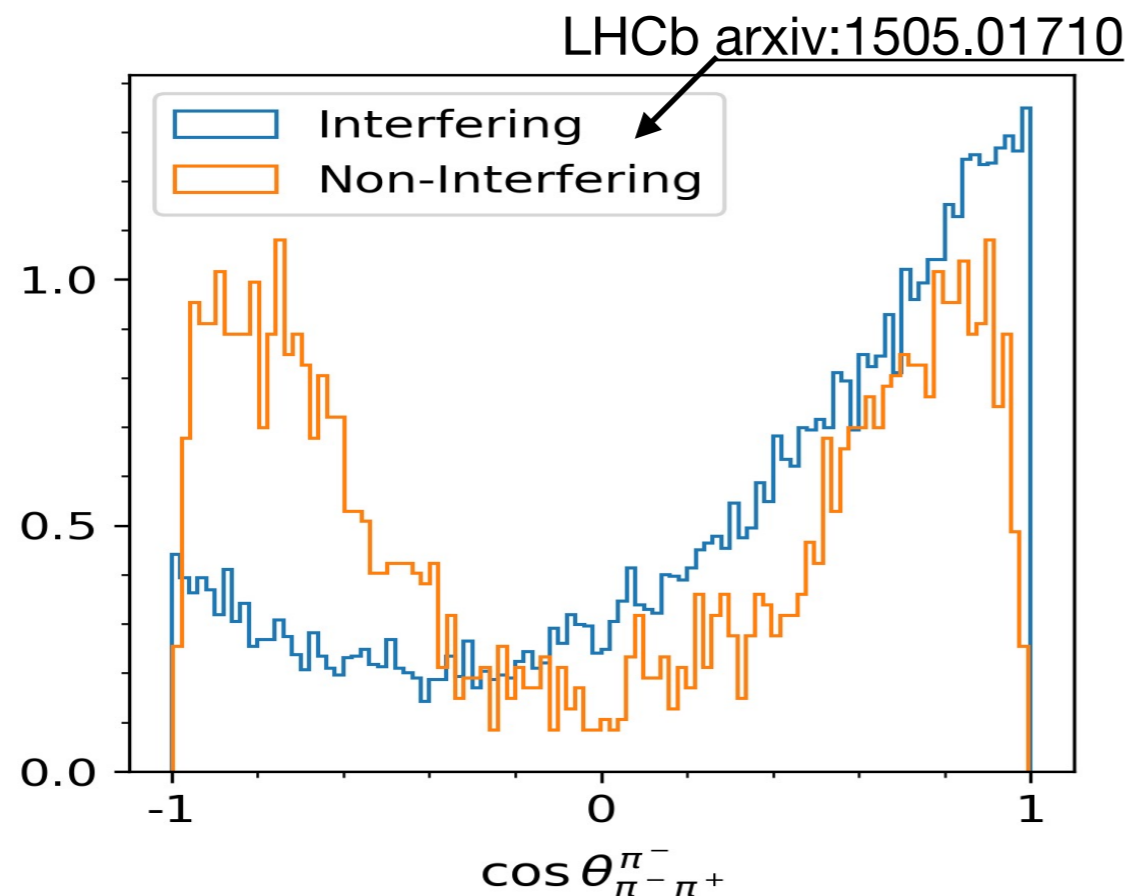


Any good ideas from this physics week... 

SW: reweight sum of two amplitudes to mimic interference, then model accordingly

Simulate interference

Simulate interference effects by weighting events according to a coherent sum of a $\rho(770)$ and S-wave $\pi\pi$ amplitude.



**Simulated interference resembles the observed data-MC differences.
Looks promising to correct MC shapes for helicity angles.**

Future plans

Use $B^0 \rightarrow D^0 \rho^0$ decays

- ◆ Simplified sample composition (signal + non-res $D^0 \pi \pi$ + $B\bar{B}$ bkg) ✓
- ◆ Add a custom-made interfering component (reweighing?) ✓
- ◆ Fit (which observables?) ?
- ◆ Check if fit is able to get the interfering shape w/ LHCb trick ?