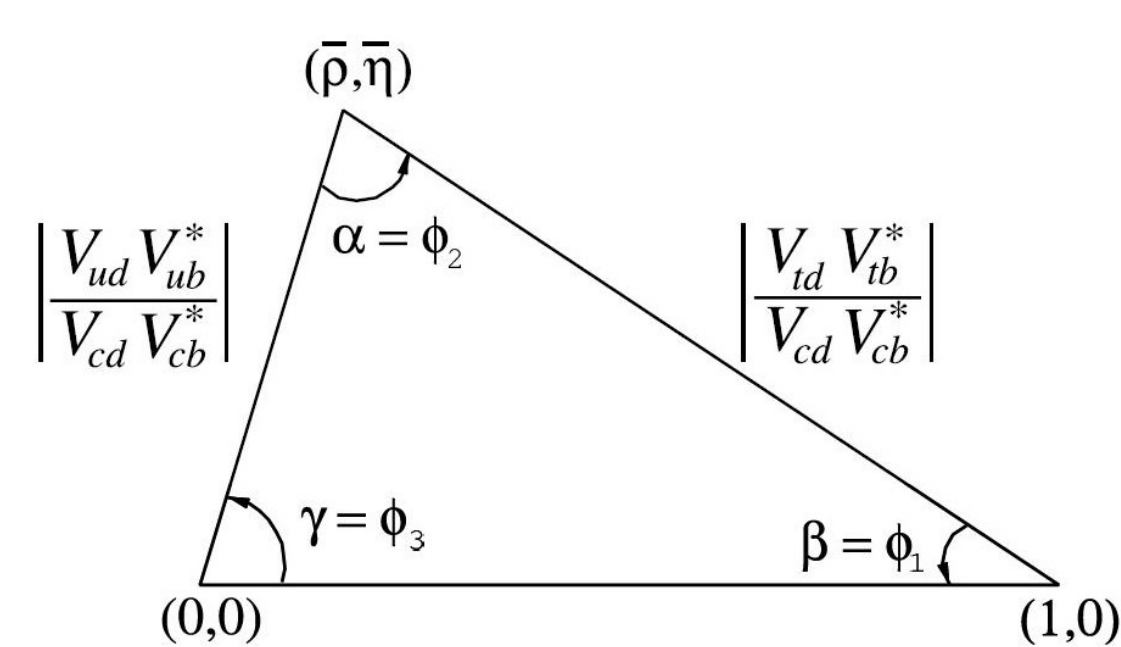


Physics Motivation

- Precise determination of the CKM angle ϕ_3 is needed to check the validation of SM and also to probe new physics.
- Substructure of $D^- \rightarrow K_S \pi^+ \pi^-$ is very much important to measure ϕ_3 .
- Not much information on the substructure of the decay $K_S \pi^0 \pi^0$.
- Help us to investigate π - π S-wave observed in $D^- \rightarrow K_S \pi^+ \pi^-$.
- Previous analysis were in 281 pb^{-1} and 818 pb^{-1} .
- No Result from Belle now.
- Normalization mode $D^- \rightarrow K_S \pi^0$.

$$\text{B.R.} = \frac{B(D^0 \rightarrow K_S \pi^0 \pi^0)}{B(D^0 \rightarrow K_S \pi^0)} = \frac{N(D^0 \rightarrow K_S \pi^0 \pi^0)}{N(D^0 \rightarrow K_S \pi^0)} \times \frac{\epsilon(D^0 \rightarrow K_S \pi^0 \pi^0)}{\epsilon(D^0 \rightarrow K_S \pi^0)}$$



CKM Triangle

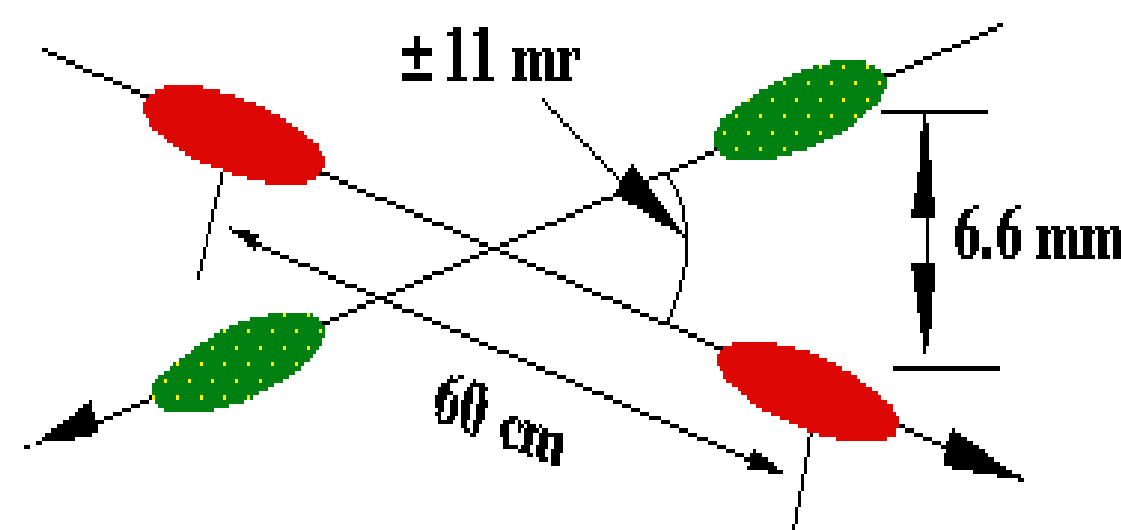
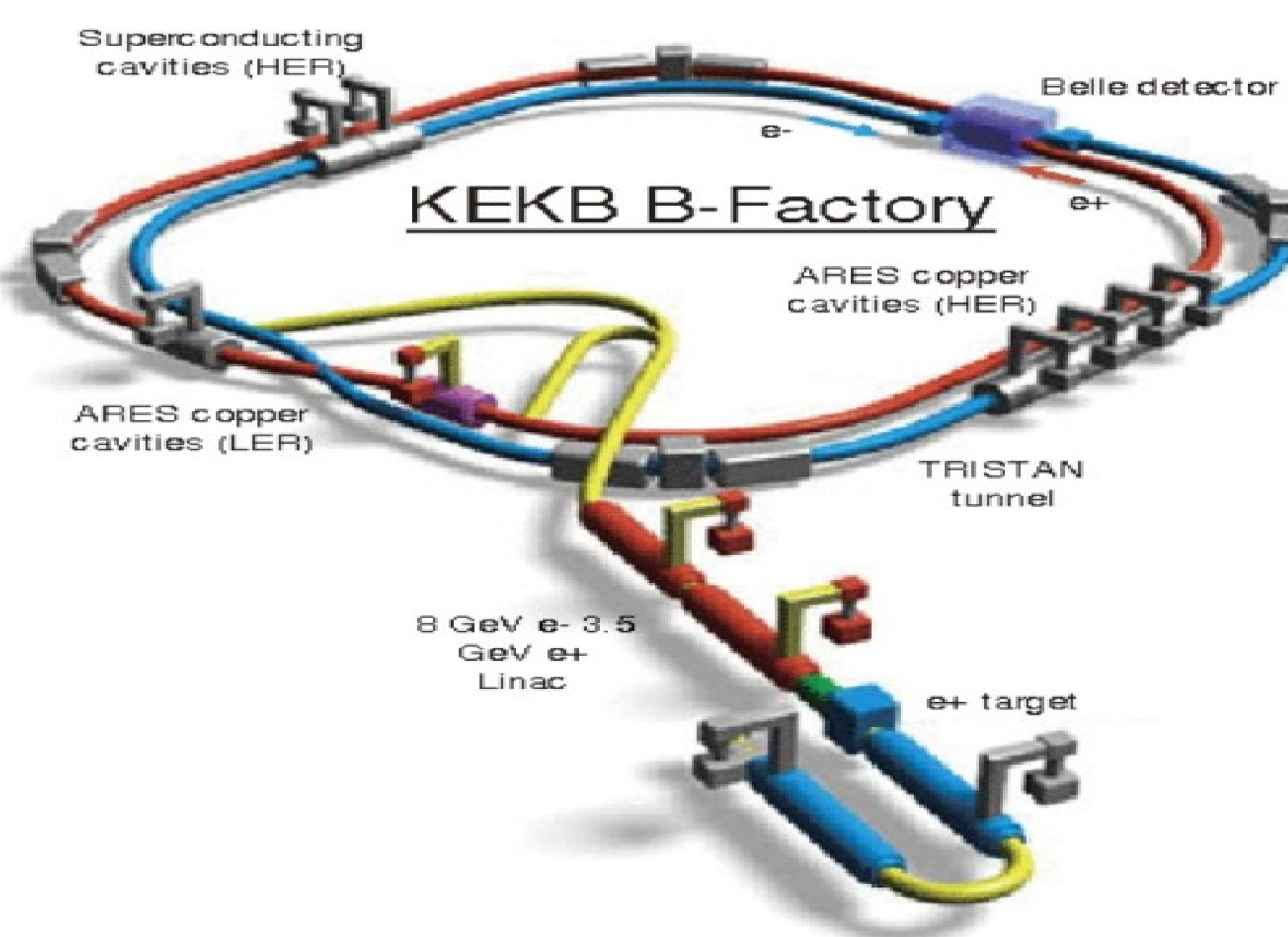
Previous result:

Experiment	$B(D^0 \rightarrow K_S \pi^0 \pi^0) * 10^{-3}$	Reference
CLEO	$10.58 \pm 0.38 \pm 0.73$	PRD 84, 092005
CLEO	$8.34 \pm 0.45 \pm 0.42$	PRD 78, 012001
World Average	9.1 ± 1.1 (Error includes scale factor 2.2)	Chin. Phys. C, 40, 100001 (2016) and 2017 update(PDG)

KEKB

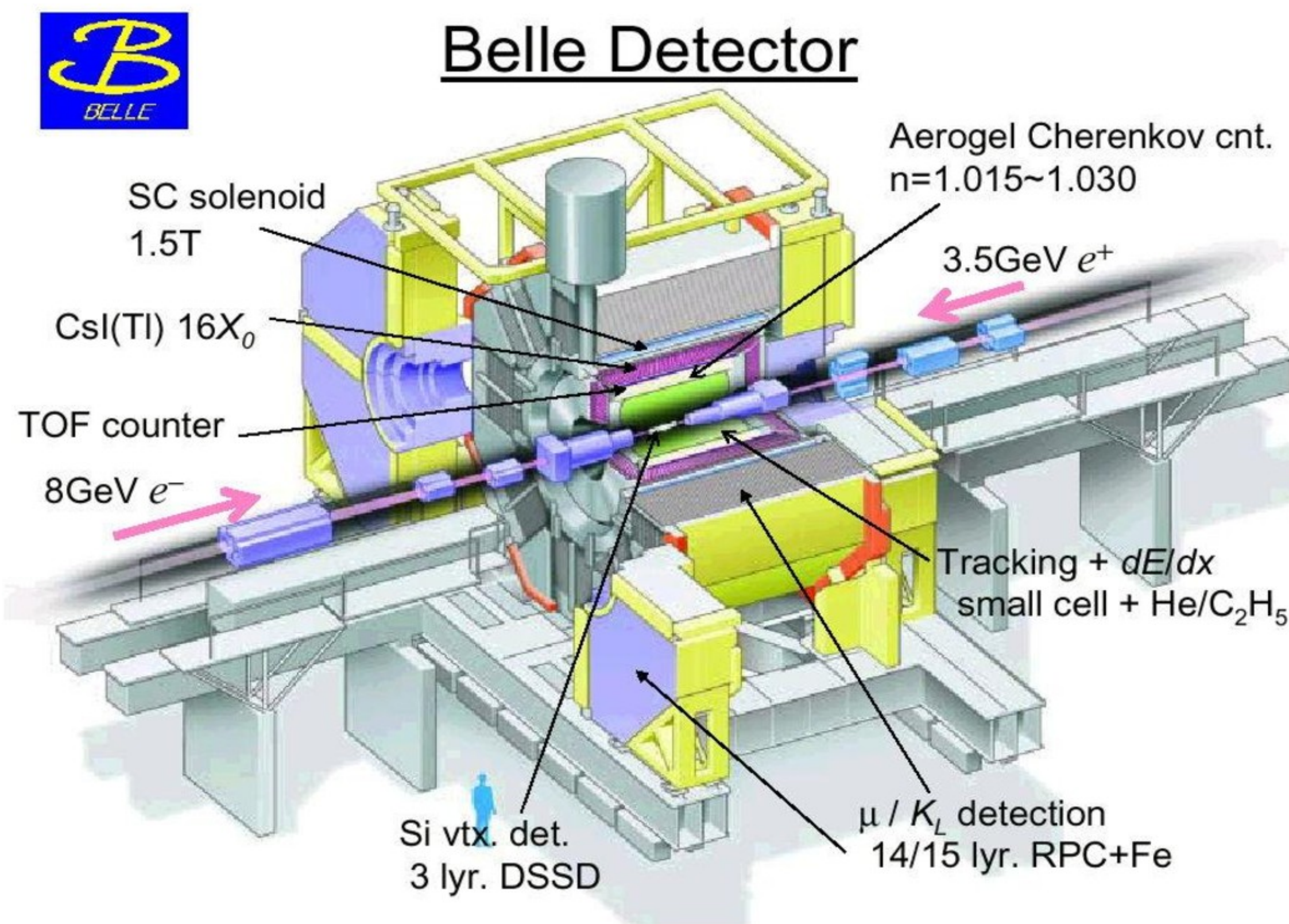
$$e^+ (3.5 \text{ GeV}) + e^- (8 \text{ GeV}) \rightarrow BB \text{ at } \sqrt{S} = 10.58 \text{ GeV } (\Upsilon(4S))$$

$$\text{Designed luminosity} = 2.11 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$$

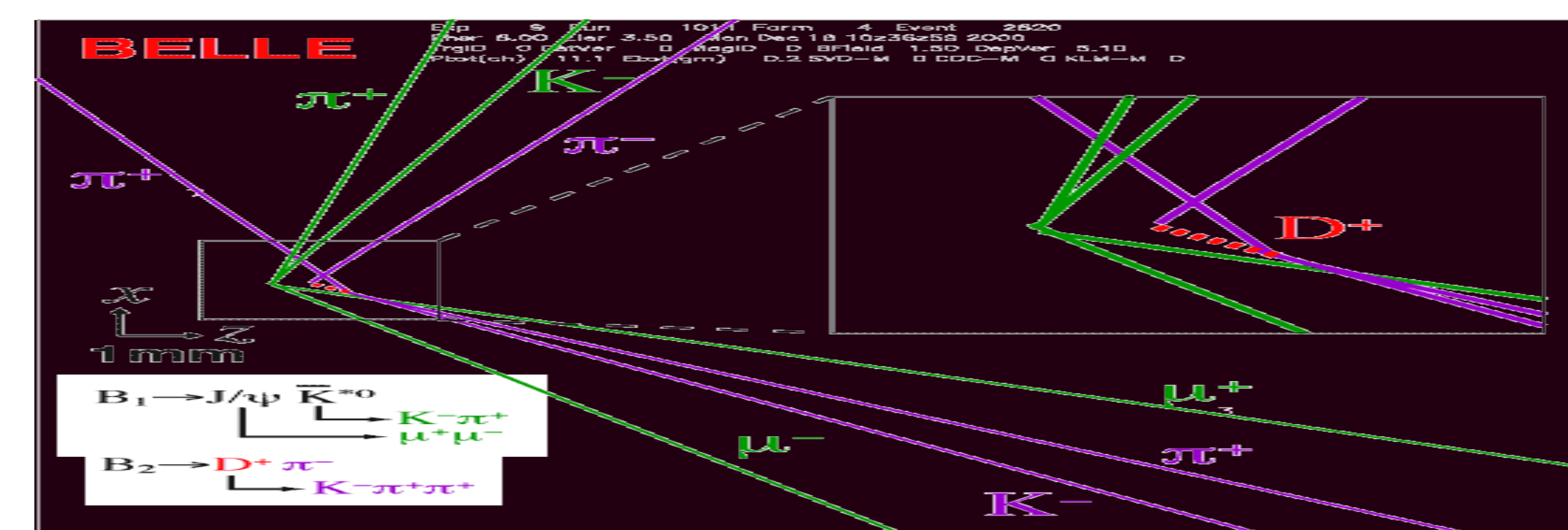


Beam crossing angle $\pm 11 \text{ mrad}$

Belle Detector

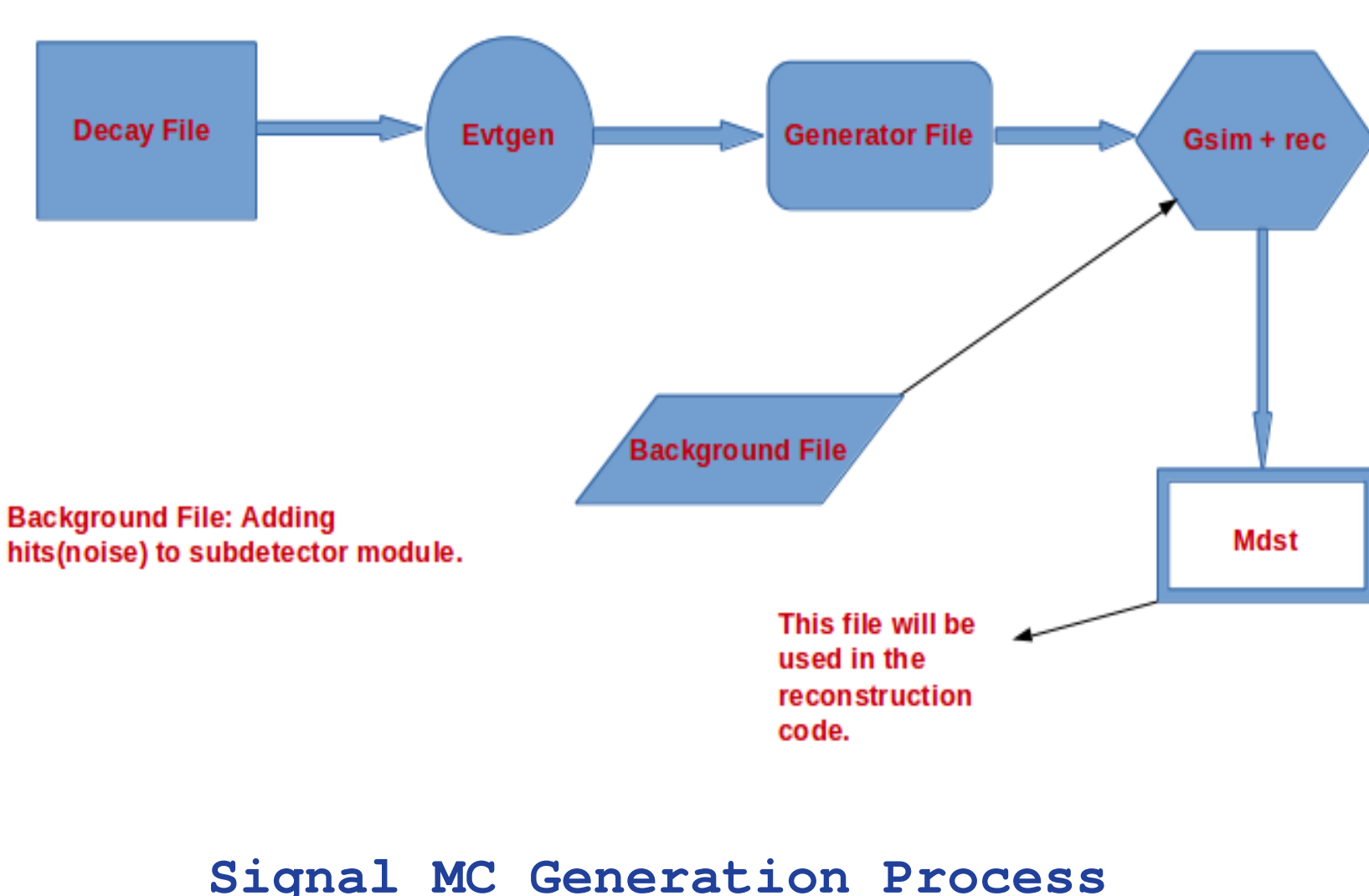
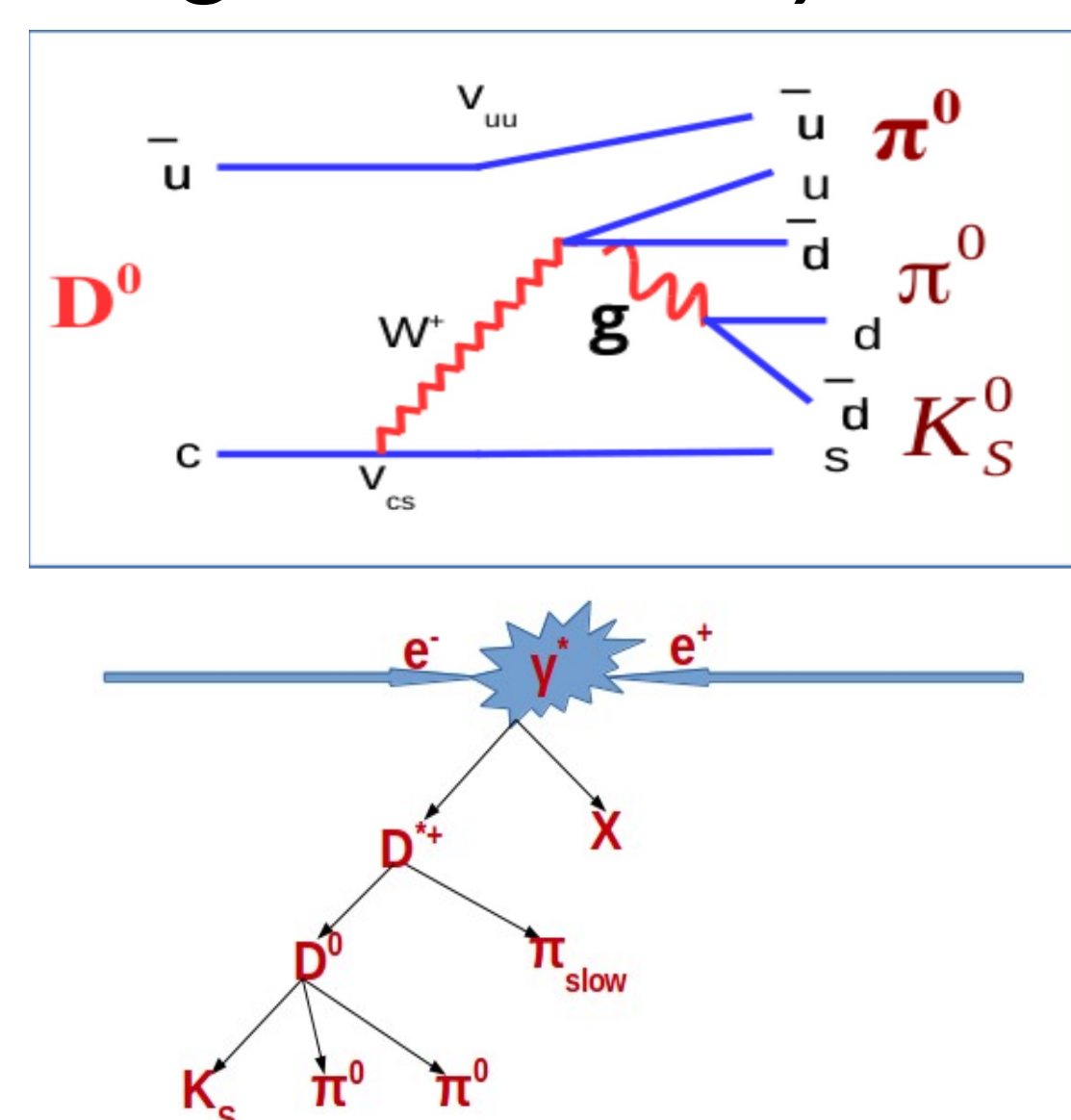


B - J/psi K*0 event display



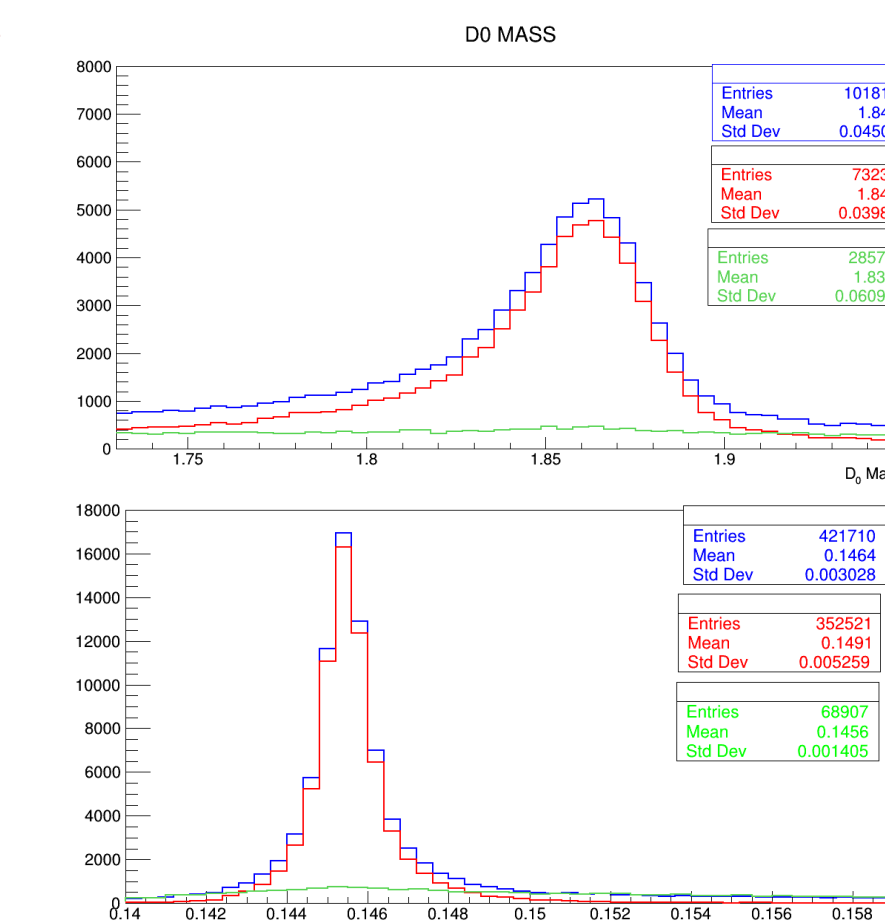
Physics Analysis of $D^- \rightarrow K_S \pi^0 \pi^0$

Signal MC study

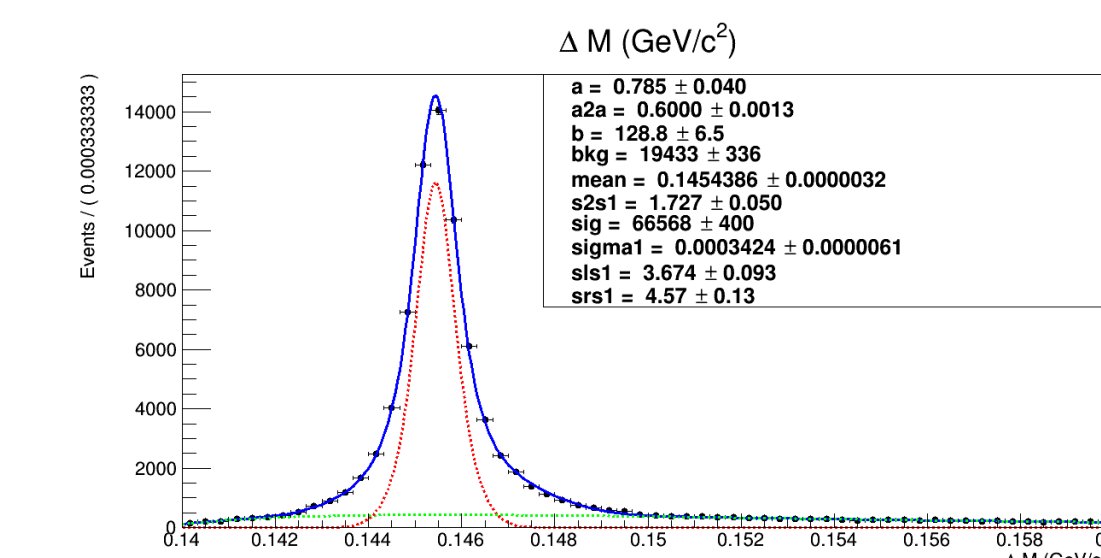


Set of cuts applied :

- π^- : $|dr| < 1 \text{ cm}$, $|dz| < 3 \text{ cm}$, $KID < 0.6$
- π^0 : Mass [110, 160] MeV, $E_{\gamma \text{ barrel}} > 60 \text{ MeV}$, $E_{\gamma \text{ endcap}} > 100 \text{ MeV}$, $p > 0.64 \text{ GeV}$
- $K_S (\pi^+ \pi^-)$: n_{isKS} , mass window $< 15 \text{ MeV}$
- D: Mass [1.75, 1.95] GeV
- D* : 2.5 GeV ΔM [0.135, 0.165] GeV



True candidate 83%
Self cross-feed 17%

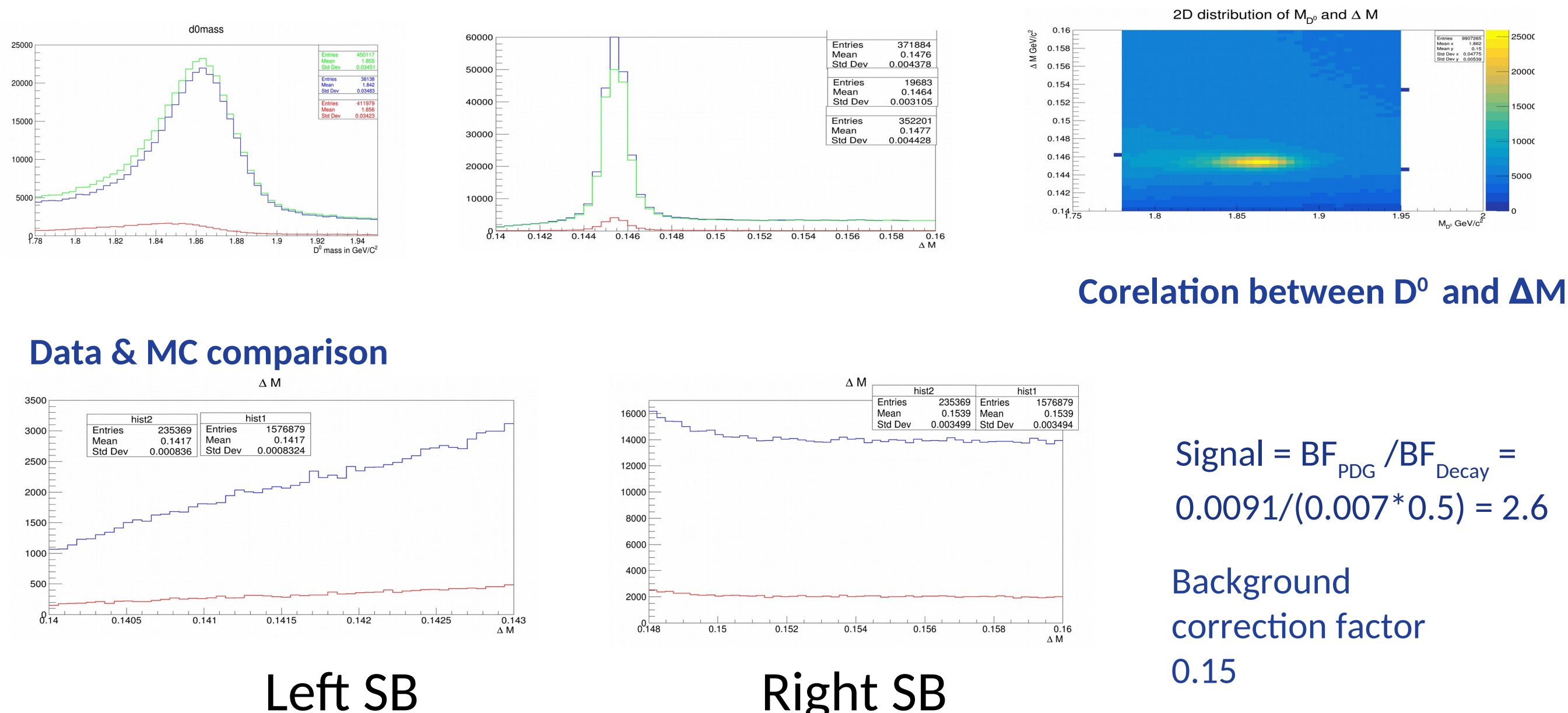


Selection efficiency: 3.3 %

BCS Efficiency 74%

2M $K_S \pi^0 \pi^0$ sample

Generic MC Study



Correlation between D^0 and ΔM

$$\text{Signal} = \frac{BF_{\text{PDG}}}{BF_{\text{Decay}}} = \frac{0.0091}{(0.007 * 0.5)} = 2.6$$

Background correction factor 0.15

Future Study

- Optimization of Variables (π^0 momenta, π^0 mass, D^0 mass, D^+ momentum)
- Peaking background study
- extract signal yield from ΔM fit.
- Calculate Branching Fraction by using normalization mode $D^- \rightarrow K_S \pi^0$.

Acknowledgements

- The authors are thankful to the Belle Collaboration for providing the opportunity to present this work.
- We are also thankful to IIT Bhubaneswar for providing the research grant.

