Charm physics at BESIII

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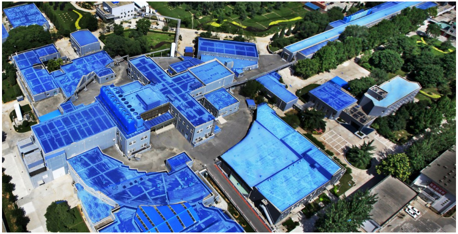
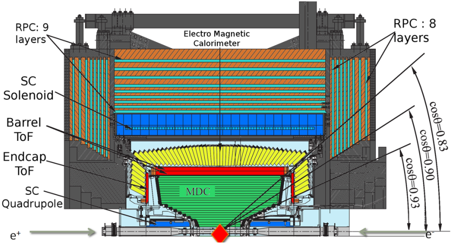
Outline

- BEPCII is a symmetric e^+e^- collider with a peak luminosity of $1 \times 10^{33}\,\mathrm{cm}^{-2}\,\mathrm{s}^{-1}$ at $\sqrt{s} = 3.773\,\mathrm{GeV}$
- Tracking: Helium-based multilayer drift chamber (MDC)
- PID: Plastic scintillator TOF system and $\frac{\mathrm{d}E}{\mathrm{d}x}$
- Magnet: 1.0 T superconducting solenoid
- Neutral particle tracking: CsI(Tl) electromagnetic calorimeter (EMC)





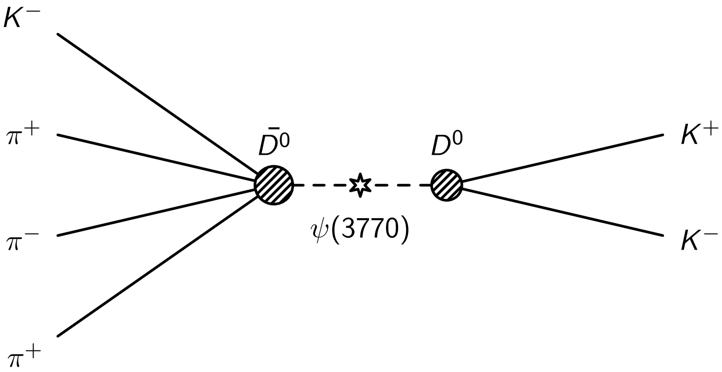
Overview of (left) BEPCII and (right) BESIII

Recent charm results from BESIII

Charm physics at BESIII can be roughly categories into three areas:

1. Strong-phase measurements
    - Measurement of $\delta_{K\pi}$ EPJC **82** 1009 (2022)
2. Amplitude analysis
3. Semileptonic charm decays

Double-tag analysis

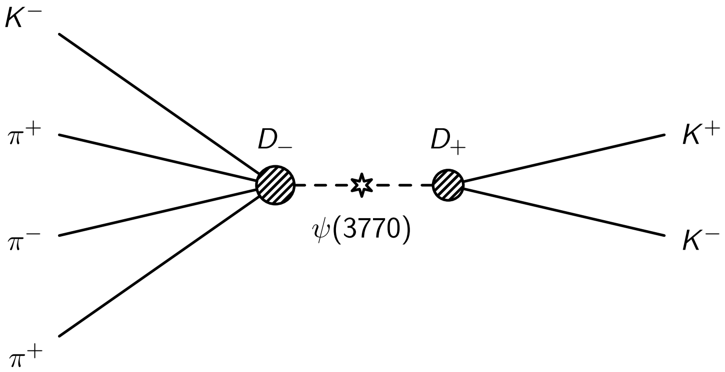


Double-tag method

The D mesons are produced in a quantum correlated state:

$$|\psi\rangle = \frac{1}{\sqrt{2}}\left(|D^0\rangle|\bar{D}^0\rangle - |\bar{D}^0\rangle|D^0\rangle\right)$$

Double-tag analysis



Double-tag method

Equivalently, we can consider the CP even (odd) eigenstates D_+ (D_-):

$$|\psi\rangle = \frac{1}{\sqrt{2}}\big(|D_+\rangle|D_-\rangle - |D_-\rangle|D_+\rangle\big)$$

Double-tag analysis

Double-tag analysis has many advantages:

1. $D\bar{D}$ pairs are quantum correlated, which provide direct access to the D^0-$\bar{D}^0$ strong-phase difference
2. Double-tag yields, which are experimental observables, are normalised by single-tag yields, and therefore the measurements are unaffected by systematic uncertainties from efficiencies and branching fractions
3. Full reconstruction ensures that the environment is extremely clean

Only one minor drawback:

1. Lower statistics