Search for rare decays at BESIII

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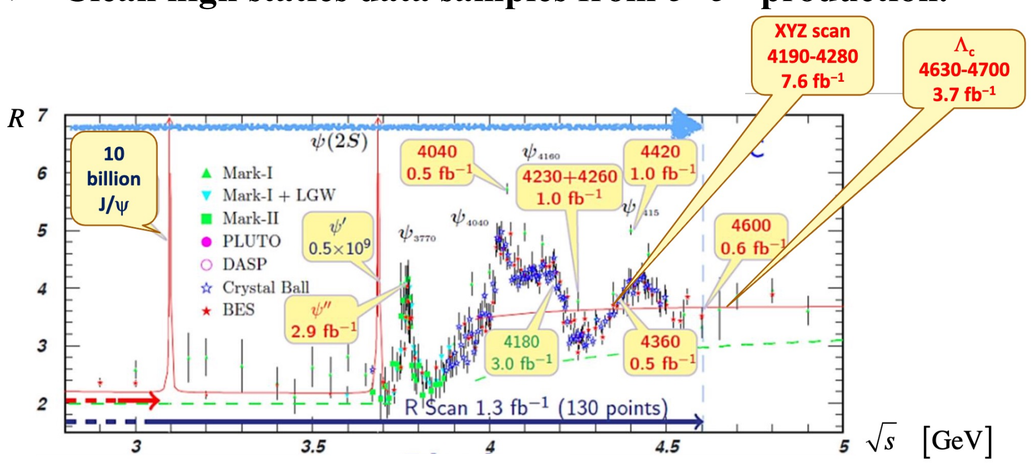
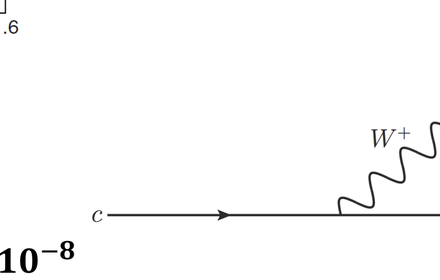
On behalf of the BESIII collaboration

BESIII DataSets & Advantages

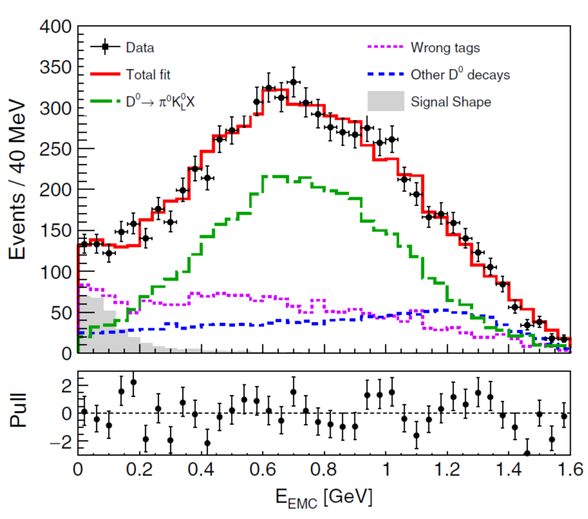
- **BESIII is an integrated part of BEPCII, a double ring e^+e^- collider operating at 2.0−4.9 GeV c.m. energies with a design luminosity of $1\times10^{33}\mathrm{cm}^{-2}\mathrm{s}^{-1}$ at c.m. energy of 3.773 GeV.**
- **The world largest J/ψ, $\psi(3686)$, $\psi(3770)$ data samples.**
- **Clean high statics data samples from e^+e^- production.**

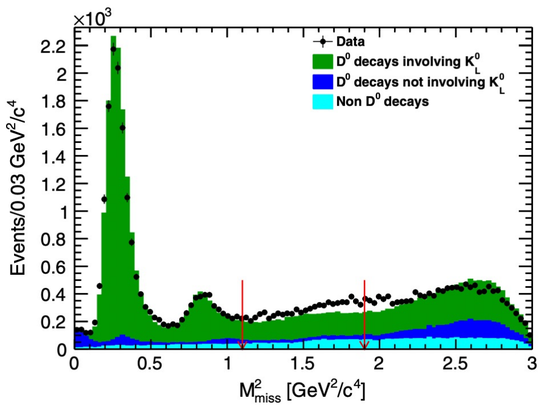


$D^0 \to \pi^0\nu\bar{\nu}$



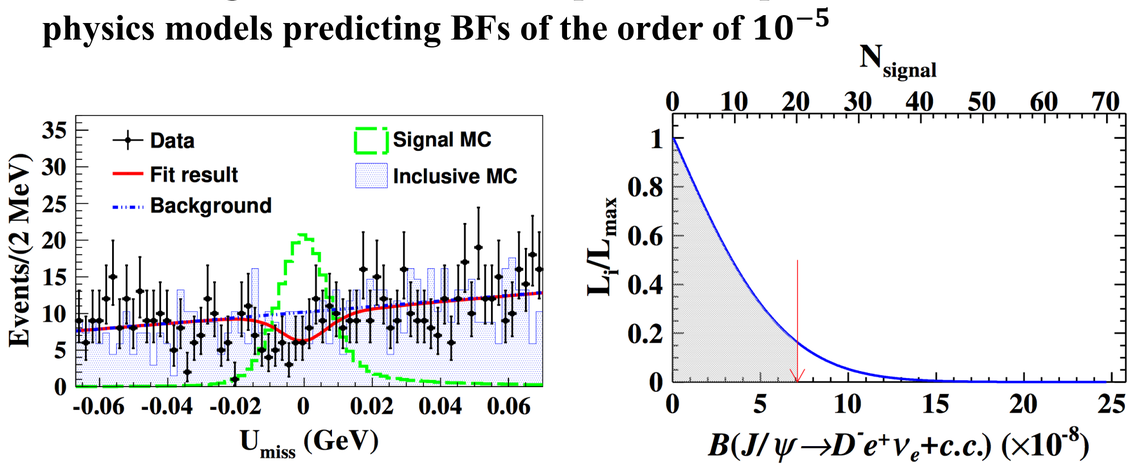
- $\mathcal{B}(D^0 \to \pi^0\nu\bar{\nu}) < 2.1\times10^{-4}$
- **FCNC is forbidden in SM at tree level but allowed in loop/box diagrams.**
- **Discriminator: EMC energy not associated with signal and tag decays.**
- **Provide a clean probe to search for New Physics in charm sector.**





$J/\psi \to D^- e^+ \nu$

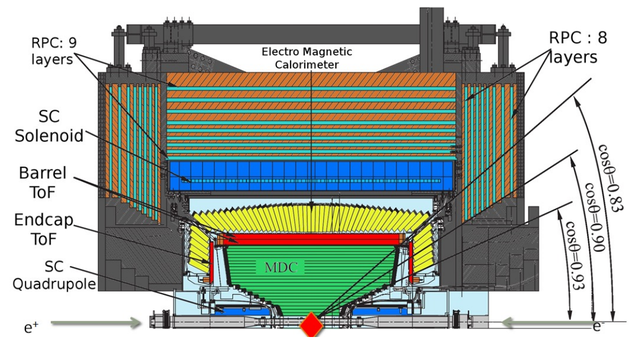
- $\mathcal{B}(J/\psi \to D^- e^+ \nu_e + c.c.) < 7.1\times10^{-8}$
- $J/\psi \to D^- e^+ \nu_e, D^- \to K^+\pi^-\pi^-$
- **Puts a stringent constraint on the parameter spaces for different new physics models predicting BFs of the order of 10^{-5}**



- **The results of $J/\psi \to D_s^{(*)-} e^+\nu_e, D^0e^+e^-, \bar{D}^0\pi^0, \bar{D}^0\rho^0, \bar{D}^0\eta, D^-\pi^+, D^-\rho^+$ using full J/ψ data are coming soon.**

BEPCII and BESIII

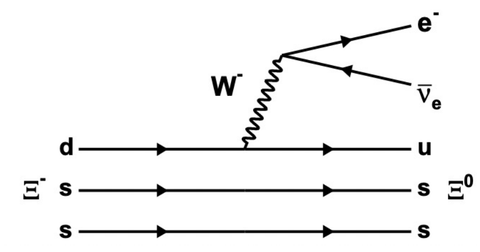
The BESIII detector at the BEPCII collider is a large solid-angle magnetic spectrometer running in τ-charm energy region with a geometrical acceptance of 93% of 4π solid angle.



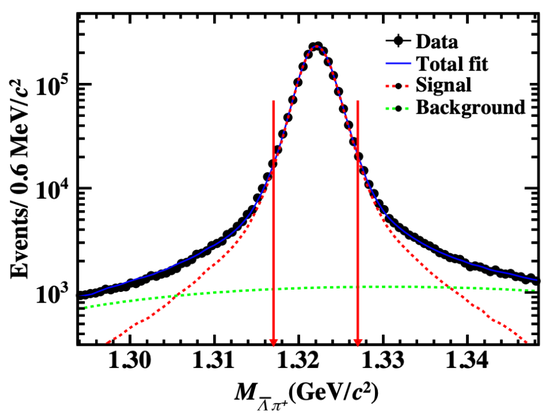
BEijing **S**pectrometers **III** and **B**eijing **E**lectron **P**ositron **C**ollider **II**

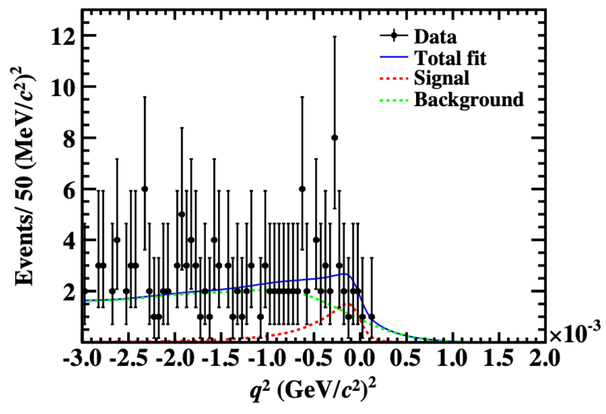
- **Main drift chamber (MDC): $\Delta P/P = 0.5\%$**
- **Time-of-Flight system (TOF): $\sigma_T = 60$ ~68 ps**
- **Electromagnetic Calorimeter (EMC): $\Delta E/E = 2.5\%$**
- **Muon chamber (MUC): $\sigma_{z,\phi} = 2$ cm**
- **Superconductor (SC): 1.0 Tesla**

$\Xi^- \to \Xi^0 e^- \bar{\nu}$



- $\mathcal{B}(\Xi^- \to \Xi^0 e^- \bar{\nu}) < 2.59\times10^{-4}$.
- **$10^6\Xi^-$ events are produced via $J/\psi \to \Xi^-\bar{\Xi}^+$ within 10^{10} J/ψ data.**
- **Provides an important experimental constraint for the theoretical study of the SU(3) symmetry-breaking mechanism.**





Summary and Prospect

- **BESIII has performed wide range of searches of BSM new physics with unique datasets and analysis techniques.**
- **BESIII will collect 20 fb^{-1}@3.773 GeV data sample. Along with 10 Billion J/ψ data and 3 Billion $\psi(3686)$ data, more searches for rare decays will bring more exciting results in the future.**

References

[1] BESIII Collaboration, Phys. Rev. D 105 L071102 (2022).
[2] BESIII Collaboration, Phys. Rev. D 104 072007 (2021).
[3] BESIII Collaboration, J. of High energy Phys. 06 157 (2021).
[4] BESIII Collaboration, Chinese Phys. C 44 040001 (2020).

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