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Measurement of time-dependent CP violation in $B^0 \rightarrow J/\psi K_S^0$ decays using early Belle II data

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The Belle II experiment at the SuperKEKB energy-asymmetric e^+e^- collider is a substantial upgrade of the B factory facility at the Japanese KEK laboratory. The design luminosity of the machine is $8 \times 10^{35} \text{ cm}^{-2} \text{ s}^{-1}$ and the Belle II experiment aims to record 50 ab^{-1} of data, a factor of 50 more than its predecessor. From February to July 2018, the machine has completed a commissioning run, achieved a peak luminosity of $5.5 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$, and Belle II has recorded a data sample of about 0.5 fb^{-1} . Main operation of SuperKEKB has started in March 2019. In this presentation we report a measurement of the time-dependent CP violation parameter for $B^0(\bar{B}^0) \rightarrow J/\psi K_S^0$ using this early data set. One neutral B meson is reconstructed in the $J/\psi K_S^0$ CP -eigenstate decay channel and the flavor of the accompanying B meson is identified to be either B^0 or \bar{B}^0 from its decay products. We present a new concept for the time-dependent CP violation fit together with initial results for the parameters of B^0 mixing-induced phenomena and the lifetime of B^0 .

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