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Time decay effect of the superconducting final focus quadrupole fields on SuperKEKB beam operation

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SuperKEKB is the particle collider of electrons at 7 GeV and positrons at 4 GeV, and it is the cutting-edge collider in the luminosity frontier using the “Nano-beam scheme”. The beam colliding operation of SuperKEKB started from 2018 May, and the peak luminosity reached at $4.678 \times 10^{-34} \text{ 1/cm}^2 \text{ 1/s}$ with quite expert beam operation. In beam operation, the vertical tune of the positron beam was measured to decline exponentially with time just after exciting the final focus quadrupole magnets. To identify the source of the tune change, we performed the magnetic field measurements of the prototype final focus quadrupole magnets, and the exponential field change with time after exciting the magnets was measured and the measured field decay rates were found to be of equal size of the measured tune change during beam operation. Because the field change is due to the magnetization decay in the superconductor, NbTi, filament, we modified the excitation pattern of the magnets and canceled the field decay. We will report the measured beam tune changes, the prototype field measurement results and the condition of beam operation with the modified excitation patterns of the quadrupole magnets.

Footnotes

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