Chiral Belle: SuperKEKB e- Polarization Upgrade

Design interfaces of the spin rotator SC magnets and cryostats

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R&D Proposal for Chiral Belle for Polarization Physics at SuperKEKB

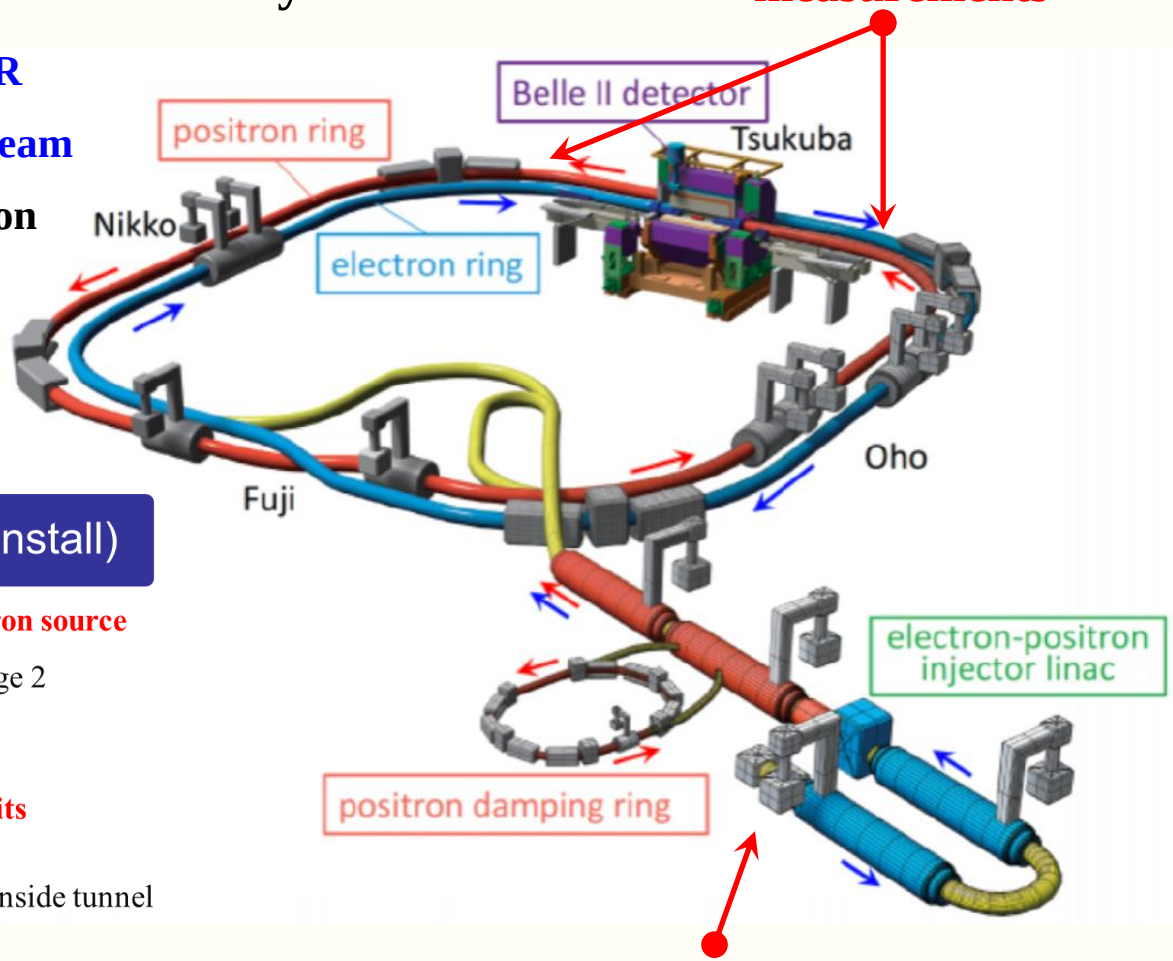
Top-level objective (or final stage) for Chiral Belle for Polarization Physics

- **To install two spin rotator units on both sides of the SuperKEKB IR**
- **To add polarized electron gun to inject freshly polarized electron beam**
- **Polarization measurement for the accelerator and detector operation**

This R&D proposal:

team assembled for the R&D of Stage 1

Stage 1 (Source)	Stage 2 (Rotator)	Stage 3 (Install)
Polarized electron source Design, fabricate, install and operation for beam lifetime study	**Polarized electron source** Maintain the performance and keep availability for running after the normal running	**Polarized electron source** The same as Stage 2
Spin rotator units Conceptual and Technical design	**Spin rotator units** Fabrication and cryogenic testing in lab	**Spin rotator units** Installation, and commissioning inside tunnel

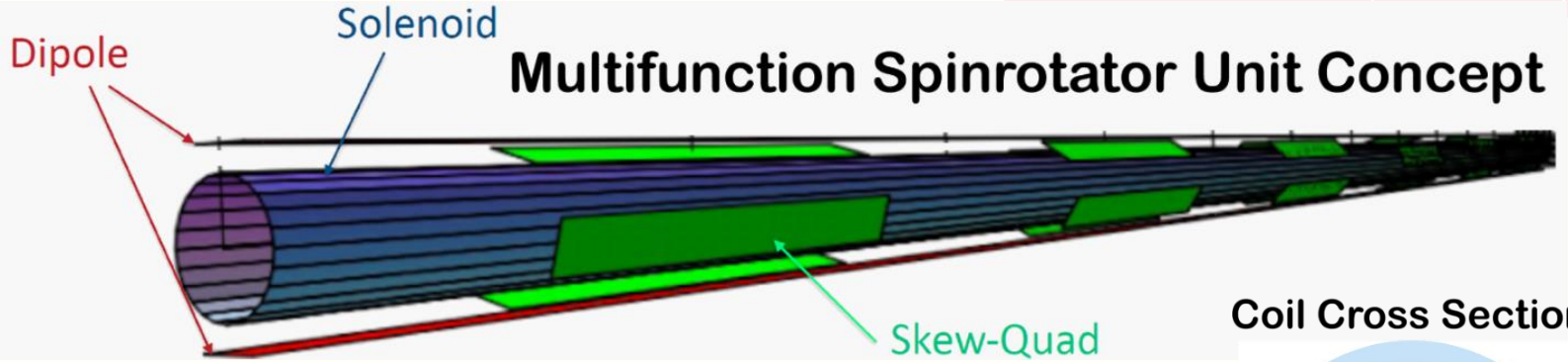


We need go forward whether the result is.

Superconducting Multifunction Spin Rotator Unit

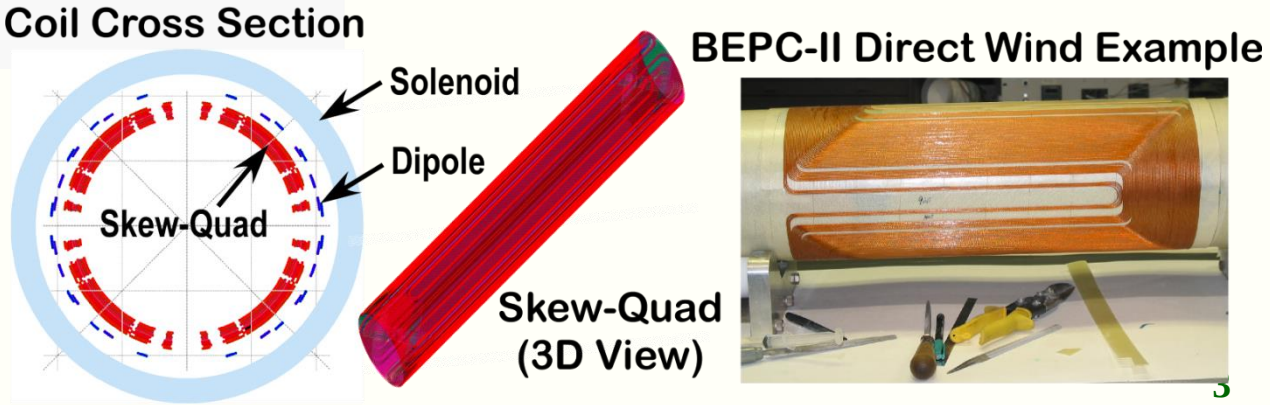
Current consideration for the rotator design to replace existing HER warm dipoles with new SC magnets in cryosats

Item	Value	Unit	Comments
Solenoid field	23.4 (4.85 × 6)	T × m (T)	As spin rotator to replace the
Skew gradient	24	T/m	Locally correct for unwanted beam coupling effects due to the solenoid
Dipole field	0.2	T	Match the existing dipole for no change in ring geometry or optics
Max. combined field	6.15	T	Peak field (depends on technical design)



Keep working conditions with the accelerator operation

BNL Direct Wind coil fabrication technology for the skew-quadrupole and dipole coils



Considerations of the spin rotator SC magnets and cryostats

Spin rotating, require field: 23.4 T×m

SuperKEKB Accelerator HER:

Current bending magnets: available space for cryostats

(Length, width and height)

Beam pipes (inner constraints): heights of the beam pipes

(1500 or 900 mm) to determine the cryostat size

Case	Comments
Multifunction unit: solenoid+dipole+quadrupole, to replace an existing warm dipole	Baseline
Cryostat: solenoid+quadrupole to replace a warm dipole Double another dipole field to compensate the dipole	Alternative ? to save cryocooler operation time