

Achievement of 200,000 Hours of Operation at KEK 7-GeV Electron 4-GeV Positron Injector Linac



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KEK electron positron injector LINAC initiated the injection operation into Photon Factory (PF) light source in 1982. Since then for 39 years, it has served for multiple projects, namely, TRISTAN, PF-AR, KEKB, and SuperKEKB. Its total operation time has accumulated 200 thousand hours on May 7, 2020. We are extremely proud of the achievement following continuous efforts by our seniors. The construction of the injector LINAC started in 1978, and it was commissioned for PF with 2.5 GeV electron in 1982. In parallel, the positron generator linac was constructed for the TRISTAN collider project. The slow

positron facility was also commissioned in 1992. After the KEKB asymmetric-energy collider project was commissioned in 1998 with direct energy injections, the techniques such as two-bunch acceleration and simultaneous injection were developed. As the soft structure design of the LINAC was too weak against the great east Japan earthquake, it took three years to recover. Then the construction and commissioning for the SuperKEKB project went on, and the simultaneous top-up injection into four storage rings contributes to the both elementary particle physics and photon science.

KEK e^-/e^+ injector LINAC has been contributing to particle physics and photon science and has established 200 k operation hours in 38 years in 2020

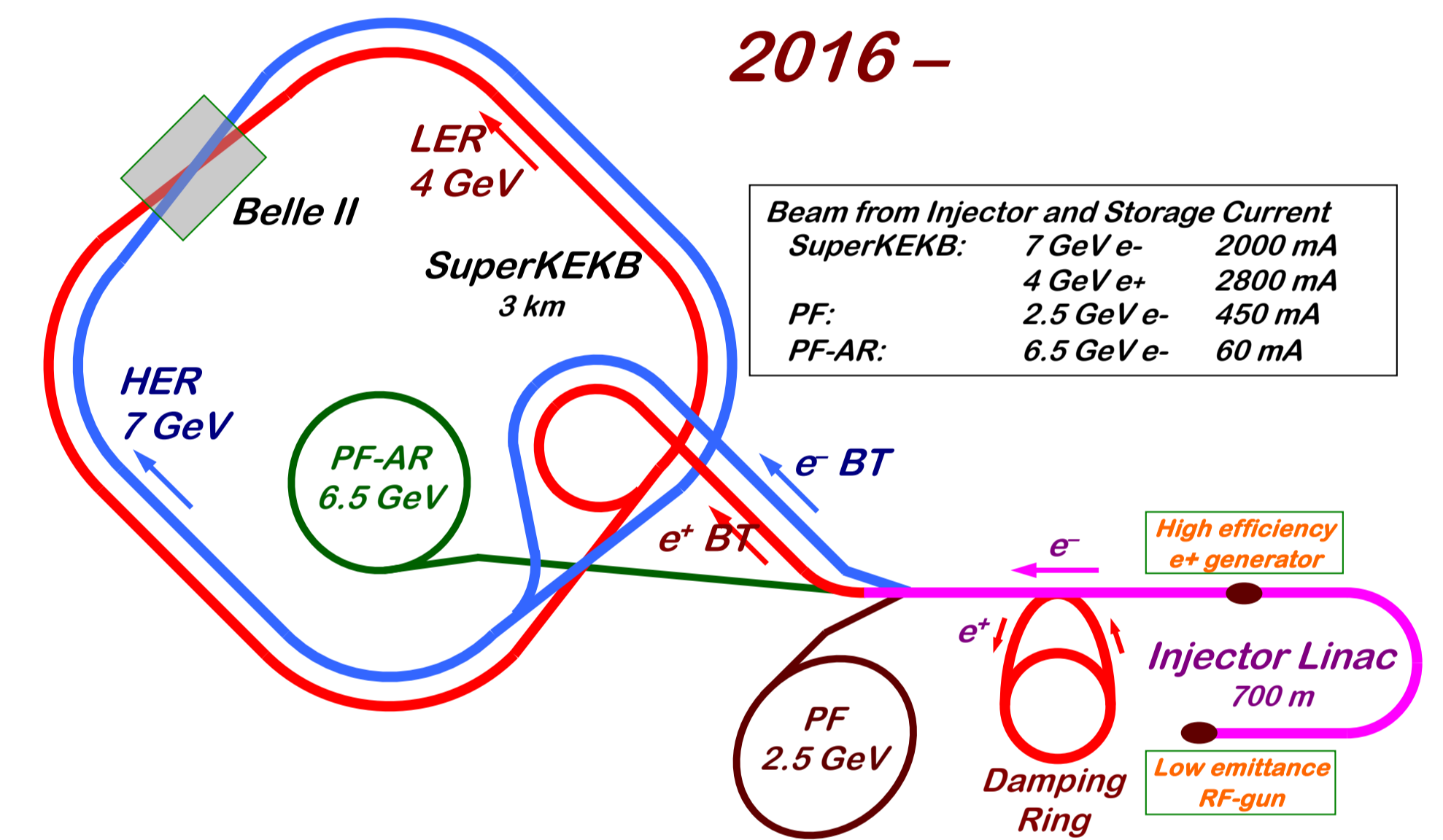
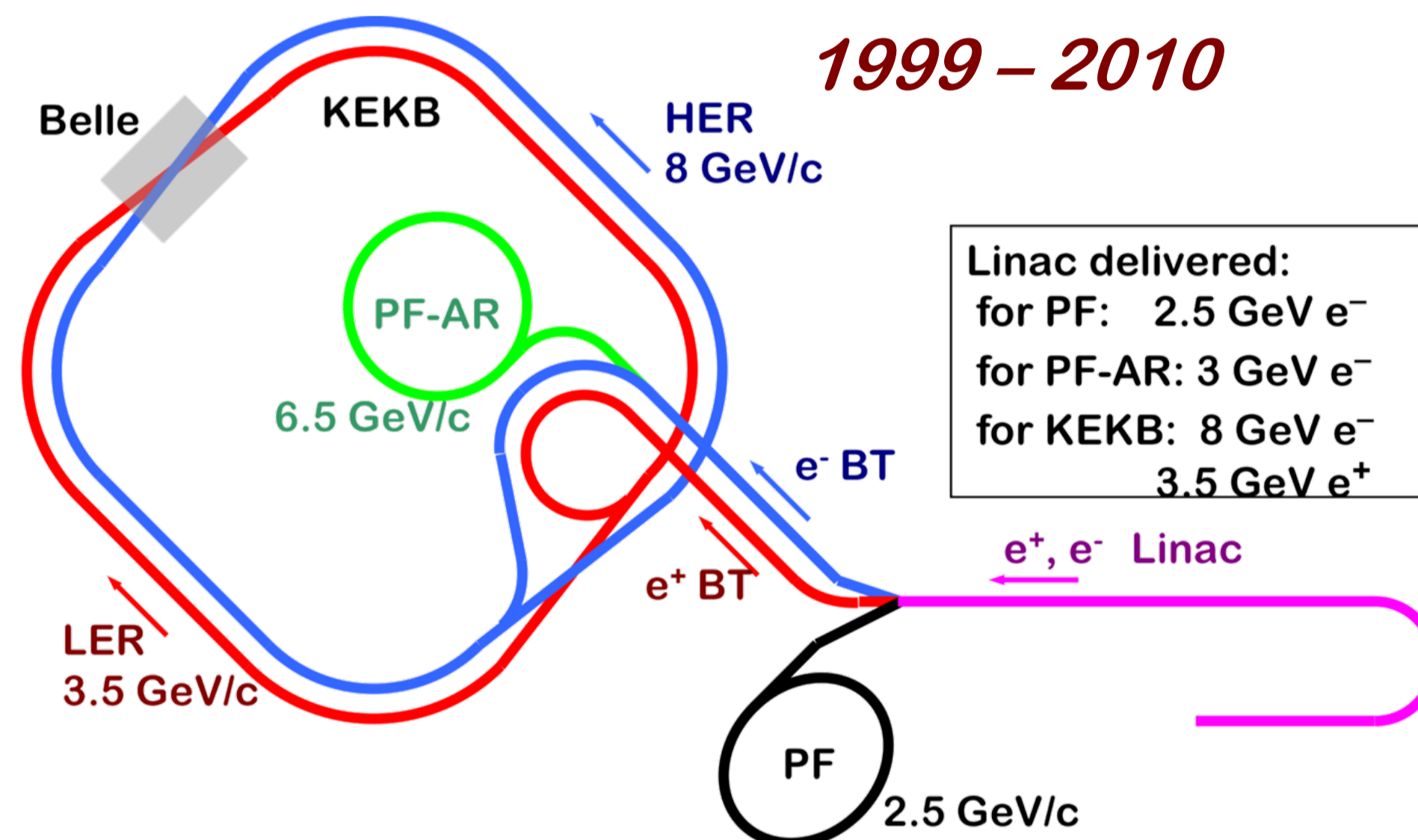
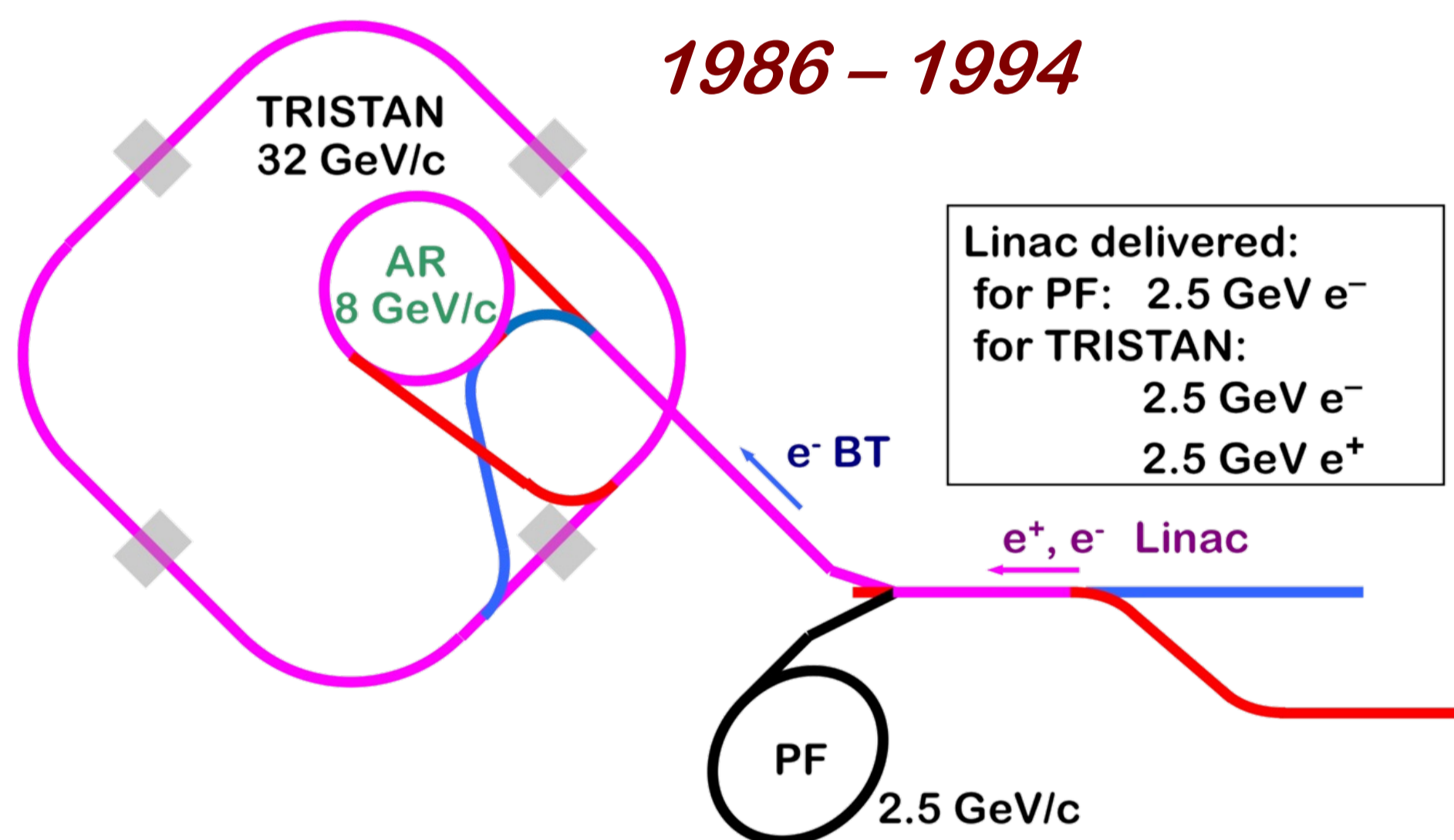
Projects Operated by LINAC

Project	Injection Energy	JFY Exp. Energy	Year																																							
			1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Photon Factory	2.5 GeV	2.5 GeV	Construct. → Injection Operation																																							
TRISTAN	2.5 GeV	32 GeV	Construct. → Injection Operation																																							
Slow Positron	2.5 GeV - 55 MeV	0.1 - 35 keV	Operation																																							
KEKB	8 / 3.5 GeV	8 / 3.5 GeV	Construct. → Injection Operation																																							
PF-AR	2.5 GeV - 6.5 GeV	5 - 6.5 GeV	Injection Operation																																							
SuperKEKB	7 / 4 GeV	7 / 4 GeV	Construction → Injection																																							

The injector LINAC has realized a number of projects for particle physics and photon science.

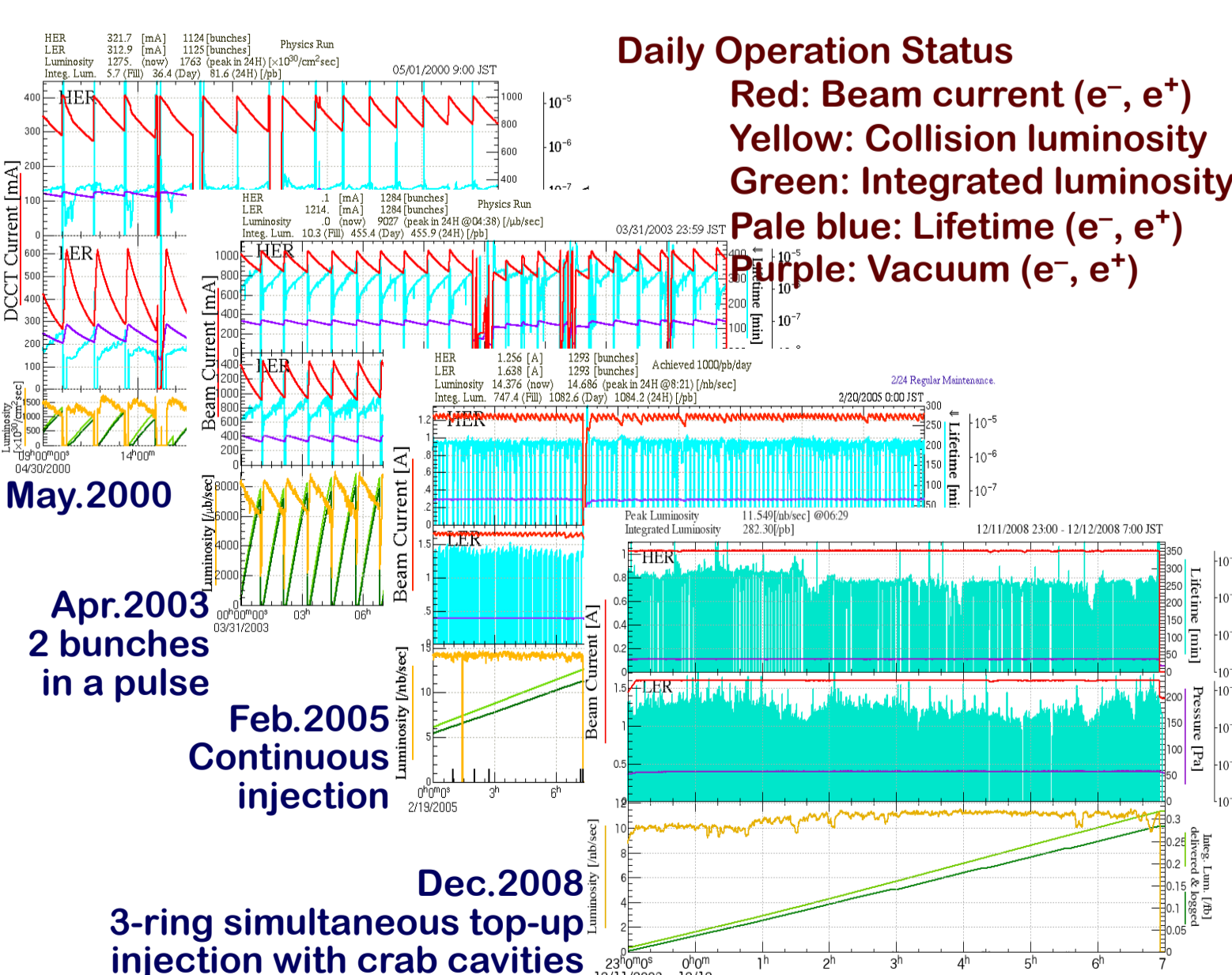
Injection Energies and Operation Periods

Accelerator Configurations

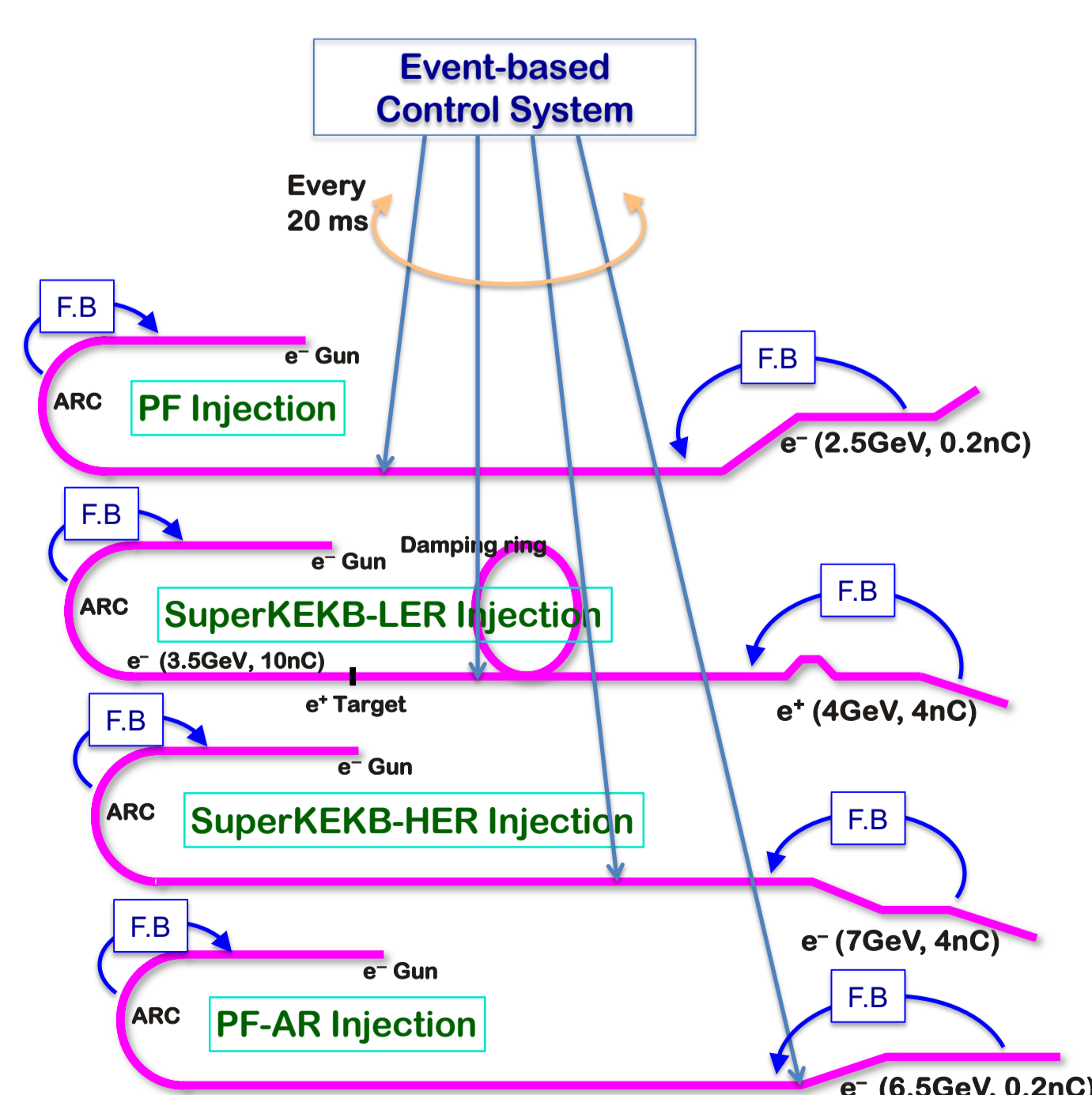


Additional accelerator components have been designed and introduced to meet the beam property requirements for each project.

Injection Progress in KEKB

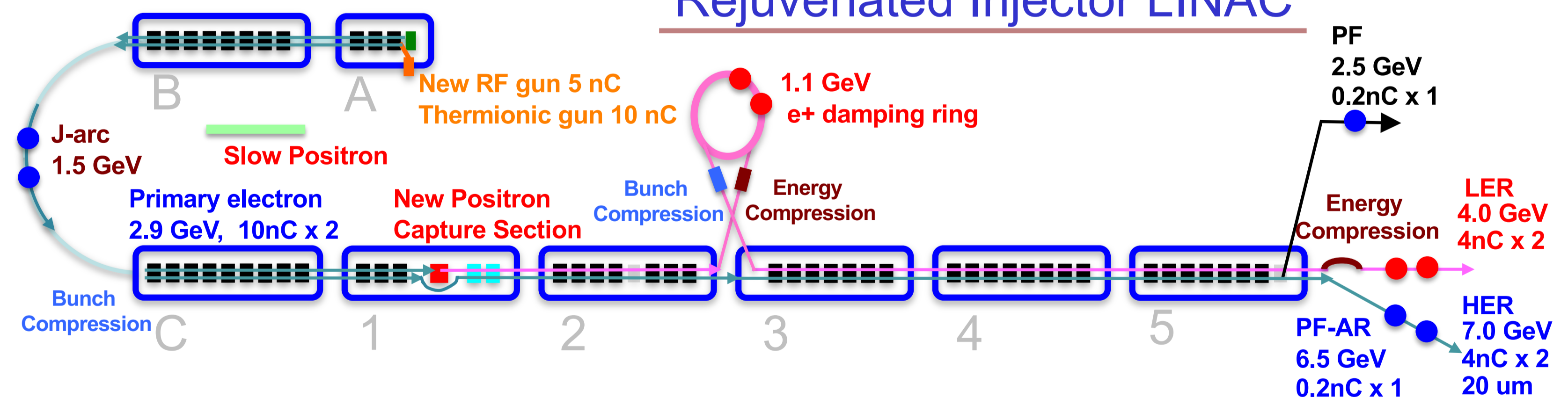


Simultaneous Top-up Injection

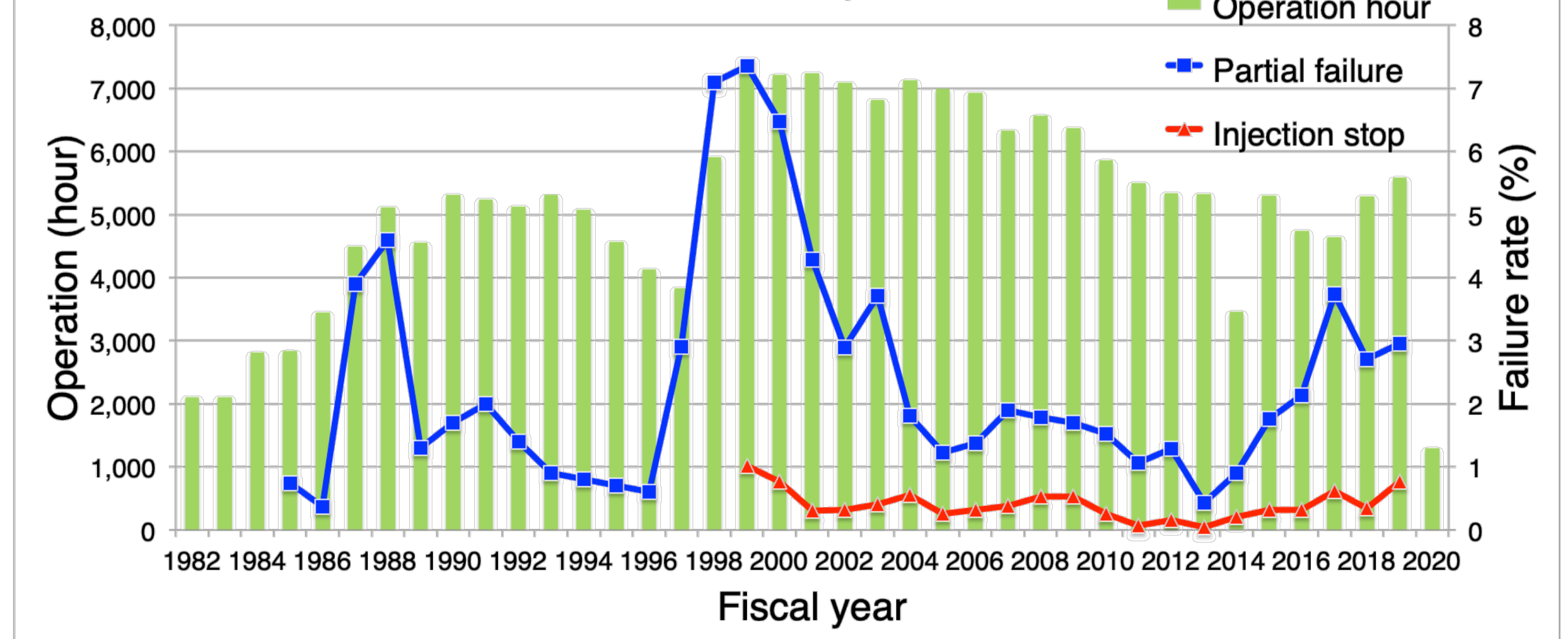


The single LINAC behaves as four virtual injectors by switching beam properties at 50 Hz.

Rejuvenated Injector LINAC



Statistics of the injector linac



Summary

- The continuous operation of the electron-positron injector has supported the history of advanced research at KEK.
- At 8:50 a.m. on May 7, 2020, the injector LINAC had accumulated its operation of 200,000 hours successfully, while continuing the simultaneous top-up injections for multiple fields of photon science and particle physics.

New technologies have been developed at LINAC to improve the experimental performance.

