



Upgrade of KEK Electron/positron Linac Control System for the both SuperKEKB and Light Sources

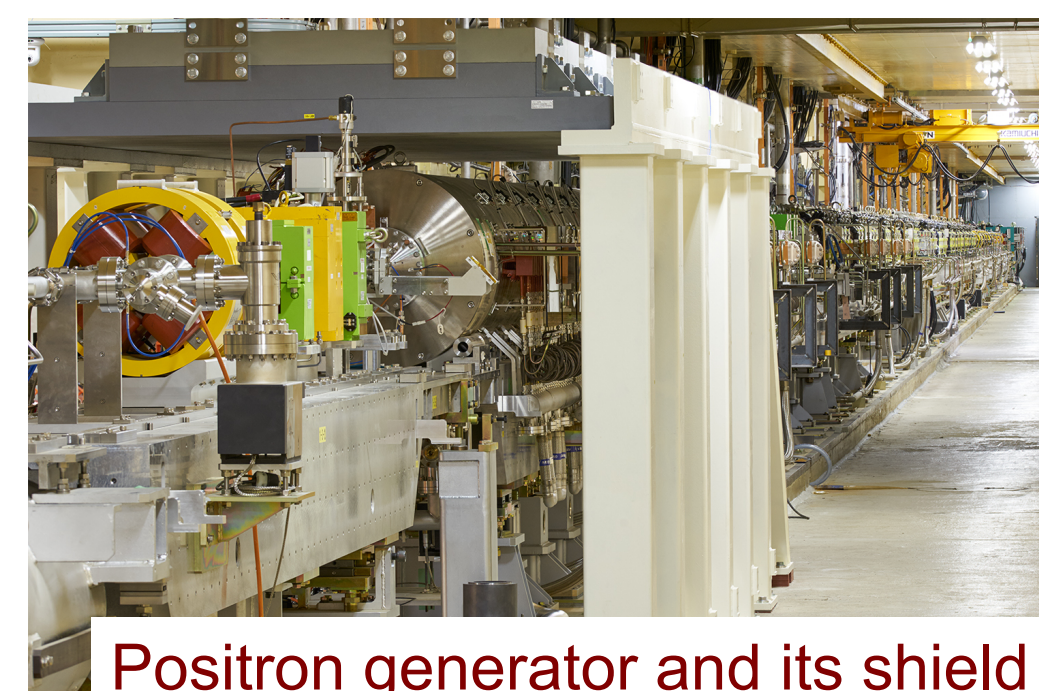
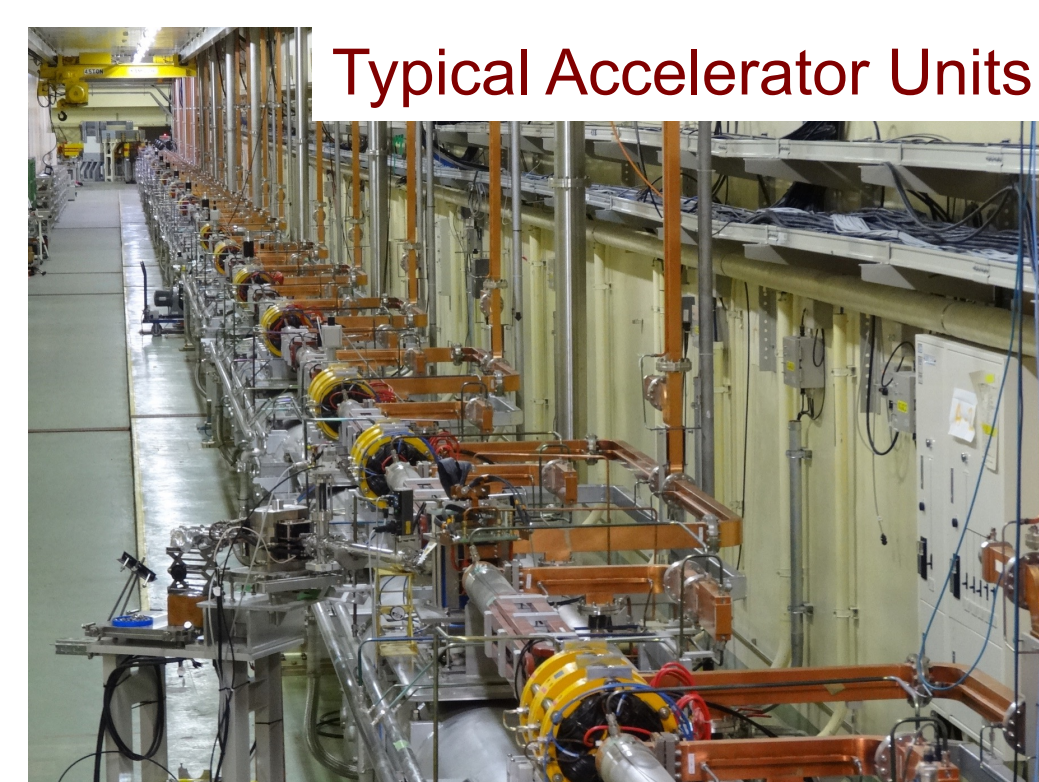
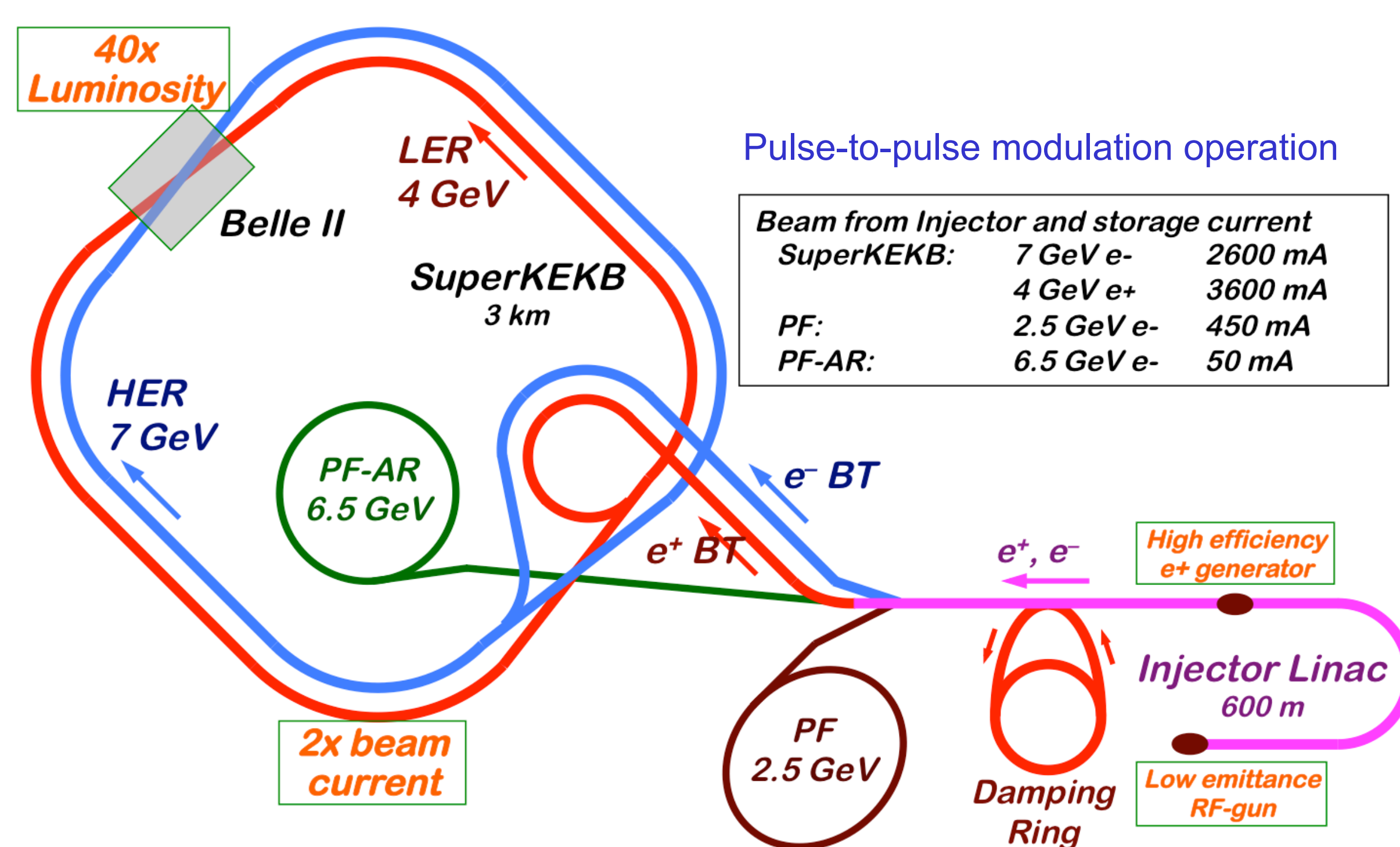
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KEK injector linac has delivered electrons and positrons for particle physics and photon science experiments for more than 30 years. It is being upgraded for the SuperKEKB project, which aims at a 40-fold increase in luminosity over the previous project of KEKB, in order to increase our understanding of flavour physics. This project requires ten-times smaller emittance and five-times larger current in injection beam from the injector. And many hardware components are being tested and installed. Even during the 6-year upgrade, it was requested to inject beams into light sources

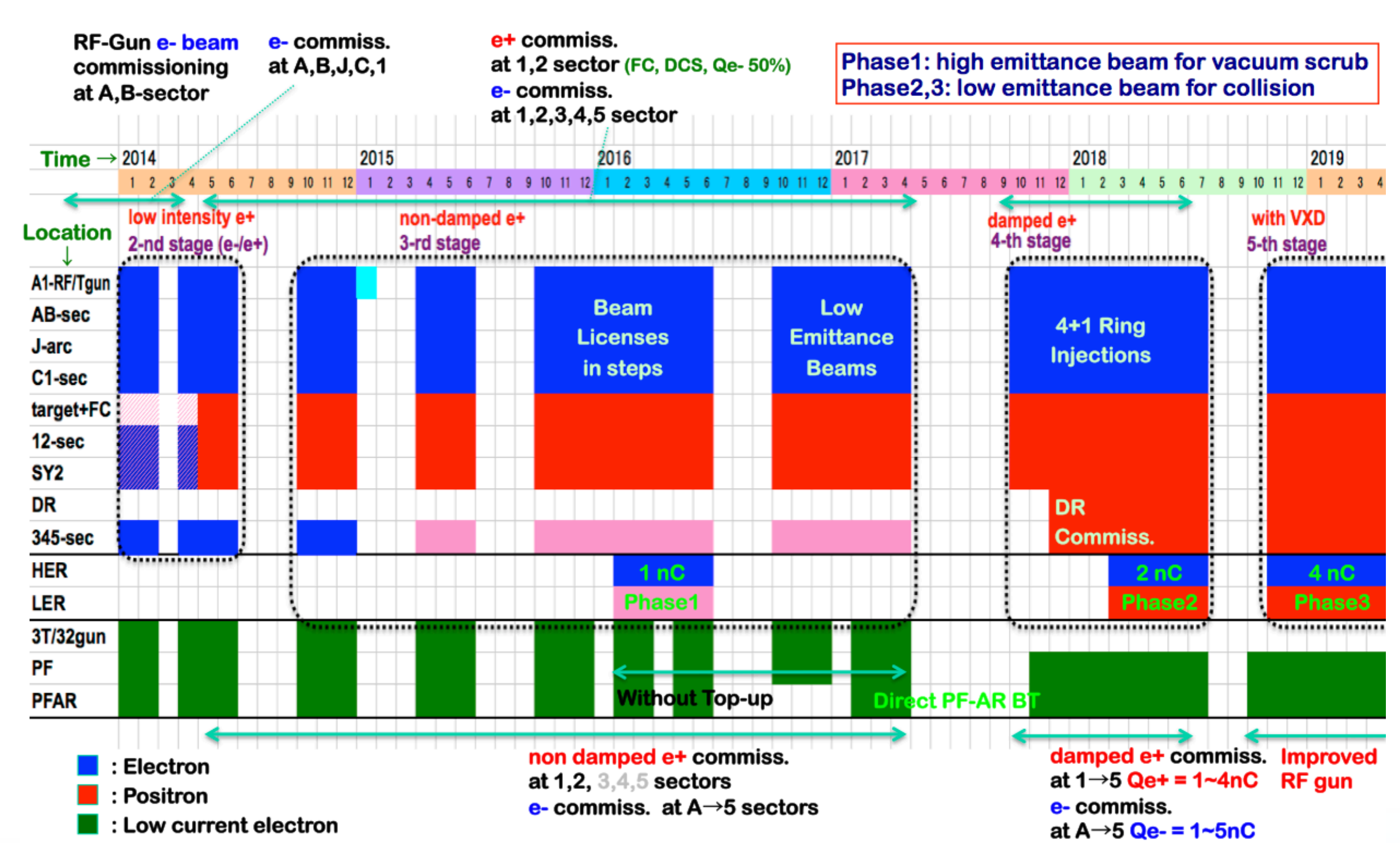
storage rings of PF and PF-AR. Furthermore, the beam demanding approaches from those storage rings are different. SuperKEKB would demand highest performance, and unscheduled interruption may be acceptable if the performance would be improved. However, light sources expect a stable operation without any unscheduled break, mainly because most users run experiments for a short period. In order to deal with the both requirements several measures are taken for operation, construction and maintenance strategy including simultaneous top-up injections.

e^-/e^+ Injector linac upgrade with high-intensity and low-emittance beams towards 40-times higher luminosity in SuperKEKB, as well as PF and PF-AR light sources

SuperKEKB Electron/Positron Complex



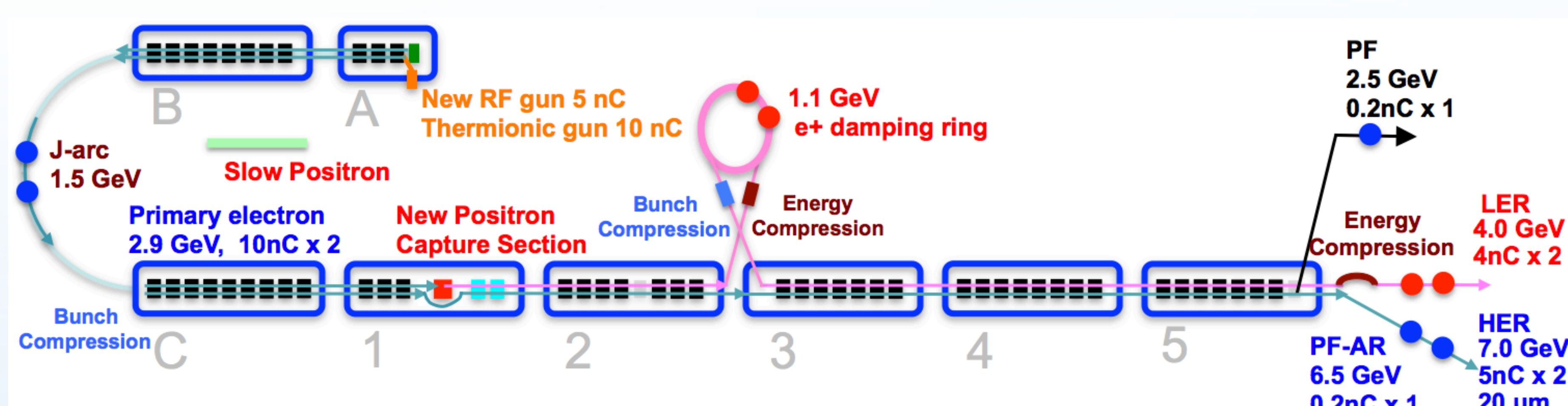
Balanced Schedule for Improvements / Stability



SuperKEKB particle physics

- ◆ Long-term and fixed users
- ◆ Performance intensive (Integrated performance)
- ◆ Minimum preventive maintenance
- ◆ Invests on improvements
- ◆ May share common goal with users
- ◆ Everyday is new
- On-the-job training for operators

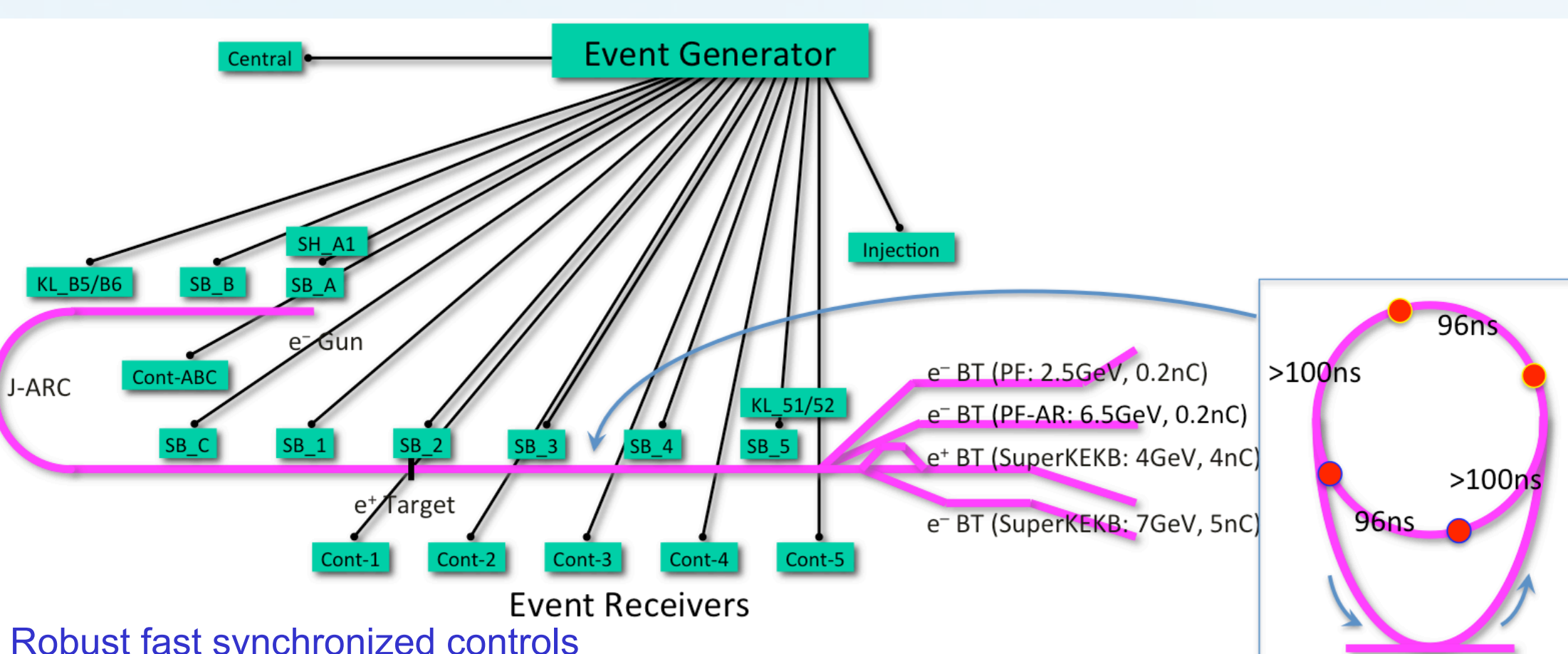
Injector Linac and Storage Rings



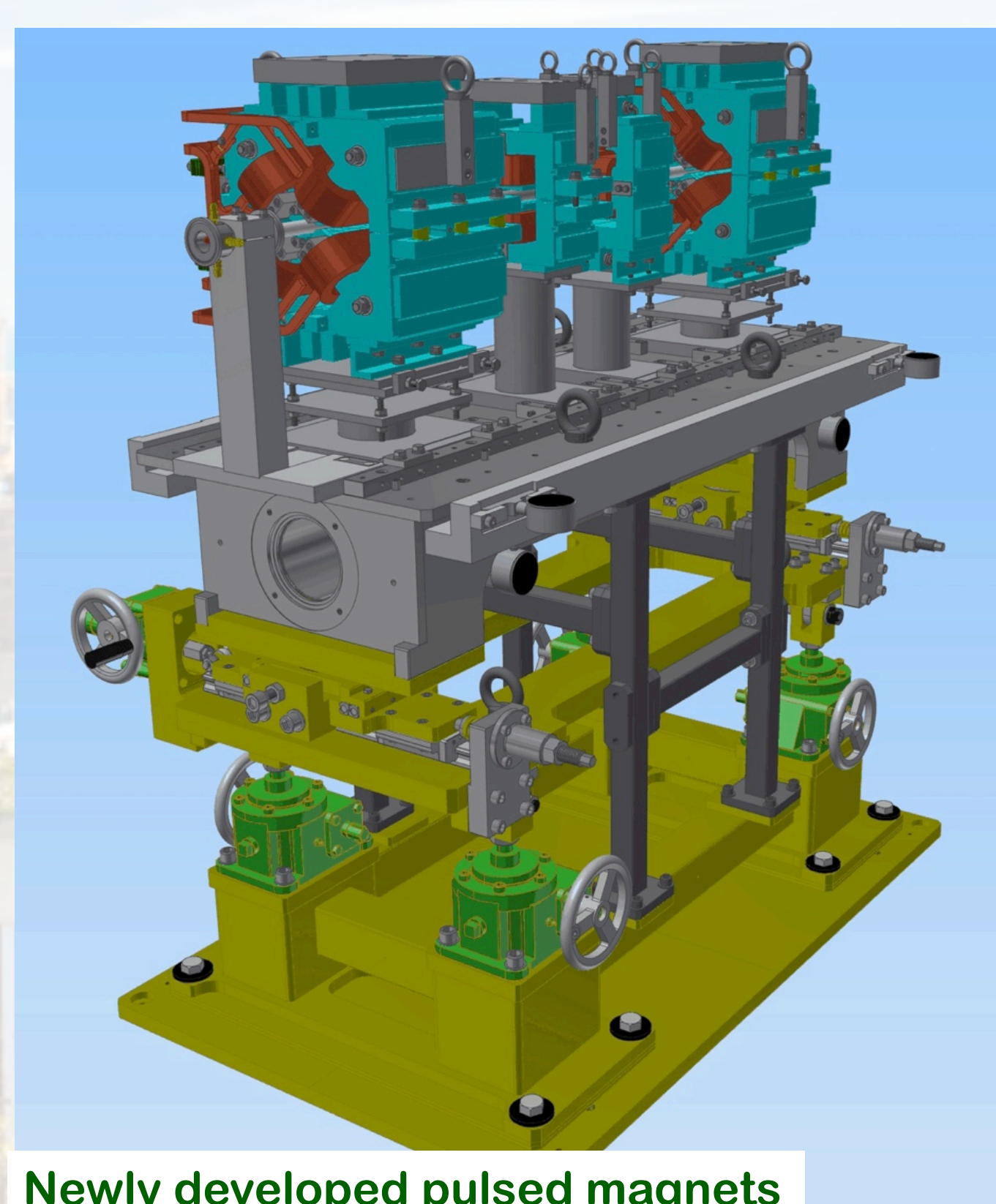
PF / PF-AR photon science

- ◆ Short-term in many groups
- ◆ Stability intensive (Hates failures)
- ◆ Deliberate scheduled maintenance
- ◆ Invests on maintenance
- ◆ Distance from users
- ◆ Fixed procedures
- Difficult to train operators

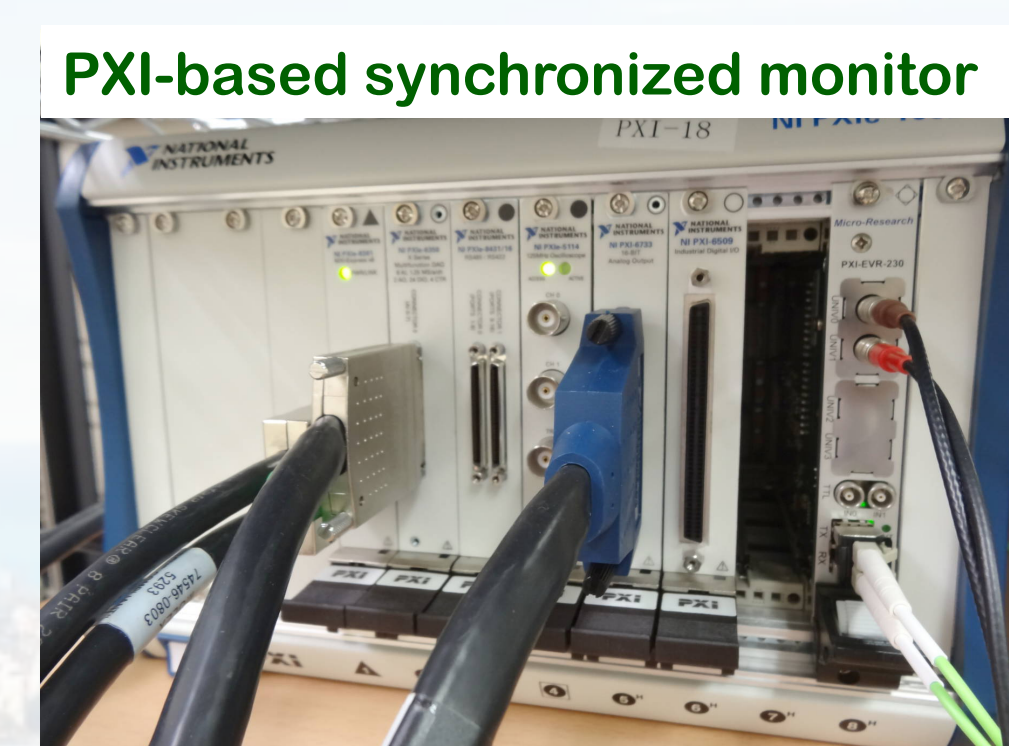
Synchronized Global Controls



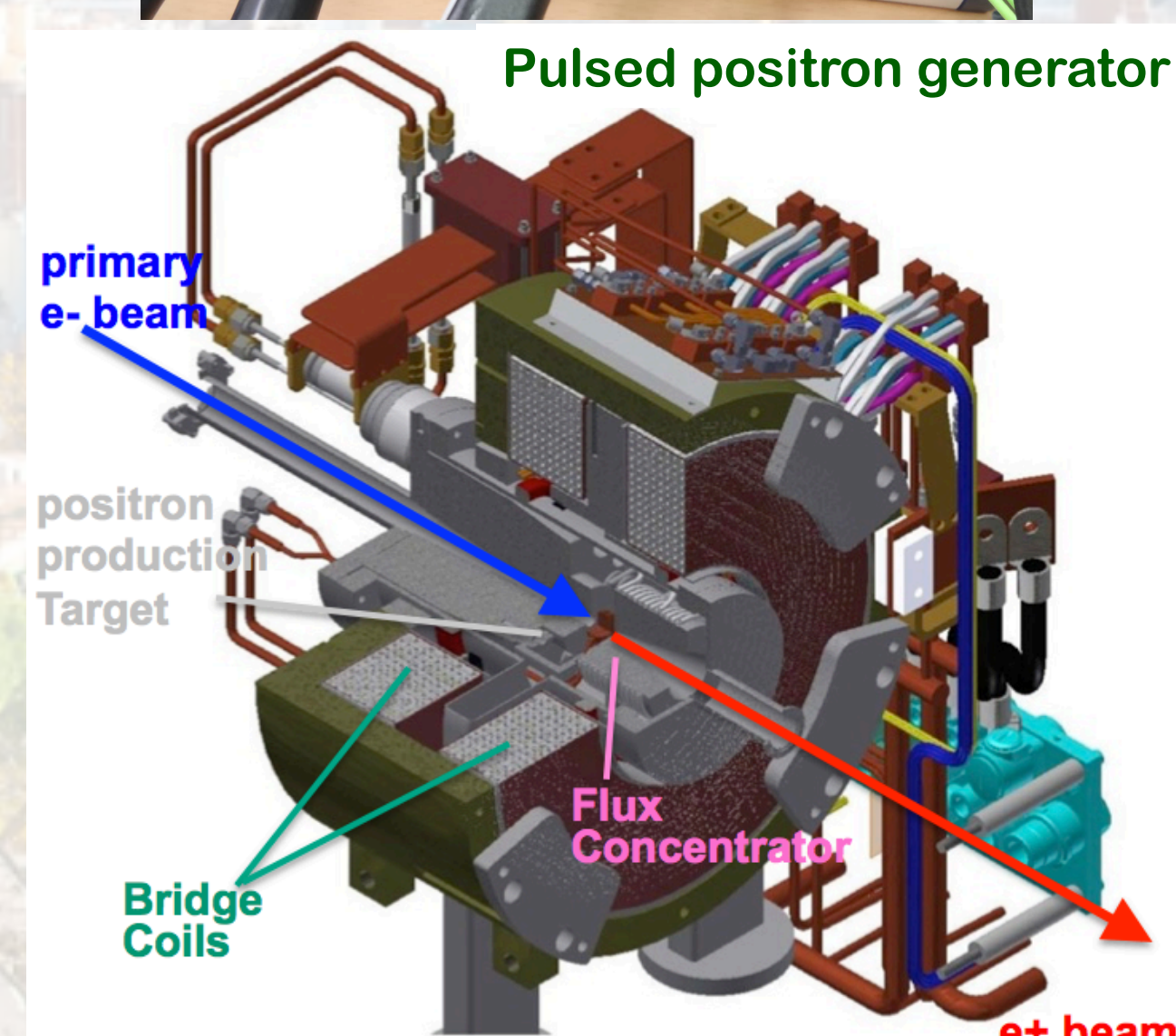
Many Devices with Pulsed Operations



Newly developed pulsed magnets

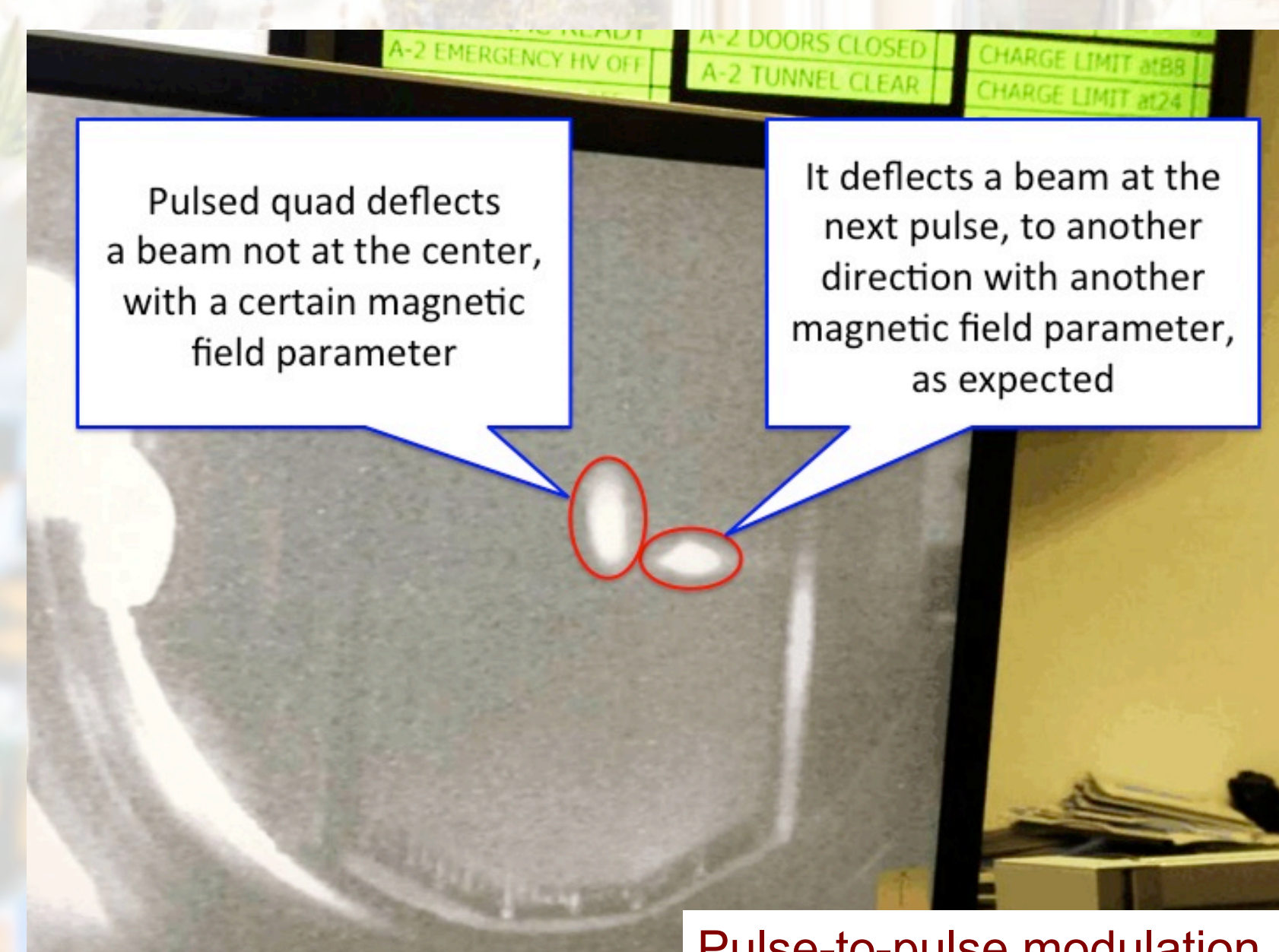
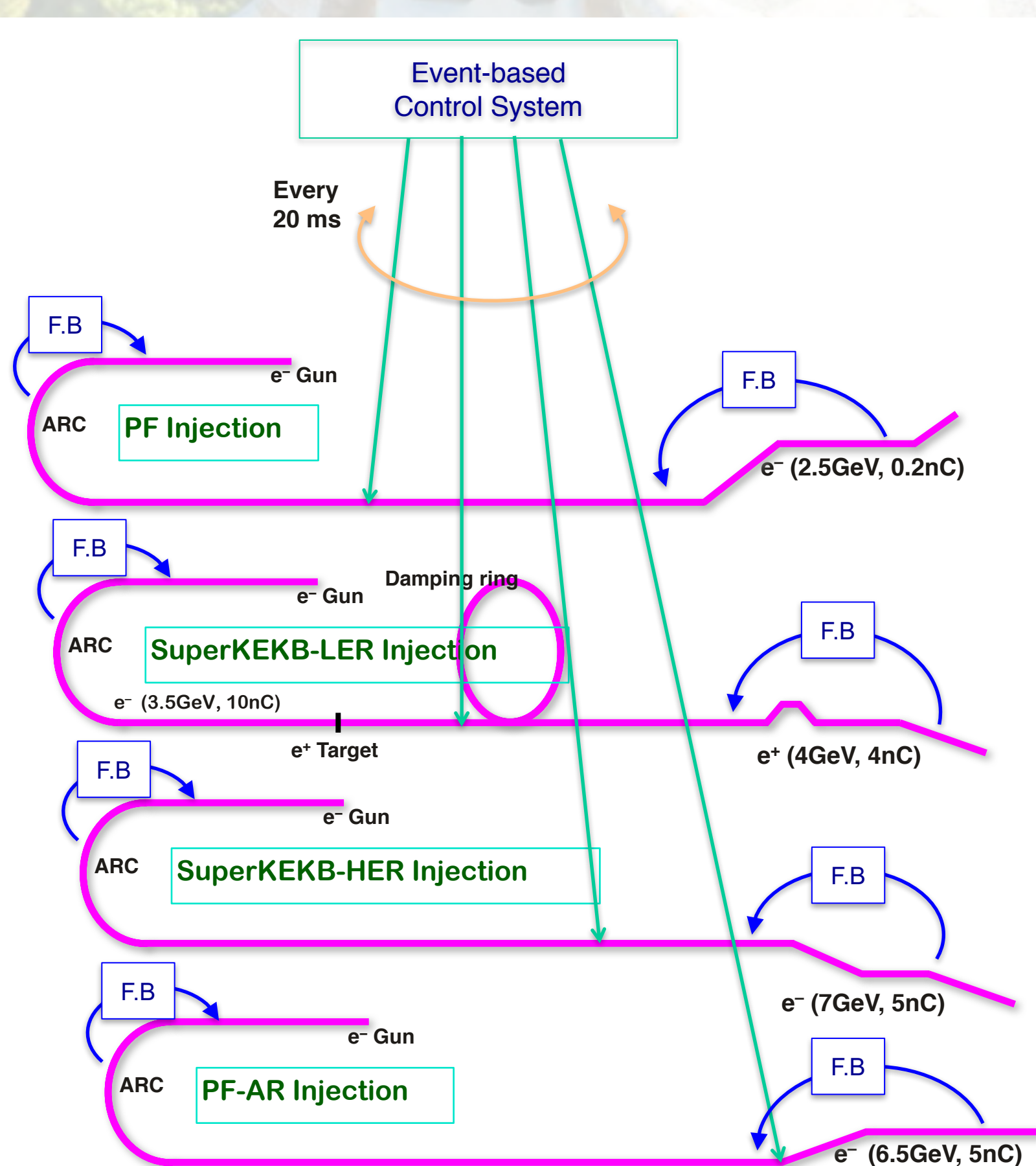


PXI-based synchronized monitor



Pulsed positron generator

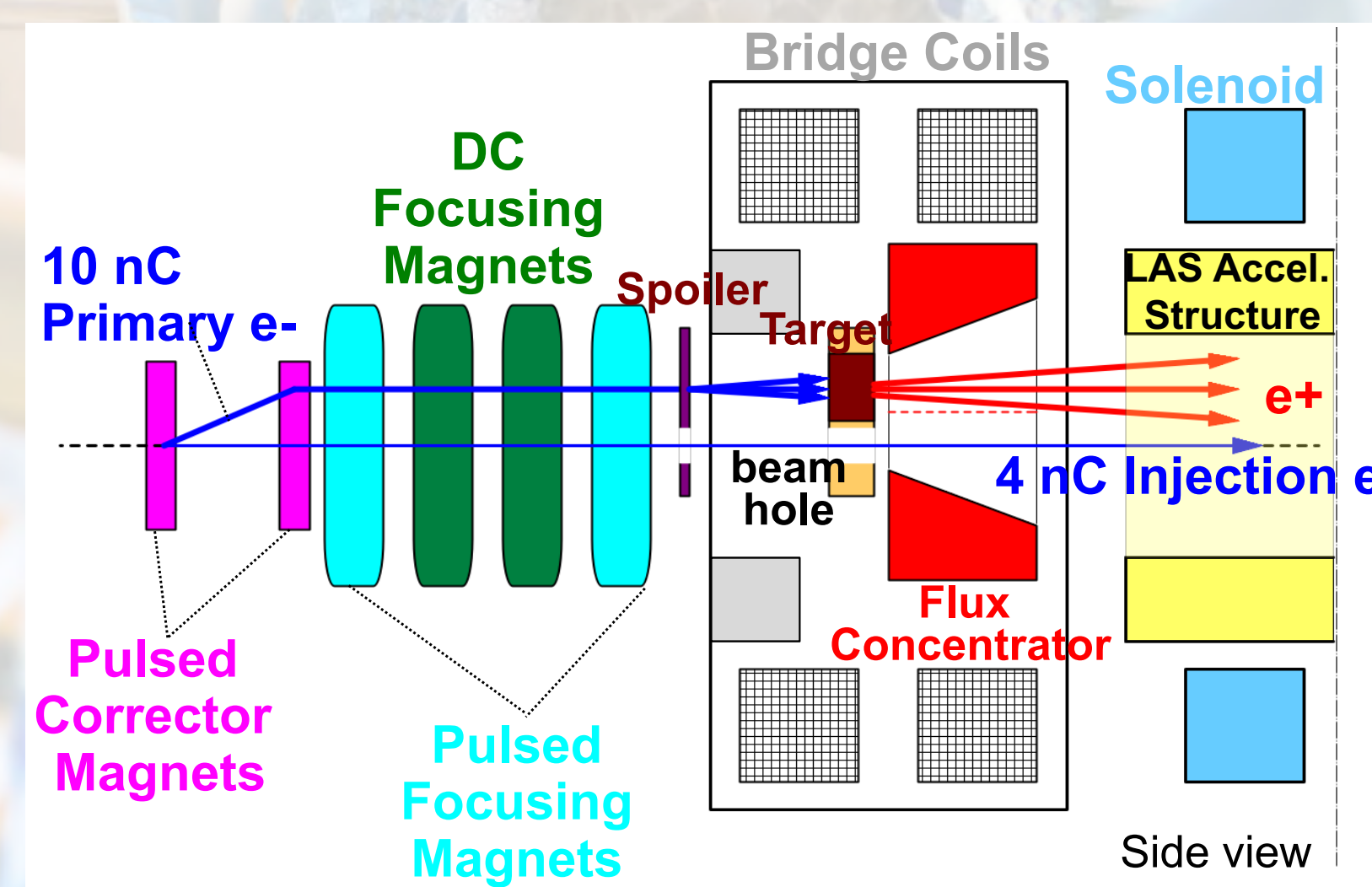
Separation of Beam Operation with Virtual Accelerator Concept



Pulsed quad deflects a beam not at the center, with a certain magnetic field parameter

It deflects a beam at the next pulse, to another direction with another magnetic field parameter, as expected

Pulse-to-pulse modulation



Conclusions

- ◆ Several considerations are necessary to make use of a single injector for different projects
- ◆ Introduction of the concept of virtual accelerators may enable multiple projects at the same time.
- ◆ Event-based synchronized and global controls, many pulsed devices such as pulsed magnets or fast monitors support such an idea.
- ◆ Online simulation environment for each virtual accelerator would further enrich the concept.