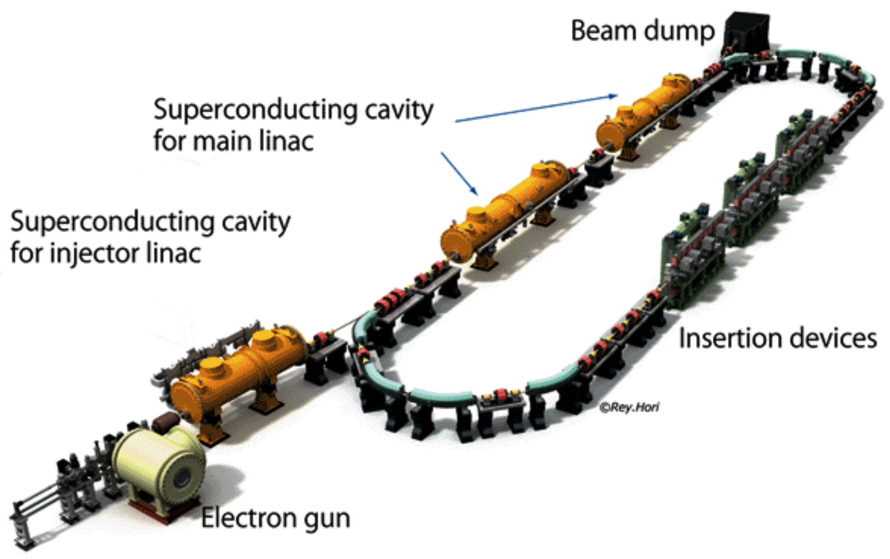
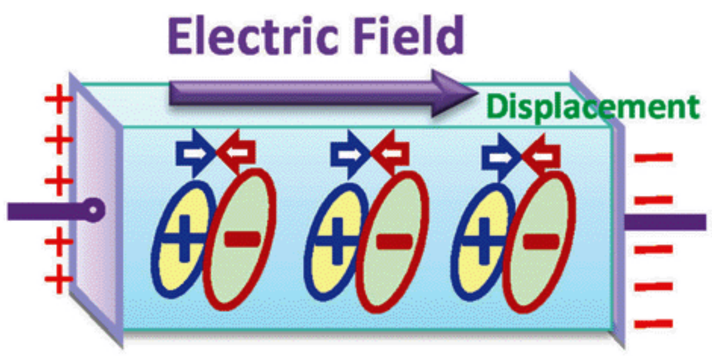
PHOTON FACTORY, IMSS, KEK



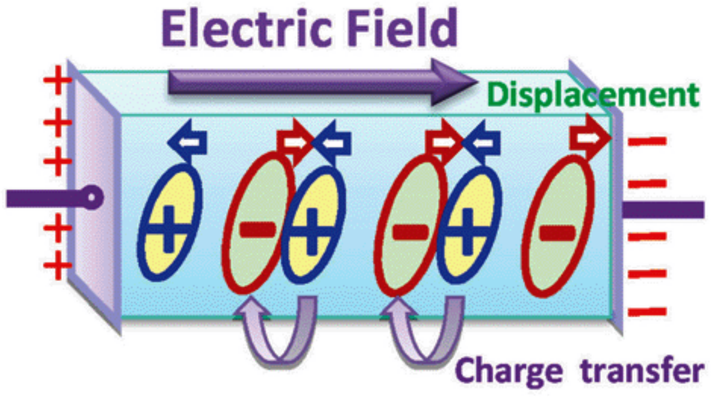
We are very pleased to deliver our facility report page in this very beautiful season. We first report on a brand-new issue, that is, the success of the electron acceleration up to 5 MeV in the compact Energy Recovery Linac (cERL). The cERL is the proto-type machine that is expected as one of the future light sources with extremely high brilliance and short pulses. We have been developing the technology required for the cERL in the collaboration with JAEA, ISSP, UVSOR, and Hiroshima and Nagoya Universities and have now reached to one of the important milestones mentioned above. One of the key technologies is a photocathode of a DC electron gun utilizing the multistage ceramic tube developed for the first time. Using this gun, we succeeded in the acceleration up to 500 keV in March 2013. This time we have guided electron beam generated from this gun into the Linac superconducting acceleration cavity and propagated it with an about 10 m distance. We have also acquired the approval from Nuclear Regulation Authority, Japan, and are now investigating the stability and emittance of the beam. We have plenty of prospect for a circulation of the beam during the operation from this fall. In the figure above, we show a design picture of the cERL. Readers who have interest are also strongly recommended to watch the conceptual movie appearing at
http://imss.kek.jp/news/2013/topics/0529cERL/egun_130528.mov

We next introduce a research outcome that has been accomplished as an in-house study mainly by two of our colleagues, Dr. K. Kobayashi and Prof. R. Kumai. In the figure below, we show a very schematic picture of ferroelectric behavior under electric field. The case of (a) will be very easily understood: a positively (negatively) charged molecule depicted by a blue (red) oval moves toward the negative (positive) electrode. This just obeys our common sense. However, in a ferroelectric molecular compound that is often shortened as TTF-CA, a completely opposite behavior as shown in (b) was observed by a careful measurement of X-ray diffraction. It is very interesting that even the researchers who have been studying this famous material intensively have not anticipated such abnormal behavior. Furthermore, the origin of this behavior is attributable to the charge (electron) inter-molecular transfer depicted by gray arrows, which origin really reveals a hidden nature of this material, that is, an electronic ferroelectricity. Readers who want to know more about the scientific details are encouraged to see Phys. Rev. Lett. 108, 237601 (2012).

(a) Conventional ferroelectrics



(b) TTF-CA



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