WG-5 Beam Loss and Machine Protection

Dmitry Kayran, BNL

Kevin Jordan (JALB)

Charge/Agenda:

Energy recovery linacs have the potential to carry highly focused electron beams with average currents that were previously the exclusive domain of storage rings. They have already reached average beam powers in the MW range, and the GW level seems to be in reach of the latest proposals. But in contrast to storage rings, ERLs have the characteristics of linacs —there is no damping and no equilibrium condition, so the parameters of each bunch are the direct result of all accelerator systems it was exposed to. On the one hand, this increases the stability requirements for many, most notably for RF, subsystems. On the other hand, beam losses become inherently harder to control. The energy recovery process itself adds to the problem.

For beams in the megawatt range, the loss even of tiny fractions of the transported charge can have grave consequences; among them are direct thermal damage of vacuum components, activation of materials, demagnetization of permanent magnets, and other types of radiation damage in the vicinity of the beamline. Therefore it is clear that high power ERLs need to be protected by active machine protection systems.

The working group will address beam loss and machine protection related issues with an emphasis on the following key points:

- **Status reports**
  Status reports on machine protection and related operational experience ("lessons learned") from ERLs, high power linacs and storage rings

- **Beam loss scenarios**
  Discussion on beam loss scenarios in ERLs: Where and why are permanent , intermittent, single-time losses to be expected? Which scenarios are avoidable, which are not? Which ones are specific to ERLs?
  (Notes: Dark current, influence of beam losses on the energy recovery and vice versa)

- **Diagnostics and controls (joint session with WG4)**
  Reports on developments in beam loss/halo diagnostics, machine protection systems, and radiation measurements

- **Beam loss tolerances**
  Simulations, measurements, and experience on beam loss tolerances for average/single time losses; discussion on limiting criteria (activation, radiation damage, mechanical damage, quenches)

- **Halo formation and beam dynamics (joint session with WG2)**
  Discussion on mechanisms of halo formation, beam loss simulations, Touschek/intrabeam scattering, CSR, ion trapping, ...

- **Collimation**
  Collimation schemes for high power ERLs
  (Notes: Does collimation at low energy help? How to deal with the high energy spread after energy recovery?)

- **Insertion devices**
  Discussion on beam loss tolerances, demagnetization studies, protection strategies
  (Note: in-vacuum undulators)