Impact of $PEP$ II higher luminosity on IFR performances

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Upper limit on local hit rate

• Limits set by electronics:
  – strip signal held in FEC for 12.5 µs (dead time)
  ⇒ max rate = 80 kHz/strip (~30 Hz/cm²).

• Limits set by the streamer mechanism:
  – very dependent on the local properties of RPC materials and operating point: presumably somewhat lower than the electronics limit.

• (Quasi-) permanent damage:
  – medium-term degradation is also likely to start at similar values.
Fwd Endcap: rates at current luminosity

$L \approx 4 \times 10^{33} \text{ cm}^{-2}\text{s}^{-1}$

$\sim 10 \text{ Hz/cm}^2$

- Overall rates in external layers (esp. 18) differ by more than an order of magnitude from those of the internal ones.
- Main source of hits in external layers is seen to come from beam-related bkg; layers < 15 mainly see IP events.
Fwd Endcap: bkg hit distribution

- Beam bkg associated to HER only affects layer 18; bkg associated to LER extends down to layer 15

**HER only**

**LER only**
Background from LER collimators

- The Outer Forward Endcap Counting Rates appear to be dominated by the LER beam scraping upstream collimators.
- The measured singles rates are well fitted by a linear function of the beam loss monitors readings.
Background from LER collimators (cont’d)

- Counts from the beam loss monitors show a quadratic dependence on the LER current
  ⇒ singles rates for the outer layers depend approximately quadratically on the LER current.

- Should this still hold after the upgrade, this would imply almost a factor 10 in rates, making layer 18 unusable and impairing portions of layer 17 ⇒ better shielding looks mandatory.
Rates in inner layers grow linearly with luminosity. A factor 10 increase should bring average rates to ~10 Hz/cm². However…
Inner layers hit distribution in endcaps

- Hits in endcaps inner layers (both Fwd and Bwd) are largely accumulated closest to the beam pipe. Maximum values are now around 1.5 - 2 kHz/strip, or ~5 Hz/cm². So there we are going to run into troubles sooner.
Barrel modules

- Singles rates for barrel RPCs also show a linear dependence with the luminosity, for values in the current range.
- The slope of the fitted straight line is higher for layers closer to the beam pipe; it gets essentially flat for outer layers, except for layer 18, where positive slopes are seen again.
• Maximum slopes per module (inner layers) are \(\sim 1.5\text{kHz}/10^{33}\text{cm}^{-2}\text{s}^{-1}\). This projects to \(\sim 60\text{ kHz/module}\) at \(L = 4 \times 10^{34}\text{ cm}^{-2}\text{s}^{-1}\), or \(\sim 3\text{ kHz/cm}^2\).

• So, assuming no big non-uniformities, this should be no concern.
Summary

- Outer modules of Forward Endcaps already suffer seriously from beam (mainly LER) background. Better shielding will be necessary in order not to lose functionality not only of layer 18, but of nearby layers as well.

- Inner layers of both endcaps are probably going to run into problems in the region closest to the beam pipe. This may be an irreducible, or hard to fight, effect (physics-related).

- Barrel is probably going to be fine (so to say…).