Electron Cloud

Contacted Jie Wei for electron cloud at SNS:

- 3 places of major e^- sources: (1) injection area [stripping foil]; (2) collimator, (3) 1-pass multipacting everywhere
- (1) injection area likely neutralized; clearing electrodes and monitoring system
- (2) collimators: estimate that 0.2% of beam hits collimators; $\rightarrow$ 100% neutralization in the simulation by Furman/Pivi; clearing electrodes not possible near collimators; specific solenoids are designed for this area
- (3) overall; TiN coating to reduce SEY from 2 to <1.5.

Electron Cloud II

Two meetings:

- 06.02.2003 Chris Benvenuti, Paolo Chigiatti, Adriana Rossi, FZ; pressure became a concern for experiments, update outgassing rates, beam pumping and pumping by electron cloud (!) should be included in pressure calculations; outgassing as function of electron energy, effect of activation cycles etc. wll be measured; low-energy reflection on getter may be of interest.
- 06.02.2003 GA, WH, FC, MJ, FR, JT, FA; position of rf buttons decided; BA2 and BA3 near start of bends (QF31410 and BPV22176); possibly additional data from Schottky monitor

ECLOUD Code

new web page:
http://www.cern.ch/proj-ecloud-code

- source code, examples, list of bugs
- versions 0.0, (1.0,) 2.0 are posted
- documentation
- need to avoid branches!?

informed users at BNL, GSI, CERN, DESY, IHEP, INFN, RAL, and TJNAF

(several plan to visit CERN)

Collimator Geometric Impedance

untapered collimator:

- K.L.F. Bane and P.L. Morton, "Deflection by the Image Current and Charges of a Beam scraper," Proc. 1986 Linac Accelerator Conference, Stanford, CA, SLAC-PUB-3983 (1986).
- F. Zimmermann, K.L.F. Bane, C. Ng, "Collimator Wake Fields in the SLC Final Focus," EPAC96, Sitges, Barcelona, SLAC-PUB-7137 (1996).

tapered collimator:

- K. Yokoya, **"Impedance of Slowly Tapered Sructures,"** CERN SL/90-88 (AP) (1990).
- G. Stupakov, **"Geometrical Wake of a Smooth Taper,"** SLAC-PUB-95-7086 (1995).
- G. Stupakov, **"Geometrical Wake of a Smooth Flat Collimator,"** SLAC-PUB-7167 (1996).

Condition of *shallow* taper:

$$kb\theta \ll 1 \quad \text{or} \quad b\theta/\sigma_z \ll 1 \; . \tag{1}$$

Wake of round collimator:

$$\Delta y_t'(s) = y_s(s) \frac{N_b r_p}{\gamma} \frac{4\theta}{b} \frac{e^{-s^2/(2\sigma_z^2)}}{\sqrt{2\pi}\sigma_z} \; . \tag{2}$$

If $y_s = 0$: no wake! If $y_s = 1\sigma_y$: relative growth $\Delta'_{y_{\rm rms}}/\sigma_{y'}$ by 5×10^{-6} per turn (for $b = 2$ mm, $\theta = 0.35$, $N \approx 10^{11}$, $\beta = 200$ m, and $\sigma_z = 7$ cm)

Wake for flat vertical collimator:

$$\Delta y_t'(s) = \frac{N_b r_p}{\gamma} \left(\frac{4\theta}{b} y_s(s) - \frac{4\theta}{b} y_t + \frac{2\pi\theta h}{b^2} y_t \right) \frac{e^{-s^2/(2\sigma_z^2)}}{\sqrt{2\pi}\sigma_z} \; . \tag{3}$$

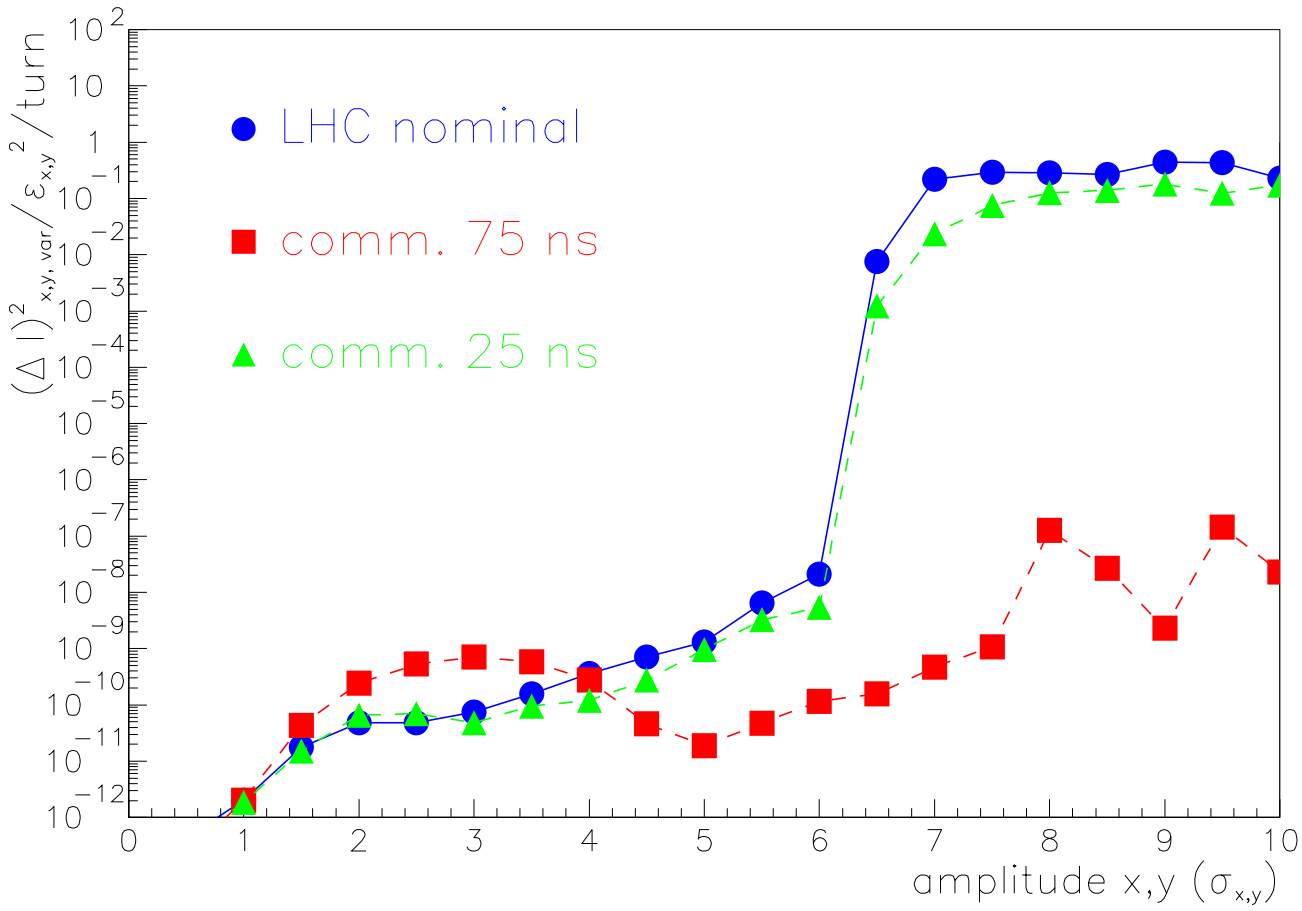
If $y_s = 0$: there is still a wake! Also there is a large term proportional to horizontal half width h.

Outlook

Elena Benedettto has implemented this wake in HEADTAIL code; will perform multi-turn simulation to quantify emittance growth including synchrotron motion and chromatcity

To my knowledge such studies of incoherent emittance growth due to collimator wake fields have never been performed for any storage ring.

Resistive quadrupole wake could be even larger than the geometric quadrupole wake! It should be included in future studies.



Diffusion rates due to Long-Range Collisions for nominal LHC parameters and 2 commissioning scenarios