Collimation, materials, failure modes

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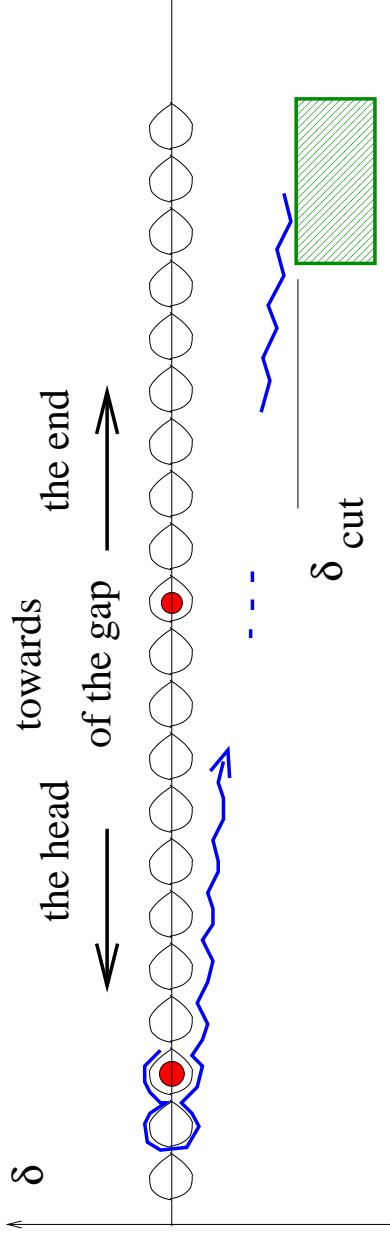
Coll. WG, May 30, 2003

`/Text/LHC/2003/coll_may/coll_may.tex`

OUTLINE

- Momentum cleaning
- Transfer line failure
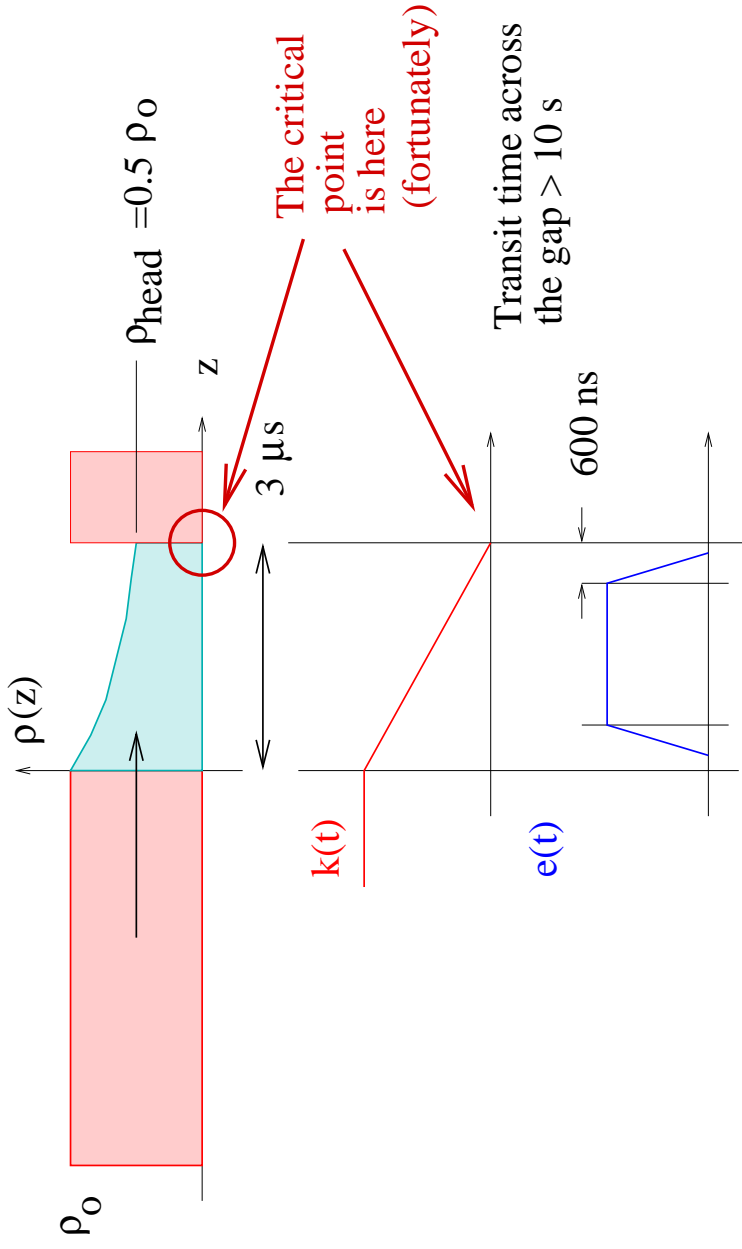- Flash-over of MKI
- C/Be baseline option

Abort gap population - I

the head towards the end
of the gap

δ

δ_{cut}

- Compute the flux for $(z_{gap} - z_{bunch})$, then $\dot{z}_{gap}$ and ρ_{gap}

- Sum over all bunches
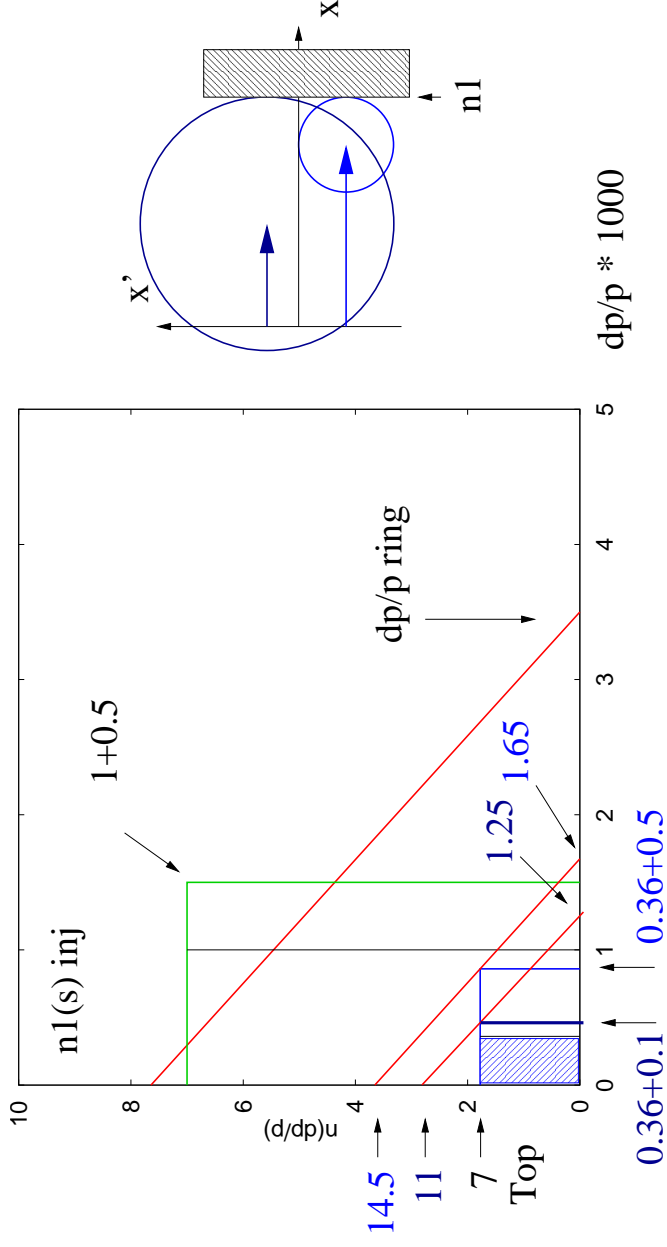
- Numeric integration needed (longitudinal motion with RF)

Paper in preparation (E. Chapochnikova, S. Fartoukh and B.J.)

Abort gap population - II

$\rho_{\mathrm{head}} = 0.5\ \rho_{\mathrm{o}}$

ρ_{o}

$\rho(z)$

z

The critical point is here (fortunately)

3 μs

Transit time across the gap > 10 s

600 ns

k(t)

e(t)

With $\tau_{\mathrm{long}} = 10$ hours, $\rho_{\mathrm{head}} = 1.2 \times 10^7$ p/m $= 4\rho_{\mathrm{tol-MQY}}$

Available damper power believed to be sufficient (W. Hofle)

$\rho \propto \delta_{\mathrm{cut}} \to \delta_{\mathrm{cut}}$ adjustable (data for 10^{-3})

Momentum cut at top energy

n1(s) inj

1+0.5

dp/p ring

1.25   1.65

0.36+0.5

0.36+0.1

14.5
11
7
Top

n(d/dp)

dp/p * 1000

x

n1

x'

Abort gap cleaning is the most demanding case for δ_{cut}

$\Rightarrow$ At top energy : Minimum $n_1 = 11$

Momentum Cleaning out of MKD failures

Transfer line failure - I

- Full batch at a single amplitude to be considered ?

- Explicit case must be exhibited

- If yes : DO NOT EXPORT TL PROBLEMS TO THE RING

- Consider improved TL collimation

CWG

Transfer line failure - II

Amplitude cut

A = 7.05

A = 5.4

x'

x

5
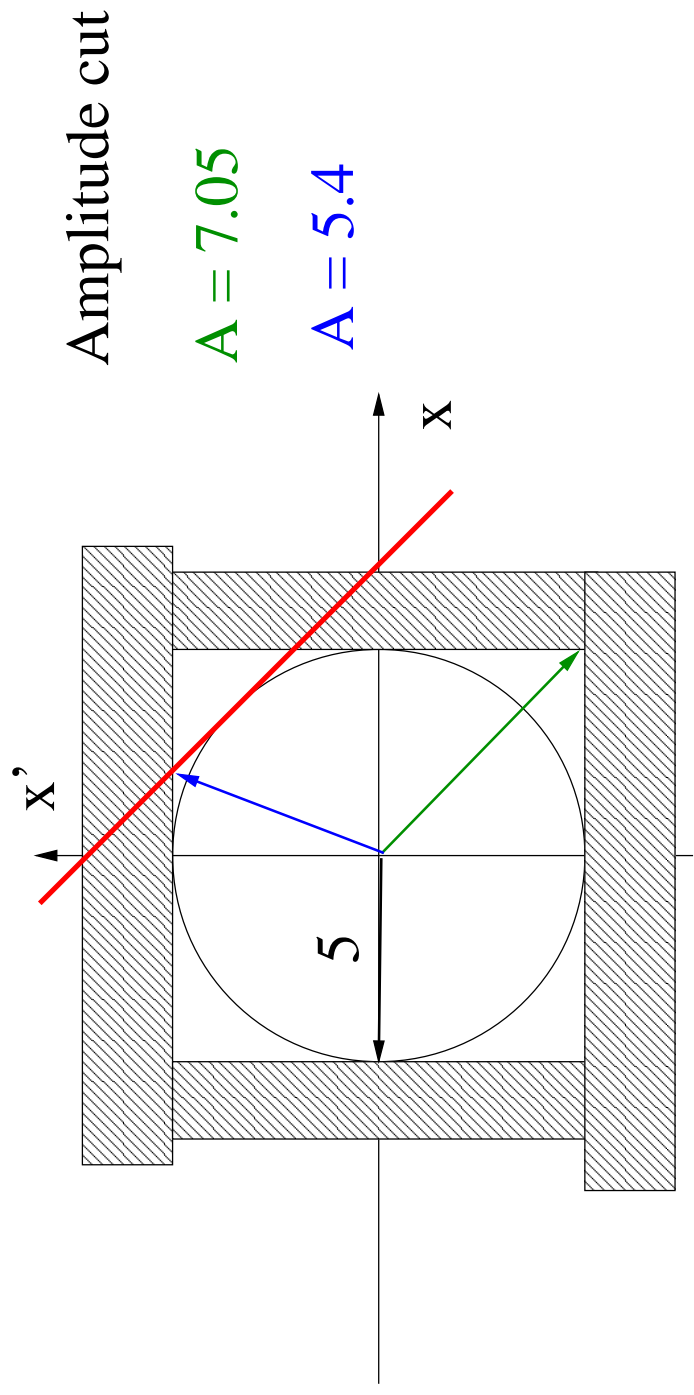
Check UTS limit of BE and C to injection bunches

Adapt the length of the 45° TL-Coll to the need

JBJ, Collimation, materials, failure modes

Transfer line failure - III

MKI 'Flash-over' mode:

- Is it cured ?

- If not, is the harmful beam stricktly at constant amplitude?

- When would we know if cured or not?

My favoured baseline

Provided that 45 GeV MKI 'Flash-over' can be cured

Assuming that TL-Collimation is adequately improved (no export)

- Graphite for betatronic H-collimators
  (on the way of mis-kicked bunches, $\sim$ 1/3 of them)

- All the others (included momentum coll.) : berylium

- Reconsider the second set of skewed β_{coll}
  (3x(1+4) = 15   vs.   4x(1+4) = 20)

- With β_{coll} at $6 - 7\sigma$ and p_{coll} at 11
  the impedance cannot be so wrong with C/Be

- Tertiary jaws at exp. useful, but not mandatory

My favoured baseline - II

- **Keep with 'few' jaws:**

  – Budget not exceeded

  – Easier operation + maintenance

- **C/Be : allows operation at $n_1 = 6/7\sigma$ at 7 Tev**

  – No loss of performance

  – Less activation of the tanks and nearby materials

  – Less thermal deformation