Modified C5b collimator with integrated ion getter pump for H1

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- C5b
- Present problems
- New design
- Calculations

C5b now

- Synchrotron radiation collimator C5b placed at $z = -1.46$ m inside the H1 beam pipe.

- Shielding the central beam pipe against backscattered radiation from -11, -19, and -26 m.

- Elliptical 'keyhole' shape, not tapered.

- $d = 2$ cm W (5.7 X_0, 0.2 λ_I, $m = 1.3$ kg).

- Coated with 0.5 mm Ag, 0.2 mm Cu.

- Not water cooled.

- Integrated in the transition between the central H1 beam pipe and the GG magnet, with flanges, a bellow, and beam position monitors.

- Aligned with H1, low by 5–6 mm w.r.t. HERA beams.

New C5b design

- Thickness can be reduced to 5 mm:
  - Reduction factor for X-rays is still 10^{-4}.
  - Increase outer radius to protect silicon detector. $m_W = 1.3$ kg.

- Add taper to reduce higher order mode heating.
- Place outside of stainless steel beam pipe.
- Add water cooling.
- Add an integrated ion getter pump.
- Keep bellow, beam position monitors.
- Vertical adjustment to compensate H1-HERA misalignment?

Synchrotron radiation shielding

- Fe taper with W core instead of optimally coated Cu-Ag-W absorber increases the local backscattering by a factor 2.4.
- However, this is outside of the Silicon detector and Central Jet Chamber.
- The Backward Proportional Chamber gets 4 mm Pb shielding.
- A vertical shift of the C5b collimator opening by 1–2 mm to compensate the H1 misalignment is possible.
- A vertical shift of 5–6 mm for full compensation is too risky, as 'sneak-through' paths open up.

Higher order mode calculation

- e-beam wake field calculation with MAFIA T3 by M. Marx, MPY.
- Single pass power loss for $I_e = 60\,\text{mA}$ ($\sim I_e^2$).
- Depends on bunch length $\sim 1/\sigma_z^2$ and beam position.

	now	new	improvement
$e^- \ \sigma_z = 4\,\text{mm}$	550 W	430 W	21%
$e^- \ \sigma_z = 12\,\text{mm}$	71 W	49 W	31%
$e^+ \ \sigma_z = 4\,\text{mm}$	650 W	550 W	15%
$e^+ \ \sigma_z = 12\,\text{mm}$	76 W	56 W	26%

- More reduction requires longer taper: $\pm 10\,\text{cm}$. Space not available.
- Calculation of absorbed power distribution in progress.
- Temperature profile modeling: large finite element calculation.

Integrated Ion Getter Pump

- Design (and unused parts) taken from H1 at HERA-I.
- 825 cells in 5 planes, diameter 5 mm in 1.16 T solenoid field.
- Nominal pumping speed is 800 l/s for N_2.
- Pressure profile calculated for Feb 2003 pump readings and with additional IGP at $z = -1.55$ m assuming 400 l/s by M.Hoffmann, MPY.
- Reduces the pressure in the GG section.
- p-gas event rate triggered in the central drift chamber is reduced by 1/3.

Summary

Proposed tapered C5b collimator with integrated ion getter pump:

- Taper reduces HOM losses by 20–30%
- Beam pipe heating at injection will be reduced by water cooling.
- IGP reduces the pressure in the cold GG beam pipe section.
- 3-D design is ready, vertical adjustment to be reduced to 1–2 mm.
- Production drawings in progress.
- Needed ready and tested for installation on 4.6.2003.