Alternative layout of the IR region

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IR brainstorming meeting

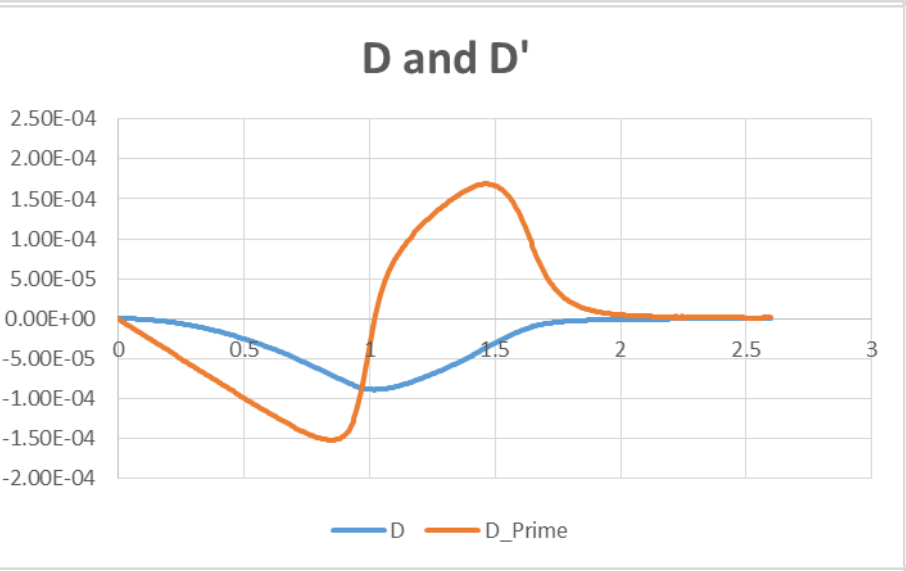
Wrednesday, 16/3/2016

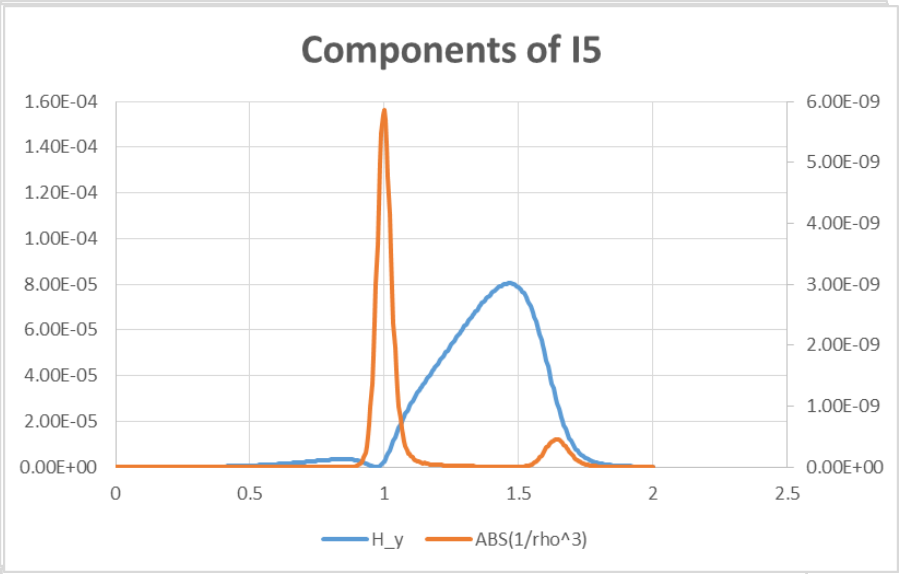
The problem

- Emittance blow up is a steeply varying function of magnetic fields and dispersion
- Moving elements by a few centimetres is enough to change the emittance blow up by factors of 2 or more.

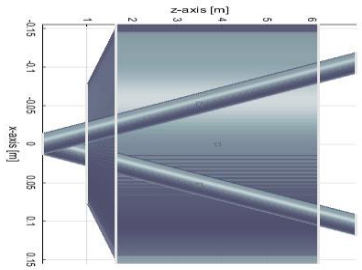
Presented baseline

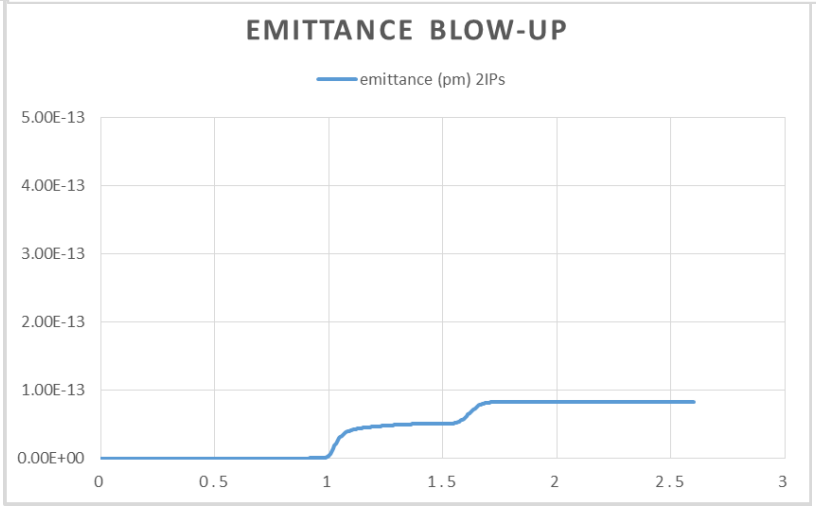
Presented baseline, 100mrad cone, solenoids start at 1.0m





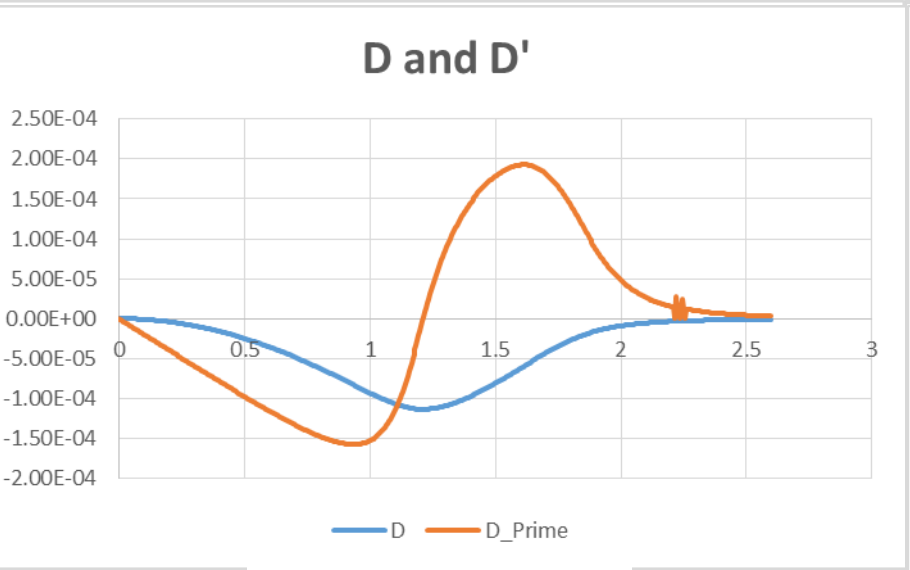
31cm

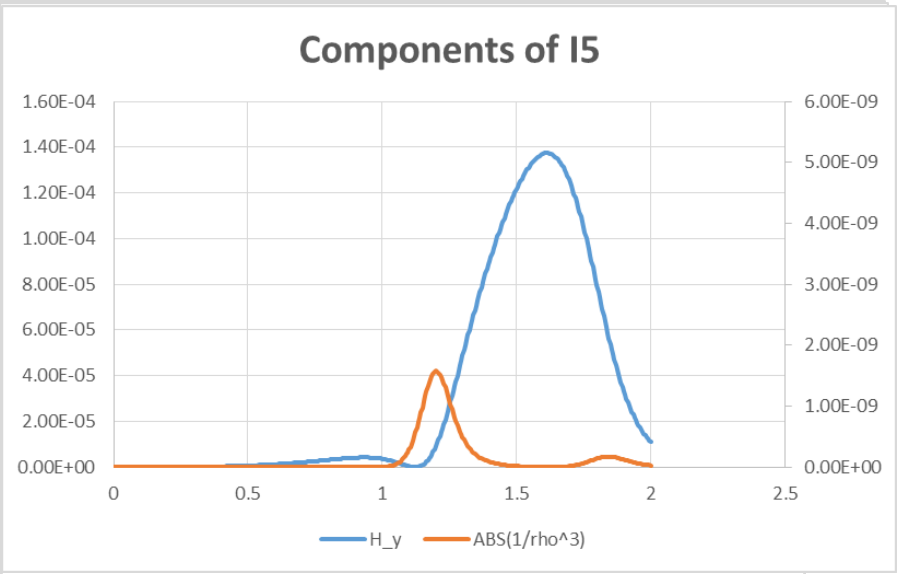




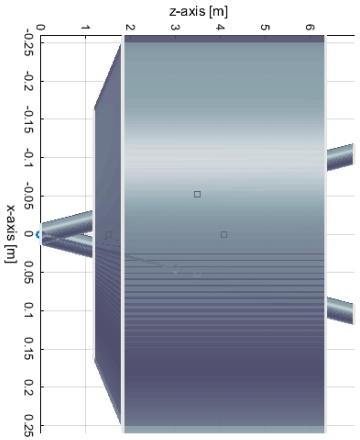
50%
of budget

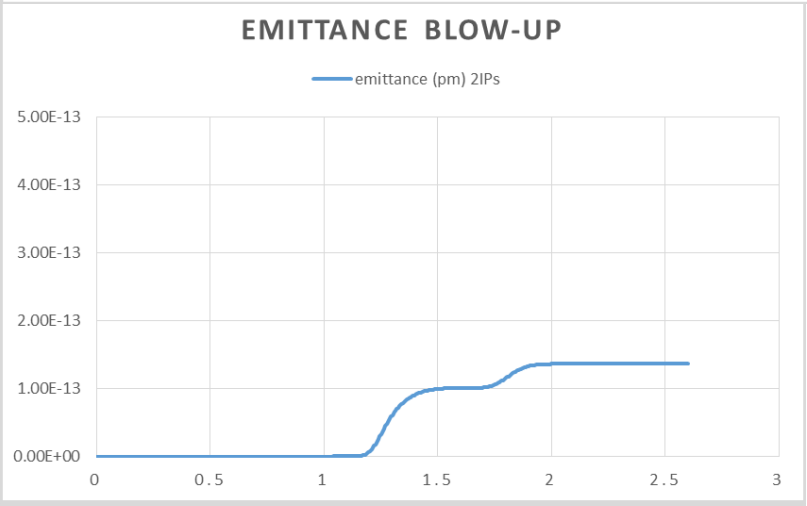
New proposal, 140mrad cone, solenoids start at 1.2m





52cm





50%
of budget

EXTRA SLIDES

Emittance blow up

More important at low energies!

Some formulas:

- Vertical emittance blow up at the IP:

$$\Delta\epsilon_{y,IP} = 3.83 \times 10^{-13} \frac{\gamma^2}{J_y} \frac{I_{5,IP}}{I_2}$$

- $I_2 \cong \frac{2\pi}{|\rho_{bend}|}$ (for ρ=11km, $I_2 = 0.00057$), $J_y = 1$
- $I_{5,IP} = \int \frac{\mathcal{H}_y(s)}{|\rho|^3} ds$
- $\mathcal{H}_y(s) = \beta {D'_y}^2 + 2\alpha D_y D'_y + \gamma {D_y}^2$, D is the dispersion

where $\alpha(s) = -\frac{1}{2}\beta'(s)$; $\gamma(s) = \frac{1+\alpha(s)^2}{\beta(s)}$

- Vertical dispersion is simply the beam offset in y:

$$D(s) = -y(s)$$