



***Flexibility of the Low Power option
regarding the pair background in the
microvertex detector at 4T***

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***Does the low power option
allow a 15mm radius beam pipe ?***

***Does a 15mm radius beam pipe
allow the low Power option?***

Where does the Low Power option come from ?

$$\mathcal{L} \propto \frac{\eta P \sqrt{\delta_B}}{E_{CM} \sqrt{\epsilon_{yN}}}$$

η : efficiency

P : power used

δ_B : energy loss by Beamstrahlung

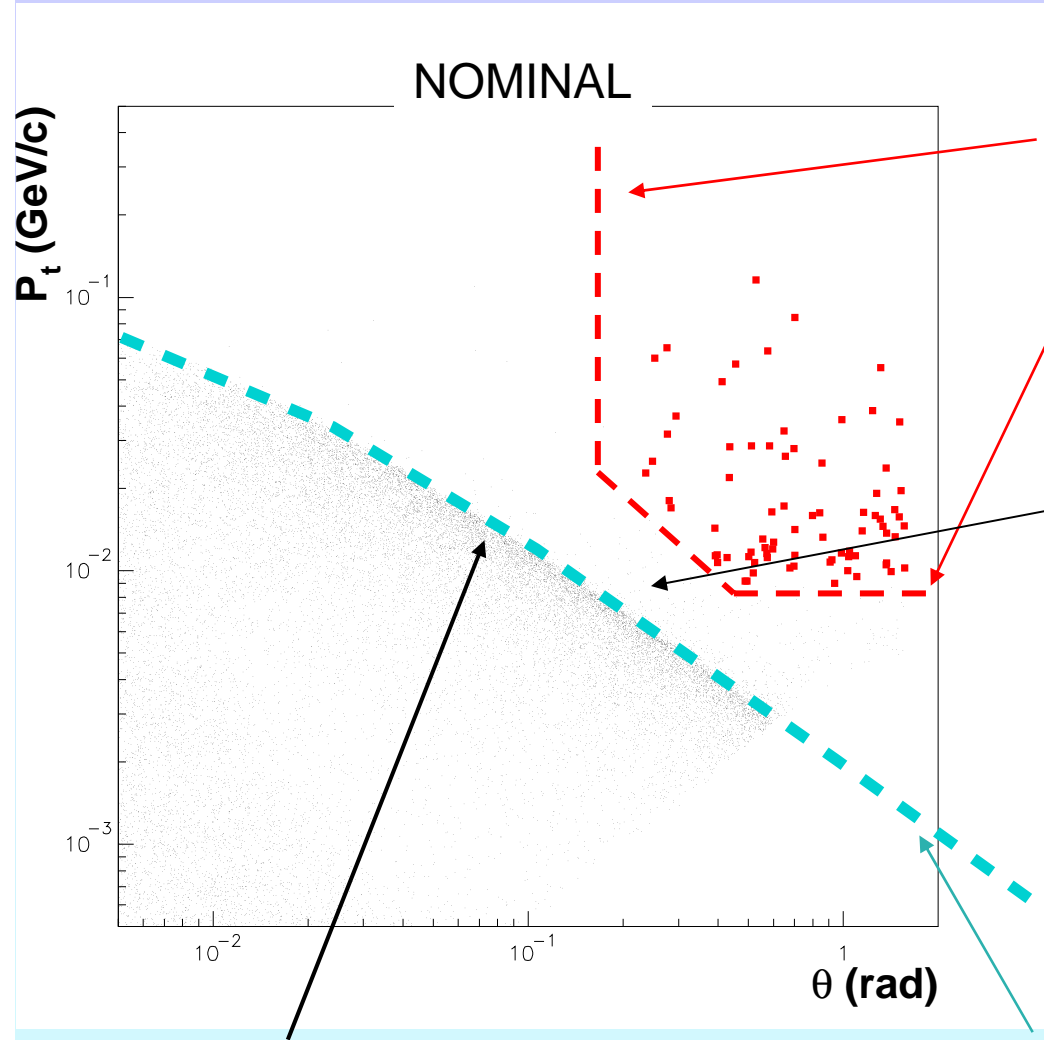
ϵ_{yN} : normalized emittance

E_{CM} : center of mass energy

$$\delta_B \approx \frac{N^2 E}{\sigma_z \sigma_x^2}$$

at 500 GeV	Nominal	Low P
N	2 10 ¹⁰	2 10 ¹⁰
bunches/train	2820	1330
σ_x [nm]	655	452
σ_y [nm]	5.7	3.8
σ_z [μ m]	300	200
ϵ_{xN} [m.rad]	1.0 E-5	1.0 E-5
ϵ_{yN} [m.rad]	4.0 E-8	3.5 E-8
β_x [mm]	21.0	10.0
β_y [mm]	0.4	0.2
δ_B	0.02	0.06
Luminosity [10 ³⁴ cm ⁻² s ⁻¹]	2.0	2.1

The pairs, the microVertexDetector and the deflection limit



VD acceptance depends on B, r_0, l
LDC : $r_0 = 15\text{mm}, l = 10\text{cm}, B = 4\text{T}$

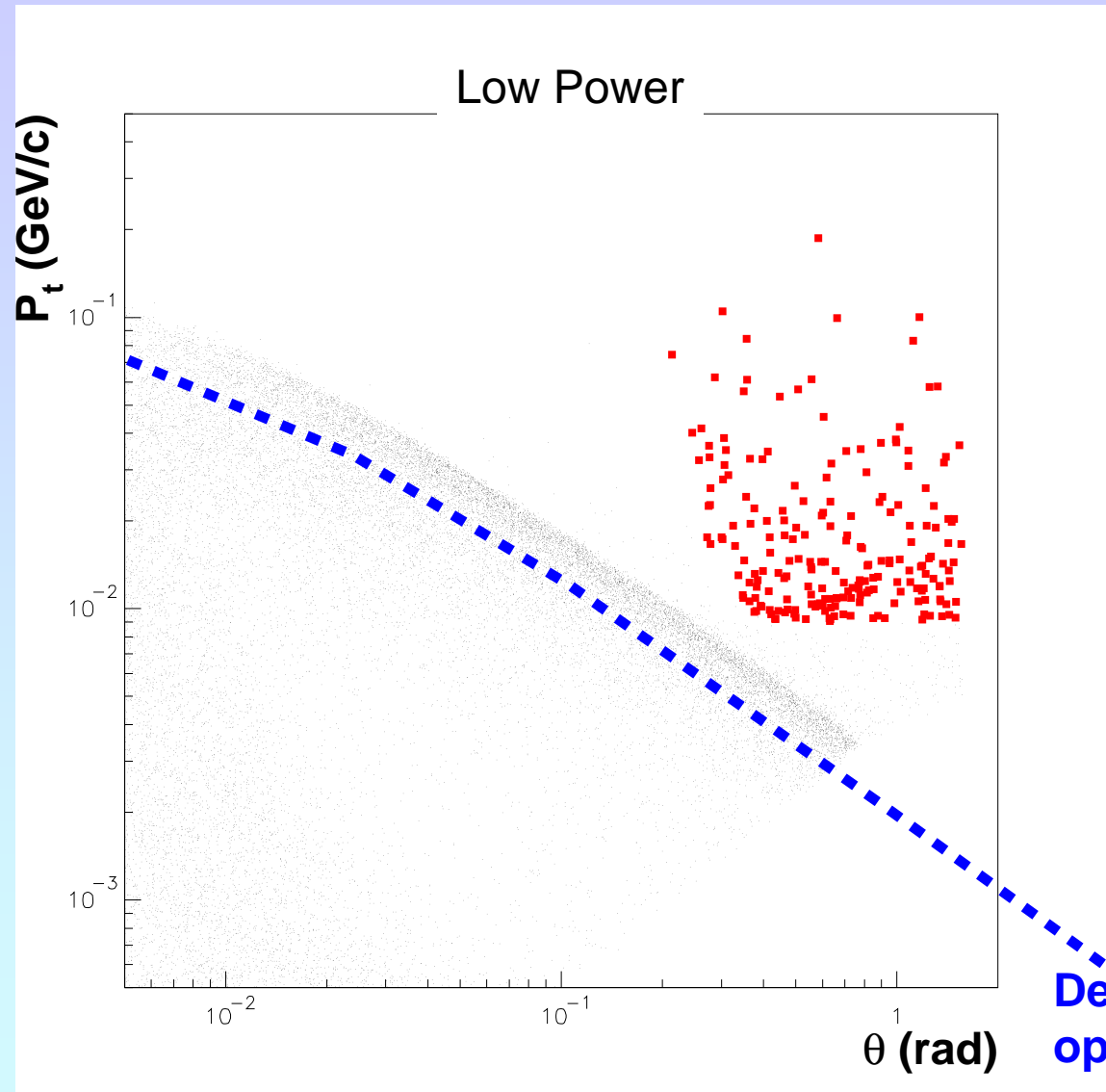
Safety Margin

**What happens
with Low Power option ?**

Pair accumulation zone

Deflection angle limit depends on
beam parameters σ_x, σ_z, N

Low Power option and pair background

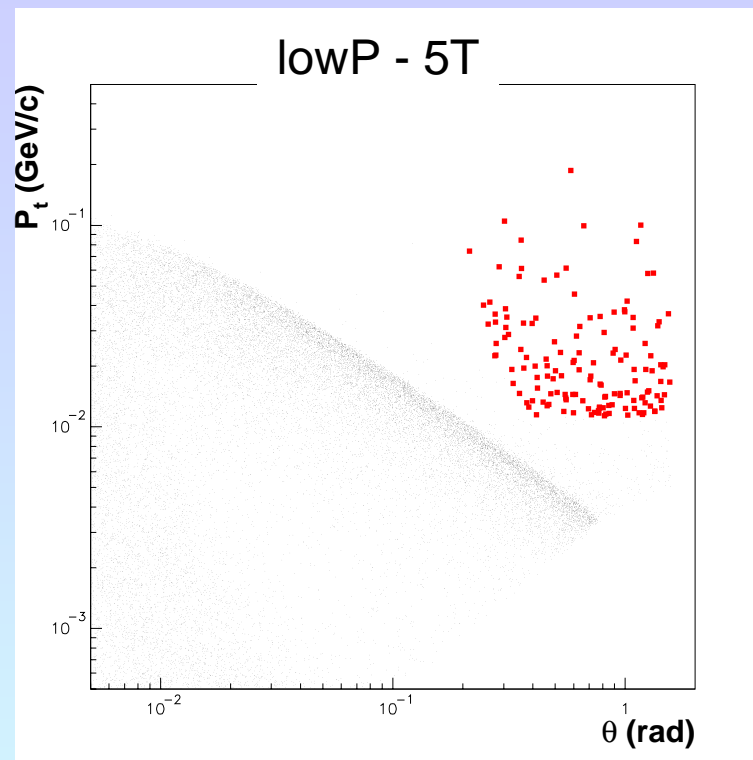
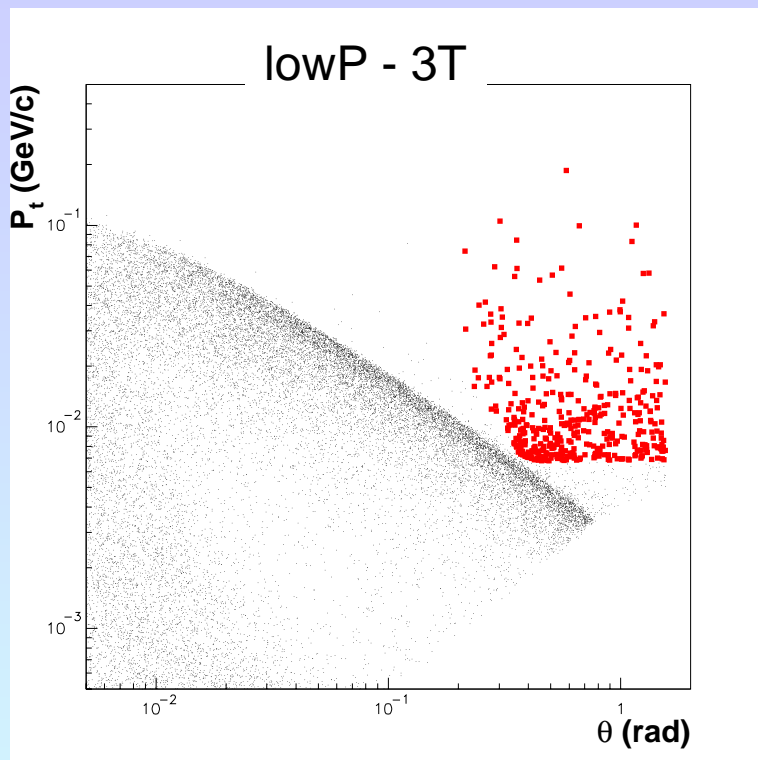


Safety margin
half reduced !

Is it a problem ?

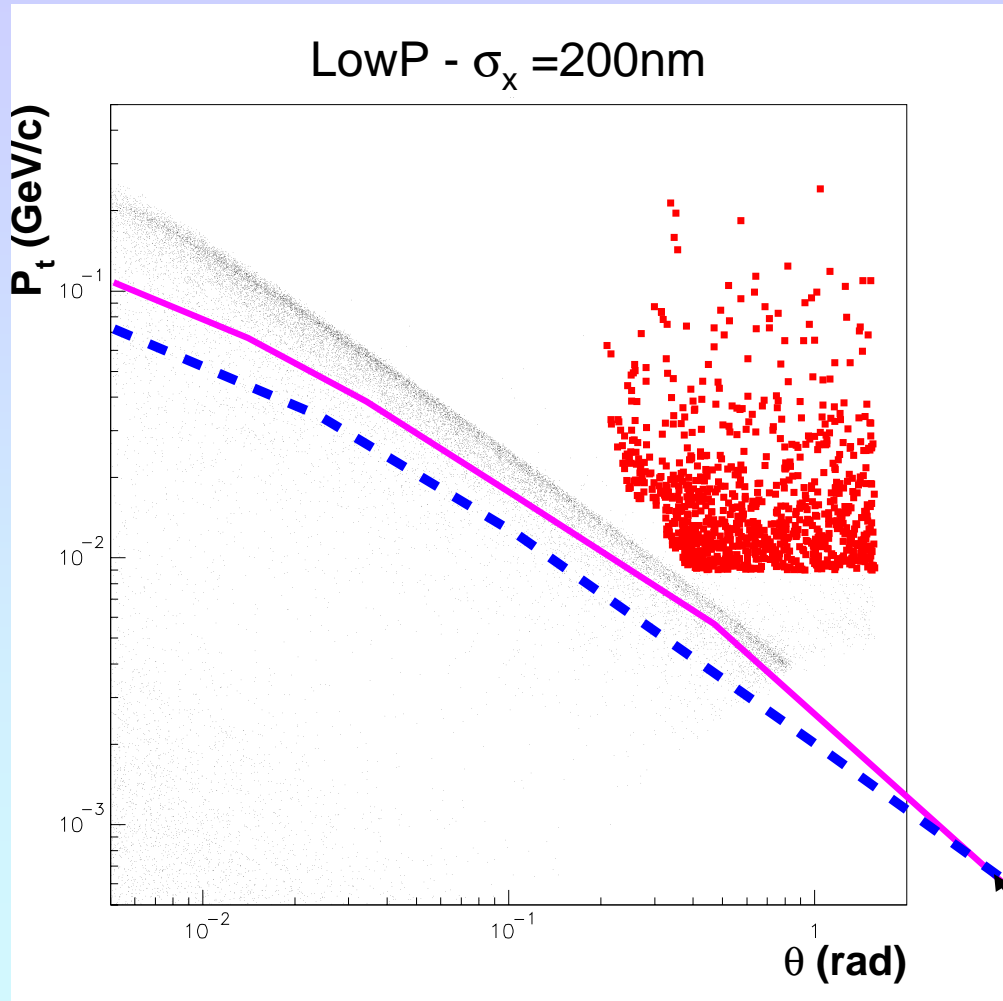
Deflection limit for Nominal
option

Remarks -1



3T Design : not possible to use 15mm radius beam pipe
5T Design : no problem to use 15mm radius beam pipe

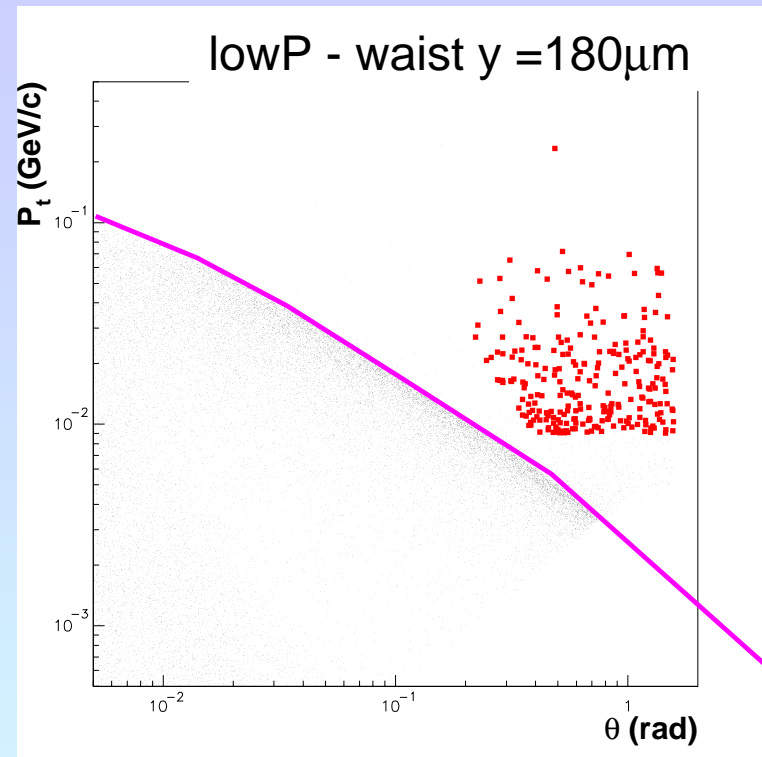
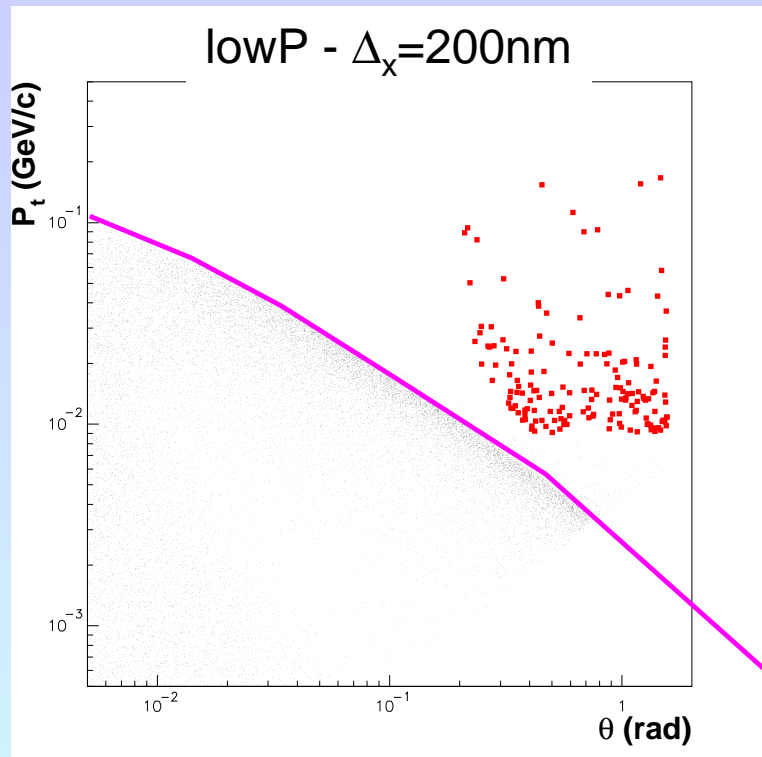
How much could beam parameters be changed individually before reaching the pair accumulation zone ?



	Low P	Nominal
$\sigma_{x\text{min}}$ [nm]	< 200 -60%	<200 -70%
$\sigma_{z\text{min}}$ [μm]	120 -40%	100 -66%
N_{max} [10^{10}]	2.9 +45%	>3

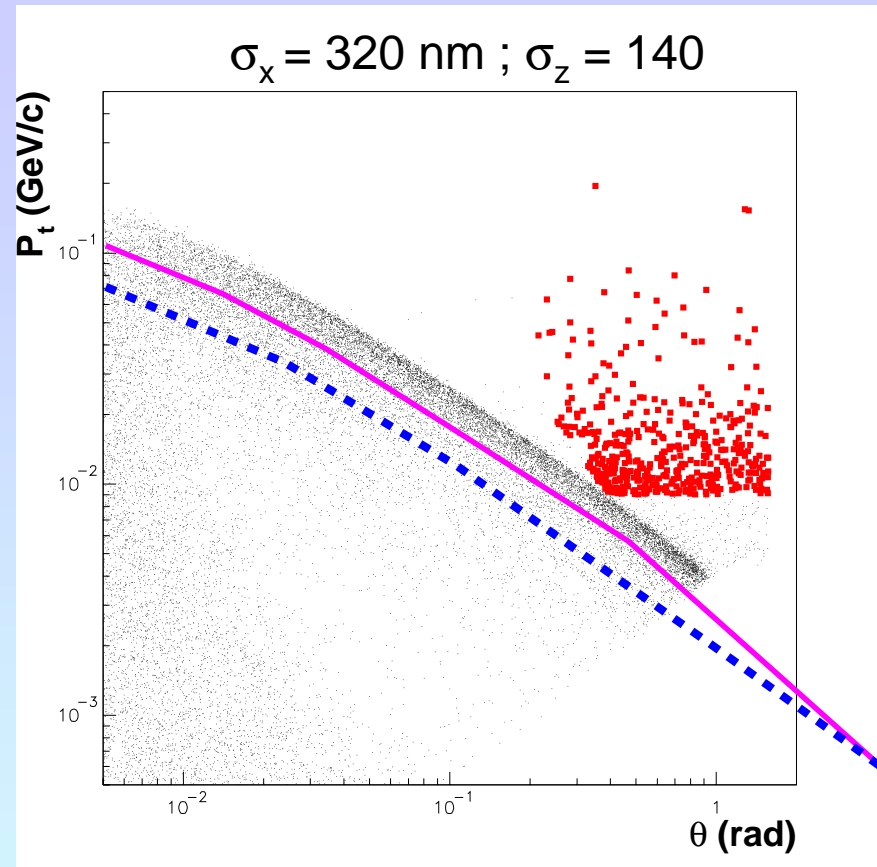
Deflection limits for **Nominal** & **LowP** options

Remarks -2



Offsets have no effect on pair deflection limit !!

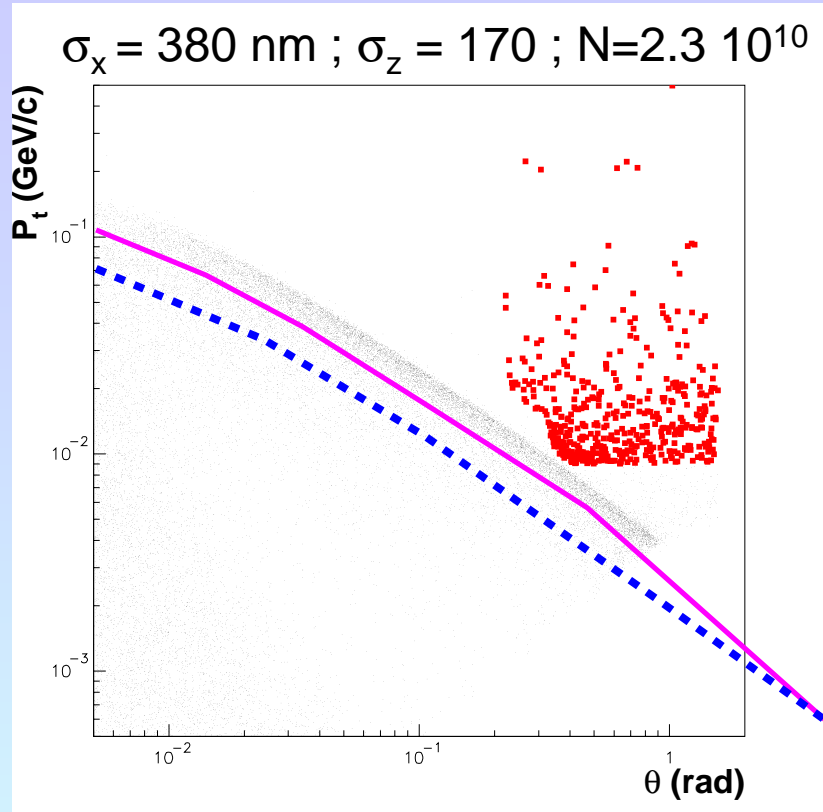
How much could beam sizes be reduced together before reaching the pair accumulation zone (for fixed intensity) ?



flexibility	Low P	Nominal
$(\sigma_{x\min} - \sigma_{x0}) / \sigma_{x0}$	-30%	-50%
$(\sigma_{z\min} - \sigma_{z0}) / \sigma_{z0}$	-30%	-50%

Deflection limits for **Nominal** & **LowP** options

How much could beam sizes and intensity be changed together to reach the pair accumulation zone for LDC?



flexibility	Low P	Nominal
$(\sigma_{x\min} - \sigma_{x0}) / \sigma_{x0}$	-15%	-40%
$(\sigma_{z\min} - \sigma_{z0}) / \sigma_{z0}$	-15%	-40%
$(N_{\max} - N_0) / N_0$	+15%	+15%

→ If LowP parameters should be used at ILC, can we safely start operation with a 15 mm radius beam pipe ?

→ If 15mm is required for physics, can we safely adopt LowP parameters ?