

How can we operate IP8 at 5 TeV ?

W. Herr, M. Meddahi, Y. Papaphilippou

Reminder:

IP8 basics:

■ At collision energy:

- Sign of effective crossing angle fixed and value different for the two spectrometer polarities
- $\beta^* \geq 2$ m for both polarities possible

■ At injection energy:

- Without angle: both polarities possible
- With angle: only one polarity at full field, other polarity requires ramping $\propto E$

■ Collisions at lower energy ?

Collisions at lower energy two cases:

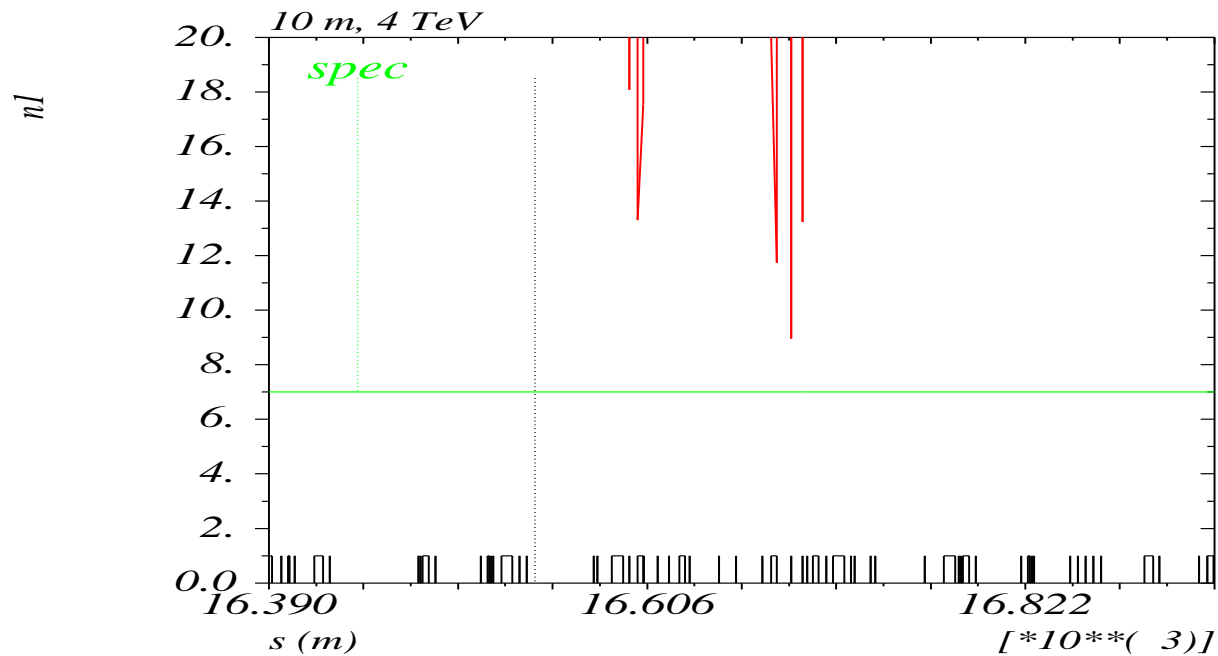
■ Without crossing angle:

- For small number of bunches
- Aperture mainly limited by $\hat{\beta}$ (collimation ?)
- Spectrometer polarity not relevant

■ With crossing angle:

- For more than 156 bunches
- Aperture mainly limited by crossing angle (and therefore β^*)
- Look at "wrong" polarity

Spectrometer(-compensator) bump (\oplus) at IP8



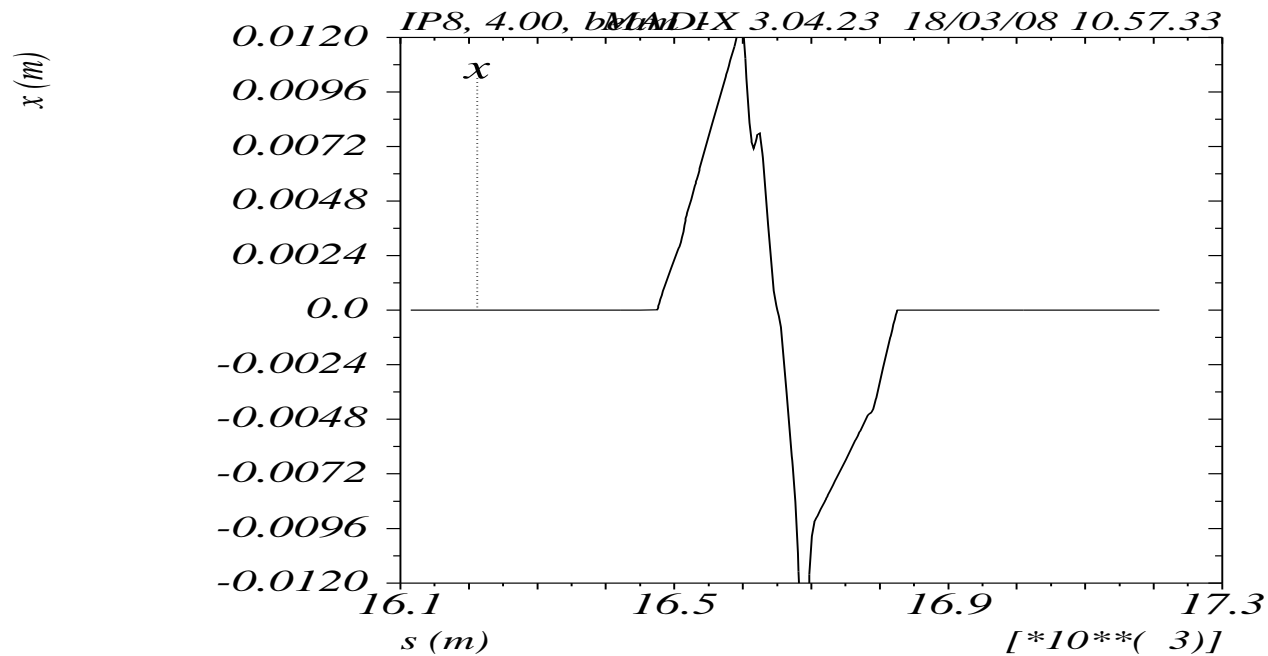
➤ Energy 4 TeV, $\beta^* = 10$ m

➤ ”Wrong” polarity, external angle ∓ 330 μ rad

Options:

- Most likely energy: 5 TeV
- Study only "wrong" polarity
 - It is of course possible with $\beta^* = 10$ m
 - Which is the smallest β^* ?
 - Find maximum possible crossing angle (compatible with aperture)
 - Does it provide sufficient separation (assume 25 ns spacing) ?

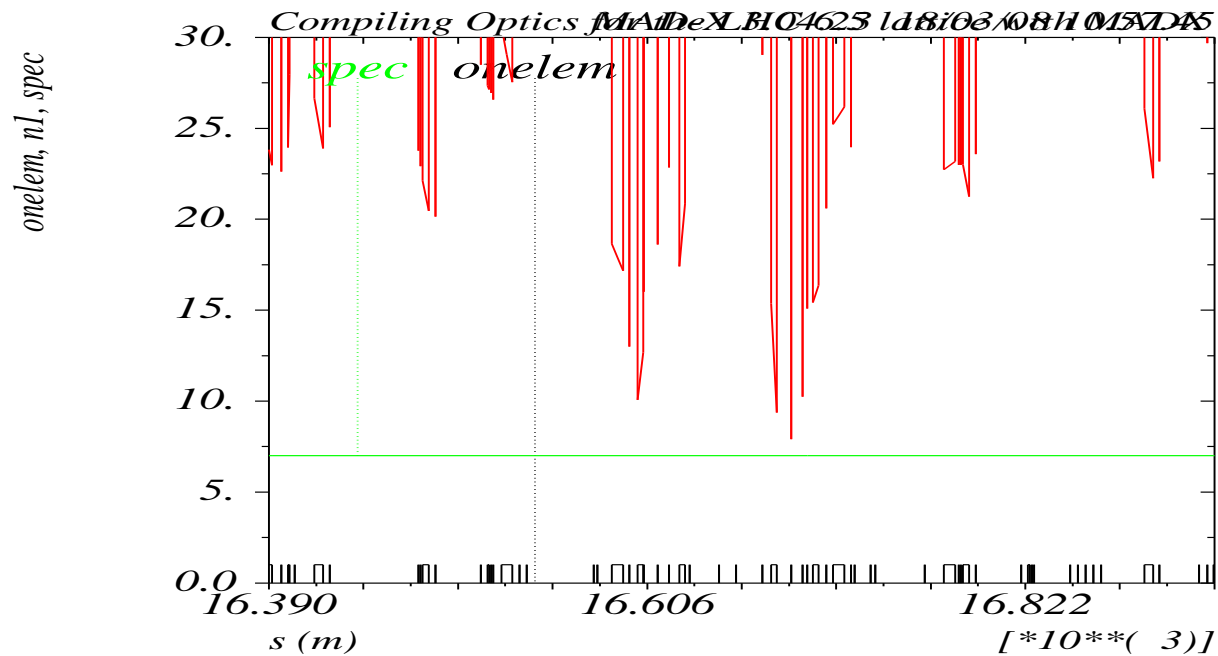
Spectrometer(-compensator) bump (\oplus) at IP8



➤ Energy 5 TeV

➤ $\beta^* = 4$ m, external angle ∓ 310 μ rad

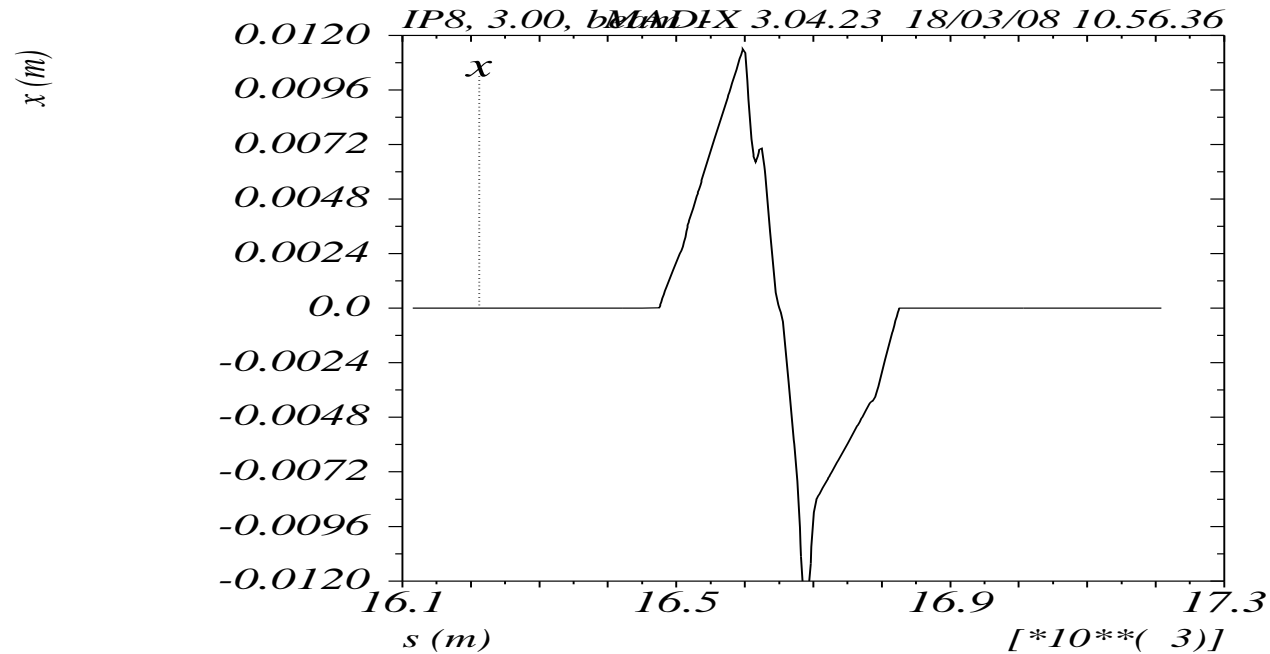
Spectrometer(-compensator) bump (\oplus) at IP8



➤ Energy 5 TeV

➤ $\beta^* = 4$ m, external angle ∓ 310 μ rad

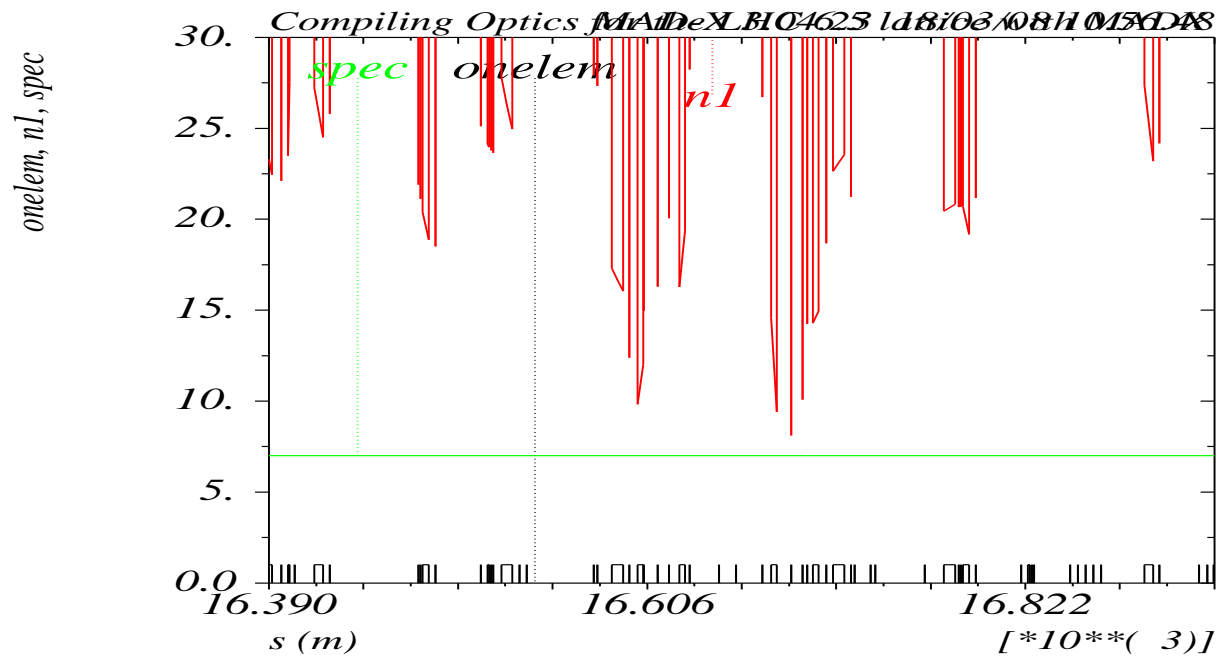
Spectrometer(-compensator) bump (\oplus) at IP8



➤ Energy 5 TeV

➤ $\beta^* = 3$ m, external angle ∓ 280 μ rad

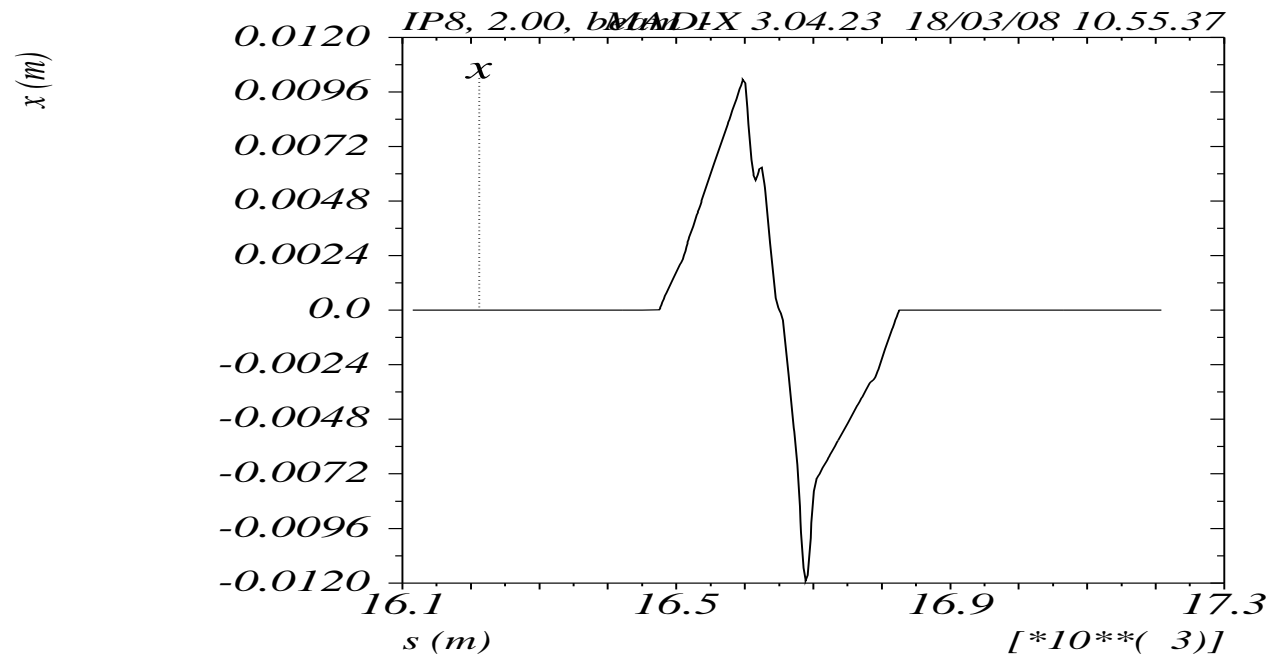
Spectrometer(-compensator) bump (\oplus) at IP8



➤ Energy 5 TeV

➤ $\beta^* = 3$ m, external angle ∓ 280 μ rad

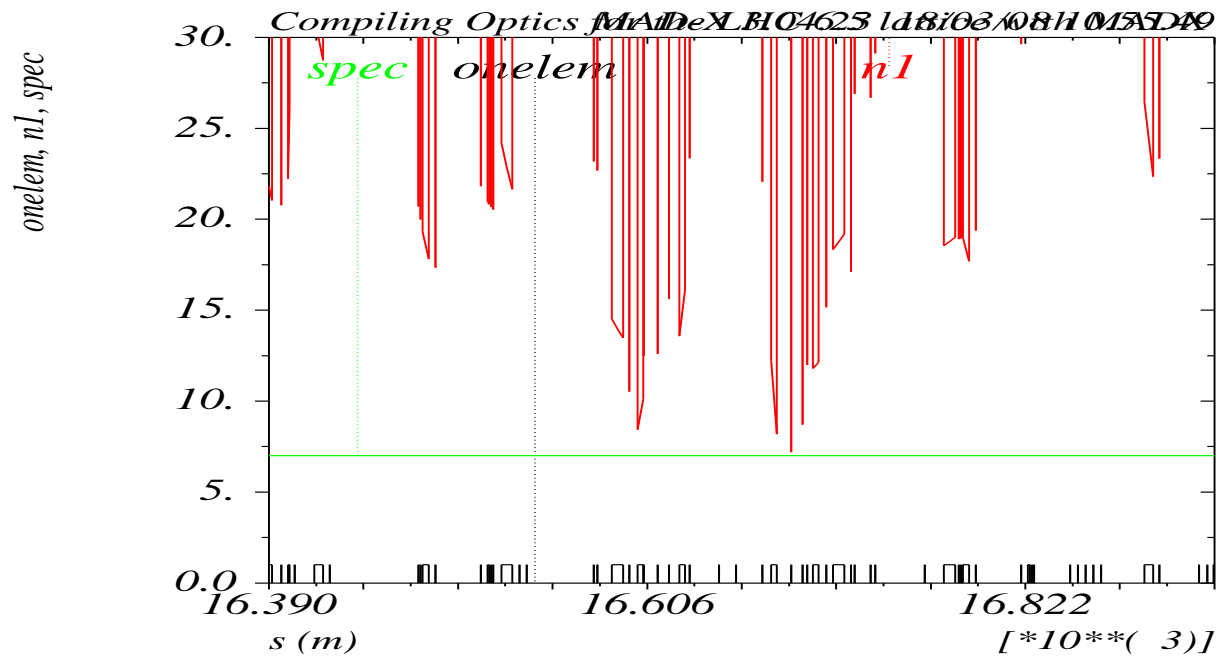
Spectrometer(-compensator) bump (\oplus) at IP8



➤ Energy 5 TeV

➤ $\beta^* = 2$ m, external angle ∓ 250 μ rad

Spectrometer(-compensator) bump (\oplus) at IP8



➤ Energy 5 TeV

➤ $\beta^* = 2$ m, external angle ∓ 250 μ rad

IP8 crossing scheme parameters

β^* m	External angle [μrad]	Effective angle [μrad]	n1	sep [σ]	
1	0	378	8.9	-	-
2	0	378	13.4	-	-
2	\mp 250	\mp 61	7.8	5.7	N
3	\mp 280	\mp 91	8.8	9.2	Y
4	\mp 310	\mp 121	8.8	12.5	Y

Conclusion

- Collisions at energies 4 - 7 TeV are possible
- For energy 5 TeV (with crossing angle):
 - Both polarities possible
 - For $\beta^* \geq 3$ m
- Limits from collimation ??