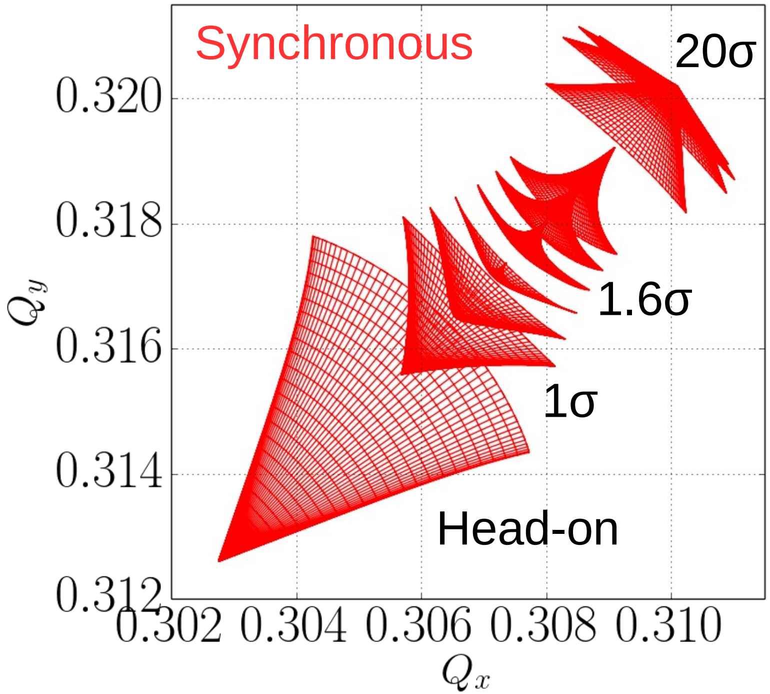
Landau damping with asynchronous collapse of the separation bumps

X. Buffat

WP2 meeting
04.09.2018

Tune footprint with separated beams

- The tune shifts due to beam-beam interactions are passively compensated when colliding synchronously IPs 1 and 5
  - This is not the case with an asynchronous collapse of the bumps
- A similar asymmetry is obtained in the tune spread, allowing for a partial mitigation of the minimum of stability with offset beams



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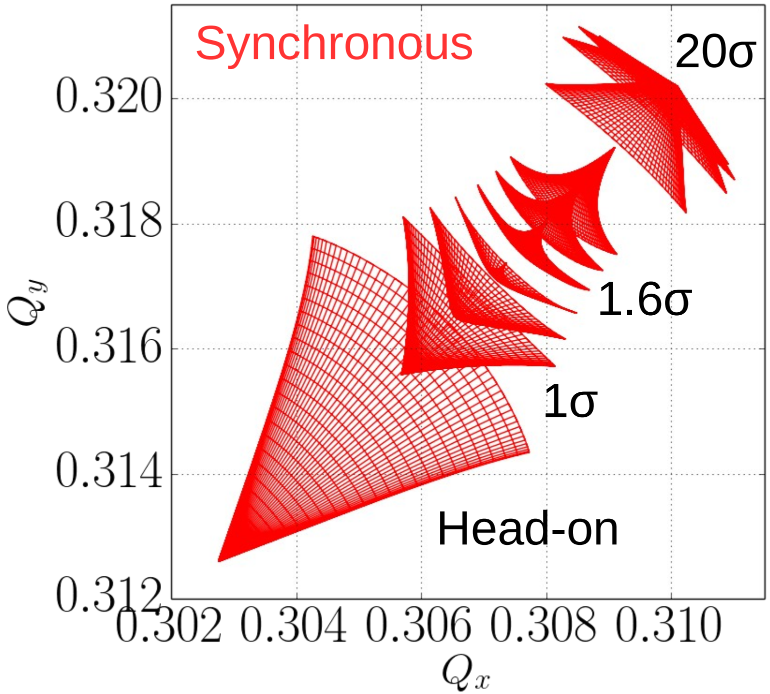

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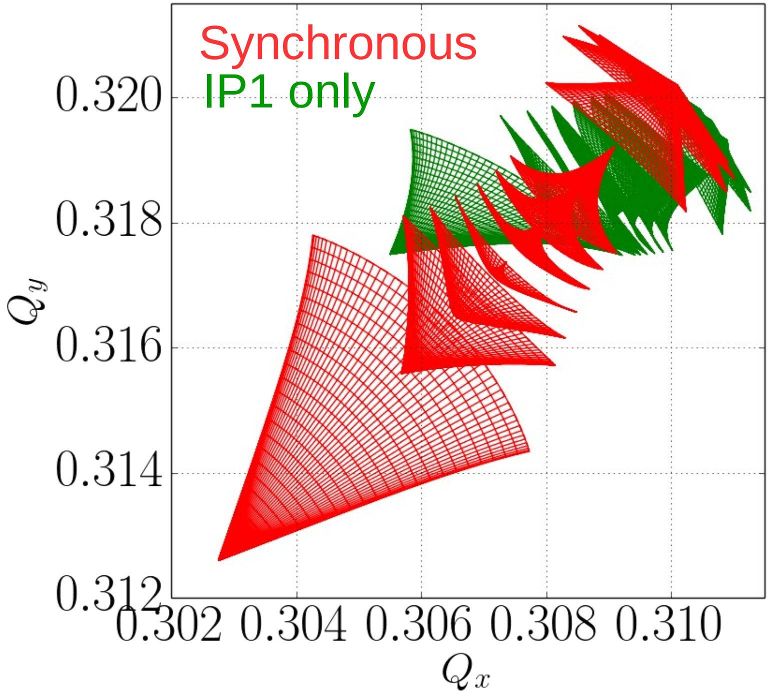

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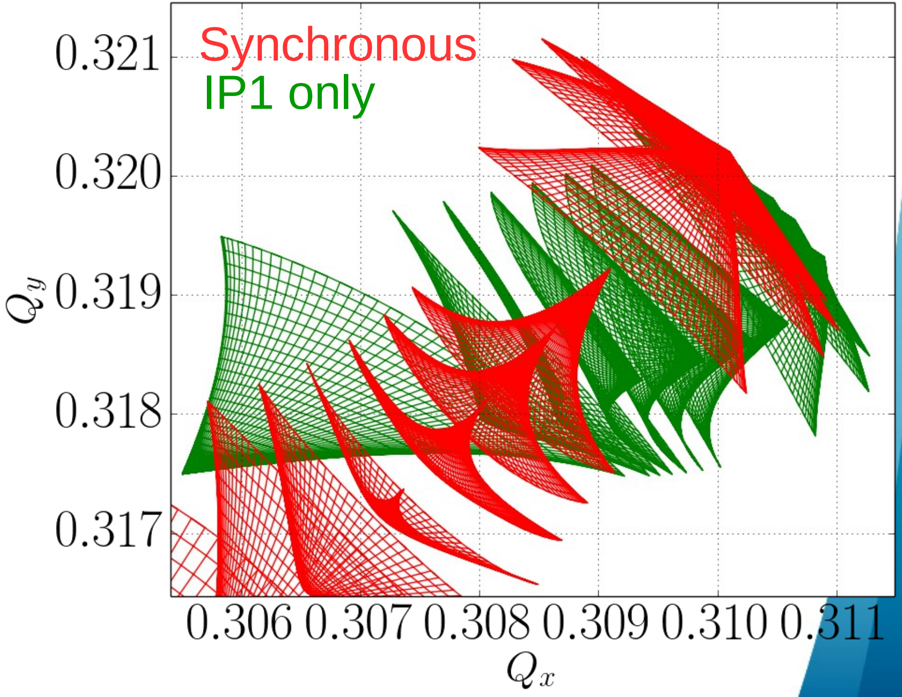

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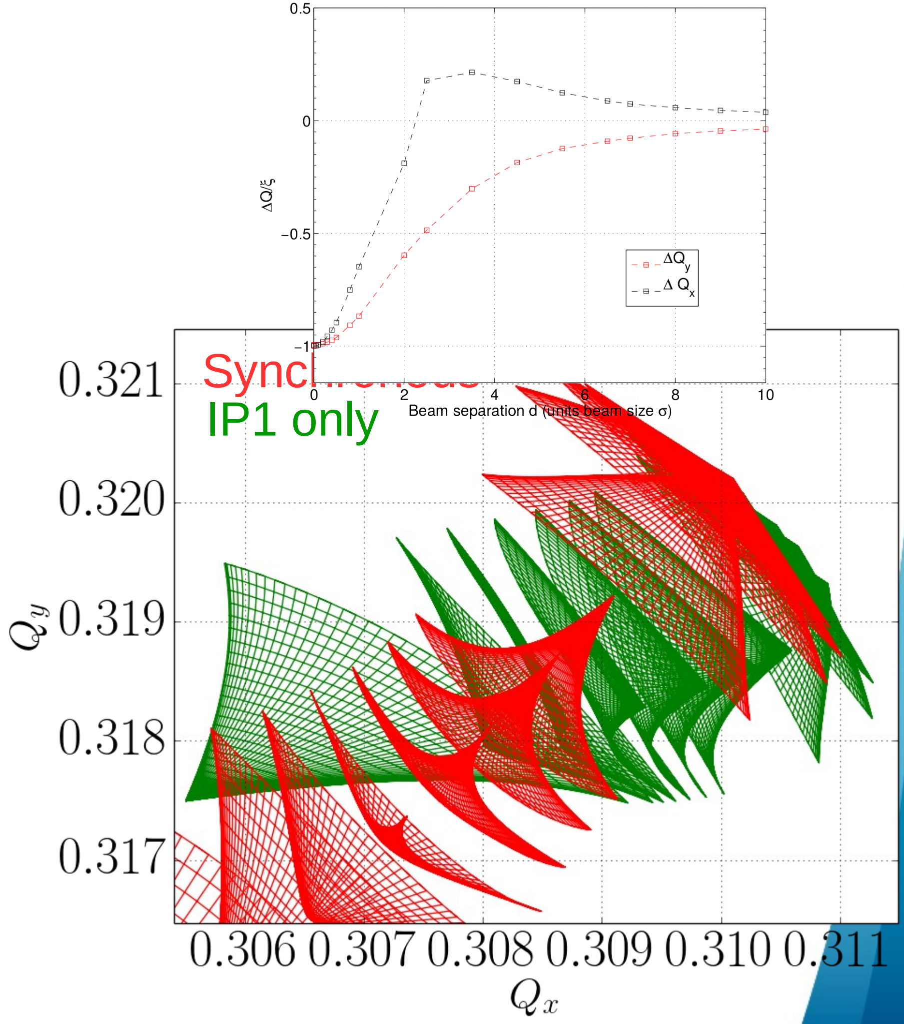

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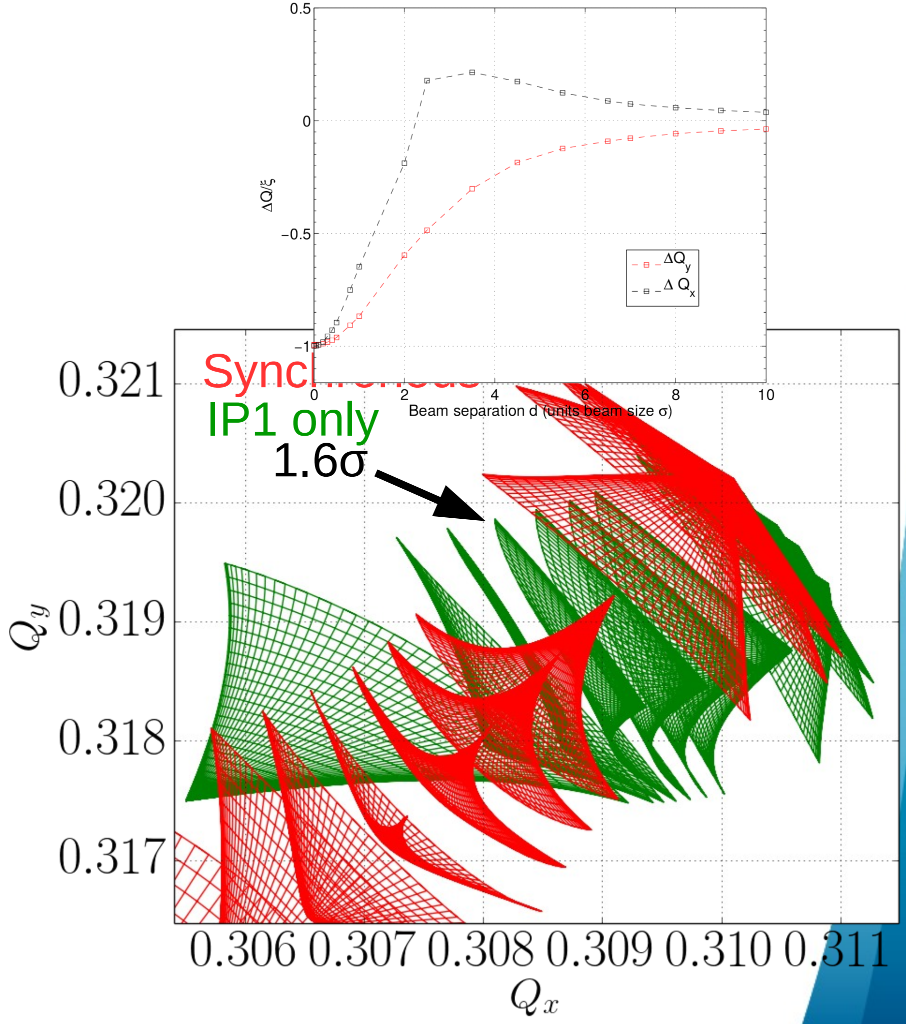

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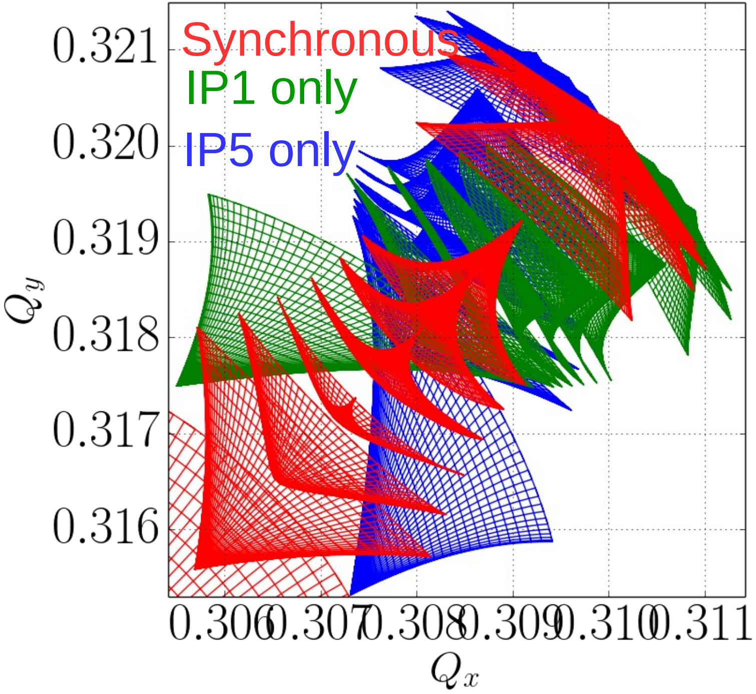
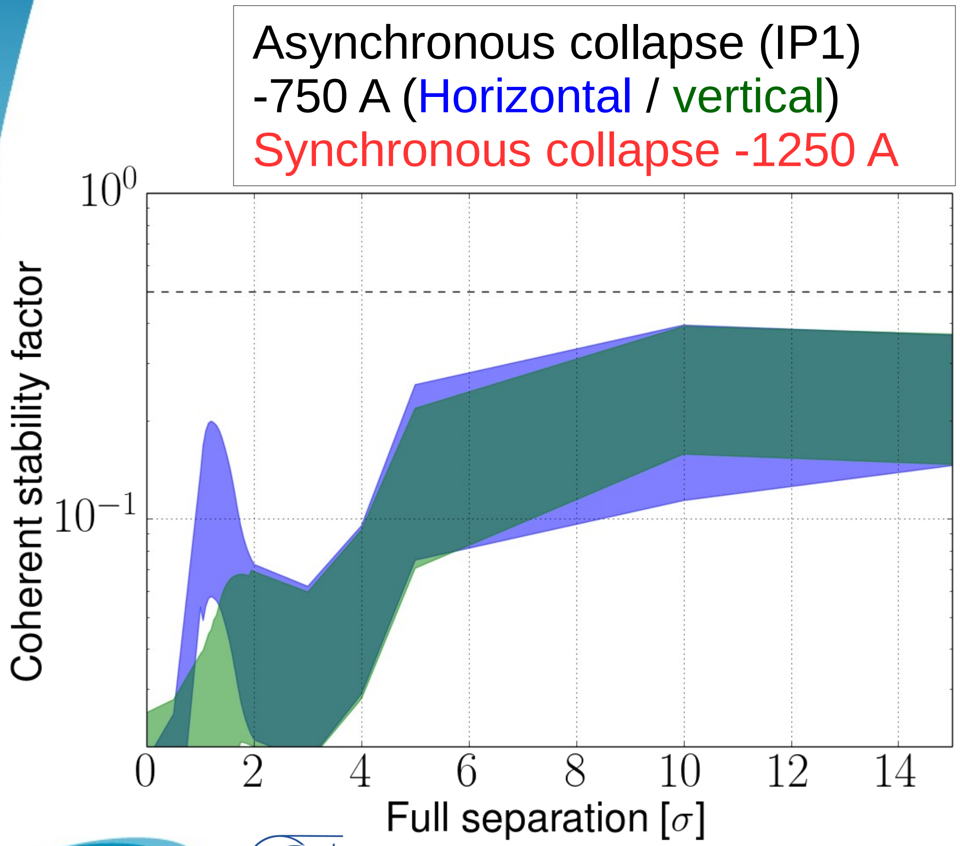


Ultimate BCMS scenario - Nominal collimator upgrade



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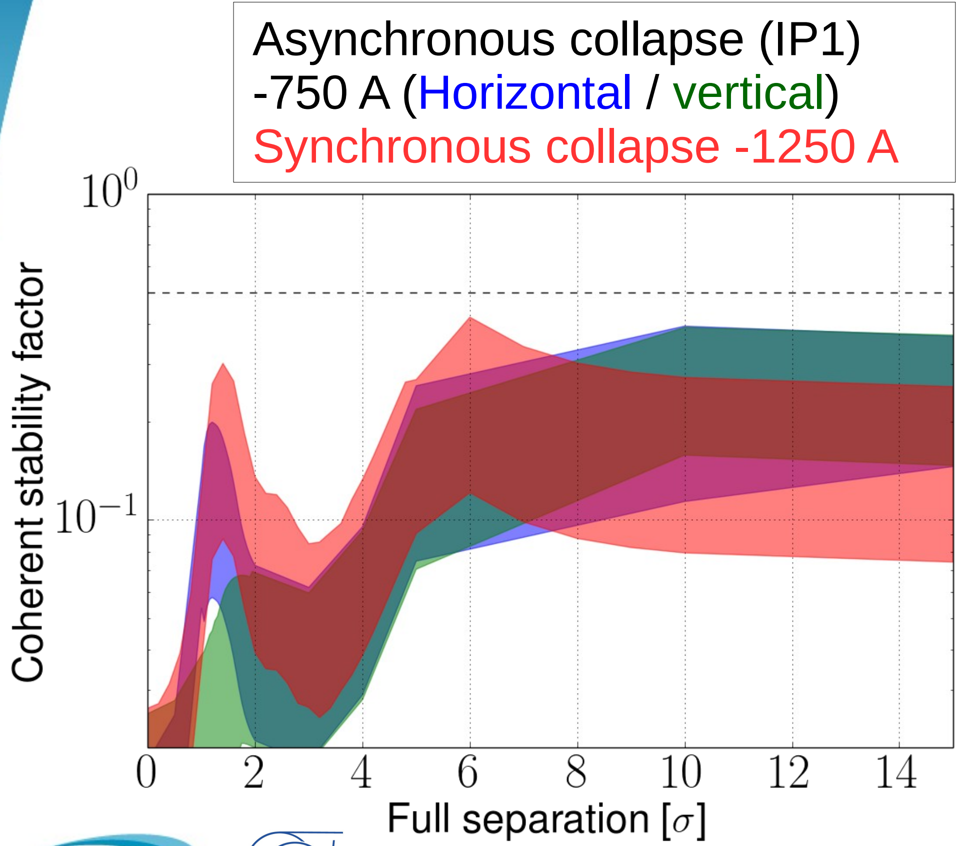
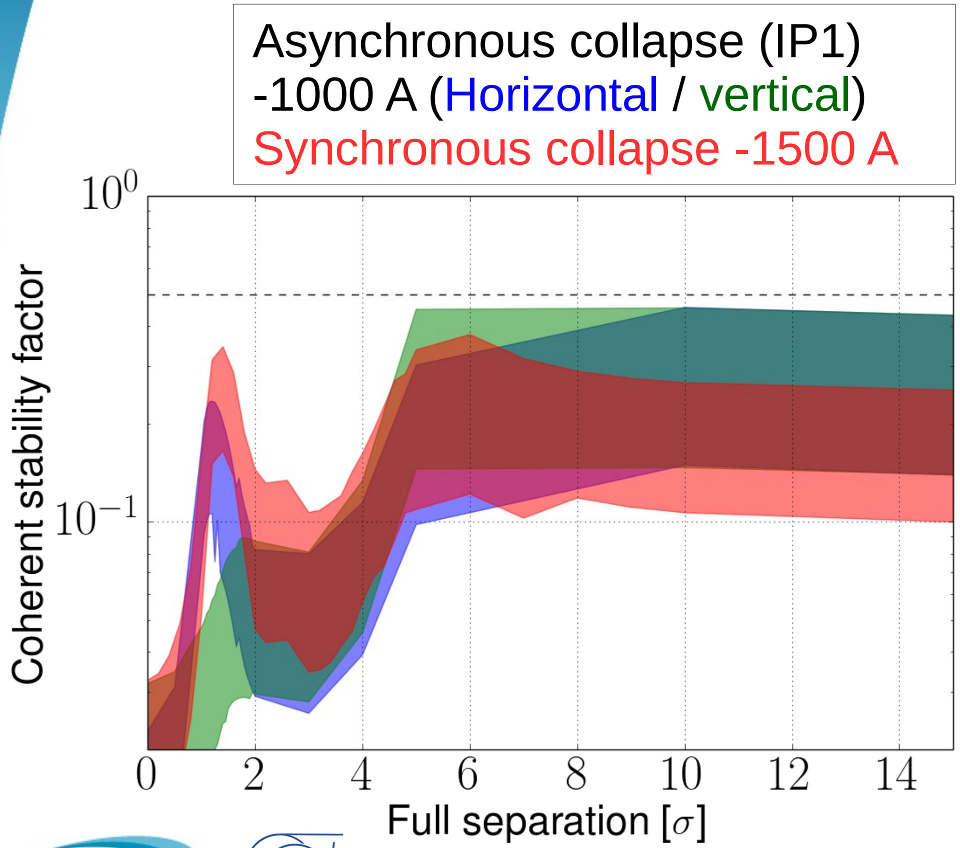


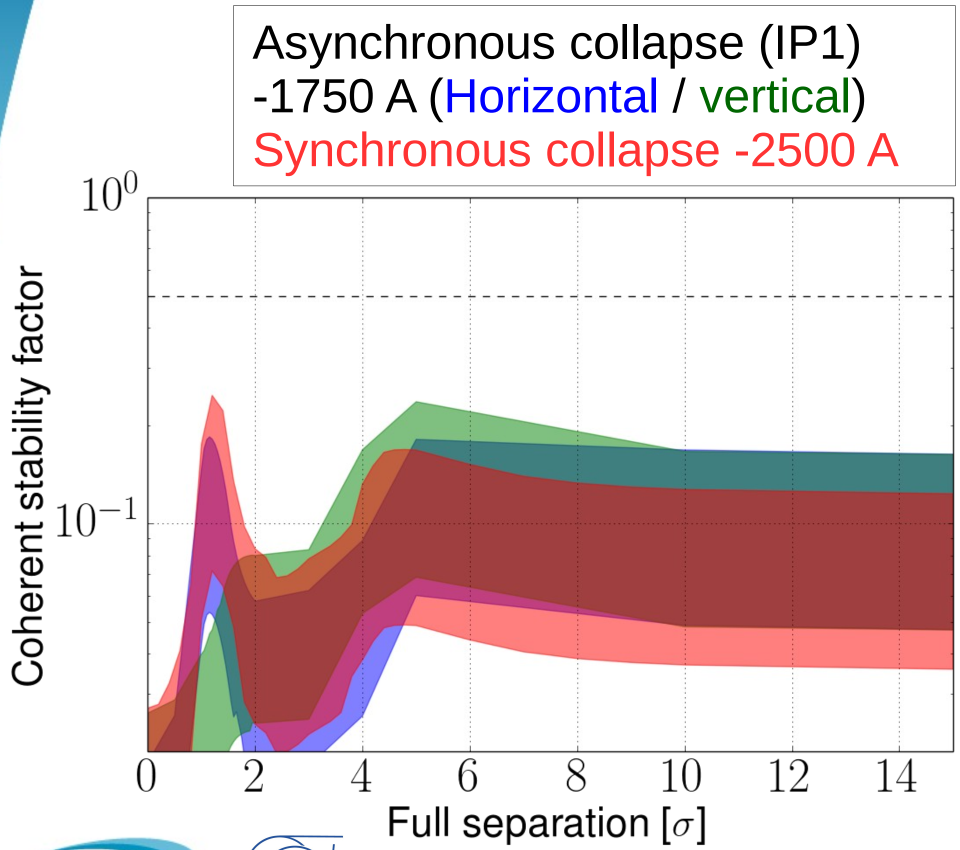
- When collapsing the separation bump of one IP :
  - The long range contribution of the second IP is reduced → Beneficial impact on the minimum of stability at 6-10 σ
  - The minimum of stability at 1-2 σ occurs only in one plane and is less critical
- The stability is ensured by this head-on interaction during the collapse of the other IPs
- With the nominal collimator upgrade, the tele-index required is reduced from ~2.3 to ~1.7

Ultimate BCMS scenario - LS2 collimator upgrade



- With the LS2 collimator upgrade, the tele-index required is reduced from ~2.9 to ~2.2

Ultimate BCMS scenario - no collimator upgrade



- Without collimator upgrade, the tele-index required is reduced from ~3.9 to ~3.0

Summary

Requirements with a synchronous collapse :

Separation [σ]	Equivalent octupole current [A] (Telescopic index)					
	Nominal			Ultimate		
	CFC	LS2 upg.	Full upg.	CFC	LS2 upg.	Full upg.
6-10	-1250 (2.6)	-1000 (2.2)	-750 (1.7)	-1020 (2.2)	-900 (2.0)	-780 (1.7)
1.5-2	-2500 (3.9)	-1000 (2.2)	-750 (1.7)	-2750 (4.2)	-900 (2.0)	-780 (1.7)

(a) $\varepsilon = 2.5\mu$m

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1.5-2	-2300 (3.8)	-1300 (2.8)	-1000 (2.2)	-2600 (4.0)	-1250 (2.6)	-1100 (2.3)

(b) $\varepsilon = 1.7\mu$m

-1750 (3.0), -1000 (2.2), -750 (1.7)

- De-synchronising the collapse of the separation bumps in IPs 1 and 5 reduces the octupole requirement by ~30 % at the end of the ramp/squeeze

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- The separation plane of the IP selected is most critical → Can be chosen according to the most critical impedance
- For luminosity levelling, there is also a gain by chosing the same levelling plane (independantly of the crossing angle plane)

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