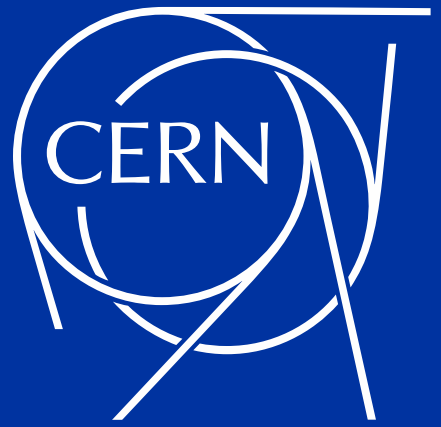


MD10703: Ions BB limit varying the crossing angles

R. Bruce, C. Droin, S. Kostoglou, M. Hostettler, G. Sterbini

https://indico.cern.ch/event/1472993/

MD10703: Ions BB limit varying the crossing angles→ 8 h + 2 h

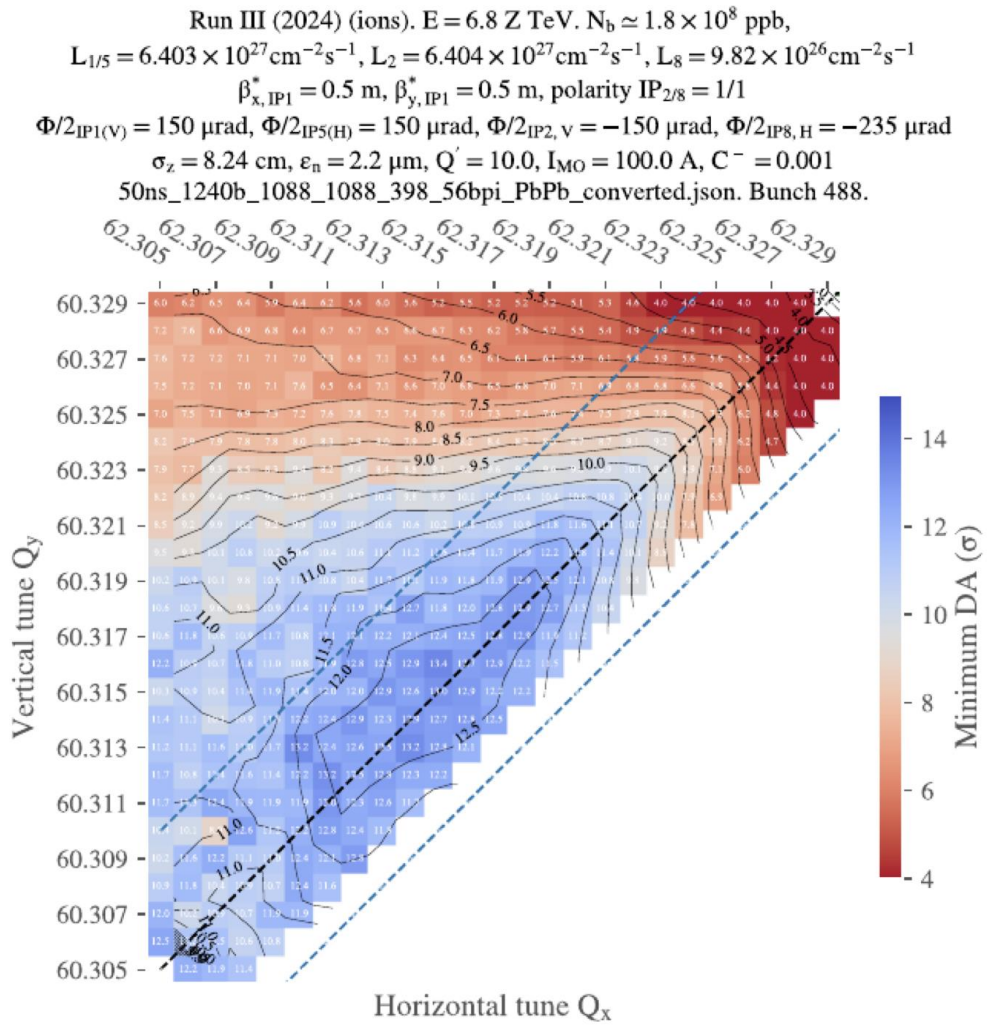
As for protons, there is an interest in reduce the crossing angle of the ions (in IP1/2/5/8). Simulations show significant margin if we adopt the proton metric (DA>6 sigma) but the DA/MD benchmarking with ions is limited.

MD benefits:

1. Potential performance gain (θ_x and $\beta*$ reduction and increased aperture margins)
2. Simulation benchmarking for ions studies

We request a 8 h (+2 h for validation if needed) MD to make one θ_x-scan in IP1/2/5/8 with β*=50/50/50/150 cm

An EoF took place in 2023 (see IPAC24 MOPS06)

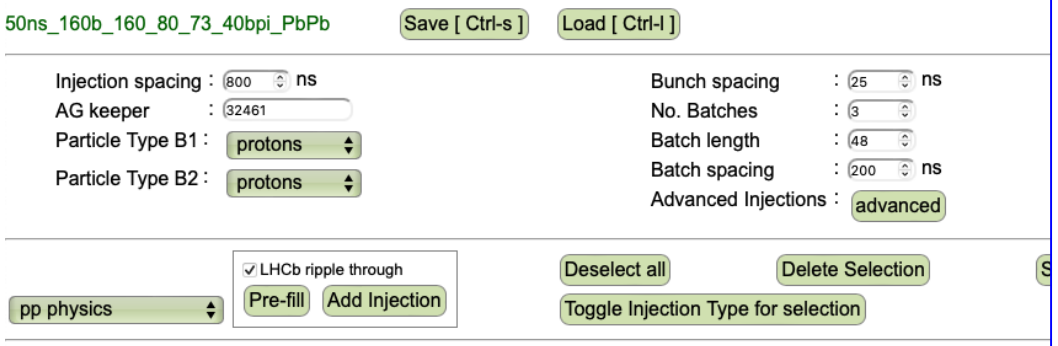


Courtesy of C. Droin

MD proposal (I): filling scheme

- **5 x 8b per batch, 4 batches per beam (50ns_160b_160_80_73_40bpi_PbPb).**

- **Bunches with nominal or pushed parameters (large intensity).**

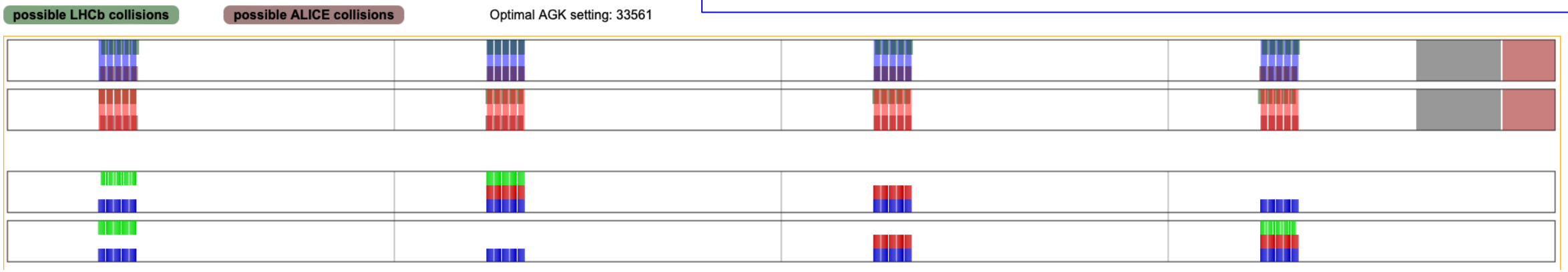


Beam Info	
Bunches B1/B2	160 / 160
Injections B1/B2	4 / 4

Collisions	
ATLAS/CMS	160
ALICE	80 (50.0%)
LHCb	73 (45.6%)
Non Colliding B1	0
Non Colliding B2	0

B1 classes : 0:0 1:47 2:0 3:40 4:0 5:33 6:0 7:40

B2 classes : 0:0 1:40 2:0 3:47 4:0 5:40 6:0 7:33



Courtesy of M. Rufolo

MD proposal (II)

From LMC 496, machine nominal IP configurations

	Injection	Flat top	End of squeeze	Physics
Energy (Z TeV)	0.45	6.8	6.8	6.8
β* (m) IP1,2,5,8	11, 10, 11, 10	1.0,1.0,1.0, 1.5	0.5, 0.5, 0.5, 1.5	0.5, 0.5, 0.5, 1.5
Half external crossing (μrad) IP1,2,5,8	170, 170, 170, -170	150†, 150, 150, -135	150, 150, 150, -210	150, ±150, 150, -210
Net half crossing (μrad) IP1,2,5,8		150, 78, 150, 4	150, 78, 150, -71	150, ±78, 150, -71
Parallel separation (mm) IP1,2,5,8	-2, 3, 2, -3	-0.55, 3, 0.55, -3	-0.55, 3, 0.55, -3	Separation levelling
On_disp knob	0	150*	150*	150*
RF voltage	8 MV	14 MV	14 MV	14 MV
Octupoles	-1 (13 A)	-0.5 (100 A)	-0.5 (100 A)	-0.5 (100 A)
Chromaticity	10	10	10	10

*final value to be tuned during commissioning based on background studies

† to be confirmed in aperture measurements, option to go to 140 if needed at IP1/2/5

Courtesy of R. Bruce

MD proposal (III): procedure

- We reach top energy collision following the nominal cycle (but loading the new collimators limits to allow for crossing angles reduction, **to be prepared**)

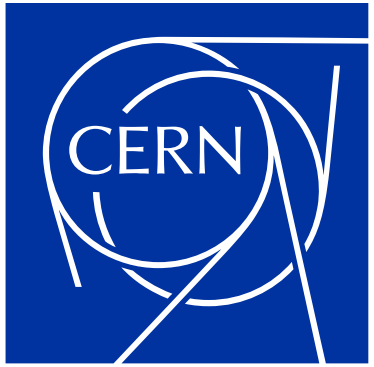
- We reduce with 5/10 urad steps the IP1/5, IP2 and IP8 crossing angles using the orchestration tools (tested during the night of 21-22 Sept 2023, F9177). If losses occurs → optimize the tunes

- The target is to reduce the external half-crossing angle of $\Delta\theta$=70 urad. That is
  - In IP1 from $\theta/2 =$ 150 to 80 urad
  - In IP2 from $\theta/2 =$ ± 150 to ± 80 urad → ± 8 urad (almost HO*)
  - In IP5 from $\theta/2 =$ 150 to 80 urad
  - In IP8 from $\theta/2 =$ -210 to -140 urad → -1 urad (almost HO*)

- Luminosity from the experiments will be required (bbb lumi whenever possible).
- Ideally, it would be good to have inputs from experiments on background levels
- We will end the cycle with emittance scan.

* We stop when we see a degradation of the lifetime

Thank you for your attention.



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