




Comments^{*)} on collisions 19./20. June

Objectives:

-  High intensity collisions in all IPs
-  Squeezed optics, $\beta^* = 3.5$ m
-  Establish crossing angles in IP1 and IP5

^{*)} preliminary, for CCC crews et al.

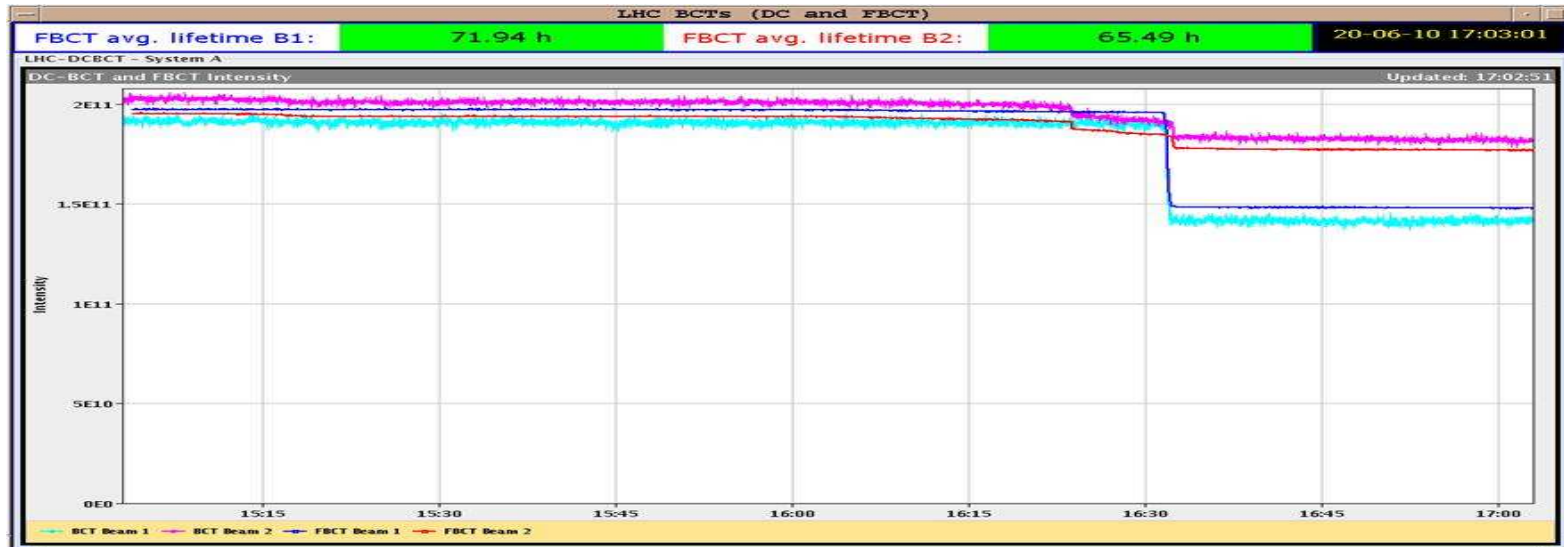


Comments on collisions 19./20. June

■ Conditions and procedure:

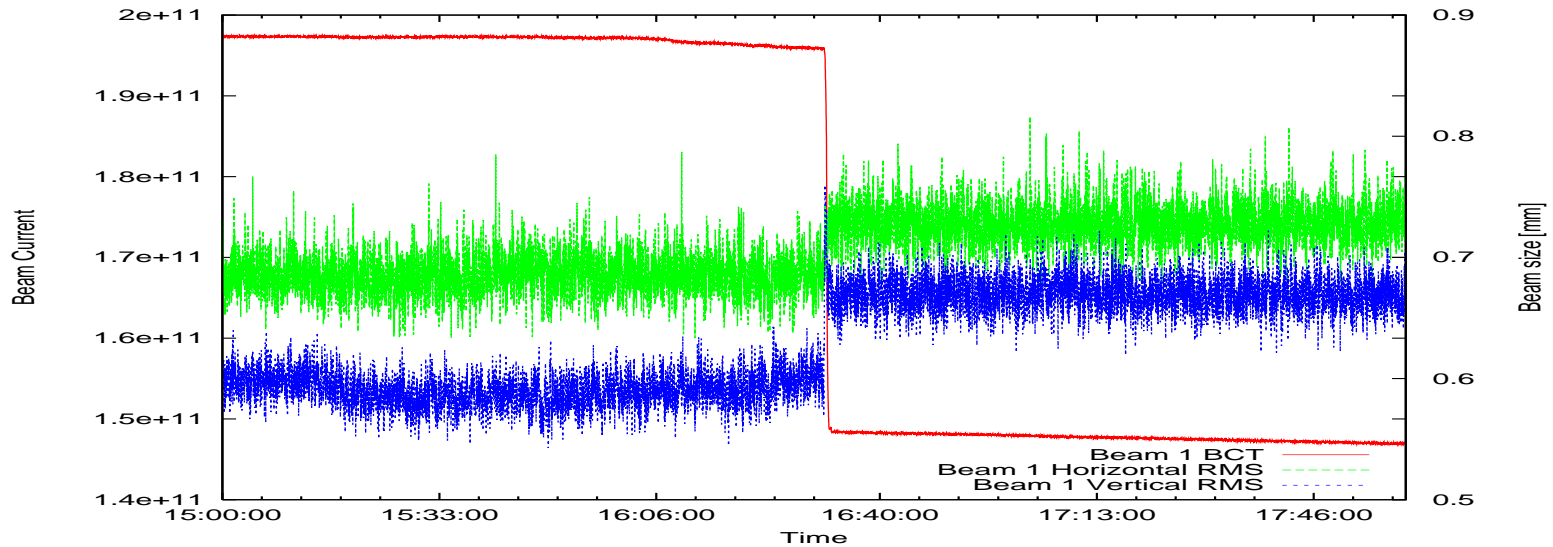
- Squeeze with separation bumps on, 2 bunches per beam, $\approx 10^{11}$ /bunch
slots: 1 - 1786 / 1 - 892
buckets: 1(3) - 17851(1) / 1(2) - 8911(2)
- Collapse separation one-by-one, order 1 - 8 - 2 - 5
(minimize unbalanced collision pattern)
- Non-closure corrected with dedicated correctors only
(Sunday)
- Transverse scans to find maximum overlap

What happened during collapsing ?



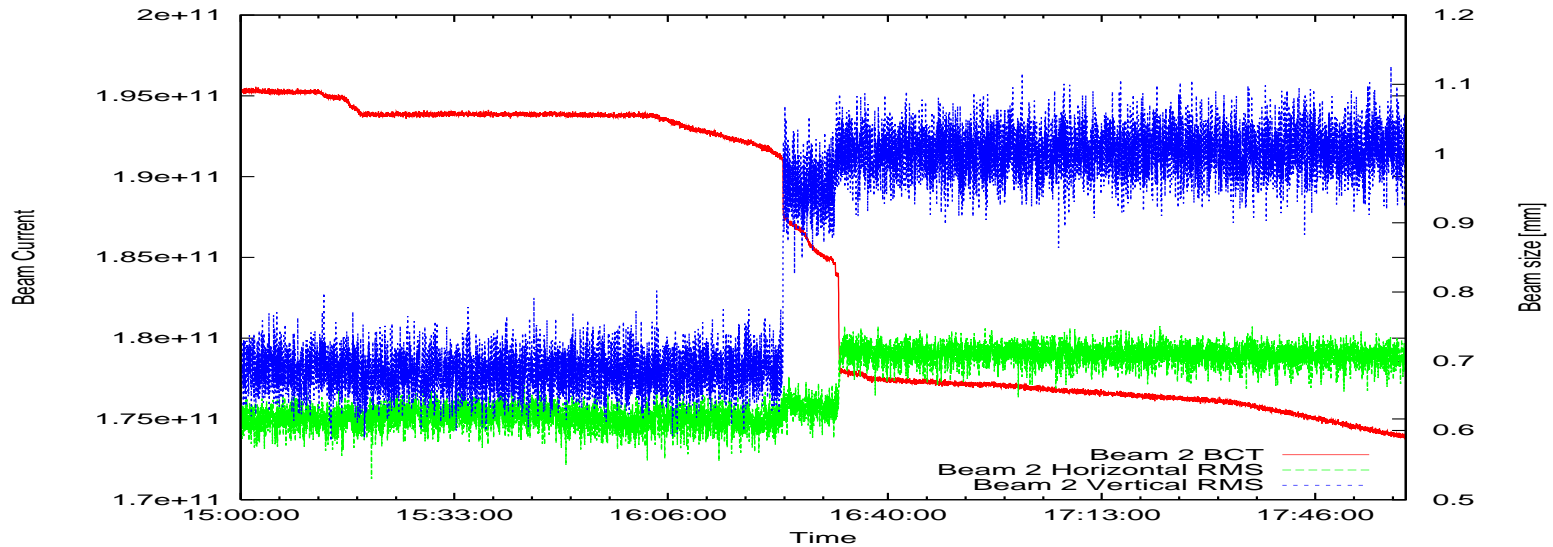
- Intensity during collapsing of bunches
- No effect when IP1 and IP8 bumps collapsed, first losses with collisions in IP2, more with IP5
- All losses occurred when lumi-scan values (previous day) were applied

Details for beam 1



- Loss when last bump (IP5) was collapsed (over ≈ 30 s)
- About half of bunch 1 (beam1) lost, nothing seen on bunch 1786, clearly visible on BQM
- Small emittance increase in both planes

Details for beam 2



- First loss when colliding in IP2, second with collisions in IP5
- Emittance increase in both planes, more pronounced in vertical plane, stronger increase when IP2 collided

Summary: emittance^{*)} evolution

collisions:	-	1	1-8	1-8-2	1-8-2-5
ϵ_x^1	4.1	4.1	4.1	4.1	6.5
ϵ_v^1	3.8	3.8	3.8	4.1	12.3
ϵ_x^2	5.8	5.9	5.8	5.7	12.1
ϵ_v^2	5.7	5.7	5.8	10.9	12.5

First visible effect after IP2 in collision

➤ Remember: bunch 892 in beam 2 sees 2 collisions

^{*)} from wire scanner, not consistent with previous pictures ...

Observations collapsing bumps

- No problems initially
- Before collapsing IP5, tune split of 0.002 was applied
- Beam loss when lumi-scan trim applied, looked like transient but coherent motion, quickly damped
- Reminder:
 - Tune split can avoid coherent oscillation driven by beam-beam, not an excitation
 - Tune split already from unequal collision pattern
 - The applied tune "split" brings beam 1 and beam 2 together !

Observations transverse scan

- Collisions in 1, 2, 5 easy to find
- IP8 was far off from the expected position (needed 6 σ offset)
- After optimization stable luminosity for most of the time

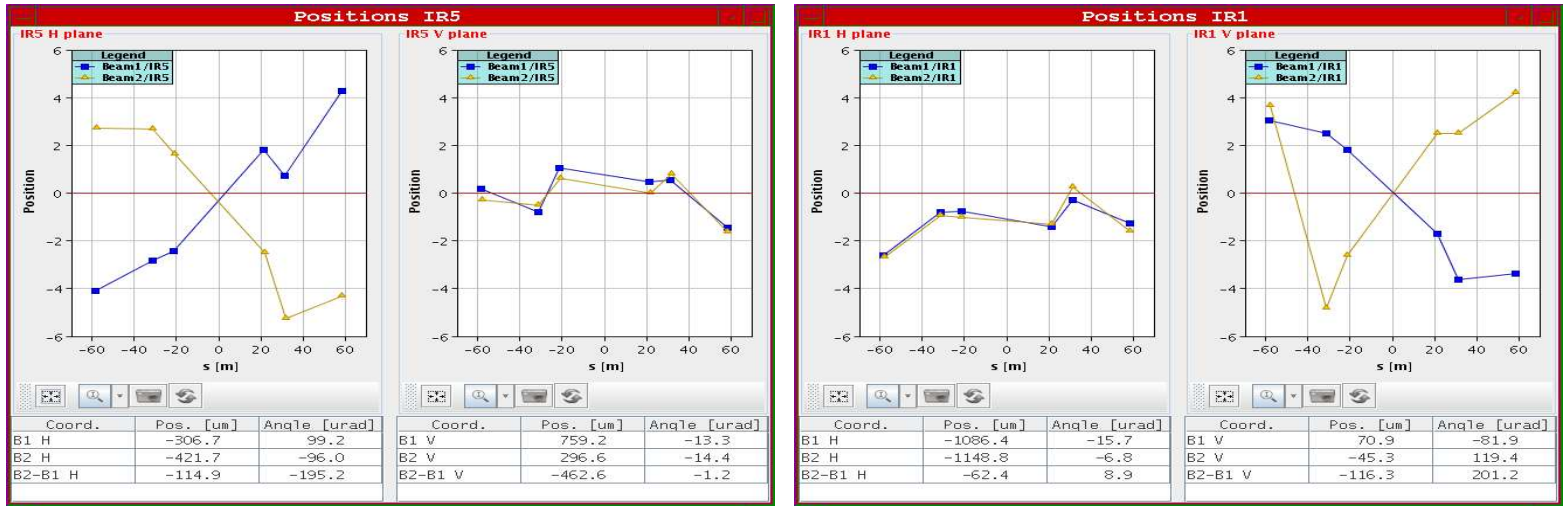


Crossing angles

- Introduce crossing angles (LHCf, avoid additional encounter in 3-bunch schemes)
 - IP1: vertical $\mp 100 \mu\text{rad}$ (beams moving downward)
 - IP5: horizontal $\pm 100 \mu\text{rad}$ (beams moving outward)
- Closure and small cross-talk corrected



Crossing angles in IP1 and IP5



➤ Crossing in IP1 and IP5 as expected without trim



Observations crossing angles

- No effect on beam lifetime, rather well closed, small coupling into other plane
 - No additional transverse scan required
 - Expected loss of luminosity: 0.5%, consistent with observations
- ➔ Don't be afraid of crossing angles, they are just bumps !



Towards higher current:

- Working point not necessarily optimized
 - Make tune scan to find best tune for this configuration
 - Check on lifetime, background, luminosity ..
 - Have to find a strategy to collide beams
 - All at once ?
 - Fast or slow ?
 - Devise a strategy for implementation of tune trim, orbit trims, IP optimization etc.
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