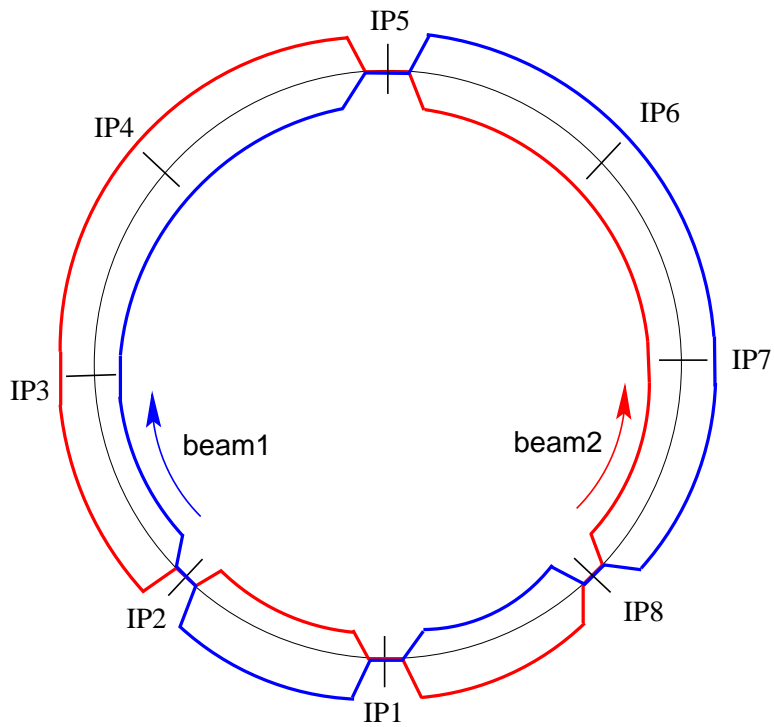


Operational scenarios for the LHCb Spectrometer magnet

Werner Herr
AB/ABP

Layout of LHC



beams cross in 1, 2, 5 and 8



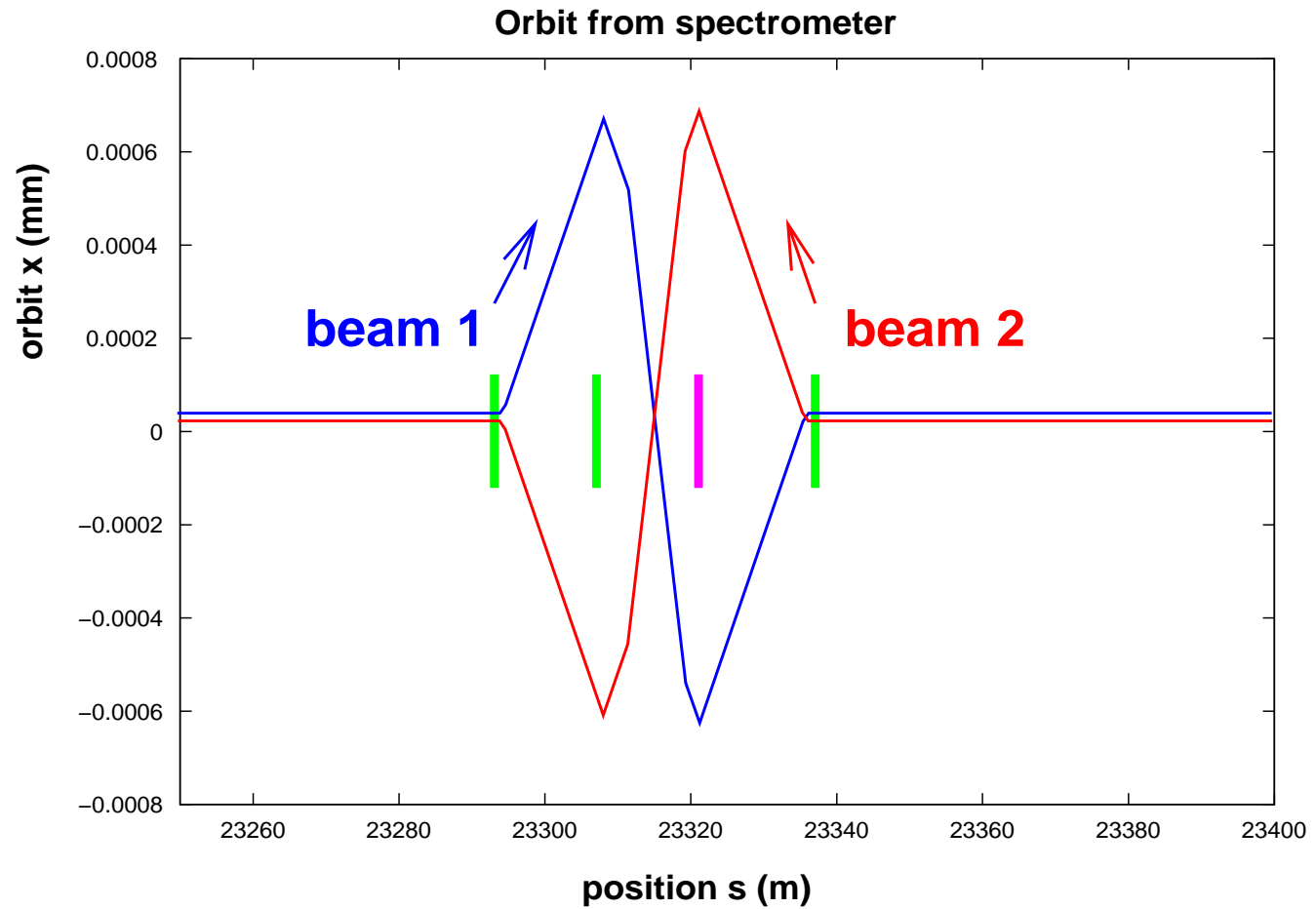
beam 1 crosses to OUTSIDE in IP5



beam 1 crosses to INSIDE in IP8



Spectrometer(-compensator) bump at IP8



Running conditions IP2 and IP8 (Optics Version 6.5)

Spectrometer polarity	$\beta_{x,y}^*$	spectrometer angle	half external angle	(net) half crossing angle
ALICE -1	10.0 m	$\mp 70.0 \mu\text{rad}$	$\mp 80.0 \mu\text{rad}$	$\mp 150 \mu\text{rad}$
ALICE +1	10.0 m	$\pm 70.0 \mu\text{rad}$	$\pm 80.0 \mu\text{rad}$	$\pm 150 \mu\text{rad}$
LHCb -1	10.0 m	$\mp 135.0 \mu\text{rad}$	$\mp 65.0 \mu\text{rad}$	$\mp 200 \mu\text{rad}$
LHCb +1	10.0 m	$\pm 135.0 \mu\text{rad}$	$\mp 210.0 \mu\text{rad}$	$\mp 75 \mu\text{rad}$

Additional requirements

- Spectrometer polarity reversal (IP2 and IP8)
- Spectrometer full field at injection (IP8, IP2 ?)
- Tuneable β^* (IP8)
- ...

LHCb magnet	$\beta_{x,y}^*$	spectrometer angle	half external angle	half crossing angle	N $\times 10^{11}$
-1	10.0 m	$\mp 135.0 \mu\text{rad}$	$\mp 65.0 \mu\text{rad}$	$\mp 200 \mu\text{rad}$	1.15
+1	10.0 m	$\pm 135.0 \mu\text{rad}$	$\mp 210.0 \mu\text{rad}$	$\mp 75 \mu\text{rad}$	1.15
-1	2.0 m	$\mp 135.0 \mu\text{rad}$	$\mp 125.0 \mu\text{rad}$	$\mp 260 \mu\text{rad}$	≥ 0.27
+1	2.0 m	$\pm 135.0 \mu\text{rad}$	$\mp 210.0 \mu\text{rad}$	$\mp 75 \mu\text{rad}$	≥ 0.25
-1	1.0 m	$\mp 135.0 \mu\text{rad}$	$\mp 150.0 \mu\text{rad}$	$\mp 285 \mu\text{rad}$	≥ 0.18
+1	1.0 m	$\pm 135.0 \mu\text{rad}$	$\mp 255.0 \mu\text{rad}$ ($\leq 200.0 \mu\text{rad}$)	$\mp 120 \mu\text{rad}$ ($\leq 65 \mu\text{rad}$)	≥ 0.16

Full spectrometer field at injection

- At top energy: crossing angle is $\mp 135 \mu\text{rad}$
- At injection: crossing angle is $\mp 2100 \mu\text{rad}$
 - For polarity (-1) : difficult
 - For polarity $(+1)$: no compensation possible due to aperture, this implies 3 crossings, not possible

Are there alternatives ?

- De-couple spectrometer angle from external angle
 - External crossing angle only vertical
 - Crossing in x-y plane, e.g. at 45°
 - Much smaller crossing angle needed
 - Change of spectrometer polarity transparent to LHC operation
- Requires discussions with LHCb collaboration, then further studies