# HP-PS circumference

The aim is to optimize the HP-PS circumference in order to improve synchronization in case of injection into SPS.

The present ratio between SPS and HP-PS is 5.88.

If we assume 25 ns beam the present harmonic number of SPS is 924. The idea is to find a ratio which is an integer or a ratio of integers.

25 ns beam leads to a revolution period of 3.85µs then circumference of 1152m.

FT beam assuming MTE extraction.

In this case the SPS extraction kicker gap (1. 1 µs) must be taken into account in the HPPS beam structure which will be, at HPPS extraction : 3.85 µs = 2.75 µs + 1.1 µs.

2.75 µs corresponds to 70% of HPPS circumference, so $h_{HPPS}$ =110 and $2.5*10^{14}/110$ = $2.27*10^{12}$ppb in the HPPS.

If we assume 5-turn MTE extraction we obtain : $2.27*10^{12}/5$ = $4.54*10^{11}$ppb in the SPS.

This is already higher than the maximum intensity which can be accepted by the SPS ($2.5*10^{11}$ppb) so it must be decreased.

5*2.75 µs = 13.75µs = 59.5% of SPS full of beam.

25 ns beam leads to a revolution period of 4.19µs then circumference of 1256.63m.

FT beam assuming MTE extraction.

In this case the SPS extraction kicker gap (1. 1 µs) must be taken into account in the HPPS beam structure which will be, at HPPS extraction : 4.19 µs = 3.09 µs + 1.1 µs.

3.09 µs corresponds to 70% of HPPS circumference, so $h_{HPPS}$ =124 and $2.5*10^{14}/124$ = $2.1*10^{12}$ppb in the HPPS.

If we assume 5-turn MTE extraction we obtain : $2.1*10^{12}/5$ = $4.03*10^{11}$ppb in the SPS.

This is already higher than the maximum intensity which can be accepted by the SPS ($2.5*10^{11}$ppb) so it must be decreased.

5*3.09 µs = 15.45µs = 67% of SPS full of beam.