Ring geometry and First HE-LHC optics release, V0.1

Demin Zhou and Michael Hofer

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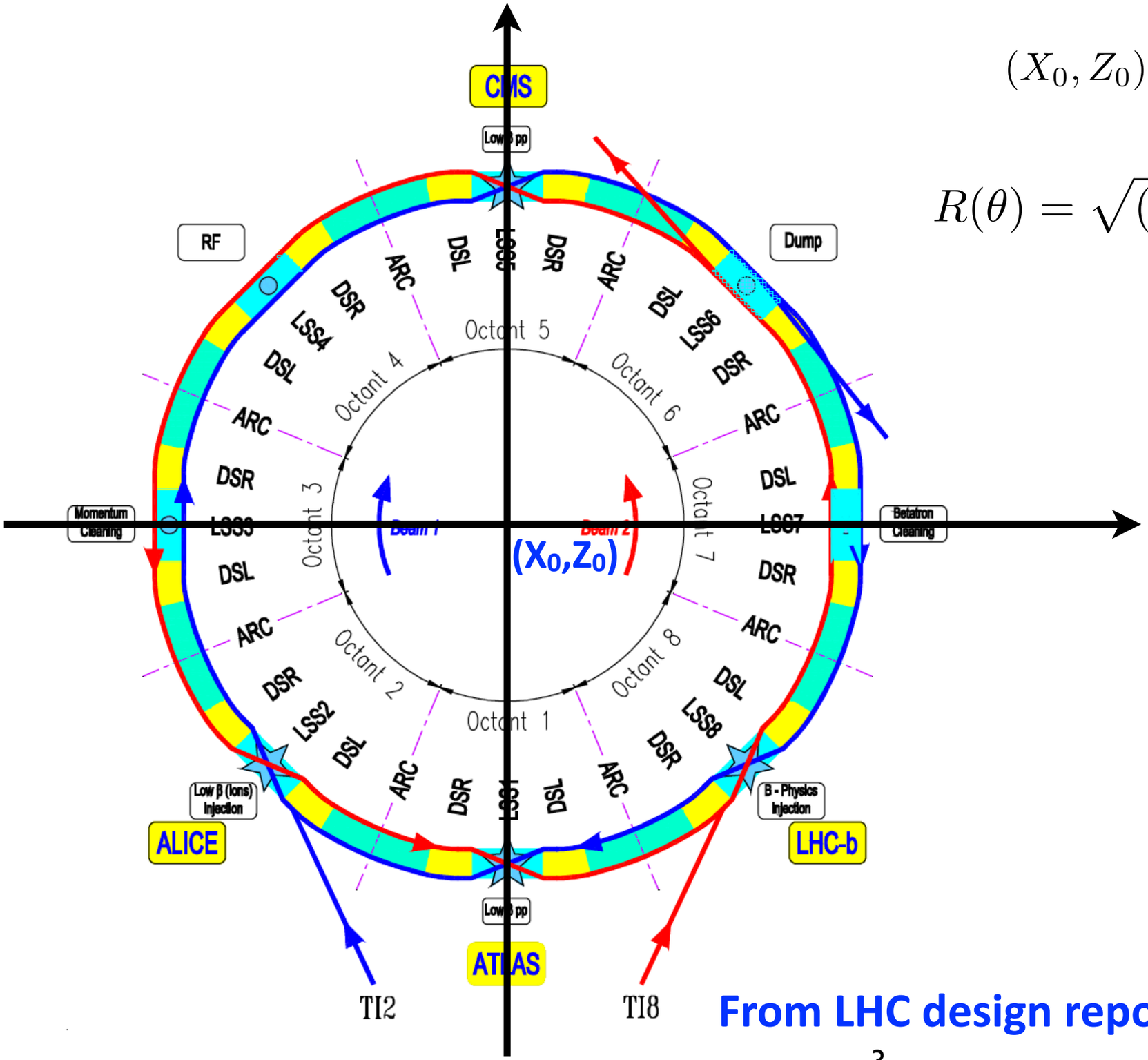
Outline

- ➤ Comparison of LEP, LHC and HE-LHC survey
- ➤ First HE-LHC optics release, V0.1

1. Ring survey

➤ Coordinate system



$$(X_0, Z_0) = \left(\frac{X_{\mathrm{IP1}} + X_{\mathrm{IP5}}}{2}, \frac{Z_{\mathrm{IP1}} + Z_{\mathrm{IP5}}}{2} \right)$$

$$R(\theta) = \sqrt{(X(\theta) - X_0)^2 + (Z(\theta) - Z_0)^2}$$

$$\theta \in [0, 2\pi]$$

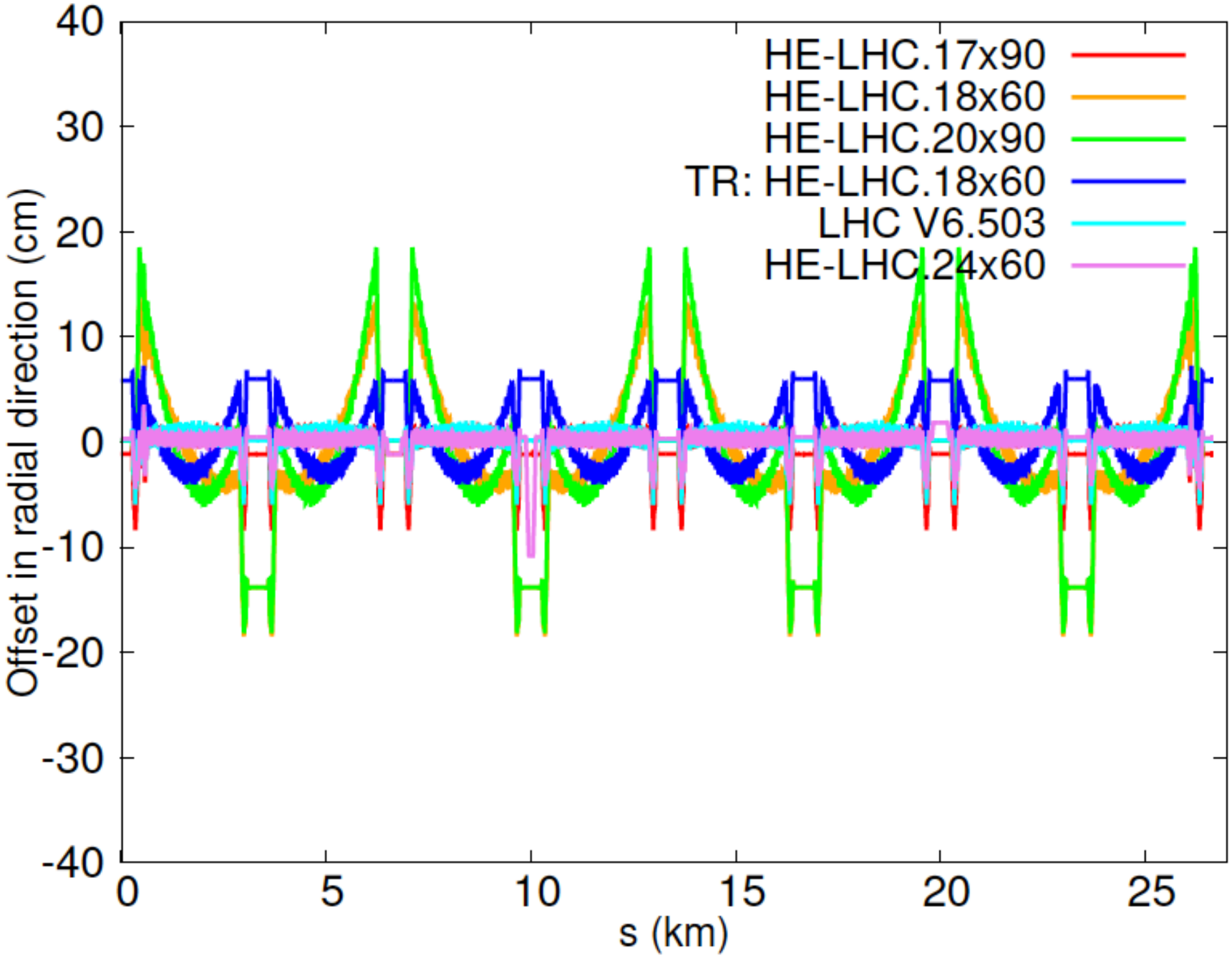
$$\theta = \theta(s)$$

From LHC design report

1. Ring survey

➤ Compare the “average beam” of LEP and (HE-)LHC

- **Suggested by Thys**



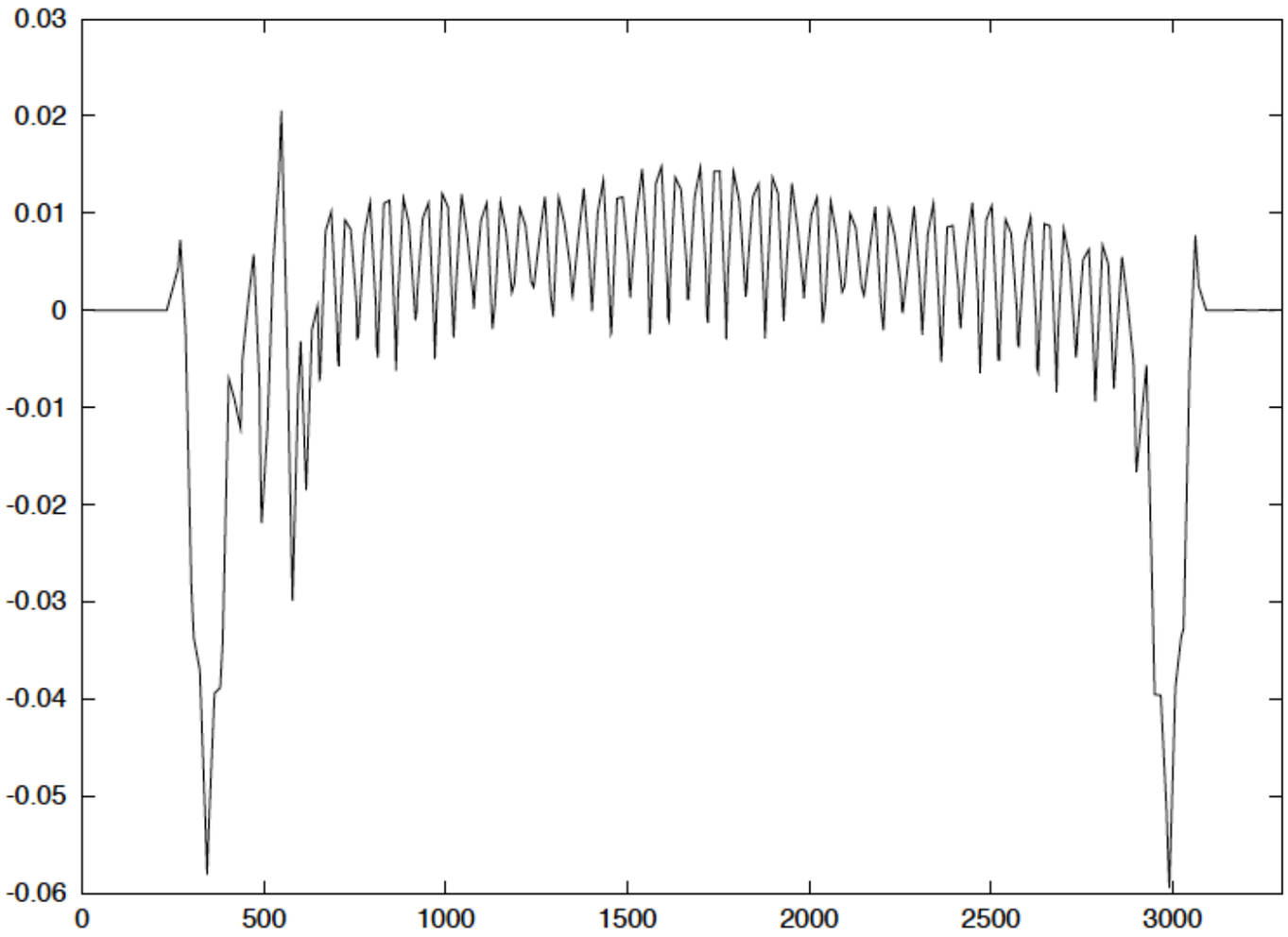
NOTE:

1) **Zero ring separation**
2) **Offset in DSs**
3) **IP1: s=0**

1. Ring survey

➤ Compare the “average beam” of LEP and (HE-)LHC

- **Suggested by Thys**



From LHC design report

Figure 3.4: The horizontal position of the LHC compared to the LEP in one sector of the machine in metres.

2. First HE-LHC optics release, V0.1

➤ Source files

- /afs/cern.ch/eng/lhc/optics/HELHC/V0.1
- see README file for basic information

```
-rw-r--r--. 1 dezhou def-cg    671 Oct  4 22:35 aperture.b1.madx
-rw-r--r--. 1 dezhou def-cg    365 Oct  4 22:35 aperture.b1.tol.madx
-rw-r--r--. 1 dezhou def-cg 128157 Oct  4 22:35 coll.out
-rw-r--r--. 1 dezhou def-cg 222104 Oct  4 22:35 helhc_18x90.seq
-rw-r--r--. 1 dezhou def-cg 128157 Oct  4 22:35 inj.out
-rw-r--r--. 1 dezhou def-cg   2121 Oct  4 22:35 job.sample.aperture.madx
-rw-r--r--. 1 dezhou def-cg   1143 Oct  4 22:35 job.sample.madx
-rw-r--r--. 1 dezhou def-cg  15039 Oct  4 22:35 opt_1100_inj.str
-rw-r--r--. 1 dezhou def-cg  15039 Oct  4 22:35 opt_25_coll.str
-rw-r--r--. 1 dezhou def-cg   1907 Oct  4 22:35 README
drwxr-xr-x. 2 dezhou def-cg   2048 Oct  4 22:35 temp
drwxr-xr-x. 2 dezhou def-cg   2048 Oct  4 22:35 toolkit
```

```
*** File descriptions
aperture.b1.madx:      Define the apertures for dipoles, quadrupoles and sextupoles
                       in arcs and dispersion suppressors.
aperture.b1.tol.madx:  Define the aperture tolerances in addition to aperture.b1.madx.
helhc_18x90.seq:       Sequence file for HE-LHC V0.1.
job.sample.aperture.madx:  Sample job file for loading apertures in arcs, tune and
                           chromaticity matching, and relevant plottings.
job.sample.madx:       Sample job file for loading sequence and strength files, and
                       relevant plottings.
opt_1100_inj.str:      Strength file for injection optics.
opt_25_coll.str:       Strength file for collision optics.
./temp/*.tfs:          tfs files saved by the sample jobs.
./toolkit/macro.madx: The file containing macros for optics tuning.
```

2. First HE-LHC optics release, V0.1

➤ Fundamental features

- Use IRs of SLHCV3.1a for all of the lattices
- 18 cells in each arc with 90 degree phase advance per cell
- Each arc cell contains 8 dipoles
- Ring separation in the arcs is 204 mm
- See Michael's talk for further information (M. Hofer, in HE-LHC design meeting, Sep. 22, 2017)

➤ History

- Developed form merged_HE-LHC.18x60_v102 (by Thys with arc layout developed by Yuri)
- IR1 and IR5 optimized by Leon (Oxford Univ.)
- IR4 is optimized by Pablo (Oxford Univ.)
- Global matching and chromaticity correction done by Michael

➤ TO-DO List

- Improve ring geometry/layout to better fit LEP survey.
- Update IR4 for better tune matching (See Leon's talk).
- Improve global tune matching to suppress beta peak in IR6.
- Develop sequence files for beam 2.