

KEKB Commissioning Plan

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(1) Ljrac, Beam Transport

Dec. 1997: the new e^- Ljrac was commissioned up to 1.5 GeV

10-13 nC(design = 10 nC)/bunch, single bunch/pulse.

repetition: 5 Hz(design = 50 Hz).

100% transmission from 19 MeV to 1.5 GeV.

reasonably good quality of the beam.

improvements are needed for further stability, etc.

Mar. 1998: Commissioning of J-Arc & AR injection.

May-June 1998: Full commissioning of 3.5 GeV e^+ & 8 GeV e^- .

including a part of beam transport to KEBB.

(2) Commissioning before Belle

a)Initial storage to enable degassing of the vacuum chamber:

(minimum 27 shifts/ring, 1 shift = 8 hours)

- flat optics (minimum chromaticity, moderate tunes)
- rf, sext off
- injection kicker = single turn mode (1 mA, 1 bunch/ring)
 - one turn looking at button signals of the beam position monitors (BPM), loss monitors, single-pass BPMs (2).
 - a few hundred turns by manual orbit/quadrupole/energy correction (1).
- rf, sext(2-6 family correction) on. (1 mA, 1 bunch/ring)
 - observation of synchrotron light
 - extend the storage time until BPM can measure the closed orbit (1).
 - primary closed orbit correction (2).
- injection kicker = storage mode (10 mA, 20 bunches/ring)
 - x,y,z tunes, dispersion, chromaticity measurement (3).
 - determination of path length & ring energy (1).
 - basic behavior of rf system, adjustment of station phases, etc. (6).
 - adjustment of timing/balance of kickers,
 - measurement of injection efficiency/optimum injection orbit/phase (2)
 - survey of optimum tunes (2).

observation of beam size by synchrotron light(2)
measurement of bunch length (2)
commissioning of the bucket section system (1).
commissioning of the beam abort system (2).

b) Toward the low- β optics (minimum 104 shifts/ring)

- Lattice、BPM diagnostics

- checking function/resolution of all BPMs by 3(4)BPM method (6).
 - measurement of steering-BPM response (3).
 - beam-BPM mapping (6).
 - commissioning of local bump generator (1).
 - calibration of quadrupole strengths by π -bump (6).
 - determination of center of sextupoles by π -bump/K-modulation methods (12).
 - commissioning of sextupole movers (6).
 - determination of BPM offset by quad-BPM response (6).
 - advanced orbit correction (6).
 - measurement of beta functions at all quads (3).
 - correction of x-y coupling (3).
 - re-measurement of main parameters after update of the database and model (6).

- Dynamic aperture

- measurement of higher order chromaticities/dispersions (2)
 - damping of coherent oscillations (3)
 - measurement of the dynamic aperture (3)

- Emittance ratio

- reduction of emittance ratio, down to less than 1% by local bump, etc., looking at the synchrotron-light interferometer. (6).

- Beam lifetime

- observation of correlation between the lifetime and intensity/beam sizes/vacuum pressure (2+anytime).

- Stability of orbit and beam size (3+anytime).

- record/log as frequent as possible.
 - correlation between room/water temperatures, etc.

- Commissioning of wigglers/chicanes (3)

- observation of damping times/emittances.

- Low- β optics

achieve the design β -functions at IP, by monitoring/controlling optics/tunes/orbits/emittance/dynamic aperture/lifetime/injection efficiency. may be done step-by-step if necessary (9).

optimize the working conditions (9).

comparison between low/high currents (3).

c) Storing high current (minimum 56 shifts/ring), from 100 mA to the design current.

- observation of single-bunch instabilities (2).
- storage with various bunch patterns (3+) .
- study of vacuum pressure/system (3+any)
- behavior of rf systems at high current:
power/voltage/loading/heating/reflection/transient/stability ... (12+)
- commissioning of bunch by bunch feedback/monitor system (6)
- observation of heating at various components (3+)
- observation/suppression of coupled bunch instability (9) .
- dependences on machine parameters (6) .
- fast ion/photo electron instabilities (FII/PEI). Choice of the bunch gap. Clearing solenoid. (12)

d) Collision of beams (minimum 33 shifts). 10 mA to design current.

- finding out the collision orbit/rf phase (3).
- commissioning of the collision feedback system (6).
- observation of beam-beam tune shift (3)
- observation of luminosity & its dependence on parameters (9).
- stabilities (3+).
- observation of beam backgrounds, tuning by masks (3).
- observation/control of beam tails (6).

Items only listed above will take at least 224 shifts, even if 2 rings are commissioned fully in parallel. Lower degree of the parallelness requires more commissioning shifts. Beside above dedicated shifts will be necessary for the beam transport and the Linac. In the actual situation, unexpected dead time must be expected. Therefore the commissioning period for 3 months is just the minimum.

It is quite likely that the experiment cannot start right after the roll-in of Belle at 3 month since the start of the ring commissioning.

As the commissioning proceeds and if such a possibility becomes very high, first conditions of the machine which ensures the safety of Belle will be found out, then several commissioning items will be postponed after installation of Bell.

LER

HER

**MISSION:
IMPOSSIBLE**

10/12/1998

Start up

10/19

10/26

11/2

11/9

11/16

11/23

Degas

11/30

12/7

12/14

12/21

12/28

1/4/1999



1/11

1/18

1/25

2/1

2/8

Start up

Lattice

High
intensity

Low β

Collision
beam-beam
background

Lattice

High
intensity

Low β

Degas

Shutdown

Belle roll-in

Solenoid

Commissioning continues, NO EXPERIMENT!

Solenoid

