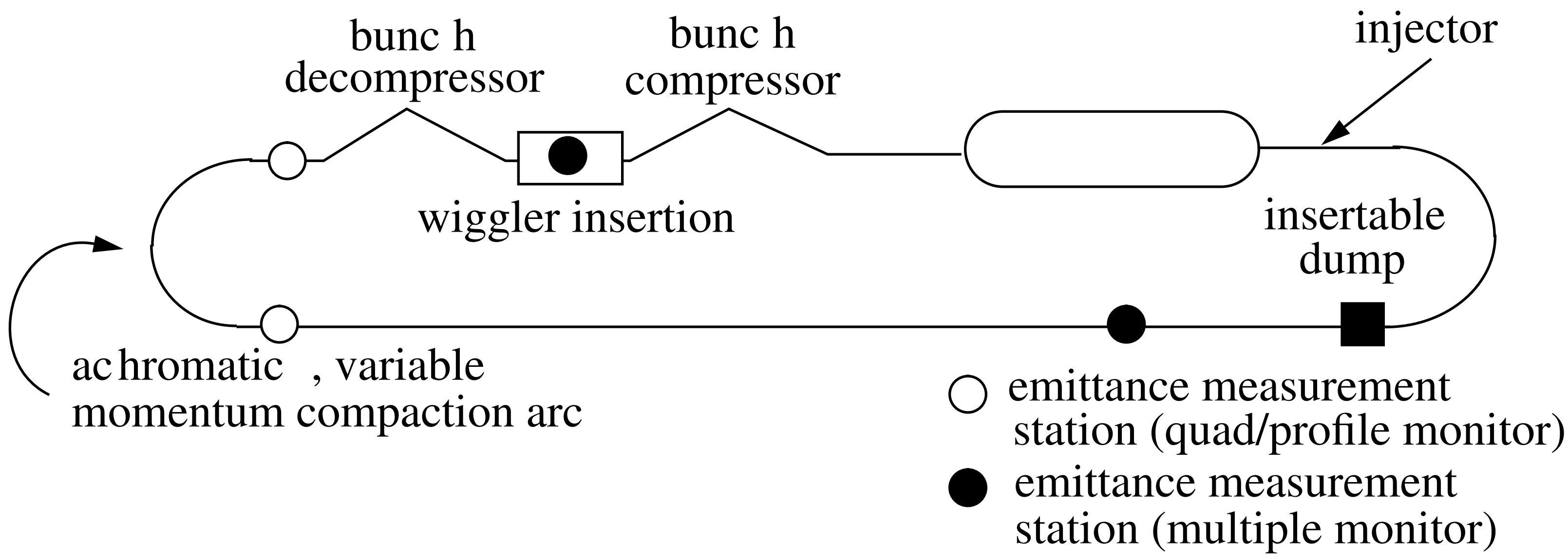
Measurement of CSR-Driven Emittance Growth

Goals

1. certify that CSR-driven emittance growth is not intolerably large for FEL operation, particularly for system upgrades (FEL systems located in the accelerator backleg)

2. investigate the parametric dependences of CSR-driven emittance growth.

System Schematic



Initial Experimental Plan ("Certification Phase")

Measure beam emittances using available diagnostics in as many locations as possible. Emittance evolution will then be characterized for nominal operating parameters of the driver. Emittance can be measured at three locations:

1. At wiggler insertion, downstream of the bunch compressor. For simplicity, this should be done with the wiggler out.
2. Downstream of the bunch decompressor (which is identical in geometry to the bunch compressor upstream of the FEL).
3. In the backleg, where multiple emittance measurement systems are available.

Ongoing Experimental Plan (“Parametric Studies”)

After initial “CSR certification” of nominal Driver parameters, exploration of parametric dependences will be made. The following parameters are readily and more or less orthogonally varied through the various bending regions:

- bunch current (60pC, 135pC being nominal operating points)
- bunch transverse size through any particular bending region, by using upstream quadrupole matching
- bunch momentum spread, through adjustment of injector parameters and RF phase during acceleration
- bunch length - in the compressor/decompressor through adjustment of incident momentum spread, in the arc through adjustment of the momentum compaction

It may additionally be possible to adjust incident emittance independently of other parameters by juggling injector parameters

Such measurements provide a sensitivity matrix that can be compared to theory and used to predict performance of upgrades

Tasks

1. Experimental design
   a. details of parametric study
   b. hardware layout
   c. modeling of measurement
   d. error analysis

2. Test plans and procedures
   a. test plan
   b. procedures

3. Software
   a. requirements
   b. development, debugging, commissioning

4. Hardware
   a. construction, installation
   b. commissioning

5. Experiment
   a. shifts
   b. data reduction
   c. report

People/Pigeonholes

Bisognano (JB), Bohn (CB), Li (RL)	theory ("BBL ")
Douglas (DD)	optics , operations
Krafft (GK), J ordan (KJ)	diagnostics , operations
Denard (JCD), Piot (PP)	diagnostics
Legg (BL)	operations
Dunham (BD)	softw are , optics , operations
Bowling (BB)	softw are

Schedule

Table 1: Draft CSR Experimental Schedule

Task	People	6/97	7/97	8/97	9/97	10/97	11/97	12/97	1/98	2/98	3/98	4/98	5/98
1. Expt. Des.													
a. para. study	BBL, DD, GK												
b. hardware	JCD, KJ, GK, PP												
c. modeling	BBL, DD, BD												
d. error an.	BD												
2.Test plans/pro.	BL in charge												
a. test plans	?												
b. procedures	?												
3. Software													
a. requirements	BB, DD, BD, GK												
b. development	BB, BD												
4. Hardware													
a. construction	KJ, GK												
b. commission	KJ, GK, PP, ?												
5. Experiment													
a. shifts	all												
b. data reduct.	BBL, BB, BD, DD												
c. report	all												