SOME REMARKS FROM THE HERA POINT OF VIEW

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1.) Collimators

used to protect the experiments…(sudden beam loss and background due to halo particles)

and to protect the machine (to avoid quench of superconducting magnets)

The Collimators are used to define the minimum aperture of the machine … in both planes and we never run without!

Loosing the beam → bad, but not very time consuming.
Boiling the helium → very bad and very time consuming.

Typical settings of the collimators jaws.

Cold aperture at flat top energy	12 σ in x and y
Collimators at flat top energy	10 σ in x and y
Collimators at collision	5-6 σ in x and y

Triggers for the beam dump systems:

- Quench Alarm
- External trigger of operators
- PFN failures
- Experiment background
- Hardware failure of important components
- AND Beam Loss Monitors … most important ones mounted downstream of the collimator jaws.

2) Reference Magnets:

Backbone for HERA operation
→ Ramp Control: All components are lockrd to the increasing energy via B_dot measurement in the reference magnets.

(Transfer function J ↔ B is very nonlinear due to eddy current effects).

→ Control of injection parameters:
Measure and correct Bo (i.e. momentum)
Q
Chromaticity
… before first bunch is transferred.

Reference magnets are equipped with

Rotating Coils → Sextupole component
Hall probes and 4 NMR's → Energy

Persistent Current Contribution of dipole to sextupole :
Chromaticity (p.c.) ξ +/_ 240

Prediction due to measurement in Ref. Magnets:
≈ +/_ 2 units.

=> Reference magnets are an excellent tool to understand and improve the model of the machine !

? Costs ?

Effects on Ramp:

We measure the decay of sextupole component at injection
$\Delta Q'$ ~ 10 units/ 30 minutes

And keep it constant … based on Reference Magnets

We measure the "snap back" of sextupole component and compensate it … based on Reference Magnets.

In addition:

We have sextupole correction tables
We have knobs for fine tuning.

3.) Knobs
We need a fast and flexible tool to handle beam parameters
→ Tunes
Energy (apply current ranges to all horizontal correction dipoles)
Q'
Any kind of orbit bumps, luminosity scans
Any kind of orbit correctors
Etc.

"Knob" means: creating bits that are sent to a power supply or a group of power supplies to do dedicated changes…

…at any time
…in addition to the ramp or other procedures

For HERA most important examples:

- Fast tune correction at injection and on the ramp
- Fast Q' correction at injection and on the ramp
- Fast coupling correction at injection and on the ramp
- Background tuning via beam steering at Lumi !!
  via tune steering at Lumi !!

"Fast" means on beam, on line, i.e. ~ seconds.

4) Meetings:

Meeting a week: (1 hour)	accelerator physicists → planning the run talking about problems
Meeting a week: (1 hour)	HERA coordinators and experiment coordinators ~ 12 people decisions for the Run

Meeting after each Shift (~15 min) among shift crew to guarantee information flow
→ only the actual shift and the coordinator are present.

5) Lumi tuning

Is the centering of the two beams sufficient and adequate if it is only based on global orbit connections?

In HERA: Beams have to be centered to $\Delta x \sim \Delta y \sim 1/10\ \sigma$

If the separation (ΔX, ΔY) is bigger, backgrounds are rising and the emittance of the beam suffers. (… sometimes even beam loss has been observed at large beam offsets)

We tried to connect both beams with reference to "golden orbits" => not good enough!

? BPM Quality

Our solution: Lumi optimization
beam steering
background optimization
(Using "Knobs" to apply local orbit bumps)

6) Q Protection/Cryo

We have MKR and Cryo-KR

⇨ Signal "Cryo-OK" as input for the Control System
⇨ Inhibit for Injection
Dump-Reset
Machine Ramping

⇨ Fast analysis of archived settings of:
BPM's
BLM's
Q – Protection
CRYO – OK
In case of a Quench.

7) Ramp Connections

- measure and correct Q ξ κ at injection
- on the Ramp:
  - lock all hardware to the (nonlinear) increase of the dipole field
  - measure the sextupole component of dipoles (Ref. Magnets) and apply correction
  - correct systematic effects by tables (cfr. Tevatron)
  - Fine tuning by the operator…using Knobs

8) Communication with the Experiments

… I will not say one word.

I will not even mention the word
"Coordinating Experiment"
(it is too dangerous)

9) NO GUNS IN THE MC ROOM ?