Draft Programme for BBLR MD's in 2003

MD1: Calibration of the BBLR BPM

The antennas of the BBLR BPM are significantly perturbed by the wire support from a first set of measurements. Nevertheless, this BPM would be very interesting if it could be cross-calibrated.
There are various possibilities. I would suggest starting with the simplest one to investigate whether it is worth putting more effort in this calibration.
We could simply note the position read vs the position interpolated from the near-by BPM's for a range of x and y positions adjusted by bumps with BBLR off:
x in a small range related to the usual spread in H horizontal orbit and y in the relevant range of beam separation, i.e. about +10 mm down to -15 mm (the BBLR is at -19 mm).
If the calibration polynomial is not too badly behaved, we get a first estimated of the position.
For this MD, we need a piece of software which gives easy access from the operations consoles to the BBLR BPM signals where we could add the calibration polynomial (help needed from Rodri? Christian? or who?)

If it is found worth, a more precise calibration could be carried out with the BBLR on by measuring as well the beam-wire tune shifts.

MD2: Correction of the dipole kick of the BBLR

The goal is to compensate the dipole kick of the BBLR by the new vertical orbit corrector MDVB 5177 in an operational way. Ideally, the operation of the BBLR and MDVB5177 should be coupled for an easy use.
The dipole kick is given by:

$$Bl = \frac{\mu_0 I\, l}{2\pi\, d} = 2\ 10^{-7}\ \frac{I\, l}{d}$$

If the calibration of the BBLR BPM is possible, the correction can be made from the equation.
If this is not the case, a correction table could be built:

1. BBLR off, adjust the vertical bump 517 for a small beam-wire separation *d* as calculated by interpolation (it should produce, for BBLR on, a large vertical orbit distortion for maximum accuracy).
2. Record the closed orbit around the machine.
3. BBLR on at 267 A
4. Correct the change of closed orbit outside of the 517 bump. Is the separation *d* restored?
5. Record the current of MDVB5177 and the beam-wire tune shifts to compute the exact value of *d* and crosscheck.
6. Repeat for another beam separation .

7. Repeat for another BBLR current, e.g. 150 A

This set of measurements should be sufficiently redundant to allow checking the consistency and building a correction table which should minimize/suppress the need to correct a la main.

Any other strategy? →YES from Jorg but I cannot find the mail anymore (sorry).

MD3: Measurement of the Diffusion

Experiment at 26 GeV on P2 aimed at debugging the principle and the software.

1. Method using a collimator

Principle: The collimator is set at: closed orbit + (n+0.5 sigma). The scraper is used to cut the beam at n sigma. The rise of the background on the collimator is measured with a BMT

Implementation: The motion of collimators being slow, this method probably requires the machine to be dedicated to this experiment.

The best collimator BRC(Z)V51932 is just outside of the BBLR bump. It is equipped with a beam loss monitor and a PMT(4) logged by the program cmon.

The scraper to be used is BSV51459 (outside the BBLR bump).

The optics functions for SPS2003 have to be found.

2. Method using a fast bump towards an aperture limit

Principle: A fast bump is used to move the beam during the P2 cycle only towards an aperture limit monitored by a PMT. Otherwise the method is the same as the former one, using a scraper.

Implementation: Unfortunately, the only monitored targets are the collimators in LSS5. A fast bump would disturb the beam-wire distance. I could not find another possibility.

3. Method using a fast bump for scraping and aperture limit

Principle: A fast bump is used to scrape the beam on an aperture limit and move it back by 0.5 sigma. The rise of the background is observed with a PMT.

Implementation: same problem as above: it does not seem possible not to interfere with the beam-wire distance. Jorg calculated that the beam motion would be 30 ms/mm with an overshoot.

4. Method using the BBLR as aperture limit

Principle: The beam is moved slowly towards the BBLR until it grazes the wire as observed on the BBLR PMT(3).. This position will be interpreted as 9.5 sigma. The wire current is scaled to the LHC value, taking into account the beam-wire separation. The orbit perturbation is corrected. The scraper is used to cut the beam at n sigma and the rise of the background is observed with a PMT on this 9.5 sigma aperture limit.

Implementation: doable directly in the control room.

5. Method requiring the software upgrade (from 1 Aug.)

Principle: The beam is scraped at n sigma and the scraper withdrawn by 0.5 sigma within 10's of ms. The rise of the background on the scraper is observed with a PMT.
Implementation: Doable one the software is ready. The scraper to be used is BSC51459 equipped with a PMT(1). See figures

MD4: Experiment at 26 GeV

1. Choice of the parameters

a. Choose a beam-wire separation Δy_0 in mm's such that the wire is the aperture limit.
b. Compute the *reference* σ_0 with $n\sigma_0 = \Delta y_0$ with $n = 9.5$.
c. Scale the wire excitation to the LHC situation:

$$\frac{I_W}{\sigma_0^2} = \frac{267}{\frac{\beta}{\gamma} \times 3.75} \qquad \frac{A}{nm}$$

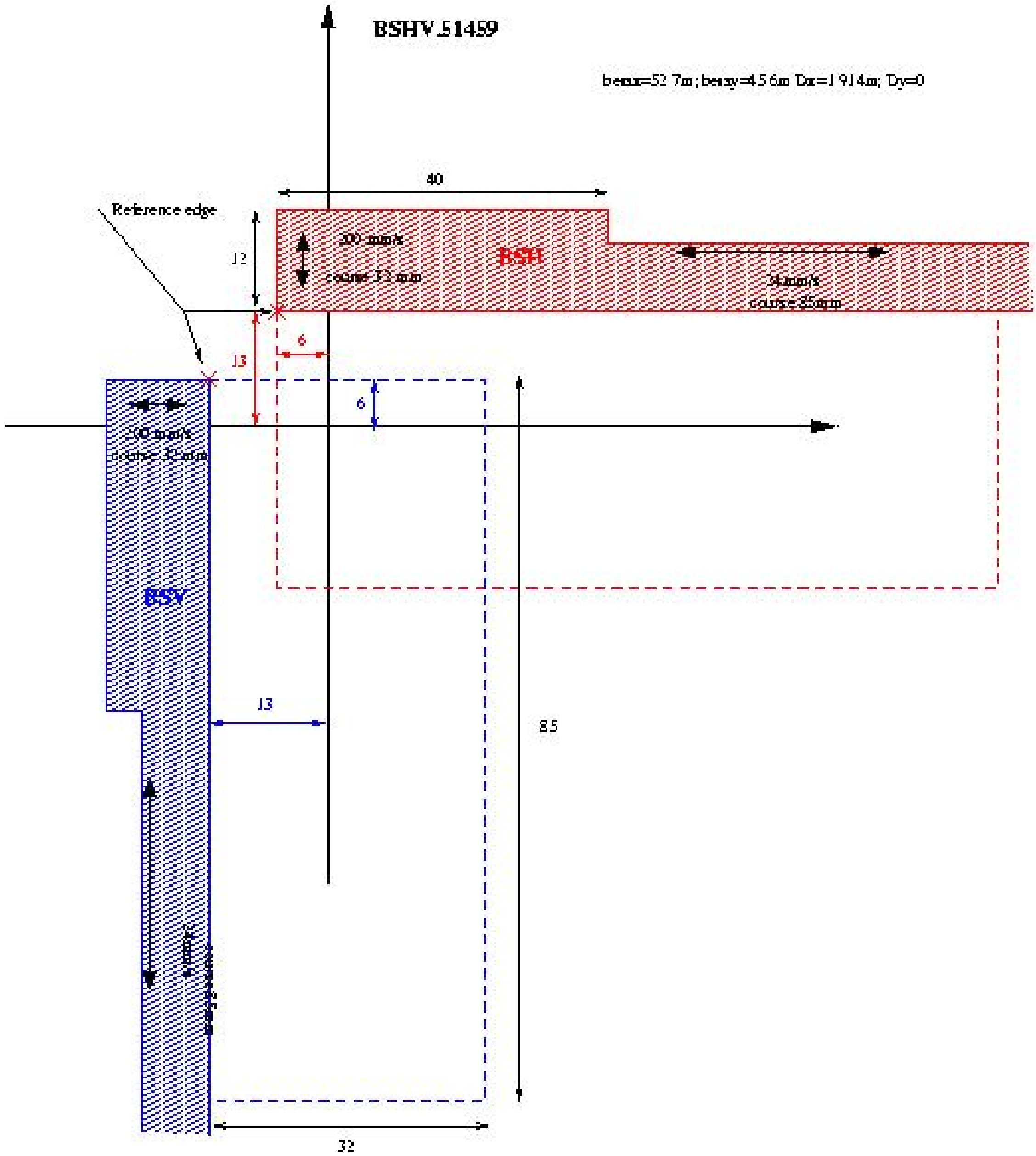
2. Set the beam-wire separation

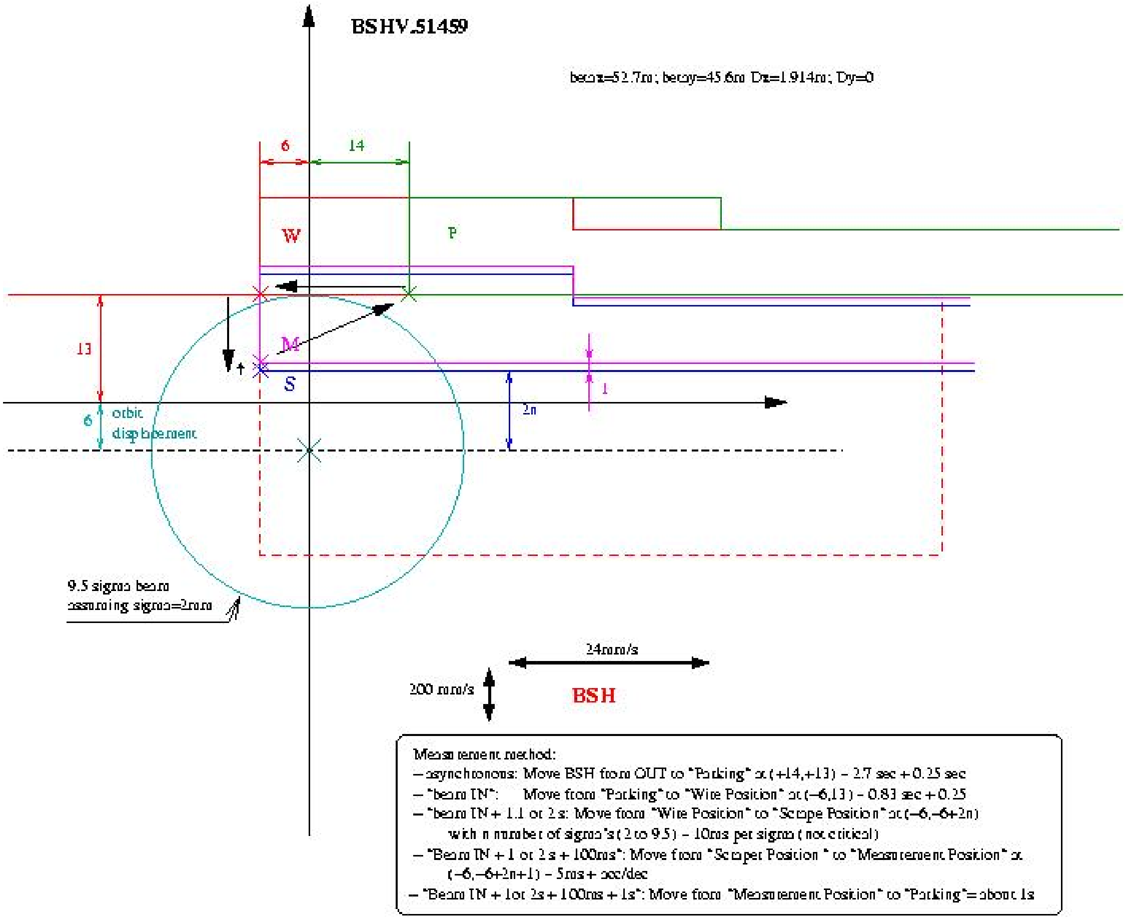
a. Wire off, adjust the beam-wire separation to Δy_0 using the bump 517.
b. Wire ON, adjust the BBLR dipole corrector to restore the beam-wire separation.

3. Measurement of the diffusion versus amplitude

a. Calibration of the y=0 at the scraper: from y = +19mm downwards, full horizontal sweep until the beam is completely scraped.
b.

Etc……..


BSHV.51459
betax=52.7m; betay=45.6m Dx=1.914m; Dy=0
40
Reference edge
12
200 mm/s
course 12 mm
BSH
34 mm/s
course 25mm
6
13
6
200 mm/s
course 32 mm
BSV
13
85
32



BSHV.51459
betax=52.7m; betay=45.6m Dx=1.914m; Dy=0
6
14
W
P
M
S
13
6
orbit
displacement
2n
1
9.5 sigma beam
assuming sigma=2mm
24mm/s
200 mm/s
BSH
Measurement method:
– asynchronous: Move BSH from OUT to "Parking" at (+14,+13) - 2.7 sec + 0.25 sec
– "beam IN": Move from "Parking" to "Wire Position" at (–6,13) - 0.83 sec + 0.25
– "beam IN + 1.1 or 2 s: Move from "Wire Position" to "Scrape Position" at (–6,–6+2n)
with n number of sigma's (2 to 9.5) - 10ms per sigma (not critical)
– "Beam IN + 1 or 2 s + 100ms": Move from "Scraper Position " to "Measurement Position" at
(–6,–6+2n+1) - 5ms + sec/dec
– "Beam IN + 1or 2s + 100ms + 1s": Move from "Measurement Position" to "Parking"= about 1s