

## A.2: Design and development of visible diagnostic beamline at Indus-2 and initial measurement results

Beamline BL-23 at 5° port of bending magnet (DP-10) of Indus-2 storage ring has been designed, developed and installed as visible diagnostic beamline (V-DBL) by Beam Diagnostics Section of Accelerator Control and Beam Diagnostic Division. The beamline front-end has been installed by ISUD. This beamline is intended for measurement of longitudinal parameters such as bunch length, bunch separation, bunch filling pattern etc. Initial measurements for bunch filling pattern, bunch length and bunch separation have been taken during trial operation of V-DBL.

In V-DBL, standard front-end components include collimator, water cooled shutter, gate valves, fast shutter etc. Other specific beamline components are remotely controlled water cooled primary mirror (with five degrees of freedom), double viewport chamber, wire beam profile monitor (WBPM), mirror/lens assemblies, light shutter, beam dump (for blocking X-rays) etc. The optics layout of V-DBL and some photographs of installed beamline components are shown in Fig. A.2.1 and Fig. A.2.2.

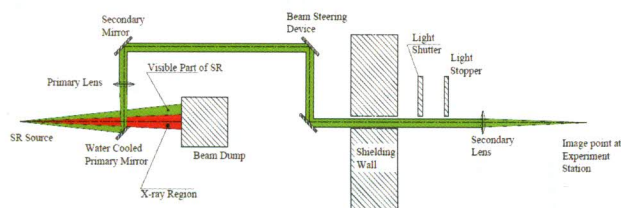


Fig. A.2.1: Optics layout for V-DBL at Indus-2.

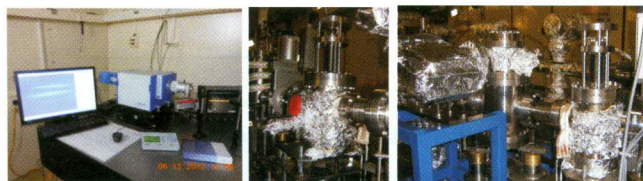


Fig. A.2.2: Some photographs of installed components and detectors at V-DBL; streak camera (left), WBPM (middle) and primary mirror chamber (right).

A remotely controlled water cooled primary mirror at a distance of 5 m from source extracts visible light from the wide synchrotron radiation (SR) spectrum of dipole magnet. Its angular acceptance is 5 mrad (H) and 4 mrad (V). A double viewport assembly is used for UHV to air isolation. Visible light is focused on optical table in a darkroom outside shielding wall by following reflective and refractive optics. Instrumentation on an optical table includes a dual sweep synchroscan streak camera, beam profiler, avalanche

photodiode, position-sensitive detectors, fast photodiodes etc.

Filling pattern of Indus-2 in different modes was measured at V-DBL using 4.5 GHz fast photo receiver. Typical digital storage oscilloscope traces showing bunch filling pattern in partial filled mode and full filled modes are shown below in Fig. A.2.3 and Fig. A.2.4 respectively



Fig. A.2.3: Typical bunch filling pattern showing 200 filled buckets out of total 291 buckets (left), filling level of individual bucket(right)

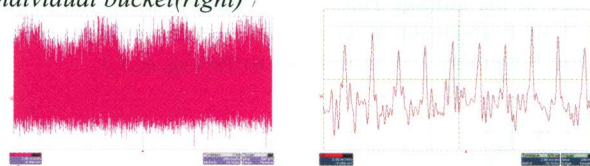


Fig. A.2.4: Typical bunch filling pattern showing all 291 filled buckets(left), filling level of individual bucket(right)

Dual sweep synchroscan streak camera (Optronis, model SC-10) has been commissioned at V-DBL. Typical bunch length (RMS) and bunch separation of five consecutive electron bunches measured with streak camera are  $53 \pm 2.5$  ps and  $1.97 \pm 0.026$  ns respectively as shown in Fig. A.2.5.

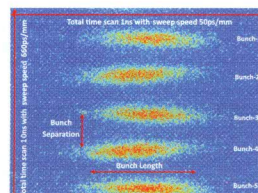


Fig. A.2.5: Typical bunch length measured using dual sweep synchroscan streak camera for five consecutive bunches at 75mA @ 2.5 GeV energy in Indus-2.

Beam profile of the visible light is measured by using beam profiler camera at experimental table in dark room. Measured beam profile has RMS size 700  $\mu$ m (H) and 350  $\mu$ m (V) with 25 msec integration time. The vertical beam profile of SR beam was also measured using WBPM as shown in Fig. A.2.6.

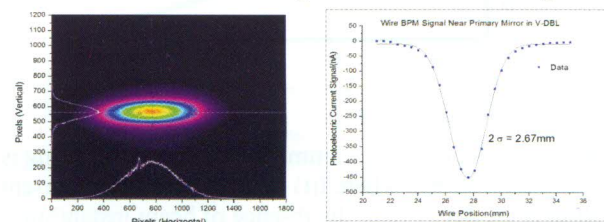


Fig. A.2.6: Measured beam profile using beam profiler at experimental table (left) and vertical beam profile of SR beam near primary mirror using WBPM at 20 mA, 2.5 GeV (right)

Reported by:

T.A. Puntambekar (tushar@rrcat.gov.in)