Synchrotron Light Monitor
- First Applications -

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1. Introduction / Experimental Setup

2. Energy / Timing jitter ACC1

3. Energy slope along bunch train

4. Vertical tilt measurements

5. Summary / Outlook
1) Beam Position Measurements

Reference orbit for bend angle -20 deg.

Horizontal position of the electron beam is related to the beam energy

\[ x = R_{16} \times \Delta E/E \quad (x = 10 \text{ mm} \cong \Delta E/E = 3\%) \]

At location of SR camera bunch appears as if ‘streaked horizontally’
1) Old Set-up SR camera
1) Layout New SR port

Fast MCP Detector (single bunch resolution)

ICCD Camera (single bunch resolution)
1) New SR Port and Camera

Movement of mirror and camera needs to be automated
1) Energy Calibration

Relative energy calibration established by scanning the dipole current
2) Energy jitter ACC1

File: 2006-03-11T040158-plot-Gcr-ctr-new.mat in /home/tflinao/user/schlarb/matlab sr

- energy jitter = 0.070%
ACC1 gradient SP = 15.32
Beam energy jitter is related to timing jitter:

\[ \Delta x = R_{16} \times \frac{\Delta E}{E} \quad \Delta t \approx \frac{R_{56}}{c} \times \frac{\Delta E}{E} \]
2) Energy/Timing jitter ACC1

Correlation between TEO and SR measurement
3) Energy slope along bunch train

Single Bunches within bunch train can be chosen by changing the delay.
3) Energy slope along bunch train

Talk by Elmar Vogel (FLASH Seminar 16/1/07)
Beam loading compensation with beam monitor signal

'Error' bars: 0.4% 'Error' bars: 0.05% 'Error' bars: 0.4%
'Slope': 0.1% / 30 µs 'Slope': 0.1% / 30 µs 'Slope': vanished?
FB = feed back, AFF = adaptive feed forward, BLC = beam loading compensation
3) Energy slope along bunch train

\[ \Delta t = \frac{R_{56}}{c} \cdot \frac{dE}{E} \]

\( R_{56} \approx 180 \text{ mm} \)
\( \frac{dE}{E} \approx 0.2\% \)
\( \rightarrow \Delta t \approx 1.2 \text{ ps} \)

Bunch Arrival Monitor
Courtesy of F. Loehl

Synchrotron Radiation Monitor

\[
\begin{align*}
\text{average bunch arrival time} \\
\text{measured at } z = 140 \text{ m} [\text{ps}] \\
bunch number
\end{align*}
\]
4) Tilt Measurement

• Vertical tilt measurements to study the resolution of the BPM

→ Next talk by Kirsten Hacker
4) Tilt Measurement

8 deg off-crest in ACC1
4) Tilt Measurement

SR Camera BC2: Bunch tilt measurement 22/12/2006

Also steerer V10ACC1 was used
Several successful cross-correlation measurements with other experiments/diagnostics

Operator friendly tools need to be developed …