LOLA Measurements vs. Beam Dynamics Simulations

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11.04.2011
DESY
Shift on 23.03.2011 (~3 hours afternoon)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Q$</td>
<td>0.35-0.4 nC</td>
</tr>
<tr>
<td>$E_1$</td>
<td>150 MeV</td>
</tr>
<tr>
<td>$\Theta_1$</td>
<td>18°</td>
</tr>
<tr>
<td>$E_2$</td>
<td>445 MeV</td>
</tr>
<tr>
<td>$\Theta_2$</td>
<td>4.58°</td>
</tr>
<tr>
<td>$E_3$</td>
<td>665 MeV</td>
</tr>
</tbody>
</table>

On-crest phases

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\phi_{11}$</td>
<td>0°</td>
</tr>
<tr>
<td>$\phi_{13}$</td>
<td>1.5°</td>
</tr>
<tr>
<td>$\phi_2$</td>
<td>-8°</td>
</tr>
<tr>
<td>$\phi_3$</td>
<td>-4.5°</td>
</tr>
</tbody>
</table>
On-crest

Longitudinal phase space

Projected energy deviation

Longitudinal bunch profile

Slice energy spread

\[ k_s = 0.9256 \]
\[ k_E = 1.1570 \] - an additional calibration of the measurement
Longitudinal phase space

Projected energy deviation

Longitudinal bunch profile

Slice energy spread

C=2.2
C₁ =1.9
C₂ =1.1
Longitudinal phase space

Projected energy deviation

Longitudinal bunch profile

Slice energy spread

C = 3.2
C₁ = 2.6
C₂ = 1.2
LOLA resolution increase. New Calibration.

\[ C = 3.2 = 2.6 \times 1.2 \]

\[ k_s = 0.9256 \]
\[ k_E = 1.1570 \]
- an additional calibration of the measurement
New additional calibration.

\[ C = 3.2 = 2.6 \times 1.2 \]

\[ k_s = 0.9256 \]
\[ k_E = 1.1570 \]

\[ k_s = 0.83 \]
\[ k_E = 1.71 \]
Longitudinal phase space

Projected energy deviation

Longitudinal bunch profile

Slice energy spread

Projected energy deviation

Longitudinal bunch profile

Slice energy spread

L-Band and 3rd harmonic rf parameters

RF sum amplitude and derivatives

\[ C = 4.5 = 3.2 \times 1.4 \]
Longitudinal phase space

Projected energy deviation

Longitudinal bunch profile

Slice energy spread

C = 4.5 = 3.2 * 1.4

L-Band and 3rd harmonic rf parameters

- Unp. L-Band [MV]: 164.4273
- Phase L-Band [deg]: 0.9129
- Unp. 3rd har. [MV]: 20.6198
- Phase 3rd har. [deg]: 162.8824

RF sum amplitude and derivatives

- Beam [MV]: 144.7
- 2sep [1/m]: -3.9189
- r [1/m]: 66.352
- r' [1/m^2]: 23222.797
C = 5.4 = 3.7 * 1.5
$C = 5.4 = 3.7 \times 1.5$

Without CSRtrack

With CSRtrack
Without CSRtrack

With CSRtrack

C = 7.6 = 4.44 \times 1.71
Current profile?

$I$ [A]

$\lambda_1$, $\lambda_2$, $\lambda_1$, $\lambda_2$

$G_1$, $G_2$, $G_{1i}$, $G_{2i}$

Gain vs compressed wavelength

$I$ [A]

$G_1$, $G_2$, $G_{1i}$, $G_{2i}$

$\lambda_1$, $\lambda_2$, $\lambda_1$, $\lambda_2$

$2.998 \times 10^{-6}$, $2.998 \times 10^{-3}$

$0.01$

$1 \times 10^{-3}$

$10$

$100$

$1000$

$1 \times 10^{3}$

$1 \times 10^{5}$

$1 \times 10^{7}$

$\text{Current profile?}$

$\text{measurements}$

$\text{simulations}$

at LOLA

start

$\text{gain vs compressed wavelength}$

$\text{Current profile?}$

$\text{measurements}$

$\text{simulations}$

at LOLA

start
Simulations at LOLA

I [A]

I [A]

at LOLA

s [mm]

s [mm]
C=7.6=4.44*1.71

smooth current

new current
RF parameters?
On-crest simulations vs the measurement.
$C = 9.4 = 4.9 \times 1.9$

$V_{13} = +1.1 \text{ MV}$

$\psi_{11} = -0.2 \text{ deg}$

Longitudinal phase space

Projected energy deviation

Longitudinal bunch profile

Slice energy spread

$V_{13} = +1.1 \text{ MV}$

$\psi_{11} = -0.2 \text{ deg}$
C=32=7.5*4.3

V13=+1.5 MV

fi11=-0.2 deg