

# VLHC Parameters

There are only 2 'official' parameters:

50 Tev beam energy

$10^{34}$  luminosity

Details of the other machine parameters will (presumably) reflect the final technology and design choices

There are however self consistent parameter sets which represent reasonable choices based on the present R&D program and optimism for the eventual outcome

One of the goals of workshops such as this one is to refine the parameter set; no major technical problem should depend on the details of the parameter set. Feel free to vary baseline numbers

## VLHC Parameters - basic

- Circumference 95 km
- Number of bunches 22000
- Bunch spacing 4.3 m (14.5ns)
- Initial bunch intensity  $1.25 \cdot 10^{10}$
- Initial transverse emittance 2 mm-mrad (rms)
- Initial longitudinal emittance 0.22 eV-s
- Injection energy 1-3 Tev
- Peak stored energy 2.2 GJ

## VLHC Parameters - lattice

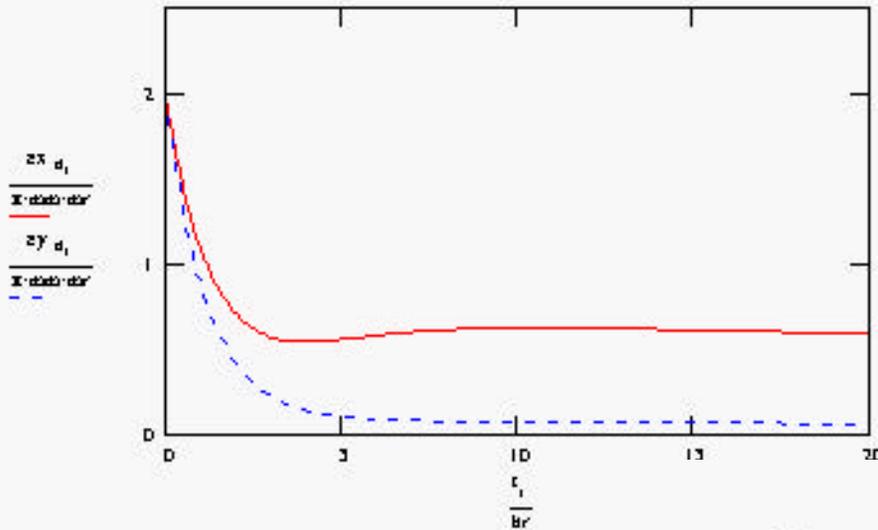
- 2 arcs, 2 IR's, 2 utility areas
- Cell length 500m (90 cells per arc), 90 deg/cell
- Betamax 850m, betamin 150m
- Dmax 12.2m, Dmin 5.8
- Dipole field 12.2 T, length 20.2 m,
- Magnet aperture ? ~  $4 \pm 1$  cm ?
- Quad GL 950T (160 T/m, 5.8m)
- IR parameters  
 $\beta_x$  500 cm,  $\beta_y$  50cm,  $\beta_{\max}$  0.5(5.6) km  
Quads 500 T/m !!, vertical X-ing angle 86  $\mu$ rad

# VLHC Parameters - synchrotron radiation

- Beam current 0.14A
- Bunch length 2 cm
- Peak current 11.8A
- Energy loss per turn 3.61 MeV/particle
- Critical photon energy 2.96 KeV
- Fractional energy loss 6 W/m (dipoles)
- Total energy loss 500 kW/ring
- Beam gap 5  $\mu$ secs

# VLHC Parameters - Time evolution

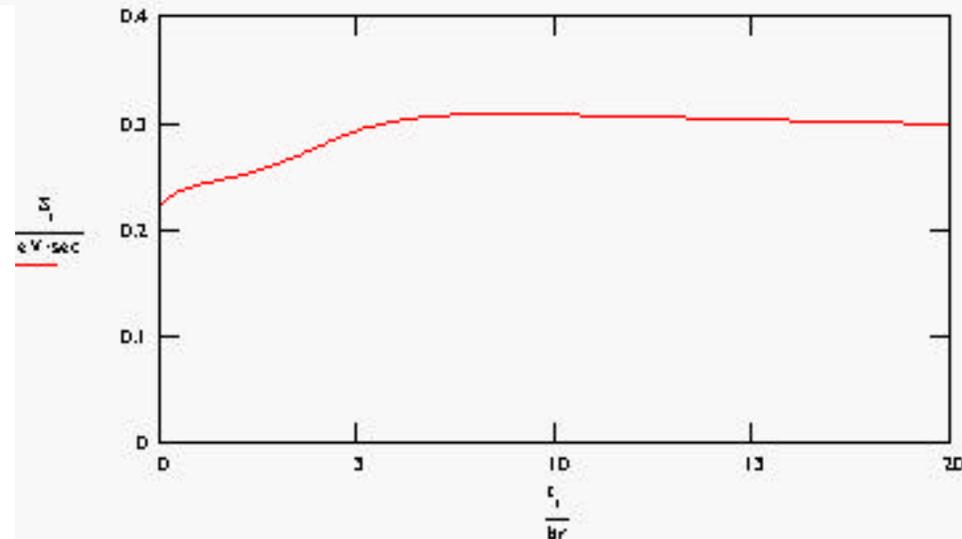
TRANSVERSE EMITTANCE



H-V coupling at 10% !!

Longitudinal heating  
0.4 eV-s/hr

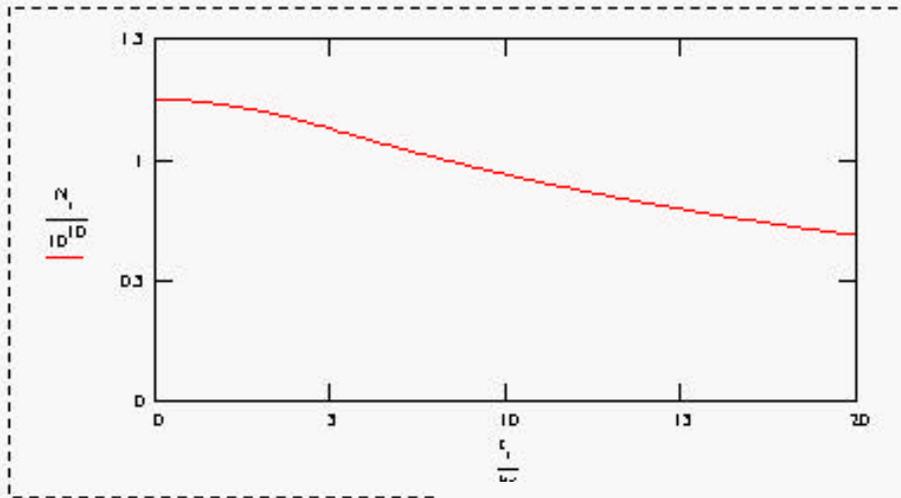
Longitudinal Emittance



# VLHC Parameters - Time evolution

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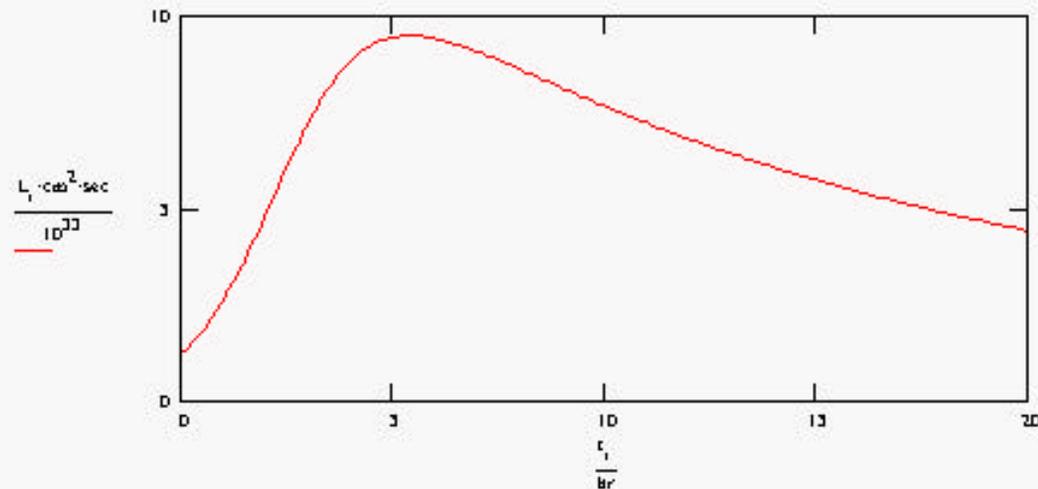
**Bunch Intensity**



Bunch intensity

**Instantaneous Luminosity**

Luminosity

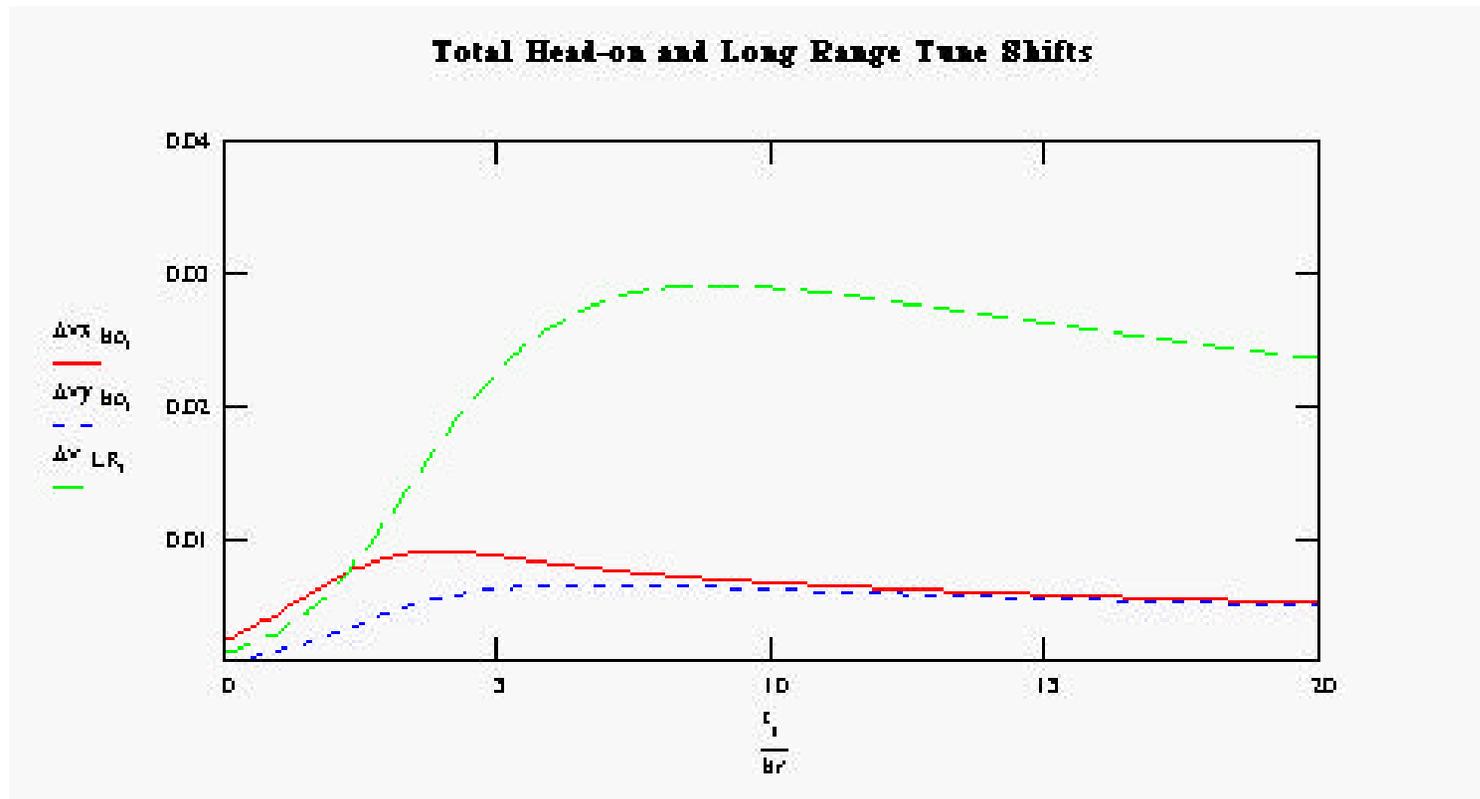


$\beta_{x \text{ star}} = 500 \text{ cm}$

$\beta_{y \text{ star}} = 50 \text{ cm}$

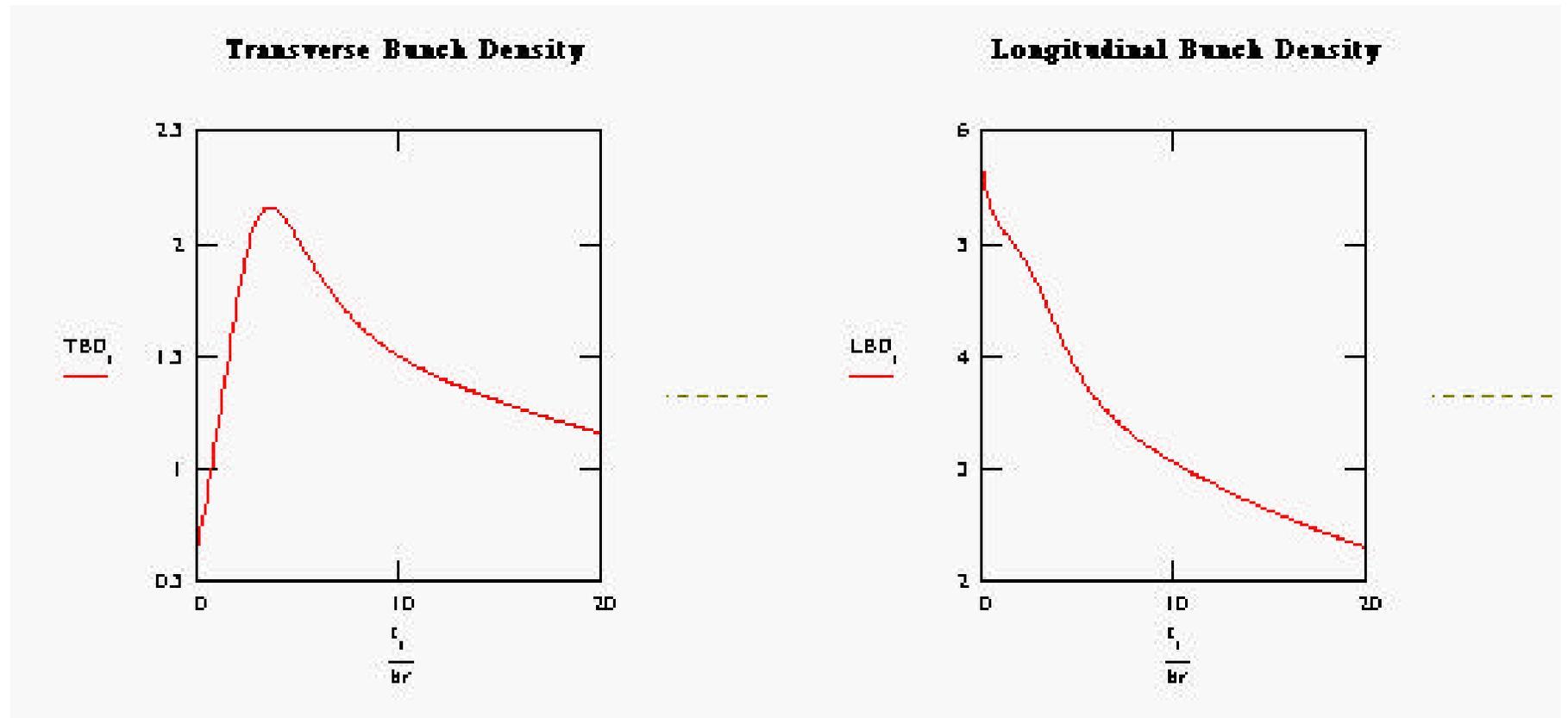


# VLHC Parameters - Time evolution



Tune shifts

# VLHC Parameters - Time evolution



Bunch densities - arbitrary units

# Workshop Goals

The workshop is intended to be 'An initial investigation into the advantages and drawbacks of synchrotron radiation in a high field VLHC. We would like to identify and clarify future topics for further investigation'.

Synchrotron radiation damping at very high proton beam energies can result in hitherto unobtainable beam densities which may prove to be very beneficial in achieving machine performance goals.

Radiated power will inevitably complicate the beam tube environment.

Is there an appropriate balance at these energies ?

# Workshop Organisation

This Workshop is one in a series looking at topics of potential interest to a next generation hadron machine organised by the VHLC steering committee

We will have three working groups:-

- Group 1            Round/Flat Beams
  - [Dick Talman \(GL\)](#) - Cornell, Steve Peggs-BNL, Jim Murphy-BNL, John Johnstone-FNAL
- Group 2            Electron Cloud & Vacuum Effects
  - [Miguel Furman\(GL\)](#)-LBL, Dejan Trbojevic-BNL, Mauro Pivi-LBL, Oswald Grobner-CERN, Kathy Harkay-ANL, Peter Limon-FNAL
- Group 3            Damping Dynamics
  - [Alex Chao\(GL\)](#)-SLAC, Gerry Dugan-Cornell, Jie Wei-BNL, Tanaji Sen-FNAL

# Workshop Schedule

- 9.00 Workshop goals and VLHC parameters Mike Harrison
- 9.30 Flat beams and optics Steve Peggs
- 10.00 Syn. Rad impact on the LHC Oswald Grobner
- 10.45 Break
- 11.00 Properties of the electron cloud measured in an electron ring Kathy Harkay
- 11.30 Open Discussions
  
- Monday p.m. Working group sessions
  
- Tuesday a.m. Working group sessions
  
- Tuesday 12.00 Plenary working lunch (if we can figure out what this actually means)
  
- Tuesday p.m. Working group sessions
  
- Wednesday
- 8.45 Report from working Group 1
- 9.45 Report from working Group 2
- 10.45 Break
- 11.00 Report from working Group 3
- 12.00 Workshop Conclusions