

KEKB: Present and Future

2/25/2002

K. Oide @ Machine Advisory Committee

- 1. Where are we now?**
- 2. When and How do we Upgrade?**

Thank to all members of KEKB, Belle, Kurokawa san ...

Luminosity of KEKB July 1999 - Feb. 2002

$(\sigma_x, \sigma_y)_{HER} =$
(0.514, 0.59)

$\sigma_y^* = 7$ mm
 $(\sigma_x, \sigma_y) = (0.52, 0.08)$

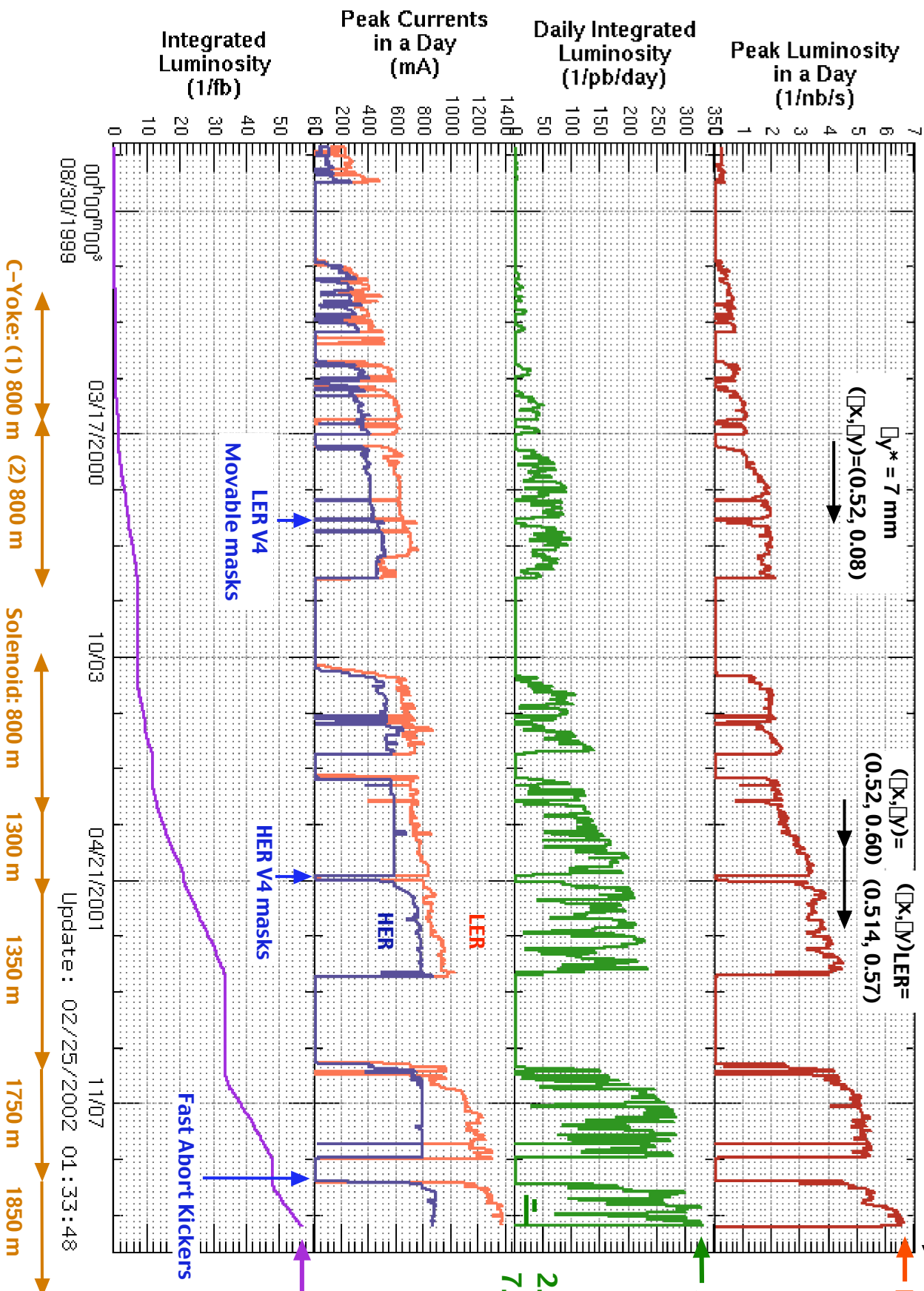
$(\sigma_x, \sigma_y) =$ $(\sigma_x, \sigma_y)_{LER} =$
(0.52, 0.60) (0.514, 0.57)

Peak Luminosity
6.62 /nb/s

329 /pb/day

2.06 /fb/7 days
7.56 /fb/30 days

56.3 /fb



08/30/1999

03/17/2000

10/03

04/21/2001

11/07

Update: 02/25/2002 01:33:48

C-Yoke: (1) 800 m (2) 800 m Solenoid: 800 m 1300 m 1350 m 1750 m 1850 m

Luminosity has been **more than doubled** since the

Last MAC:

1. Higher beam currents were made possible by
 - **Additional solenoid** windings for LER
 - extended from 1300 m to 1850 m
 - **Moving-chamber damage-free masks** in HER
 - Fast abort kickers / Recovery of a few rf cavities /
New abort chambers / Better coolings /
Higher positron charges from Linac, etc.
2. Optimize/maintain machine parameters:
 - Horizontal tunes closer to the half integer
 - Tune management with gated betatron tune meter
 - Circumference control / Skew correction at IR, etc.

2/24/2002

3/15/2001

	LER	HER		LER	HER	
Horizontal Emittance	18	24	nm	18	24	nm
Beam current	1333	822	mA	680	530	mA
Number of bunches	1223			1153		
Bunch current	1.09	0.67	mA	0.59	0.46	mA
Bunch spacing	2.4		m	2.4		m
Bunch trains	1			1		
Horizontal size at IP σ_x^*	103	121	μm	103	123	μm
Vertical size at IP σ_y^*	2.7	2.7	μm	2.2	2.2	μm
Emittance ratio σ_y/σ_x	6.3	4.4	%	3.7	2.8	%
σ_x^*/σ_y^*	59 / 0.65	61 / 0.70	cm	59 / 0.70	63 / 0.70	cm
beam-beam parameters σ_x/σ_y	0.069 / 0.046	0.074 / 0.042		0.047 / 0.043	0.040 / 0.029	
Beam lifetime at collision	180 @ 1200 mA	250 @ 800 mA	min.	180 @ 700 mA	300 @ 550 mA	min.
Luminosity (Belle CSI)	6.62		/nb/s	2.90		/nb/s
Luminosity records per day / 7 days / 30 days	329 / 2060 / 7560		/pb	168 / 970 /		/pb

Tune Management with the Gated Tune Meter

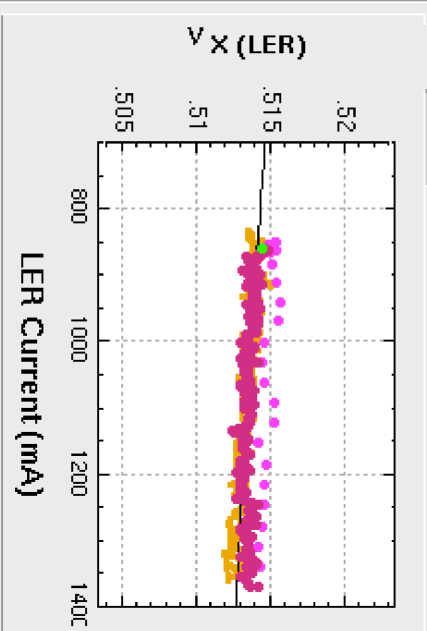
File Edit H.Axis Window

Gated Tune

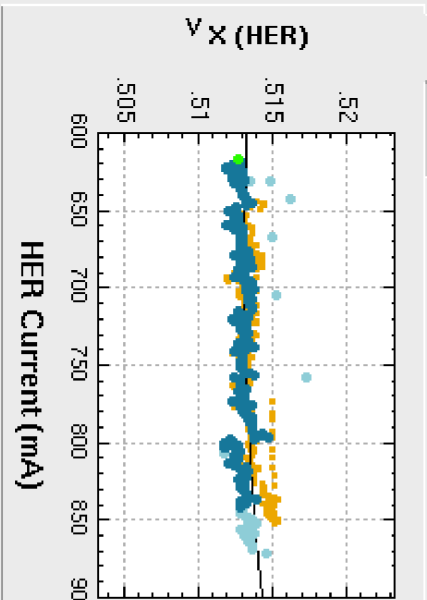
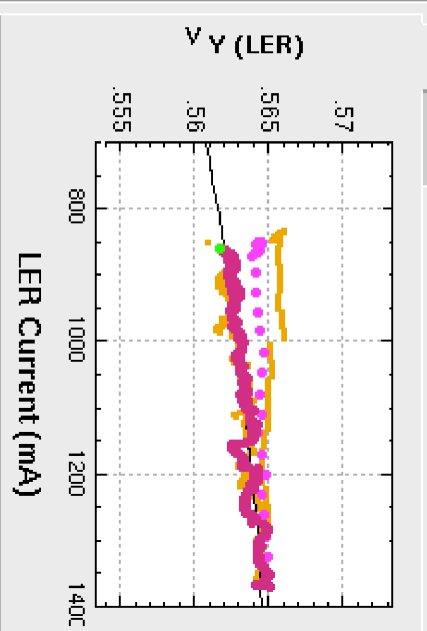
LER: Lum2002_2_23_6_43_8.dat

HER: Lum2002_2_21_8_11_17.dat

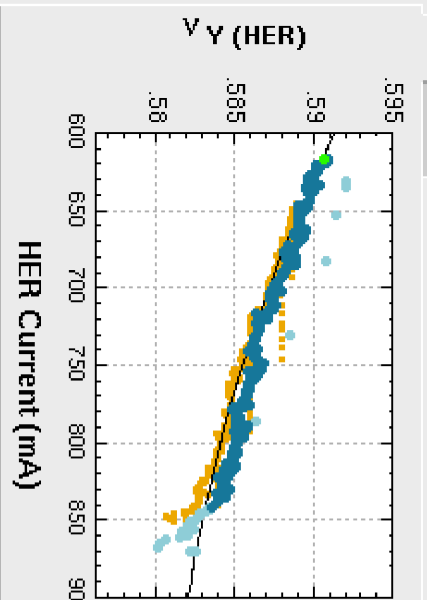
This Fill



Fit Peak

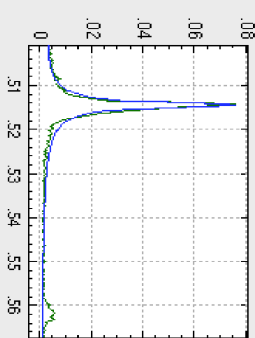


Fit Peak

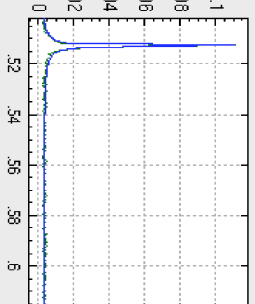


File Edit Window

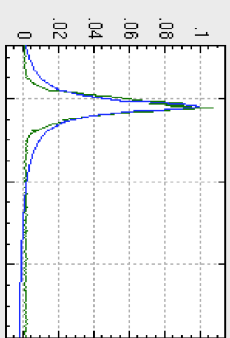
02/24/2002 11:05:37 He



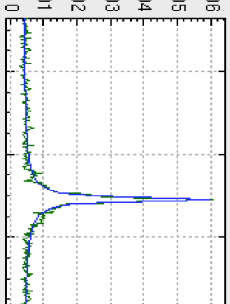
Gated Tune LER H
Fitted Tune: .5144



Gated Tune HER H
Fitted Tune: .5128



Gated Tune LER V
Fitted Tune: .5618



Gated Tune HER V
Fitted Tune: .5909

HER V
VY max. 5/34 8900
Mit
H.Axis M
H.Axis Min. 7000
Set & Plot

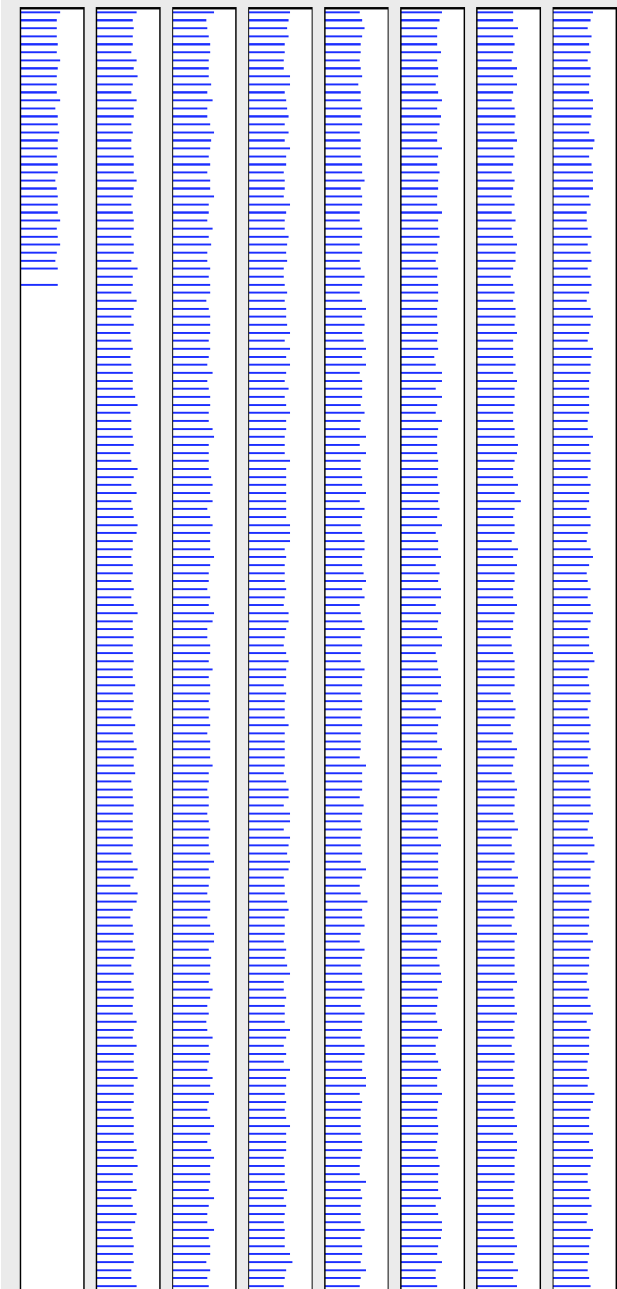
- Off-collision
- Feedback is vetoed at the pilot bunches

Hard Copy



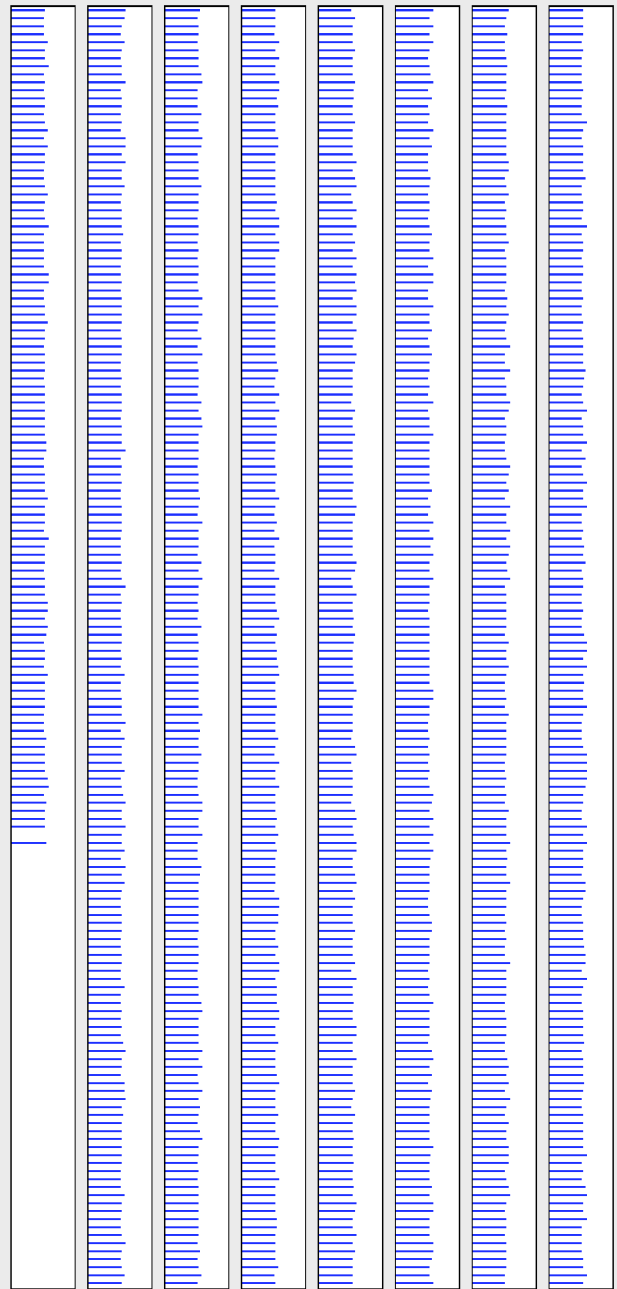
Dec 2001

1 153 bunches



Feb 2002

1 224 bunches



Pilot bunch

More Progress

Continuous Injection

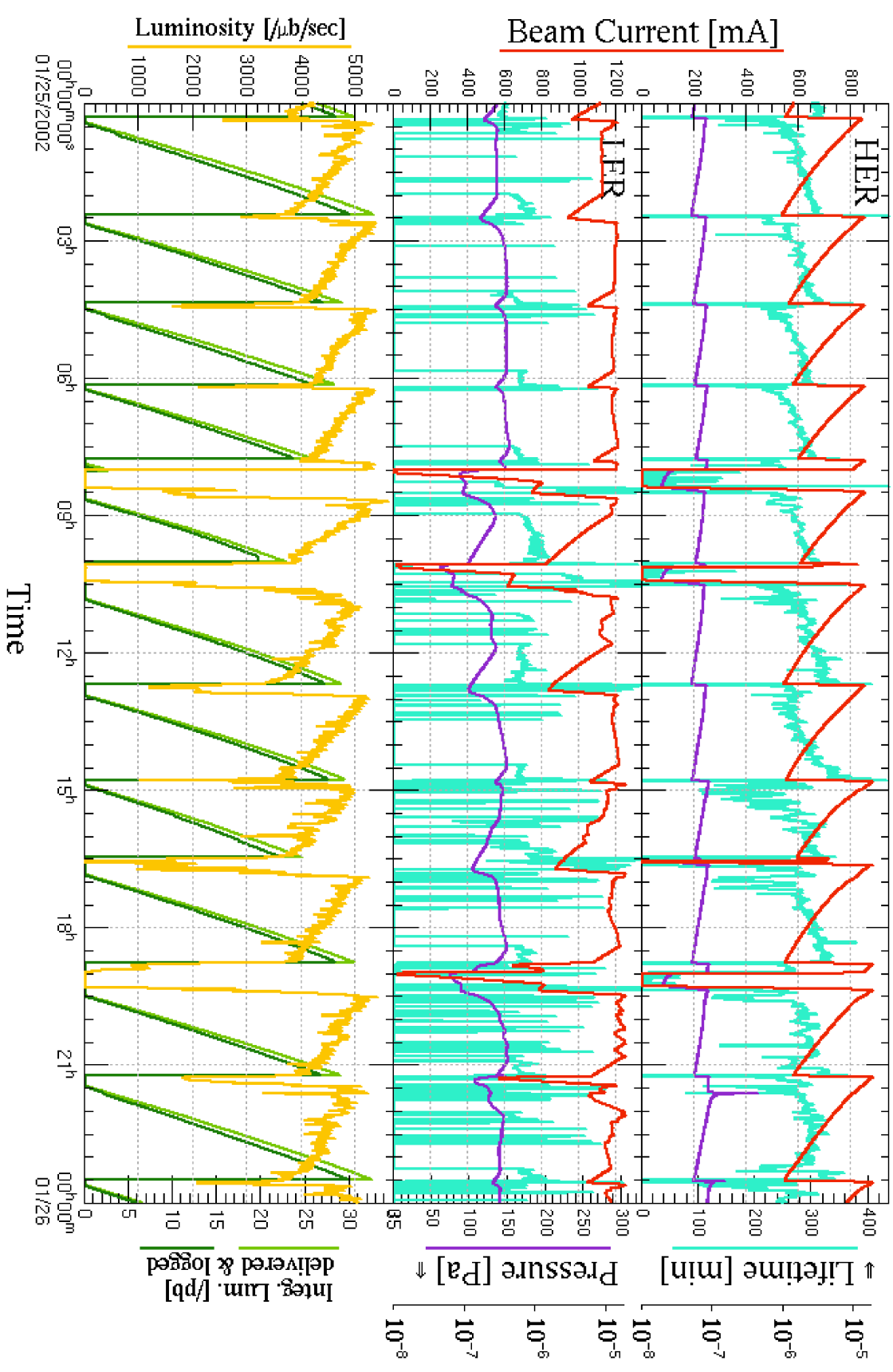
- Tried a few times with an increase of integ. Luminosity by 15-20%.
- Rise of vacuum pressure in LER due to heating of NEG by the **TE mode** near the movable masks.
- Some (should be minor) problems in DAQ at Belle.

2 bunch/rf pulse injection of positron

- Initial success with 50% increase of the injection rate.
- Debug is necessary in the bunch current monitor/equalizer.

Continuous Injection

Peak Luminosity 5429. [$\mu\text{b}/\text{sec}$] @08:41
Integrated Luminosity 297.3 [pb]
01/25/2002 0:00 - 01/26/2002 0:00 JST



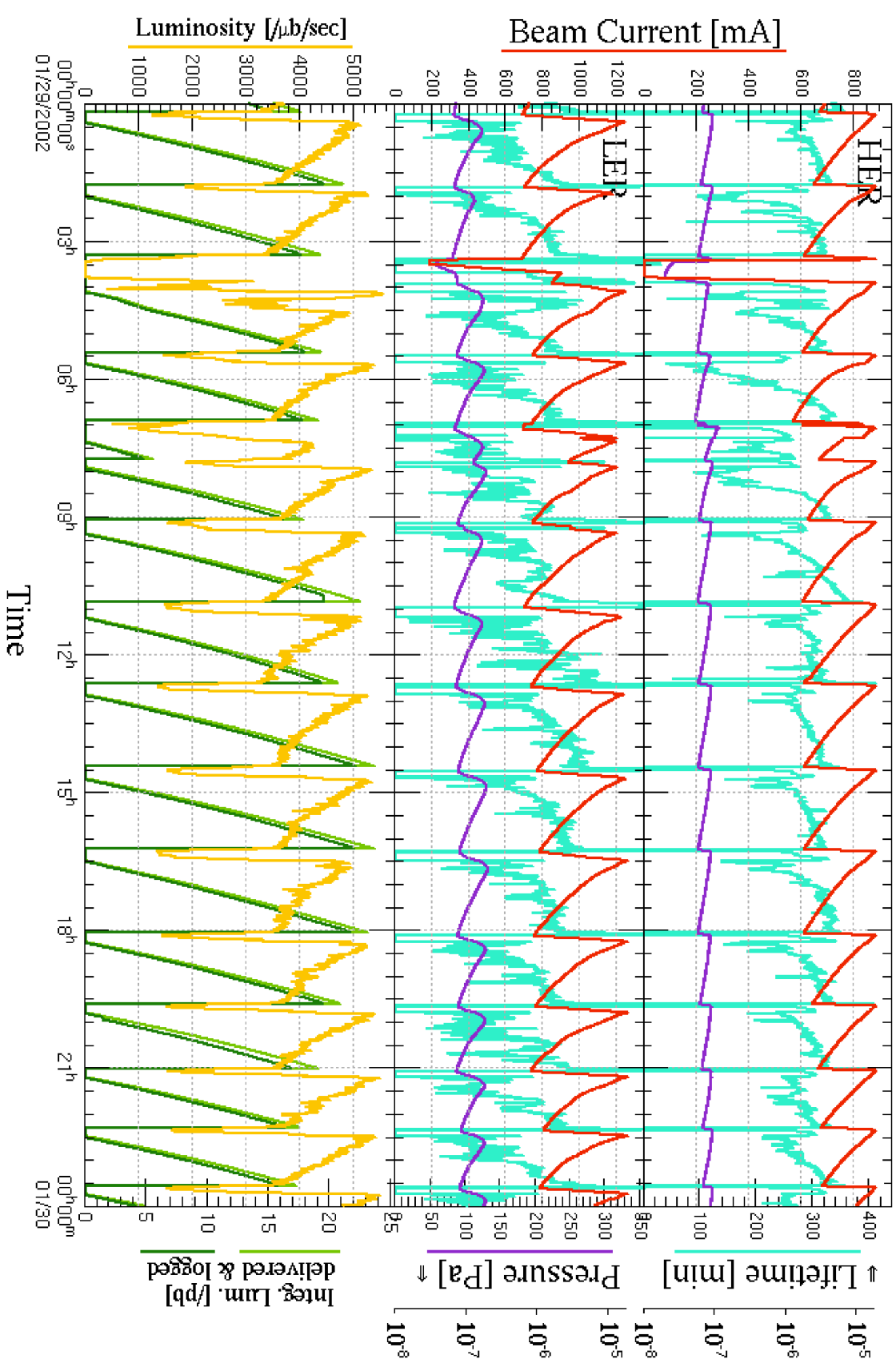
From Year: 2002 Month: 1 Day: 25 Hour: 0 For 1 Days Plot fill numbers peak curs Print transparency

Hard Copy

Regular Injection

Peak L uminosity 5485. [$\mu\text{b}/\text{sec}$] @23.46
Integrated L uminosity 272.1 [pb]

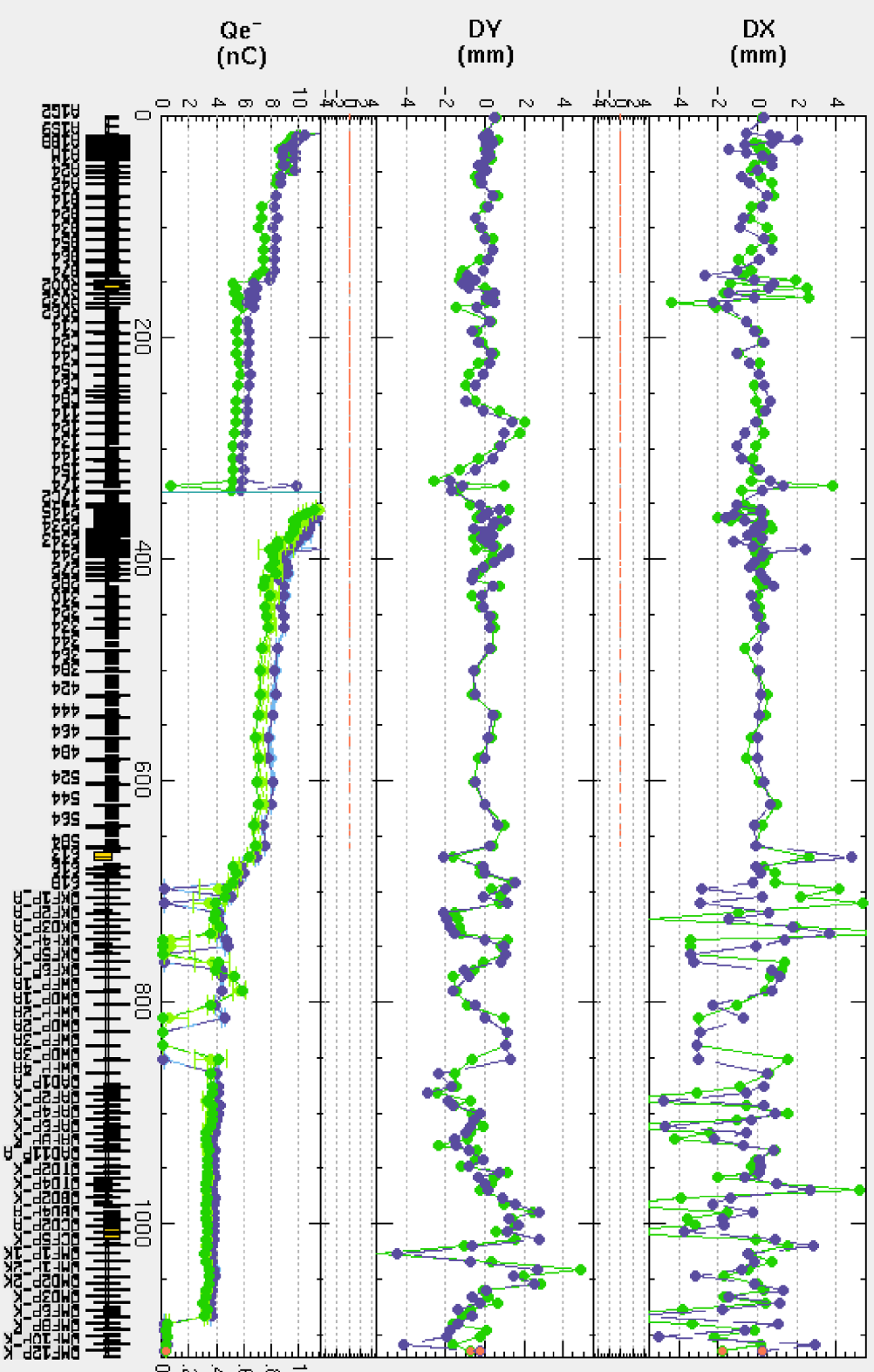
01/29/2002 0:00 - 01/30/2002 0:00 JST



From Year: 2002 Month: 1 Day: 29 Hour: 0 For 1 Days Plot fill numbers peak currs Print transparency

Positron Linac/BT Orbit (2-bunch)

measuring at intervals of 1 sec
 measured 02/15/2002 17:31:47



r.m.s = 1.6 mm
 max = 4.805 mm
 @ SP613
 min = -7.413 mm
 @ SPQMF8P_JK

267 mm
 @ SPQMD13P_JK
 (262±1.09mm)

r.m.s = 1.115 mm
 max = 2.773 mm
 @ SPQCD2P_A
 min = -4.435 mm
 @ SPQMD2P_JK

-218 mm
 @ SPQMD13P_JK
 (-04±.59mm)

.026 nC
 .034 nC
 @ SPQMD13P_JK
 (.031±.003 nC)
 (.033±.002 nC)

.004

golden_10_02_2001_13:53:02.dat

range DX Auto Fx (5) DY Auto Fx (5) Q Auto Fx (2) e-7e+ 10 Replot

meas stat ref meas-ref stat-ref gold mea-gold sta-gold

meas stat ref meas-ref stat-ref gold mea-gold sta-gold

meas stat ref meas-ref stat-ref gold mea-gold sta-gold

meas -> gold meas -> ref stat -> ref

single double

Clear Statistics Standard Size

Hard Copy



New Issues

1. Vacuum leak at the **wiggler chambers** due to synchrotron light. (managed)
2. Vacuum leak at the **abort chambers** due to heating by the wall current or hit of the aborted beam. (to be cured in March)
3. Heating of **synch. light mask at IP**. (to be cured in this summer)
4. Heating of NEG cartridge by the **TE mode near the movable masks**. (to be cured in March)
5. Low frequency horizontal instability at HER (**resistive walls?**)
6. Bunch current monitor/equalizer. (to be cured in March)

Luminosity increase in the near future

Now we guarantee **7.8 /fb/month** to Belle.

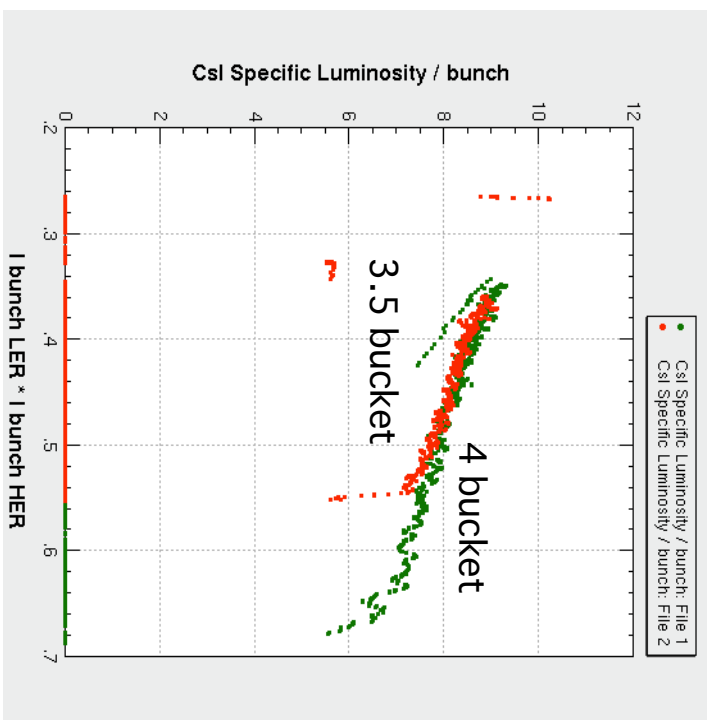
After March:

- Continuous injection
- 2 bunch injection of positrons
- 3.5 bucket spacing
- Increase LER to 1.5 A, HER to 0.9 A.

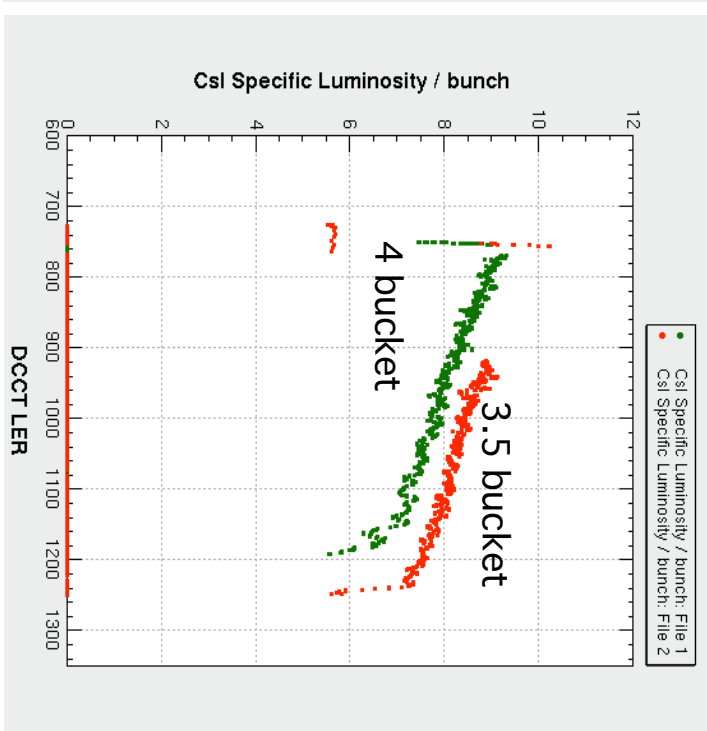
After the summer shutdown in 2002:

- Less than 3 bucket spacing.
- Increase HER to 1.1 A (design).
- Increase LER as long as luminosity increases.

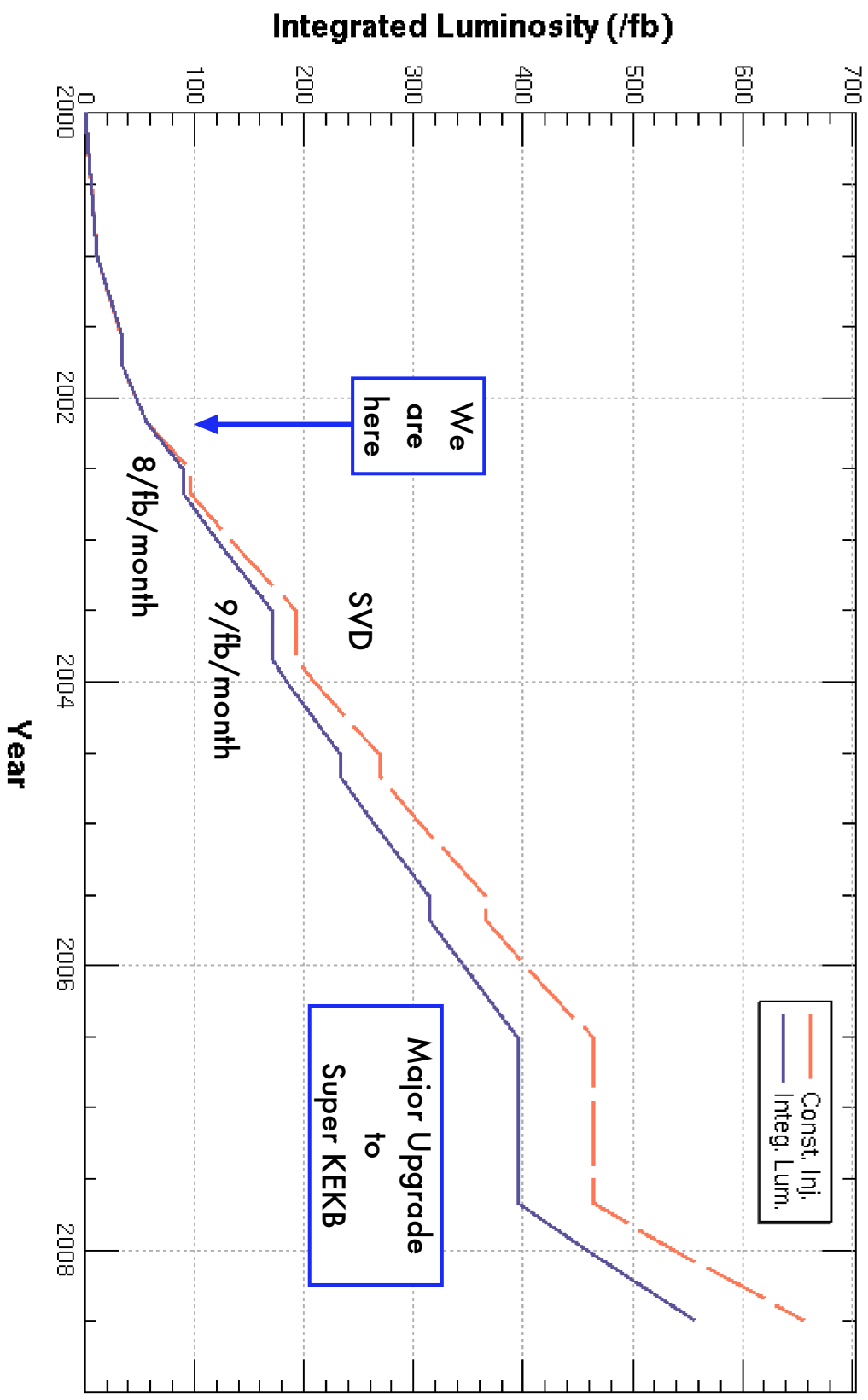
File 1 Fill#: 6657 Lum2001_11_18_6_47_45.dat
File 2 Fill#: 7099 Lum2001_12_19_3_48_45.dat



File 1 Fill#: 6657 Lum2001_11_18_6_47_45.dat
File 2 Fill#: 7099 Lum2001_12_19_3_48_45.dat



Projection of KEKB Luminosity



"Super KEKB"

- ✓ 10^{35} /cm²/s peak luminosity
- ✓ LER 10 A + HER 4 A (roughly)
- ✓ Redesigned IR with larger crossing angle
- ✓ Preserve arc lattice/magnets
- ✓ Double the ring RF system
- ✓ Totally new vacuum chambers in both rings
- ✓ Renewed cooling/electricity facilities
- ✓ Charge switch with a high-gradient linac
- ✓ Positron damping ring
- ✓ Separate injector for PF/PF-AR
- ✓ 80 - 100 MW wall-plug power
- ✓ 50 BY construction cost