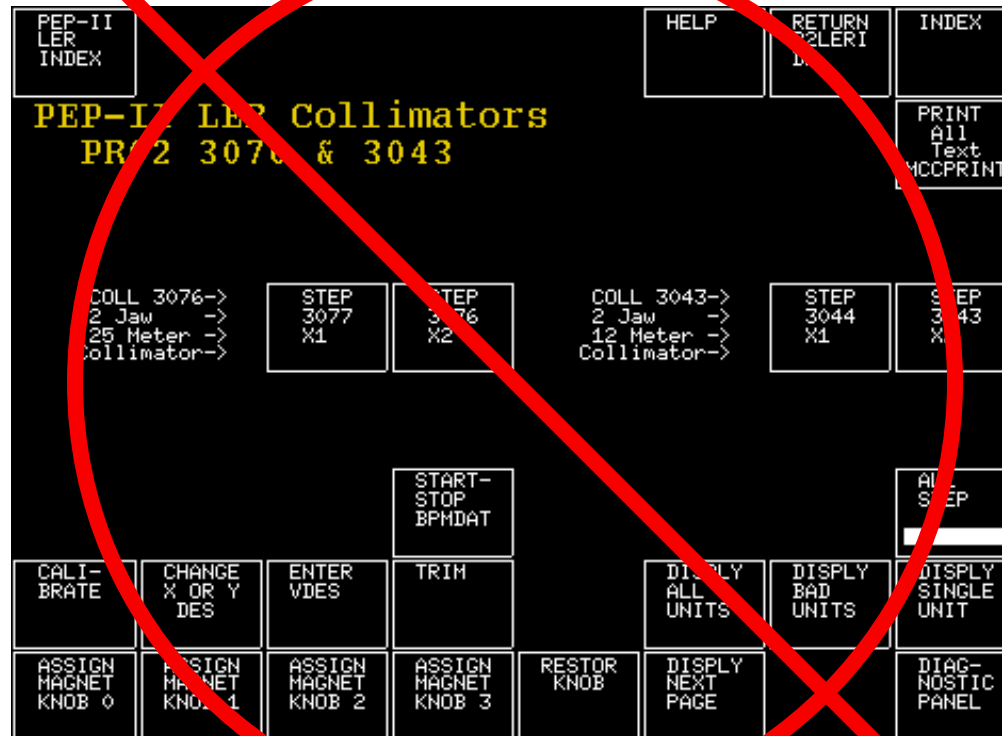


Changes in PEP for Run 5

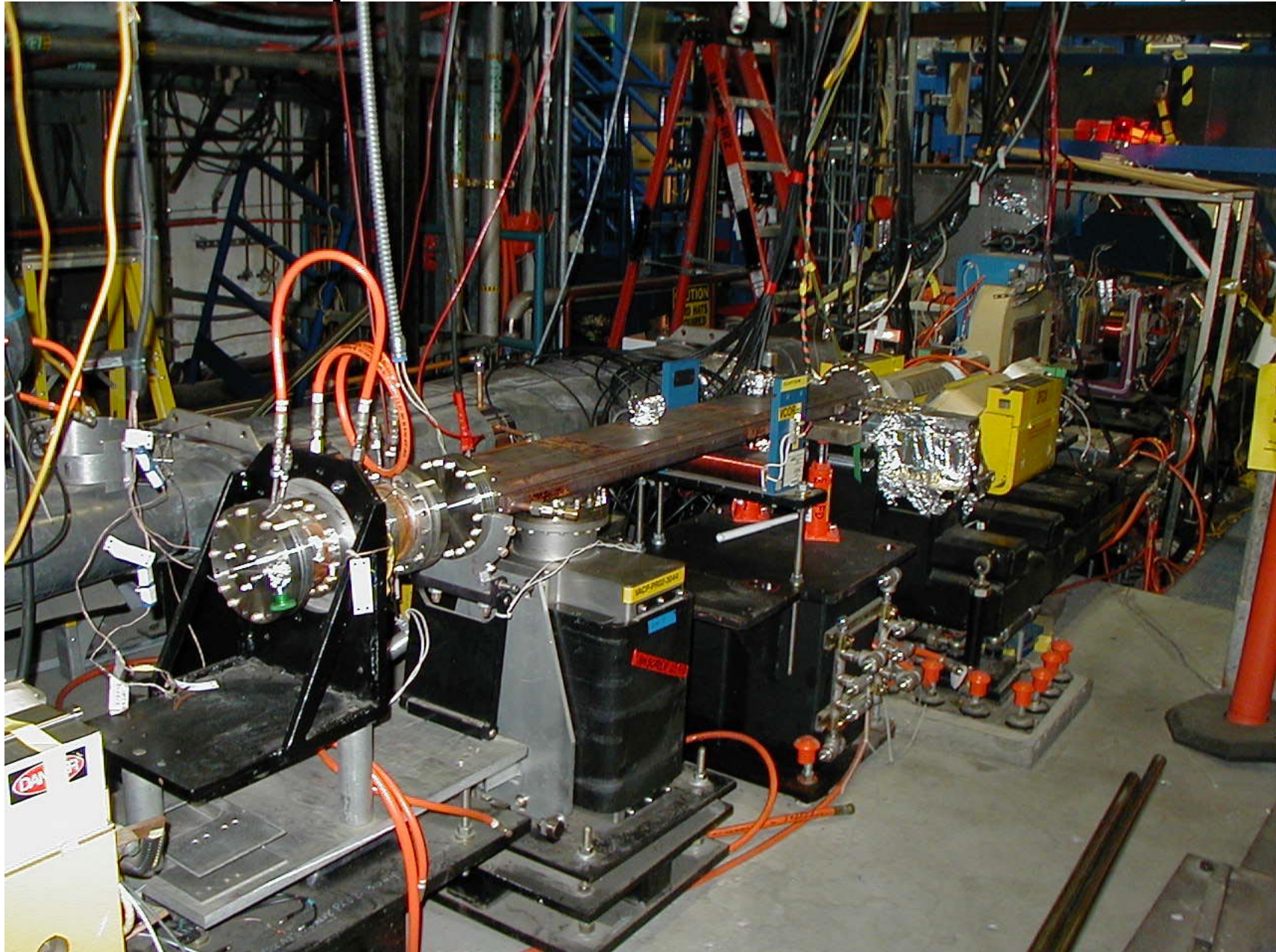
- What is no longer there:
 - LER moveable IR-2 collimators
 - PR02-307x (25-m) and PR02-304x (12-m)
 - Many LER IR-2B NEG's removed
 - “fix” heating problem
 - IR-2 “Ice wagon” cooler
 - replace by heat exchanger to tower water.
- What is new:
 - 2 Injection pulsers/ring
 - LER Rf 4-2
 - HER Rf 12-1 split in two
 - 12-1 and 12-2, 2 cav's ea.
 - LER LFB kickers
 - LER TFB kicker electrodes
 - TFB diag. data acquisition
 - New LGD Woofers, both rings
 - LER BBA system
 - BIC IOC
 - address stalls & crashes
 - HER bellows fans deployed

LER Moveable Collimators

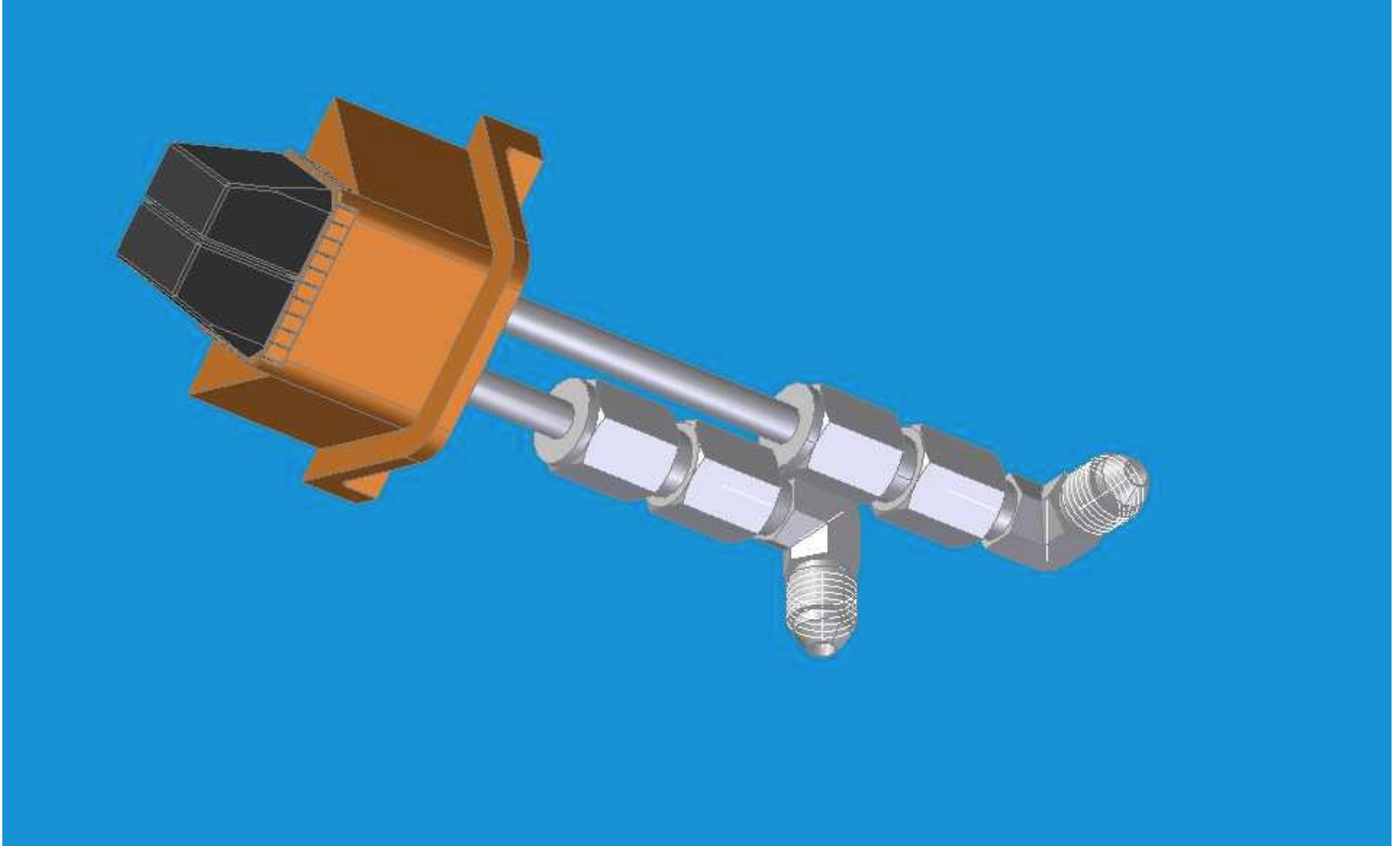
- These have been found to generate high HOM power, => partial cause for NEG heating
- Since their benefit was small they have been removed



LER Upstream IR 2 (25-m coll)



HOM Absorber for NEG channels



LER IR-2 NEG chamber



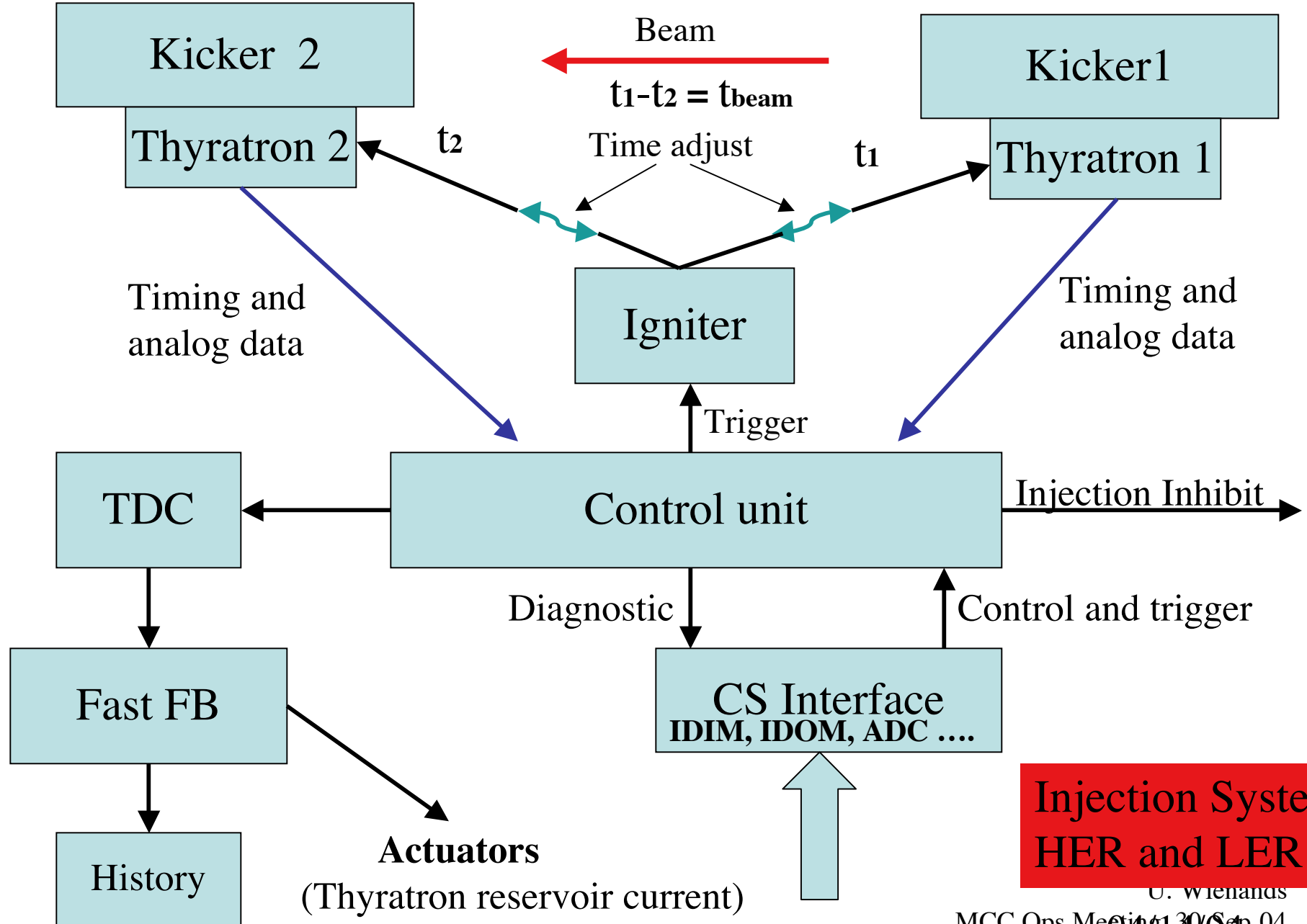
New Injection Pulsers

- Now each kicker is powered individually,
=> can much better close the bump
=> simultaneous firing no longer absolutely guaranteed

Old kicker panel

New kicker panel

ANALOG STATUS DIAG	INJ Kicker Analog	Low Energy Ring PANEL	UPDATE D STAT 123-567 890123456	HELP	RETURN P2LERI DX	ANALOG STATUS DIAG	INJ Kicker Analog	Low Energy Ring PANEL	UPDATE D STAT 123-567 890123456	HELP	RETURN DEWPAN EL	INDEX		
LER INJECTION KICKER PANEL				Prev Page	Next Page	PRINT Graph Disply MCCPRINT	LER INJECTION KICKER PANEL				PRINT All Text MCCPRINT			
PROB TRIG PANEL						PI01 TRIG PANEL	Kicker Intlck Status Panel	Thy Driver Trig FAULT	Emerg Status FAULT	LER SBDL Injectn Kicker OK	SBDL Status Panel			
	THYRA-TRON HEATER FAULT	THYRA-TRON TUBE NOTREADY				MOD1 Ready Status FAULT	HVPS1 Intlck Summary FAULT			MOD2 Ready Status FAULT	HVPS2 Intlck Summary FAULT			
LGPS 2024 INJKCK						LGPS 2024 HWPS 1	SMPS 2024 ResPS1			LGPS 3036 HWPS 2	SMPS 3036 ResPS2			
TURN OFF LGPS	TURN ON LGPS	LGPS RESET				TURN OFF LGPS	TURN ON LGPS	LGPS RESET						
ENTER BDES	TRIM				DISPLY ALL UNITS	DISPLY SINGLE UNIT	ENTER BDES	TRIM		DISPLY ALL UNITS	DISPLY SINGLE UNIT	DISPLY BAD UNITS		
RESTOR KNOB	MAGNET ADJUST KNOB 0	MAGNET ADJUST KNOB 1	MAGNET ADJUST KNOB 2	MAGNET ADJUST KNOB 3	HALT DISPLY (ALL)	DISPLY NEXT PAGE	RESTOR KNOB	MAGNET ADJUST KNOB 0	MAGNET ADJUST KNOB 1	MAGNET ADJUST KNOB 2	MAGNET ADJUST KNOB 3	HALT DISPLY (ALL)	DISPLY NEXT PAGE	DIAG-NOSTIC PANEL



**Injection System
HER and LER**

Rf System Changes

Print Exit

PEP-II EPICS

RF	Station State	Gap Voltage (kV)	Current	Setpoint
4-2	Not connected No val?	Not connected	Not connected	Not connected No val?
4-3	Not connected No val?	Not connected	Not connected	Not connected No val?
4-4	OFF	0	1270	
4-5	OFF	0	1270	
Total		Not connected		

4-1	Not connected No val?	Not connected	Not connected	Not connected No val?
8-1	Not connected No val?	Not connected	Not connected	Not connected No val?
8-3	OFF	0	2550	
8-5	OFF	0	2650	
12-1	Not connected No val?	Not connected	Not connected	Not connected No val?
12-2	Not connected No val?	Not connected	Not connected	Not connected No val?
12-3	OFF	0	2700	
12-5	OFF	0	1450	
12-6	OFF	0	1400	
Total		Not connected		

1 4-cav-stn -> 2 2-cav-stns

Bunch Inj Ctrl

Tune Tracker

Ring Current (mA)

LER HIGH:DCCT:SUMY
Not connected
No val

HER HIGH:DCCT:SUMY
Not connected
No val

Longitudinal Fbck

HER

LER

Damping Ring RF

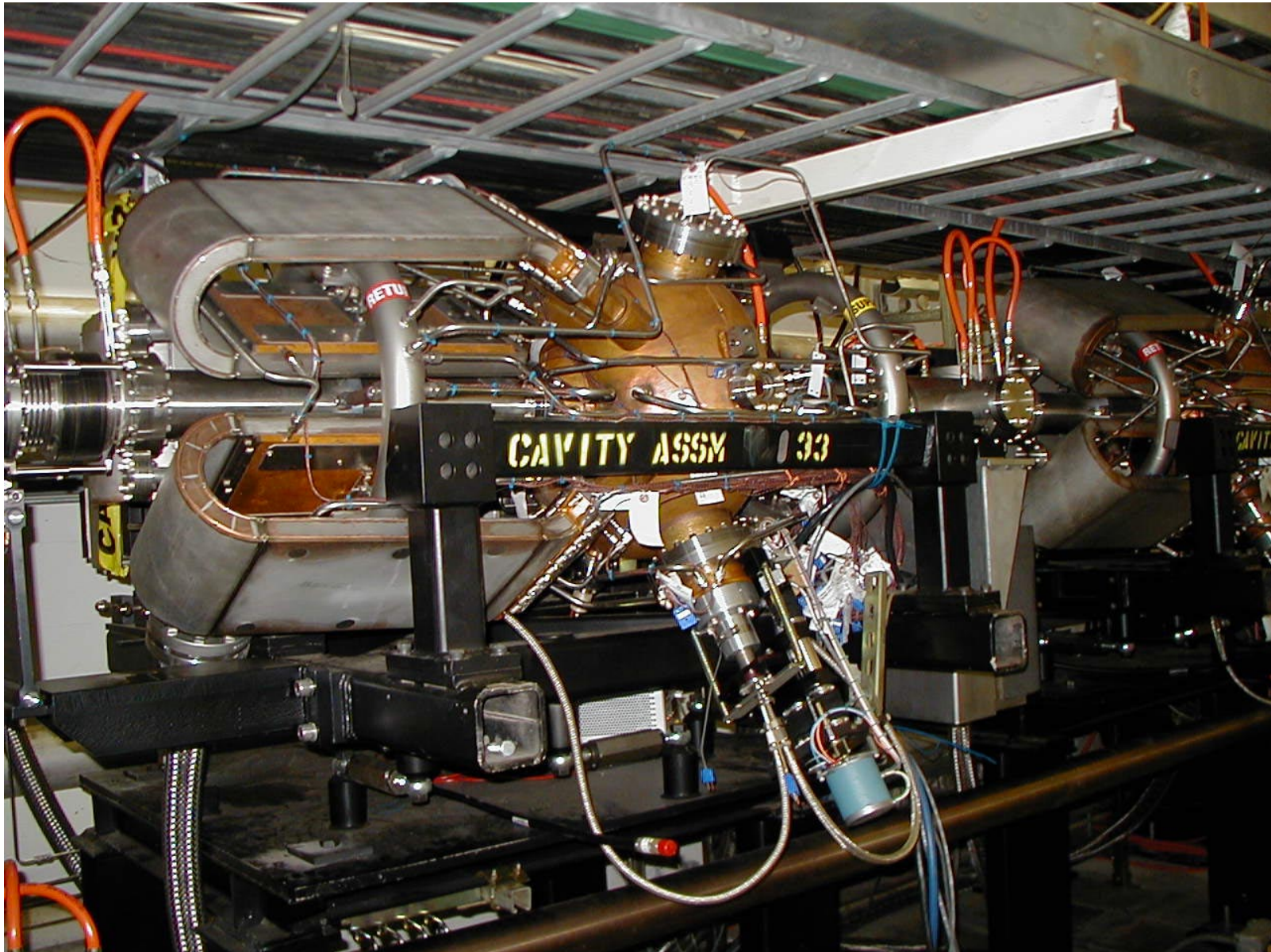
North

South

PEP Rf Changes (cont'd)

- Effective gain: 1 MW in power/ring
 - LER current limit \rightarrow 3.5 A
 - HER current limit \rightarrow 1.8 A
- HER max $V_{\text{rf}} \approx$ unchanged (\approx 20 MV)
 - We still aim to raise op. voltage beyond 16.5 MV
- LER max V_{rf} up by \approx 1.5 MV
 - Aim for 5.5 MV total for bunch length
- Higher voltage helps stability
- 2 more LER cavities hurt stability

LER Rf 4-2 Cavity B



Other Rf upgrades

- 12-6 has new cavity probe (avoid drop-outs)
- all Comb boards now have the “stuck-comb-reset board”... should expect this to be fixed.
- Temperature stability should be improved.
- All stations have PPC IOC
- Moveable tuners serviced
- All fixed tuners now are on their own cooling circuit
 - clogged spools no longer as big a problem
 - new Tcs for spools.

Thermocouple readouts/spools

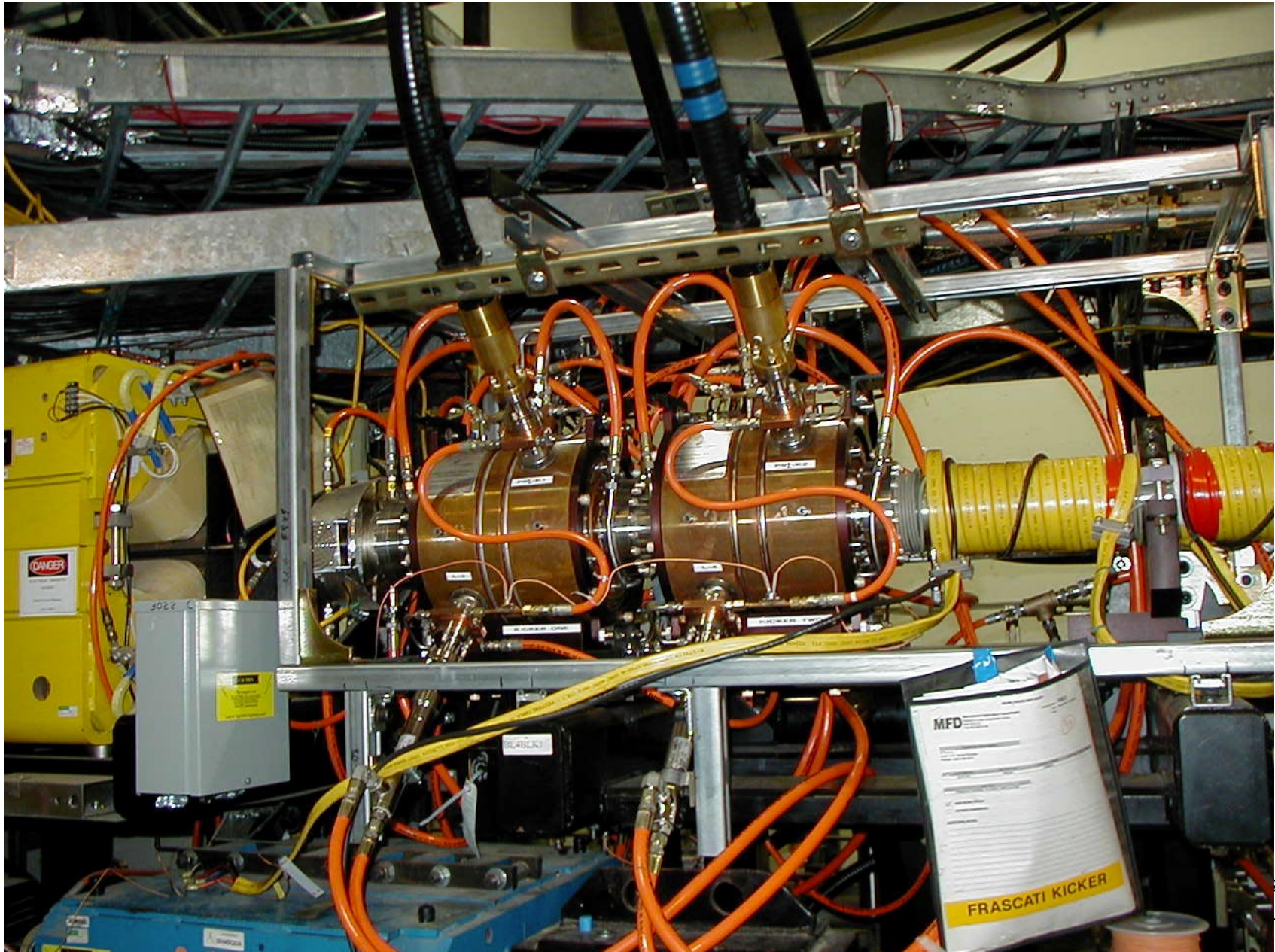
on {HER,LER}CAV Bellow Temps panel...

```
ANALOG STATUS NORMAL MODE (ABS) DISPLAY: HER_TCAV : Thermocouples
PR04 PR08 PR12
T7024CAV De F 70.394 78.893
T7024BLW De F 65.577 71.319
T7026CAV De F 70.625 78.575
T7026BLW De F 68.123 71.639
T7034CAV De F 72.014 78.806
T7034BLW De F 67.451 71.028
T7036CAV De F 72.968 78.951
T7036BLW De F 68.444 70.650
T7044CAV De F 74.382 78.864
T7044BLW De F 69.786 71.115
T7046CAV De F 75.909 78.777
T7046BLW De F 70.718 70.184
T7054CAV De F 76.140 78.864
T7054BLW De F 71.241 70.446
T7056CAV De F 76.226 78.748
T7056BLW De F 71.096 69.484
T7064CAV De F 75.535 78.864
T7064BLW De F 70.514 69.176
T7066CAV De F 81.707 78.893
T7066BLW De F 70.339 70.400
T7074CAV De F 75.189 78.835
T7074BLW De F 70.962 69.381
T7076CAV De F 74.930 78.864
T7076BLW De F 71.573 68.535
T8044CAV De F 94.103
T8044BLW De F 69.908
T8046CAV De F 93.961
T8046BLW De F 70.083
```

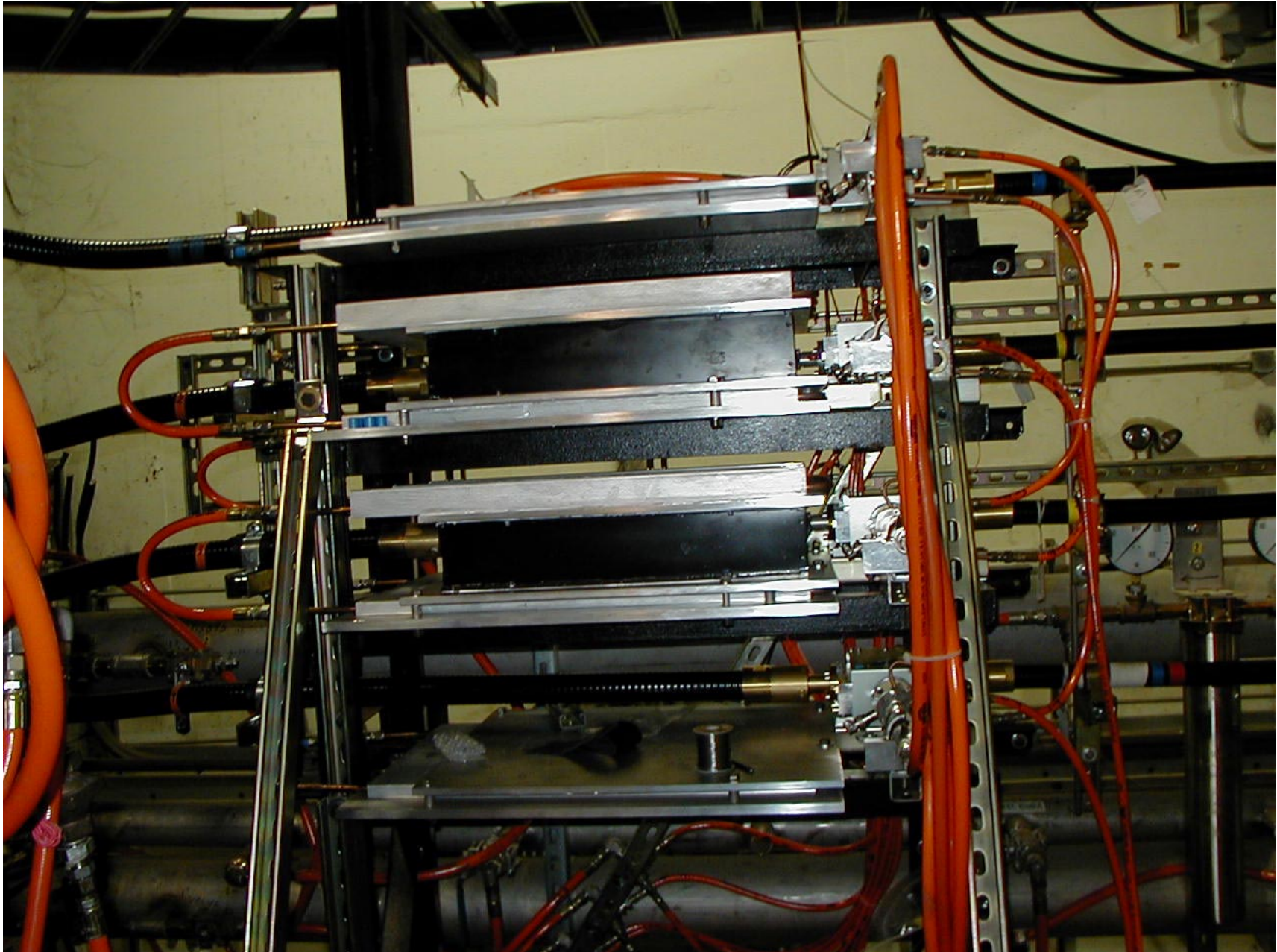
LFB Feedback Upgrades

- LFB:
 - “Frascati-style” overdamped ($Q \approx 5$) cavity kicker
 - better cooling, higher shunt impedance
=> stronger kick, higher max. beam current
 - Not directive => reflected-power characteristics will change.
 - Back to short delay in front-end filter
 - => no more by-3 bunch pattern possible!
 - Larger feedthrough & cable size for kicker,
 - less heat problems
 - One kicker will not have filters in tunnel due to late delivery
 - will need to watch circulator
- Tc assignments will change, D. Anderson documenting
- If successful, might build a new kicker for the HER also.

The New LER LFB Kicker



Circulator & Filter Rack



New LGD Woofers

- The HER LGD Woofer installed during Run 4 was a “pre-production” unit.
- Production versions for both rings are being built & will be installed before startup.
- One PC running a “virtual IOC” for both.
- EPICS Panels to be very similar to extant HER LGD-Woofer panel.
- (Dmitry gave details last week)

LGD Woofer Panels

PEP-II
Low Group Delay
Woofer

EXIT

ON

LER SETUP

ON

HER SETUP

PEP-II LER LOW GROUP DELAY WOOFER

EXIT

FIR COEFFICIENTS

Coefficient Set 0				Coefficient Set 1			
0	0	8	0	0	0	8	0
1	0	9	0	1	0	9	0
2	0	10	0	2	0	10	0
3	0	11	0	3	0	11	0
4	0	12	0	4	0	12	0
5	0	13	0	5	0	13	0
6	0	14	0	6	0	14	0
7	0	15	0	7	0	15	0

CONTROL REGISTER

MEMORY CTRL MUX CPU

DATA ACQ CONTROL STOP

COEFF SET SELECT Set 0

TRIGGER SOURCE INT

SHIFT GAIN 0

OUTPUT DELAY 1

Control register (CR256) 0x100

Port fault Clock missing Saturation

944209

COUNT

944209

COUNT

944209

COUNT

LER SAVE/RESTORE

MEMORY

read

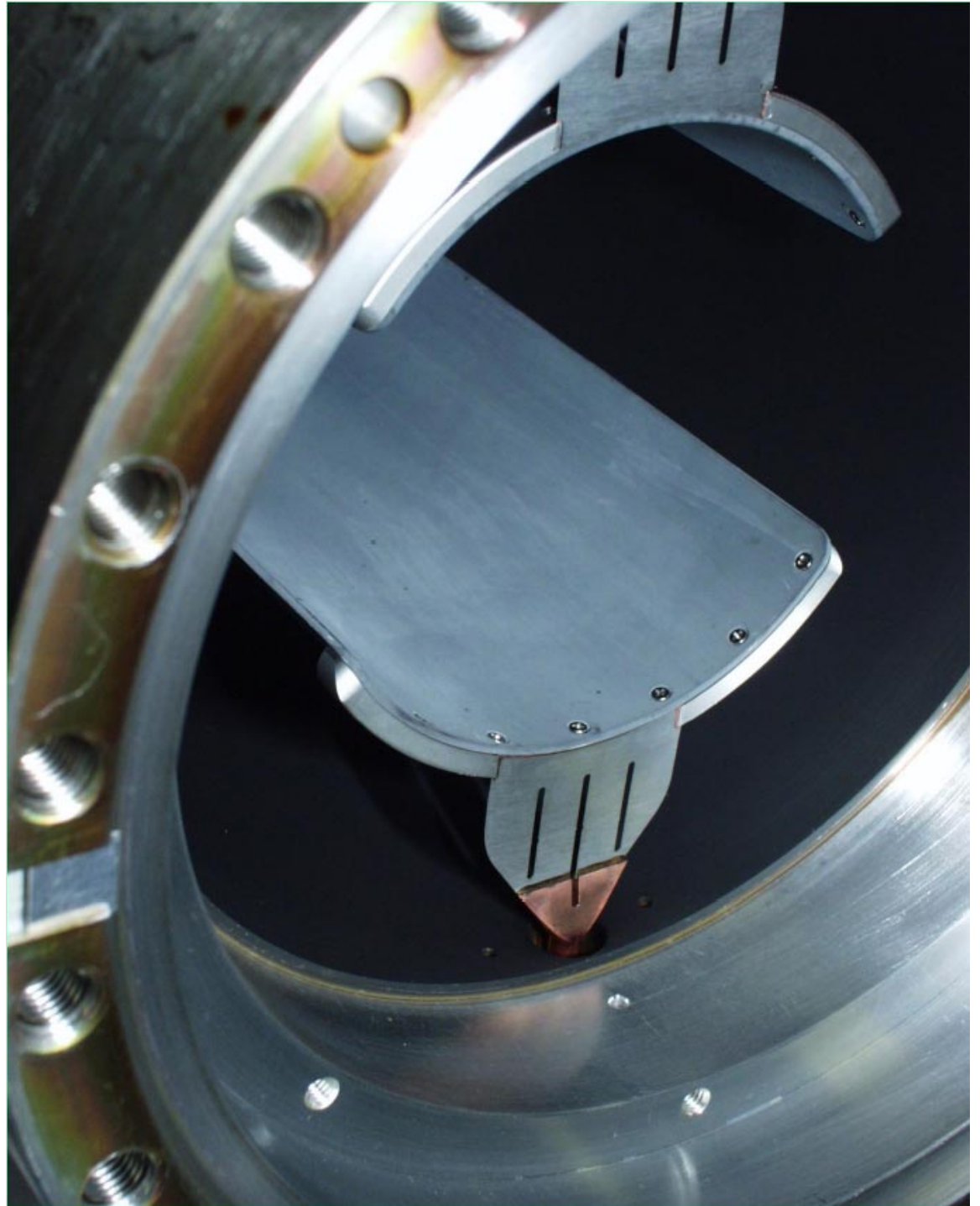
write

Waveforms

TFB Feedback Upgrades

- Replaced Al electrodes with Mo electrodes
 - Much higher temperatures allowable => higher beam I
 - May get higher temperatures for same I due to higher loss
- HER Receiver upgraded to allow better timing
- New bunch-by-bunch diagnostics & event buffer.
- Operationally, no changes expected in setup
- New. digital delay line expected by Xmas
 - 2-tap filter => no orbit harmonics to amp
 - less digital noise on signals => better gain margin

TFB
Kicker
Mo
Electrode

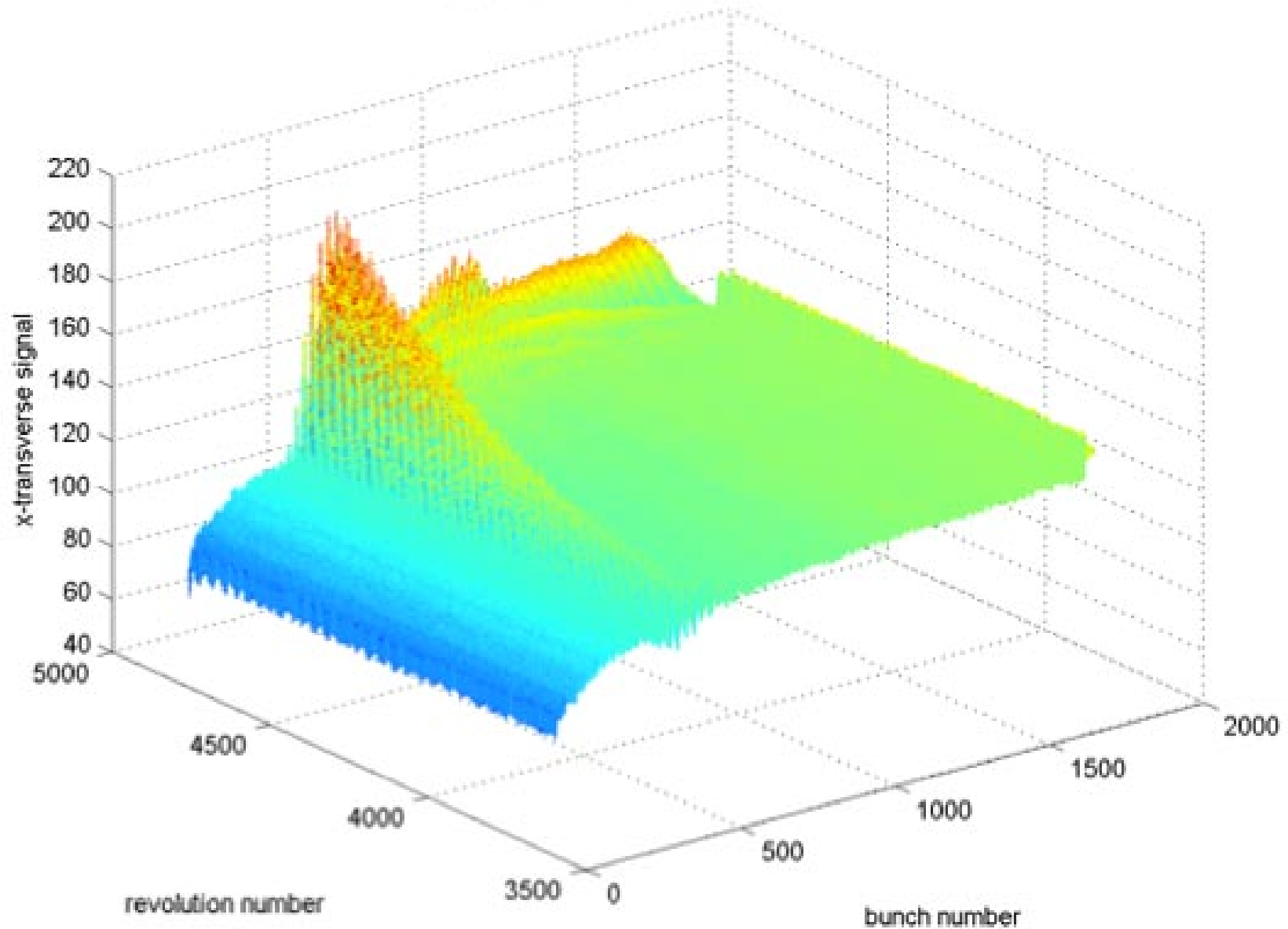


New TFB Diagnostics

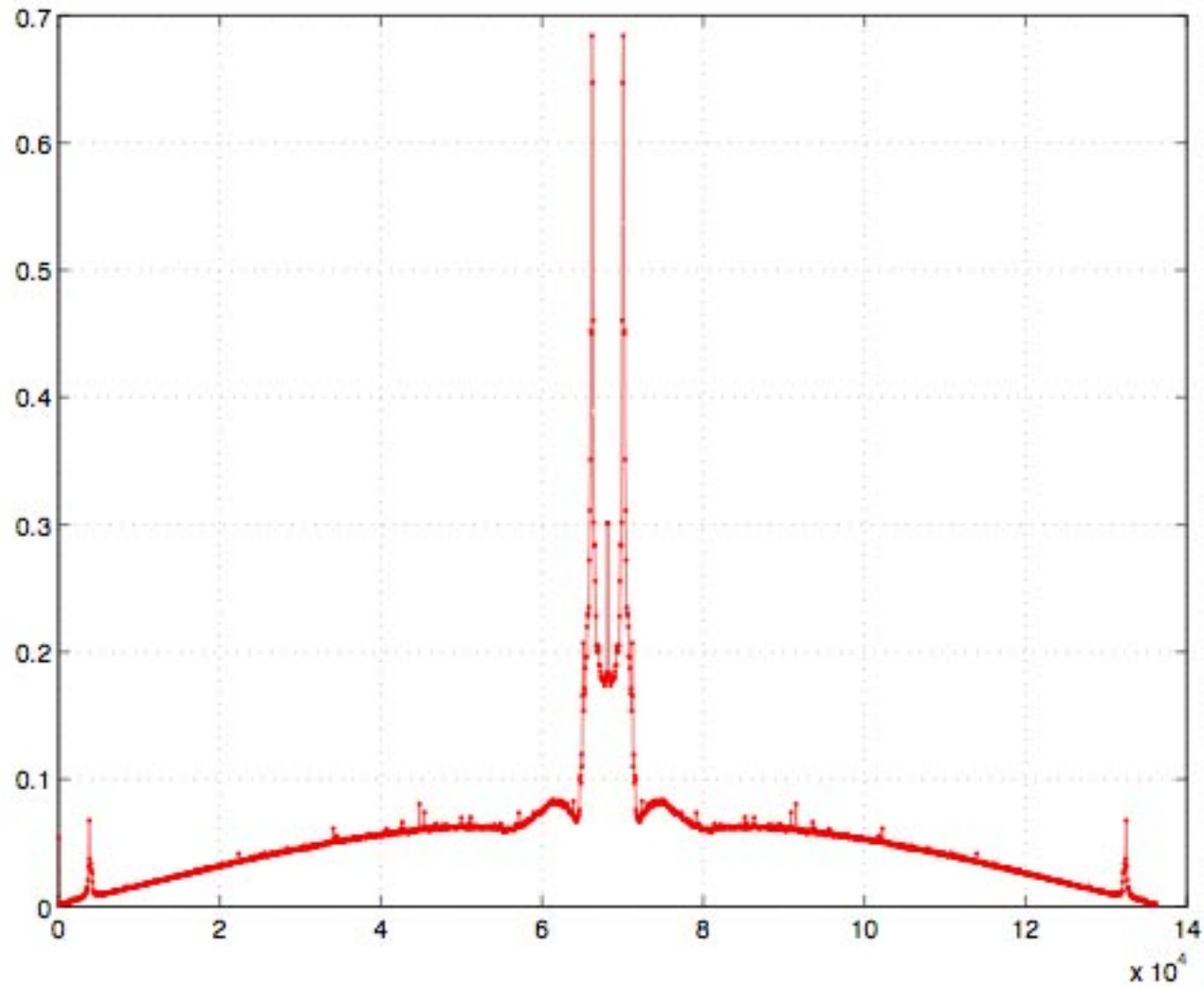
- Fast digitizer boards can store 40 ms of TFB data
 - bunch-by-bunch, turn-by-turn,
 - 4 channels: HER, LER; X, Y
- Can be triggered on a beam abort or deliberately
 - abort diagnostics, grow-damp measurements.
- Boards run by local PC (Win XP (yuck!!))
 - Data to be transferred to NFS server,
 - specific machines on PEPnet and also SLAC site network
- 1 board ran the last day of Run 4: proof it works
- Plan to develop canned routines for analysis
 - Matlab, somewhat similar to Rf GUI

GAGE Board data sample (LER)

LER, X-transverse instability, 7-31-04



FFT of one bunch data



New BBA system

(Smith, Nelson, Ross, Yocky *et al.*)

- 42 shunts being installed on the LER
 - IR-2 quad families
 - Selected quads in the arcs, moveable on RODs
- Turn-on, off on SCP panels
 - fixed current, $\approx 1...2\%$ [$3...4\%$ in arcs] (resistor)
- Will show **RED** on SDS CUD if (left) on

New BBA system (cont'd)

- To find the magnetic center of quadrupoles at optically sensitive locations in the ring. Shunts are used to vary the field in one magnet which otherwise lacks individual control.
- In IR2, there are four strings powering a total of 14 quads: QFCY1 (4), QDCY2 (4), QFCX3 (2), QDCX2 (4)
- Throughout the ring there are 37 individual QD and QF quads which have been identified as prime candidates for BBA.
 - These are in the arcs, immediately adjacent to sextupoles
 - There are 2-5 quads per half-arc

SCP Panel & Analog display

Shunt Analog Disply	ANALOG STATUS DIAG	UPDATE PANEL 23-SEP 11:18:48	HELP	RETURN DEVPAN EL	INDEX
---------------------------	--------------------------	---------------------------------------	------	------------------------	-------

PEP Quad Shunts

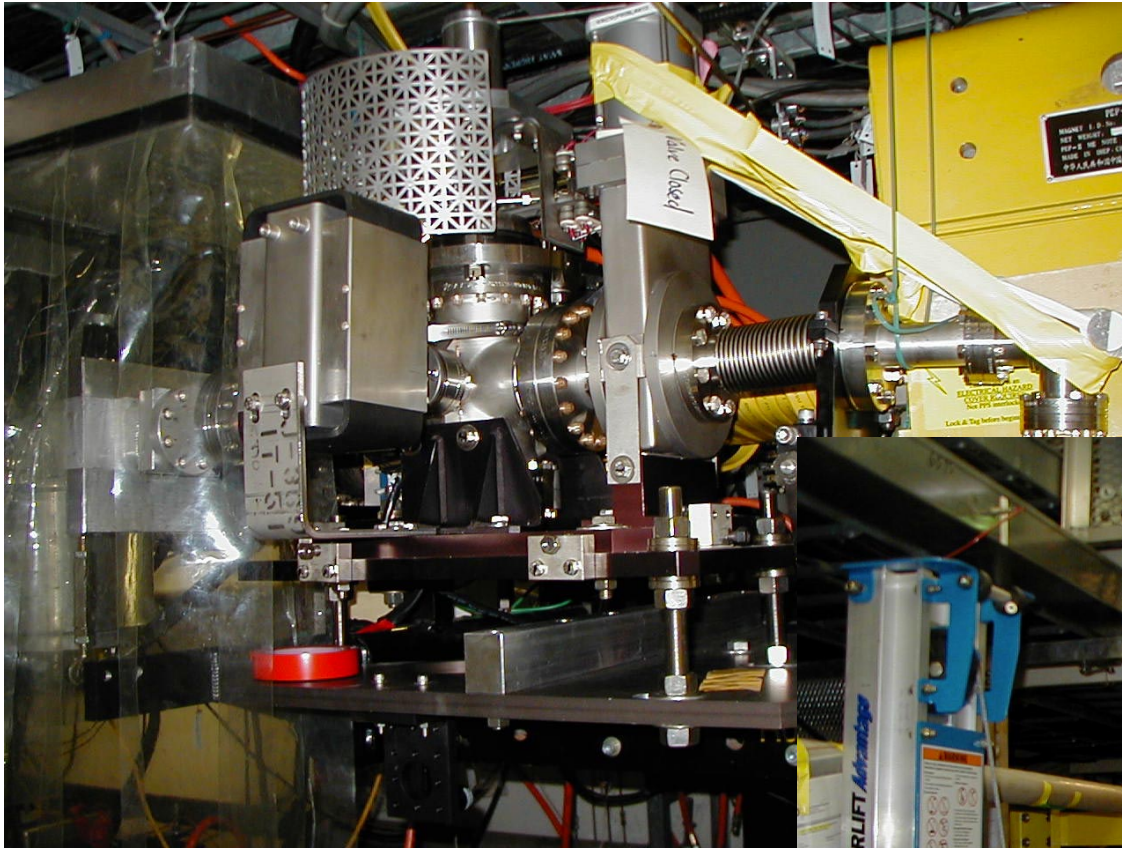
SHUNT1 PR04 ON	SHUNT2 PR04 ON	SHUNT3 PR04 ON	SHUNT1 PR06 ON	SHUNT2 PR06 ON	SHUNT3 PR06 ON	SHUNT4 PR06 ON	SHUNT1 PR08 ON
SHUNT1 PR04 OFF	SHUNT2 PR04 OFF	SHUNT3 PR04 OFF	SHUNT1 PR06 OFF	SHUNT2 PR06 OFF	SHUNT3 PR06 OFF	SHUNT4 PR06 OFF	SHUNT1 PR08 OFF
SHUNT2 PR08 ON	SHUNT1 PR10 ON	SHUNT2 PR10 ON	SHUNT3 PR10 ON	SHUNT4 PR10 ON	SHUNT1 PR12 ON	SHUNT2 PR12 ON	SHUNT3 PR12 ON
SHUNT2 PR08 OFF	SHUNT1 PR10 OFF	SHUNT2 PR10 OFF	SHUNT3 PR10 OFF	SHUNT4 PR10 OFF	SHUNT1 PR12 OFF	SHUNT2 PR12 OFF	SHUNT3 PR12 OFF

* When SHUNT is ON, ?? Amps is shunted away from Quad

* When SHUNT is OFF, the magnet has normal current through it

ANALOG STATUS NORMAL MODE (ABS) DISPLAY: PEP SHUNT :					
	PR04	PR06	PR08	PR10	PR12
SHUNT01	.30968	.31572	.30315	-5.814e-5	.03527
SHUNT02	-4.576e-6	.30576	.03429	.27648	-2.287e-5
SHUNT03	.27944	.27550		-8.427e-5	-7.843e-6
SHUNT04		.28595		-5.879e-6	

New LER SRM Arc 7a



Valve @ PR06-4012

Light pipe through gate



Run 5 Startup Tasks

- Commissioning of new injection system
- New converted BPMs need checkout, timing
- New Rf setup (12-1 and 12-2, 4-2 setup)
- New LFB setup (LGDW, LER from scratch)
 - woofers will start in Run-4 configuration, i.e. old ones
- New HER TFB setup (mod'd receiver)
 - both need back-end timing check
 - Gage boards to be done parasitically
- New SRM commissioning (if ready)
- “The usual”: steering, collide,
 - **scrub vacuum while delivering**

Particulars of Run 5

- No more by-3 pattern!
 - By-2 with initially rather short mini trains
- We will maintain our good HER orbit
- We will steer the LER down, hopefully
- We expect less IR-2 vacuum problems
- We should improve our understanding of the rings
 - New SRM will give better LER beam-size information
 - New BBA system will facilitate better orbits
 - BaBar-provided beam-size diags will be used routinely
 - New “fudge factors” from ORM analysis => better models

More Particulars...

- We will likely be pushing the rf voltages both rings
 - reduce bunch length but also increase stability margins
- We will likely try to reduce β_y^* in both rings
 - Presently we think we have 10.5 mm,
 - would like to go below 10 mm
 - need to make sure we get luminosity for this!
- Maybe *not* β_x^* (presently ≈ 30 cm)
- We will raise the bunch currents
 - only way to increase beam current after filling by-2 pattern
 - This may well require us to turn on the LER wiggler

Run 5 Goals

- Integrated Luminosity: 129.5 fb^{-1}
- Peak Luminosity: 1.3×10^{34}
- Beam currents: $3.3 \text{ A} \times 1.8 \text{ A}$ (LER \times HER)
- 1720 bunches, $\leq 1 \text{ cm}$ bunch length
 - $1.92 \times 1.05 \text{ mA/bunch}$, (not record numbers)
- Total delivered: 385 fb^{-1} by end of June 2005

PEP Run 5 Luminosity Goal

