

Status of HERA and Plans for Starting-Up

HERA-Experiments-Coordination Meeting

July 1st 2003

DESY

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- o Status of the Shut Down Works
- o Re-commissioning of the Machine Components
- o Startup-Plans
- o Vacuum Reconditioning Strategy
- o Luminosity Running

Update on Shut Down Activities

- NEG-Pumps in the GA-e-beam pipe NL/SL; Status: completed with delays of 2 weeks
- Molybdenum Coating of Absorbers4 at 11m SR/NR, Status: The elaborate procedure failed, Absorber4 will not be exchanged for the start-up, the option for a later installation is still open**
- Improvement of Cooling of GI/GJ SR/NR, Status: canceled after test in February**
- Enlargement of Pumping slits of Absorber 1 und 2 SR/NR 3.8m, 6m, Upgrade of the Getterpumps (120l/s instead of 60l/s), Status : completed
- Moveable Absorber 66m SL/NL, Status completed with some delay
- Neuer Valve for GG insulationg Vacuum, Status: completed
- Synchrotron Radiation Masks for the Bellows in the Straight Section:Completed in Time
- Improved RF Screens at Rotator Beam Pipes N/S: completed in time
- Installation of cold bypass to make room for VPS: Completed with about 3 weeks of delay
- Fixing the leak a SR28m, proton beam line: repaired
- X-Ray of all the cold straight sections in HERA-p: result: no anomalies, status: completed
- Exchanging the corroded connectors for the HERA-p cold corrector circuits: not planned, since discovered only during shut down, impact on overall schedule, completed

Update on Shut Down Activities, continued

- Bipolar Choppers for VO/VG: completed
- **New Electronics for e-BPM system: Cards completed, program for logic chips still being improved, not available for start-up, planned to be installed during maintenance days**
- Alignment of H1 Detector, and GO: Status: reduced to align H1 beam pipe and Go alignment, done
- Maintenance of p-BPM System with many replacements, completed
- Electrical Safety Check of tunnel electronics: completed
- Improvement of the cooling of QR57, completed
- Improvement of cavity water cooling ring-wide, completed
- Improvement of injection by additional fast kicker magnet, magnet tested, waiting for beam
- Superconducting cavities: Exchange of RF window and repair of faulty High bias-voltage insulation: completed

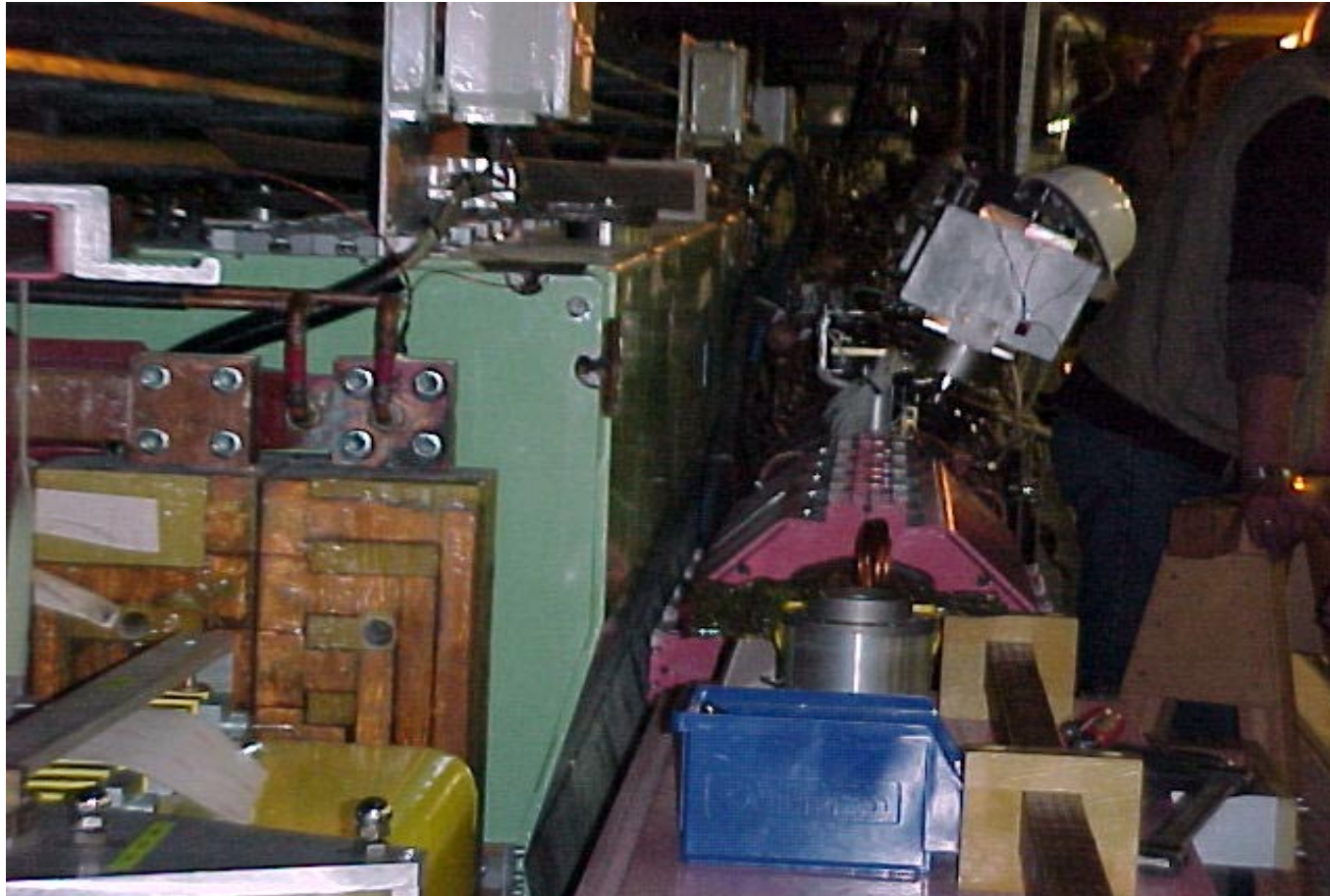
Update on Shut Down Activities, continued

- New 208 MHz RF transmitters final amps for protons: completed
- 52MHz RF system for protons: new tuner supplies to fix a 25Hz distortion close to the synchrotron tune, done
- Radiation Interlock Systems: Work toward DESY-wide standards, done
- Repair of the e-Synchrotron Radiation Monitor (new Be mirror): done
- Making a synchrotron radiation monitor for p-available, waiting for beam
- Beam Profile oscillation OTR monitor of injection matching in HERA-p: done
- **Wire-Magnet Position Detection System: will not be available due to scheduling problems, adjustment during maintenance days, if possible**
- Survey of the IR s, Octant NE: in progress, delayed

Re-Commissioning

- P-Ring Cold
- SC cavities cold,
- Cool-down H1 in progress
- Most of the warm magnet power circuits tested
- **Testing of cold power circuits: delayed**
- Testing of power supplies for bridge magnets: rescheduled after closing of Experiments
- **Re-commissioning of large ring-wide power circuits: Ground faults**
e-ring: fixed,
p-Ring broken BU-coil NR75m, being replaced, finished by the end of this week
- Surveying the IR's: in progress
- **Re-commissioning of the RF: fire spark-gap room in hall south: Transmitter SR not available for start-up (no major problem)**

Re-Commissioning of the Proton Main Power Circuit:
Detection of a Ground Fault by a broken BU-Coil
→ Need 2 weeks for exchanging the coil with a spare



Recommissioning of Transmitter SR: Failure of a 120kV Transformer in the Klystron Protection Circuitry which caused a fire in the modulator room at the 6th floor in hall South



HERA Start-up and Schedule 2003

	Start	Qt / 8h	End
Start-up with beam p&e	7/21/03 15:00	33	8/1/03 15:00
Machine studies	8/1/03 15:00	17	8/7/03 7:00
<i>Maintenance Day</i>	8/7/03 7:00	2	8/7/03 23:00
Machine studies	8/7/03 23:00	16	8/13/03 7:00
12GeV conditioning e	8/13/03 7:00	66	9/4/03 7:00
<i>Maintenance Day</i>	9/4/03 7:00	2	9/4/03 23:00
12GeV conditioning e	9/4/03 23:00	18	9/10/03 23:00
Preparation of Polarization Studies	9/10/03 23:00	3	9/11/03 23:00
Polarization+ 27GeV conditioning	9/11/03 23:00	24	9/19/03 23:00
Prepare Luminosity Run	9/19/03 23:00	25	9/28/03 7:00
<i>Tag der offenen Tuer</i>	9/28/03 7:00	3	9/29/03 7:00
<i>Maintenance Day</i>	9/29/03 7:00	2	9/29/03 23:00
Lumirun	9/29/03 23:00	112	11/6/03 7:00
<i>Maintenance Day</i>	11/6/03 7:00	2	11/6/03 23:00
Lumirun	11/6/03 23:00	82	12/4/03 7:00
<i>Maintenance Day</i>	12/4/03 7:00	2	12/4/03 23:00
Lumirun	12/4/03 23:00	37	12/17/03 7:00
Machine studies	12/17/03 7:00	15	12/22/03 7:00

Program			
Start-up with beam: inject and store p	7/21/03 7:00	8	7/23/03 23:00
Start-up with beam: accelerate p	7/23/03 23:00	8	7/26/03 15:00
Start-up with beam: inject and store e	7/26/03 15:00	8	7/29/03 7:00
Start-up with beam: accelerate e	7/29/03 7:00	8	7/31/03 23:00
Establish eOptik (SM & 72 degr exact per fodo cell)	7/31/03 23:00	5	8/2/03 15:00
ORM e-Ring 12GeV, 27GeV, Lumi	8/2/03 15:00	5	8/4/03 7:00
check 72 degree, and correct if necessary	8/4/03 7:00	3	8/5/03 7:00
Check on e Chromaticity	8/5/03 7:00	1	8/5/03 15:00
ORM p-ring to check BPM, CX, CP, QQ	8/5/03 15:00	3	8/6/03 15:00
Scan apertures e & p	8/6/03 15:00	2	8/7/03 7:00
Maintenance Day	8/7/03 7:00	2	8/7/03 23:00
Set up injection with fast injection kickers (opti kickers)	8/7/03 23:00	3	8/8/03 23:00
Beam based Alignment reference measurement	8/7/03 23:00	3	8/8/03 23:00
Set up collimators on the ramp	8/8/03 23:00	3	8/9/03 23:00
Commission of the Finger Monitors	8/9/03 23:00	2	8/10/03 15:00
Check on backscattering from SR	8/10/03 15:00	3	8/11/03 15:00
Set up new e-Feedback	8/11/03 15:00	1	8/11/03 23:00
Check on backscattering from SR	8/11/03 23:00	2	8/12/03 15:00
Set up new e-Feedback	8/12/03 15:00	1	8/12/03 23:00
HOML Experiment 12GeV	8/12/03 15:00	2	8/13/03 7:00
12GeV conditioning e	8/13/03 7:00	66	9/4/03 7:00
Maintenance Day	9/4/03 7:00	2	9/4/03 23:00
12GeV conditioning e	9/4/03 23:00	18	9/10/03 23:00
Opimize Orbits at Lpol	9/10/03 23:00	1	9/11/03 7:00
Test Beam based alignment in the arc	9/11/03 7:00	2	9/11/03 23:00
Polarization+ 27GeV conditioning	9/11/03 23:00	24	9/19/03 23:00
Lumirun aufsetzen	9/19/03 23:00	12	9/23/03 23:00
Alternative e Optics for luminosiy operation	9/23/03 23:00	11	9/27/03 15:00
Test Lumipilot	9/27/03 15:00	2	9/28/03 7:00

Vacuum Conditioning Strategy

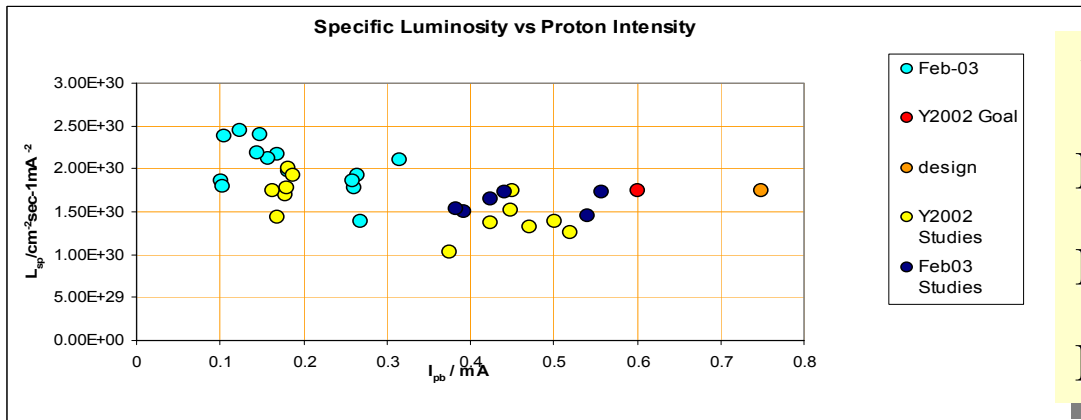
- Heat IR by 12GeV beam and induce thermal absorption for 4 weeks (plus parasitic study program)

Warm up cold surfaces and regenerate NEG pumps 4-5 times in this period, first time after 5 days

Record total gas load and check for gradient in deposited gas load

- After exhausting induced thermal bake-out, SR cleaning of IR vacuum with 27.5GeV beam, about 8 days, combine with polarization tuning

High Luminosity

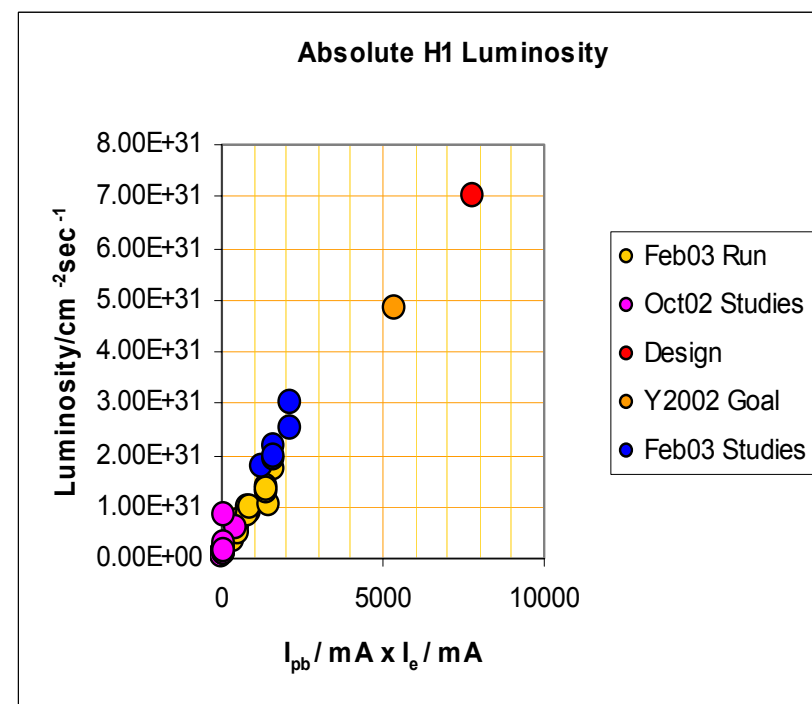
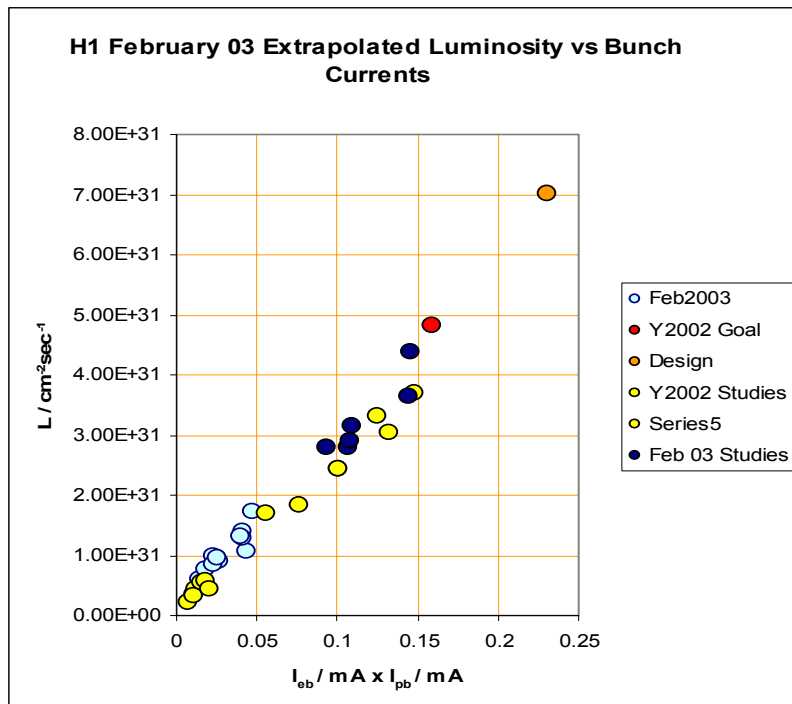


120 Bunches

$$I_p < 70 \text{ mA}$$

$$I_e < 35 \text{ mA}$$

$$L_{\text{peak}} < 2.7 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$$



Maximum Peak Luminosity

$$L = \frac{n_b \cdot I_{eb} \cdot I_{pb}}{2\pi e^2 f_0 \cdot \sigma_x \cdot \sigma_y}$$

$$I_e \cdot I_p \leq I_{\max}^2$$

→

$$L = \frac{I_{\max} \cdot \sqrt{I_{eb} \cdot I_{bp}}}{2\pi e^2 f_0 \cdot \sigma_x \sigma_y}$$

$$I_{eb} = \begin{cases} 0.300\text{mA (design)} \\ 0.600\text{mA (2 x design)} \end{cases}$$

$$I_{pb} = 0.600 \text{ mA (Y2000 max)}$$

$$I_p \cdot I_p \leq \begin{cases} 2000 \text{ mA}^2 = I_{\max}^2 \\ 1500 \text{ mA}^2 \\ 4000 \text{ mA}^2 \end{cases}$$

Can't get to maximum Luminosity with 180 bunches

Peak Luminosity Prospects 2003

I_{\max}^2/mA^2	I_{ep}/mA^2	I_{pb}/mA	n_b	$L/\text{cm}^{-2}\text{sec}^{-1}$
2000	0.3	0.6	100	3.75535E+31
1500	0.3	0.6	90	3.37982E+31
4000	0.3	0.6	140	5.2575E+31
2000	0.6	0.6	70	5.2575E+31
1500	0.6	0.6	60	4.50643E+31
4000	0.6	0.6	90	6.75964E+31

←

A likely scenario

Luminosity Strategy

Go for optimum Luminosity from the very beginning

Since the total beam currents will be limited in the beginning

→ Operation with 120 bunches

Luminosity goal $\sim 40\text{pb}^{-1}$

Conclusions

- Shut Down end delayed by 7 days because of a number of unforeseen events, additionally scheduled work and delays with some of the components
- Detailed planning for start-up with beam available
- Preparations for start-up still underway with high level of activity
- Strategy on vacuum conditioning, discussed, proposed, to be decided
- Strategy for luminosity operations discussed, proposed, to be decided