

HERA

Coordination Meeting March 2005

15-03-2005

- Luminosity Production
- Backgrounds
- Electron Lifetime Effects
- Polarization
- Hardware Issues
- Operational Issues

Beam Currents in the 2005 Luminosity Run

60 bunches in dec, 120 bunches in Jan-Febr, 150 bunches in March

Proton beam currents

up to $8.3 \cdot 10^{10}$ per bunch

Limitations: injectors

e-Currents

Stagnated since Febr.14

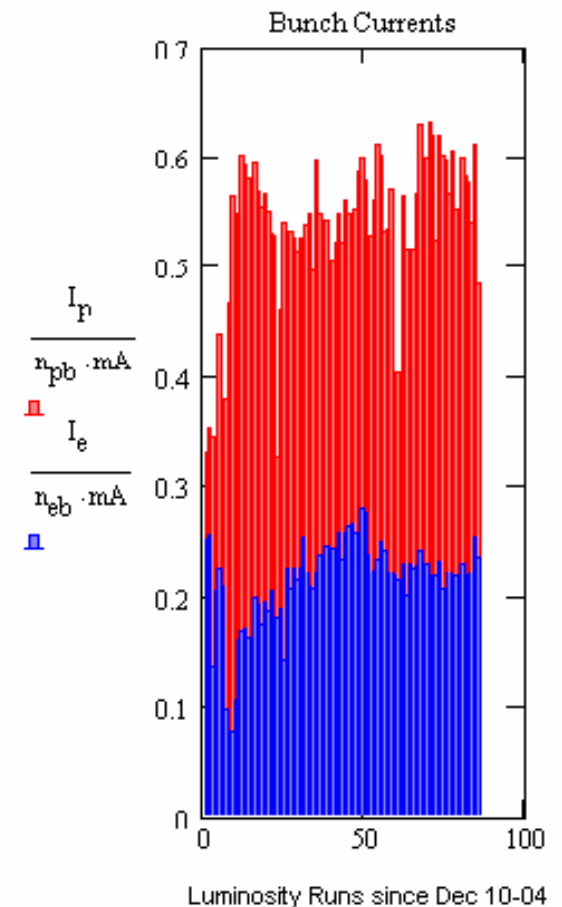
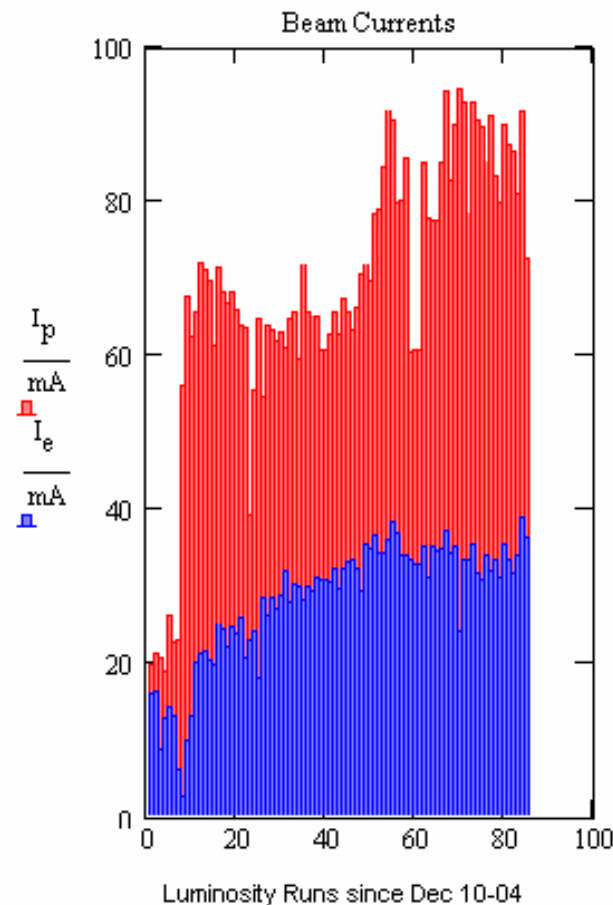
so far little from increased number of bunches

Limitations:

- techn. RF problems,
- operational issues

Further plans

Keep increasing e beam currents and eventually switch to 180 bunches



Peak- and Specific Luminosity

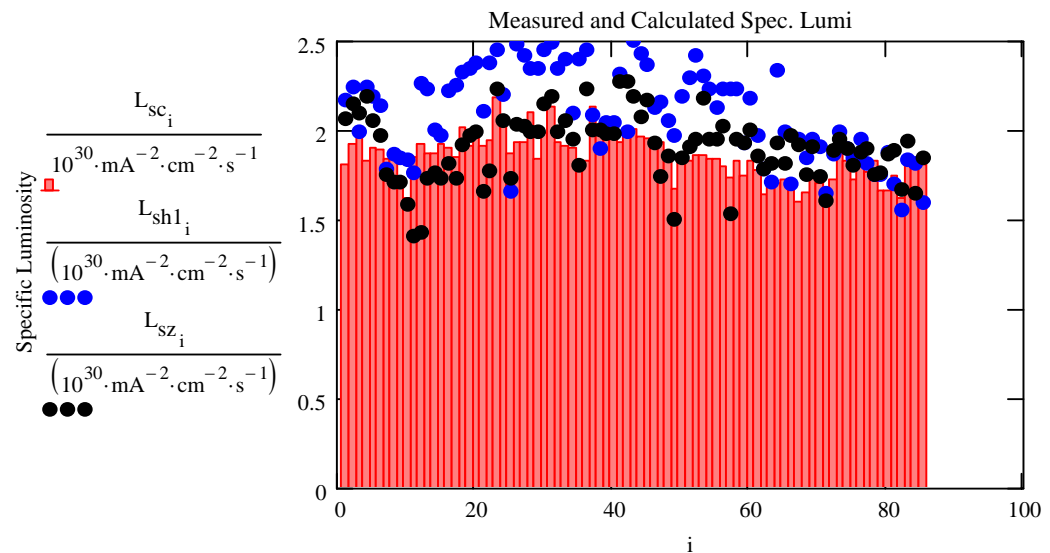
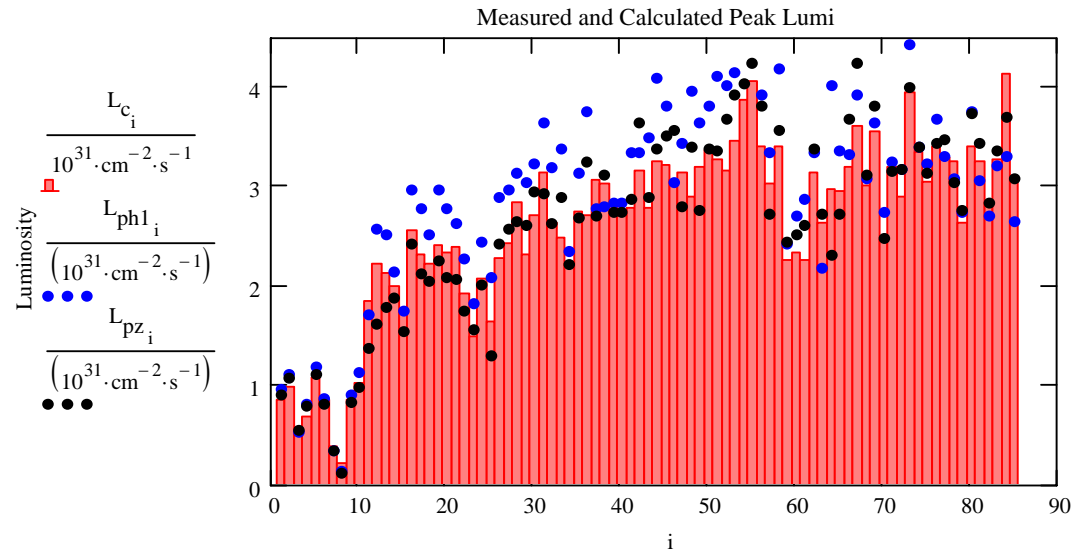
With larger proton beam currents per bunch and larger total currents

- Specific luminosity reduced
- Peak Luminosity stagnated

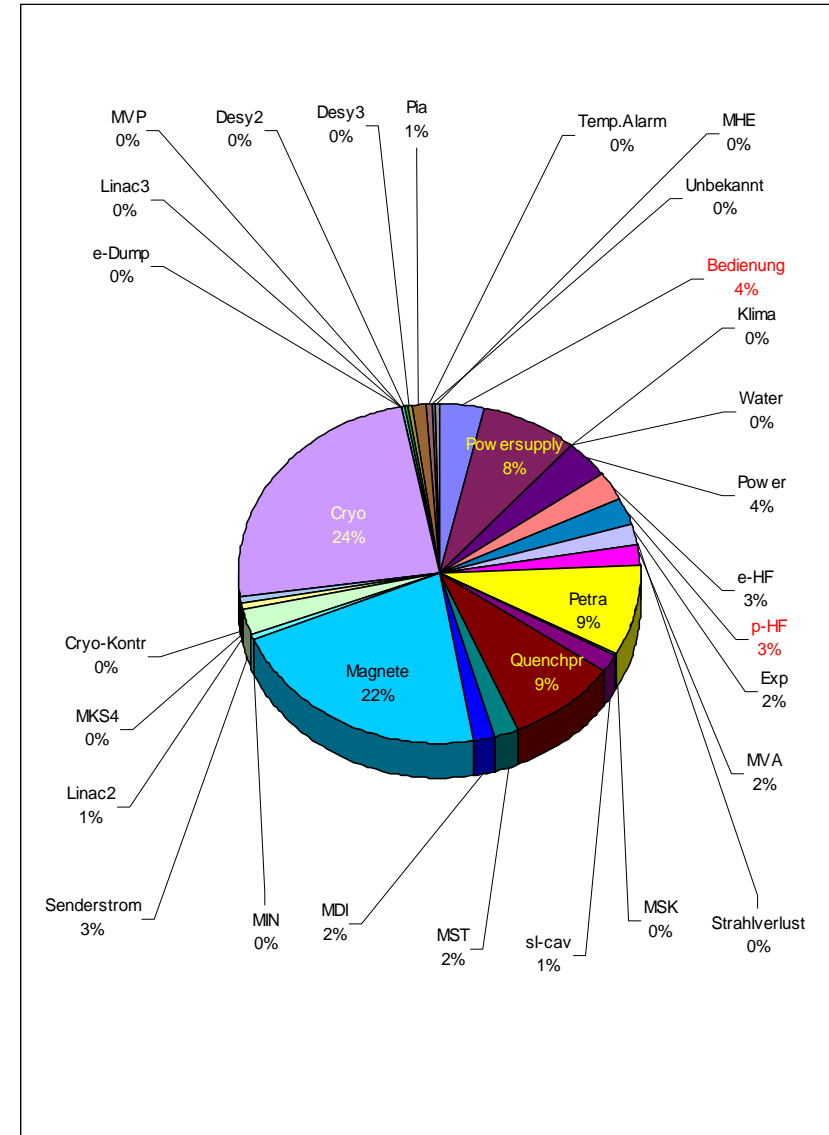
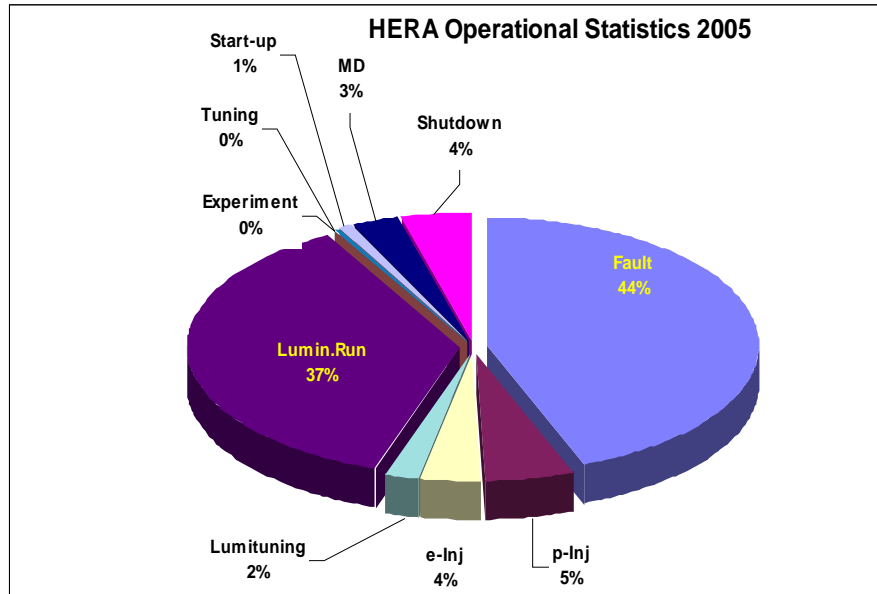
Reasons:

- *larger p-emittance,*
- *larger p-beam blow-up*
- *more attention paid to operational issues*

Better agreement between H1 measurements and calculations from beam parameters

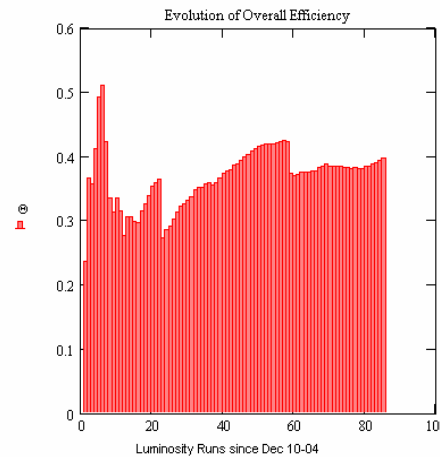


Luminosity Production: Operational Efficiency

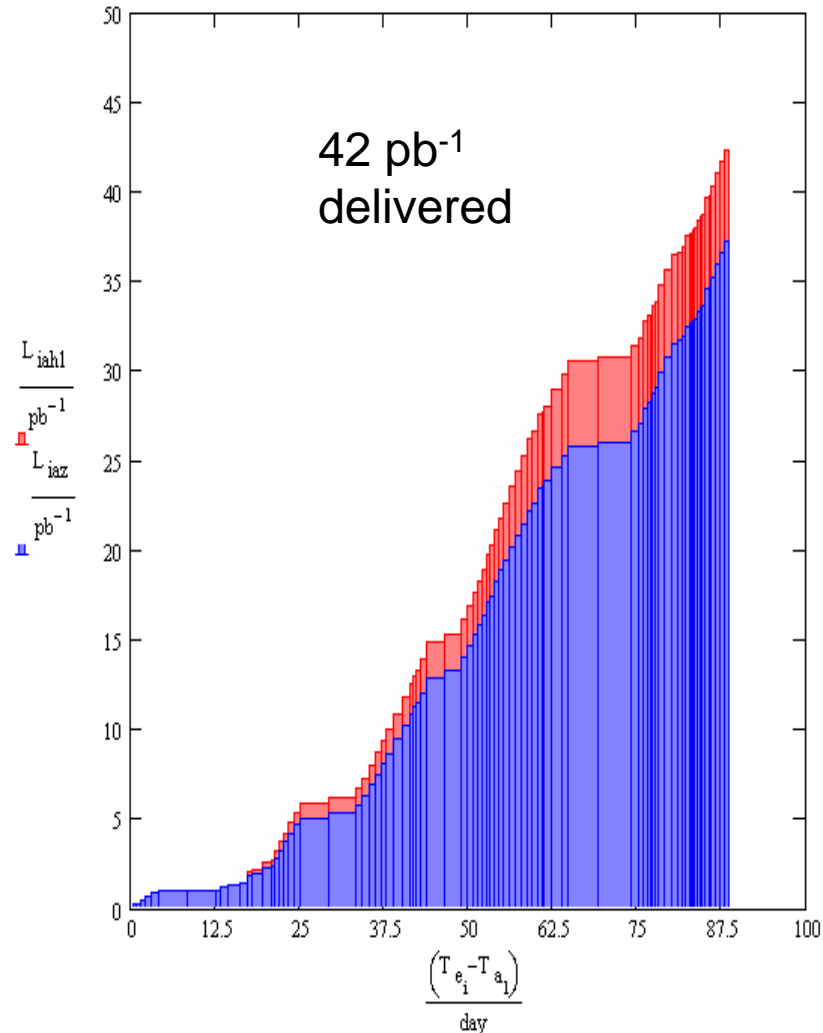


Operational Statistics dominated by technical faults

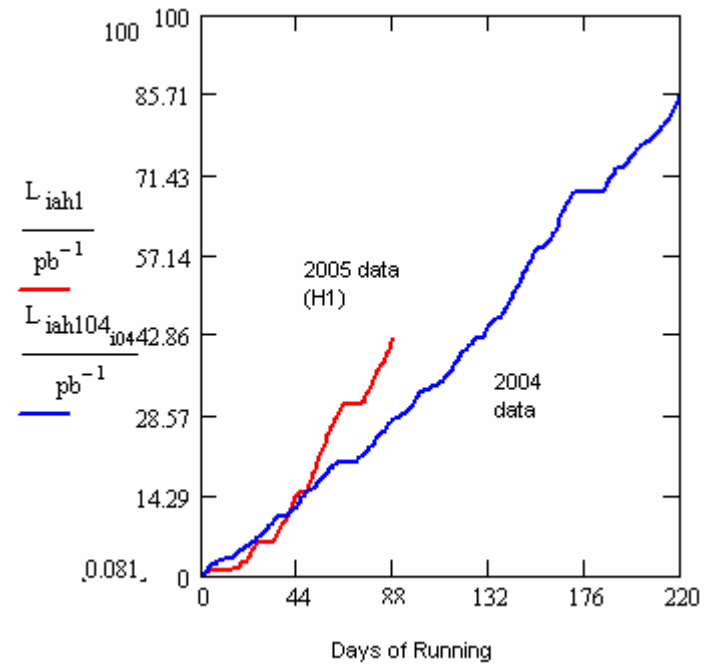
Technical faults are especially an issue at areas with critical support



Luminosity Production



Comparison with 2005 p-e+
Luminosity production



Backgrounds

Background conditions from **halo protons** more critical in 2005 compared to 2004

Reasons:

- Larger luminosity, smaller e-Beam sizes, less beam-beam blow-up of electrons
- higher sensitivity to small defects
- probably a damaged BU coil in HERA SR 65m
- Additional effects from **halo electrons** (ions, dust particles)

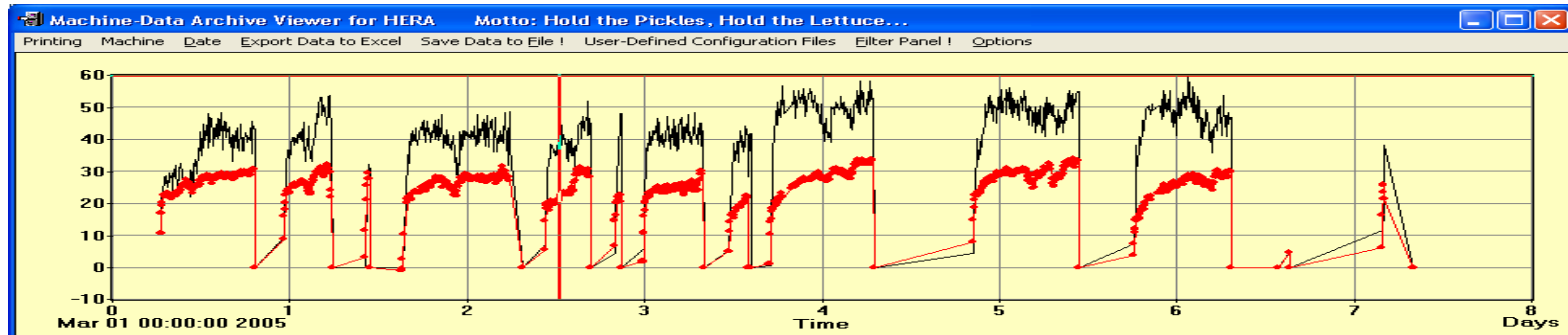
Counter measures so far:

- Comprehensive diagnostics and maintenance on magnet power supplies (quite unsuccessfully)
- Alternative collimator tuning
- Orbit stabilization HERA-p put into operations
- Lengthy collimator adjustment procedure
- beam-scraping
- Re-adjustments of collimators
- Frequent bump- and collimator tuning

Solutions

Fix the BU -coils (shutdown)

Polarization



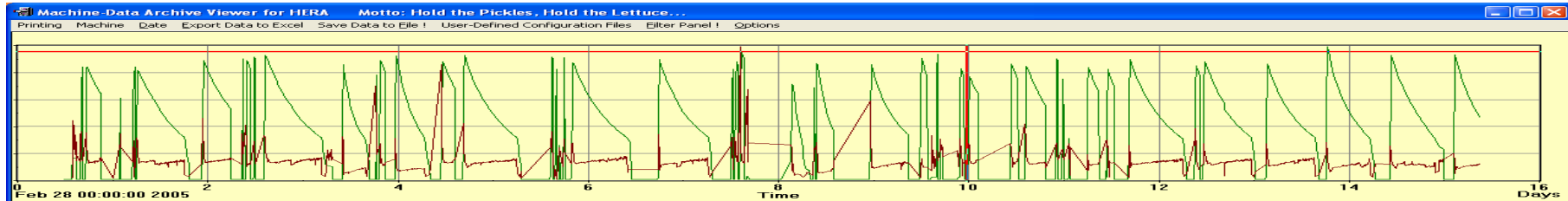
Polarization 50%-55% → well optimized

Strong beam-beam effects → colliding bunches only 30%

Counter measures under discussion and under preparation

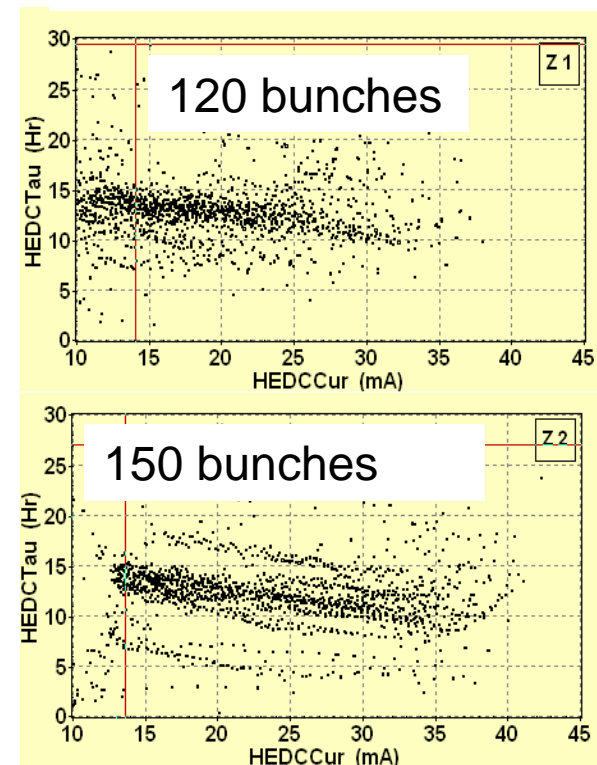
→ Voght

e-Lifetime Effects



March Operation: Frequent sudden reduction and sudden recovery of electron lifetime, fortunately rarely: reduction to below 5h for the entire run

- So far we do not have sufficient statistics for systematic assessment
- There are effects which can only be explained by dust trapping
- So far they are rare
- With more bunches filled, the probability is expected to rise



Trapping of particles in the beam

Previous studies indicate: Dust particles trapped in the beam (switched harmonic oscillator: if the lens becomes too strong (e-bunch density too high) or the distance between the lenses becomes too long (bunch distance, abort gaps etc), there is no stable trapping (over-focusing)

Ion stability: H⁺ ions trapped stably in the beam for $1 \cdot 10^{10}$ electrons and no abort gap in the beam

For full beam intensity and 1 μ sec abort gap can trap only very heavy ions or dust clusters

Narrow band of stability (very nonlinear oscillator, nonlinear resonances)

Particles are only stable for small amplitudes inside the beam

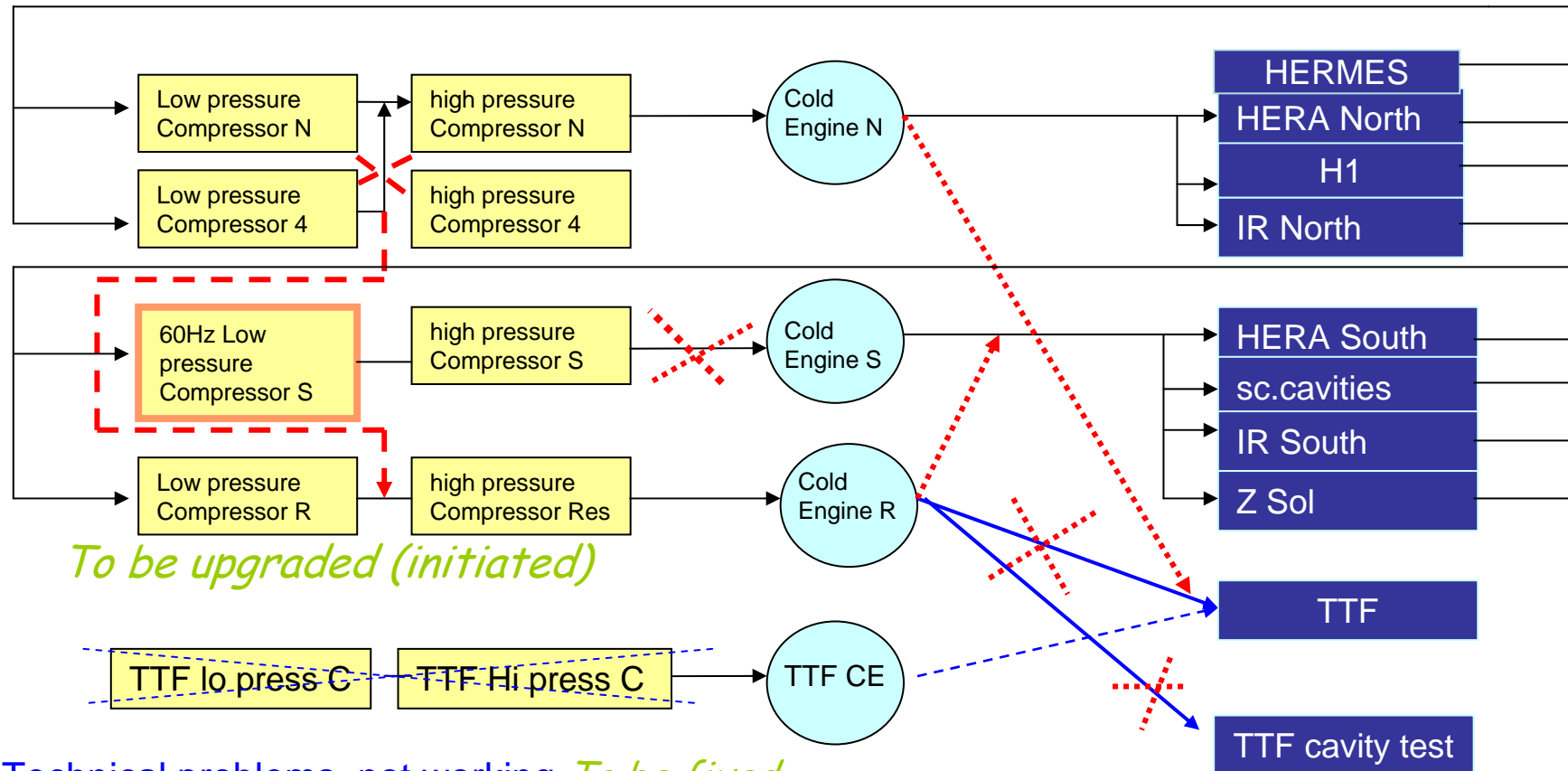
→ Fortunately the probability of trapping a particle is not too large

(for HERA II just subcritical)

Technical Issues

- Redundancy of HERA Cryogenic Plant
- BU –Magnets
- Operational Concerns

Redundant HERA Cryogenic Supply



This scheme was not applied since:

- It is too intricate and it takes too much time, experts not available
- Cannot afford interruption of Cryogenic supply of the VUVFEL cryo system

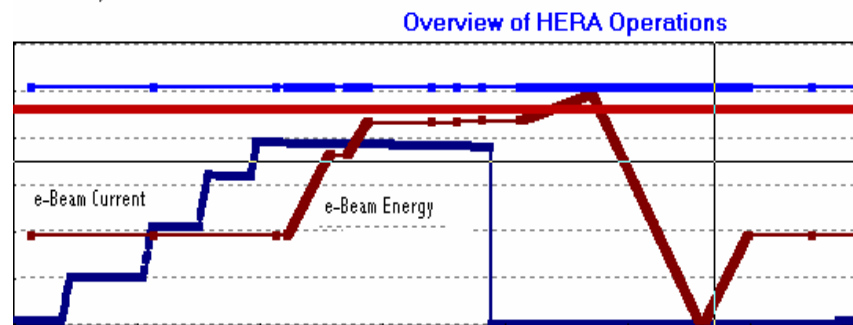
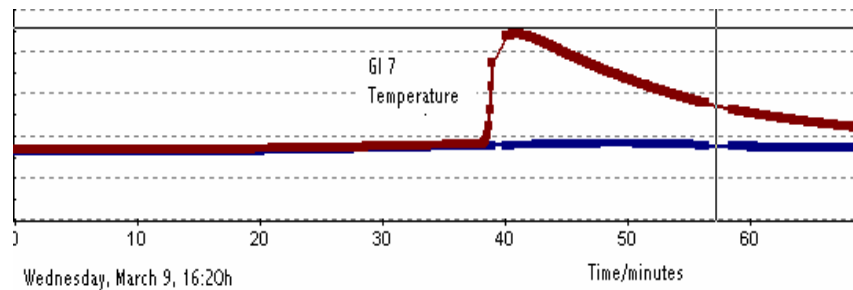
BU -Magnet Update

- **First spare** coil will arrive from Efremov in May 2005 (despite delays in Copper delivery by supplier)
- **Most of the coils** needed in shutdown (12) arrive July/August 05, the rest until the end of the year (so far as planned)



Operations:

- In general quite smooth
- Problems with operational mistakes if large deviations from routine operations
- Recent problem with orbit stabilization



Last Wednesday:

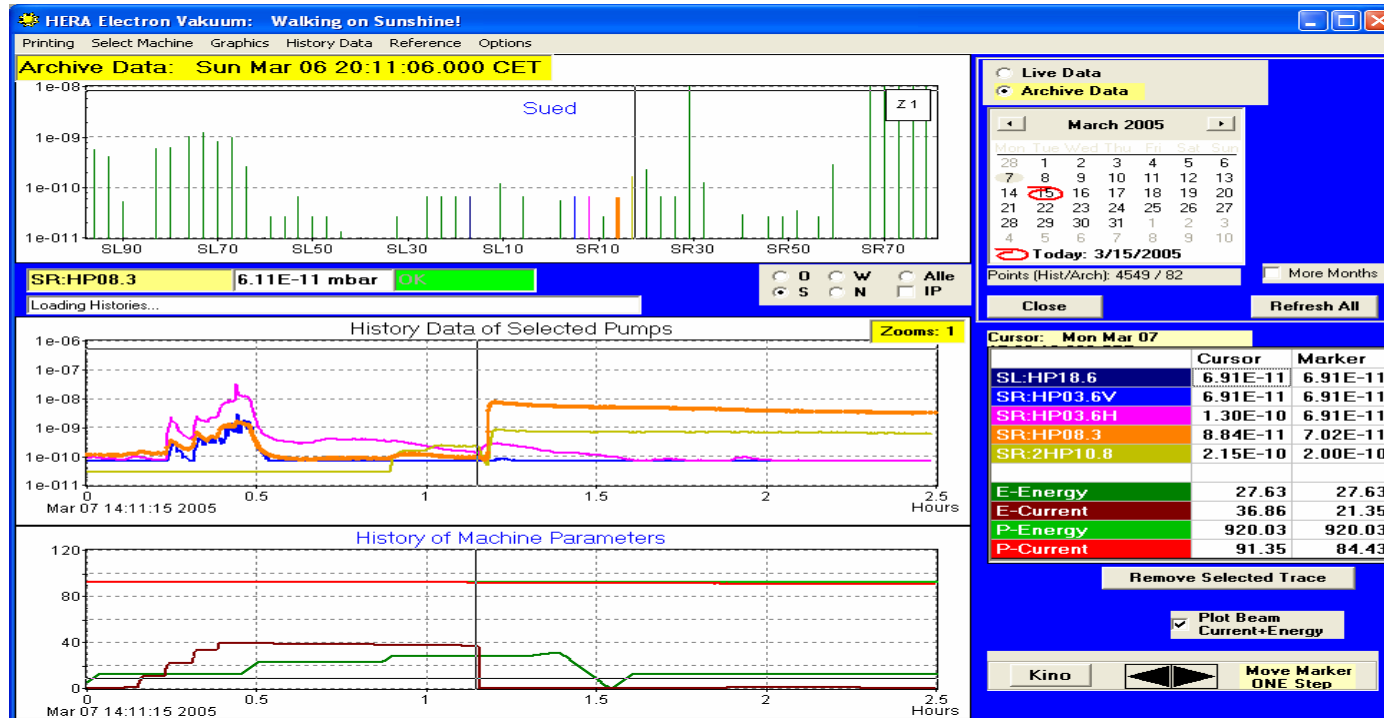
Sudden (with 45 sec)
increase of GI NR7
temperature to 95°C

Problem was analyzed and
understood:

Due to a repair of an IR
BPM, larges differences
between reference and
Orbit measurements

➔ Counter measures
discussed and in progress

Leak in SR 11m



- 2 minutes after beam dump
- No unusual heating of the beam pipe
- Fixed by tightening the flange e-11m
- Expected to become leak again in the near future: two days to fix, +4 days to pump and activate NEG Pumps

Conclusions

- HERA electron-proton operation proceeds well,
- luminosity production satisfactory
- Conditions for experiments not without problems but in general tolerable
- Polarization with electrons and strong beam-beam is critical
- Major concern are the overall reliability, the availability and the support

Further Plans

- Keep increasing the beam currents
- Increase luminosity production
- Continue to make operating more efficient