ZEUS Report

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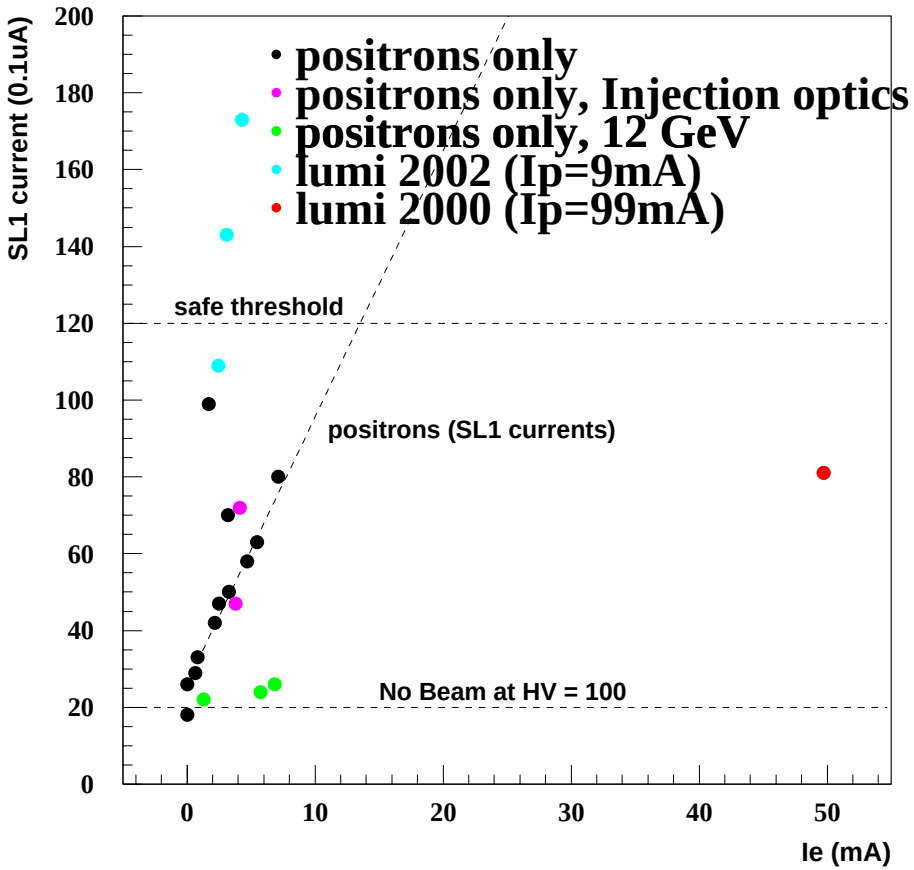
On behalf of the Collaboration

- Summary of BG document
- Operational issues
- Shutdown plans
- Preferred schedule

Positron-induced background

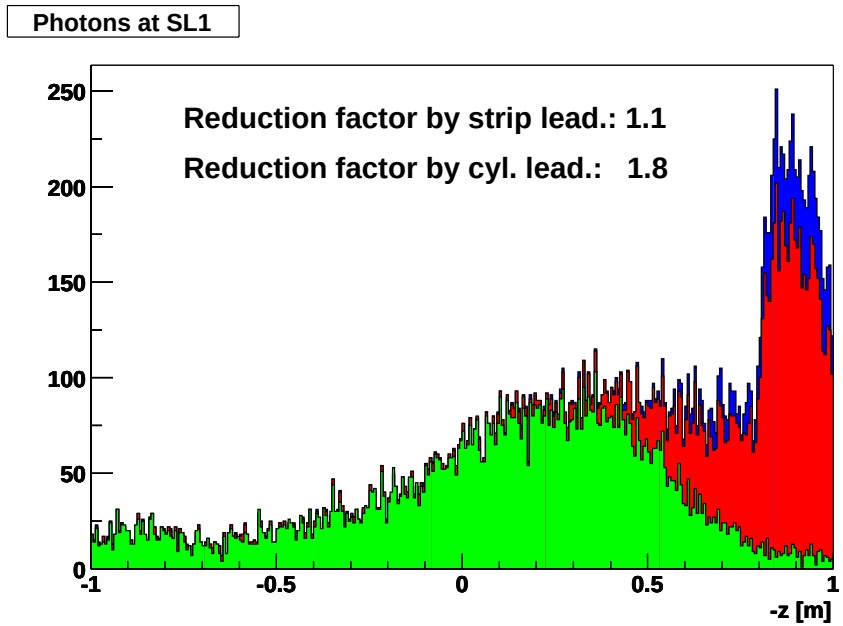
- With e^+ only, ~13mA beam induces the limit CTD current.
- At low currents, the b.g. is dominated by Synch. Radiation.
- Red point = lumi 2000 (100mA*50mA)
- Need to reduce by ~1/10 to make S.R. contribution low enough.

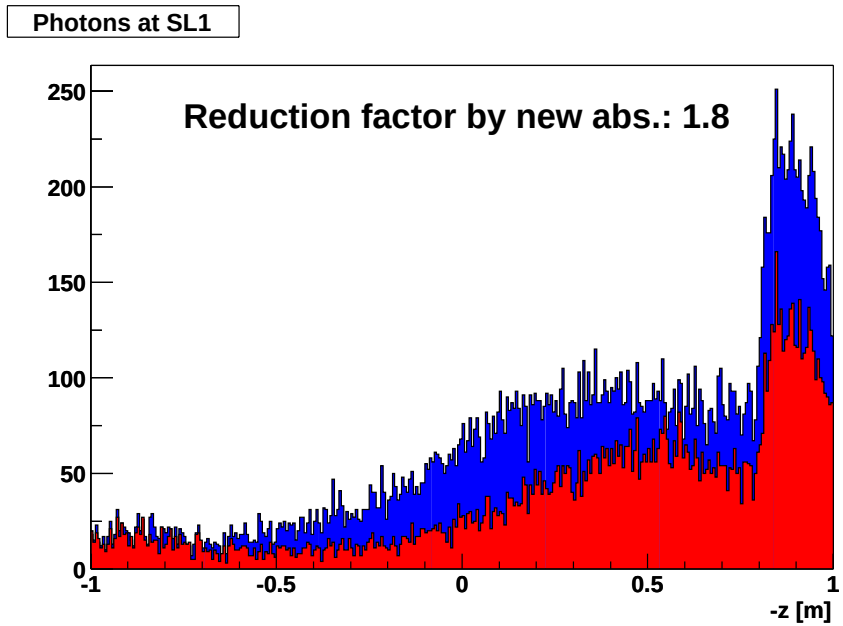


Synchrotron Radiation

- Suspected source: SR11m Abs4
  (from drift-time spectrum).
- “Sneakthrough hole” for photons between C5A and C5C realized
  (should be closed).
- Shield C5A and rear-wards with 2mm Pb (fig.) gives factor 1/1.8
  (actual solution will be W inside BP).
- Vertical absorber at SR3.6m will reduce by factor 1/1.8.

- Implementing all above measures, a preliminary reduction 1/6 was obtained from a very recent simulation.
  (fig. next page)

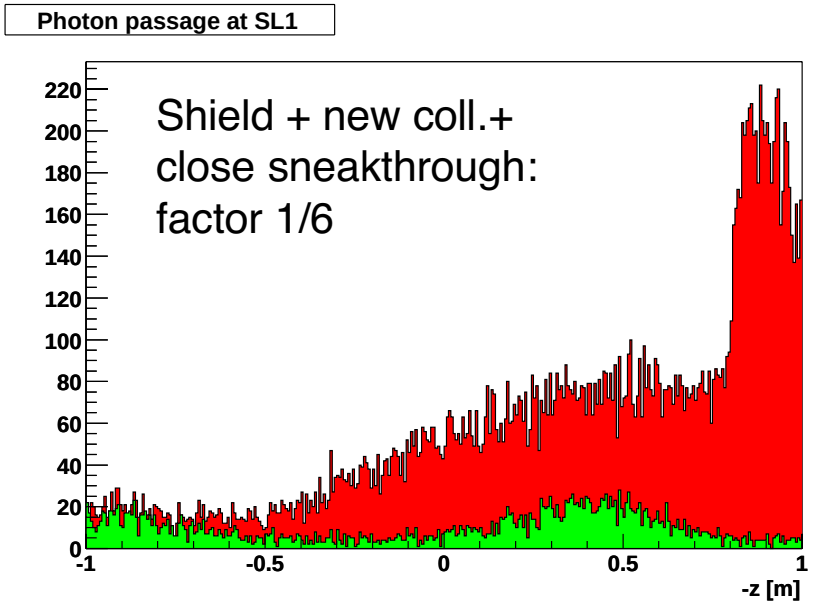


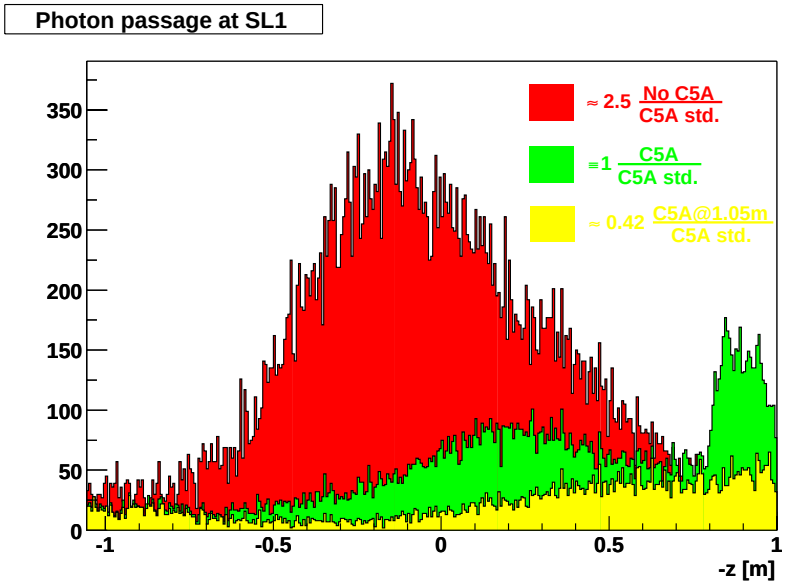


Synchrotron Radiation (cont.)

- Coating of Abs4 by Au/Ag/Cu (H1 study): 1/1.8 backscatter.
- Reconfiguration of C5A being studied (e.g. move to -1m).
- Will make C5A thinner for particle bg: effect seems not dramatic (+6% increase).

- We seem to able to manage SR for positron running.
  Electron simulation should be done urgently (more photons with harder spectrum).

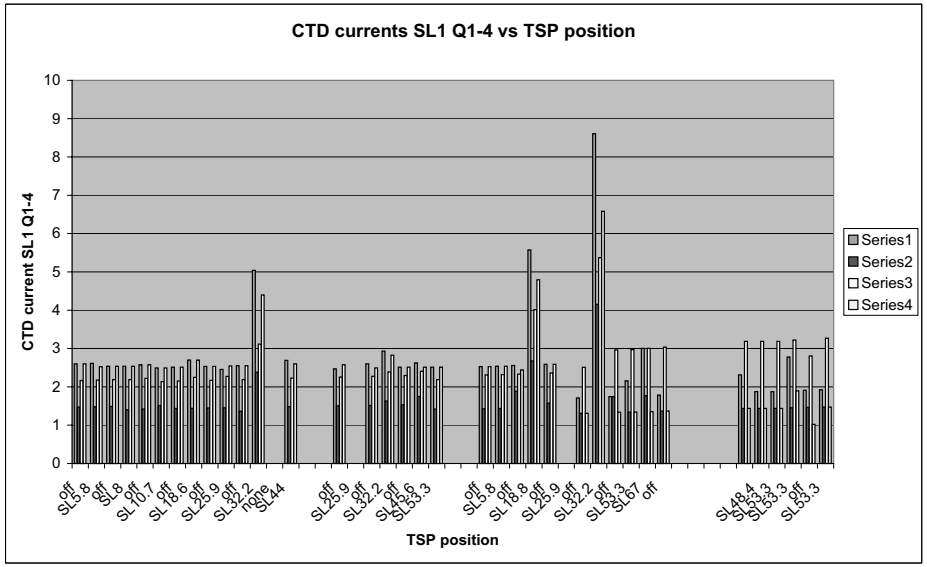




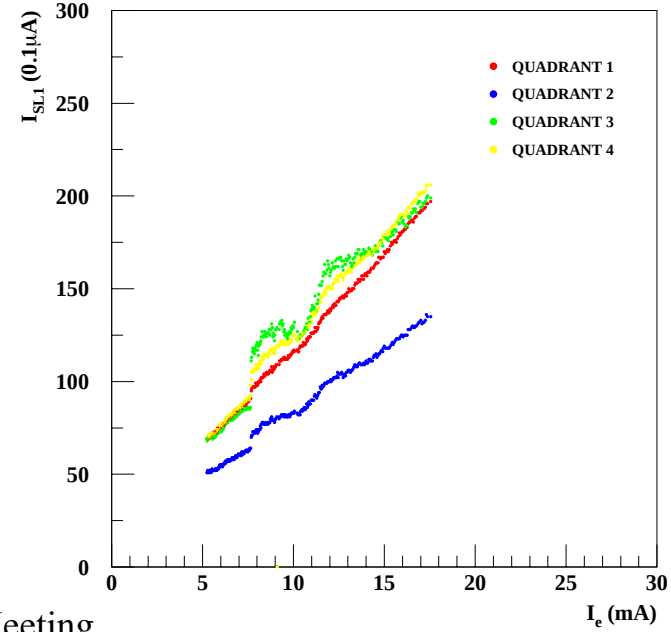
Off-momentum positrons

- Suspected source from TSP-firing experiment: SL18.8/32.2 ?
- Reducing the C5A thickness gives only a factor of 1/2.
- Should have non-linear rise as Ie rises: last long e^+ fill not conclusive: would need another stable fill.
- Imposing same 1/10 reduction: remaining 1/5 needed from SL vacuum improvement?

- This bg is much less in e^- optics (~1/4).

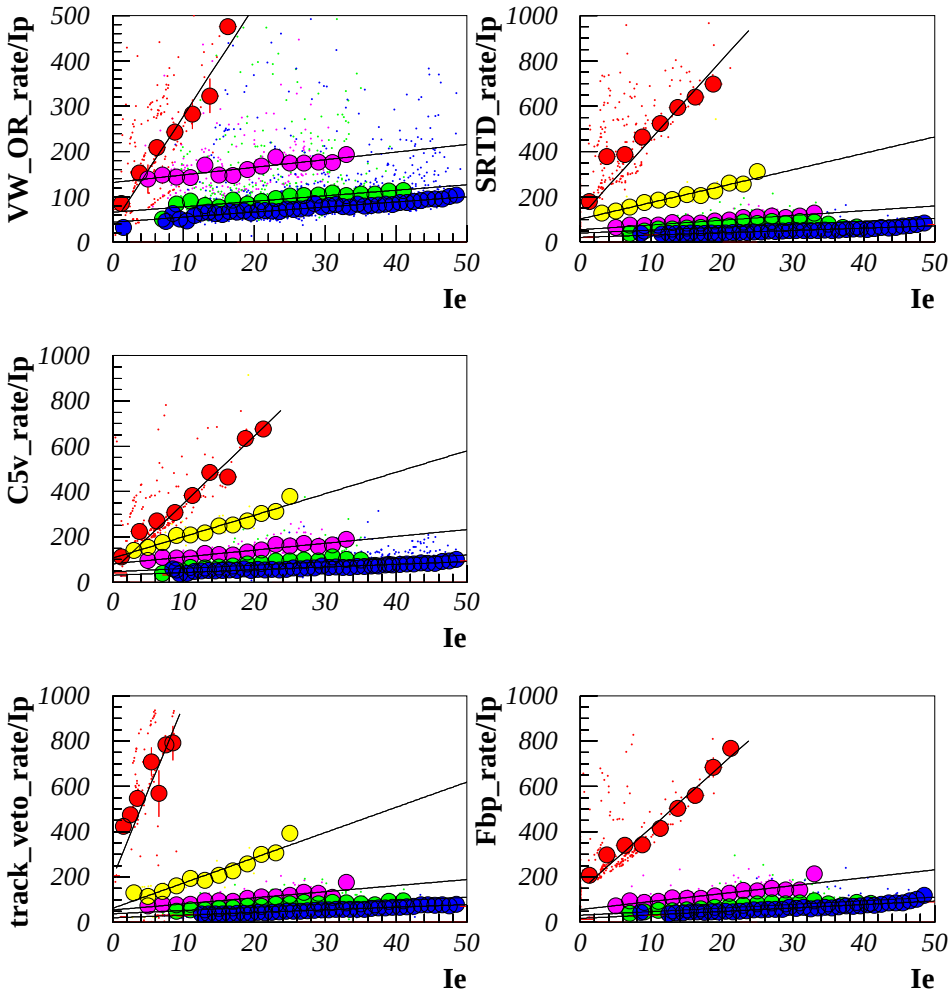


e^+ only 11th September 2002



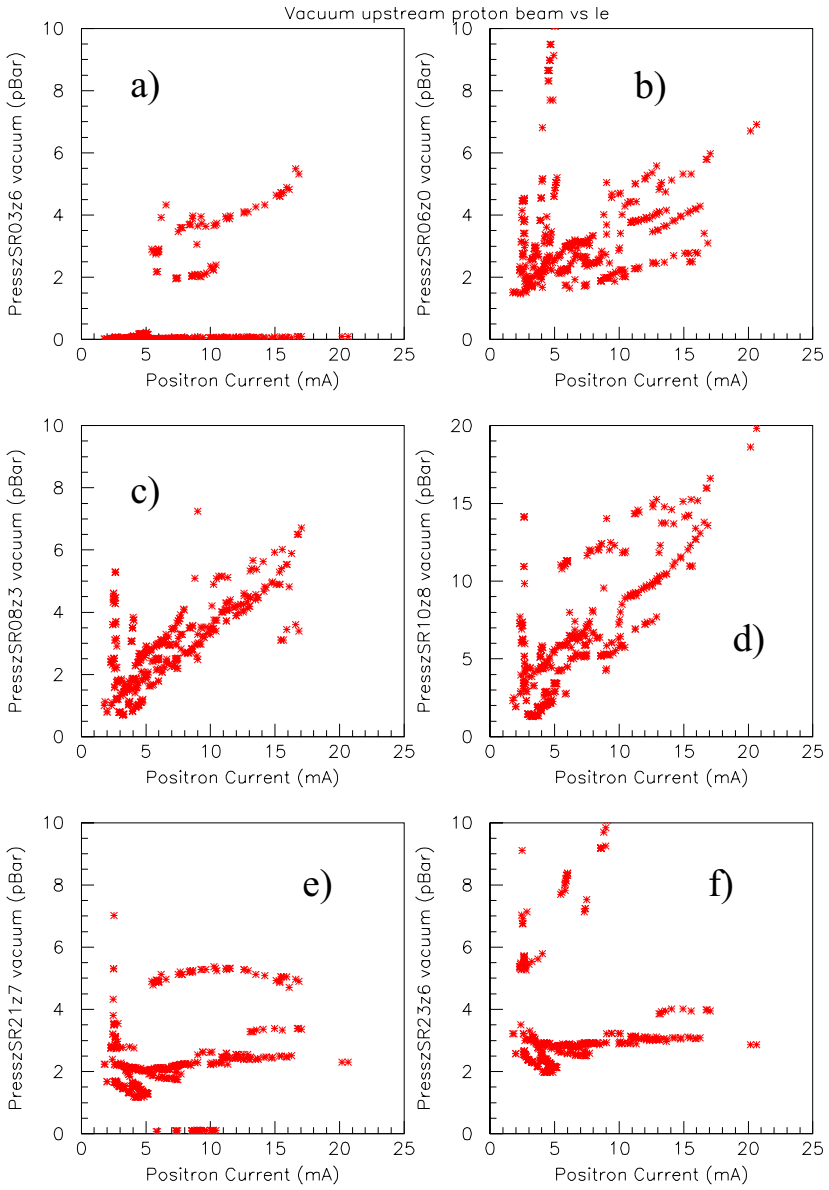
Proton background

- P-beam only: 60mA brings limit chamber current: static vacuum already bad compared to 2000.
- With e^+ beam: drastic increase of vacuum (dynamic vacuum) dominates the trigger rate (fig).
- Worse than early 1998 (yellow), >10 worse than 2000 (blue).



Proton background (cont.)

- Vacuum vs. Ie for SR region:
  a)3m b)6m c) 8m d)11m e)21m f)23m
- "Linear" behaviour seen up to 11m.
- At 11m, the slope is ~1.0 pbar/mA.
  Cf. NR8.3m in 2000: 0.12 pbar/mA.
  (H1 document)



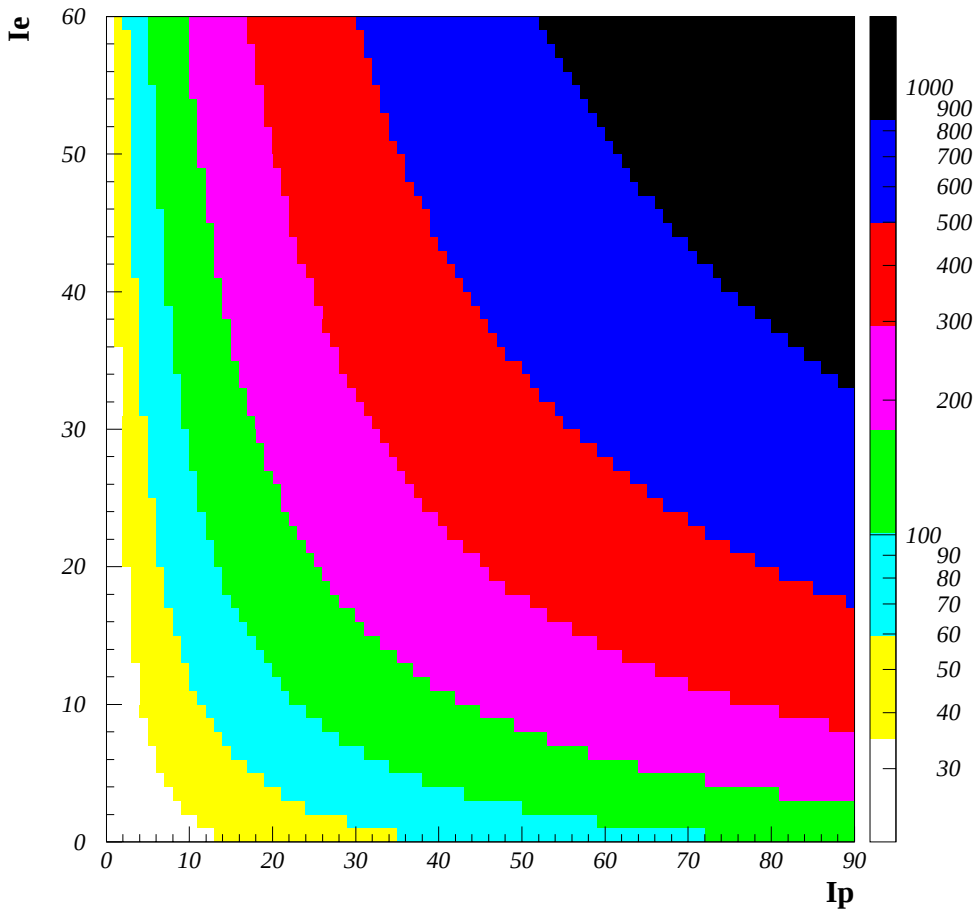
Proton background (cont.)

- Applying the relative increase of the trigger rates to the p-only chamber current: predict the proton-induced contribution as a function of Ie and Ip.

- Limit is reached at
  $Ie*Ip < \sim 300mA^2$
  (ignoring the positron-induced current!)

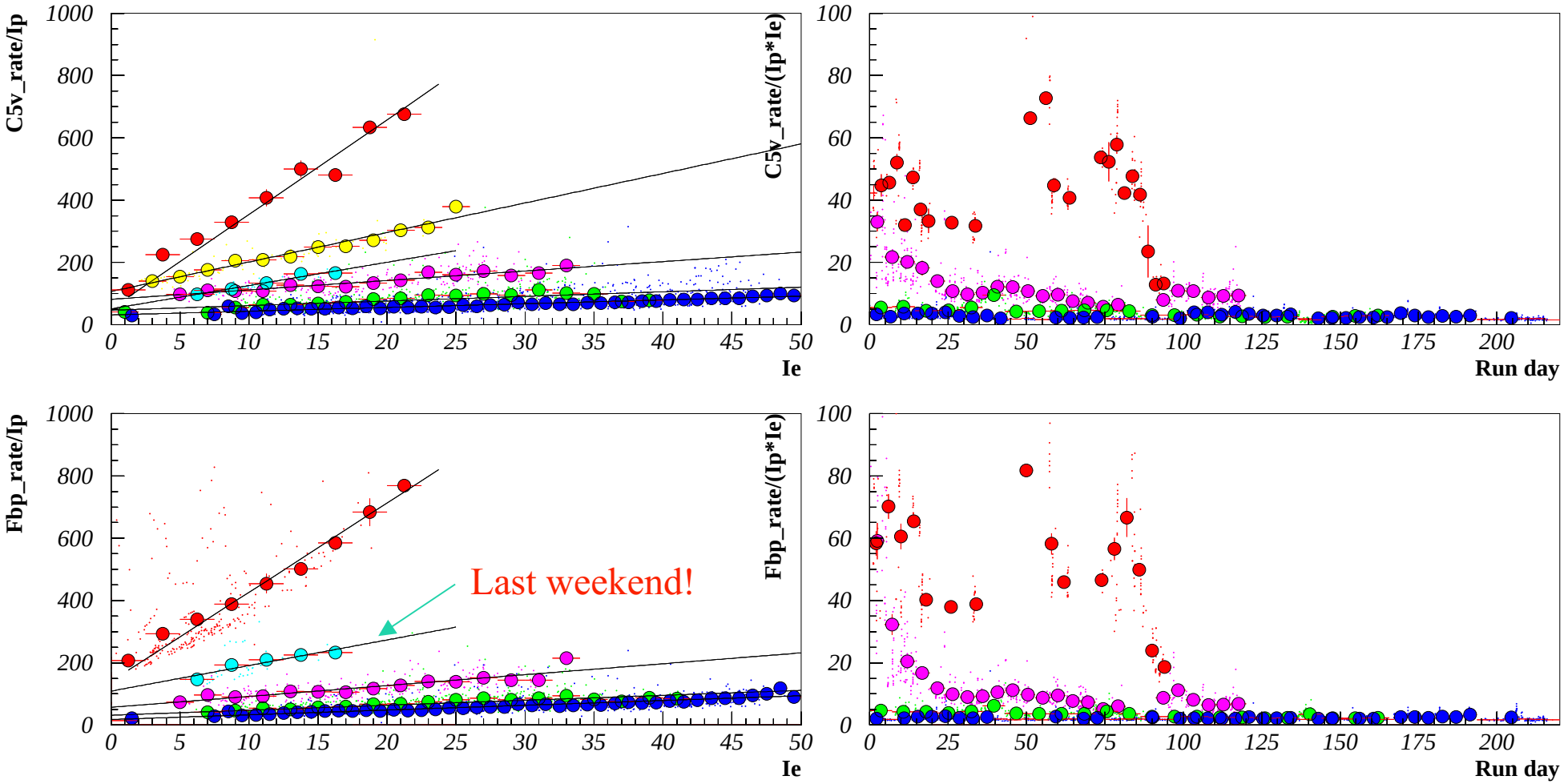
- Design current is >20x away.

- Effect of thin C5A: only 10-15% improvement.



After vacuum improvement last week

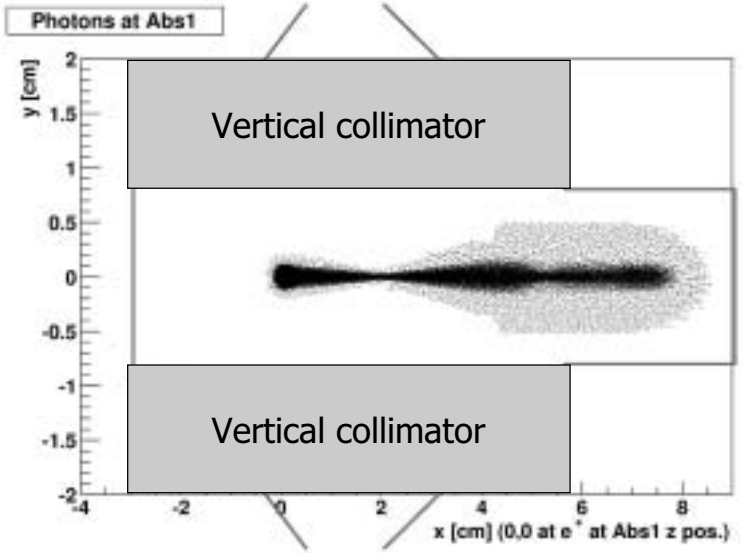
> Factor 3 improvement in the slope

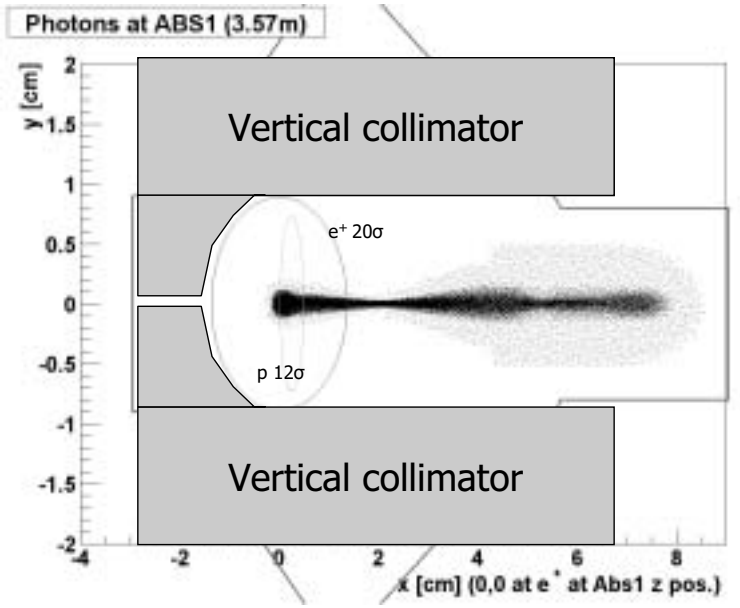


Should look at e-side, too.

Counter-measures to be taken

- New S.R. masking scheme C5A-C
  - Close sneak-through hole
  - Shield rear part of the CTD
  - C5A will be thinner for particle b.g.
  - Optimization of mask shape?
  - Reconfigure (-1.0m)?
- New movable collimator at -3.6m
  - Optimization of shape (eg. fig.)
- Coating of -11m absorber (Abs4)
  - Common study with H1
  - Technical investigation by vacuum group





Operational Issues (W.Zeuner)

- Central tracker operation -
  HV 90% $I_p \approx 20$ mA $I_e \approx 17$ mA - gas gain reduced by factor ≈ 4
  HV 95% $I_p \approx 20$ mA $I_e \approx 11$ mA - gas gain reduced by factor ≈ 2
  HV 100% $I_p \approx 20$ mA $I_e \approx 8$ mA

  ➔ Data taking efficiency is low

- High radiation dosage at e^+ injection
  Frequent check of injection efficiency necessary

- Radiation dosage in normal ep running usually bearable.

- Accumulated radiation dosage at the radiation monitor is 75 kRad

Shutdown Plans (W.Zeuner)

Minimum work:

- Modification of interaction region
  - Un-cable Rear Calorimeter and move on extension rails
  - Remove MVD cables from GG magnet and disconnect from Patch-Box
  - Remove GG magnet
  - Modify interaction region
  - Reassemble and test

- Repair undercarriage of iron yoke

Time estimate – 12 weeks – safe schedule

Additional work – not yet decided

- Repair of the Straw-Tube-Tracker
  - Un-cable Forward Calorimeter and move on extension rails
  - Remove GO magnet
  - Remove entire Forward-Tracker
  - Repair STT – 4 weeks work in a lab.
    - Repair electronics – fuses, capacitors
    - Reduce cross talk
  - Re-assemble and test

- Time estimate 20 weeks – safe schedule
- Main uncertainties on GO/GG on re-installation – under investigation
- Reduction to 16 weeks is feasible by re-assembling cold magnets and calorimeter in parallel $\Rightarrow$ risk of delay if GO or GG have problems after installation

Proposal for shutdown schedule

- Considerations towards successful HERA-II program
  - HERA hasn't yet demonstrated its full potential for whole HERA-II physics programmes.
  - It will be plausible that new problems will turn up as the machine steps forward with each of the planned achievements.
  - Some of the problems may be serious enough to necessitate a long shutdown (work for experiments, for machine or for both).
  - Therefore, if we go into the next long shutdown before all goals are (reasonably) demonstrated, there's a high risk of another long shutdown.
  - Two long shutdowns bring into serious doubt of achieving the physics goals we have set until the end of 2006, i.e. large chunk of data for e^+_L, e^+_R, e^-_L, e^-_R, summing up to $O(1fb^{-1})$.

Proposal for shutdown schedule (cont.)

- Therefore, our 1st preferred schedule is:
  - From now till Christmas 2002:
    - Remaining background studies
    - Polarisation commissioning
    - Demonstrate design spec. luminosity with high bunch currents
  - Switch to electron over the Christmas / New year
  - Run with electrons Jan-Mar 2003:
    - Demonstrate high current electron, good lifetime, high luminosity and polarisation.
    - Study experimental background
  - Long shutdown from April 2003: the only long shutdown in HERA-II.

- If this cannot be agreed between all the parties:
  - We want to start the “1st” shutdown as soon as we are ready.
  - Common proposal from H1 and ZEUS (next page)

Common proposal from H1 and ZEUS (26/09/2002)

1. We consider it is essential that the HERA machine group works on polarisation commissioning and on high-current running tests (to demonstrate design specific luminosity with large bunch currents) until the end of November 2002.

2. Then we propose to have a stable data-taking period for December 2002 and January 2003, in which the beams are brought into collision and serve data for all four experiments. Following the outcome of the polarisation commissioning, a polarised positron beam is highly desired for this data-taking.

3. The shutdown should start no later than 1st of February 2003.