Polarization in HERA–e

03.05.2005

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- Polarization has not fully recovered after BU–repair shutdown

$\leftarrow$ substancial orbit changes $\Rightarrow$ new harmonic bump settings

$\leftarrow$ before the BU–repair: periodic p–spikes partially masked other p–background problems

$\rightarrow$ after repair : still background tuning necessary

$\Rightarrow$ little time for polarization tuning

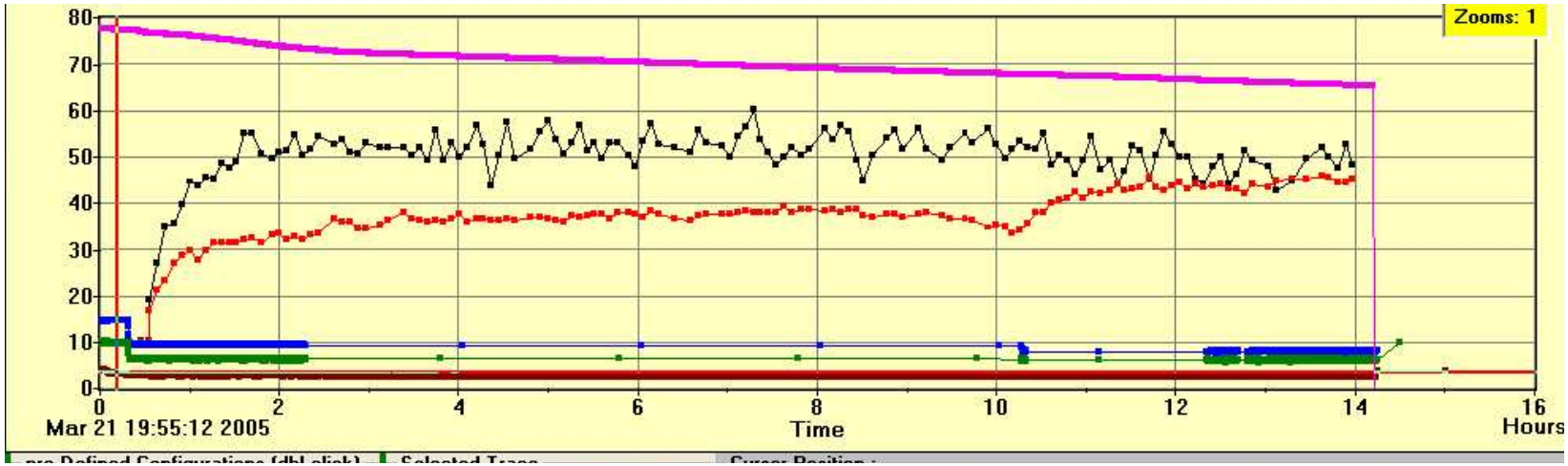
$\Rightarrow$ suspicionen raised that (e-) polarization tunes increase p–background

$\rightarrow$ Time needed for bump scans $\rightarrow$ 1-st order bumps done, 2-nd order partly done

$\rightarrow$ Time needed to "rehabilitate" the polarization tunes $\rightarrow$ almost done ...

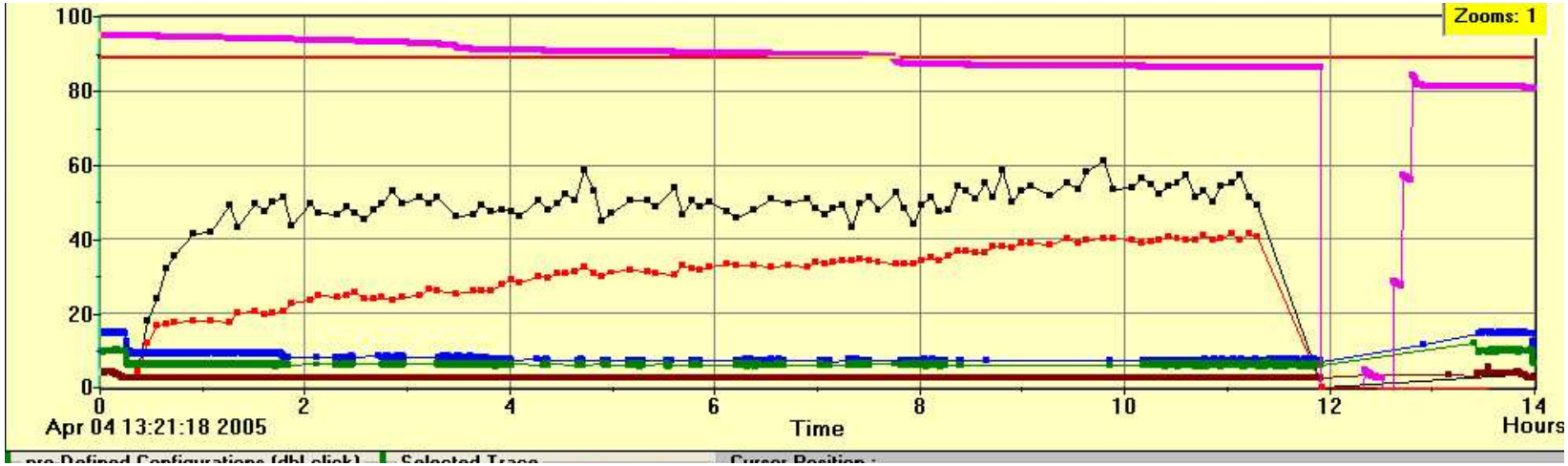
$*$: D.P.Barber, M.Vogt

Tune dependence of $P_{\mathrm{colliding}}$



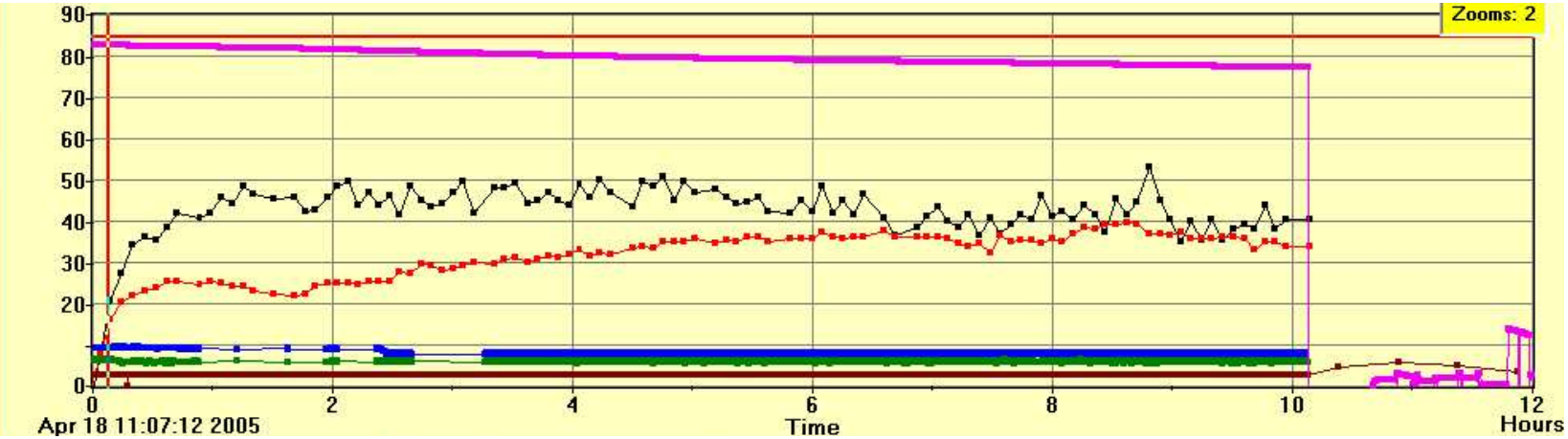
- 21.03.2005 : before BU repair shutdown
- TPOL-pilots-5min/%, TPOL-coll-5min/%, $f_y^{e,\mathrm{pil}}$ /kHz, $f_x^{e,\mathrm{pil}}$ /kHz, I_p/mA
- I_p from ca. 75 mA to ca. 65 mA
- 06:15 : $f_y^{e,\mathrm{pil}}$ from 9.3 kHz to 8.0 kHz & $f_x^{e,\mathrm{pil}}$ from 6.4 kHz to 6.1 kHz
- If e-tunes are properly set : $\boxed{P_{\mathrm{coll}} \approx 45\%}$

Tune dependence of $P_{\mathrm{colliding}}$



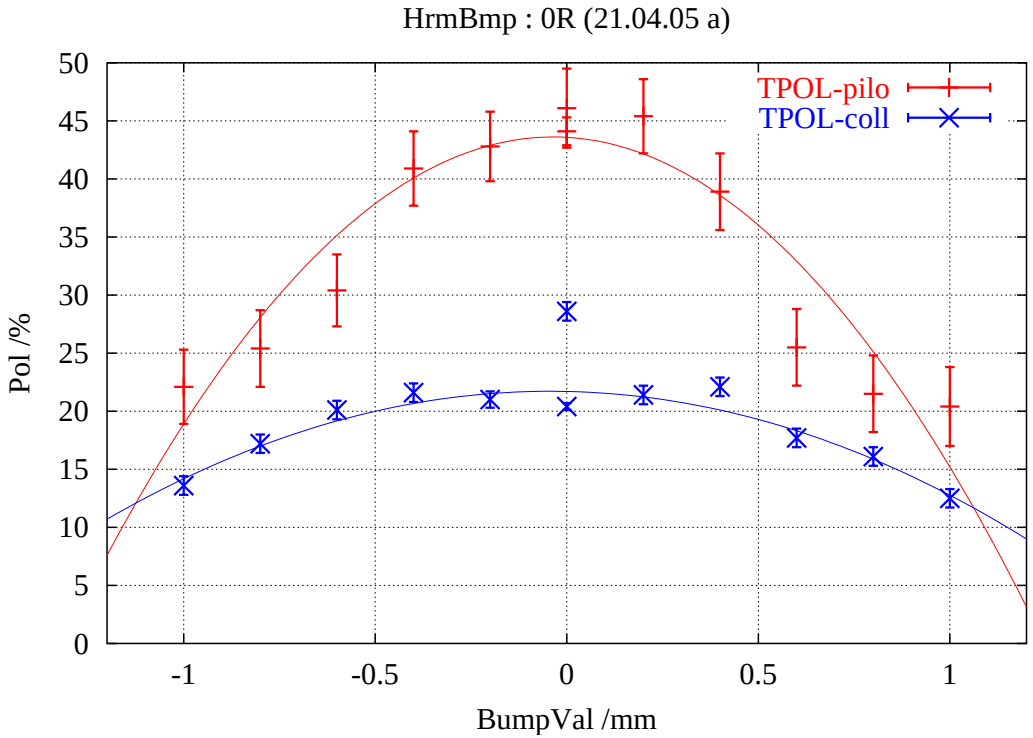
- 04.04.2005 : before BU repair shutdown
- TPOL-pilots-5min/%, TPOL-coll-5min/%, $f_y^{e,\mathrm{pil}}$ /kHz, $f_x^{e,\mathrm{pil}}$ /kHz, I_p/mA
- I_p from ca. 90 mA to ca. 85 mA
- 17:10 : $f_y^{e,\mathrm{pil}}$ from 8.1 kHz to 7.4 kHz & $f_x^{e,\mathrm{pil}}$ from 6.2 kHz to 6.1 kHz
- P_{coll} hardly reaches ca. 40%
- . . . "properly set" means : according to I_p ($\leftarrow$ beam-beam tune shift)

Tune dependence of $P_{\mathrm{colliding}}$



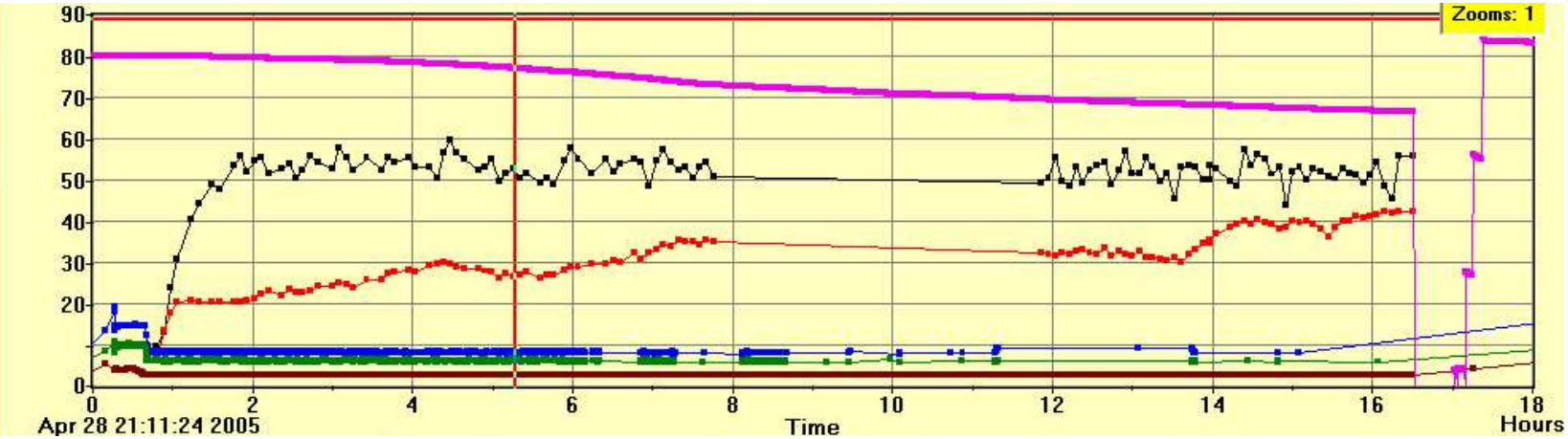
- 18.04.2005 : after BU-repair shutdown , begin of bump scans
- TPOL-pilots-5min/%, TPOL-coll-5min/%, $f_y^{e,\mathrm{pil}}$ /kHz, $f_x^{e,\mathrm{pil}}$ /kHz, I_p/mA
- I_p from ca. 83 mA to ca. 78 mA
- 13:30 : $f_y^{e,\mathrm{pil}}$ from 9.0 kHz to 8.0 kHz & $f_x^{e,\mathrm{pil}}$ from 6.0 kHz to 5.9 kHz

Exampel of a Beautiful Harmonic Bump Scan



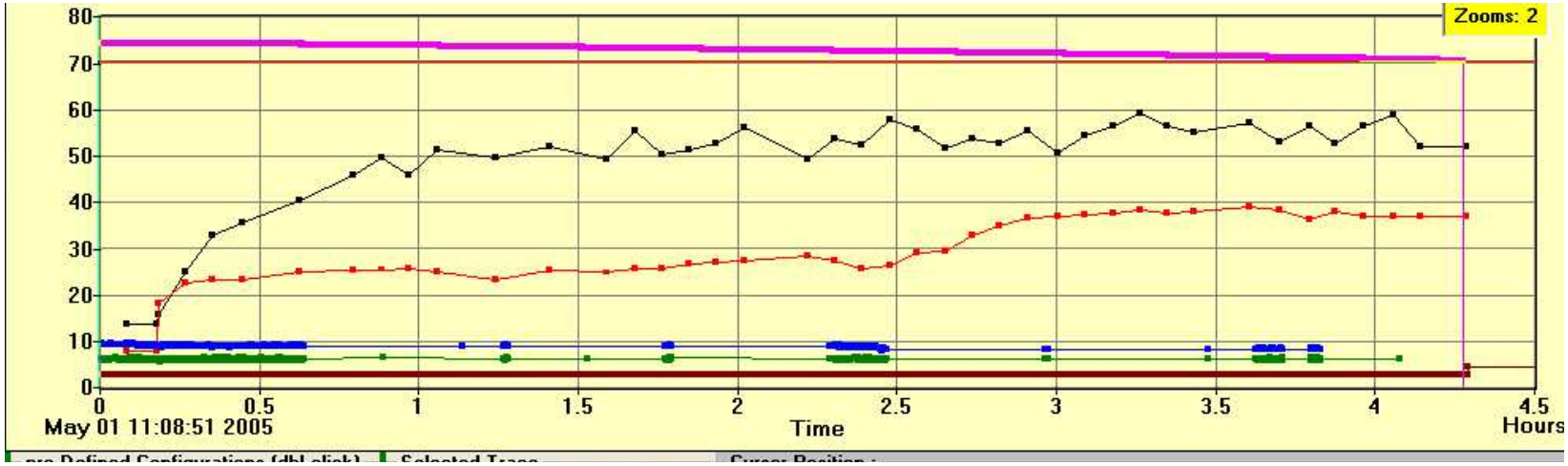
- 21.04.2005 : scan of harmonic bump 0R
- we only need the position (amplitude) of the maximum !!!!
- alternating sign of bump amplitude cancels drift of P_{coll} due to "dying protons" ($\rightarrow$ decreasing beam–beam tune shift)
  $\Rightarrow P_{\mathrm{coll}}(\mathrm{ampl}) + P_{\mathrm{drift}}(\mathrm{time})$ has symmetry point at maximum of P_{pilots}

Tune dependence of $P_{\mathrm{colliding}}$



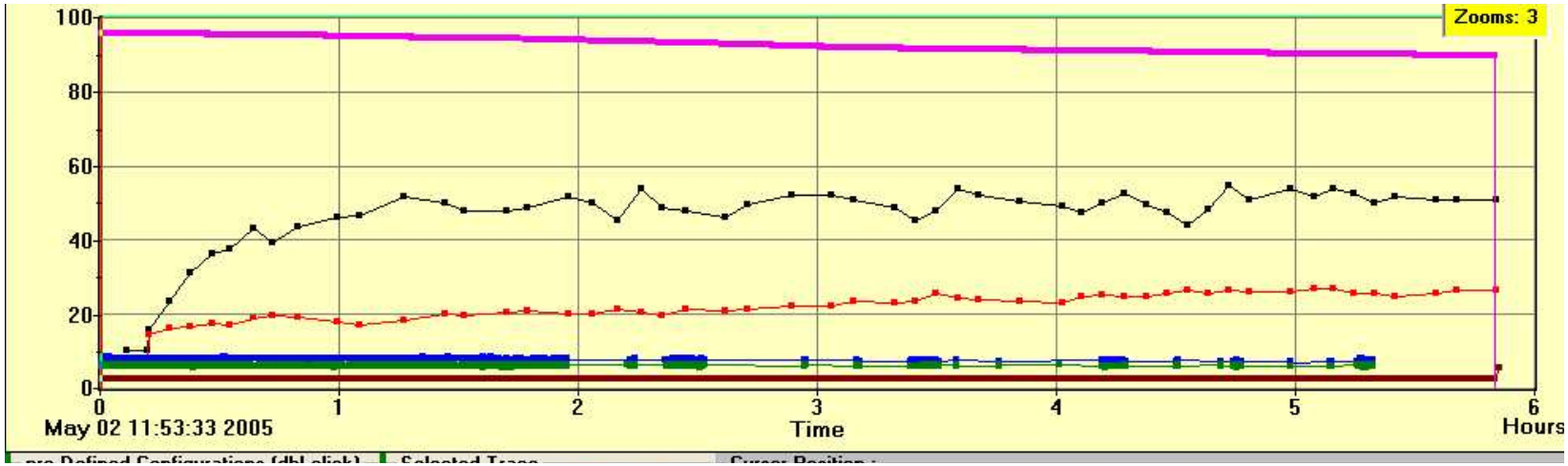
- 28/29.04.2005 : 1-st order bumps finished
- TPOL-pilots-5min/%, TPOL-coll-5min/%, $f_y^{e,\mathrm{pil}}$ /kHz, $f_x^{e,\mathrm{pil}}$ /kHz, I_p/mA
- I_p from ca. 80 mA to ca. 68 mA
- 29. 11:00 : $f_y^{e,\mathrm{pil}}$ from 9.4 kHz to 8.0 kHz & $f_x^{e,\mathrm{pil}}$ from 6.0 kHz to 5.9 kHz

Tune dependence of $P_{\mathrm{colliding}}$



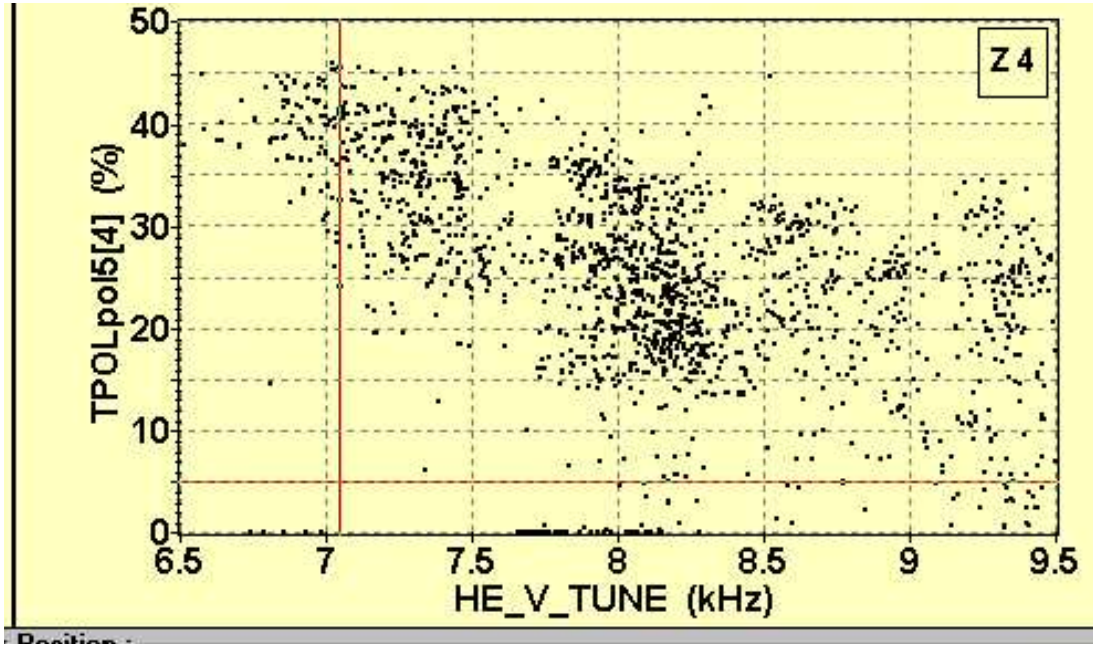
- 01.05.2005
- TPOL-pilots-5min/%, TPOL-coll-5min/%, $f_y^{e,\mathrm{pil}}$ /kHz, $f_x^{e,\mathrm{pil}}$ /kHz, I_p/mA
- I_p from ca. 75 mA to ca. 70 mA
- 13:30 : $f_y^{e,\mathrm{pil}}$ from 8.7 kHz to 8.1 kHz with $f_x^{e,\mathrm{pil}}$ at 6.1 kHz

Tune dependence of $P_{\mathrm{colliding}}$



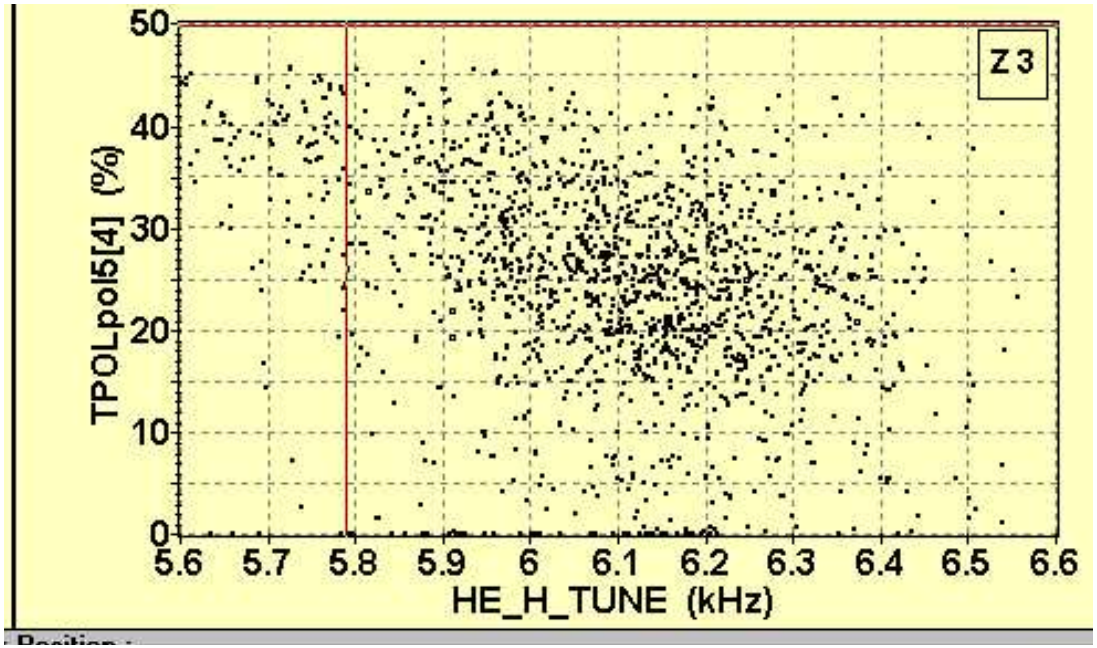
- 02.05.2005 : 1-st order bumps finished
- TPOL-pilots-5min/%, TPOL-coll-5min/%, $f_y^{e,\mathrm{pil}}$ /kHz, $f_x^{e,\mathrm{pil}}$ /kHz, I_p/mA
- I_p from ca. 95 mA to ca. 90 mA
- several steps of $f_y^{e,\mathrm{pil}}$ from 8.1 kHz to 7.4 kHz (with $f_x^{e,\mathrm{pil}}$ at 6.1 kHz)
- . . . but marginal effect due much higher I_p ($\rightarrow$ beam–beam)

April Data : Correlation : P_{coll} vs. $Q_y^{e,\mathrm{pil}}$



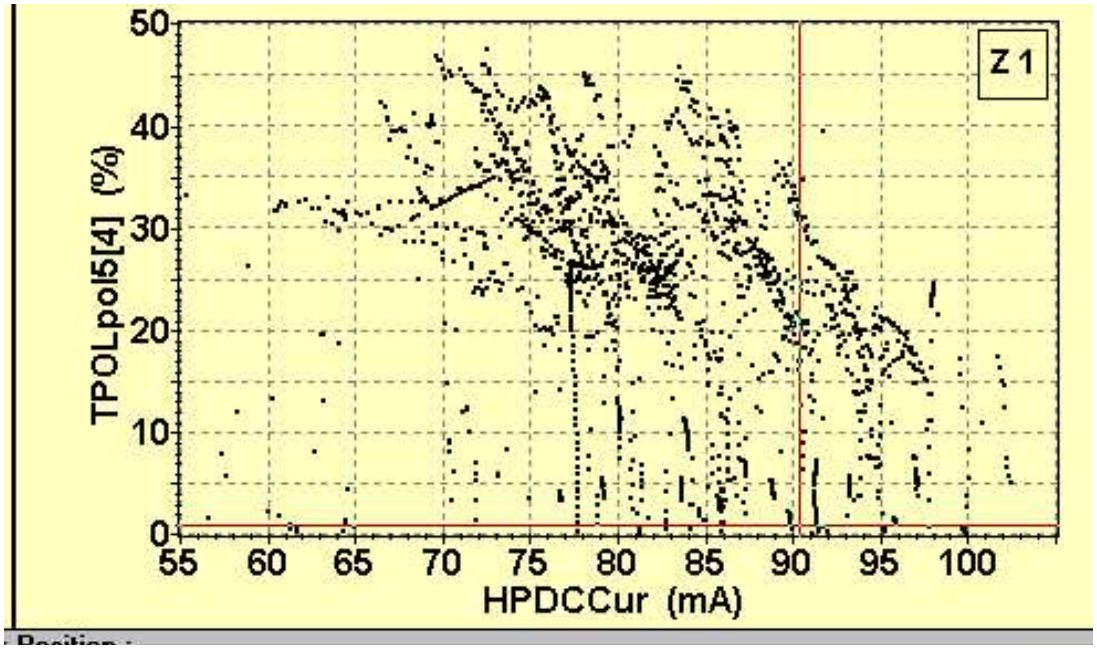
- P_{coll} vs. $Q_y^{e,\mathrm{pil}}$: 01.04.2005 — 30.04.2005
- although many other factors play an important role :
  in the acessible tune window polarization favours **low vertical** e–tunes

April Data : Correlation : P_{coll} vs. $Q_x^{e,\mathrm{pil}}$



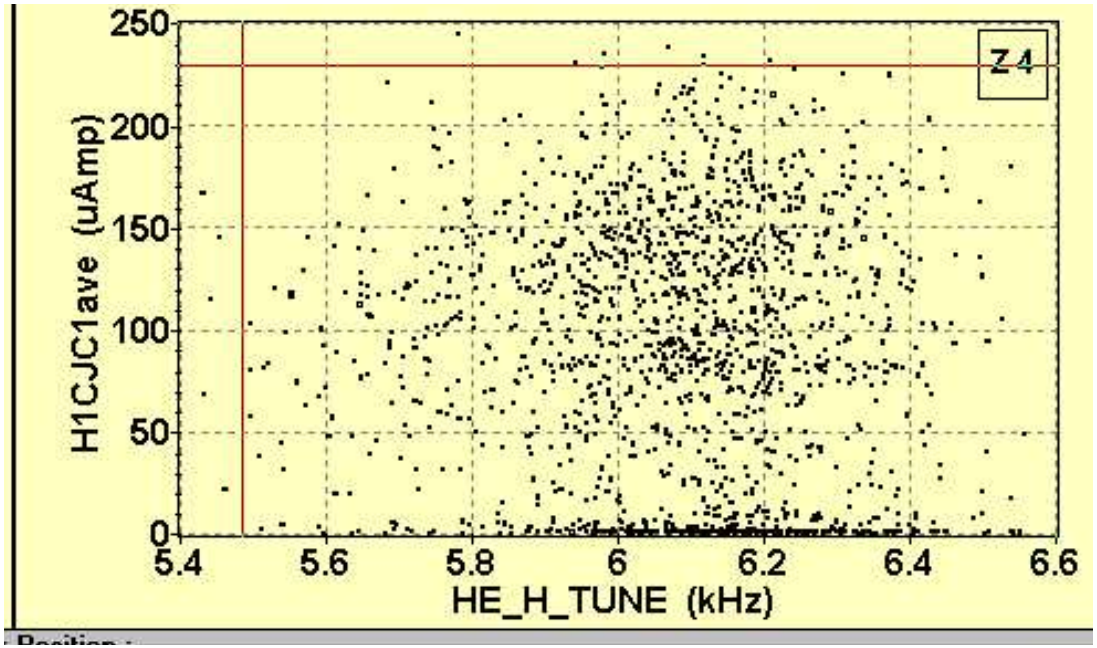
- P_{coll} vs. $Q_x^{e,\mathrm{pil}}$: 01.04.2005 — 30.04.2005
- although many other factors play an important role :
  in the acessible tune window polarization favours **low horizontal** e–tunes

April Data : Correlation : P_{coll} vs. I_p



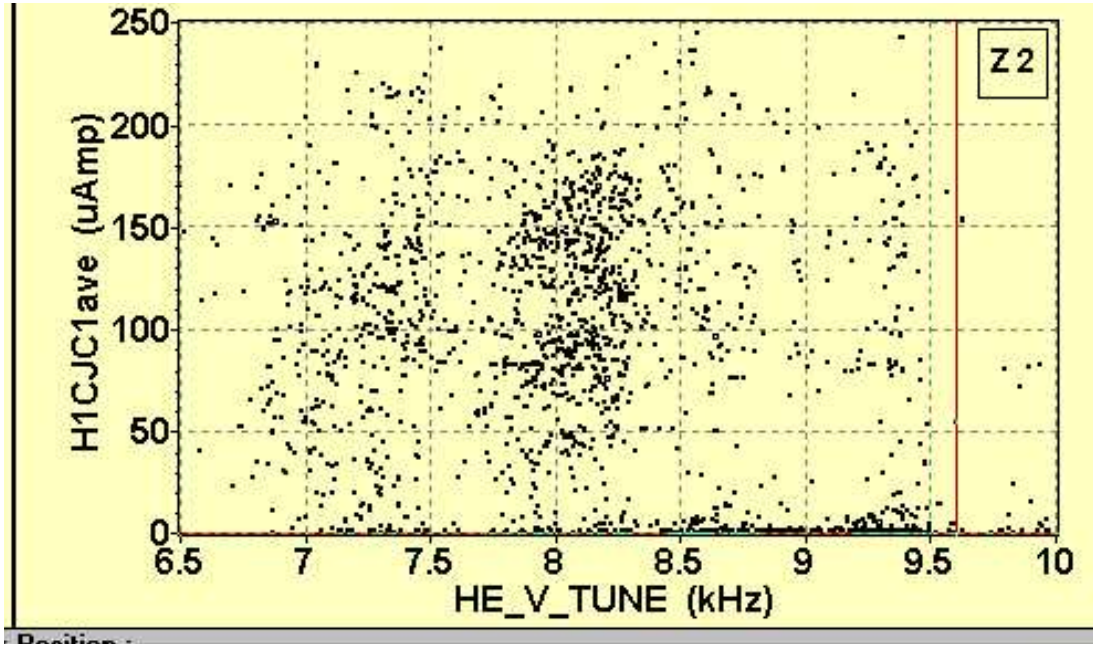
- P_{coll} vs. I_p : 01.04.2005 — 30.04.2005
- it is clear that the tunes, controlled via the pilot bunches, have to be adapted to the **beam–beam tune shift**, i.e. I_p

April Data : Correlation : H1:CJC1 current vs. $Q_x^{e,\mathrm{pil}}$



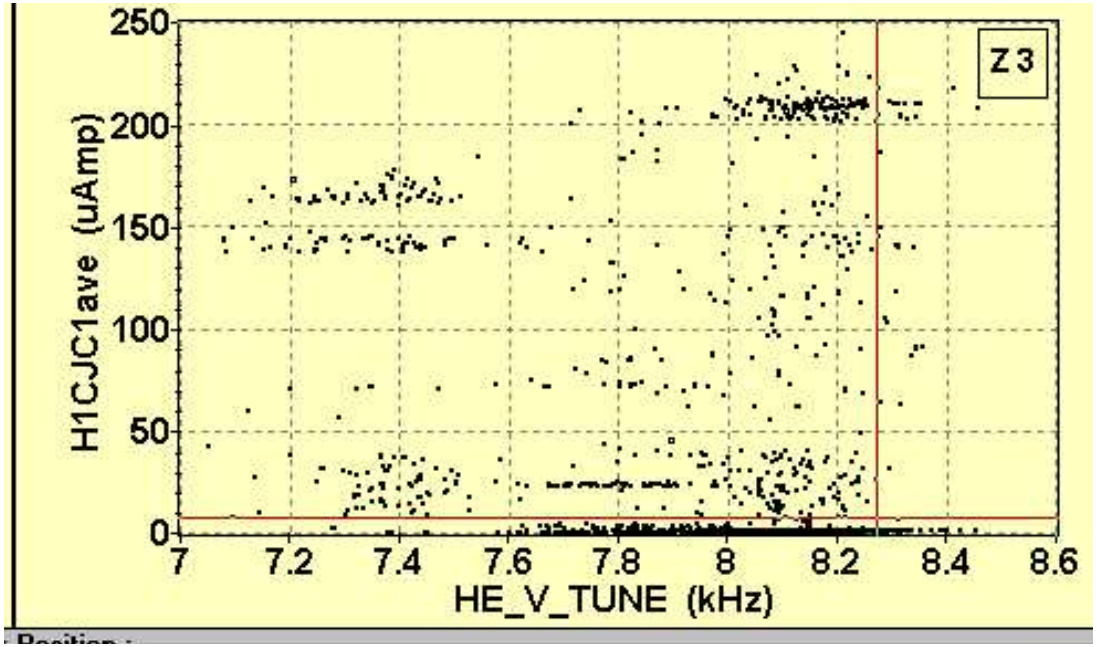
- H1:CJC1 current vs. $Q_x^{e,\mathrm{pil}}$: 01.04.2005 — 30.04.2005
- **no correlation between $Q_x^{e,\mathrm{pil}}$ and CJC1 current seen**

April Data : Correlation : H1:CJC1 current vs. $Q_y^{e,\mathrm{pil}}$



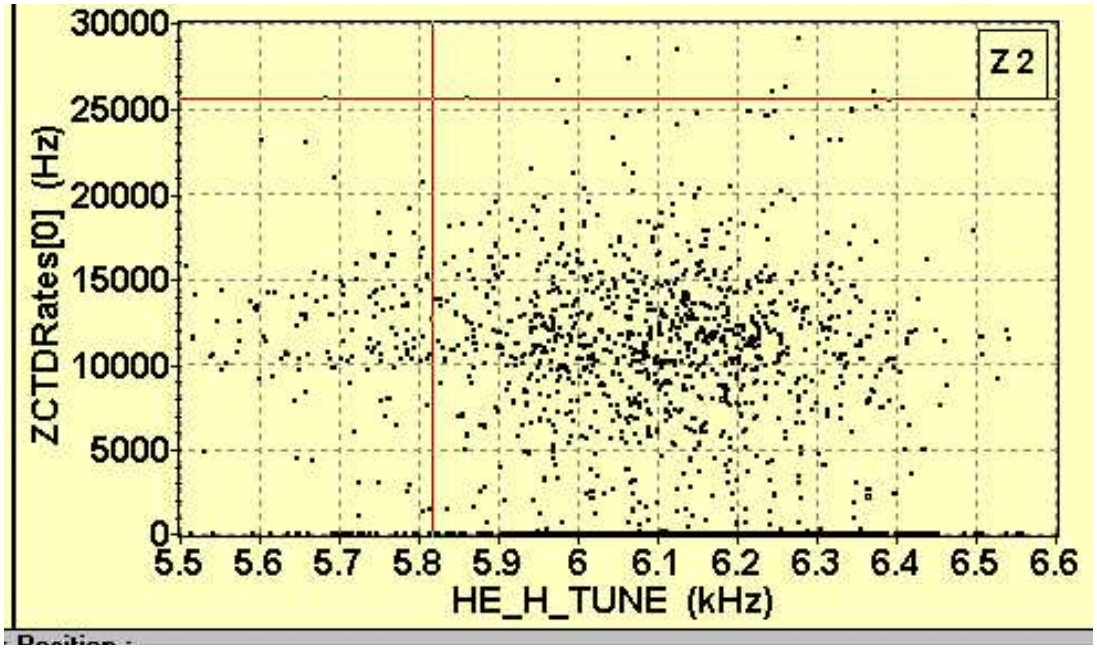
- H1:CJC1 current vs. $Q_y^{e,\mathrm{pil}}$: 01.04.2005 — 30.04.2005
- **no correlation between $Q_y^{e,\mathrm{pil}}$ and CJC1 current seen**

Run 02.05.2005 : Correlation : H1:CJC1 current vs. $Q_y^{e,\mathrm{pil}}$



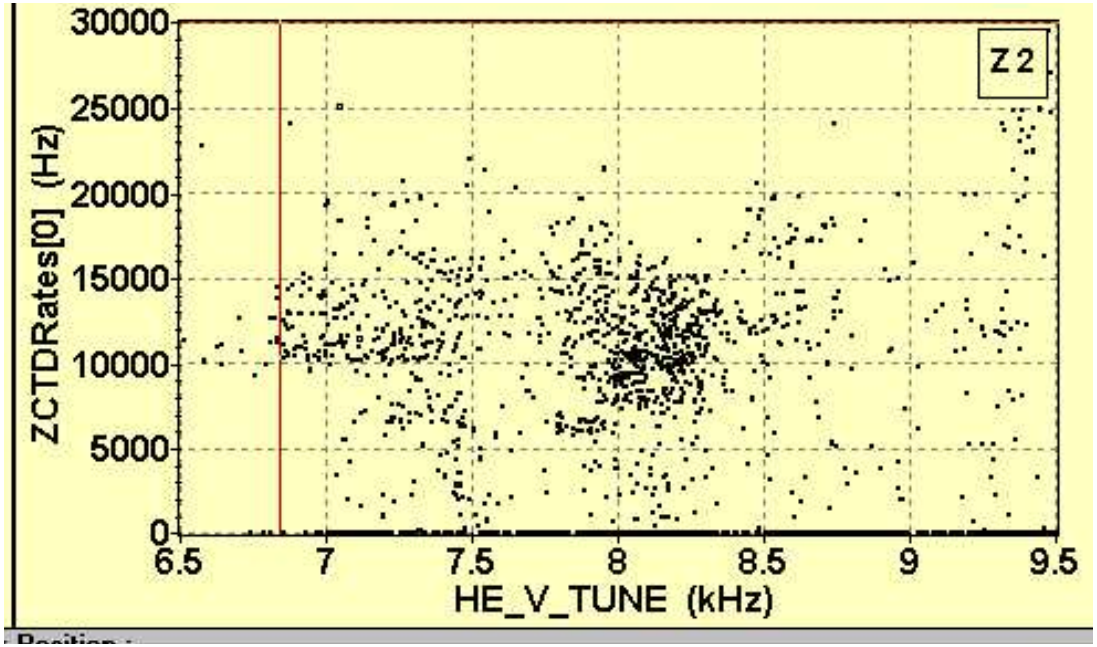
- H1:CJC1 current vs. $Q_y^{e,\mathrm{pil}}$: 02.05.2005
- parasitic study during single lumi run
- CJC1 current seems to decay with I_e
  if $Q_y^{e,\mathrm{pil}}$ has an effect at all, then it's rather positive

April Data : Correlation : ZEUS:CTD rates vs. $Q_x^{e,\mathrm{pil}}$



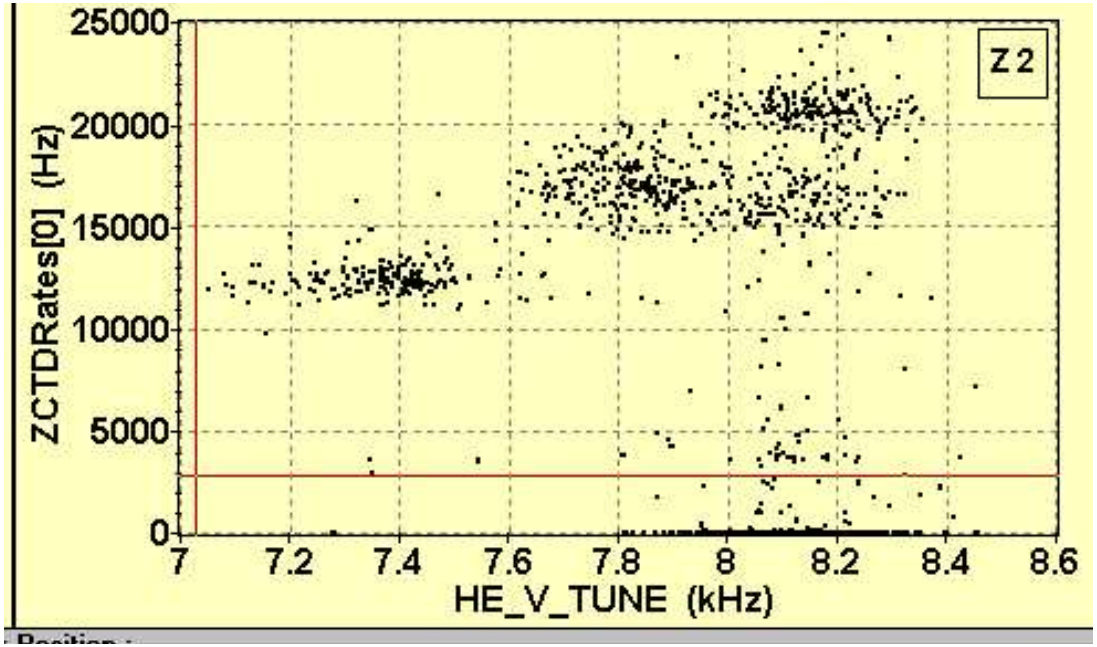
- ZEUS:CTD rates vs. $Q_x^{e,\mathrm{pil}}$: 01.04.2005 — 30.04.2005
- **no correlation between $Q_x^{e,\mathrm{pil}}$ and CTD rate seen**

April Data : Correlation : ZEUS:CTD rates vs. $Q_y^{e,\mathrm{pil}}$



- ZEUS:CTD rates vs. $Q_y^{e,\mathrm{pil}}$: 01.04.2005 — 30.04.2005
- **no correlation between $Q_y^{e,\mathrm{pil}}$ and CTD rate seen**

Run 02.05.2005 : Correlation : ZEUS:CTD rates vs. $Q_y^{e,\mathrm{pil}}$



- ZEUS:CTD rates vs. $Q_y^{e,\mathrm{pil}}$: 02.05.2005
- parasitic study during single lumi run
- CTD rate seems to decay with I_e
  if $Q_y^{e,\mathrm{pil}}$ has an effect at all, then it's rather positive !