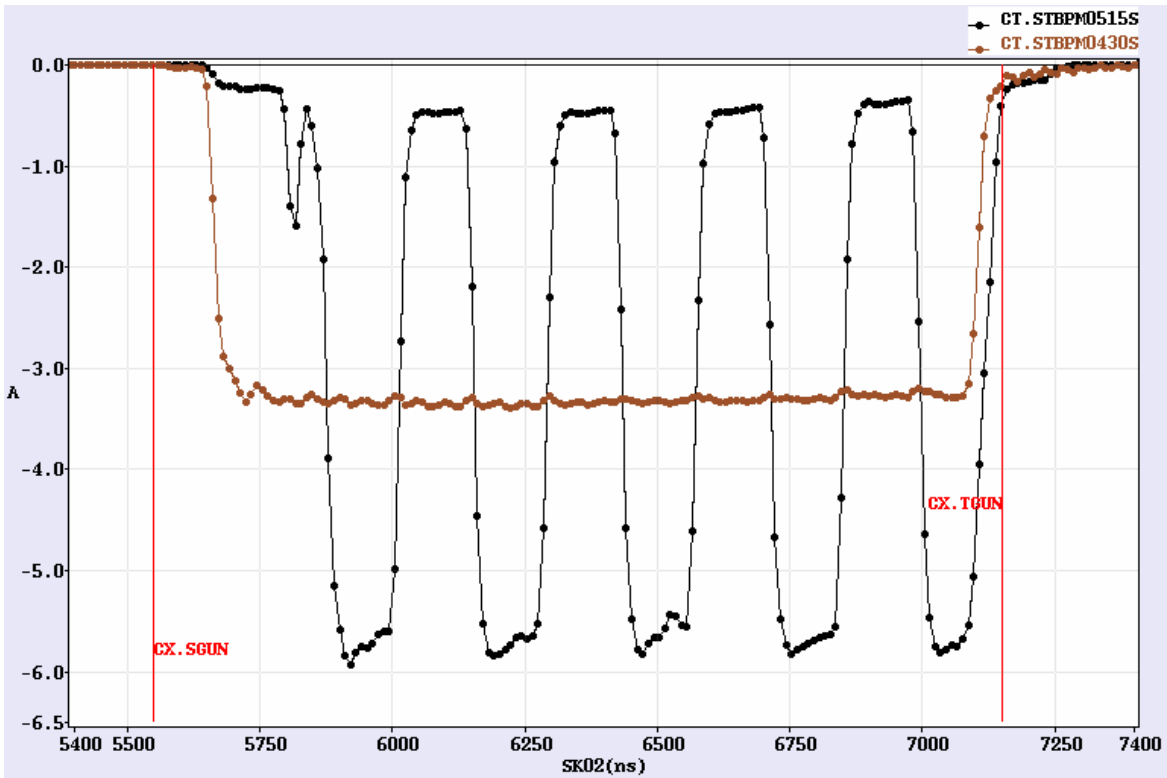
CTF 3 Commissioning 2006

Frank Tecker - AB/OP

- Quad scan results
- Dispersion
- DL length

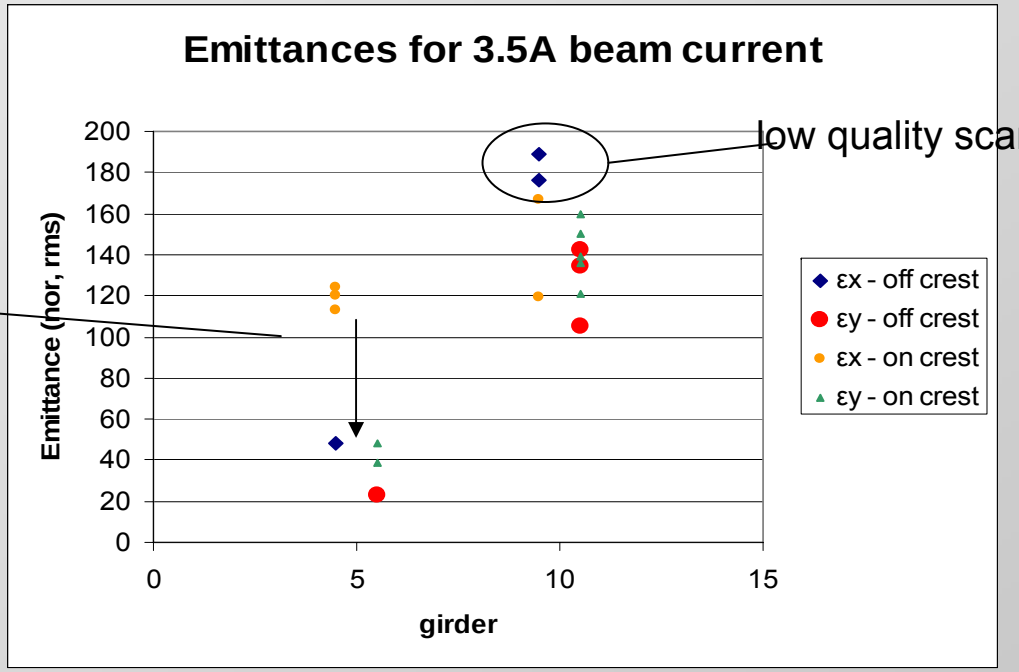


Results III

Quad Scans 2005

Injector was not optimised at the beginning.

Gain due to the optimisation of the injector (solenoid currents, steering)



How to obtain a better understanding of the measurement results?

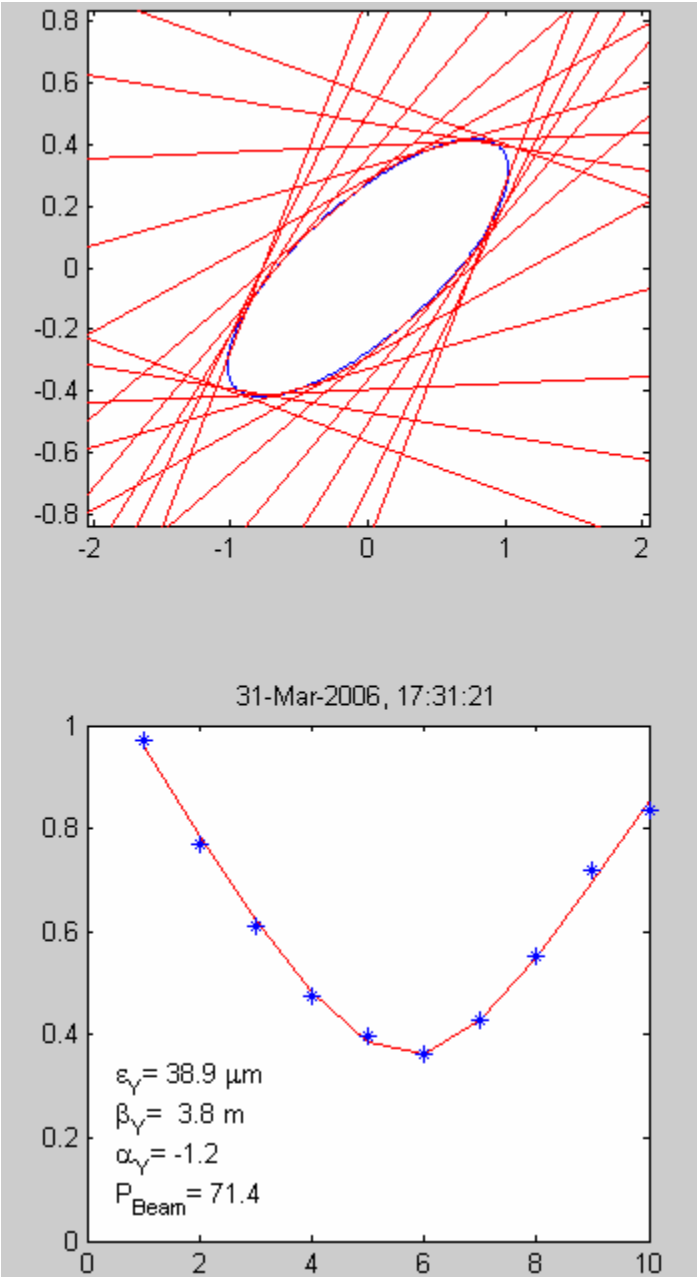
(I) Girder 5: Scans with opposite polarity of quadrupoles to distinguish if the difference in horiz. and vert. emittance is a beam property or related to diagnostics.

(II) - same magnification for beam diagnostic instrumentation in girder 5 and 10.
- use quadrupoles in girder 9 for quad scans.

(III) Quadrupole scans at the end of the Linac, to obtain a better understanding of the measured emittance values.

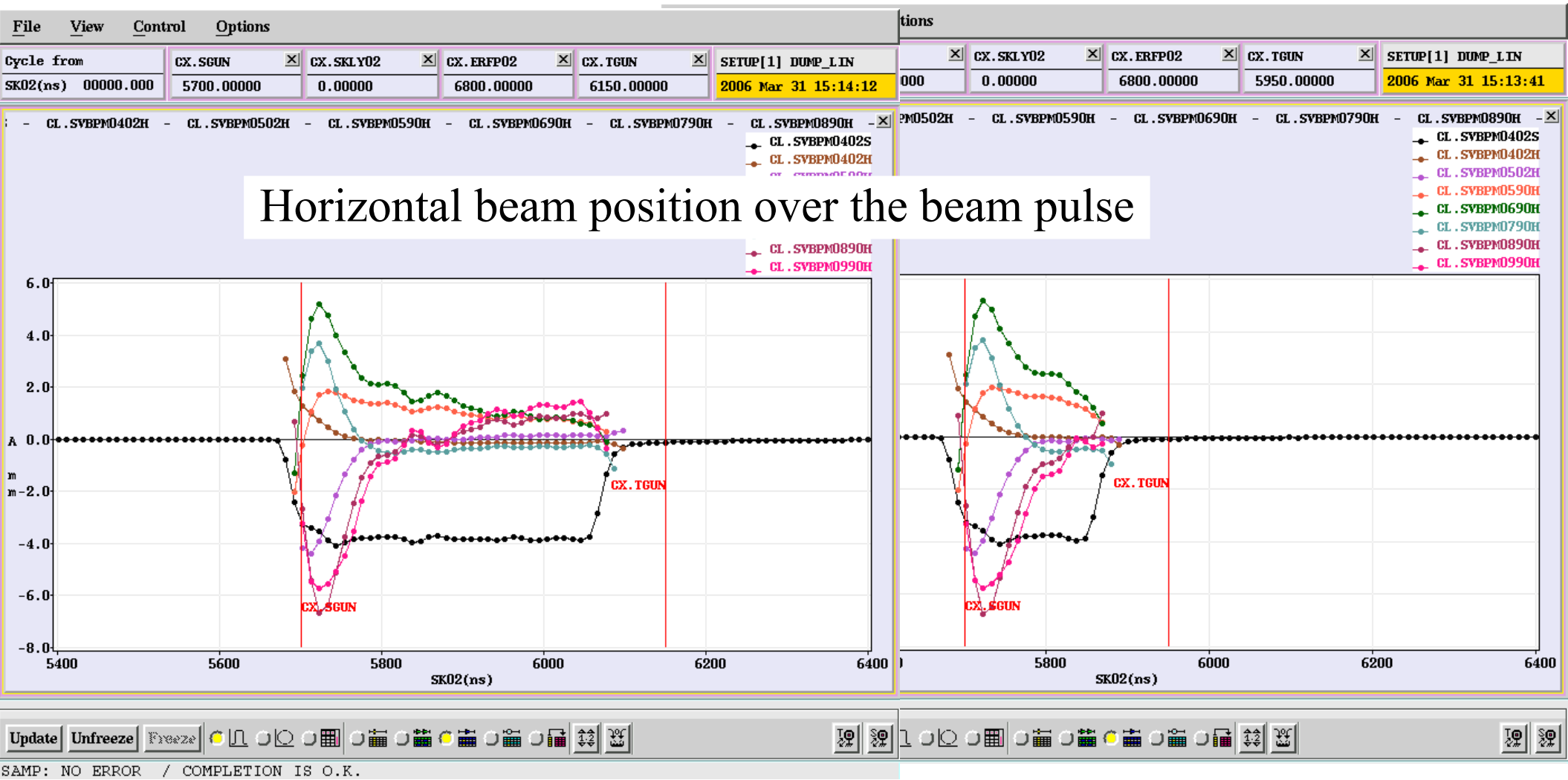
Quad Scans 2006

- > 90 scans done
  (documented in the logbook)
  - 3 on girder 5
  - 60 on girder 10
  - 27 in the CT line
- automatic program works well
  (averaging could be useful)
- variety of studies done
  - filters/screens
  - scan ranges
  - pulse length
  - transient subtraction



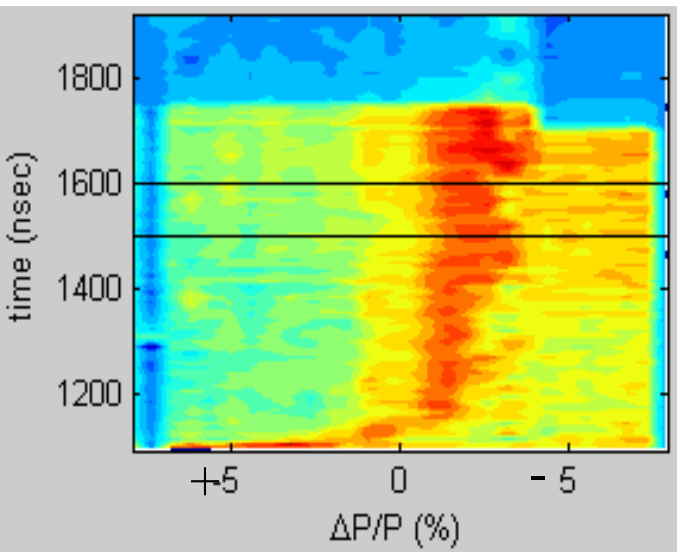
Transient subtraction

- image subtraction of long and short pulse for scans
- only the steady state part is analyzed

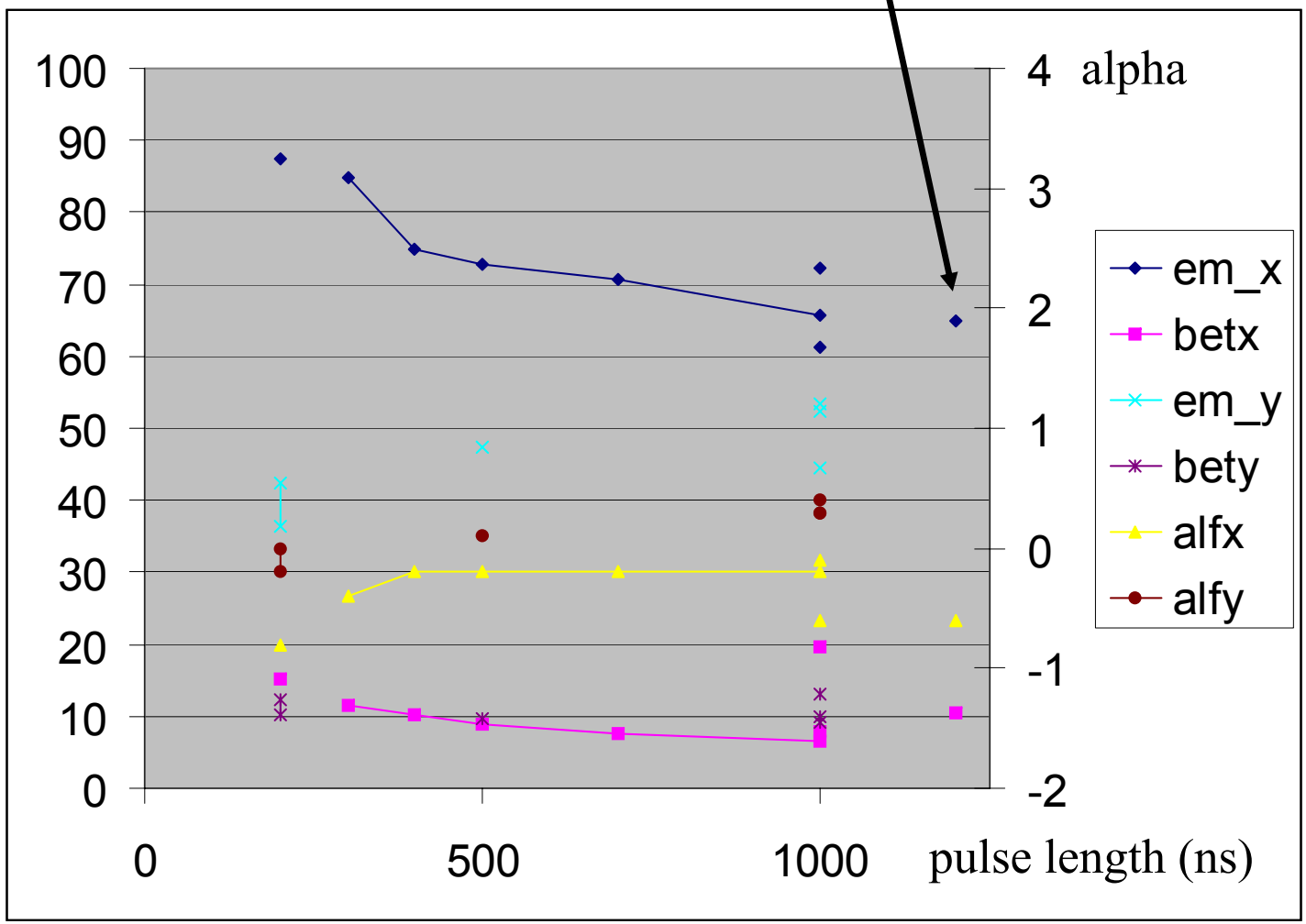


Quad Scans – Pulse Length

- Beam transient => Scan results dependant on pulse length
- image subtraction for long and short pulse for scans (700ns – 300ns)



- Girder 10



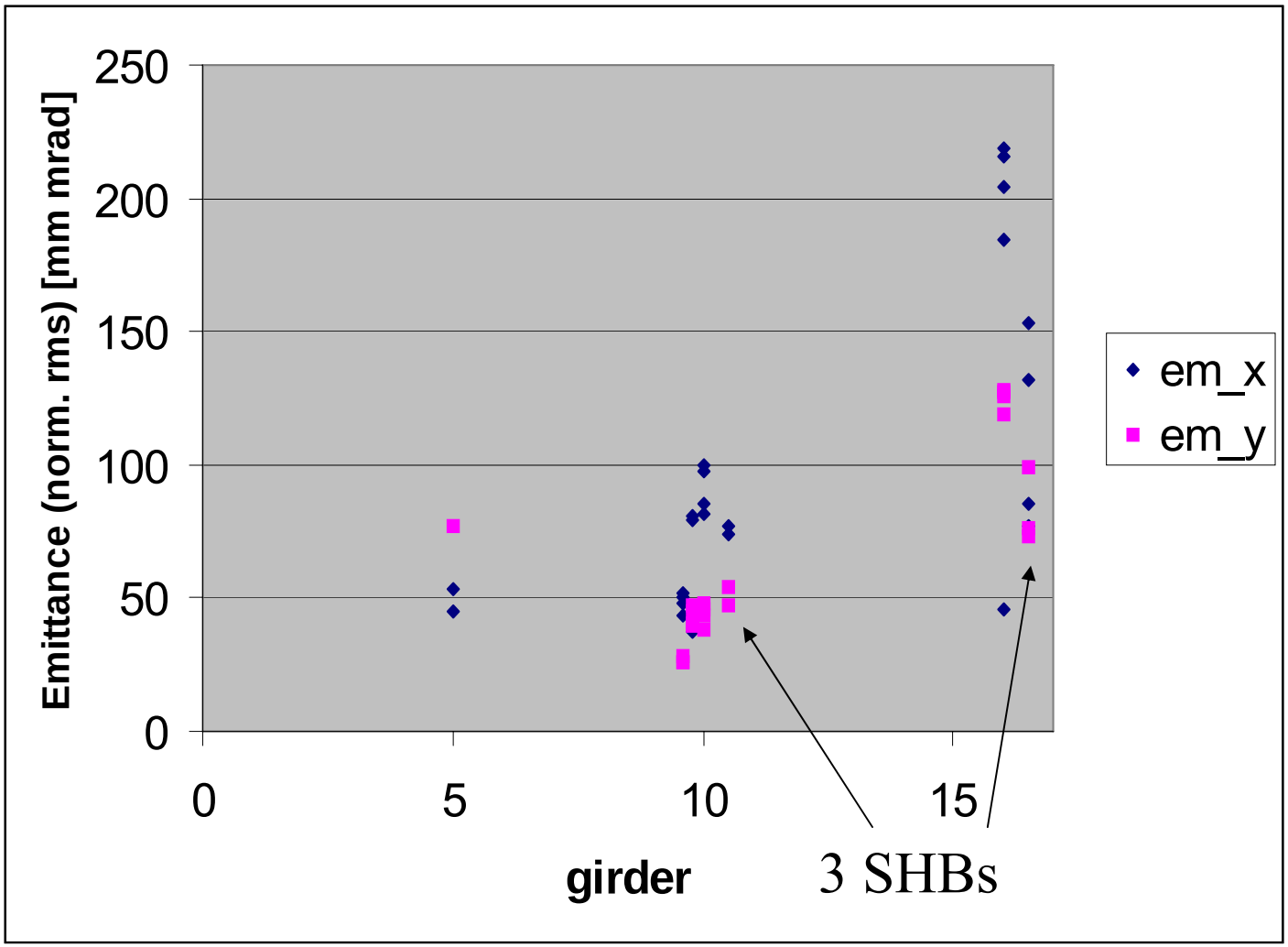
Emittance – data collection

- optical magnification on girder 10 as on girder 5
  => we measure now also small ε < 50 mm mrad in both planes

- larger ε values
  in CT line
  still ε < 100 μmrad

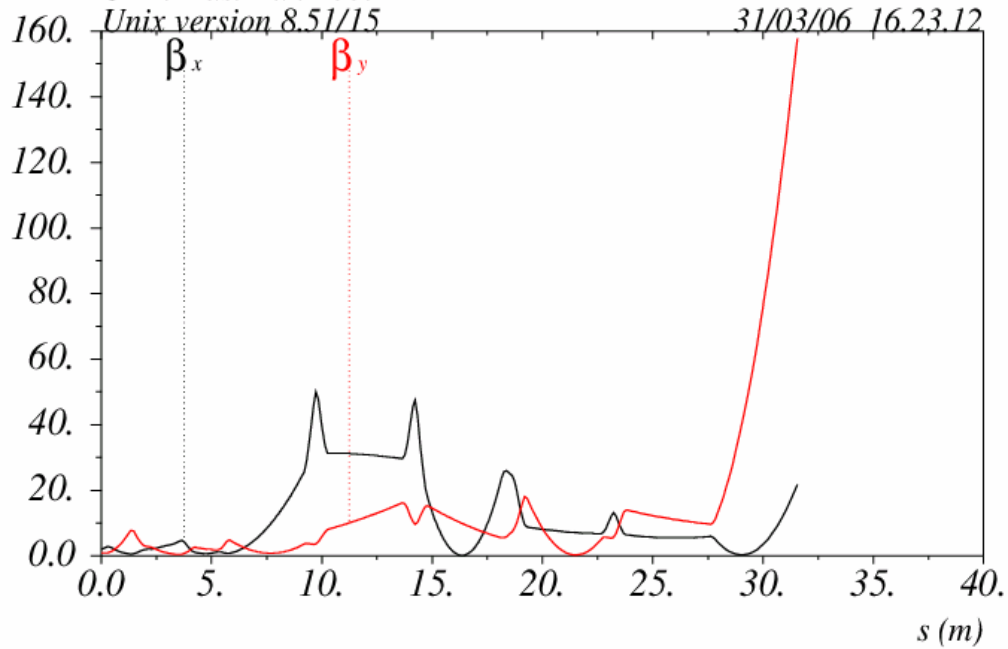
  higher energy
  => smaller beam
  => optical limit ?

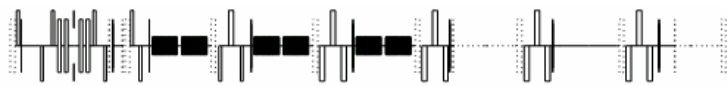
- to be analyzed
  in detail…

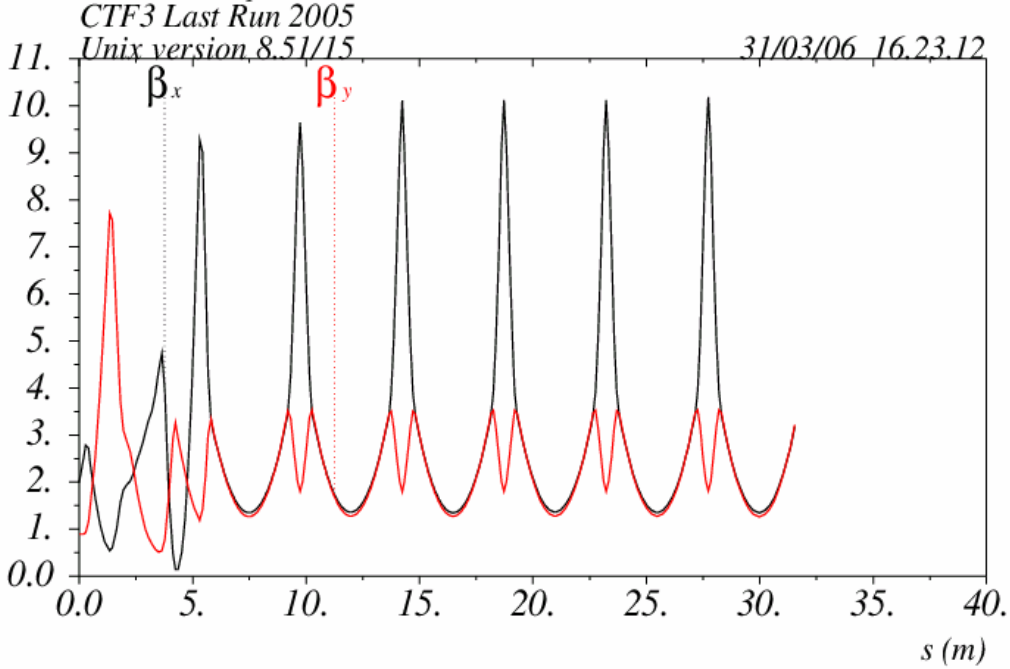


Optics matching (1)

- Linac rematched based on quad scan results on girder 10
- intermediate energies calculated from RF signals
- results in 71.4 MeV compared to 71 MeV measured

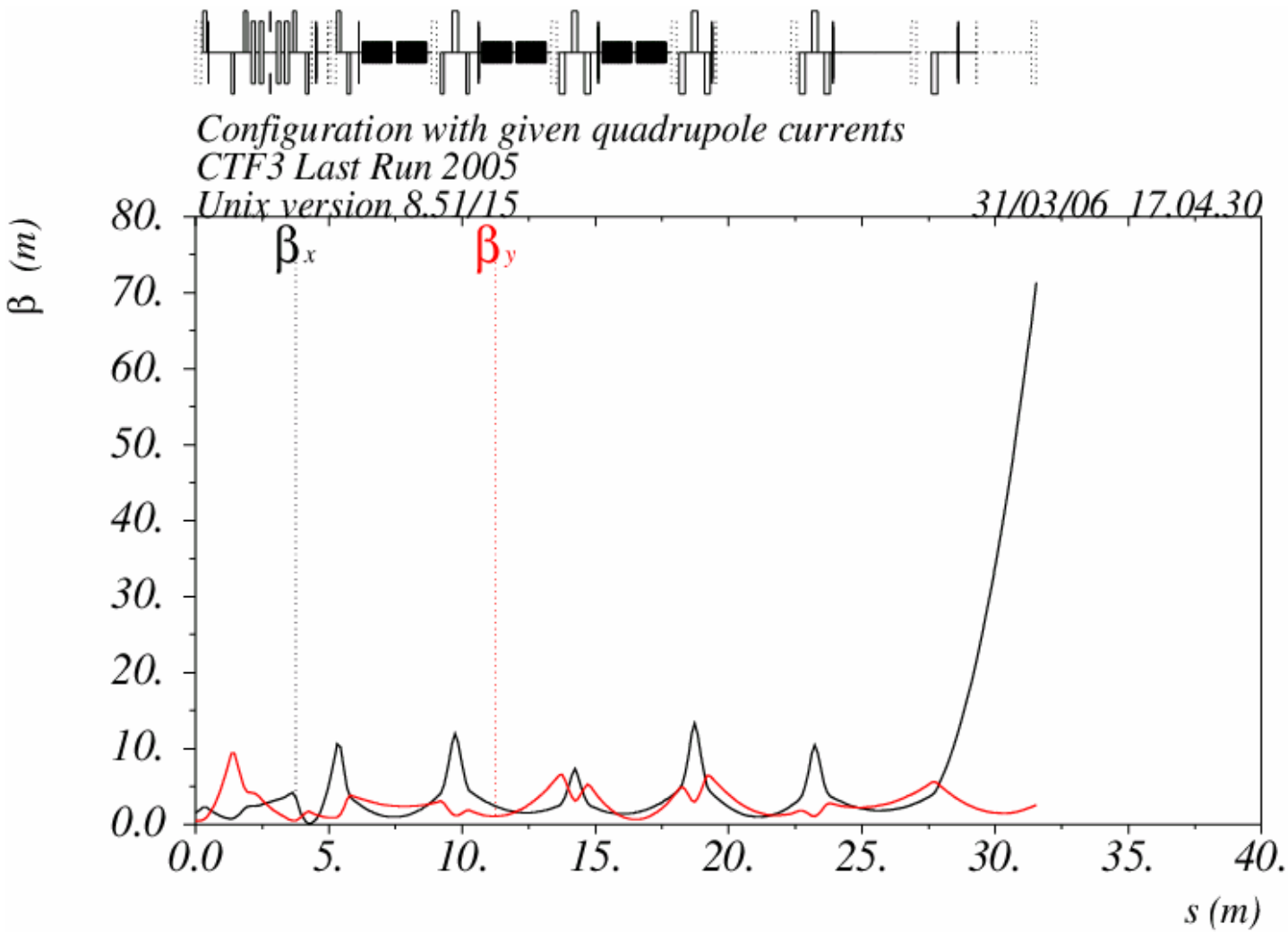






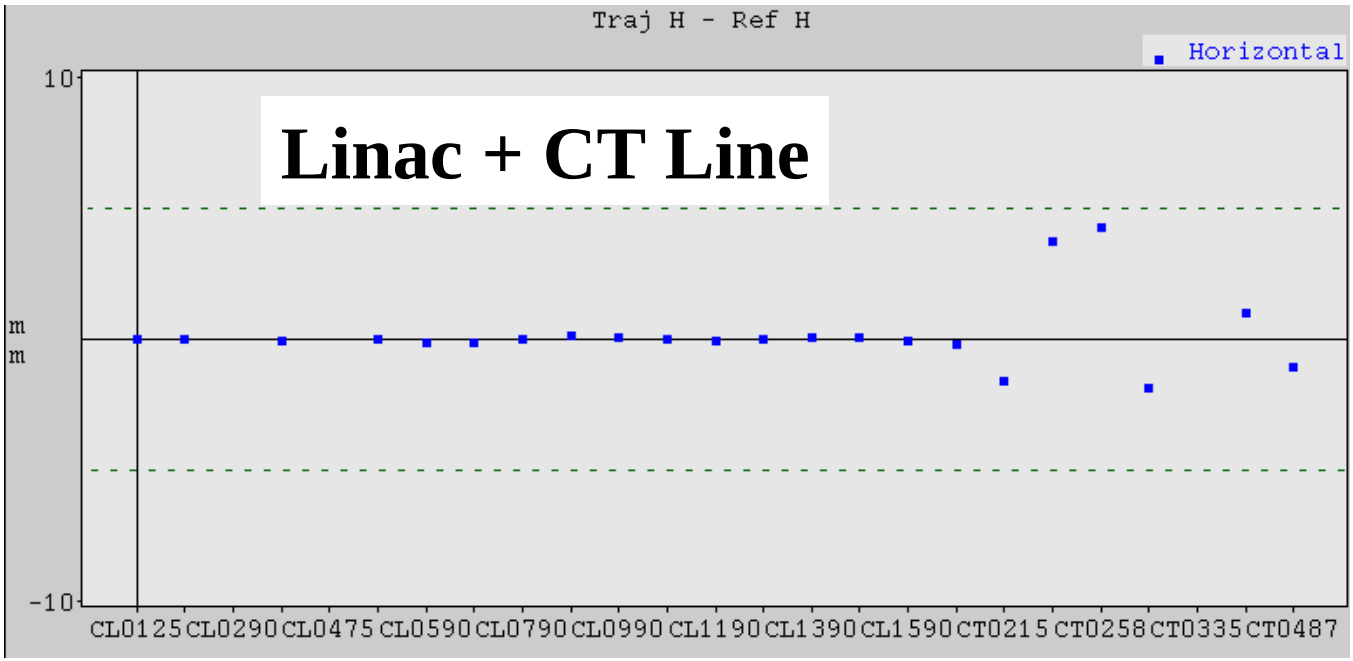
Optics matching (2)

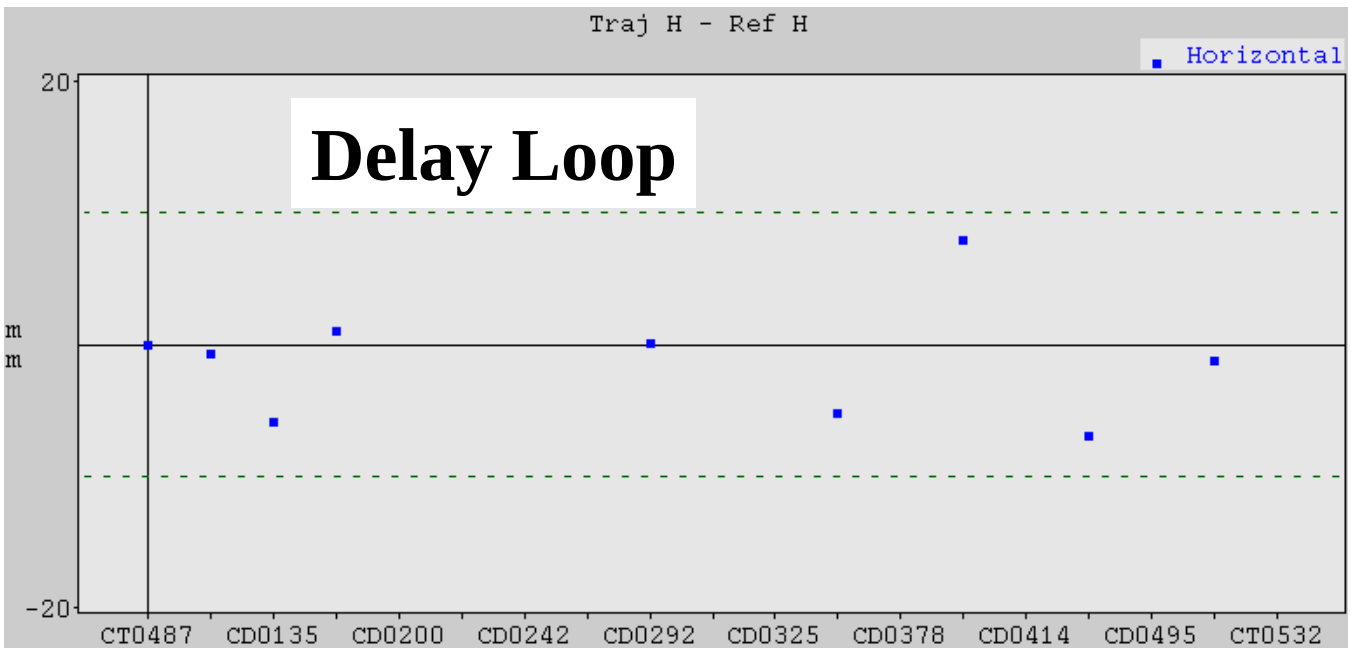
- verified by new scans, expect β=3.4m α=-1.2
- measured:
  β: 2.3 – 4.5m
  α: -0.8 – -1.2
- => model well established
- also used for
  - linac downstream
  - CT line



Dispersion Measurement (1)

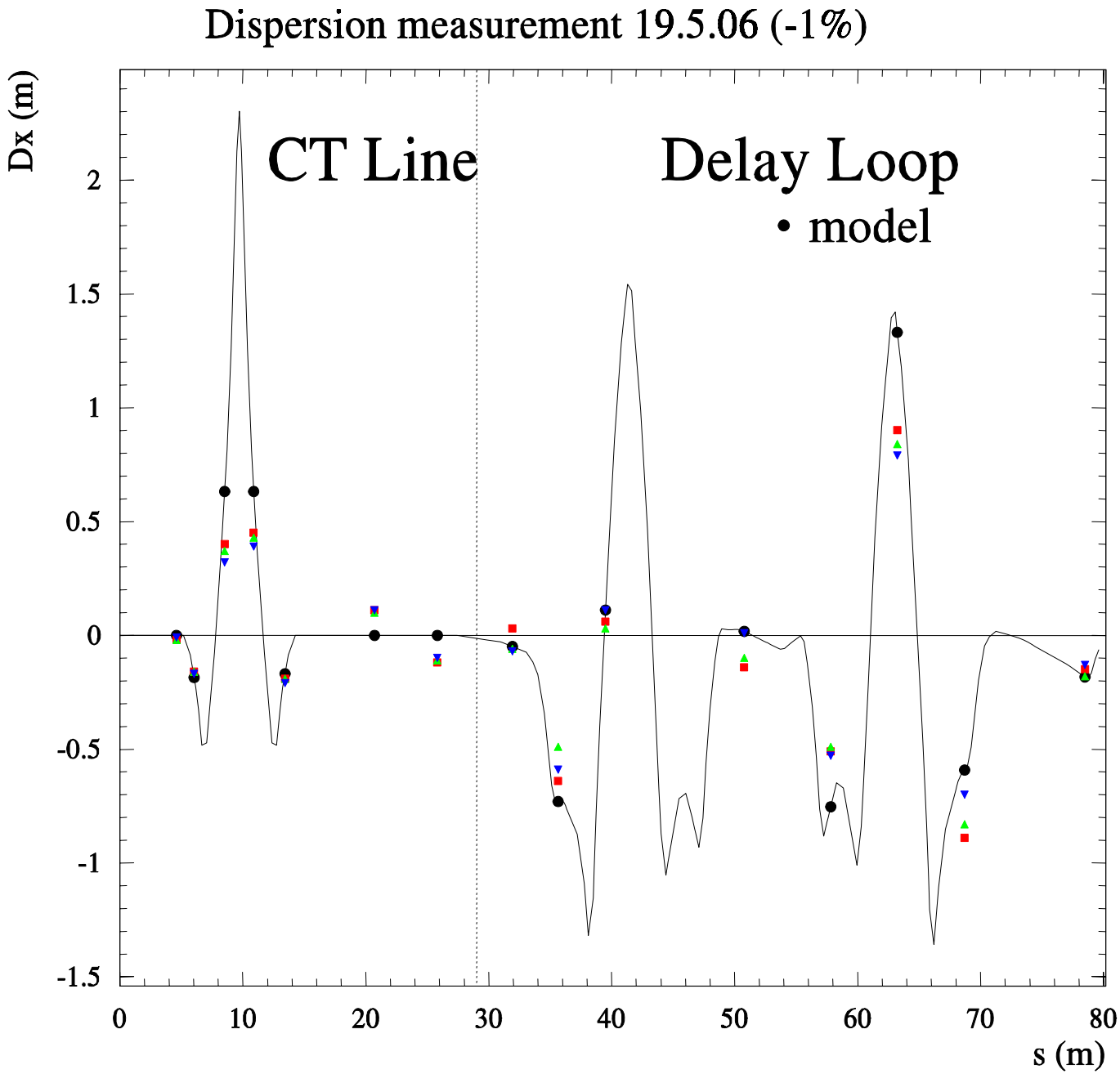
- measure reference trajectory at nominal magnet settings
- scale magnets by small amount (~1%)
  - CT Line
  - Delay Loop
- observe difference trajectory
- E = 101 MeV





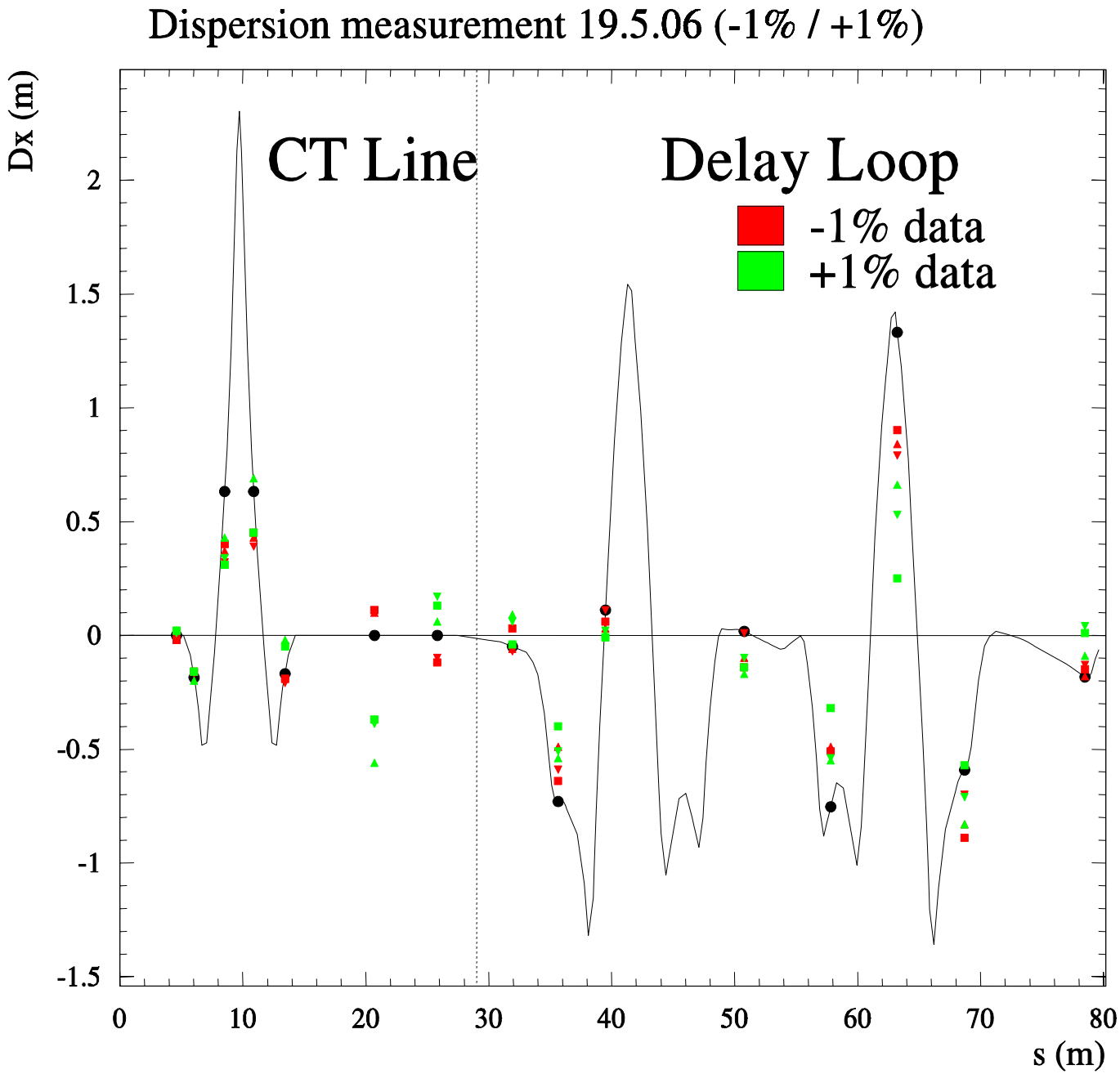
Dispersion Measurement (2)

- relative good agreement between model and measurement
- worse in the second half of DL wiggler mismatch?



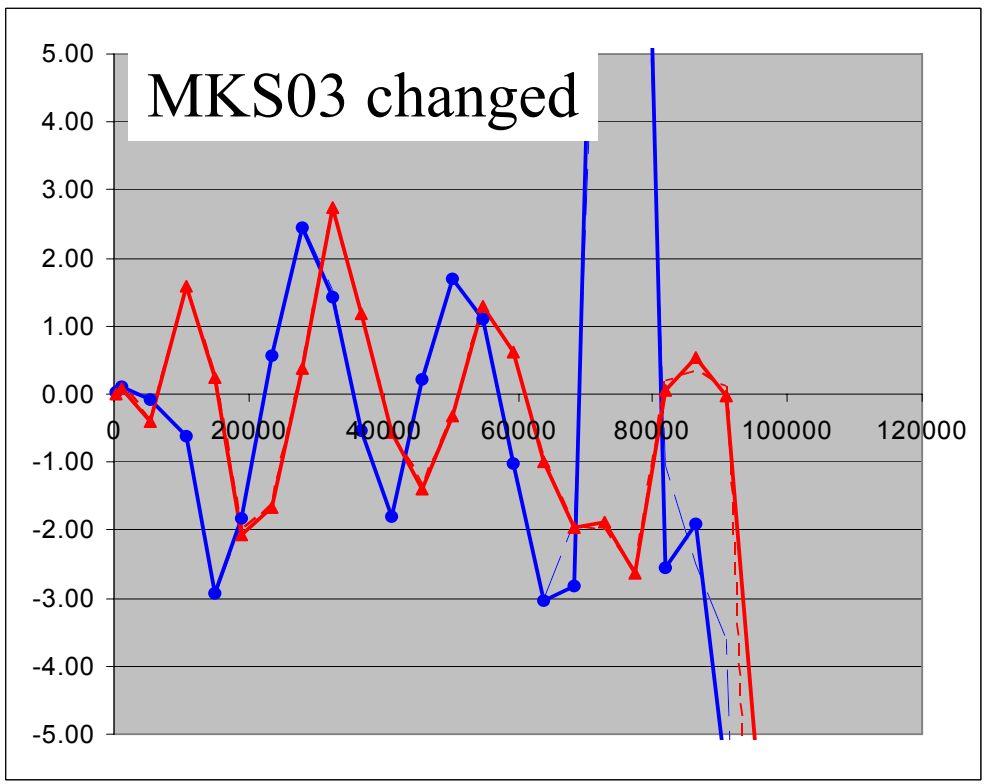
Dispersion Measurement (3)

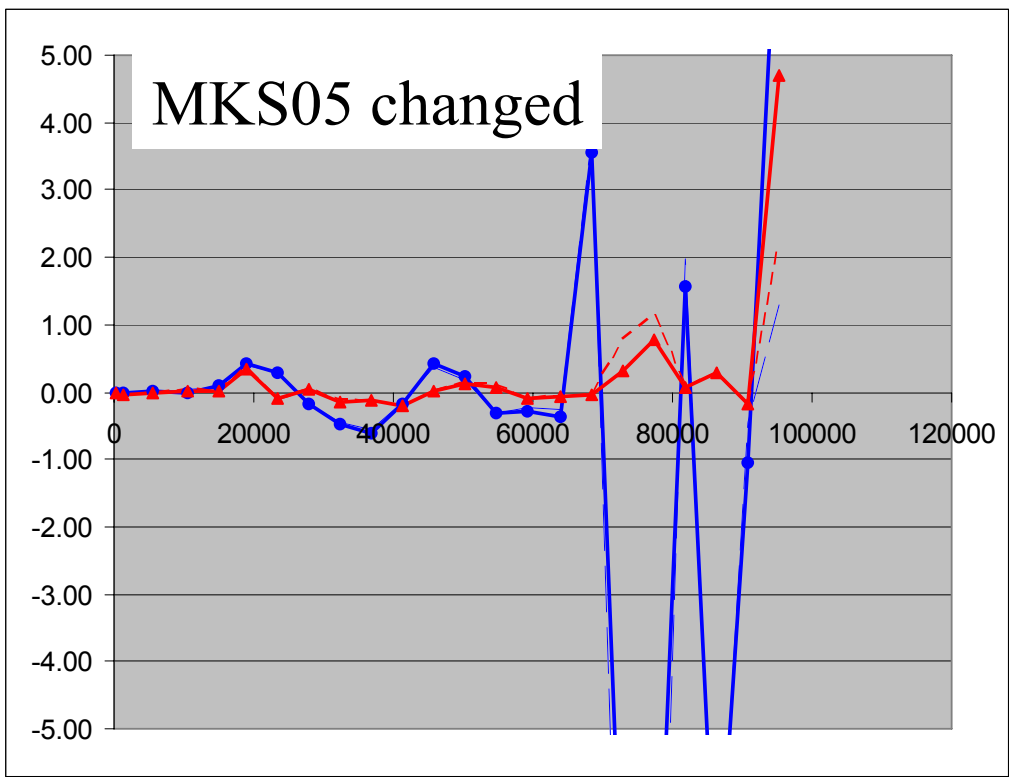
- overall, data for lower currents fits better
- energy lower than assumed
- more analysis to be done…



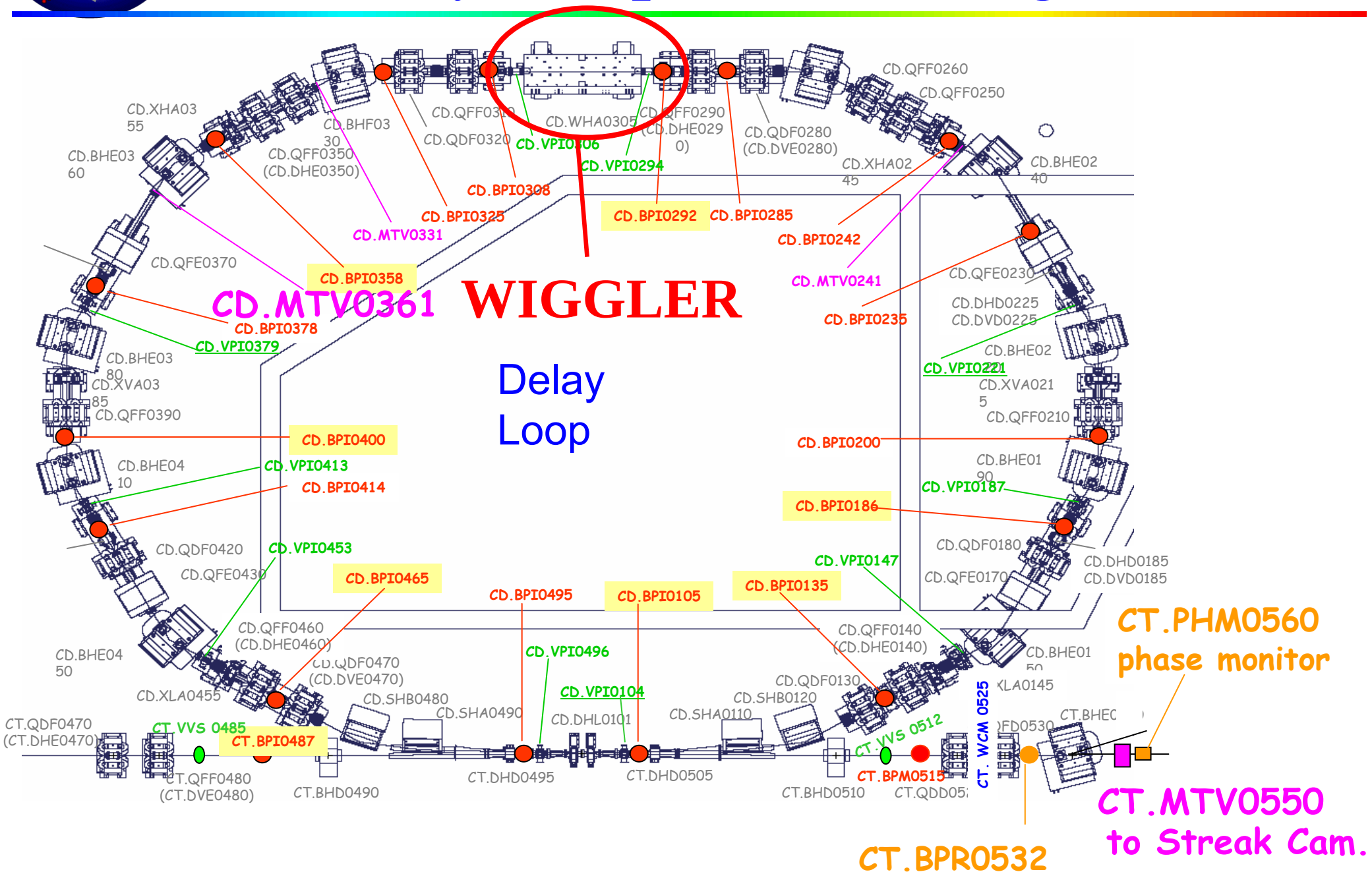
Residual dispersion

- Energy change in the linac and difference trajectory
- Source in the linac mainly chicane on girder 04
- Also in vertical plane !?
- CT line chicane another source



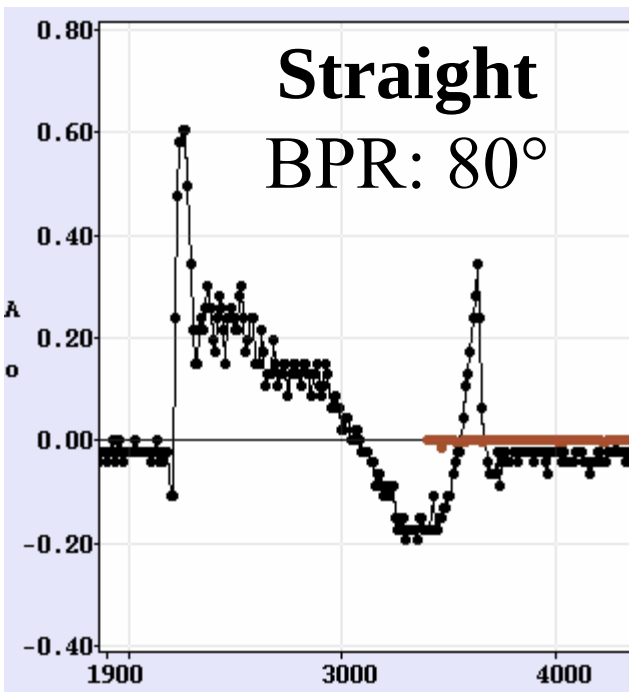


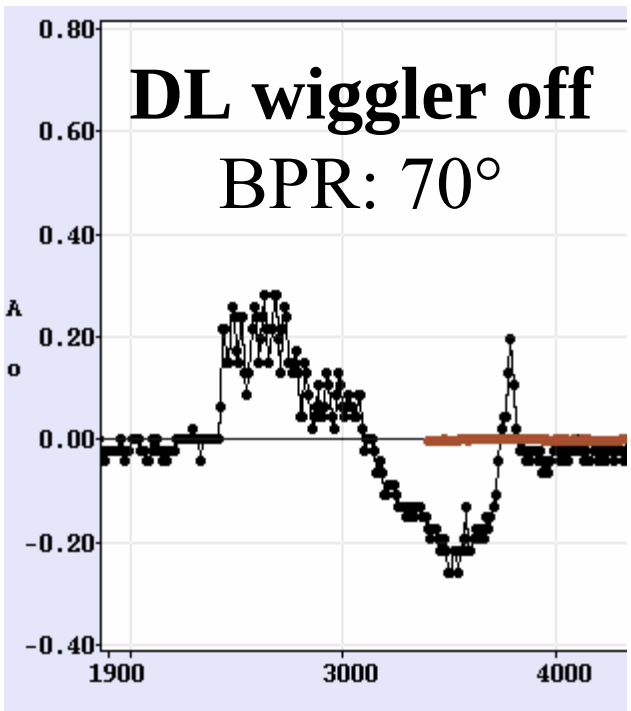
Delay Loop – Path Length

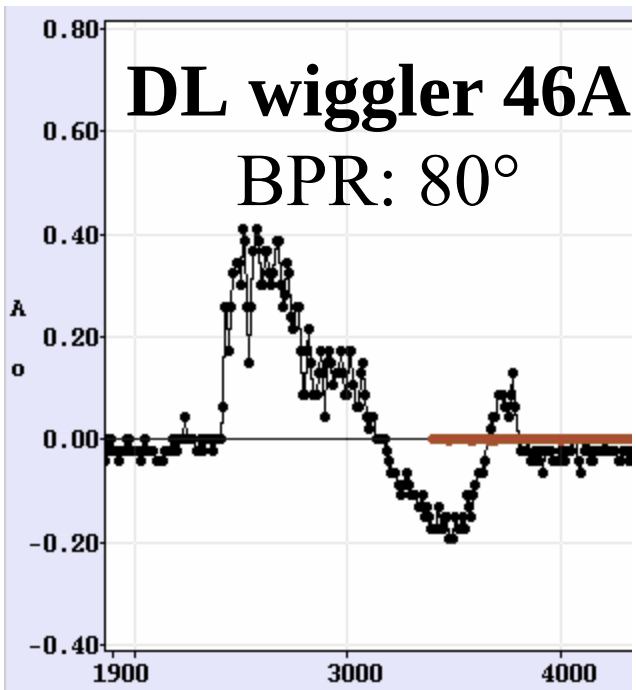


DL path length - BPR

- DL wiggler has path length tuning range of ~ 9 mm
- phase measurement on CT.**BPR**0532 after DL
- change mixer (3 GHz) phase until signal close to 0 (10° ⇔ 2.8 mm)
- => DL has the correct length within the tuning range

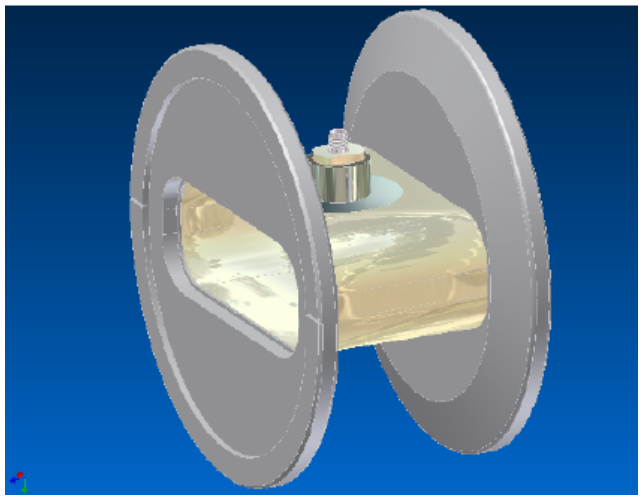


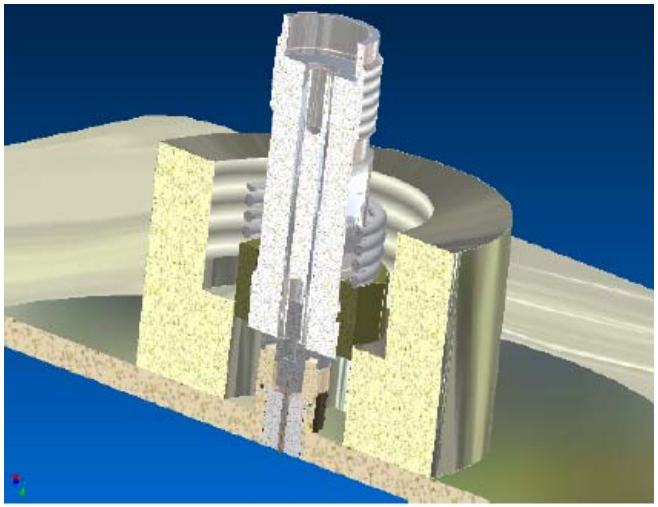




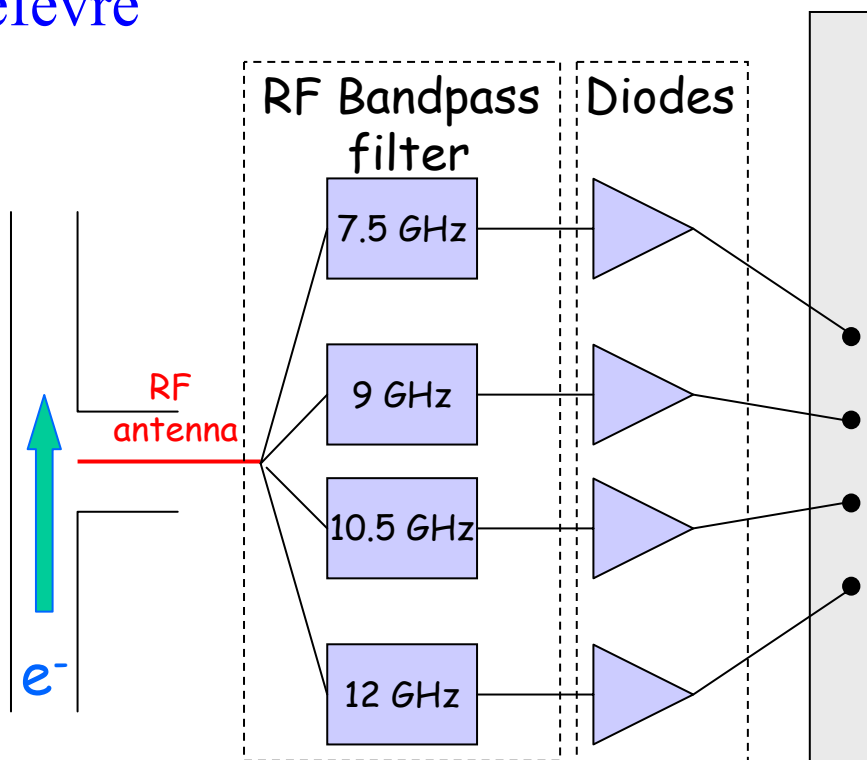
Phase Monitor Developed by Uppsala University

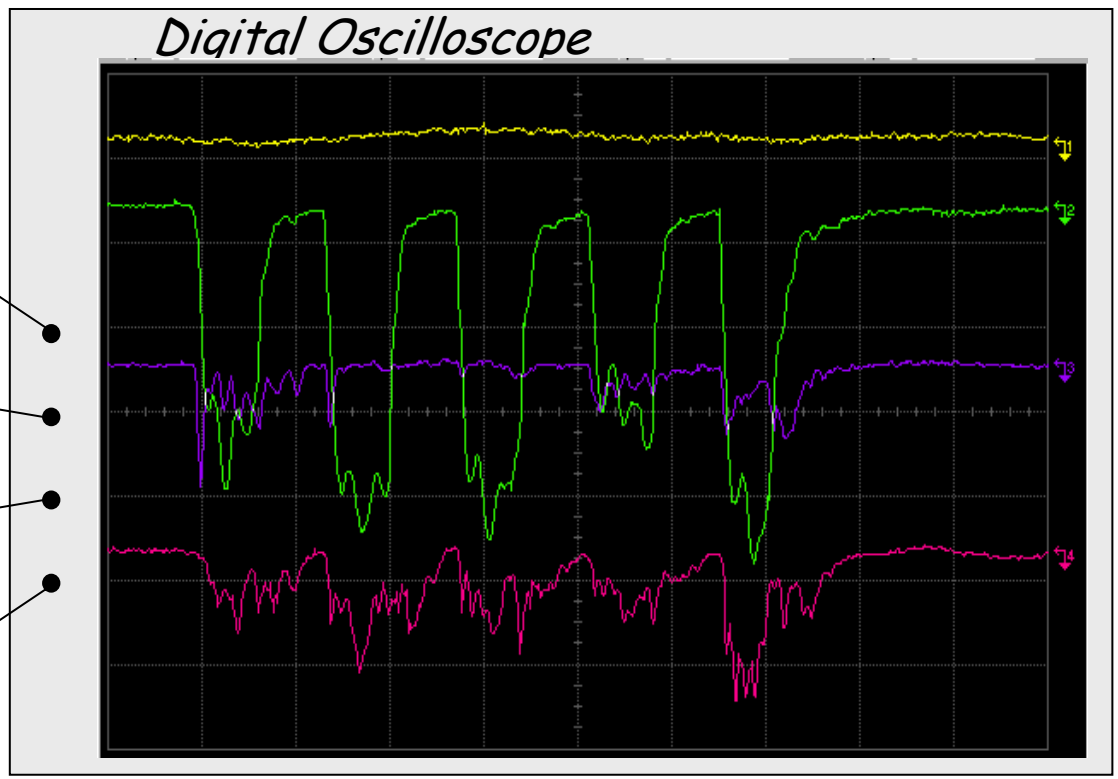
'To measure phase error in the RF bunch combination'





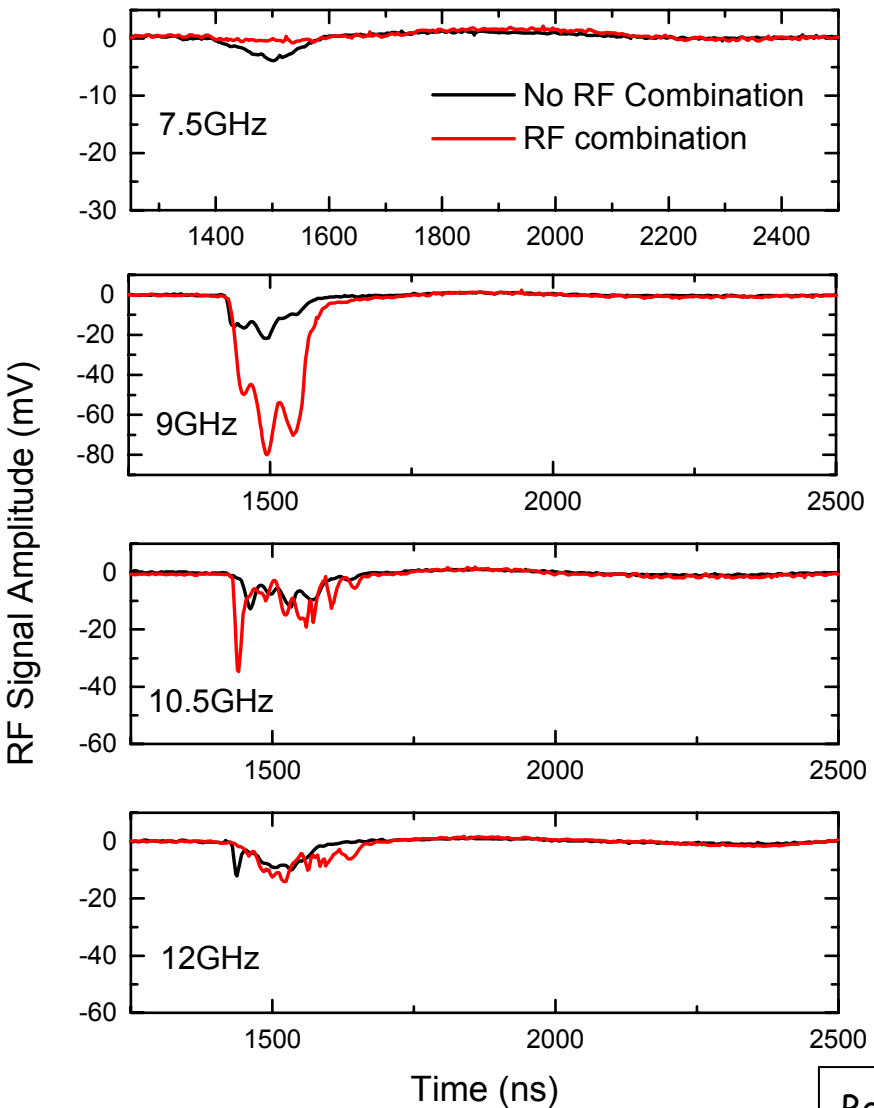
T.Lefevre



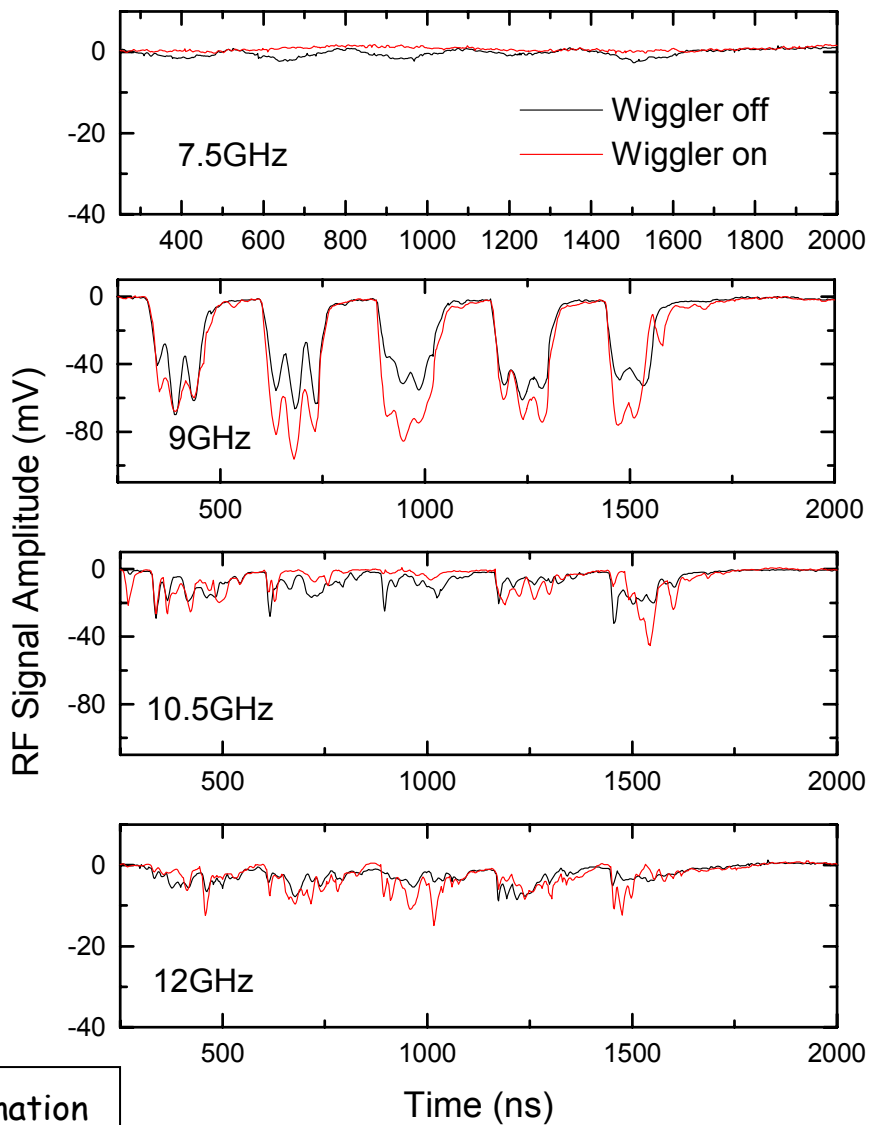


Phase Monitor Developed by Uppsala University

Pick-up signals with and without the combination (1.5 – 3 GHz)



RF combination optimization with the Wiggler magnet

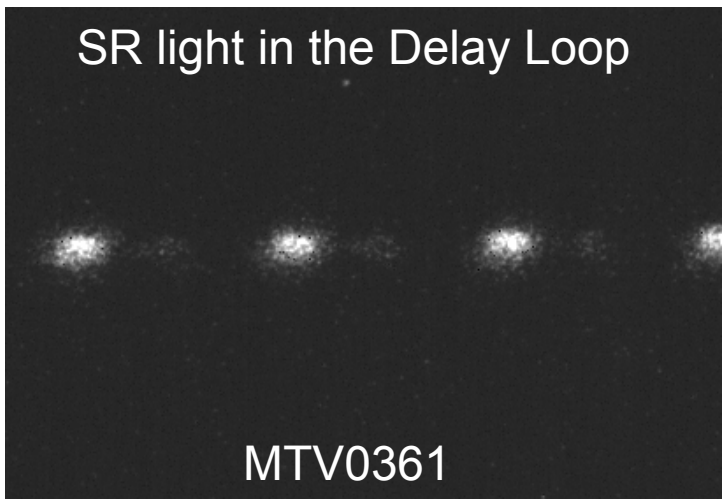


Better RF combination
- 7.5 & 10.5GHz ↘
- 9 & 12 GHz ↗

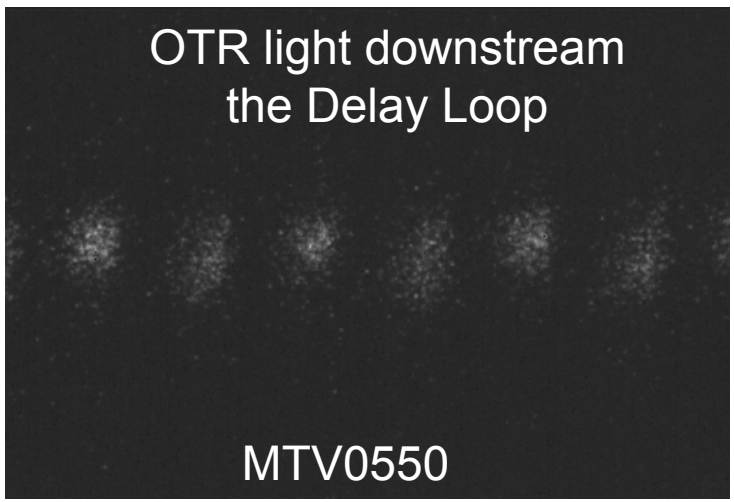
T.Lefevre

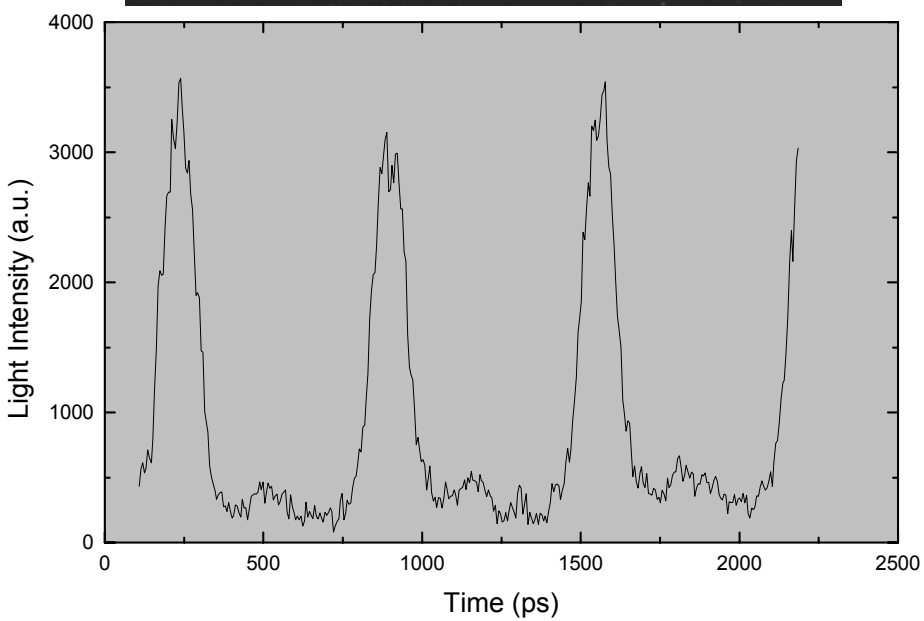
RF combination : 11th May 2006

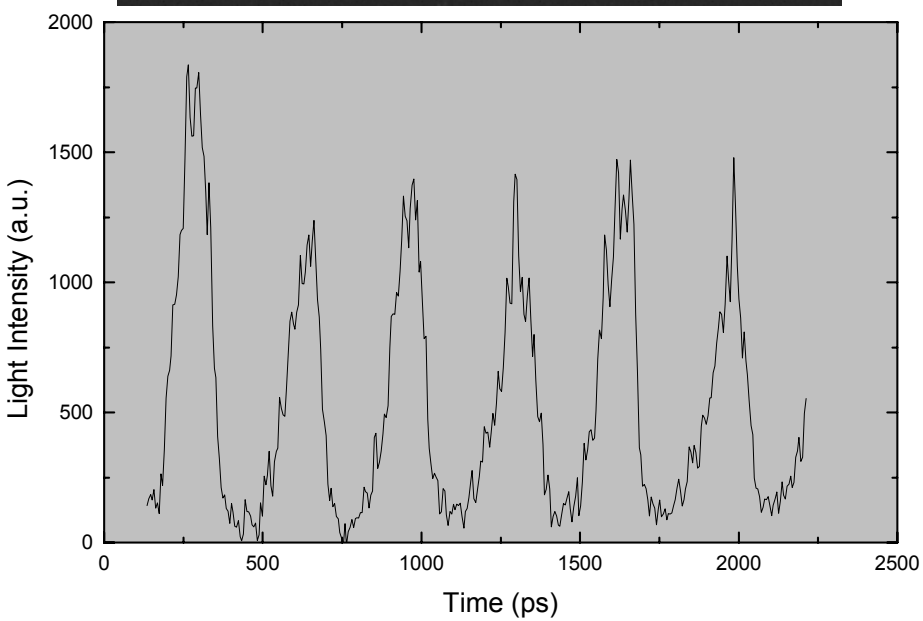
T.Lefevre, C.Welsch



Sweep speed
250ps/mm



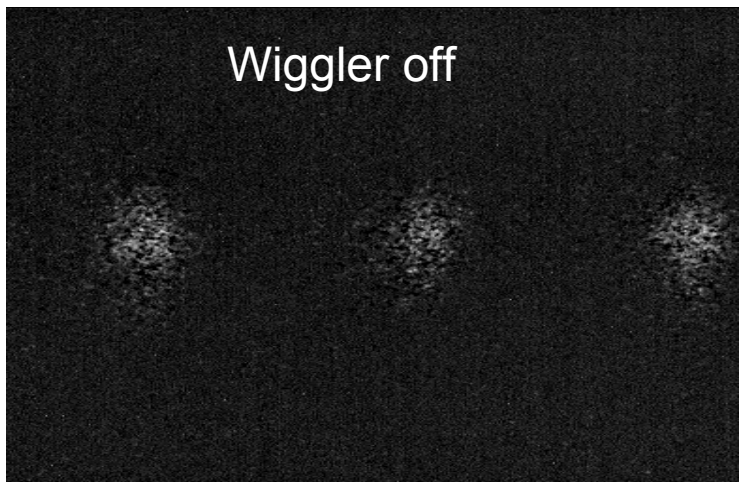


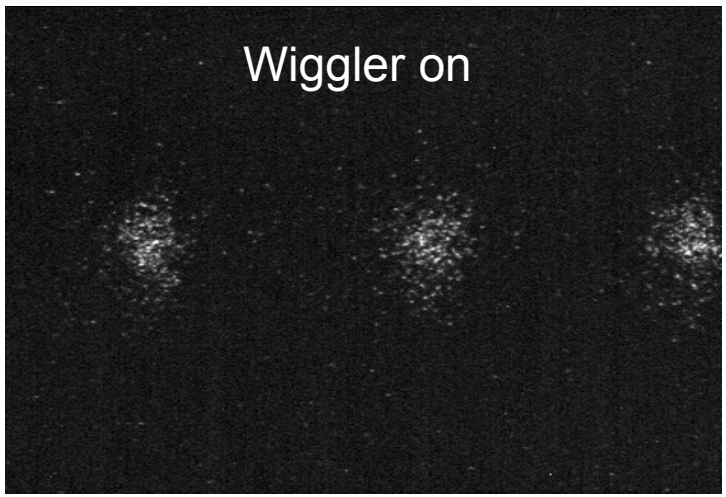


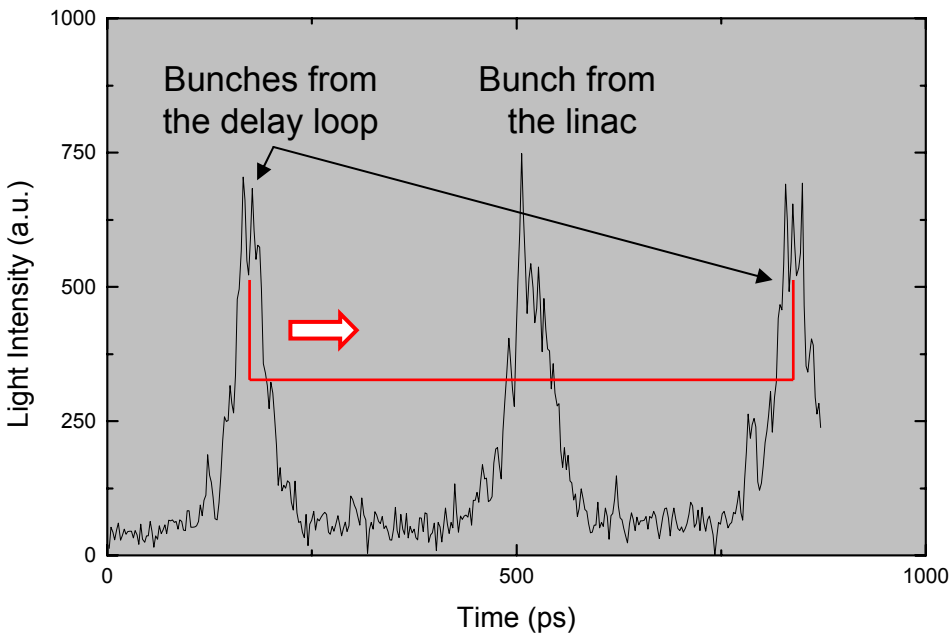
RF combination – Wiggler on & off : 12th May 2006

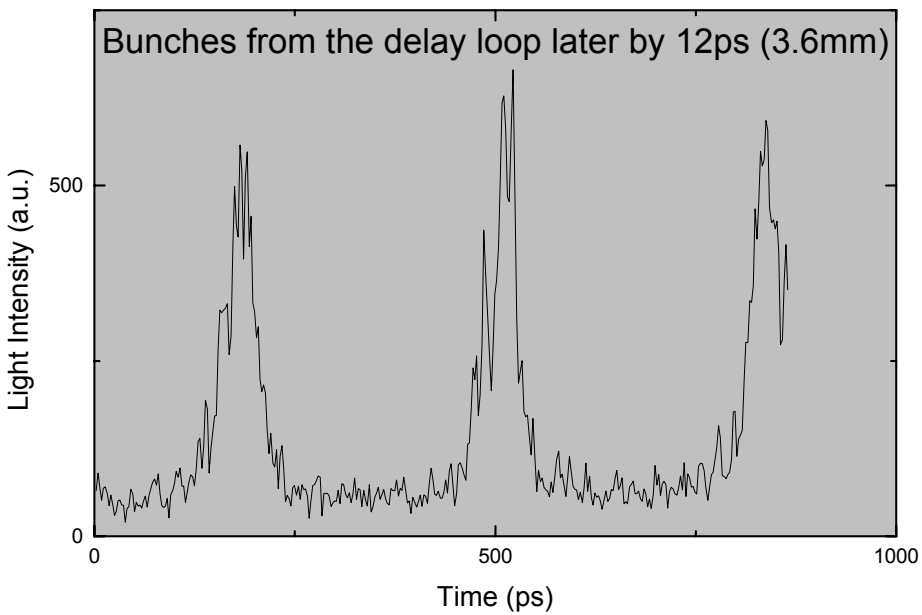
OTR light downstream the Delay Loop @MTV0550 Sweep speed 100ps/mm

C.Welsch, T.Lefevre









Conclusion

- Quad scan results show reasonable emittances
- Dispersion very close to expected values
- => optics well understood
- DL loop length correct

- trajectory measurements to be analyzed

- verify magnet currents from control system to magnet!

- Thanks to everyone involved!