Analysis of MD data using the on-line model tools

I. Agapov 19.11.2007 @ LCU section meeting

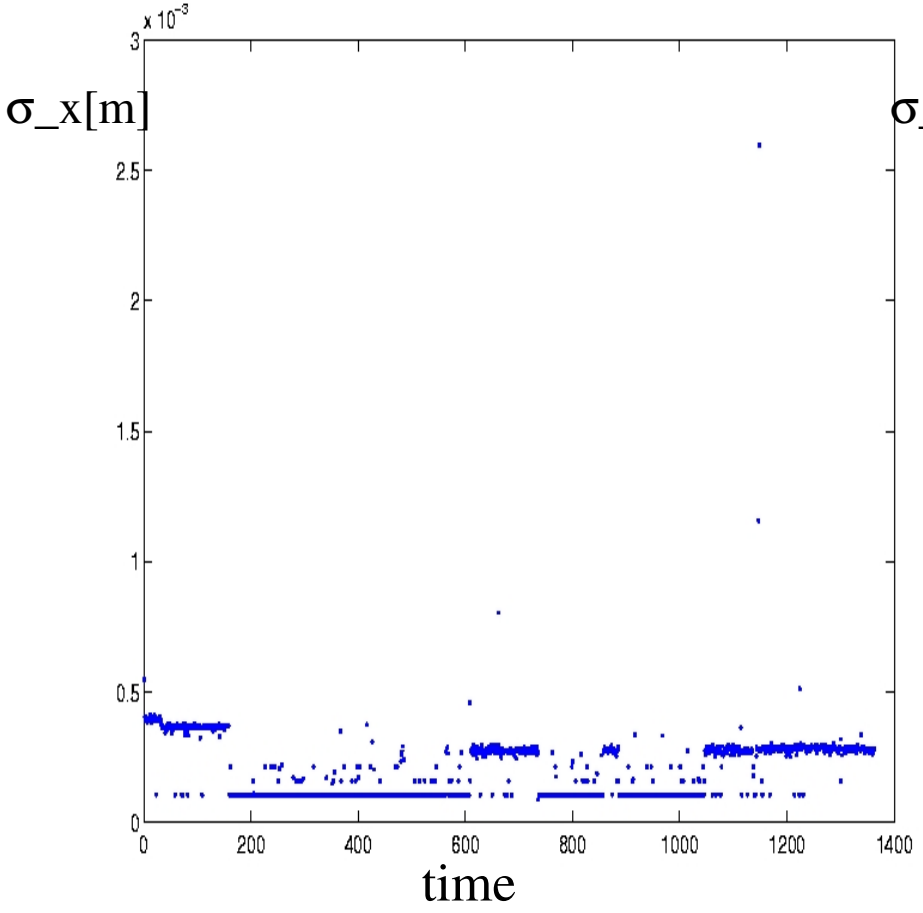
thanks to : G.Arduini, E.Benedetto, J. Wenninger ...

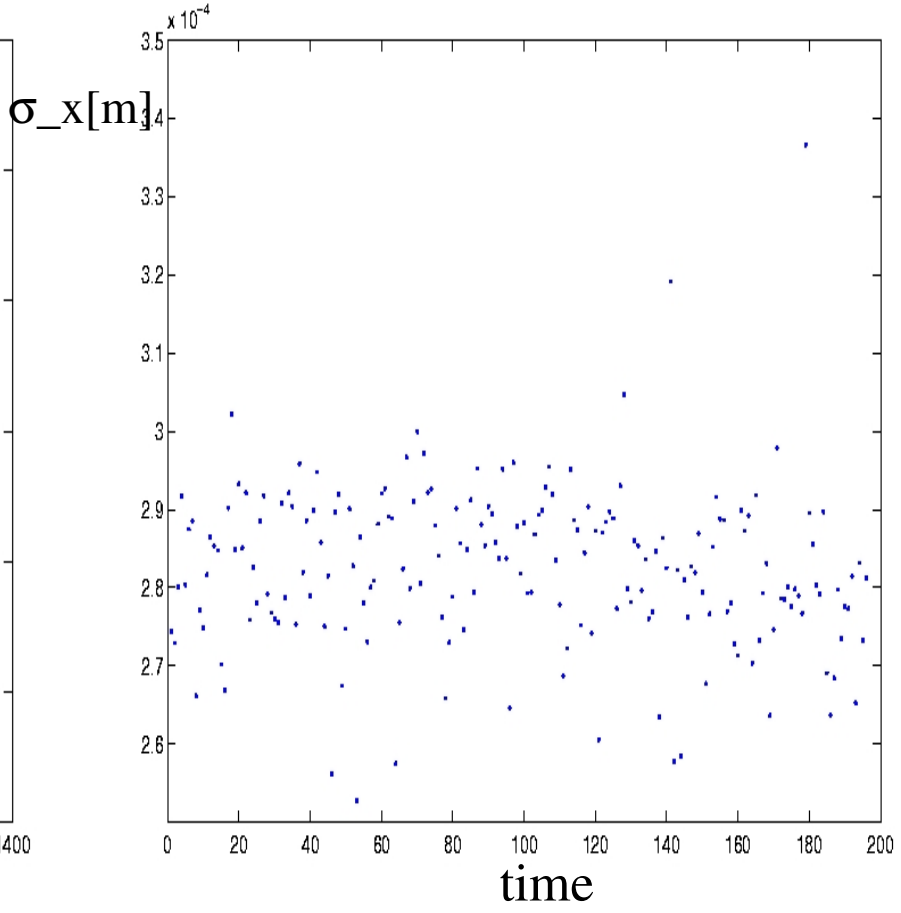
- Tools for data analysis
- TI2 - beam screen measurements
- SPS – model fit along the cycle
- SPS - orbit correction
- Remarks

Tools for data analysis

- Data collection tools – processing measurement data (sdds files) and parameter settings (lsa archive)
- OM Parameter database for quick access
- Statistical toolbox
- Aiming at automatic procedure of estimating reproducibility of all parameters and model updating

TI2 beam screen matching

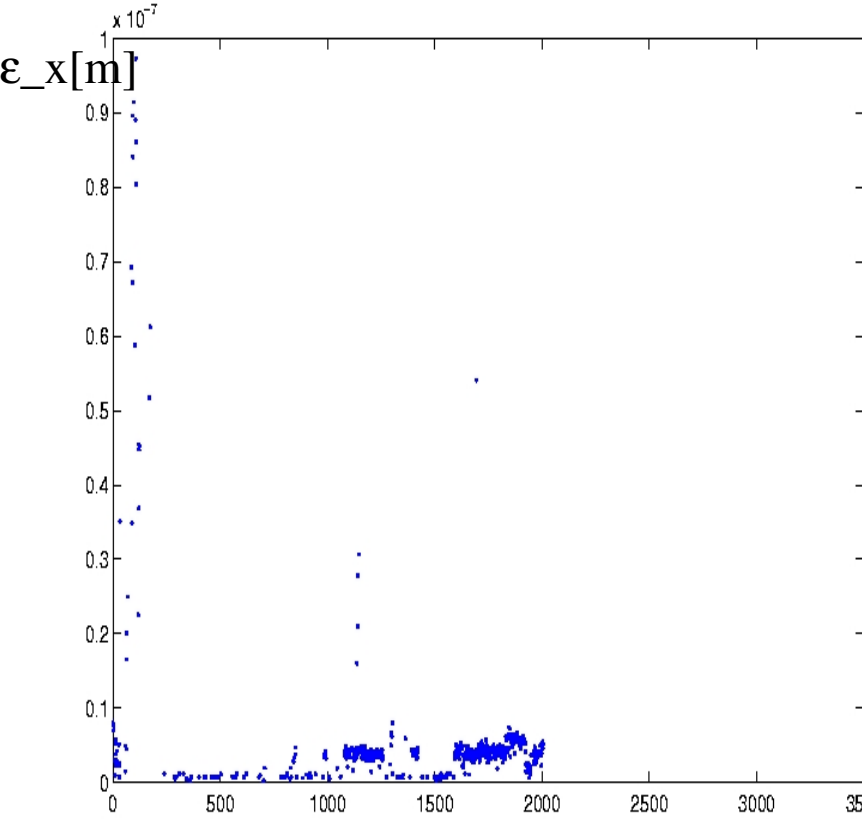


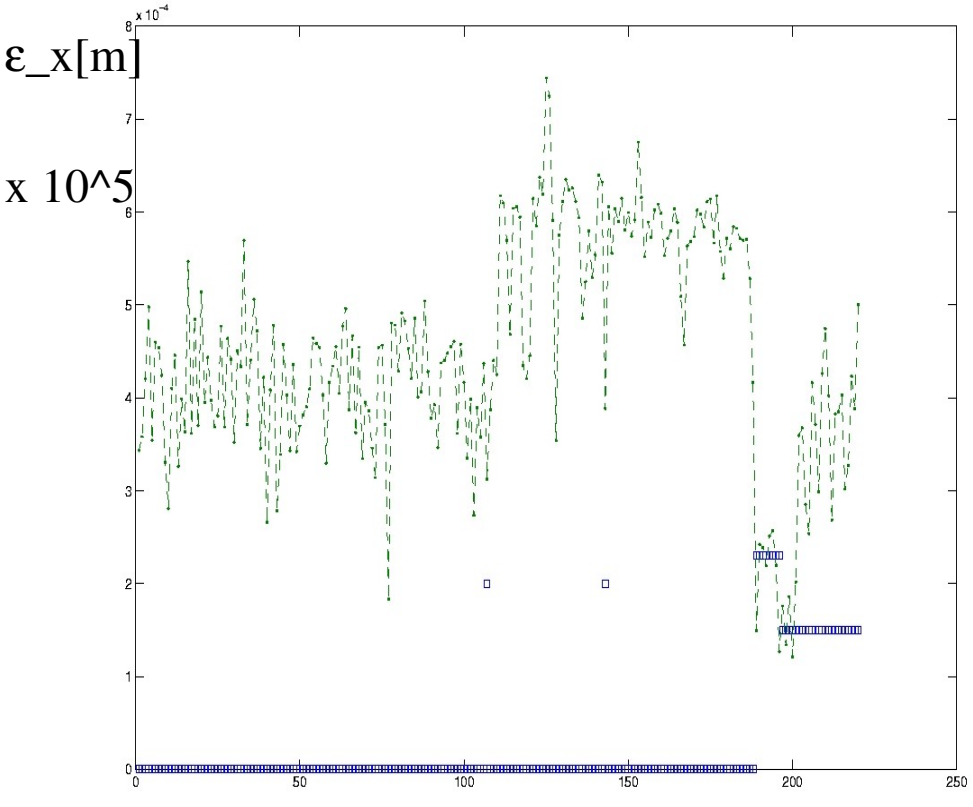


11 screens in TI2 ; 9 used

sigma_x[m] at BTV.610018 all data (left) and a relatively good piece of data

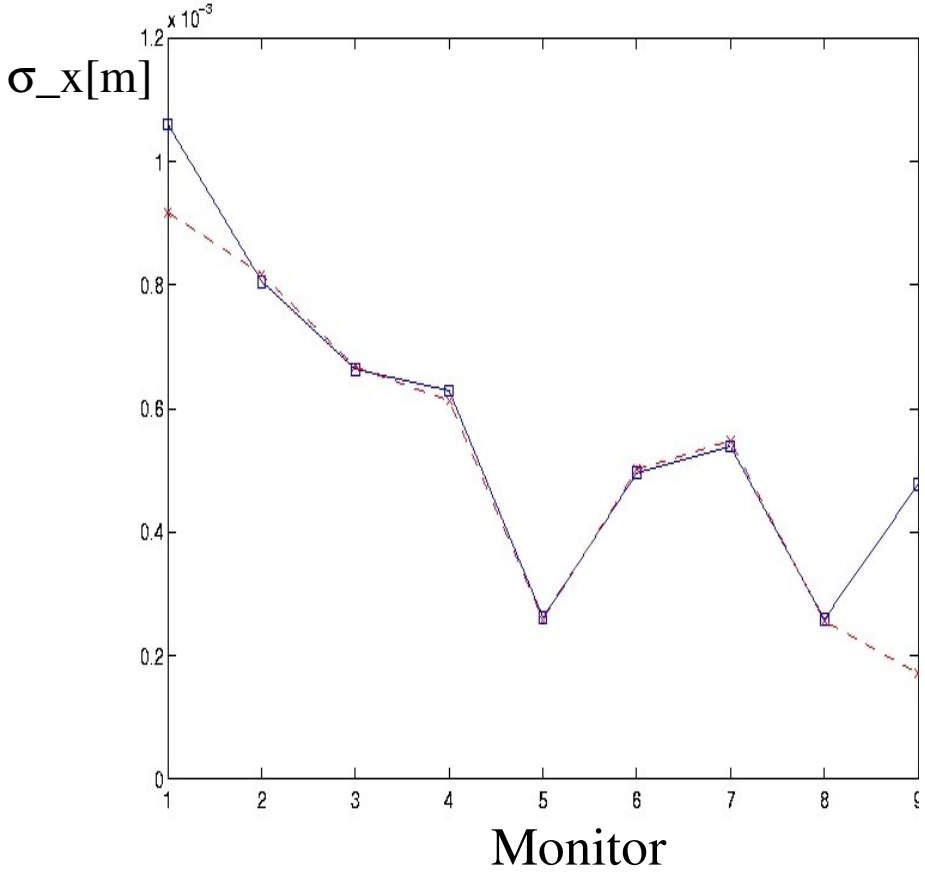
TI2 beam screen matching

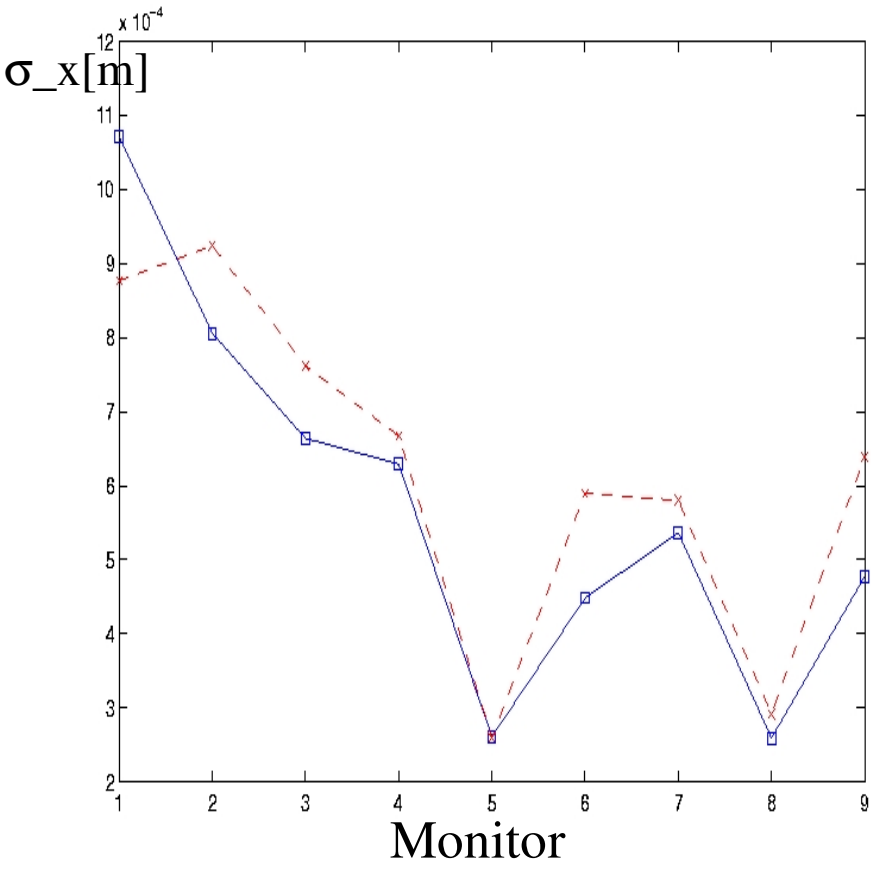




Emittance x all (left) and a relatively good piece of data (right, scaled 10^5).
Dp/p recorded by the emittance matching program on the right plot in blue

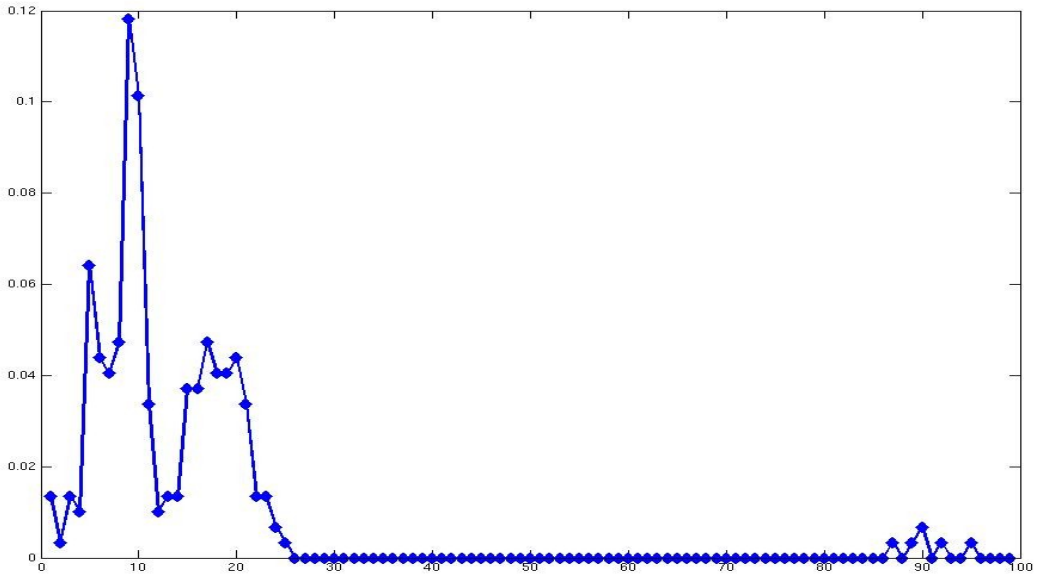
TI2 beam screen matching





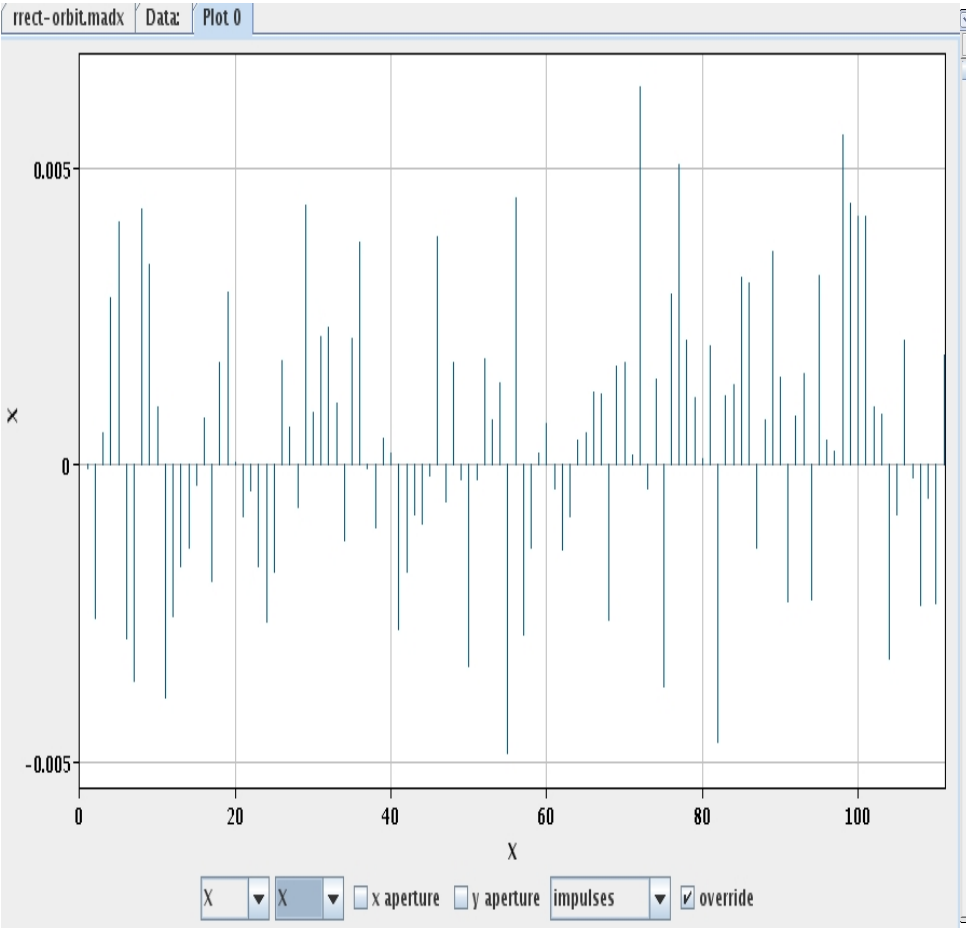
Comparison to mad (in blue) – an individual measurement (left) and average over 1h (right, distribution cut at 5 sigma)

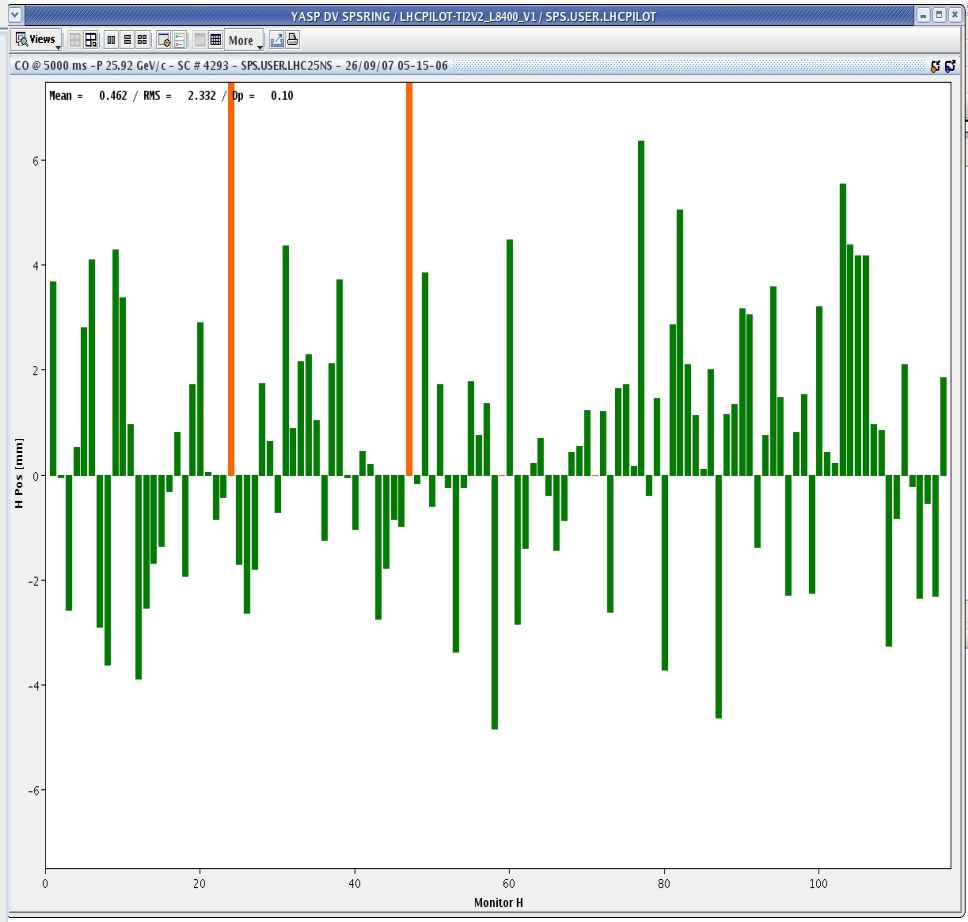
TI2 beam screen matching



If measurement error distribution is not Gaussian white noise – indication of hidden parameters (binning of emittance_x plotted here) (methods of detecting under study)

Orbit correction at SPS





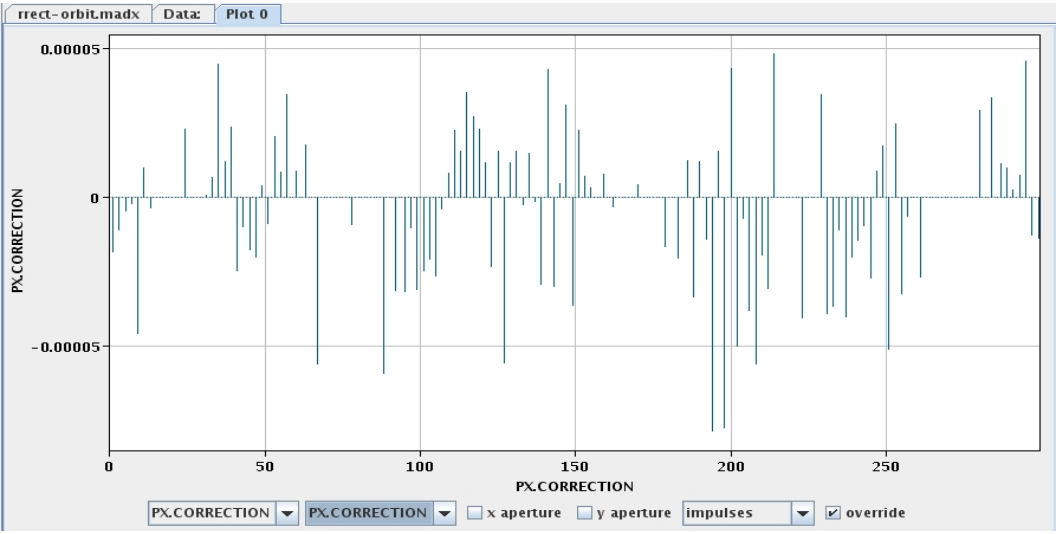
Tested sending corrections computed with OM to SPS

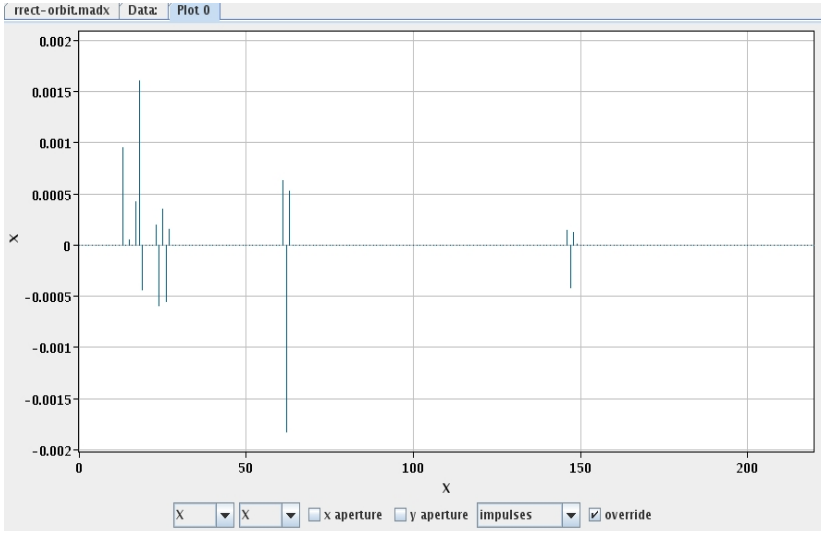
checked correcting a simulated distorted orbit - ok

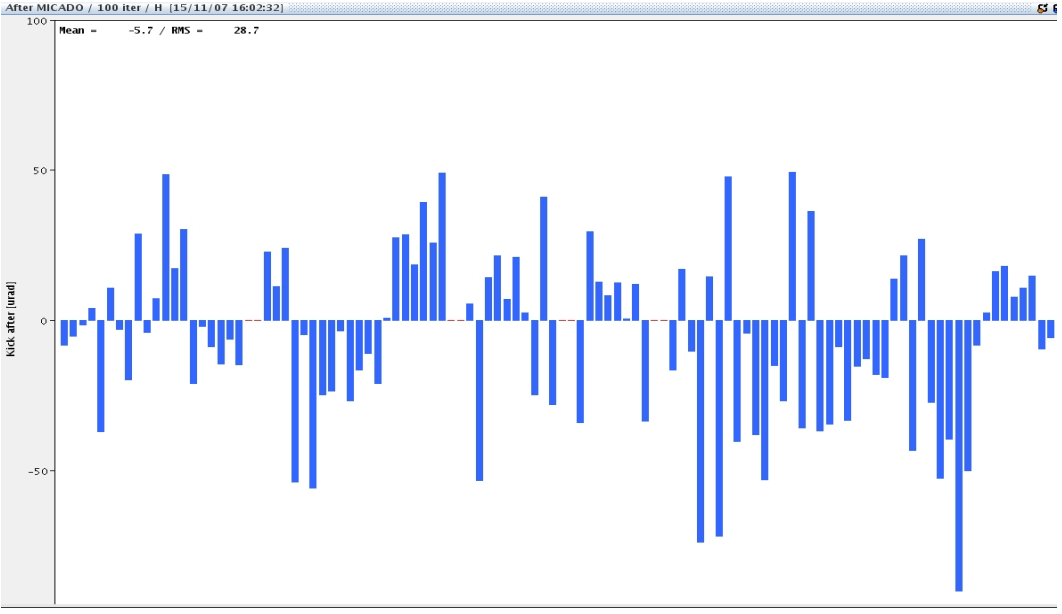
cross-check with YASP – generally good agreement

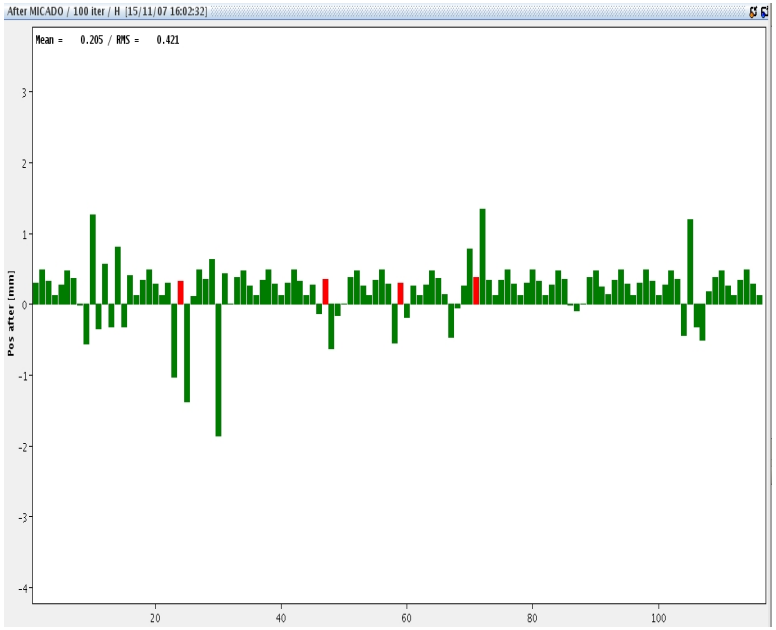
in madx micado often does not converge when the orbit data is bad (like in this picture)

Orbit correction at SPS (om upper, yasp lower)

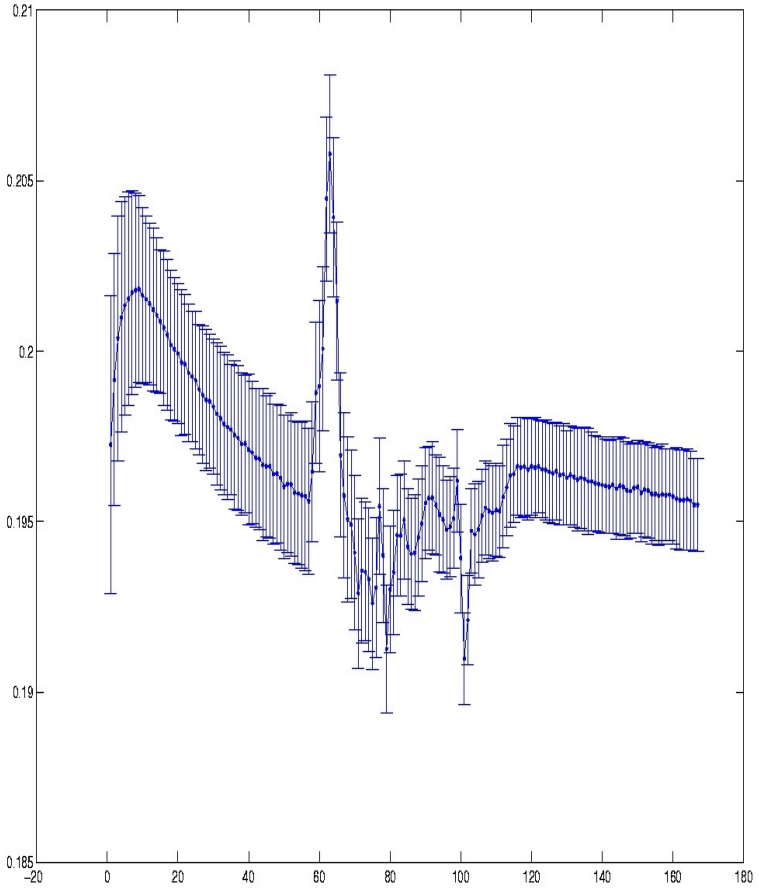


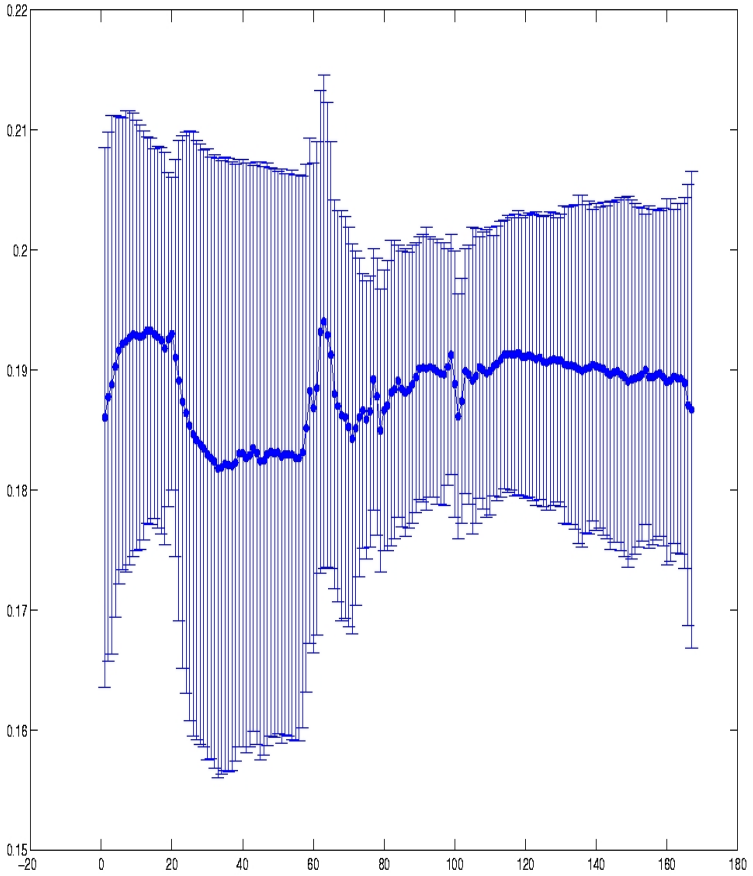






SPS model fit along the cycle (in progress)





Qx and Qy for MD1 on 02/11

Estimating the tune reproducibility is important for model fitting

Conclusions/outlook

- More data in *~iagapov/public/notes/ti2-commissioning.pdf*
  ~iagapov/public/notes/sps-cycle-match.pdf
- Multiple models should be available - including empirical and empirical corrections to madx model
- Models should have time dimension (since control system has it)
- Models should have a 'confidence level' ('uncertainty estimate') for every computation. Uncertainty estimates can be optimistic or pessimistic.
- Automatic procedure for updating the online model – this involves a separate 'om' parameter database
- Automatic procedure to a) decompose measurements into noise and signal b) estimate parameter reproducibility c) estimate model accuracy – essential for model fits