

High Level applications development status



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Some rules

- ▶ Interfaces to be implemented into MML (MATLAB) and / or directly using Taurus (Python)
- ▶ High level interfaces design should be done by machine experts and could evolve
 - Periods of training and development is necessary
 - Easy installation, versioning, and user manuals are needed
- ▶ General single common scripts for raw signal analysis :
 - Beam charge extraction (from Wavecatcher)
 - YAG : Spot analysis tool (extract size, position, ...)
 - BPMs ...
- ▶ High level variables (Calibrations, Twiss parameters, ...) coming from calculation should be included in Tango
 - No differences for same variable should appear in different IHM
- ▶ Single programming language is not mandatory (MATLAB, Python)
 - TANGO binding should prevent any incompatibility



High level applications are done with MML

- ▶ MML : communication with **TANGO** and a **Simulation tool** (Accelerator Toolbox)
 - Binding MATLAB / TANGO done
 - Tested on multi-platform (Windows, MacOS, and Linux)
- ▶ MML : **At platform** used to develop and test high level interfaces
- ▶ MML : simulation tool used for the Transfer lines and the Ring
 - And Linac beam dynamics analysis
- ▶ Next need :
 - Connect MML to simulation TANGO variables
 - ▶ Simulation TANGO variable will be very useful also during commissioning to test newly developed tools before using them on
 - Connect MML to final TANGO variables



MML/AT current status

Control applications for commissioning and operation are under development using the Matlab Middle Layer (MML).

MML status:

- ▶ Installation of the MML and AT software together with other applications. New version of AT (v 2.0) is tested. Next step: test a new release of MML (from G. Portmann / May 2018).
- ▶ Test version of the master files (thomxinit, TLinit, setoperationalmode, updateatindex, magnetcoefficient...) for the machine (TL and SR) is ready. Next step: put appropriate tango names/variables (collection is ongoing) + **many many tests with Tango**.
- ▶ Eventually switch from « personal PC/working locally » style to the dedicated ThomX/MML server (as it will be during the operation, more easy to maintain and track changes/modifications).



High level applications with MML

There are already a lot of functions for accelerator control and measurements but mainly for the damped SR.

In the ThomX SR the e- beam is stored only for 20 ms => can be a difficulty for some type of measurements => specificities to be addressed in the case of the ThomX SR

The work now is focused on the applications for the Day-ONE:

- ▶ Save/Restore the machine configuration
- ▶ BPM GUI/test programs
- ▶ Orbit/signal-sum measurements
- ▶ First turns applications (orbit correction, tune/chromaticity measurements)

Done (version 0):

- ▶ Orbit correction (global)
- ▶ Beta function measurement
- ▶ Lattice symmetry restoration (LOCO)
- ▶ Display (plotfamily)
- ▶ Injection matching
- ▶ Emittance measurement

Ongoing:

- ▶ Orbit correction (local)
- ▶ Dispersion measurement
- ▶ RM measurements (orbit, tune, chromaticity)
- ▶ Quadrupole centering (BBA)
- ▶ ...

To be addressed:

- ▶ Tune display and control
- ▶ Beam diagnostics (beam size, bunch length...)
- ▶ Analysis of nonlinearities
- ▶ Analysis of the collective effects
- ▶ ...



Need for trend plots :
easy to compute and very useful

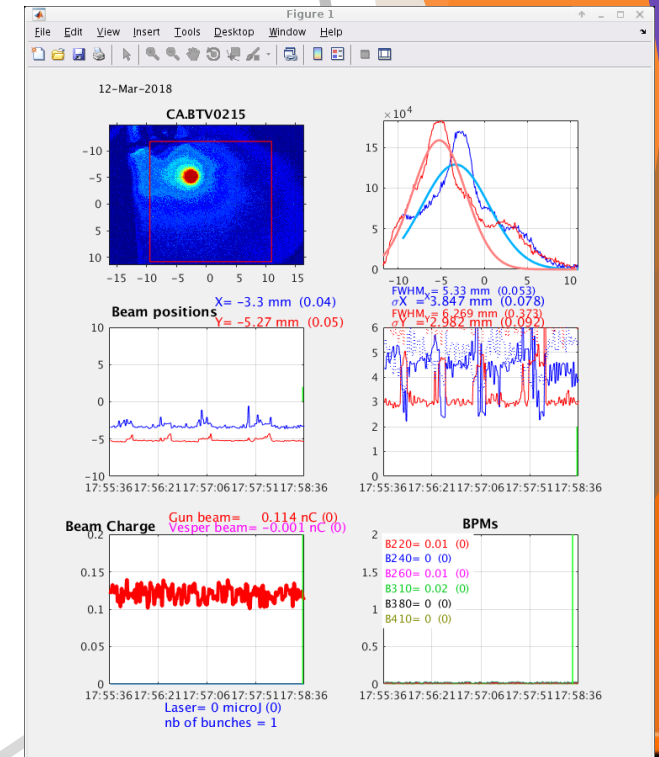
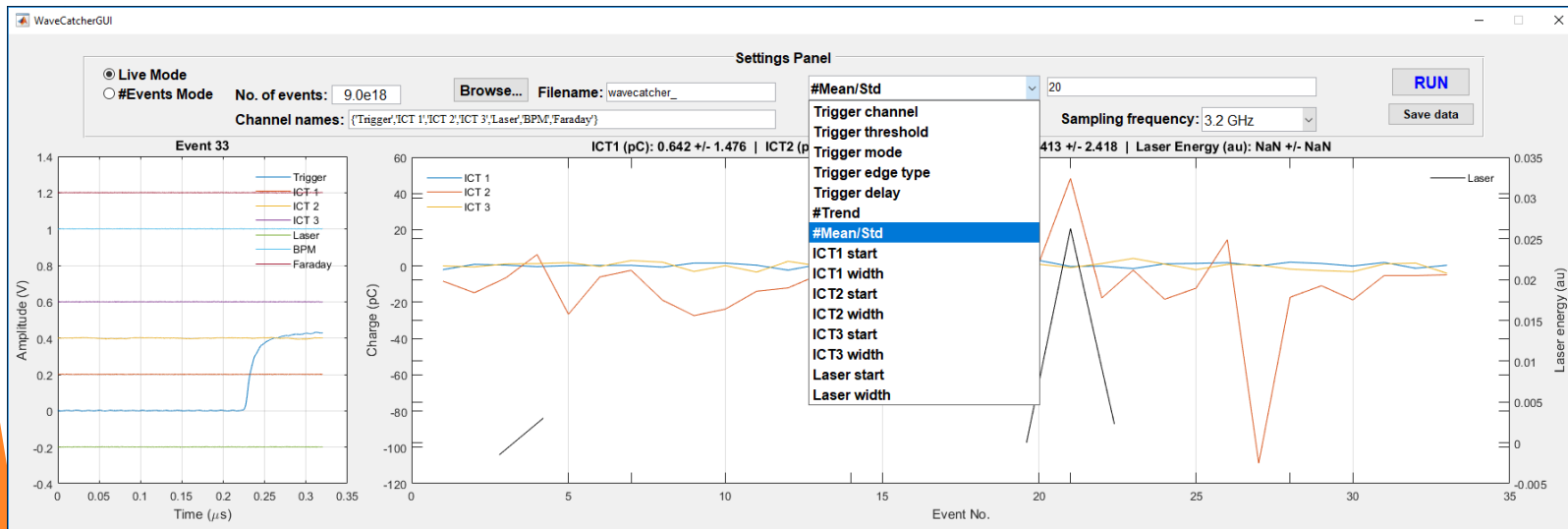


Interfaces needed for beam tuning for single pass (Linac-TL-EL)

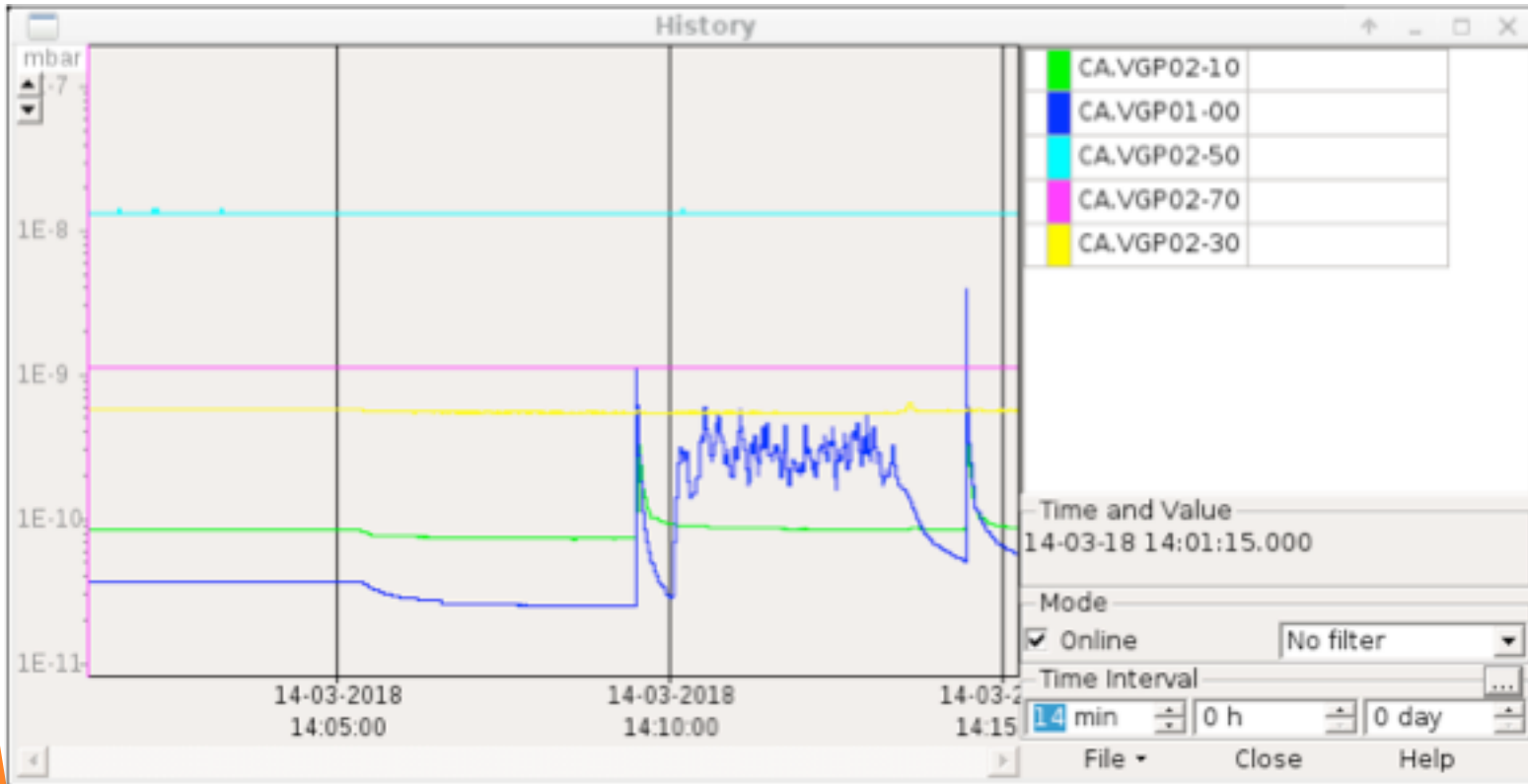
- ▶ During the Linac + TL + EL commissioning
 - To help the beam tuning
 - ▶ Useful for beam alignment
 - ▶ Follow trends for ICT, BPMs
 - For example Trend of the beam charge / position

- ▶ Example of interface @CLEAR
 - Choose screen
 - Measure beam spot size, position
 - ▶ Plots trends
 - Get beam charge / position at different locations
 - ▶ Plot trends

Example of interface used at PHIL



Trend plots for vacuum



- ▶ During RF conditioning for RF-Gun or Linac Section.
- ▶ Very useful for conditioning

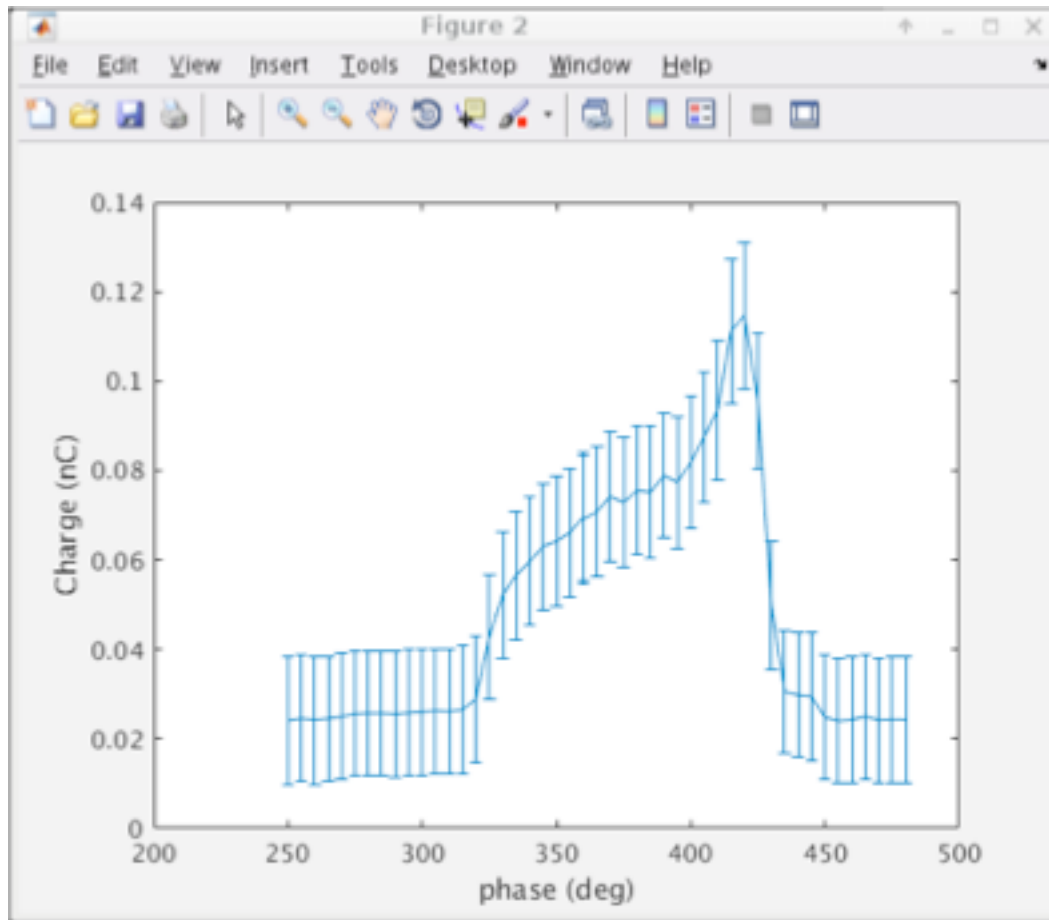
Scan measurements : To be adapted for ThomX



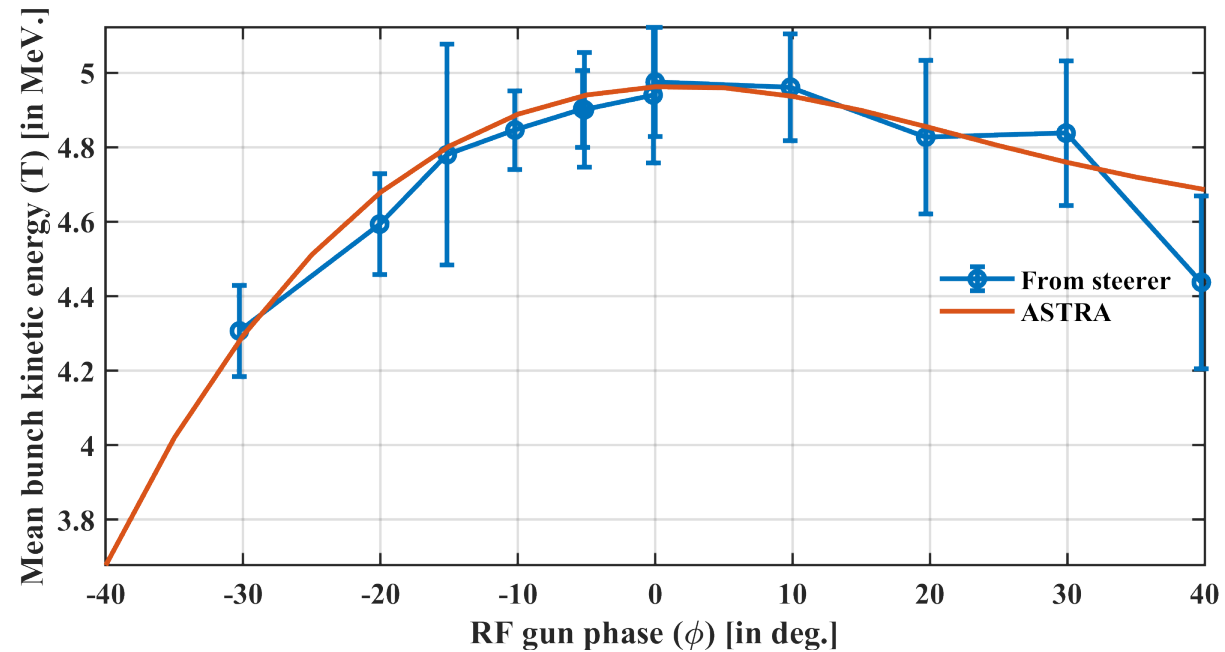
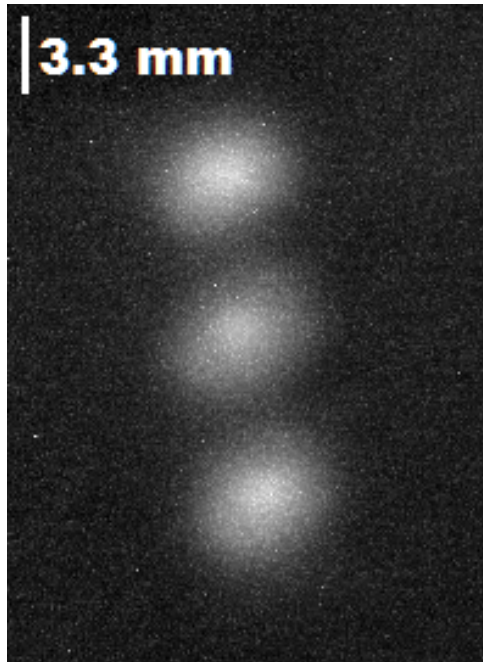
Example of Scan interfaces to be included in MML

Charge phase scan (from CLEAR)

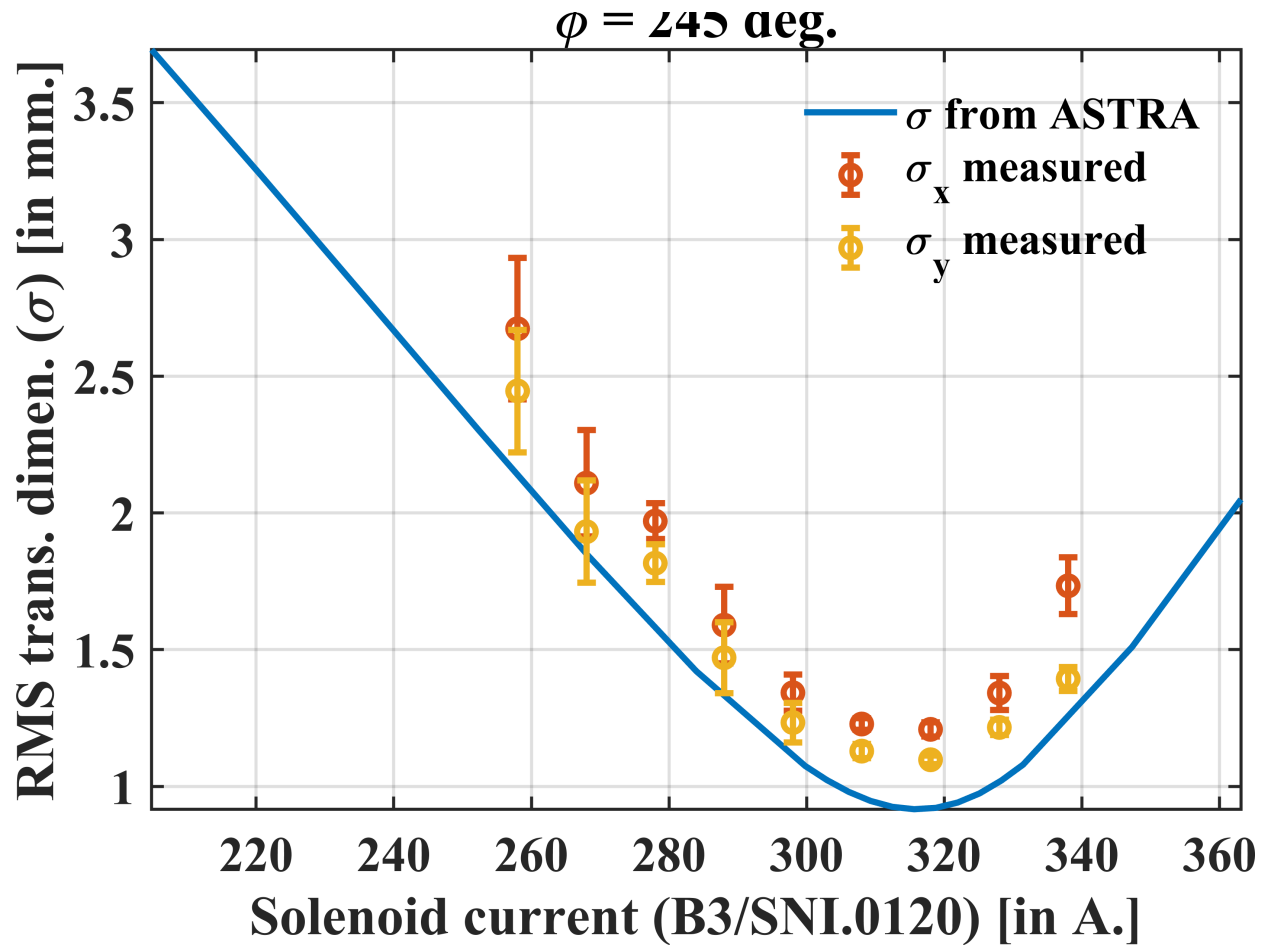
- ▶ Script to adapt for ThomX (could be done in MML or Taurus)



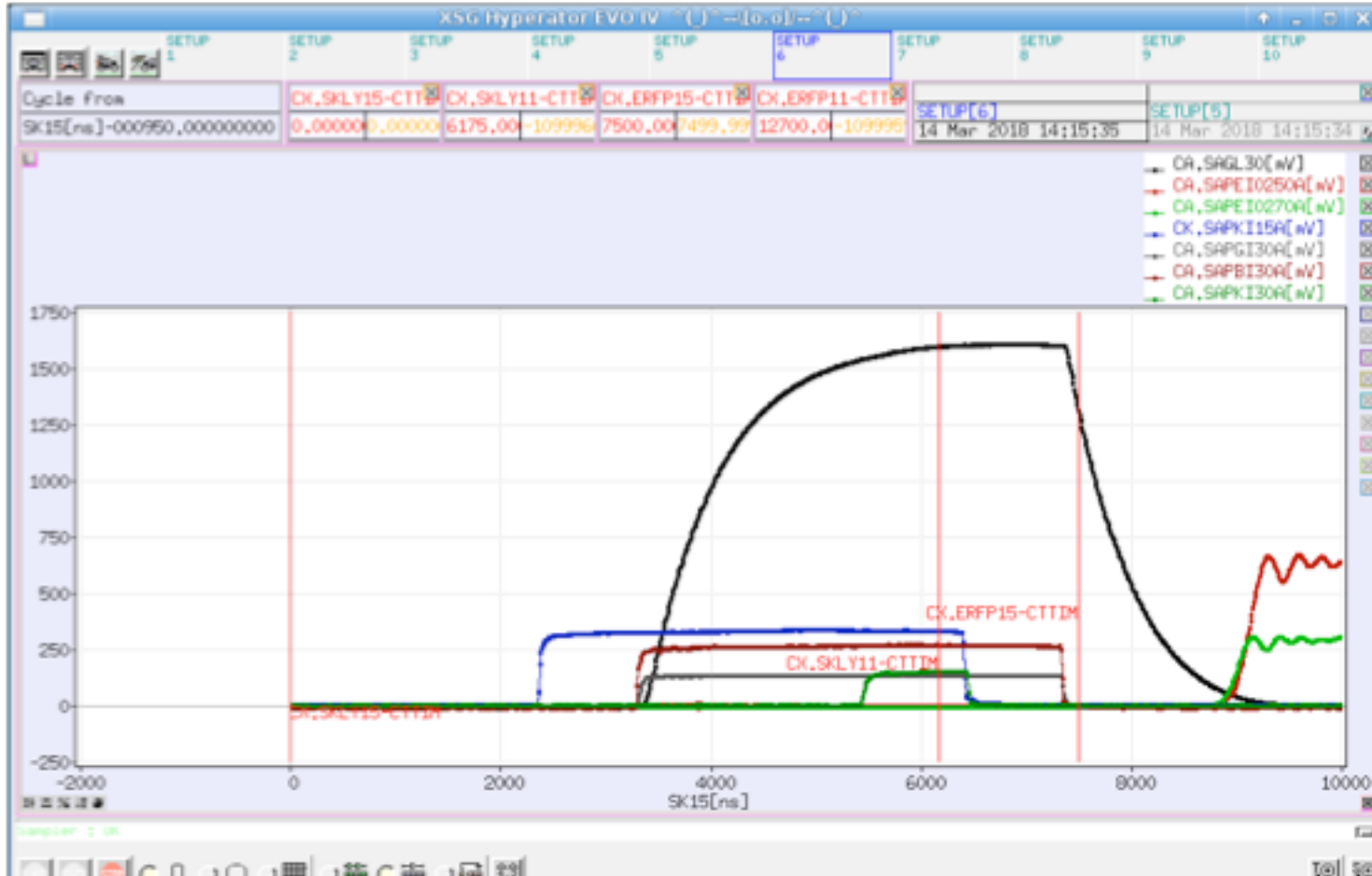
Example scan for energie steerer



Example of solenoide scan



Interface with RF-Signals



- ▶ Could be very useful to understand the Timing status
- ▶ Need to keep the possibility to access the analog signals (scope)

Interfaces roadmap (< 6 months)

- ▶ Upgrade MML test-version to add operating points :
 - Linac-TL-EL, Linac-TL-Ring-EL, and Linac
 - Already existing Lattices (MadX and Beta)
- ▶ Trends :
 - For vacuum
 - For beam charge, position ...
- ▶ Diagnostics
 - General interface :
 - ▶ Diag stations (Yag)
 - ▶ ICTs
 - ▶ BPMs
 - Automatic measurements
 - ▶ Charge:Phase, Energy steerer, Solenoid scan, energy dispersion
 - ▶ Alignment, orbit correction

