

Flight Simulator Progress and Test Plans

Glen White (LAL / SLAC)
Yves Renier (LAL)

- Core software status
- ATF apps (Lucretia and PLACET)
- FS installation plans and schedule
- Tests of applications at ATF in May

Core FS Software Status

Overview

- Total FS package growing quite large, contains 11 discrete software packages, including
 - Matlab, Lucretia, Floodland, Lucretia2AML
 - EPICS (hardware IOC's + simulation)
 - Movers, bpms, power supplies, ATF interface
 - PLACET (+ tcl/tk, octave)
- Documentation effort starting
 - <https://confluence.slac.stanford.edu/display/ATF/ATF2>
 - Just basic installation instructions at the moment

ATF Modifications

- ATF-IOC written
 - “soft” EPICS IOC
 - Serves BPM and magnet data from ATF server interface to ATF control system for ring and extraction-line devices.
 - Provides write access to magnet power supplies
 - e.g. “ATF:QUAD:QD1X:IACT”
“ATF:BPMS:ML4X:Y”
- ATF ring and EXT model in Flight Simulator.

Core Functionality

- 2 Installations, “trusted” and “test”
- At ATF, each runs on different hostname +username environment. “Trusted” has complete access, “test” has to request access on a per-PV basis from “trusted”.
- Also operates in simulation mode away from main ATF control environment
 - “trusted” acts as an accelerator simulator, using Lucretia tracking and modeling tools.
 - “test” then operates as per the ATF environment.

“Trusted” Functions

- Complete access to all EPICS PV's
- Provides access control for “test” installation.
- Maintains current versions of Lucretia and AML lattices reflecting machine state.
- Data service provider through tested apps.
- In simulation mode, simulates accelerator (through Lucretia tracking engine). Includes control of errors (static and dynamic).

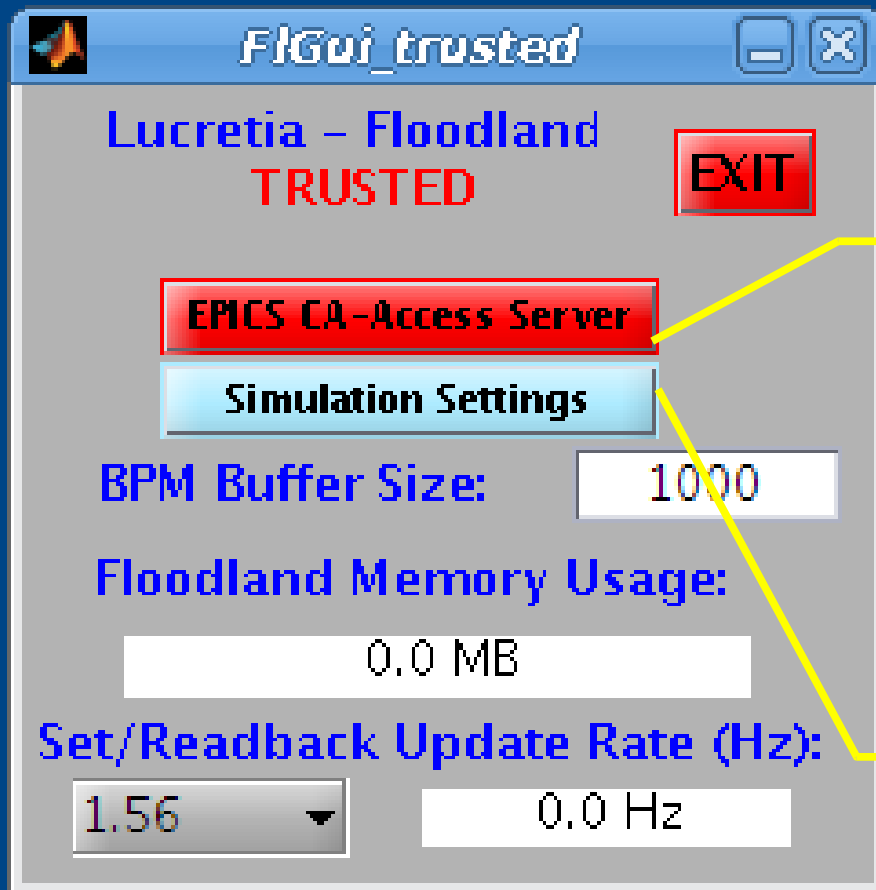
“Test” Functions

- Reads model parameters into Lucretia (and optionally local AML file) from “trusted”, at a fixed rate or on-demand.
- Provides all core Lucretia functionality, plus tools to request and interrogate access to alter machine states (Power supplies, movers etc.). After being granted, standard Lucretia tools can be used (PSTrim, MoverTrim etc).
- Server for non-Matlab clients (PLACET, SAD)
 - Extends full flight simulator functionality through tcp socket client/server based interface.
 - Example client tool provided.
 - PLACET interface developed by Yves using tcl socket functionality.
 - Utility provided for sharing of data between Lucretia and non-Lucretia apps and for calling either from either environment.

Example Server Commands from testClient

- Get/set power supply settings for magnets
 - *fl_socket* << *"amlget('PS1:design:num','PS2:design:num','PS5:design:num');"*;
 - *fl_socket* << *"amlset('PS1:design:num',1.2,'PS2:design:num',0.96,'PS5:design:num',0.5e-3);"*;
- Get average orbit from last 20 bpm pulses, applying default quality cuts
 - *fl_socket* << *"bpmave(20,1);"*;
- Request control access
 - *fl_socket* << *"access-request PS39 PS40;"*;

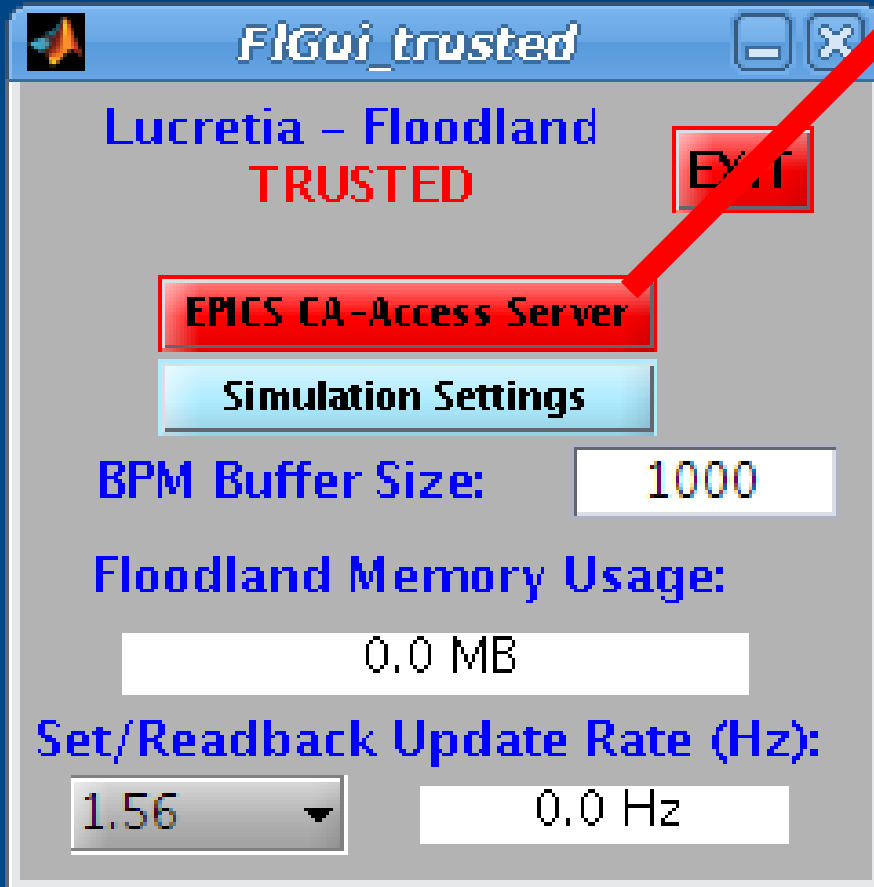
“Trusted” GUI



Access Server for granting PV write permissions to “test”

In Sim Mode, provides options to change the way the accelerator is modeled

Access Control GUI



FGui_trusted

Lucretia - Floodland
TRUSTED

Exit

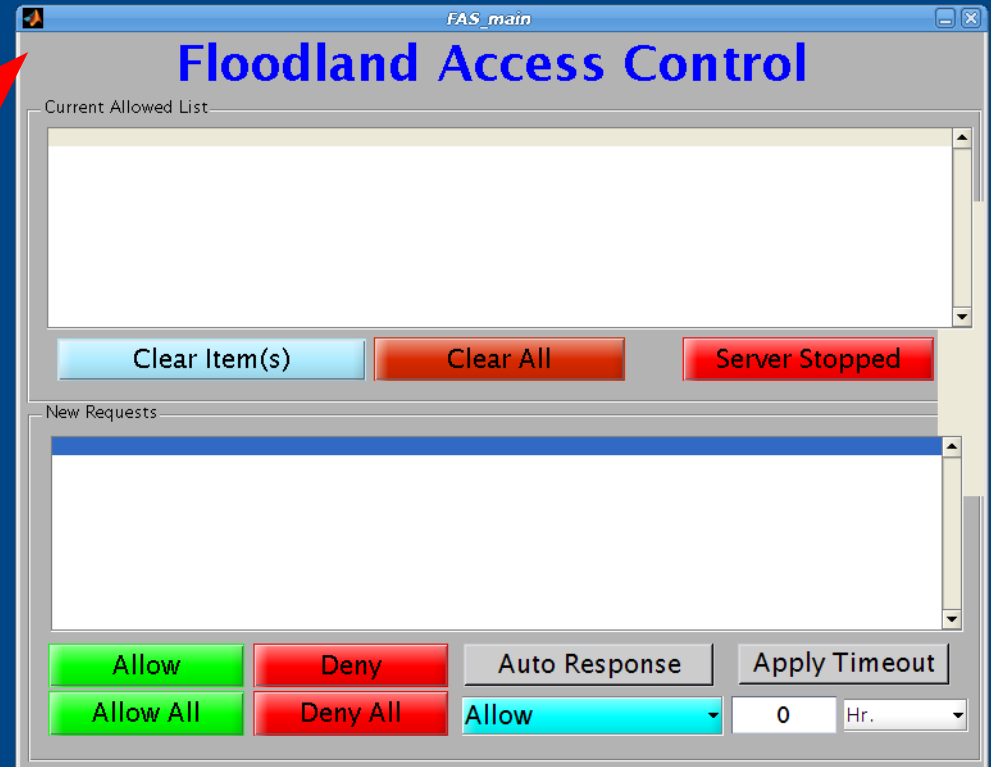
EPICS CA-Access Server

Simulation Settings

BPM Buffer Size: 1000

Floodland Memory Usage:
0.0 MB

Set/Readback Update Rate (Hz):
1.56 0.0 Hz



FAS_main

Floodland Access Control

Current Allowed List

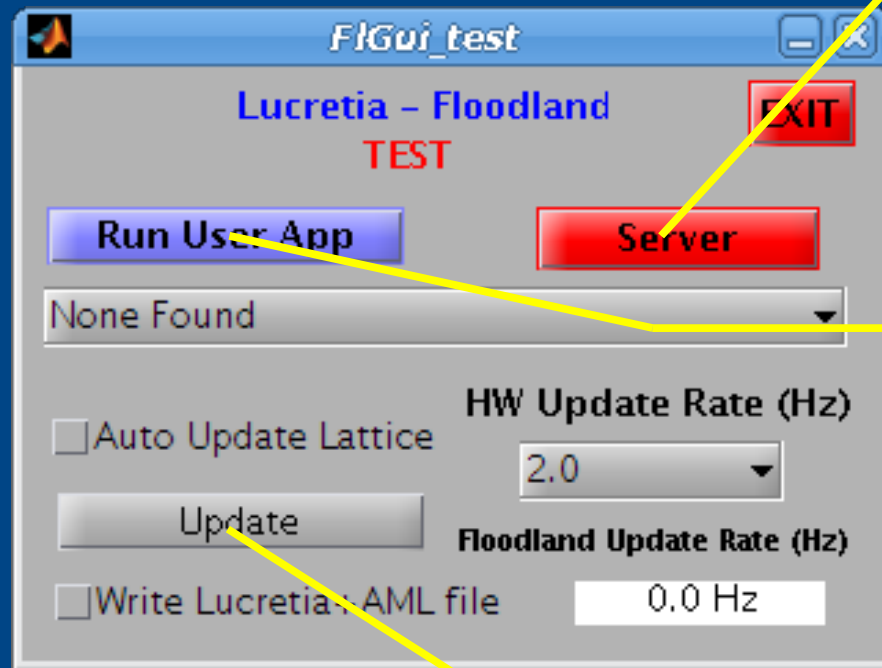
Clear Item(s) **Clear All** **Server Stopped**

New Requests

Allow **Deny** **Auto Response** **Apply Timeout**

Allow All **Deny All** **Allow** 0 Hr.

“Test” GUI



Server Program for apps external to Matlab

Run user application (Lucretia, PLACET, SAD...)

Model synchronisation with control system via “trusted”

Lucretia2AML

- Module written by S. Molloy- now in CVS.
- AML forms common lattice format for all tracking codes.
- Forms basis for passing control commands to FS (e.g. For PS's via controller name and values).

```
</controller>
<element name = "L004">
  <length design = "0.150546" />
</element>
<element name = "BS1X_1">
  <bend>
    <g_u design = "0.199503" err = "0" />
    <e1 design = "0" />
    <e2 design = "0" />
    <h_gap1 design = "0" />
    <h_gap2 design = "0" />
    <f_int1 design = "0.5" />
    <f_int2 design = "0.5" />
    <h1 design = "0" />
    <h2 design = "0" />
    <orientation origin = "CENTER">
      <x_offset design = "0" />
      <x_pitch design = "0" />
      <y_offset design = "0" />
      <y_pitch design = "0" />
      <s_offset design = "0" />
      <tilt design = "0" />
    </orientation>
  </bend>
  <length design = "0.6" />
</element>
<controller name = "PS30" variation = "ABSOLUTE" design = "1" step = "0.00390625" default attribute = "bend:g u">
```

ATF Apps. Development

“Trusted” Apps

- BPM processing:
 - Buffered readings
 - Averaging with controllable quality checks
 - Abs vals, bad vals, fliers, charge
- Energy estimation from ring arc bpms
 - DE from mean for buffered BPM data
- Extraction line dispersion measurements
 - Correlate svd calculated “jitter modes” with ring dE calculations to form dispersion measurements at BPM locations in the extraction line
 - Use model to interpolate to other elements.

“Test” Apps

- Beam steering algorithm for ATF extraction line developed in PLACET by Yves.
- Others in development in Lucretia and/or in PLACET (as time permits):
 - Quad scanning
 - Experimental R matrix determination
 - EXT orbit Feedback
 - EXT dispersion correction

EXT Beam Steering

- Yves's “1-all” algorithm.
- Uses “test” FS Server to synchronise with current model and to set correctors and to request orbit averaging.
- Tested with FS (simulation mode).
- Interface via tcl/tk and octave.
- Tk gui.

PLACET Beam Steering Interface

flight-simulator.tcl

no_EPICS

Gain for x steering correction :

Gain for y steering correction :

steering correction

ground motion

initial misalignment

display size

display <x??>

display <x??>

display <y??>

display <y??>

Time of a step [s] :

Number of steps :

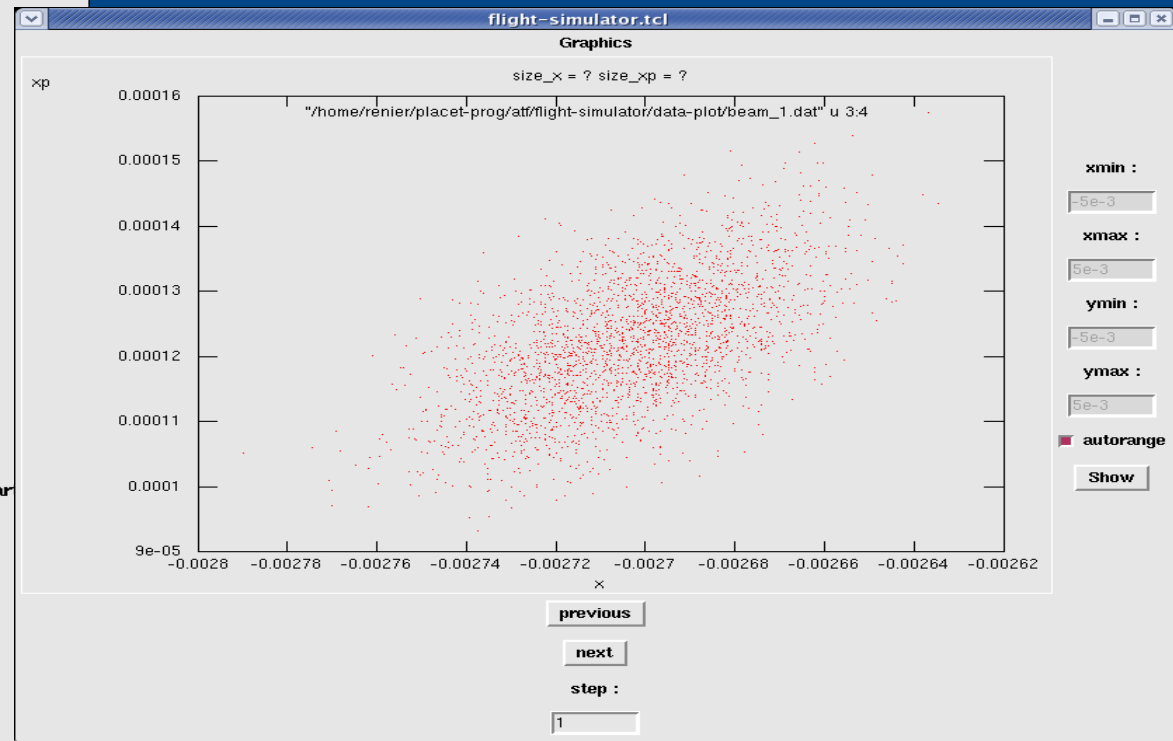
Time between GM generator and simulation start :

First seed used for GM (DON'T USE 0 !):

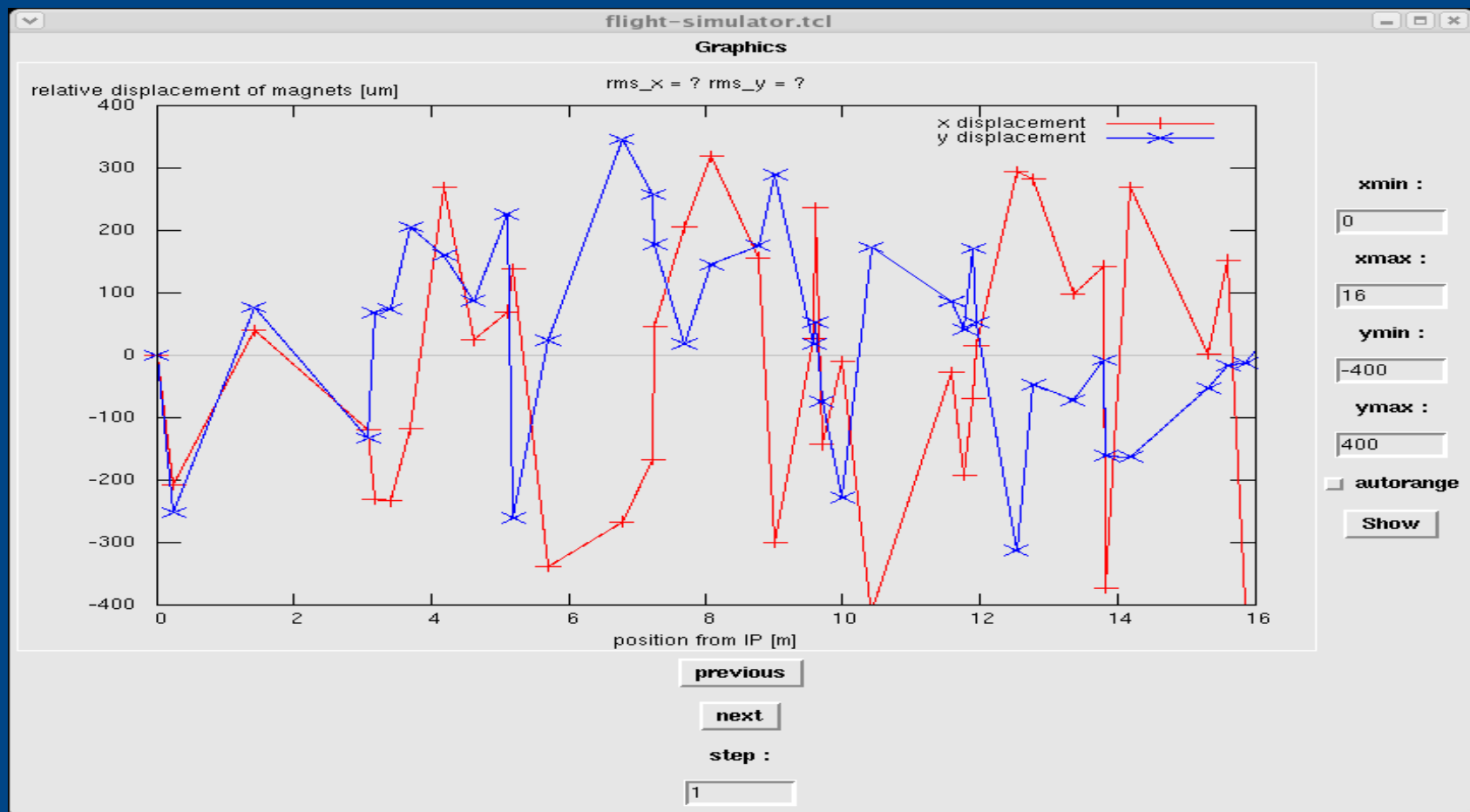
Number of seeds for GM :

rms of initial disalignment

rms of initial disalignment



PLACET Beam Steering Interface



FS Installation @ ATF

Visit to ATF in May

- Glen at ATF May 7th -> May 31st
- Yves at ATF May 7th -> May 20th
- Installation Plans
 - Week 1: Install ATF IOC on linux box (nanolinux, or...), and FS “trusted” installation on control room PC.
 - Any problems installing on control room linux box?
Should we use dedicated box?
 - Week 2+:
 - Check data format, stability of software, access control functionality, server/client tests...
 - Start testing developed applications.

Application Testing

Priority of Tests

- Utility apps (BPM averaging, dE & disp. calculations and other data services).
- Beam steering in EXT line using PLACET code.
- Experimental R matrix determination and steps to model EXT beamline.
- Utility tasks to help expedite Quad scan process.
- EXT dispersion correction.
- Optics matching (integration of MAD/AT etc).