



- Integrating SAD code within Flight Simulator

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Organization of Software Projects

Expression of interests (Eols) for the projects has been called,
24 June, 2008.

We adopt the two software environments, i.e.

- (1) in framework of V-system (ATF control system) and
- (2) the flight simulation

Many softwares based on the V-system have been developed and used at ATF and the flight simulator is very useful to develop the softwares for colleagues especially outside of KEK.

Overall coordinator : Shigeru Kuroda (KEK)

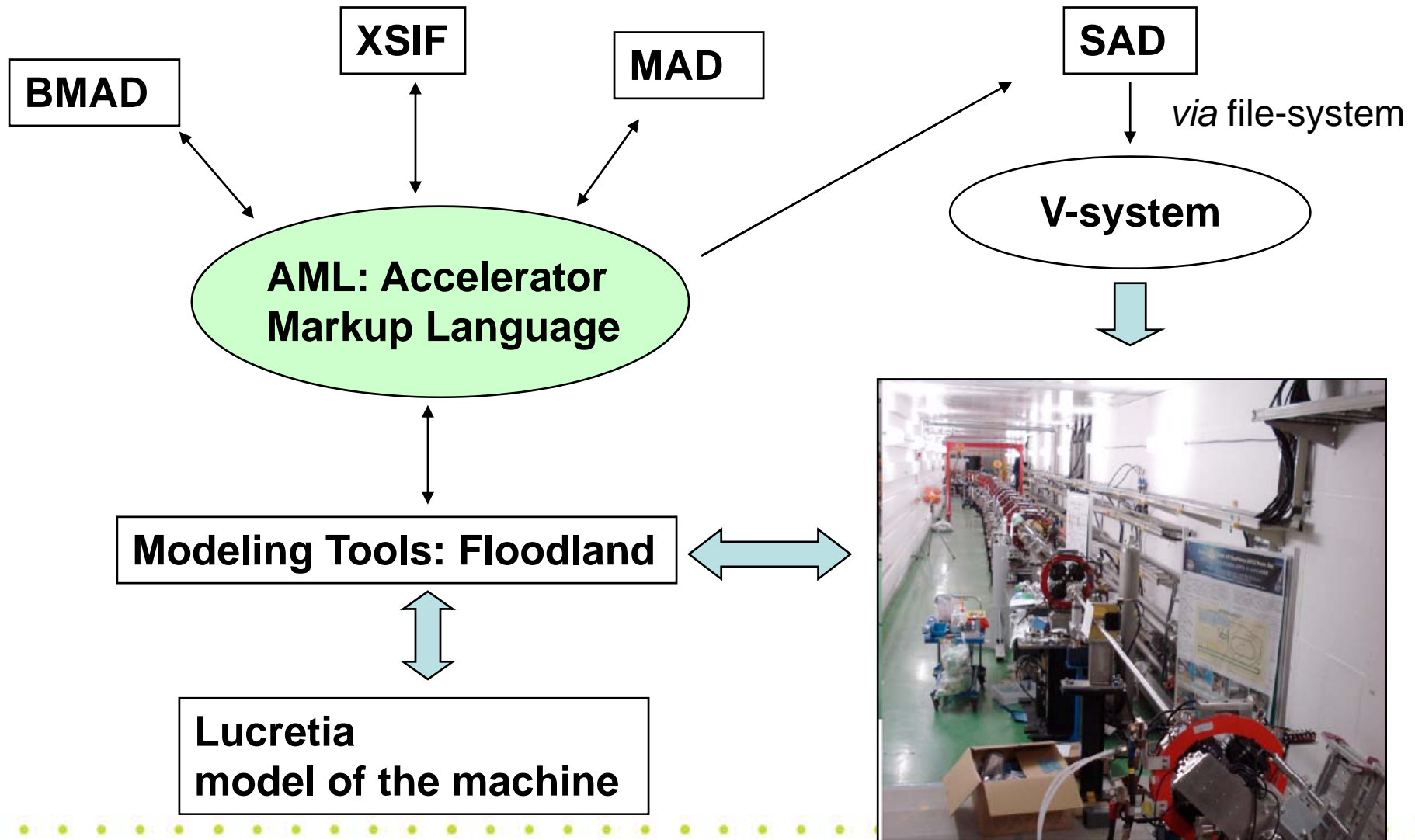
T. Tauchi

Organizing task groups with priorities and task leaders



- Goal: from Flight Simulator generate SAD machine representation
- Flight Simulator:
 - Lucretia model
 - Upload ATF2 machine configuration (Floodland/EPICS)
 - Apply Flight Simulator modeling tools (S. Molloy's talk)
 - Translation chain: Lucretia → AML → SAD
 - AML → SAD via a "SADParser"

Codes: Lucretia (P. Tenenbaum) Accelerator Markup Language AML (D. Sagan)
SAD (K. Oide)





SAD representation

Actual translation includes:

- Beam line elements with offset and rotation errors
- Bend linear fringe fields
- Magnets multipoles

- Apertures and higher order multipoles to be included



Flight simulator panel

FLGui_trusted

Lucretia - Floodland **EXIT**

TRUSTED (SIM-MODE)

EPICS CA-Access Server

Simulation Settings

BPM Buffer Size: 1000

Floodland Memory Usage: 9.7 MB

Measured Update Rate: 0.8 Hz

HW Update / File Save Rates (Hz): 1.56 0.01

Lattice Save Options

None

Lucretia

Lucretia+AML

Lucretia+AML+SAD

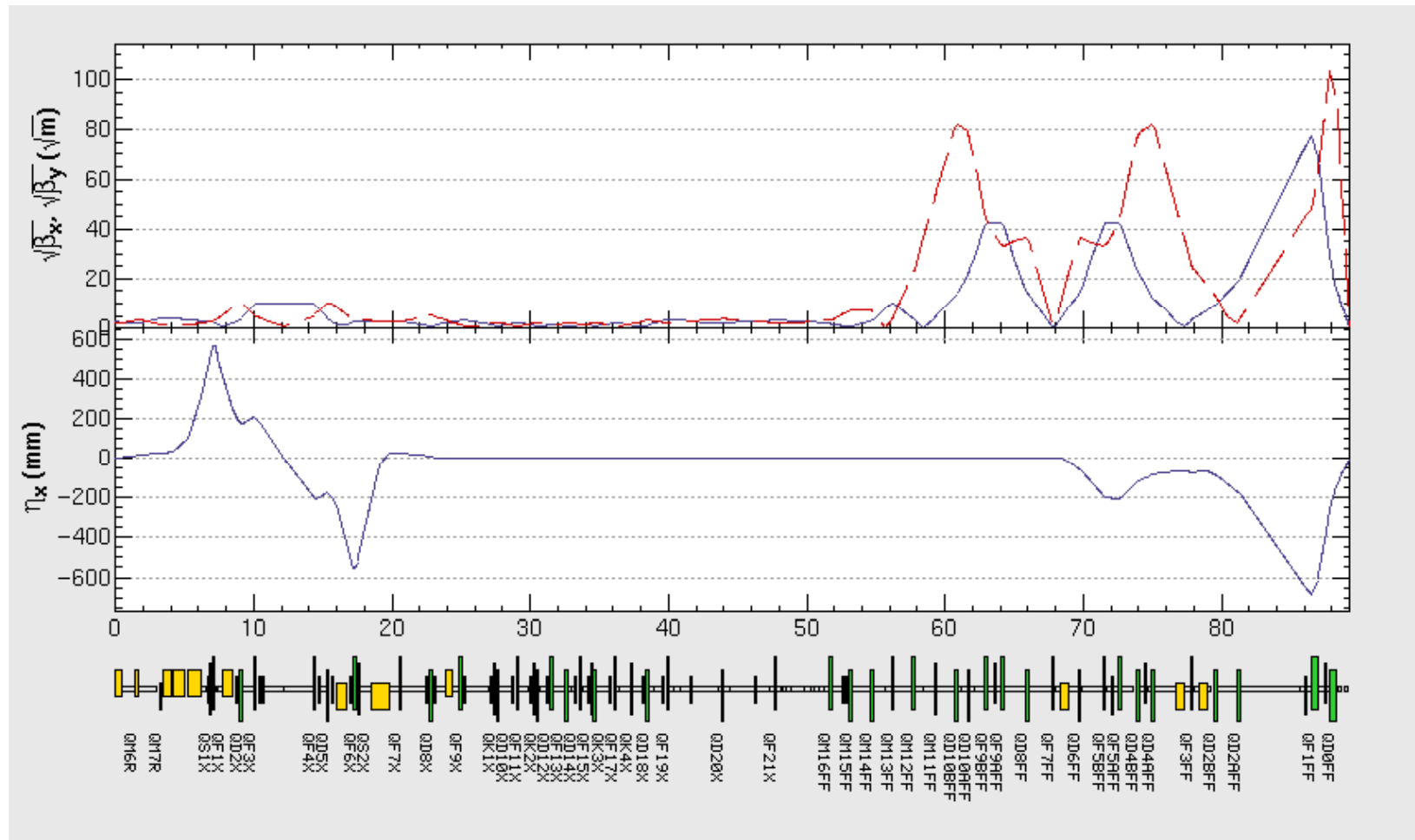
Auth List Apps Panel

SAD beamline file

```
MONI IEX = ();
BEND KEX1A = (e2 = 1 L = 0.500002 ANGLE = 0.005 F1 = 0.0381 FRINGE = 1 );
DRIFT L001 = (L = 0.923139 );
BEND QM6R = (k1 = -0.71174 L = 0.198749 ANGLE = 0.00462193 );
DRIFT L002A = (L = 1.39819 );
mark COLL = ();
DRIFT L002B = (L = 0.065003 );
MONI MB1X = ();
DRIFT L002C = (L = 0.0855505 );
BEND QM7R = (k1 = 0.40822 L = 0.0789113 ANGLE = -0.00917478 );
DRIFT L003 = (L = 0.150547 );
BEND BS1XA = (L = 0.6 ANGLE = 0.0280357 F1 = 0.096 FRINGE = 1 );
DRIFT L004 = (L = 0.2 );
BEND BS2XA = (L = 0.8 ANGLE = 0.0743434 F1 = 0.096 FRINGE = 1 );
DRIFT L005A = (L = 0.1 );
MONI MB2X = ();
DRIFT L005B = (L = 0.1 );
BEND BS3XA = (L = 1 ANGLE = 0.235022 F1 = 0.096 FRINGE = 1 );
DRIFT L006A = (L = 0.32 );
MONI OTR1X = ();
DRIFT L006B = (L = 0.186905 );
BEND ZV1X = (L = 0.1248 ROTATE = 90 DEG KO = -0 );
DRIFT L006C = (L = 0.008265 );
QUAD QS1X = (k1 = 0 L = 0.07867 ROTATE = 45 DEG );
LINE GIRDER1= (QS1X);
DRIFT L006D = (L = 0.08136 );
QUAD QF1X = (k1 = 1.07347 L = 0.19861 );
LINE GIRDER2= (QF1X L007A MQF1X);
DRIFT L007A = (L = 0.020695 );
```



Translation to SAD of ideal ATF2 Lucretia lattice



Obtained at IP $BX^*=4.00\text{mm}$, $BY^*=1.00\text{E-}4\text{m}$ (--> Perfect agreement with Lucretia model)



run.out - WordPad

File Edit View Insert Format Help

Courier New 10 Western B I U

| AX | BX | NX | EX | EPX | Element | Length | Value | s (m) | AY | BY | NY | EY | EPY | D |
|---------|---------|---------|---------|---------|---------|--------|-----------|-----------|---------|---------|---------|--------|--------|---|
| -814.78 | 5297.46 | 5.09092 | -.64219 | -.09877 | L226D | .03310 | .0331000 | 86.050775 | -438.85 | 2255.24 | 3.94985 | .00000 | .00000 | . |
| -818.93 | 5351.54 | 5.09092 | -.64546 | -.09877 | SF1FF | .10000 | -2.578000 | 86.083875 | -441.68 | 2284.39 | 3.94985 | .00000 | .00000 | . |
| -831.46 | 5516.58 | 5.09093 | -.65534 | -.09877 | L227 | .28750 | .2875000 | 86.183875 | -450.22 | 2373.58 | 3.94986 | .00000 | .00000 | . |
| -867.49 | 6005.03 | 5.09093 | -.68374 | -.09877 | QF1FF | .47500 | .7417880 | 86.471375 | -474.77 | 2639.52 | 3.94987 | .00000 | .00000 | . |
| 3108.24 | 4795.12 | 5.09095 | -.61098 | .39605 | L228A | .05254 | .0525440 | 86.946375 | -3352.7 | 4270.39 | 3.94990 | .00000 | .00000 | . |
| 3002.37 | 4474.04 | 5.09095 | -.59017 | .39605 | MQF1FF | .00000 | 0 | 86.998919 | -3491.0 | 4629.99 | 3.94990 | .00000 | .00000 | . |
| 3002.37 | 4474.04 | 5.09095 | -.59017 | .39605 | L228B | .41686 | .4168560 | 86.998919 | -3491.0 | 4629.99 | 3.94990 | .00000 | .00000 | . |
| 2162.49 | 2321.03 | 5.09097 | -.42508 | .39605 | MSDOFF | .00000 | 0 | 87.415775 | -4588.3 | 7997.93 | 3.94991 | .00000 | .00000 | . |
| 2162.49 | 2321.03 | 5.09097 | -.42508 | .39605 | L228C | .03310 | .0331000 | 87.415775 | -4588.3 | 7997.93 | 3.94991 | .00000 | .00000 | . |
| 2095.80 | 2180.08 | 5.09097 | -.41197 | .39605 | SDOFF | .10000 | 4.3118600 | 87.448875 | -4675.4 | 8304.57 | 3.94991 | .00000 | .00000 | . |
| 1894.33 | 1781.07 | 5.09098 | -.37237 | .39605 | L229 | .28750 | .2875000 | 87.548875 | -4938.6 | 9265.98 | 3.94991 | .00000 | .00000 | . |
| 1315.07 | 858.366 | 5.09102 | -.25850 | .39605 | QDOFF | .47500 | -1.363970 | 87.836375 | -5695.4 | 12323.3 | 3.94992 | .00000 | .00000 | . |
| 246.857 | 243.775 | 5.09120 | -.13776 | .13950 | L230A | .05254 | .0525440 | 88.311375 | 9879.45 | 9755.92 | 3.94992 | .00000 | .00000 | . |
| 233.722 | 218.524 | 5.09124 | -.13043 | .13950 | MQDOFF | .00000 | 0 | 88.363919 | 9353.77 | 8745.33 | 3.94992 | .00000 | .00000 | . |
| 233.722 | 218.524 | 5.09124 | -.13043 | .13950 | L230B | .32750 | .3275000 | 88.363919 | 9353.77 | 8745.33 | 3.94992 | .00000 | .00000 | . |
| 151.853 | 92.2481 | 5.09160 | -.08474 | .13950 | SWEEP | .00000 | 0 | 88.691419 | 6077.28 | 3691.66 | 3.94993 | .00000 | .00000 | . |
| 151.853 | 92.2481 | 5.09160 | -.08474 | .13950 | L230C | .18250 | .1825000 | 88.691419 | 6077.28 | 3691.66 | 3.94993 | .00000 | .00000 | . |
| 106.231 | 45.1477 | 5.09205 | -.05928 | .13950 | MBS2IP | .00000 | 0 | 88.873919 | 4251.45 | 1806.67 | 3.94995 | .00000 | .00000 | . |
| 106.231 | 45.1477 | 5.09205 | -.05928 | .13950 | L230D | .27500 | .2750000 | 88.873919 | 4251.45 | 1806.67 | 3.94995 | .00000 | .00000 | . |
| 37.4864 | 5.62533 | 5.09480 | -.02092 | .13950 | M1 2IP | .00000 | 0 | 89.148919 | 1500.21 | 224.961 | 3.95001 | .00000 | .00000 | . |
| 37.4864 | 5.62533 | 5.09480 | -.02092 | .13950 | L230E | .14996 | .1499560 | 89.148919 | 1500.21 | 224.961 | 3.95001 | .00000 | .00000 | . |
| 1.06E-4 | .00400 | 5.34054 | -7.3E-7 | .13950 | MBS1IP | .00000 | 0 | 89.298875 | -.03038 | 1.00E-4 | 4.20474 | .00000 | .00000 | . |
| 1.06E-4 | .00400 | 5.34054 | -7.3E-7 | .13950 | \$\$\$ | .00000 | 0 | 89.298875 | -.03038 | 1.00E-4 | 4.20474 | .00000 | .00000 | . |

In[5]:= Symplectic transfer matrix from LEX to MBS1IP

| | | | | |
|-----------|------------|------------|-----------|------------|
| .007437 | .136303 | .000000 | .000000 | -7.2732E-7 |
| -8.525484 | -21.789198 | .000000 | .000000 | .139503 |
| .000000 | .000000 | -.008676 | .017275 | .000000 |
| .000000 | .000000 | -85.865891 | 55.716512 | .000000 |

In[6]:= ;

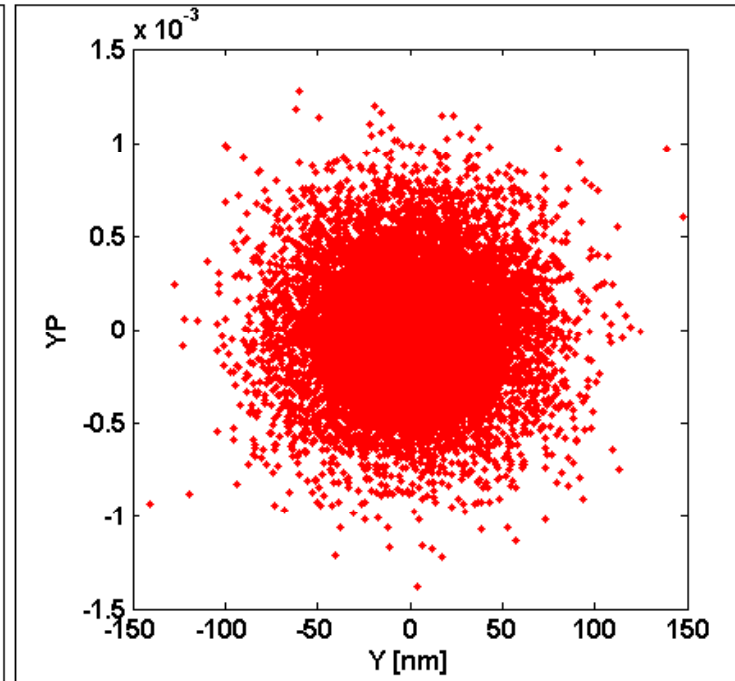
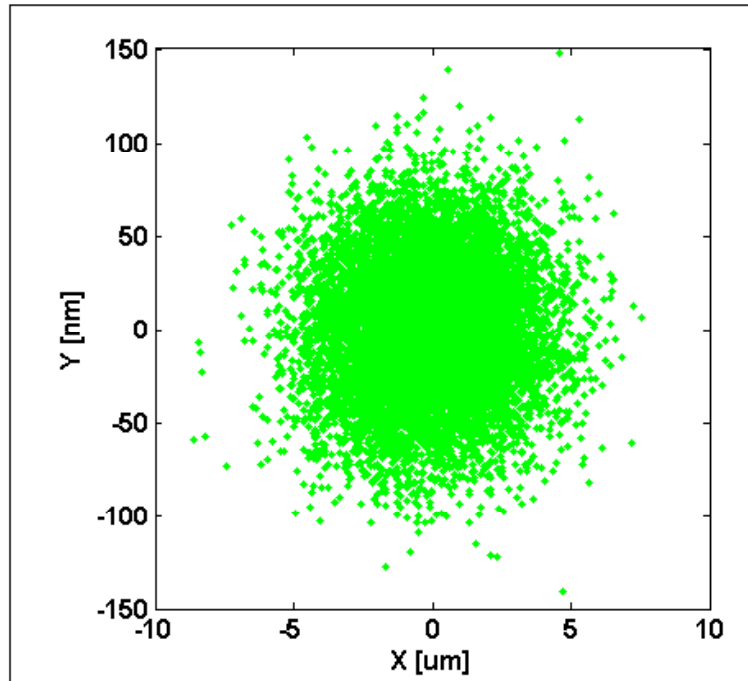
MOPT MBS1IP = ()

SAD Twiss at end of ATF2 beam line

For Help, press F1

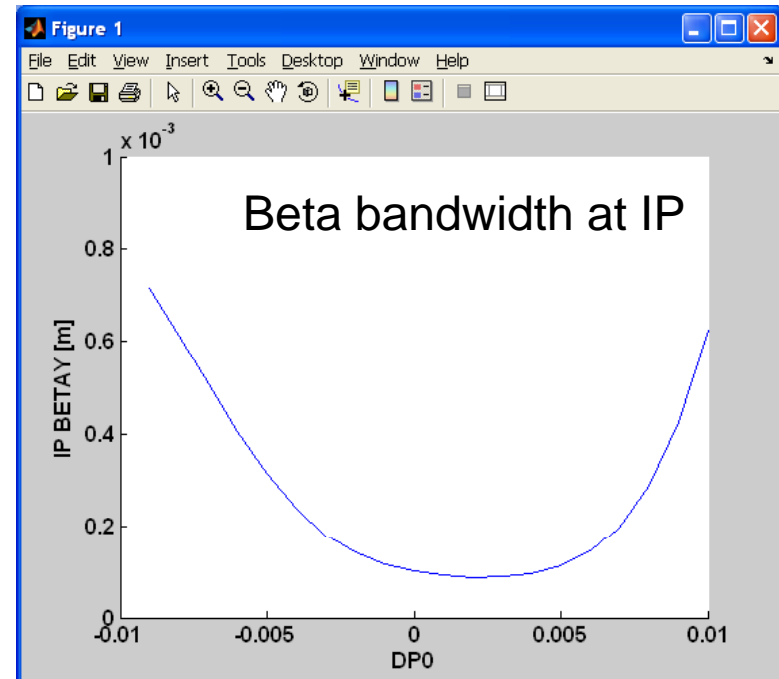


at IP



Tracking with SAD

$$\sigma_y^* = 34.8 \text{ nm}$$
$$\sigma_{y'}^* = 3.3 \text{E-}04$$
$$\sigma_x^* = 2 \text{ um}$$





Summary

- Link between software environments
- SAD representation of the machine available now also through Flight Simulator