



Envelope Tool



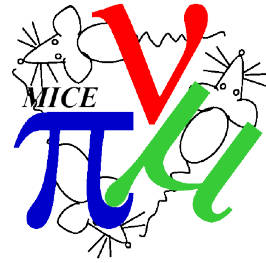
Chris Rogers,
ASTeC,
Rutherford Appleton Laboratory





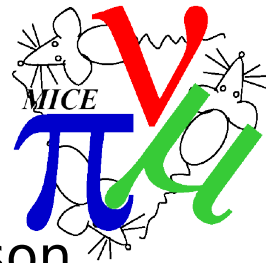
- Aim of Envelope Tool is to start to provide some framework for “online analysis”
 - Look at response of beam to changing magnet settings
 - At least open discussions of what one might want
- Attempt to provide some useful tool also for doing optics analysis
 - Support e.g. studies on what magnet settings to look at
- Some GUI backend work as well
 - GUI layout etc controlled from json configuration files
 - All managed in python
 - Wrapping ROOT QT stuff

GUI Backend



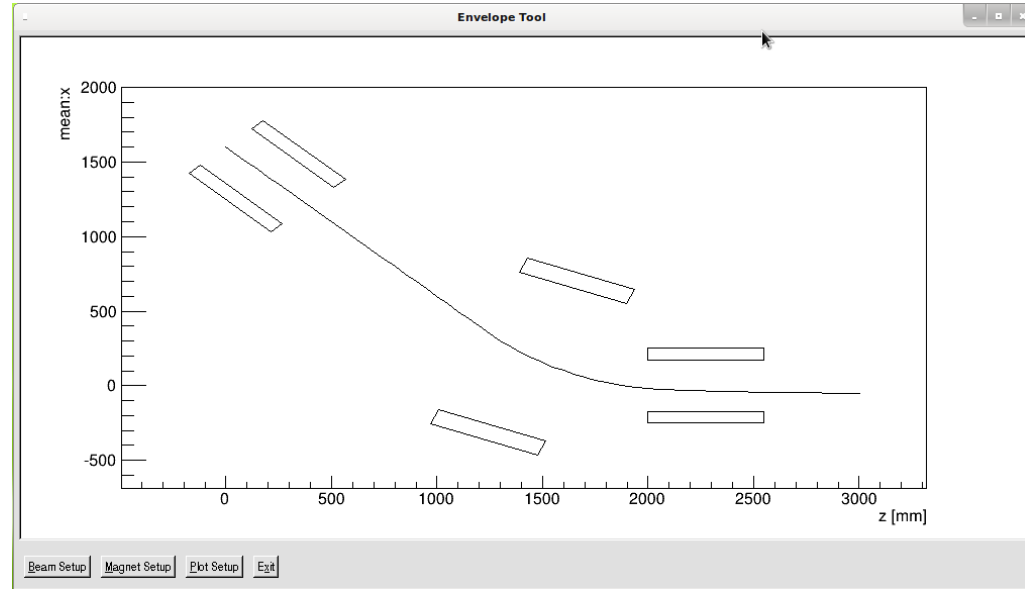
- New modules
 - src/common_py/gui
 - src/common_py/gui/window
 - src/common_py/gui/window.Window wraps ROOT.TGMainFrame
 - src/common_py/gui/window.Label wraps ROOT.TGLabel
 - src/common_py/gui/window.NamedTextEntry combination of ROOT TGLabel and ROOT TGTextEntry
 - src/common_py/gui/window GuiError exception class
- Json files describe layout of window
 - Typically window elements are nested set of objects
 - This is easily described by a dictionary object
 - Less cutting and pasting when building GUI windows
 - ROOT fiddles get handled once
 - e.g. TextEntry has to be disabled before window can be closed; this is done once
 - **name** names the element
 - **type** defines element type (button, drop down list, etc)
 - **layout** defines e.g. close packed, etc
 - Few other parameters specific to the **type**
 - Customizable **type** “special”

Example Config



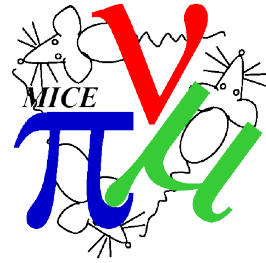
Example - bin/utilities/envelope_tool/share/main_frame.json

```
{
  "type": "main_frame",
  "name": "Envelope Tool",
  "children": [{
    "name": "main_canvas",
    "type": "canvas",
    "width": 1000,
    "height": 500
  }, {
    "type": "horizontal_frame",
    "children": [{
      "type": "button",
      "name": "&Beam Setup"
    }, {
      "type": "button",
      "name": "&Magnet Setup"
    }, {
      "type": "button",
      "name": "&Plot Setup"
    }, {
      "type": "button",
      "name": "E&xit"
    }
  ]
}]
}
```



- Setting out a GUI is probably less fiddly
 - A bit less control over “look and feel”
- Caller then has job to make logical connections between e.g. *this* button and *that* function

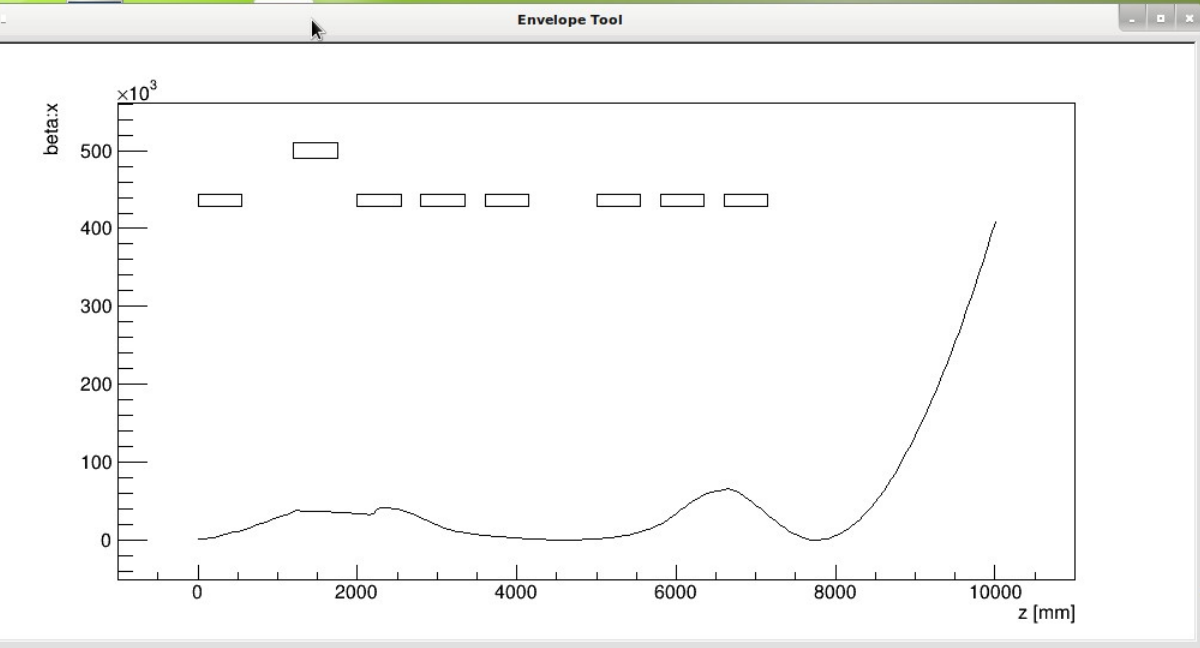
Usage



- After sourcing the environment, do:

```
$ python ${MAUS_ROOT_DIR}/bin/utilities/envelope_tool/envelope_tool.py \  
--configuration_file ${MAUS_ROOT_DIR}/bin/utilities/envelope_tool/share/pseudobeamline.py
```

- Some further documentation in the MAUS user guide



Beam Setup Magnet Setup Plot Setup Exit

Beam Setup

x: 1600.0 y: 0.0 z: 0.0
 px: -141.2662 py: 0.0 pz: 141.26625
 pid: -13

	t	Energy	x	Px	y	Py
t	5.288719	-0.0	0.0	0.0	0.0	0.0
Energy	-0.0	2110.849	0.0	0.0	0.0	0.0
x	0.0	0.0	528.8719	-0.0	0.0	0.0
Px	0.0	0.0	-0.0	21.10849	0.0	0.0
y	0.0	0.0	0.0	0.0	528.8719	-0.0
Py	0.0	0.0	0.0	0.0	-0.0	21.10849

Twiss Penn
 Okay Cancel

Twiss Setup

beta_x: 1000.0 alpha_x: 0.0 emittance_x: 1.0
 beta_y: 1000.0 alpha_y: 0.0 emittance_y: 1.0
 beta_l: 10.0 alpha_l: 0.0 emittance_l: 1.0
 disp_x: 0.0 disp_prime_x: 0.0 disp_y: 0.0 disp_prime_y: 0.0

Okay Cancel

Plot Setup

beta x
 Plot Apertures
 Okay Cancel

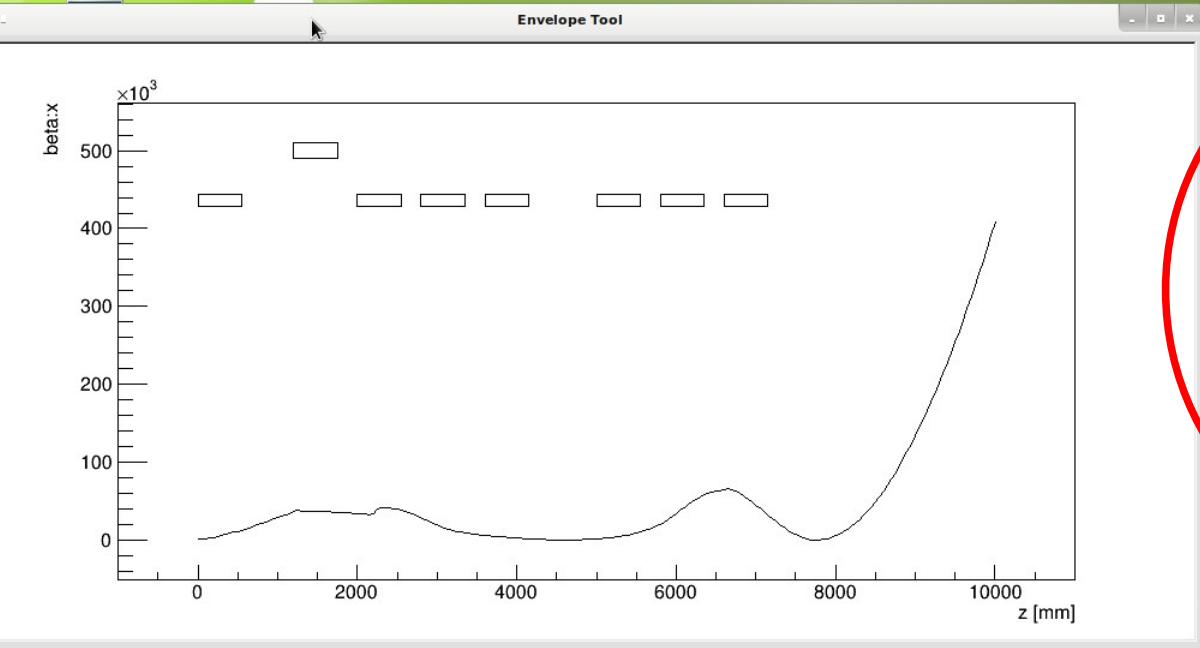
Magnet Setup

Q1: -1.0
 D2: -0.55
 Q2: 1.0
 Q3: -1.0
 Q4: 1.0
 Q5: -1.0
 Q6: 1.0
 Q6: 1.0

Okay Cancel

STFC_Project Framework.pdf
 IMC-P57-13_isis-running-schedule_2013-15_at06aug13.xlsx

Front_End_Management



Beam Setup Magnet Setup Plot Setup Exit

Beam Setup

1600.0 y 0.0 z 0.0
 px -141.2662 py 0.0 pz 141.26625
 pid -13

	t	Energy	x	Px	y	Py
t	5.288719	-0.0	0.0	0.0	0.0	0.0
Energy	-0.0	2110.849	0.0	0.0	0.0	0.0
x	0.0	0.0	528.8719	-0.0	0.0	0.0
Px	0.0	0.0	-0.0	21.10849	0.0	0.0
y	0.0	0.0	0.0	0.0	528.8719	-0.0
Py	0.0	0.0	0.0	0.0	-0.0	21.10849

Twiss Setup

beta_x	1000.0	alpha_x	0.0	emittance_x	1.0
beta_y	1000.0	alpha_y	0.0	emittance_y	1.0
beta_l	10.0	alpha_l	0.0	emittance_l	1.0
disp_x	0.0	disp_prime_x	0.0	disp_y	0.0
				disp_prime_y	0.0

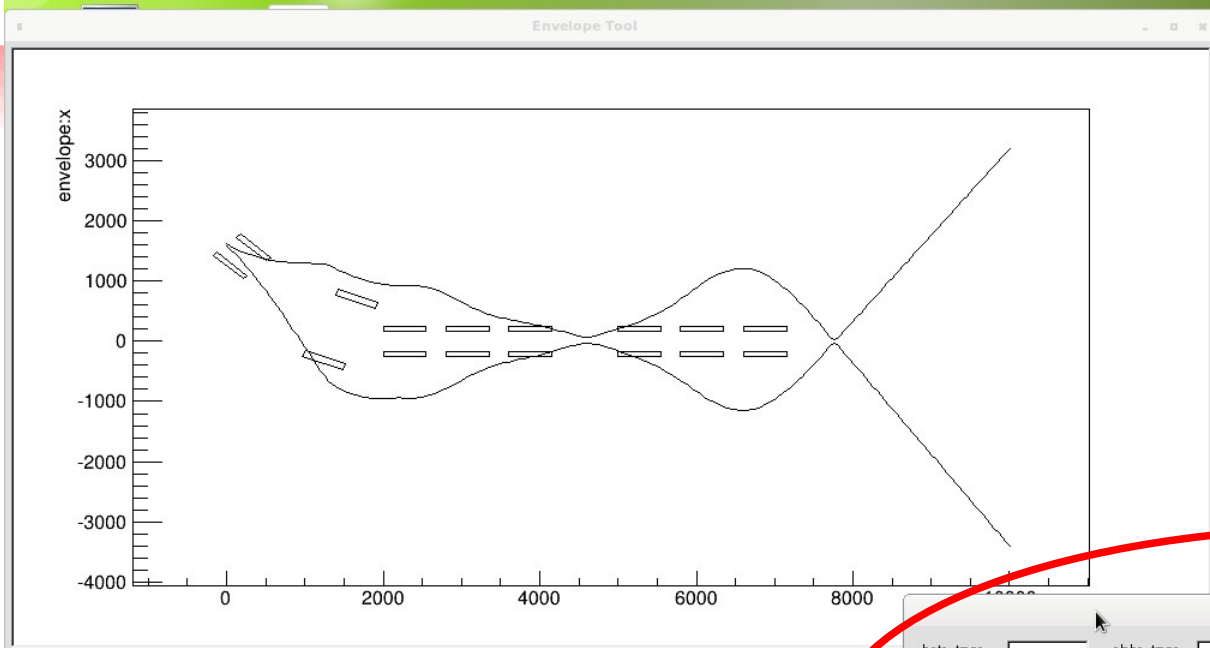
Plot Setup

beta x

Plot Apertures

Magnet Setup

Q1 -1.0
 D2 -0.55
 Q2 1.0
 Q3 -1.0
 Q4 1.0
 Q5 -1.0
 Q6 1.0
 Q6 1.0



Beam Setup

x: 1600.0 y: 0.0 z: 0.0
 px: -141.2662 py: 0.0 pz: 141.26625
 pid: -13

t	Energy	x	Px	y	Py
5.288719	-0.0	0.0	0.0	0.0	0.0
Energy	-0.0	2110.849	0.0	0.0	0.0
x	0.0	0.0	528.8719	-0.0	0.0
Px	0.0	0.0	-0.0	21.10849	0.0
y	0.0	0.0	0.0	0.0	528.8719
Py	0.0	0.0	0.0	0.0	-0.0
					21.10849

Twiss Penn
 Okay Cancel

Penn Setup

beta_trans: 1000.0 alpha_trans: 0.0 emittance_tr: 1.0 B0: 0.0 Lc: 0.0
 beta_l: 10.0 alpha_l: 0.0 emittance_l: 1.0
 disp_x: 0.0 disp_prime_x: 0.0 disp_y: 0.0 disp_prime_y: 0.0

Get B0 Constant Beta
 Okay Cancel

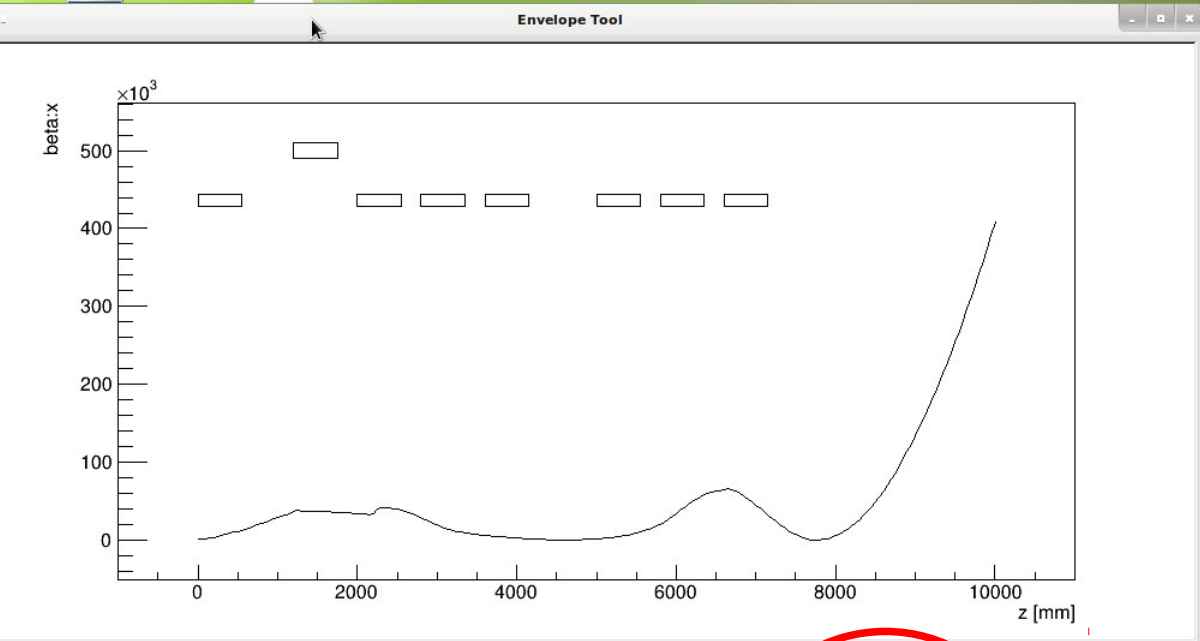
Magnet Setup

Q1: -1.0
 D2: -0.55
 Q2: 1.0
 Q3: -1.0
 Q4: 1.0
 Q5: -1.0
 Q6: 1.0
 Q6: 1.0

Okay Cancel

Plot Setup

envelope x
 Plot Apertures
 Okay Cancel



Beam Setup

x: 1600.0 y: 0.0 z: 0.0
 px: -141.2662 py: 0.0 pz: 141.26625
 pid: -13

	t	Energy	x	Px	y	Py
t	5.288719	-0.0	0.0	0.0	0.0	0.0
Energy	-0.0	2110.849	0.0	0.0	0.0	0.0
x	0.0	0.0	528.8719	-0.0	0.0	0.0
Px	0.0	0.0	-0.0	21.10849	0.0	0.0
y	0.0	0.0	0.0	0.0	528.8719	-0.0
Py	0.0	0.0	0.0	0.0	-0.0	21.10849

Twiss Penn
 Okay Cancel

Beam Setup Magnet Setup Plot Setup Exit

Twiss Setup

beta_x: 1000.0 alpha_x: 0.0 emittance_x: 1.0
 beta_y: 1000.0 alpha_y: 0.0 emittance_y: 1.0
 beta_l: 10.0 alpha_l: 0.0 emittance_l: 1.0
 disp_x: 0.0 disp_prime_x: 0.0 disp_y: 0.0 disp_prime_y: 0.0

Okay Cancel

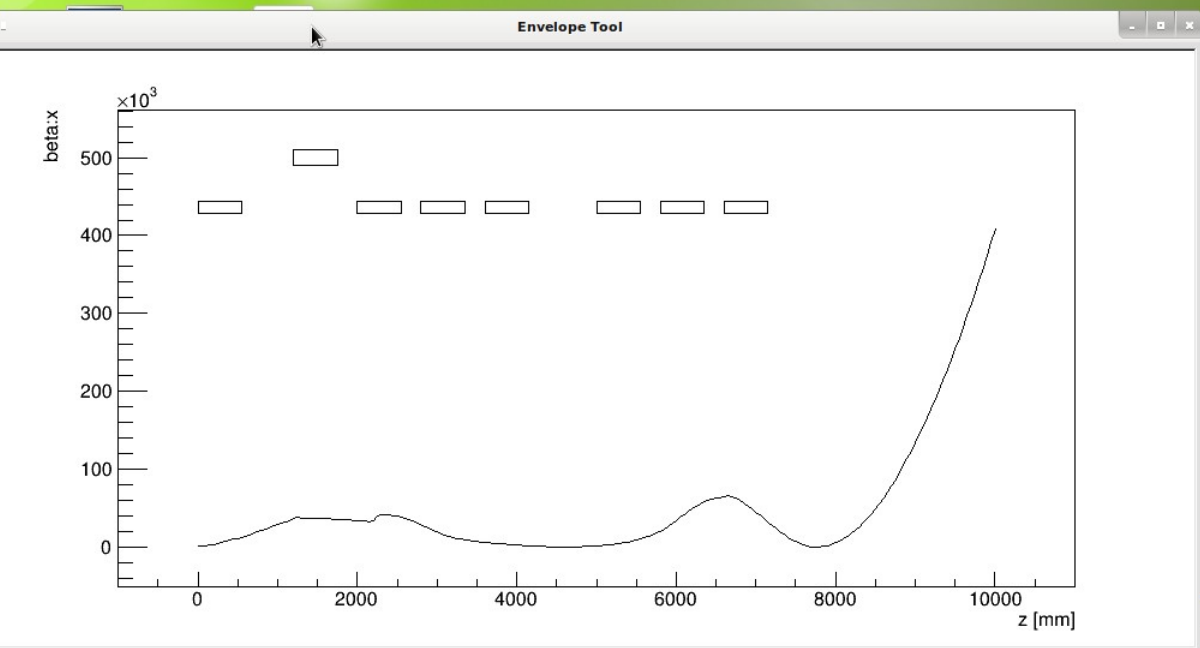
Plot Setup

beta x
 Plot Apertures
 Okay Cancel

Magnet Setup

Q1: -1.0
 D2: -0.55
 Q2: 1.0
 Q3: -1.0
 Q4: 1.0
 Q5: -1.0
 Q6: 1.0
 Q6: 1.0

Okay Cancel



Beam Setup

x: 1600.0 y: 0.0 z: 0.0
 px: -141.2662 py: 0.0 pz: 141.26625
 pid: -13

	t	Energy	x	Px	y	Py
t	5.288719	-0.0	0.0	0.0	0.0	0.0
Energy	-0.0	2110.849	0.0	0.0	0.0	0.0
x	0.0	0.0	528.8719	-0.0	0.0	0.0
Px	0.0	0.0	-0.0	21.10849	0.0	0.0
y	0.0	0.0	0.0	0.0	528.8719	-0.0
Py	0.0	0.0	0.0	0.0	-0.0	21.10849

Twiss Penn
 Okay Cancel

Beam Setup Magnet Setup Plot Setup Exit

Twiss Setup

beta_x: 1000.0 alpha_x: 0.0 emittance_x: 1.0
 beta_y: 1000.0 alpha_y: 0.0 emittance_y: 1.0
 beta_l: 10.0 alpha_l: 0.0 emittance_l: 1.0
 disp_x: 0.0 disp_prime_x: 0.0 disp_y: 0.0 disp_prime_y: 0.0

Okay Cancel

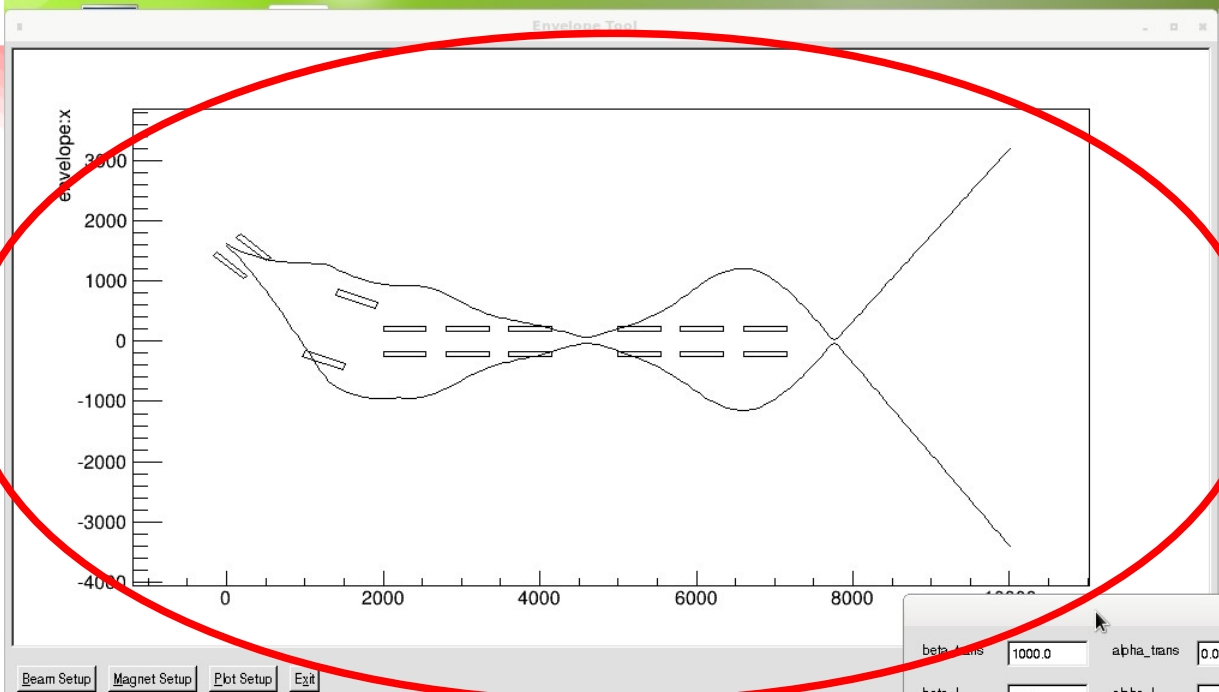
Magnet Setup

Q1: -1.0
 D2: -0.55
 Q2: 1.0
 Q3: -1.0
 Q4: 1.0
 Q5: -1.0
 Q6: 1.0
 Q6: 1.0

Okay Cancel

Plot Setup

beta x
 Plot Apertures
 Okay Cancel



Beam Setup

x: 1600.0 y: 0.0 z: 0.0
 px: -141.2662 py: 0.0 pz: 141.26625
 pid: -13

	t	Energy	x	Px	y	Py
t	5.288719	-0.0	0.0	0.0	0.0	0.0
Energy	-0.0	2110.849	0.0	0.0	0.0	0.0
x	0.0	0.0	528.8719	-0.0	0.0	0.0
Px	0.0	0.0	-0.0	21.10849	0.0	0.0
y	0.0	0.0	0.0	0.0	528.8719	-0.0
Py	0.0	0.0	0.0	0.0	-0.0	21.10849

Penn Setup

beta_trans: 1000.0 alpha_trans: 0.0 emittance_tr: 1.0 B0: 0.0 Lc: 0.0
 beta_l: 10.0 alpha_l: 0.0 emittance_l: 1.0
 disp_x: 0.0 disp_prime_x: 0.0 disp_y: 0.0 disp_prime_y: 0.0

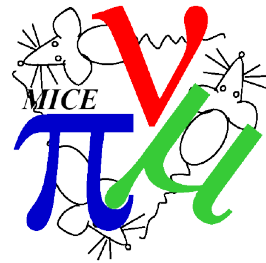
Magnet Setup

Q1: -1.0
 D2: -0.55
 Q2: 1.0
 Q3: -1.0
 Q4: 1.0
 Q5: -1.0
 Q6: 1.0
 Q6: 1.0

Plot Setup

envelope x
 Plot Apertures

Extensions



- Needs a “reasonable geometry”
 - Would like to load in “reasonable time”
- Get currents from CDB for e.g. this run
- Plot beam cross sections
 - i.e. x-px ellipse for a given z-position
- Interface to (online, pseudo online) global reconstruction output
 - Use global recon reducer?
- Scattering in materials → emittance growth
 - Energy loss is implemented
- Materials in the beamline → event display
- Tracking backwards along the beamline
- Probably some more stuff