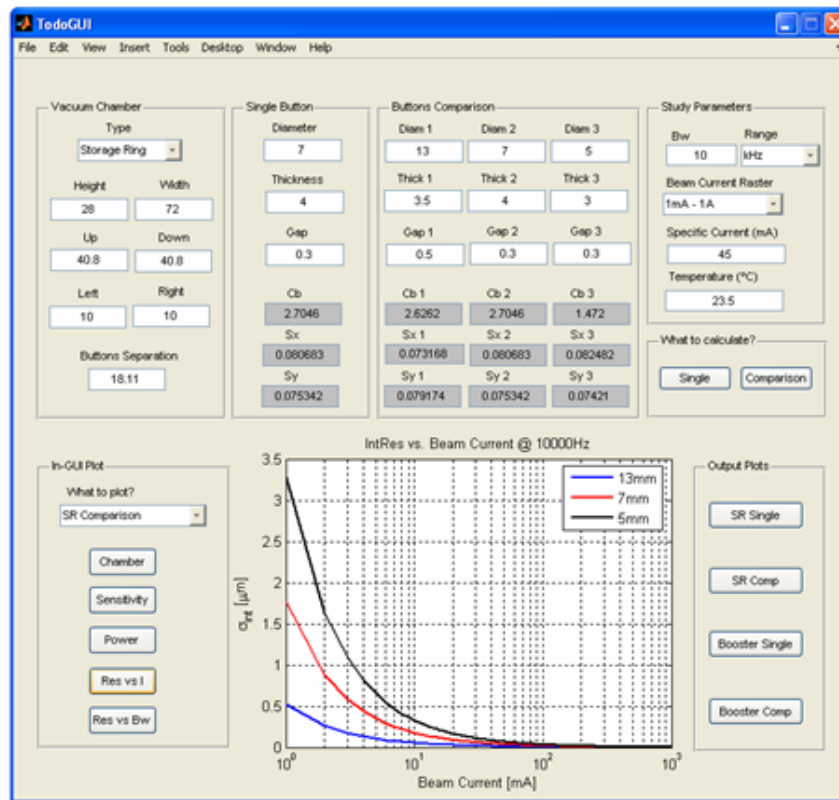


BPMs GUI

This Matlab GUI calculates BPMs parameters like sensitivity, induced power on the pickups and intrinsic resolution (click to enlarge).



It is based on G. Rehm (Diamond) code and can be used for round (Booster type) and octagonal (Storage Ring type) BPM chambers analysis.

Utilities

Following calculations can be performed, for a defined button geometry (single) or for 3 different ones (comparison):

- Buttons positioning on the chamber
- Non-Linear BPM response
- Buttons capacitance calculation
- BPM sensitivity
- Induced power on a 50 ohms load
- BPM Intrinsic Resolution vs. Beam Current
- BPM Intrinsic Resolution vs. Measurement Bandwidth

Downloads

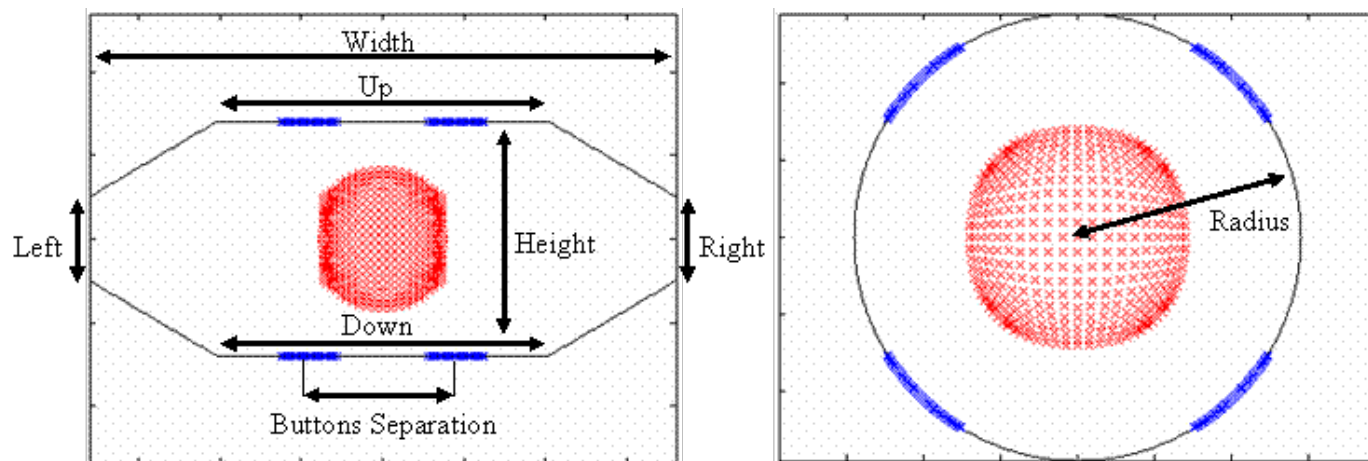
Matlab files needed for running the GUI:

- TodoGUI3 (.fig file of the GUI)
- Additional M-files (.zip file)
- Index of M-Files (.txt file)

How does it work?

1 - Vacuum chamber definition

First thing to be done is the selection of the "Vacuum Chamber" type. Storage ring stands for octagonal chambers and booster for the round ones. Storage ring octagonal chambers are defined by the following dimensions:



Booster vacuum chambers are just defined by their duct inner radius and the buttons are placed in a 45° symmetry from axis. Vacuum chamber parameters are set with the following edit controls in the GUI.

Vacuum Chamber	
Type Storage Ring	
Height 28	Width 72
Up 40.8	Down 40.8
Left 10	Right 10
Buttons Separation 18.11	

Vacuum Chamber
Type Booster
Chamber Radius 14.5

2 - Buttons geometry

Next step is the definition of the buttons geometry. Here we can either define a "Single Button" geometry to perform a calculation based on this button or define up to 3 different geometries to perform a "Buttons Comparison" study.

Single Button		Buttons Comparison		
Diameter	<input type="text" value="7"/>	Diam 1	Diam 2	Diam 3
	<input type="text" value="7"/>	<input type="text" value="10"/>	<input type="text" value="7"/>	<input type="text" value="4"/>
Thickness	<input type="text" value="4"/>	Thick 1	Thick 2	Thick 3
	<input type="text" value="4"/>	<input type="text" value="4"/>	<input type="text" value="4"/>	<input type="text" value="4"/>
Gap	<input type="text" value="0.3"/>	Gap 1	Gap 2	Gap 3
	<input type="text" value="0.3"/>	<input type="text" value="0.3"/>	<input type="text" value="0.3"/>	<input type="text" value="0.3"/>
Cb	<input type="text" value="2.7046"/>	Cb 1	Cb 2	Cb 3
	<input type="text" value="2.7046"/>	<input type="text" value="3.8172"/>	<input type="text" value="2.7046"/>	<input type="text" value="1.5915"/>
Sx	<input type="text" value="0.095277"/>	Sx 1	Sx 2	Sx 3
	<input type="text" value="0.095277"/>	<input type="text" value="0.077998"/>	<input type="text" value="0.080683"/>	<input type="text" value="0.08316"/>
Sy	<input type="text" value="0.095693"/>	Sy 1	Sy 2	Sy 3
	<input type="text" value="0.095693"/>	<input type="text" value="0.076645"/>	<input type="text" value="0.075342"/>	<input type="text" value="0.073767"/>

Buttons are defined as:

- **Diameter:** electrode diameter [mm]
- **Thickness:** electrode thickness [mm]
- **Gap:** gap between the electrode edge and the vacuum chamber [mm]

Once the calculations are performed, output data like button capacitance (Cb in pF) and BPM sensitivities (Sx and Sy in mm-1) are shown at the bottom.

3 - Study parameters

These parameters refer to the specific environment we want to emulate in our calculations.

Study Parameters	
Bw	Range
<input type="text" value="4"/>	<input type="text" value="kHz"/>
Beam Current Raster	
<input type="text" value="1mA - 1A"/>	
Specific Current (mA)	
<input type="text" value="100"/>	
Temperature (°C)	
<input type="text" value="23.5"/>	
What to calculate?	
<input type="button" value="Single"/>	<input type="button" value="Comparison"/>

- Combination of **Bw** and **Range** will determine the "Measurement Bandwidth" setting for the resolution study

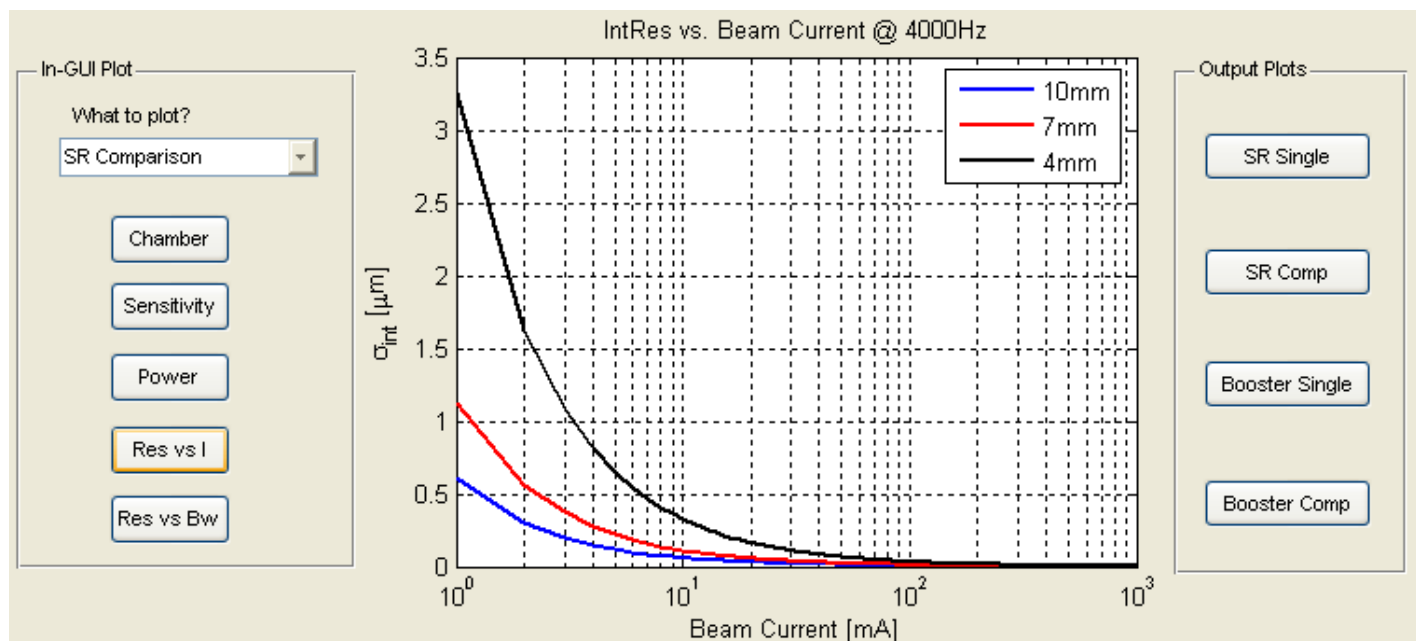
- **Beam Current Raster** defines the min and max beam current thresholds (usually lower currents for boosters and higher for storage rings)
- **Specific Current** sets the beam current value at which the Resolution vs. Measurement Bw study is done
- The temperature defined for all calculations is set in the **Temperature** control

After setting all the vacuum chamber dimensions, buttons geometry and study parameters, we just launch the desired calculation: **Single** or **Comparison** (and wait for a few seconds 🤖🕒)

4 - Output Information

Calculation results are presented in plots. Two different kinds of plots can be generated: **In-GUI** (shows each one of the studies in the graph located in the GUI) and **Output Plots**

(generates figures including all results).



For the **In-GUI** plots, first we have to select the study we want to show from the **What to plot?** combo-box menu (SR Single, SR Comparison, Booster Single or Booster Comparison). Then just pushing on the appropriate button, the desired calculation results are shown:

- **Chamber** creates a drawing of the vacuum chamber, including the pickups and the rastered beam
- **Sensitivity** shows the Delta-over-Sum curves that define the BPMs horizontal and vertical sensitivities
- **Power** shows the detected power signal on a 50ohms load (e.g. electronics) according to the beam current level
- **Res vs I** draws the curves for the calculated Intrinsic Resolution vs. Beam Current (@ the define Measurement Bw and Temperature)
- **Res vs Bw** draws the curves for the calculated Intrinsic Resolution vs. Measurement Bw (@ the Specific Current and Temperature)

Regarding the **Output Plots** buttons, they create an independent window figure showing 4 plots with all the study results in each case.

More information:

- DIPACo7-MATLAB CODE FOR BPM BUTTON GEOMETRY COMPUTATION (Paper, A. Olmos)
- DIPACo7-MATLAB CODE FOR BPM BUTTON GEOMETRY COMPUTATION (Poster, A. Olmos)



Any comment ?

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