

Portmap Analyzer V3.0

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1. Load port map

The program can load a jpg, or png image. The data accuracy will depend on the pixs/mm resolution of the image.

2. Enter engine data

Use a positive deck height if the piston is below the top of the cylinder at TDC.

The bore diameter is used for calculating the horizontal resolution of the portmap image, so it should not be changed after the horizontal pixels/mm have been calculated see below. All other values can be changed at any time.



3. Rotate image

If the scanned portmap is not horizontal, you can turn on an alignment cursor to help choose the correct rotation angle. The portmap can only be rotated before any ports have been traced.

To rotate the portmap, after any ports have been traced, you must first erase all traces using the 'Clear Traces' button.

4. Trace ports

The 'Trace' button opens a keypad window with port names. In this case the main exhaust port is about to be traced, so the 'MainExh' button is pressed. Notice the small black box to the right of the 'Delete Trace' button. This is a color box that shows the color of the pixel under the mouse. As you move the mouse on the exhaust port outline, the color of this box changes. To start a trace, move the mouse till the box color changes to the color of the port outline. In this case the port outline is black, so we want to click on the outline when the color box is as dark as possible. Best places to start the trace is on the top, or bottom

of a port.

Portmap data	units	Exhaust	Transfer	Blowdown
mean areas	cm ²	0.00	0.00	0.00
angle areas	deg-cm ² /cm ³	0.00	0.00	0.00
time areas @ 12.5K	sec-mm ² /cm ³	0.000000	0.000000	0.000000
BMEP(Blair)	PSI	0.00		
power(BMEP)	HP	0.0		

1. Load jpg or png portmap
2. Enter engine parameters

Deck 0.7mm
Intake ports have stock width

22.45mm

36.7mm
70% Bore

AuxExhLeft OFF LeftExh OFF MainExh OFF RightExh OFF AuxExhRight OFF
AuxTxLeft OFF MainTxLeft OFF MainTxRight OFF AuxTxRight OFF
AuxBoostLeft OFF LeftBoost OFF MainBoost OFF RightBoost OFF AuxBoostRight OFF

TRACE

Before starting the trace, the program will prompt you for the port distance to the top of the barrel. You can type in the distance or, if the same height has been used on another port, select the height from the 'Saved port heights' drop down control.

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angle areas	deg-cm ² /cm ³	0.00	0.00	0.00
time areas @ 12.5K	sec-mm ² /cm ³	0.000000	0.000000	0.000000
BMEP(Blair)	PSI	0.00		
power(BMEP)	HP	0.0		

1. Load jpg or png portmap
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AuxExhLeft OFF LeftExh OFF MainExh ON RightExh OFF AuxExhRight OFF
AuxTxLeft OFF MainTxLeft OFF MainTxRight OFF AuxTxRight OFF
AuxBoostLeft OFF LeftBoost OFF MainBoost OFF RightBoost OFF AuxBoostRight OFF

Enter port height to top of barrel

Saved port heights

22.45 OK

TRACE

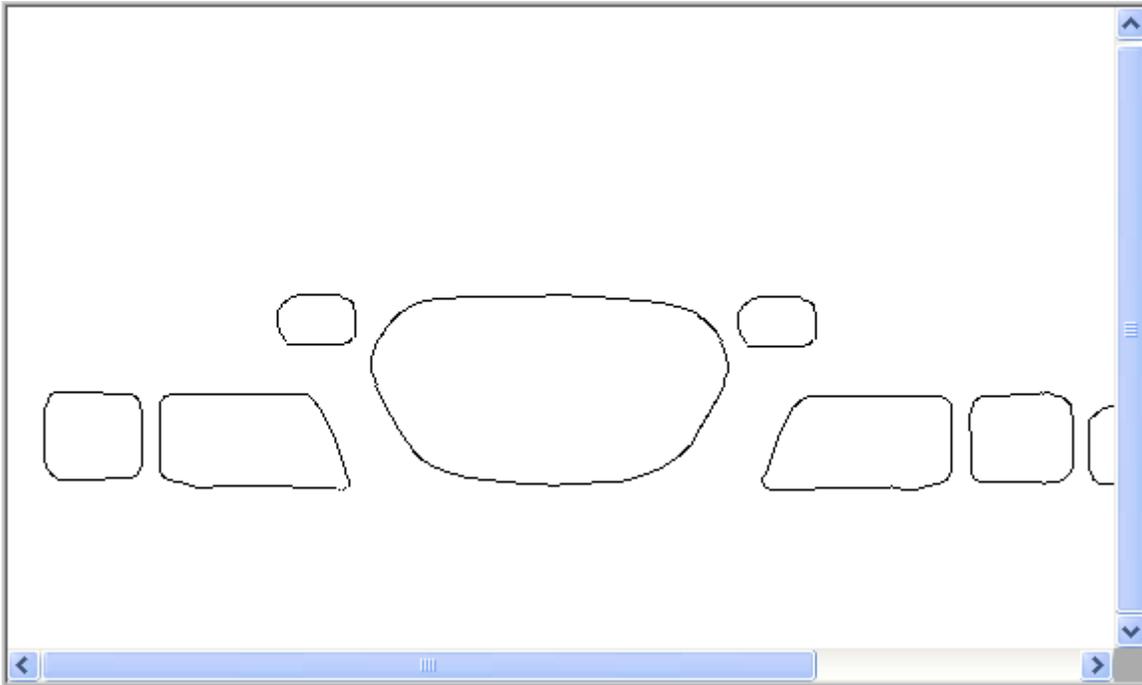
If the trace wanders off the port outline, try darkening that section. If it wanders off on a corner, try rounding the corner off slightly, or thicken the outline by adding a few dark pixels on the inside of the corner.

If at any time you need to erase a trace, for example if you made a mistake in naming

a port, or the program traced incorrectly, just press the button with the same name as the port you want to erase, and hit the 'Delete Trace' button.

5. Check traces

You can check the program's traces from menu->Traces->View traces.

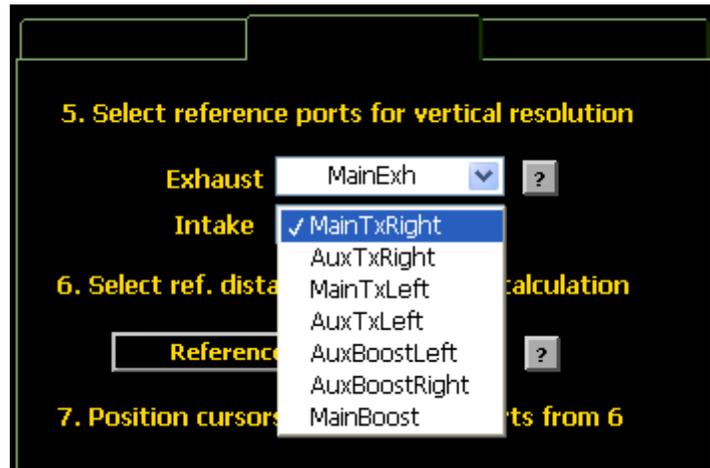


6. Reference distances

Once the ports have been traced, the program knows the pixel location of the port outlines, and the distance of each port from the top of the barrel. It must now convert the port's pixel location to an absolute position in mm. To do this it needs to know the vertical and horizontal resolution, in pixels/mm.

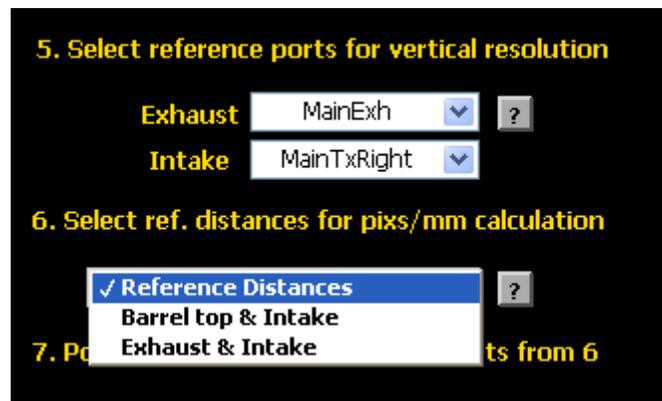
To calculate vertical pixs/mm you need to select 2 known vertical distances. You have the option of using either one intake port roof, and one exhaust port roof, or, one intake port roof and the top of the barrel. Note that the distances from the port roofs to top of barrel are known, because they were entered when tracing the ports.

In the figure below you can see two drop down controls: one for exhaust, with a list of all exhaust ports that have been traced, and one for intake, with a list of all traced transfer and boost ports. Select the exhaust and intake ports whose distances to top of barrel you would like to use for calculating pixs/mm. If you are going to use an intake port and top of barrel, you do not need to select an exhaust port.

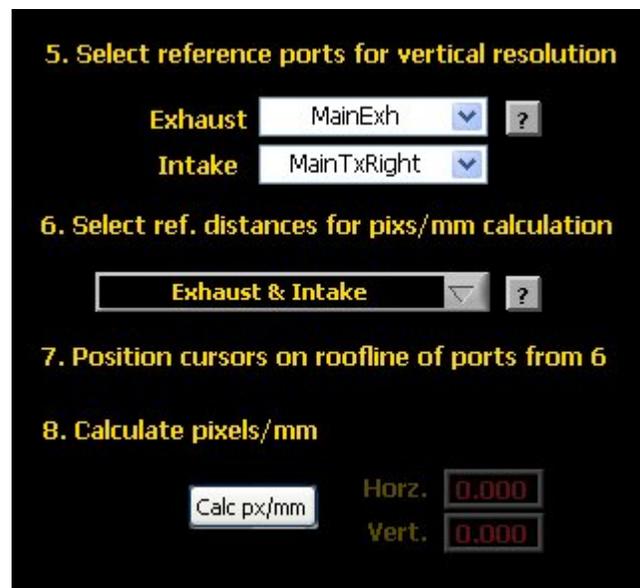


7. Reference cursors

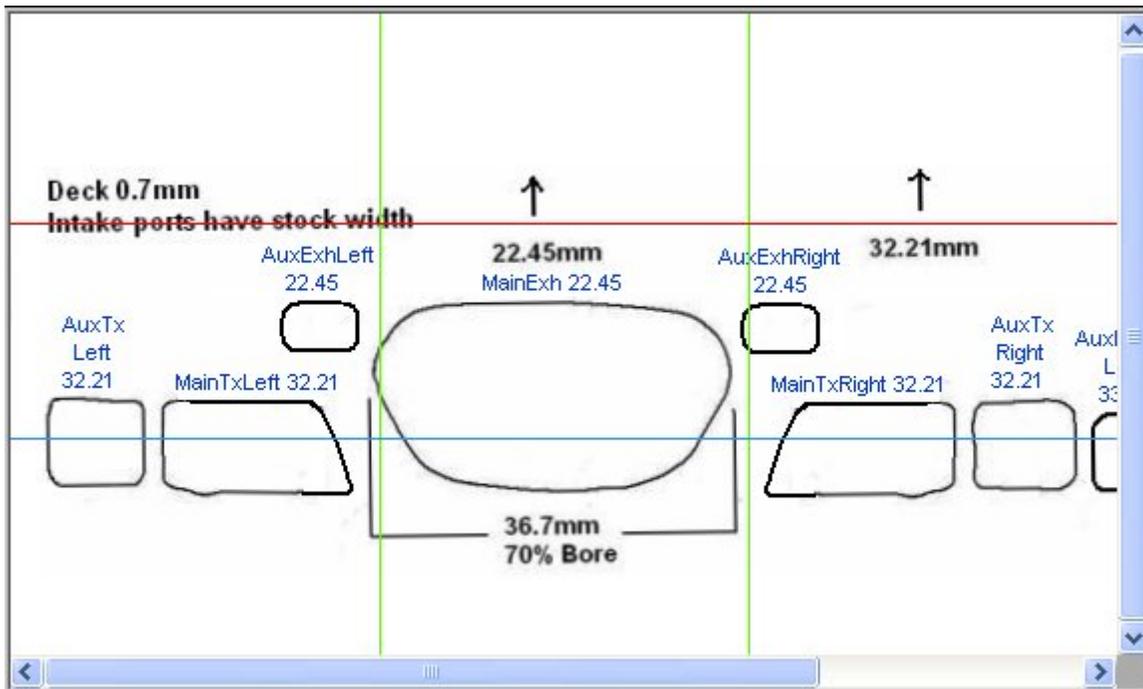
Now you tell the program which type of measurement will be used for calculating vertical resolution. Select intake and exhaust heights, or intake height and barrel top, from the ref distances drop down control. In this case we will use exhaust and intake distances, using the ports that were selected above: main exhaust, and right main transfer.



The panel should now look like the figure below, with the "Calc px/mm" button enabled, ready for you to position the image cursors.

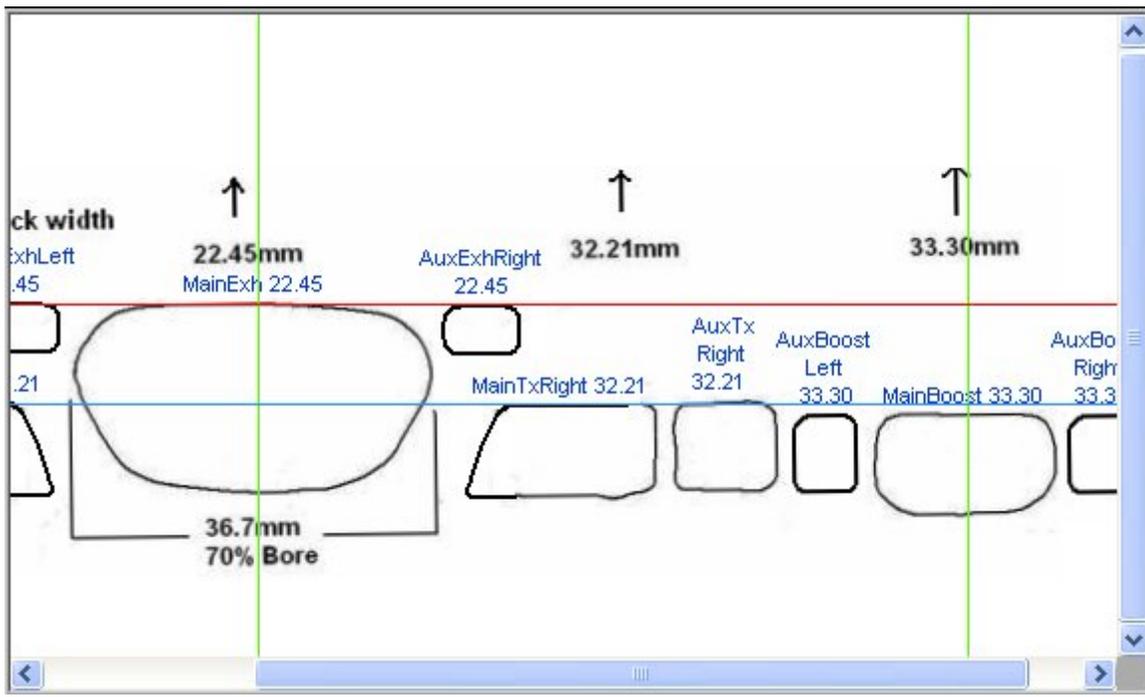


The portmap image is shown below with the reference cursors. The port names have been turned on (menu->image text->show port names and heights) to make sure the cursors will be set on the correct ports.



There are two horizontal cursors. The red cursor is for the exhaust, and will be positioned on the top of the main exhaust. The blue cursor is for the intake, and will be positioned on the right main transfer. The cursors must be positioned on the ports that were selected above (step 5.). In this case the main and aux transfers are at the same height, so the intake cursor could be placed on either one, as long as the heights are the same.

The vertical green cursors are used to set the reference horizontal distance. This distance is always the bore size. One is set on the exhaust center, the other on the boost port center. Note that if you change the engine's bore size, you must recalculate pixs/mm.



After positioning the cursors and hitting the Calc px/mm button, the resolution displays will light up showing the calculated values:

5. Select reference ports for vertical resolution

Exhaust: MainExh

Intake: MainTxRight

6. Select ref. distances for pixs/mm calculation

Reference Distances

7. Position cursors on roofline of ports from 6

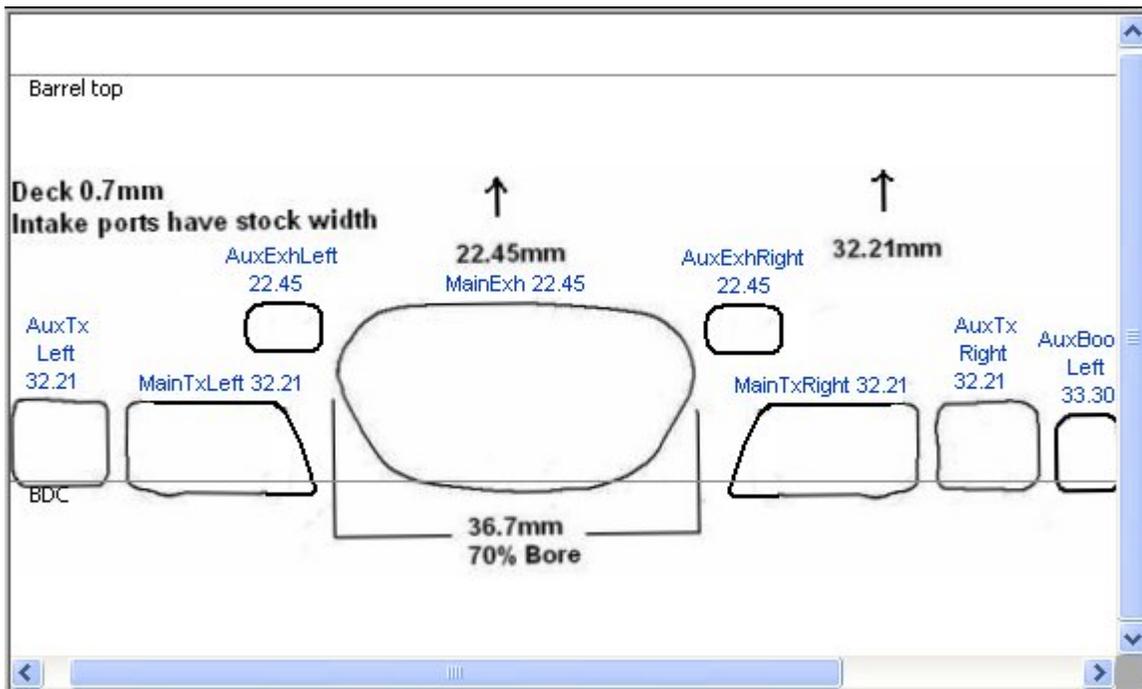
8. Calculate pixels/mm

Calc px/mm

Horz. 4.822

Vert. 5.123

The portmap image should look like this, with correctly positioned barrel top, and BDC cursors:



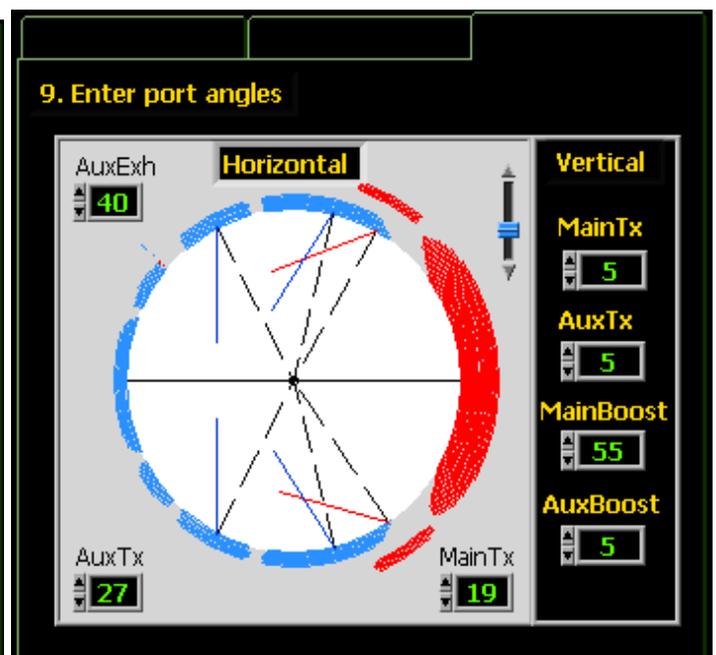
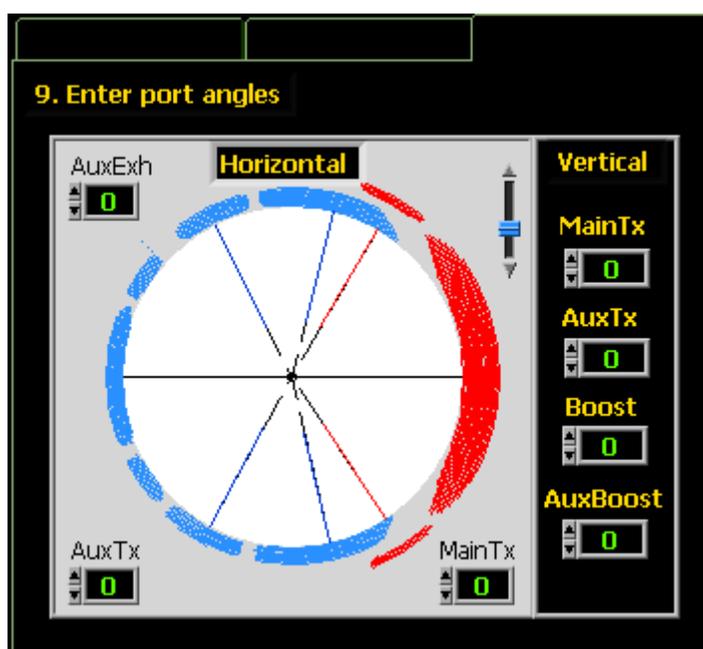
8. Port angles

Port angles are referenced to a line between port center, and center of bore.

The last tab shows a picture of the bore, with controls to set the port angles.

On first opening, after setting pixs/mm, the image will need rotating to the position shown below, with exhaust on the right, and boost on the left. Use the slider, with knob, to rotate the image.

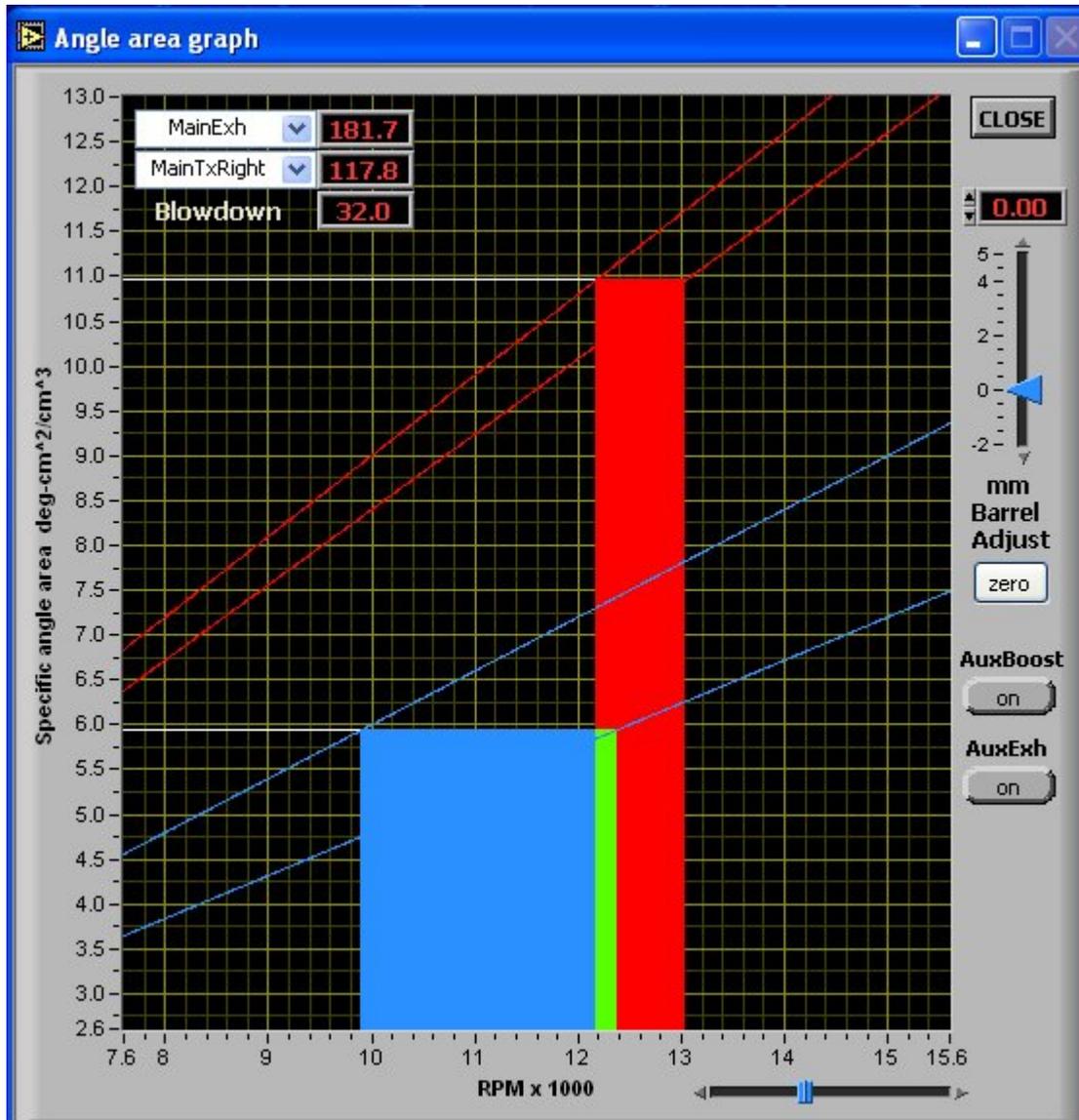
You can change the angles by clicking on the increment/decrement tabs, to the left side of the controls. You can also type a value directly into the controls, but it may not register till you mouse click on the main portmap image.



10. Angle area graph

Open the angle area graph from menu->Tools->Time-Angle area graph.

The angle area graph shows the transfers (blue) and exhaust (red) rpm ranges, based on the angle areas from the data table. If you traced auxiliary exhaust, or boost ports, you can turn these on/off to see their effect on the rpm ranges. You can also adjust the barrel height.



The straight reference lines represent fixed time areas in $(\text{sec-cm}^2)/\text{cm}^3$.

Exhaust : 0.00015 (upper red line), and 0.00014 (lower red line)

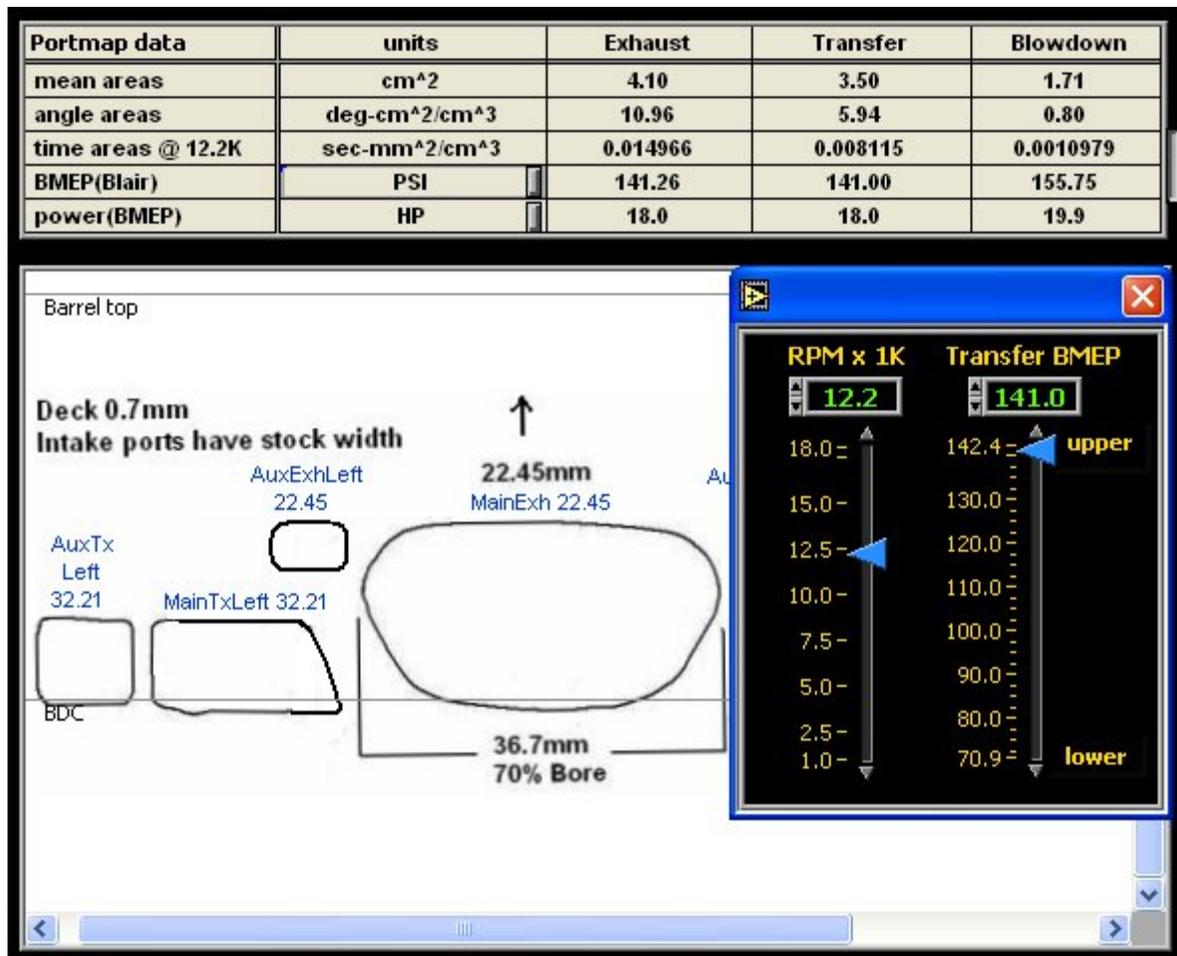
Transfers: 0.00010 (upper blue line), and 0.0008 (lower blue line)

For an explanation of the fixed time area values (where they come from), and how the angle area graph is derived from them for your engine, please see this [article by Gordon Jennings](#) ⁽¹⁾.

9. Port areas and power

The top table displays total port areas, bmep and power. A small button, to the right of the time area row, opens a small window with rpm and bmep controls. Here you can set the rpm

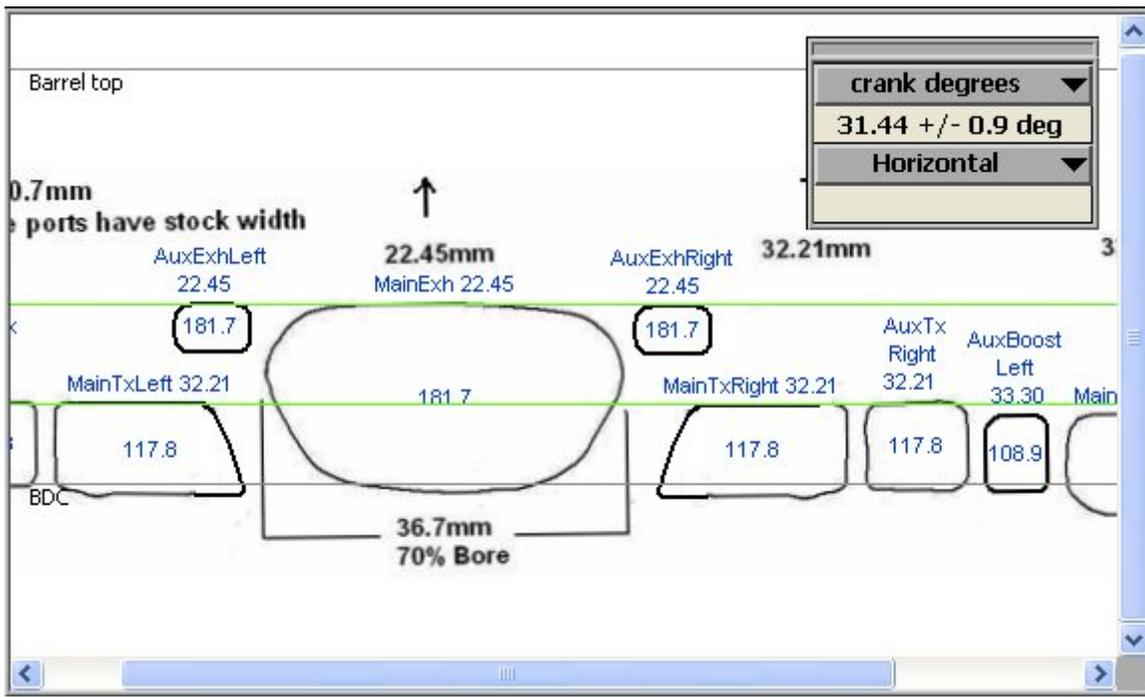
rpm value used to calculate the time areas, and choose the bmep setting for high or low case compression.



11. Portmap measurements

A portmap measurement tool is available from Menu->Tools->Portmap measurements. You can use this to measure vertical mm, vertical crank degrees, horizontal mm, horizontal cord distance, and horizontal percent of bore. There is one drop down menu for vertical measurement selection, and one for the horizontal measurements. Both can be selected at the same time.

In the figure below, the vertical measurement selector is set on crankshaft degrees. In this mode the cursors are limited to between BDC and TDC.



A note on the measurements tolerances. You will note that, when measuring crank degrees, the error increases as the cursor positions get closer to TDC or BDC. This is due to the vertical resolution being equal to a larger value of crank degrees. To help reduce this error, while measuring a crank distance relative to TDC or BDC, the following correction is made: If a cursor is positioned on TDC, the height for that cursor is not calculated from its pixel position, but given the exact value of "stroke" mm above BDC. This way one of the cursor errors can be set to zero, and the total error is reduced. The same applies to a cursor positioned at BDC: its height is not calculated from the pixel position, but given the exact value of 0 mm above BDC.

When measuring horizontal distances, cord or % bore, you will note that the error decreases as the horizontal measure gets closer to the bore distance. This is due to the pixel location relative to the curved surface of the bore. When the map (flat) distance is equal to the bore diameter, the small map area, represented by an end pixel, is actually oriented perpendicular to the plane of the image (in and out of the image). In this case the pixel's horizontal width error, now oriented perpendicular to the measurement being taken, does not contribute to the measurement error.

Links for pdf version of this page:

1. Gordon Jennings time area article
<http://www.porting-programs.com/pdf/timeareas.pdf>
 Note: The graph in the pdf shows exhaust range between 0.00016-0.00015, it should be just below, between 0.00015-0.00014.