Pic2Mag's Field Calculator™

Full Version 1.04 by Michael Snyder 09/03/2019

You draw virtual magnets and Pic2Mag draws the fields! ™

Windows Usage, place the executable FieldCalc.exe into any folder and double click FieldCalc.exe. When you download the Field Calculator program, you should run an antivirus scan on it before you run it.

You can download the program from this URL http://www.pic2mag.com/Pic2Mag_FieldCalc_v101.zip

The Pic2Mag's Field Calculator™ is a Windows Forms application build using Microsoft's ClickOnce security framework and can run on any windows computer with Microsoft .NET Framework 4.5.2 or better, including Vista to Windows 10.

This version of the program NEEDS a large high resolution monitor to see all the buttons. The present application is locked to a resolution of 1164x896 pixels, and ideally needs a1920x1080 or a 1600x900 screen to run it.

Note if your computer has the Windows Icon/Font DPI scaling set from the 100% default; to the 125% Medium or 150% Larger setting(s) then this image size increase ALSO applies to Windows Form applications. Windows might draw some of the application buttons off the screen. The present solution is to use a larger screen and/or use the default Icon/Font DPI size settings. One can try to (right click) properties on the FieldCalc.exe, click on Compatibility, then click on 'Disable display scaling on high DPI settings', then click on 'ok'.

For the new features of Version 1.01 please see page twelve, and for the newest features of the Full Version 1.04 please see page eighteen of this manual.

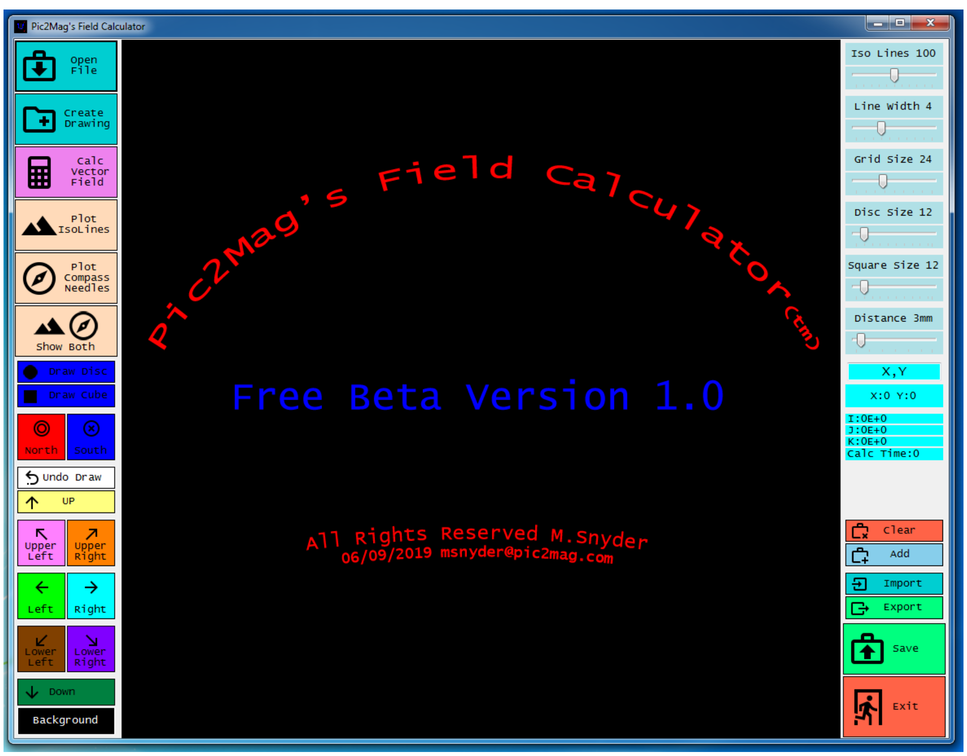


Figure #1 - The Pic2Mag's Field Calculator Introduction Screen.

Figure #2 - Pressing the 'Calc Vector Field' Button.

Pic2Mag uses colors in a graphics file to represent magnetic materials with different magnetic moments.™ The program looks for certain RGB values in the png file and when it finds the exact match the program plots that pixel as a one millimeter cube permanent magnet with a defined magnetic moment angle. Different colors have different magnetic moment directions and angles.

In Figure #2, The Introduction screen is made up of red and blue pixels which represent one millimeter cube permanent magnets with either the North (red) or the South (blue) poles facing the viewer. Go ahead and click the purple 'Calc Vector Field' button on the left hand side to start the processing of the image.

Clock Color Spin Vectors™ on a Black Background (0 0 0)

XY Plane Color RGB values

12:00 o'clock light yellow	**(255 255 128) 000 Degrees (up)**
1:30 o'clock orange	**(255 128 000) 045 Degrees (upper right)**
3:00 o'clock aqua	**(000 255 255) 090 Degrees (right)**
4:30 o'clock purple	**(128 000 255) 135 Degrees (lower right)**
6:00 o'clock dark green	**(000 128 064) 180 Degrees (down)**
7:30 o'clock brown	**(128 064 000) 225 Degrees (lower left)**
9:00 o'clock green	**(000 255 000) 270 Degrees (left)**
10:30 o'clock lavender	**(255 128 255) 315 Degrees (upper left)**
blue z axis into page south	**(000 000 255) (away from viewer)**
red z axis out of page north	**(255 000 000) (towards viewer)**
dark purple monopole sink	**(128 000 128) (away from viewer)**
pink monopole source	**(255 000 128) (towards viewer)**

You can edit your 1280x1280 png file in any graphics editor as long as you set the correct RGB colors for each magnet and then load it into the Field Calculator for processing. The Author uses AutoCAD to draw precise magnet layouts and then MSpaint to color the layouts before processing them with Pic2Mag.

The Field Calculator program has basic graphics editing capabilities and can be used for drawing disc and cube magnets on the screen and also playing the interactive 'what if' game of what happens if I add a magnet to this spot, etc.

Depending on the number of processed pixels, Pic2Mag's Field Calculator can take 30 seconds to 10 minutes to process an image. The reason it takes so long is that each pixel interacts with every other pixel in the image. For every pixel, the program first computes the complete 1280x1280 magnetic field vectors for that pixel; then using the superposition principle adds the results for all the pixels.

The good news is that you can save the vectors for a processed image and reload them at a later time, using the 'Export' and 'Import' buttons on the right hand side. For example an instructor could process images ahead of time and have students load the vector fields for a starting point in a lab exercise.

In Figure #3, we can see the processing has finished in 174 seconds and the program has drawn isopotential lines showing the relative strength of the magnetic field. You can have your students easily check the equal potential lines by clicking on point on a isopotential line and writing down the I,J,K vectors (shown on the right hand side) for that point, then picking another point on the same line. Anywhere on the line, I*I + J*J + K*K should give very similar values. Go ahead and click the 'Plot Compass Needles' Button on the left hand side.

Figure #3 - Showing the Isopotential lines of a processed image.

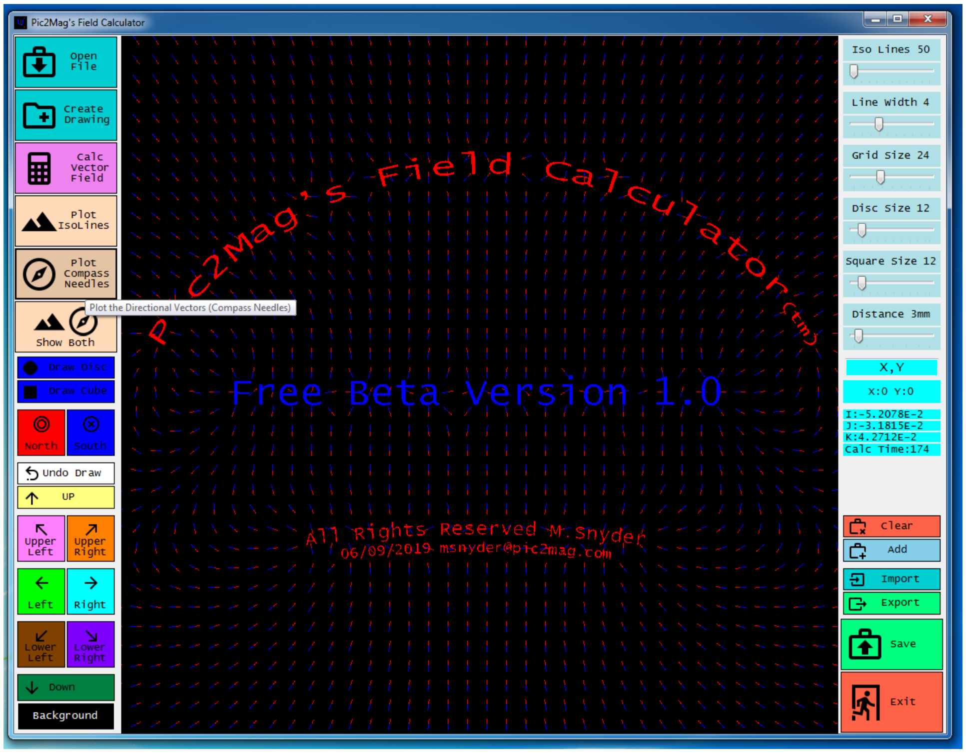


Figure #4 - Showing the compass needle plot of a processed image.

In Figure #4, we can see the results of plotting the Compass Needles. Notice that the red part of the Compass Needle always points the closest North pole and the blue part of the Compass Needle always points to the closest South pole.

The Compass Needles are really just the combined I and J vectors of a selected point plotted as an unscaled vector using a grid layout. The plotted directional vectors show the direction of the magnetic field but not the magnitude of the field.

One question that I have received is that because the divergence of magnetic field equals zero, can two compass needles point at each other? The answer is yes that two compass needles can point at each other because they are being plotted in two dimensions, and have the same limitations of a physical compass.

For example if you lay twenty compasses on a tabletop and put a magnet in the middle of the compasses, the compass needles will point to the magnet, and viewed from above on a 2d plane, the physical compass needles point at each other. Basically the divergence being equal to zero property is still preserved on a 2d plane plot by the non-plotted K vector which points in the Z direction.

The number of Compass Needles that the program plots can be set using the 'Grid Size' Control on the upper right side of Field Calculator application. Go ahead and press the 'Show Both' button in the middle of the left hand side of the application.

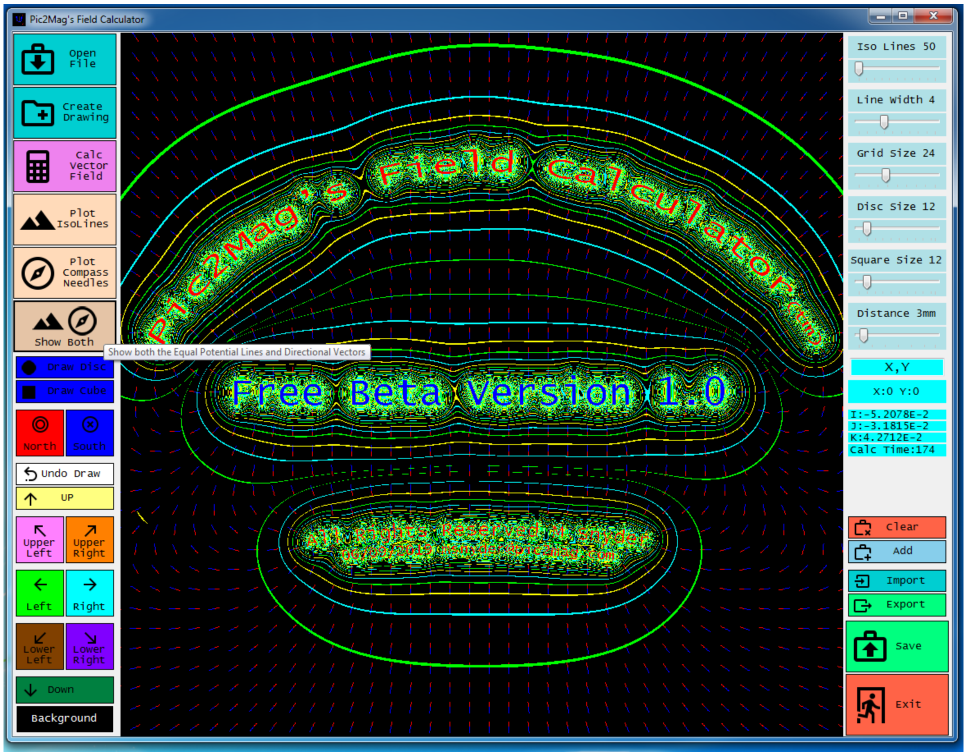


Figure #5 - Showing both the Isopotential lines and Compass needles

In Figure #5, we can see both the relative strength of the magnetic field from the Isopotential lines and the direction of the magnetic field from the Compass needles. The number of Isopotential lines and width of the lines can be set using the 'Iso Lines' and 'Line Width' controls which are on the upper right hand side of the program.

We can click anywhere on the image, or enter Cartesian coordinates 'X,Y' values in the teal textbox in the middle of the right hand side of the application to display the I,J,K vectors for that point.

In this document, +X,+Y,+Z are directions. +X starts in the middle of the screen and runs to the right hand size of the screen. +Y starts in the middle of the screen and goes up to the top of the screen. +Z starts in the middle of the screen and approaches the viewer out of screen.

The references to I,J,K vectors means the float32 values for a vector located at an X,Y,Z indexed position. I think of I,J,K as databases that have millions of stored float32 values located at X,Y,Z integer indexes. Implicit in the definitions of the X,Y,Z indexes and I,J,K vectors are $\hat{i},\hat{j},\hat{k}$ one millimeter unit vectors.

It should be noted that the program uses an internal μ constant that equals one to decrease the number of cpu operations; and that the computed I,J,K vectors shown in the program need to be appropriately scaled with a measured μ constant to match real world experiments and/or gauss readings.

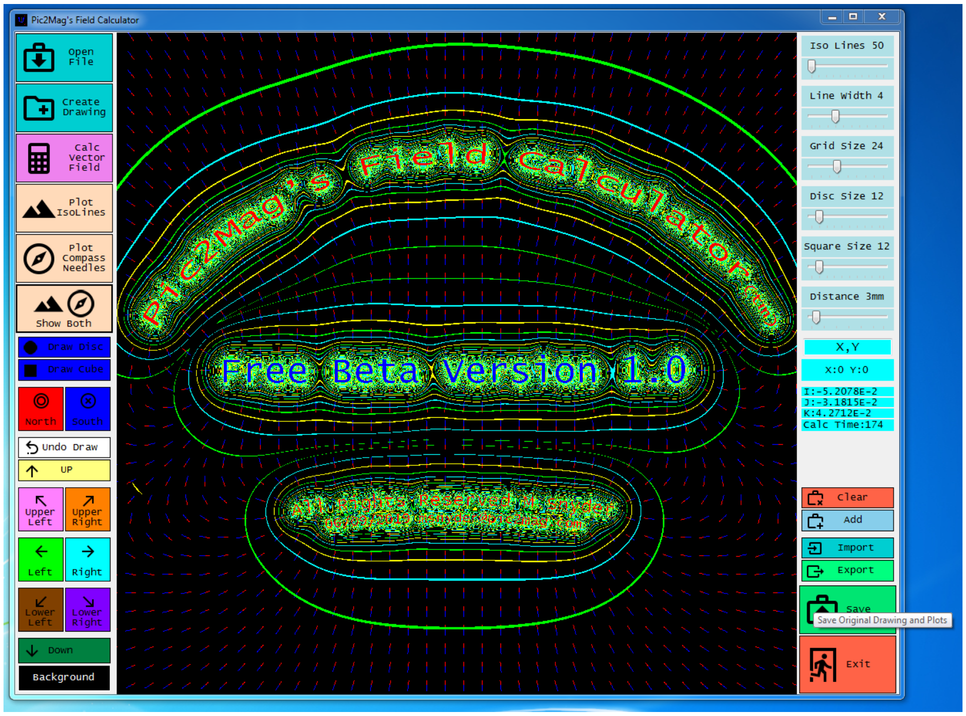


Figure #6 - Showing the 'Save' button on right hand side.

Now that we have plotted both the Isopotential lines and Compass needles we can hit the 'Save' button on the lower right hand side of the application. The system save dialog will ask for a file location and file name and will save five files with similar names to the location that you pick.

The original file is saved with the given name, then a plotted Isopotential lines version called '_iso' and then two combined Isopotential lines and Compass needles versions. One version with a black background called '_scr', and one version with a white background called '_prn' which is meant for printing.

Pic2Mag's Field Calculator can also draw it's own magnet arrays on the screen by pressing the 'Create Drawing' on the upper left hand side which clears the last drawing from memory.

As seen in Figure #7, First press 'Create Drawing to clear the screen then press the 'North' button to pick a color and magnetic moment direction, then click anywhere on the screen to place your first magnet.

The magnet sizes can be picked using the 'Disc' and 'Square' controls on the middle left hand side of the program.

Seen in Figure #8, we can place our second magnet by first clicking the 'South' button to the set the color to blue, and clicking on a spot in the center screen.

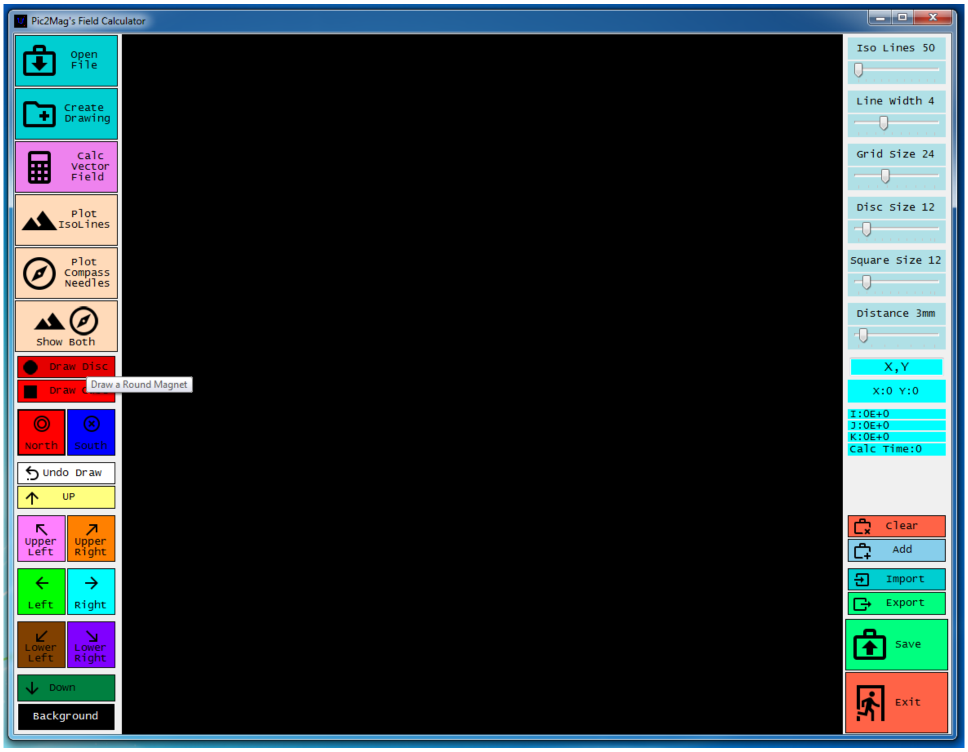


Figure #7 - Creating a new drawing and drawing a magnet.

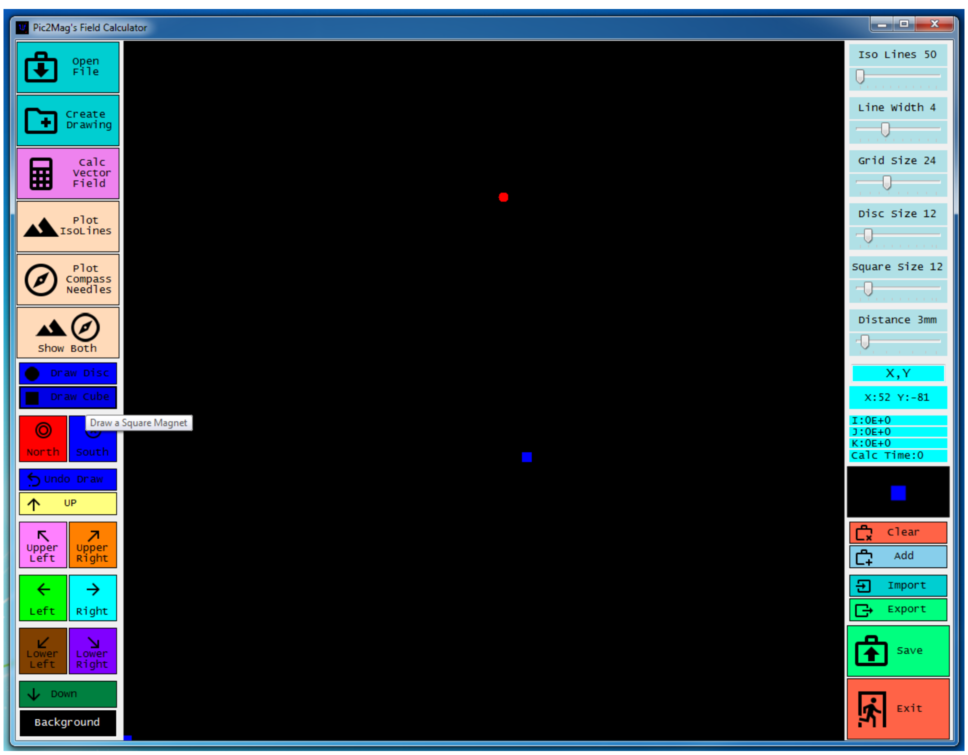


Figure #8 - Drawing round and square magnets on the screen.

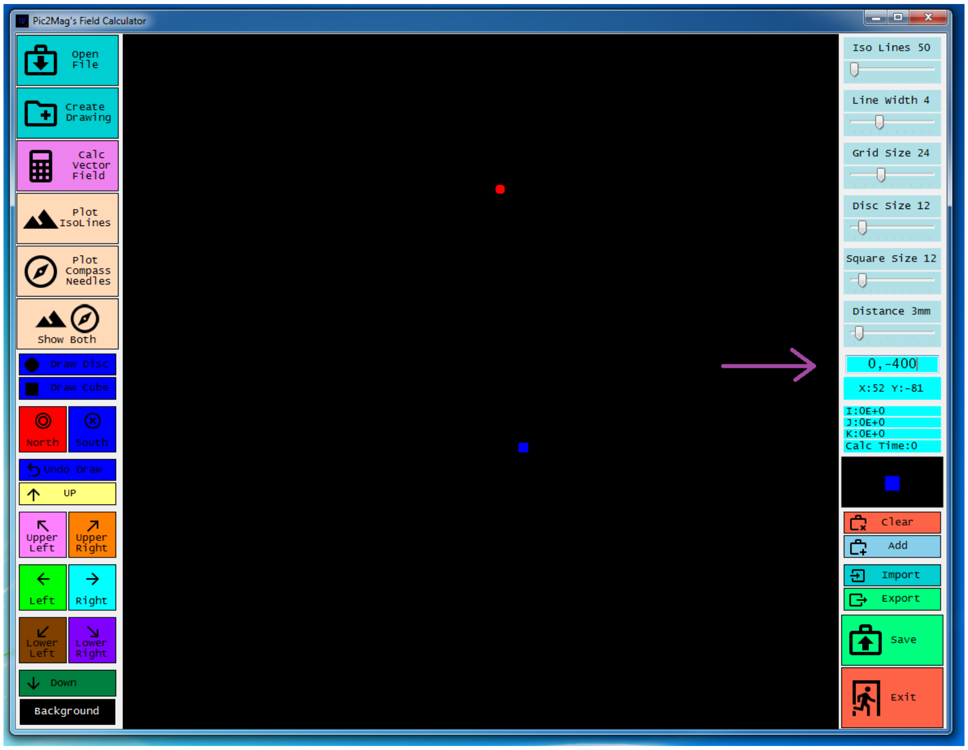


Figure #9 - Using the textbox to enter magnet X,Y coordinates .

In Figure #9, we are doing something different. First we pick a color, in this case first the blue 'South' button, then we press the 'Draw Cube' button but instead of clicking on the screen to pick a position for the magnet, we click on the teal colored textbox on the middle right hand size of the program.

Figure #10 - Positioning a magnet using a textbox.

We can enter X,Y coordinates and have them accepted as mouse clicks for positioning magnets. In this case we entered the position of 0,-400 and the new magnet is shown in Figure #10.

Of course we can now process these three magnets by pressing the 'Calc Vector Field' button on the upper left hand side and the results are shown in Figure #11.

Figure #11 - Calculating the vectors and Isopotential lines of the three magnets.

Clearly the textbox method is useful for laying out precise magnet arrays.

For example, first we press the 'Create Drawing' button to clear the screen.

Second we press the 'South' button, then the 'Draw Disc' button then enter into the textbox 100,100.

Third we press the 'South' button, then the 'Draw Disc' button then enter into the textbox -100,-100.

Forth we press the 'North' Button, then the 'Draw Cube' button then enter into the textbox 100,-100.

Fifth we press the 'North' Button, then the 'Draw Cube' button then enter into the textbox -100,100 and then press the 'Calc Vector Field' button.

The result is seen in Figure #12, the traditional quadrupole magnetic field, which has four poles.

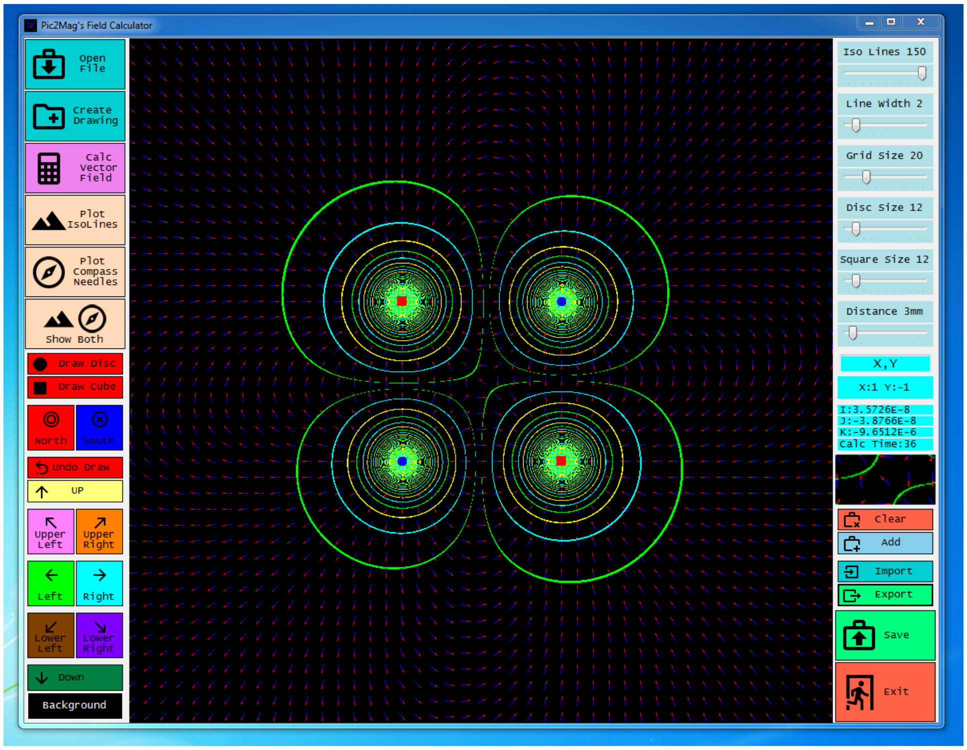


Figure #12 - Plotting the traditional quadrupole magnetic field.

The remaining colors on the lower left hand side are just for different magnetic moment directions. For example imagine you have a cube magnet sitting on a table with the south pole surface touching the table. That means the north pole surface is facing the viewer and we should use a red color to represent it.

If we turn the cube magnet on it's side then we could use the yellow color to represent the magnet with it's north pole surface pointing away from viewer on the 2d plane of the table. You can imagine each of the different drawing colors as different directions of cube magnets sitting on a table.

Next we put a sheet of glass over the cube magnets and take gauss readings on the top surface of the glass. How thick is the glass?

Let's say it's 3mm thick. On the upper left hand side of the application is a 'Distance' setting control which allows you to set the distance between the magnetic surface and viewing plane.

The default viewing distance is 3mm but you can set it to different values. Each time you change the viewing distance, the vector field will need to be recalculated!

On the lower right hand side of the application is 'Add' button. It allows you to add a vector field stored in memory and a vector field stored using the 'Export' button. Ideally the more complex magnet arrays could be stored after plotting and then added to new designs to save computation times.

Pic2Mag Cache Files

Each time you observe a different color and z distance, the program computes new internal data structures and saves them to disk for later reuse. This doubles the program speed when you process that same color again!

But the cache files take up space on your hard drive and you can delete the files using the 'Clear' button on the middle right hand side of the program. If you are done computing vector fields then press 'Clear' button and then the 'yes' button to delete the temporary cache files. The program only creates cache files as they are needed and will produce smaller numbers of cache files, if the user uses a smaller set of colors and distances.

Parallel Processing with Pic2Mag's Field Calculator

The program is designed to be self contained and has about a 500 megabyte RAM memory footprint while processing. Other than writing a cache file when the file is not found, and reading cache files; the program has no temporary file operations meaning that you can run multiple copies of Pic2Mag's Field Calculator in the same program directory while sharing the same cache files.

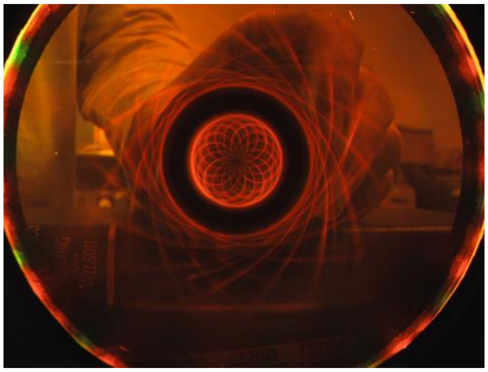
The Free Beta Version 1.0 uses four processor threads and is highly parallel both in the number of threads that it uses, and the number of program instances that can be ran from the same directory sharing the same cache files.

Pic2Mag's Field Calculator Pricing

The Free Version 1.01 supports four processor threads and may be used by everyone and shared with everyone; including professors, students, and school computer labs, but the program may not be resold. All Rights are Reserved.

Please email questions and bug reports to msnyder@pic2mag.com

Own your own copy of **Pic2Mag's Field Calculator** for $9.95. The paid version supports up to twelve processor threads and is over two times faster, and has support for thicker magnets, printing, and scanning images.



Email msnyder@pic2mag.com for support and orders.

New Features of Pic2Mag's Field Calculator Free Version 1.01

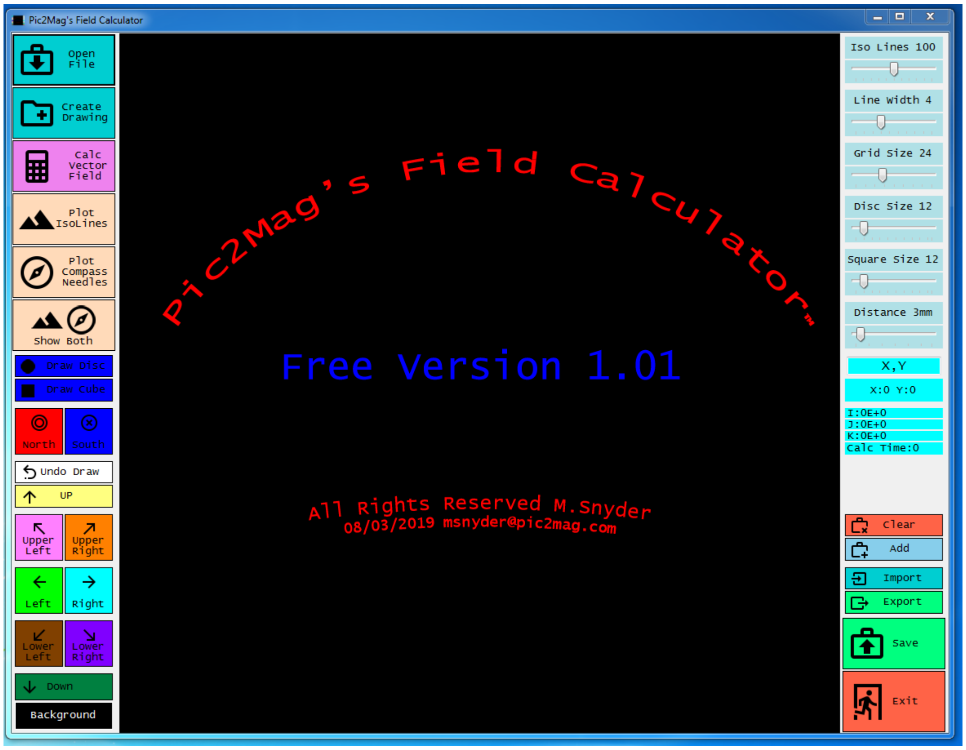


Figure #13 - Showing the Free Version 1.01 introduction screen

The new free version 1.01 of Pic2Mag's Field Calculator is nearly identical to the free beta version 1.0 . The new program version has four new (right click) commands which were part of my earlier wish list but did not make it into the version 1.0 program release. While not required for daily use, but still fun.

The new program version has a better load balancing algorithm to share computational loads between threads. Another change as shown in Figure #14 is that the program now is digitally signed in order to help people download and use the program with confidence that the program is directly from its author.

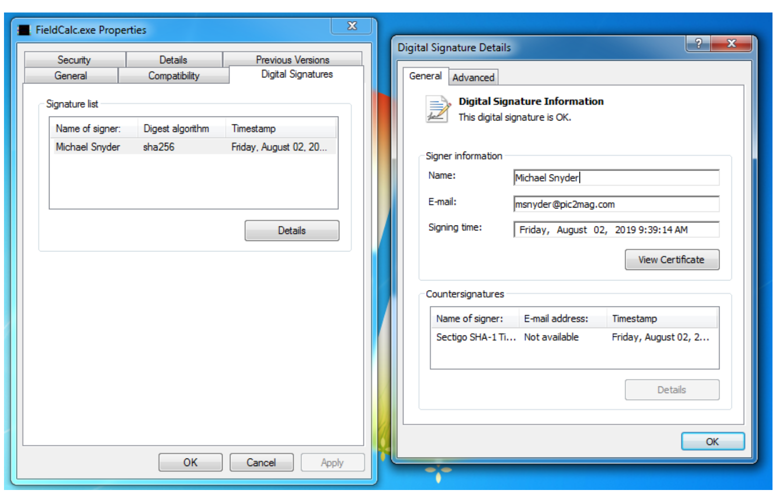


Figure #14 - Showing the new Pic2Mag Digital Signature

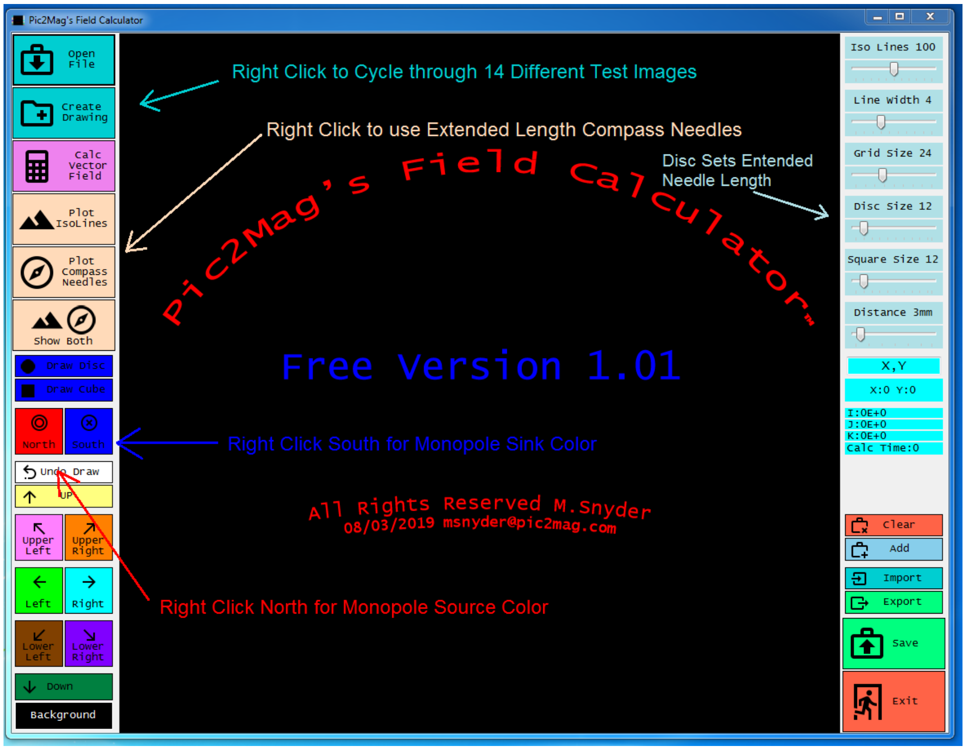


Figure #15 - Showing the new right click version 1.01 features.

The most useful new command is when you right click the 'Create Drawing' button on the upper left hand side. Each time you right click the 'Create Drawing' button the screen will cycle through fourteen different test images. Any of the images can be processed using the 'Calc Vector Field' button, with five to ten minute processing time on most computers, to see their magnetic fields.

There are also two new commands for drawing monopoles. As shown in Figure #16, if the user right clicks the 'North' color button, the program will switch to the pink monopole source <255,0,128> color. If you right click the 'South' color button, the program will switch to the purple monopole sink <128,0,128> color.

I have had requests for monopole processing, and as shown in Figure #17, Pic2Mag's Field Calculator can process monopoles. While Pic2Mag is written for Magnetic Fields, in theory you can also use the pink monopole source and purple monopole sink colors for electric charge processing. The Isopotential lines would represent voltage and the compass needles would then just show the electric field direction at those points. The compass needles are just plotted directional vectors as shown in Figure #18.

The last new command is when you right click the 'Plot Compass Needles' button on the left hand side. This switches to an extended Compass Needle plotting mode. The normal Compass Needle algorithm and the extended Compass Needle algorithm are nearly identical with the difference being the length of the plotted directional vector and the number of pixels drawn to the screen.

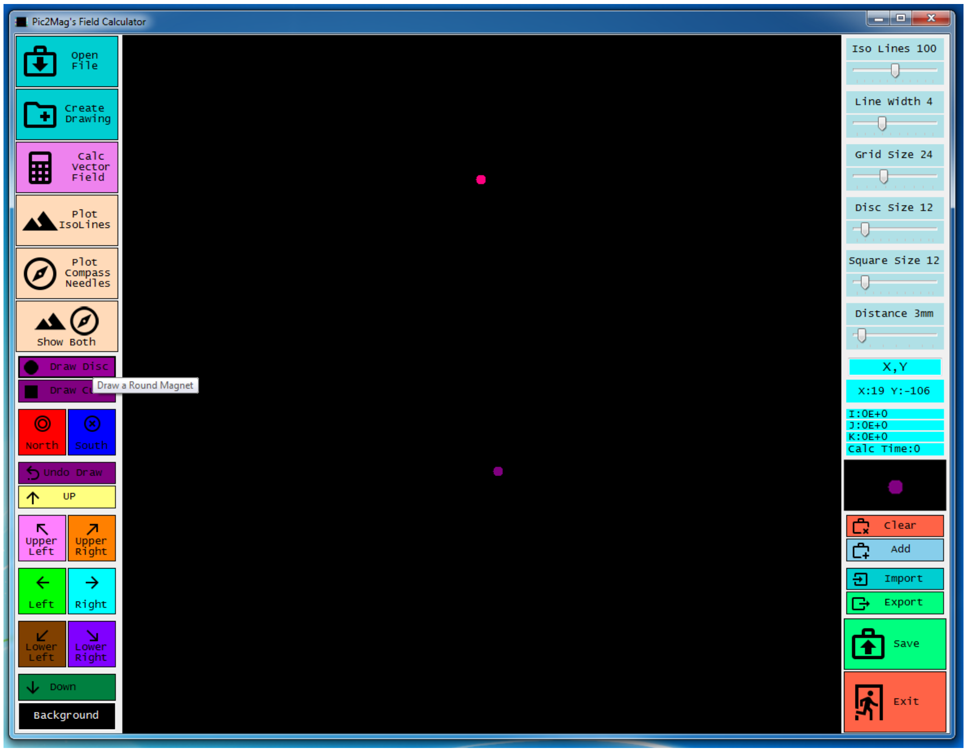


Figure #16 - Drawing with monopole colors.

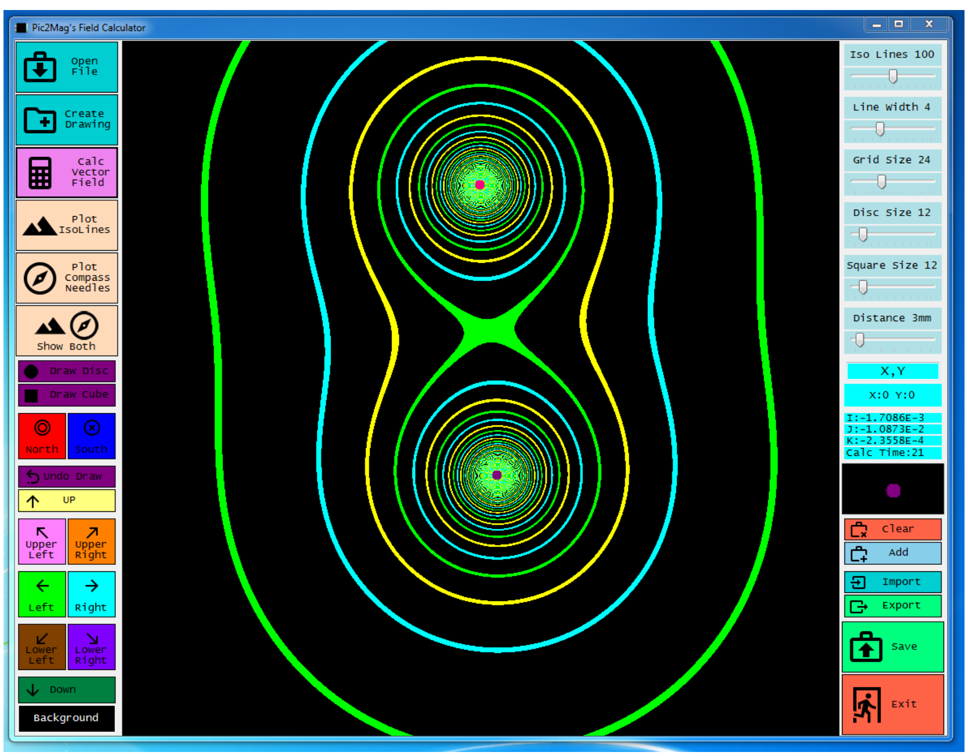


Figure #17 - Isopotential lines of the two monopoles.

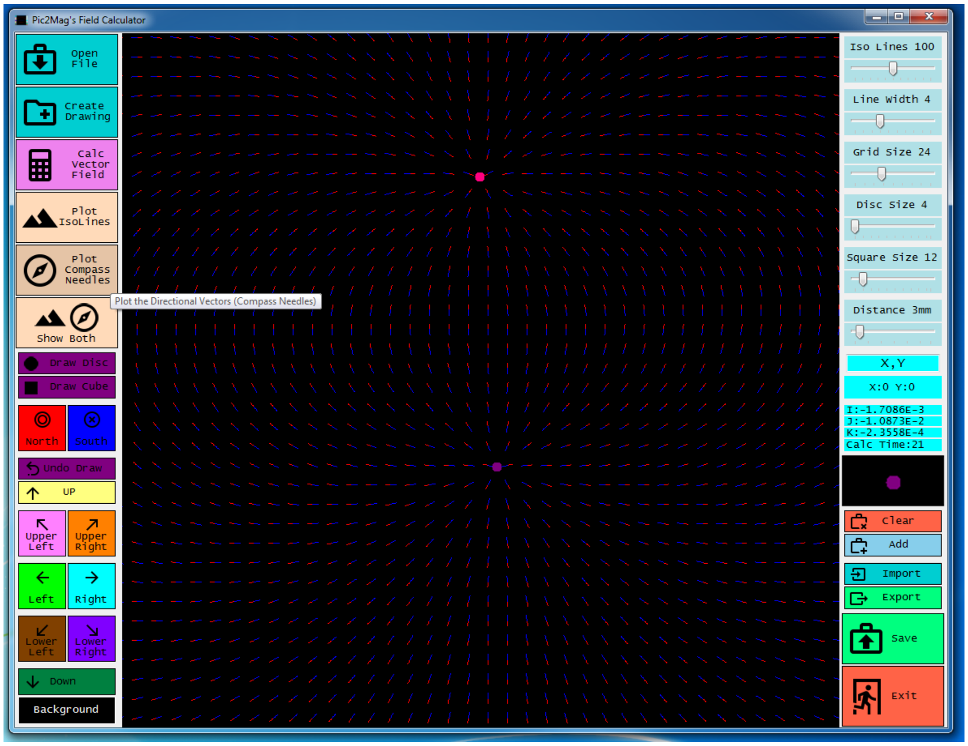


Figure #18 - Plotting the compass needles of two monopoles.

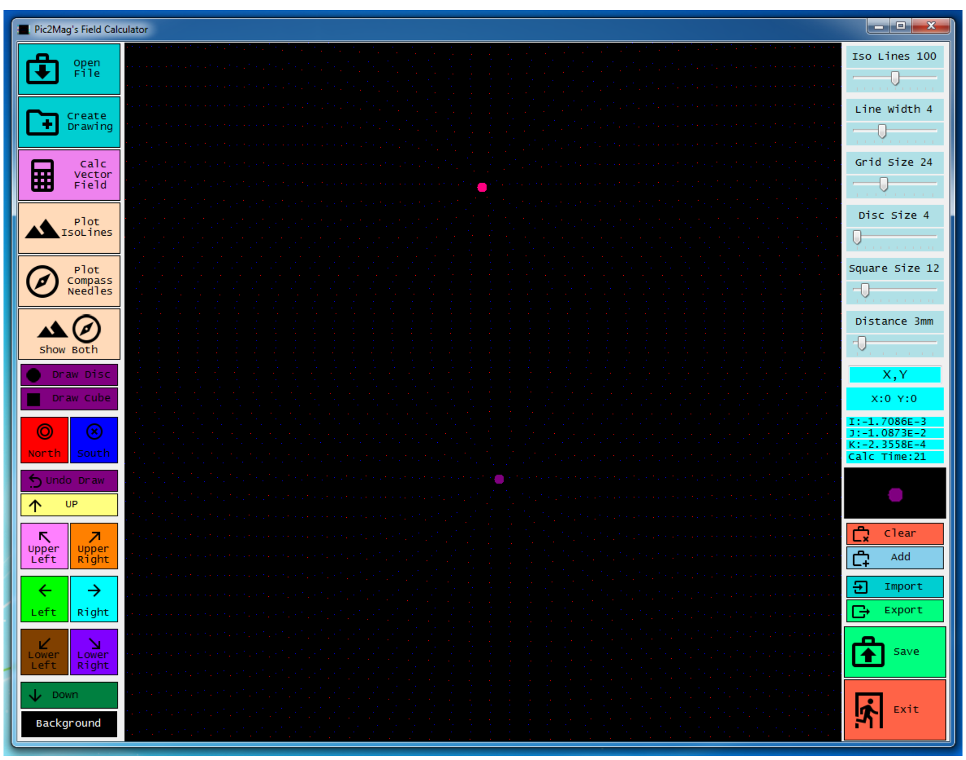


Figure #19 - Plotting the extended compass needles of two monopoles.

If you zoom into Figure #18 and Figure #19 you can compare the Compass Needle mode and the Extended Compass mode.

In Figure #18 you will see that we are just plotting a directional vector by reading the combined I,J vectors at a grid location and projecting the 2d vector nine pixels forward and then nine pixels backward. The nine pixels forward is plotted with red pixels and the nine pixels backward from the central point is plotted blue.

In Figure #19 you have the same combined I,J vectors at a grid location and projecting the 2d vector nine pixels forward and then nine pixels backward. In this case the central point is plotted as a blue pixel, the nine pixels forward point is plotted as a red pixel and the nine pixels backward is plotted as blue.

What I did not mention is that the extended compass needle mode requires one more parameter which sets the length of the needle plots. Because the 'Disc Size' track bar is not used after you draw a drawing, I choose it to be overloaded and set the extended compass needle parameter. Notice the different 'Disc Size' settings in Figure #19 and Figure #20, one is set to 4 and one is set to 80.

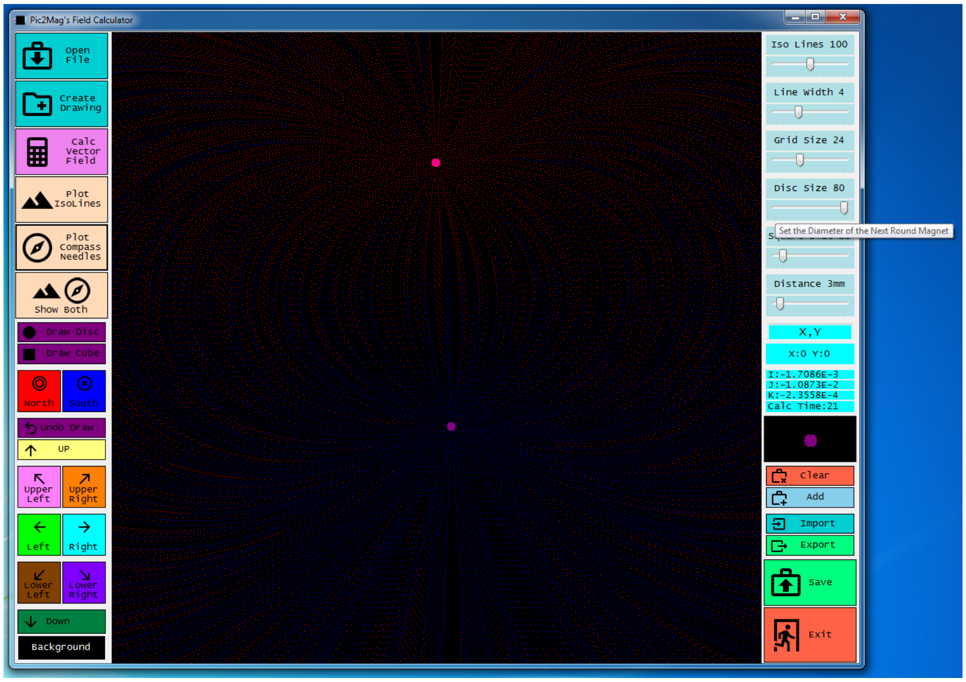


Figure #20 - Plotting the extended compass needles of two monopoles.

In Figure #20 you have the same combined I,J vectors at a grid location and then projecting the 2d vector nine pixels forward and then nine pixels backward. The central point is plotted as a blue pixel, the nine pixels forward point is plotted as a red pixel and the nine pixels backward is plotted as blue.

But because the extended compass needle length parameter is now set to 80, the algorithm restarts itself at the nine pixels forward point, and reads the combined I,J vectors at the forward point and projects the new vector nine more pixels forward, and then plots it as a red pixel.

This plotting process continues till the designated plotted length is reached.

The nine pixels backward part of the algorithm works in the same way with a projection backward of nine pixels, read the combined I,J vector data at that new point, plot that pixel as blue, and repeat the process till the designated length is reached.

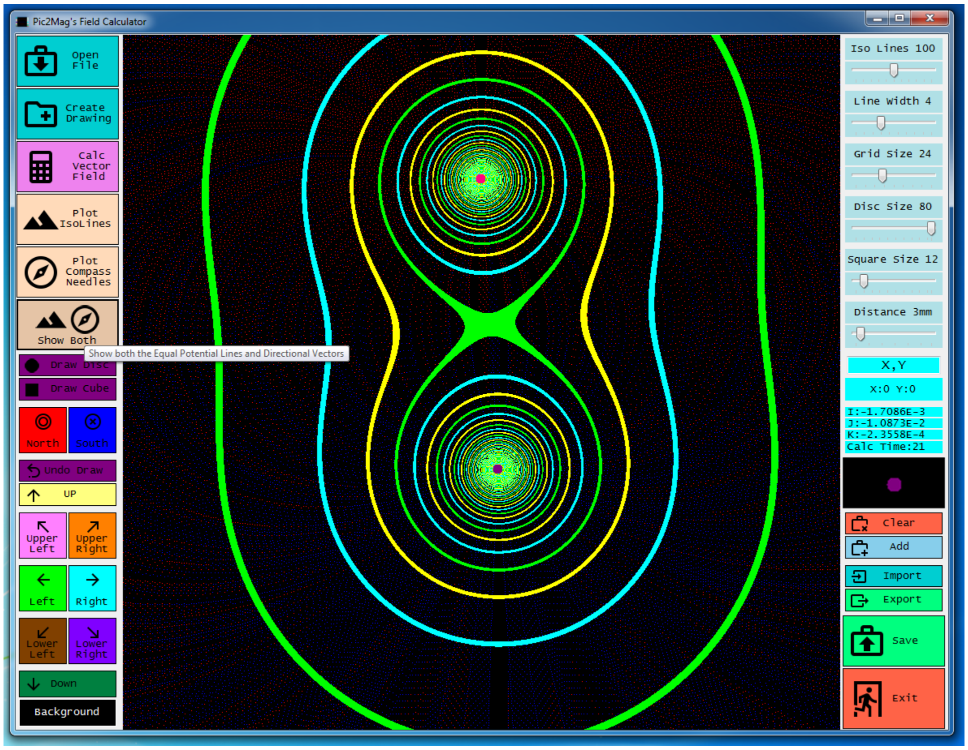


Figure #21 - The combined isopotential lines and extended compass needles.

The user can easily convince themselves that the two compass needle plotting algorithms are showing the same data by processing any Pic2Mag drawing and playing with left and right clicks on the 'Plot Compass Needles' button, and playing with the 'Disc Size' track bar.

In Figure #21, we see the results of using the new right click commands. We have two monopoles with some extra long Extended Compass Needles™.

New Features of Pic2Mag's Field Calculator Full Version Beta 1.04

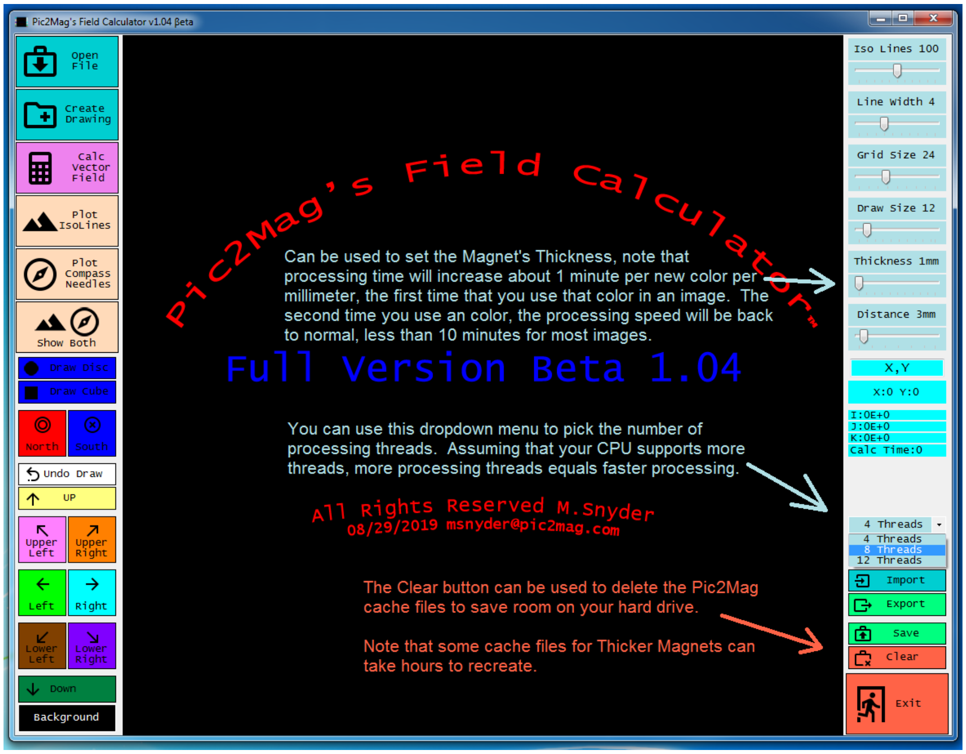


Figure #22 - Showing the new menu items in the Full Version Beta 1.04 .

The newest version of Pic2Mag's Field Calculator can process thicker magnets and supports up to twelve processing threads.

The Thickness control can be set from 1mm to 120mm and sets the number of lower layers which to sum in order to produce the final vector fields. For example, if you are working with 10mm cube magnets then you should set the Thickness to 10mm.

Do to the nature of static inverse squared fields, it is the layers of the magnet closest to the observer that makes the most contribution to the field vectors of the observed layer. On the other hand, increasing the Thickness setting of the program from the default 1mm will add about 1 minute processing time per color per millimeter for the initial processing of the image!

In other words, if you set the magnet thickness to 60mm then expect to wait hours for your image to process the first time. The first time the Pic2Mag engine will make cache files for new 60mm colors and save them and then the second time you process the same colors and shapes, the image processing time will return back to normal, ideally less than 10 minutes on the average computer.

There's a dropdown menu on the right hand side of the Field Calculator window that will allow the user to pick the number of processing threads from 4, 8, or 12 threads. Assuming that your processor supports more threads, more threads equals faster processing times.

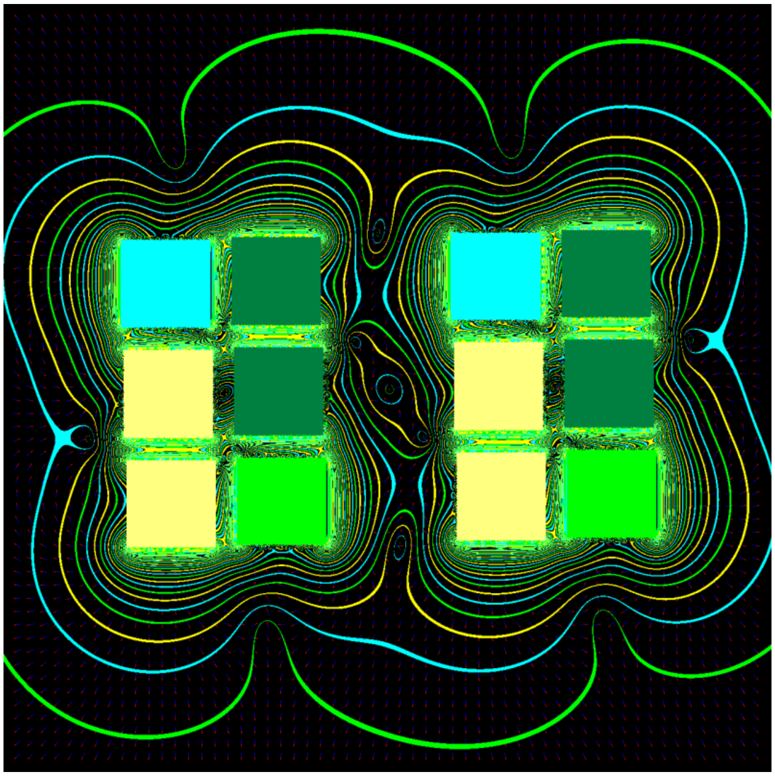


Figure #23 - Showing results of 1mm processing.

In Figure #23 and Figure #24 we see the same image processed at different Thickness settings. The plotting settings of the Field Calculator are the same for both images. Clearly Figure #24 has a bit more information and field resolution.

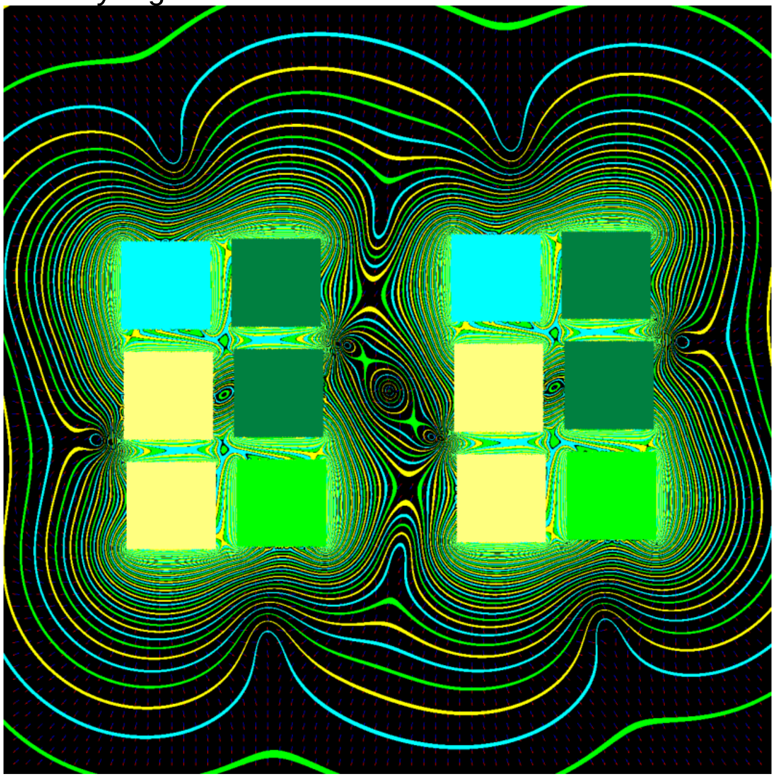


Figure #24 - Showing results of 100mm processing

So the question is how much better is Figure #24 than Figure #23? Or another way of saying it, is how many layers do we need to produce accurate results?

With static inverse squared fields, the first layer contributes 1/1 of the total result then the second layer contributes 1/4 of the total result and then the third layer contributes 1/9 of the total result and so forth for given point at a X,Y,Z location on the observed layer.

Clearly if you are working with physical magnets, just use the thickness measurement of the magnet and call it done. If are using 1" cube magnets, then use the 25mm setting. The first time you process new images the program will be slow in order to make the cache files, but after the first time the Field Calculator will process images at normal speeds and you will have the highest possible accuracy for your system of magnets.

On the other hand if you are just playing around with the program and you are wondering what is my maximum theoretical error of just using one layer to represent a very thick magnet? We can calculate the error percentage based on the Basel problem.

We know that the maximum contribution of all the lower identical layers, going to infinity will be no greater than the solution of the Basel problem which is $\frac{\pi^2}{6}$. Since we have a upper bounds to our theoretical error, then error percentage for using a finite number of layers is just $100\left(1-\frac{\sum_{1}^{\#layers}\frac{1}{k^2}}{\frac{\pi^2}{6}}\right)$.

Our error equation shows that using one layer to represent a very thick magnet will never have a higher than 39.2 percent lost of accuracy for any possible thickness from 1mm to infinity. In other words, if use the default setting of 1mm then you will always have at least 60.8 percent accuracy for any possible system.

Figure #24 looks like it has more information than Figure #23, what is it's accuracy? Using the same equation, we find for using just the first 100 layers that our maximum error is 0.29 percent. In other words assuming that Figure #24 is a very thick magnet and we are just processing the first hundred layers, this produces a lower bounds of 99.7 percent of accuracy.

Number of Layers	Maximum Error Percentage
1	39.21
2	24.01
3	17.25
4	13.45
12	04.86
20	02.96

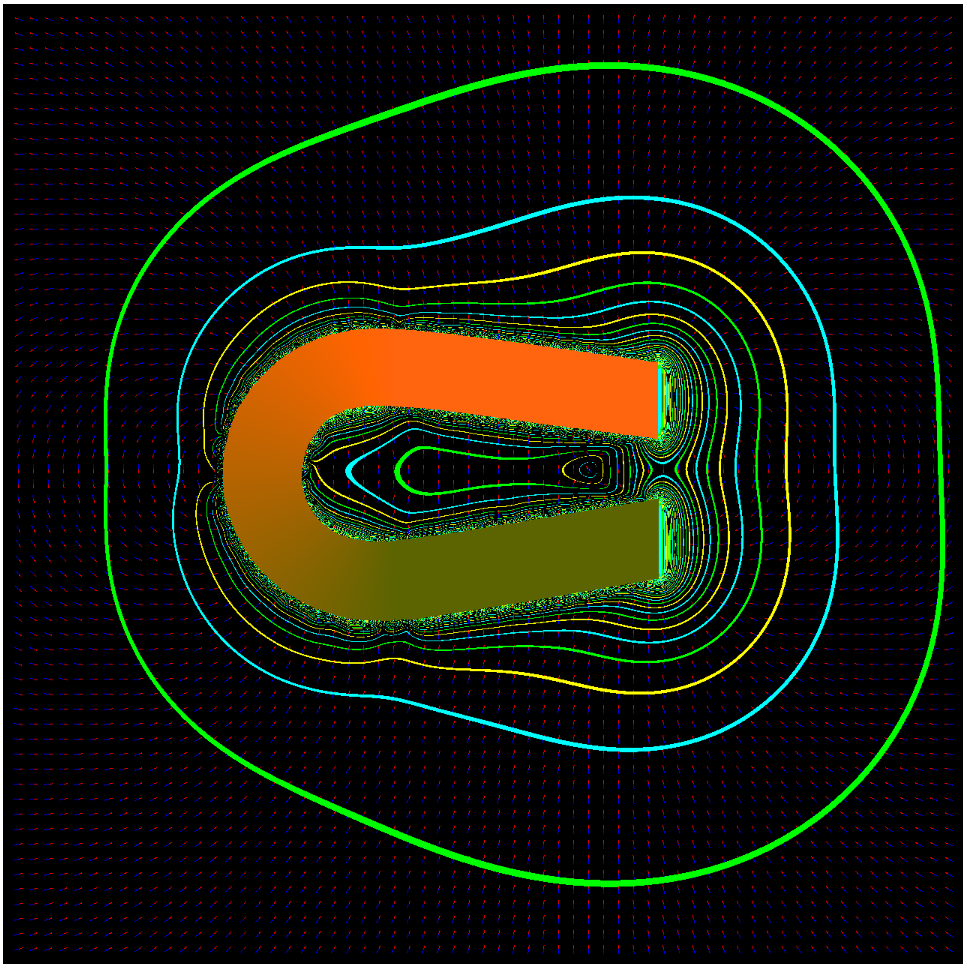


Figure #25 - Showing a plot of a Horseshoe Magnet.

Pic2Mag's Field Calculator can process an extended set of colors representing a full 360 degrees on the XY plane which are listed from page twenty two to page twenty seven.

The requirement for processing a Horseshoe magnet is to able to have the head to tail magnetic moments that make a full 180 degree turn as shown in Figure #25. The figure literally has over 180 different colors from the Extended Color Table and is an example of using over 30 Gigabytes of hard drive space for all the Pic2Mag cache files.

The author used a MatLab script to put all the right colors in the right locations for the image of the Horseshoe Magnet. The reader can email me (msnyder@pic2mag.com) and I will be happy to share the Matlab script.

The author believes that processing a Horseshoe Magnet is one of the harder possible calculation tasks and should be a criteria in rating magnetic software.

Pic2Mag Extended Color Table - Degree <Red,Green,Blue>

(When in doubt, put a small circle of the color in question on a black image and process it.)

0° <1,100,1>
1° <2,100,1>
2° <3,100,1>
3° <4,100,1>
4° <5,100,1>
5° <6,100,1>
6° <7,100,1>
7° <8,100,1>
8° <9,100,1>
9° <10,100,1>
10° <11,100,1>
11° <12,100,1>
12° <13,100,1>
13° <14,100,1>
14° <15,100,1>
15° <16,100,1>
16° <17,100,1>
17° <18,100,1>
18° <19,100,1>
19° <20,100,1>
20° <21,100,1>
21° <22,100,1>
22° <23,100,1>
23° <24,100,1>
24° <25,100,1>
25° <26,100,1>
26° <27,100,1>
27° <28,100,1>
28° <29,100,1>
29° <30,100,1>
30° <31,100,1>
31° <32,100,1>
32° <33,100,1>
33° <34,100,1>
34° <35,100,1>
35° <36,100,1>
36° <37,100,1>
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38° <39,100,1>
39° <40,100,1>
40° <41,100,1>
41° <42,100,1>
42° <43,100,1>
43° <44,100,1>
44° <45,100,1>
45° <46,100,1>
46° <47,100,1>
47° <48,100,1>
48° <49,100,1>
49° <50,100,1>
50° <51,100,1>
51° <52,100,1>
52° <53,100,1>
53° <54,100,1>
54° <55,100,1>
55° <56,100,1>
56° <57,100,1>
57° <58,100,1>
58° <59,100,1>
59° <60,100,1>

Pic2Mag Extended Color Table - Degree <Red,Green,Blue>

60° <61,100,1>
61° <62,100,1>
62° <63,100,1>
63° <64,100,1>
64° <65,100,1>
65° <66,100,1>
66° <67,100,1>
67° <68,100,1>
68° <69,100,1>
69° <70,100,1>
70° <71,100,1>
71° <72,100,1>
72° <73,100,1>
73° <74,100,1>
74° <75,100,1>
75° <76,100,1>
76° <77,100,1>
77° <78,100,1>
78° <79,100,1>
79° <80,100,1>
80° <81,100,1>
81° <82,100,1>
82° <83,100,1>
83° <84,100,1>
84° <85,100,1>
85° <86,100,1>
86° <87,100,1>
87° <88,100,1>
88° <89,100,1>
89° <90,100,1>
90° <91,100,1>
91° <92,100,1>
92° <93,100,1>
93° <94,100,1>
94° <95,100,1>
95° <96,100,1>
96° <97,100,1>
97° <98,100,1>
98° <99,100,1>
99° <100,100,1>
100° <101,100,1>
101° <102,100,1>
102° <103,100,1>
103° <104,100,1>
104° <105,100,1>
105° <106,100,1>
106° <107,100,1>
107° <108,100,1>
108° <109,100,1>
109° <110,100,1>
110° <111,100,1>
111° <112,100,1>
112° <113,100,1>
113° <114,100,1>
114° <115,100,1>
115° <116,100,1>
116° <117,100,1>
117° <118,100,1>
118° <119,100,1>
119° <120,100,1>

Pic2Mag Extended Color Table - Degree <Red,Green,Blue>

120° <121,100,1>
121° <122,100,1>
122° <123,100,1>
123° <124,100,1>
124° <125,100,1>
125° <126,100,1>
126° <127,100,1>
127° <128,100,1>
128° <129,100,1>
129° <130,100,1>
130° <131,100,1>
131° <132,100,1>
132° <133,100,1>
133° <134,100,1>
134° <135,100,1>
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136° <137,100,1>
137° <138,100,1>
138° <139,100,1>
139° <140,100,1>
140° <141,100,1>
141° <142,100,1>
142° <143,100,1>
143° <144,100,1>
144° <145,100,1>
145° <146,100,1>
146° <147,100,1>
147° <148,100,1>
148° <149,100,1>
149° <150,100,1>
150° <151,100,1>
151° <152,100,1>
152° <153,100,1>
153° <154,100,1>
154° <155,100,1>
155° <156,100,1>
156° <157,100,1>
157° <158,100,1>
158° <159,100,1>
159° <160,100,1>
160° <161,100,1>
161° <162,100,1>
162° <163,100,1>
163° <164,100,1>
164° <165,100,1>
165° <166,100,1>
166° <167,100,1>
167° <168,100,1>
168° <169,100,1>
169° <170,100,1>
170° <171,100,1>
171° <172,100,1>
172° <173,100,1>
173° <174,100,1>
174° <175,100,1>
175° <176,100,1>
176° <177,100,1>
177° <178,100,1>
178° <179,100,1>
179° <180,100,1>

Pic2Mag Extended Color Table - Degree <Red,Green,Blue>

180°	<181,100,1>
181°	<182,100,1>
182°	<183,100,1>
183°	<184,100,1>
184°	<185,100,1>
185°	<186,100,1>
186°	<187,100,1>
187°	<188,100,1>
188°	<189,100,1>
189°	<190,100,1>
190°	<191,100,1>
191°	<192,100,1>
192°	<193,100,1>
193°	<194,100,1>
194°	<195,100,1>
195°	<196,100,1>
196°	<197,100,1>
197°	<198,100,1>
198°	<199,100,1>
199°	<200,100,1>
200°	<201,100,1>
201°	<202,100,1>
202°	<203,100,1>
203°	<204,100,1>
204°	<205,100,1>
205°	<206,100,1>
206°	<207,100,1>
207°	<208,100,1>
208°	<209,100,1>
209°	<210,100,1>
210°	<211,100,1>
211°	<212,100,1>
212°	<213,100,1>
213°	<214,100,1>
214°	<215,100,1>
215°	<216,100,1>
216°	<217,100,1>
217°	<218,100,1>
218°	<219,100,1>
219°	<220,100,1>
220°	<221,100,1>
221°	<222,100,1>
222°	<223,100,1>
223°	<224,100,1>
224°	<225,100,1>
225°	<226,100,1>
226°	<227,100,1>
227°	<228,100,1>
228°	<229,100,1>
229°	<230,100,1>
230°	<231,100,1>
231°	<232,100,1>
232°	<233,100,1>
233°	<234,100,1>
234°	<235,100,1>
235°	<236,100,1>
236°	<237,100,1>
237°	<238,100,1>
238°	<239,100,1>
239°	<240,100,1>

Pic2Mag Extended Color Table - Degree <Red,Green,Blue>

240° <241,100,1>
241° <242,100,1>
242° <243,100,1>
243° <244,100,1>
244° <245,100,1>
245° <246,100,1>
246° <247,100,1>
247° <248,100,1>
248° <249,100,1>
249° <250,100,1>
250° <251,100,1>
251° <252,100,1>
252° <253,100,1>
253° <254,100,1>
254° <255,100,1>
255° <255,100,1>
256° <255,100,2>
257° <255,100,3>
258° <255,100,4>
259° <255,100,5>
260° <255,100,6>
261° <255,100,7>
262° <255,100,8>
263° <255,100,9>
264° <255,100,10>
265° <255,100,11>
266° <255,100,12>
267° <255,100,13>
268° <255,100,14>
269° <255,100,15>
270° <255,100,16>
271° <255,100,17>
272° <255,100,18>
273° <255,100,19>
274° <255,100,20>
275° <255,100,21>
276° <255,100,22>
277° <255,100,23>
278° <255,100,24>
279° <255,100,25>
280° <255,100,26>
281° <255,100,27>
282° <255,100,28>
283° <255,100,29>
284° <255,100,30>
285° <255,100,31>
286° <255,100,32>
287° <255,100,33>
288° <255,100,34>
289° <255,100,35>
290° <255,100,36>
291° <255,100,37>
292° <255,100,38>
293° <255,100,39>
294° <255,100,40>
295° <255,100,41>
296° <255,100,42>
297° <255,100,43>
298° <255,100,44>
299° <255,100,45>

Pic2Mag Extended Color Table - Degree <Red,Green,Blue>

300° <255,100,46>
301° <255,100,47>
302° <255,100,48>
303° <255,100,49>
304° <255,100,50>
305° <255,100,51>
306° <255,100,52>
307° <255,100,53>
308° <255,100,54>
309° <255,100,55>
310° <255,100,56>
311° <255,100,57>
312° <255,100,58>
313° <255,100,59>
314° <255,100,60>
315° <255,100,61>
316° <255,100,62>
317° <255,100,63>
318° <255,100,64>
319° <255,100,65>
320° <255,100,66>
321° <255,100,67>
322° <255,100,68>
323° <255,100,69>
324° <255,100,70>
325° <255,100,71>
326° <255,100,72>
327° <255,100,73>
328° <255,100,74>
329° <255,100,75>
330° <255,100,76>
331° <255,100,77>
332° <255,100,78>
333° <255,100,79>
334° <255,100,80>
335° <255,100,81>
336° <255,100,82>
337° <255,100,83>
338° <255,100,84>
339° <255,100,85>
340° <255,100,86>
341° <255,100,87>
342° <255,100,88>
343° <255,100,89>
344° <255,100,90>
345° <255,100,91>
346° <255,100,92>
347° <255,100,93>
348° <255,100,94>
349° <255,100,95>
350° <255,100,96>
351° <255,100,97>
352° <255,100,98>
353° <255,100,99>
354° <255,100,100>
355° <255,100,101>
356° <255,100,102>
357° <255,100,103>
358° <255,100,104>
359° <255,100,105>