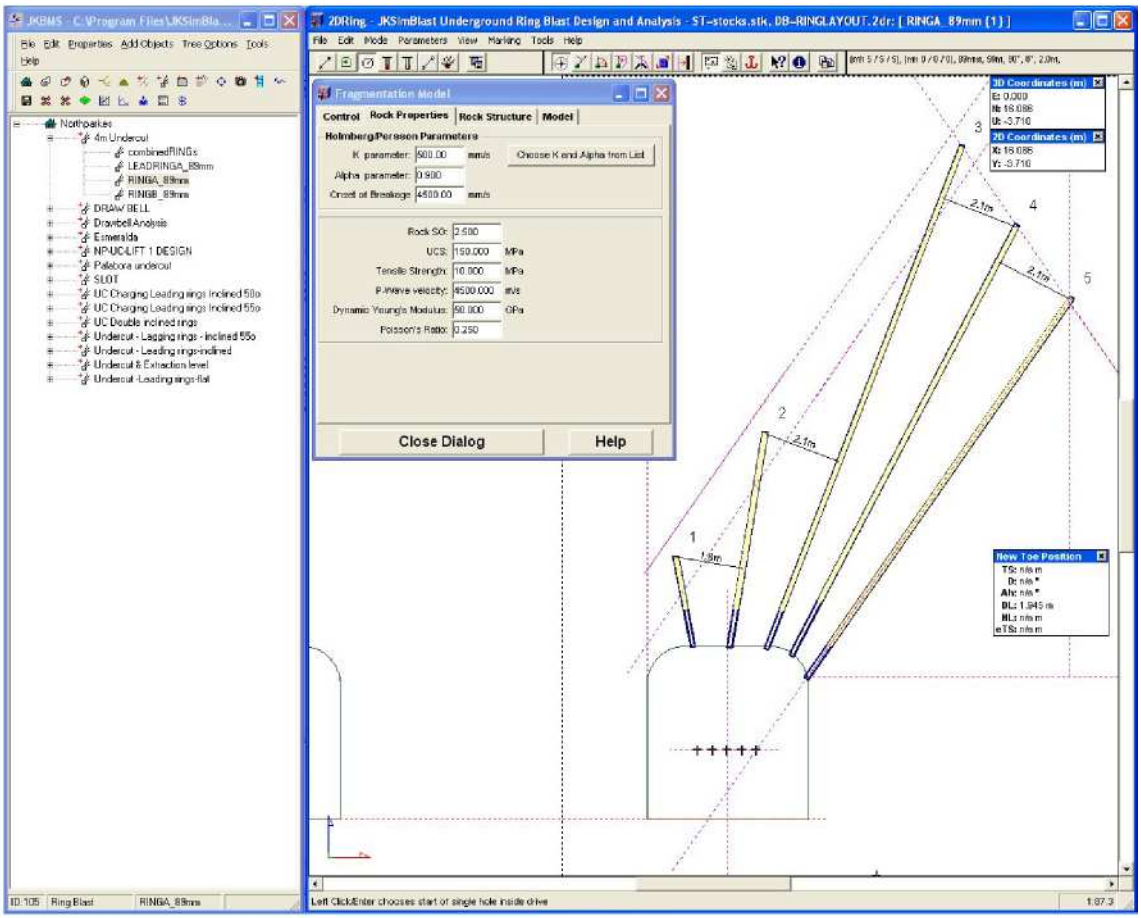
JKSimBlast Underground Software

JKSimBlast developed by the Julius Kruttschnitt Mineral Research Centre (JKMRC) was used to encode the single ring component of *FRAGMENTO.* The figure below shows the graphical user interface currently available. Specific programming allowed for the requirement to enable the direct transfer of all modelling output into Excel spreadsheets for final analysis and interpretation.

The package runs under the Microsoft Windows operating system (i.e. Win98,2000, NT & XP). It consists of two modules, the blast management system (BMS), shown on the left of the screen dump; and the 2DRing design and analysis module, shown on the right on the screen dump. The BMS is the organisation centre, where the user can define and relate the data created and collected by the 2DRing design program and other applications. A BMS database is automatically generated and displayed in a Tree-View control. In 2DRing, the user can create multiple ring designs consisting of blast holes, decks, down-hole and surface delays and connections. The design can be further described by strings and polygons defining orebody outlines, drilling boundaries and underground openings. All data is stored in Microsoft Access databases with full 3D details.



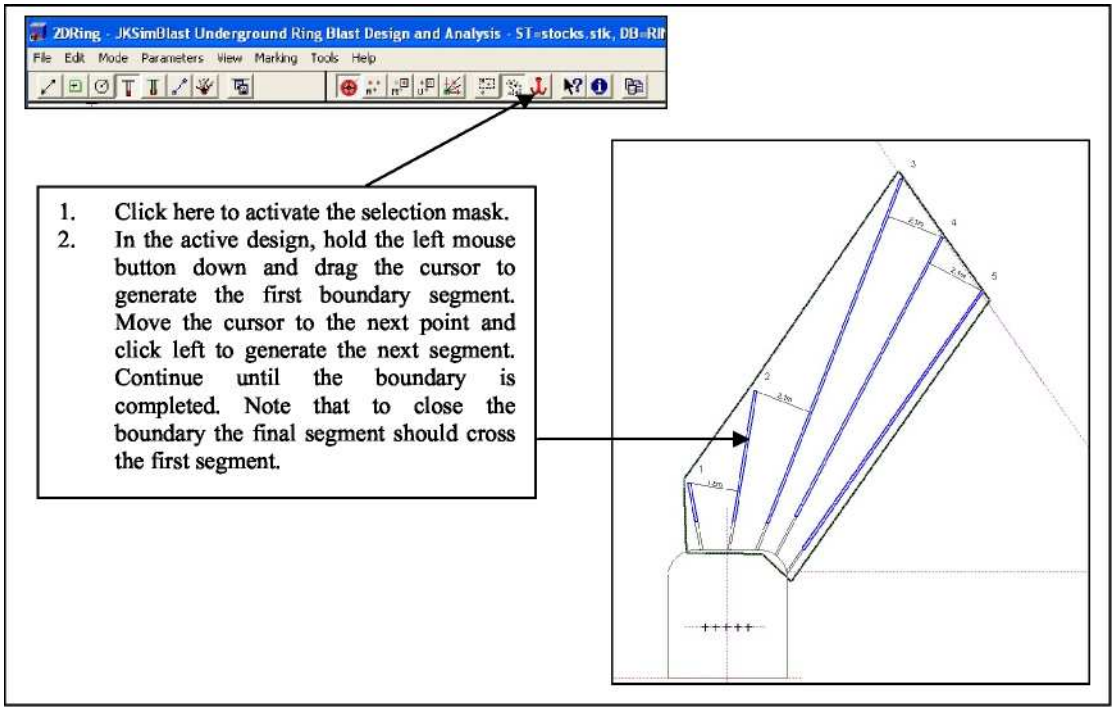
Single ring fragmentation model- Quick user's guide

This guide assumes that the user is familiar with the input of design information into the BMS and 2DRing design modules. Detailed help files are available to software users and can be obtained from http://www.jksimblast.com/help.htm.

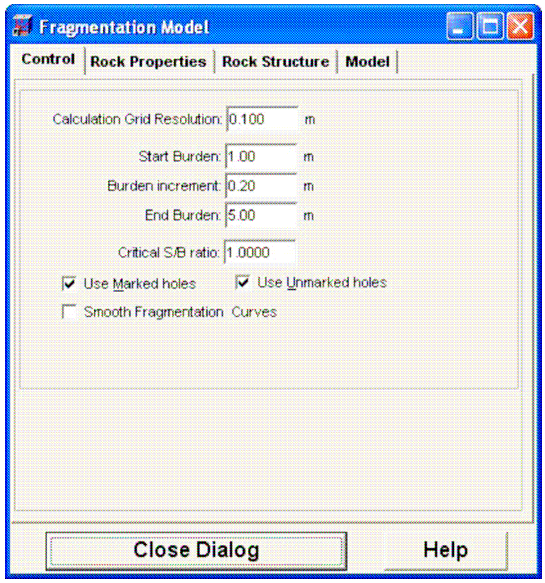
This document guides the user through the procedures required to run the single ring

component of *FRAGMENTO.* As mentioned earlier, the output available consists mainly of the algorithms developed to estimate “coarse” fragmentation outcomes. Only a simplified version of the fines modelling component has been incorporated in the software at this stage.

For a given drilled and charged ring, activate the selection mask and define the blasting area or boundary region bounded by the drilled and charged blastholes



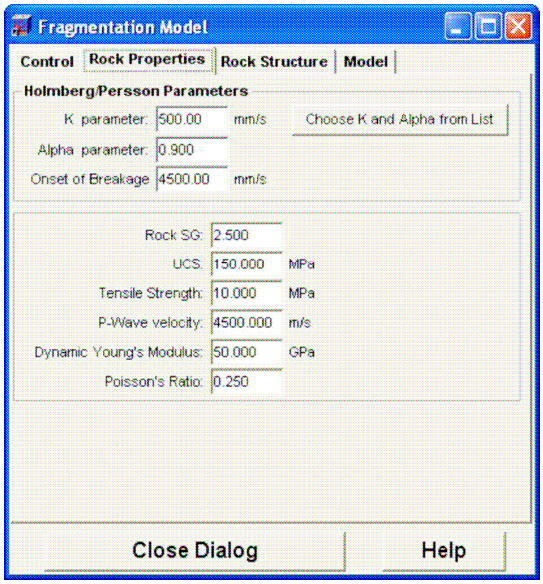
From the Tools+Fragmentation Model… menu item, activate the fragmentation model dialog. This main dialog contains four major tabs which help the user manage all key input parameters and final output. The following table describes the items in each of these tabs.



In the Control tab the user sets the basic calculation requirements of the model:

- The calculation grid resolution sets the resolution of the PPV point calculation at a distance in 3D space. The value of 0.1 m is adequate and should be maintained in most underground production blasting conditions. It should be noted that finer resolutions will increase calculation times.
- Start burden, Burden increment and End burden allow the user to set a range of burden configurations to evaluate fragmentation outcomes.
- The critical S/B ratio is a simple empirical threshold which is used by the program to highlight the final selection of fragmentation results given in the Model Tab (see Model Tab description).
- Option to invoke a smoothing algorithm for the fragmentation curves output by the program and activated in the Model tab.

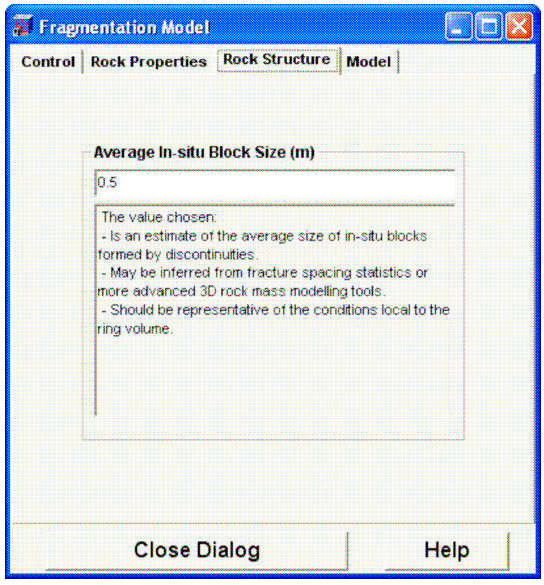
In the Rock Properties tab, the user sets the rock input parameters required by the model.



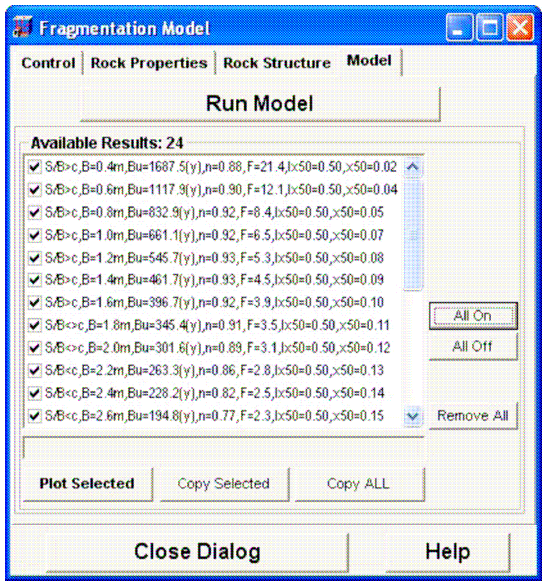
- The first set of rock input parameters are the Holmberg/Persson attenuation constants K, ~ and the PPV onset of breakage. The default parameters given have been shown to adequately represent metalliferous hard rock conditions.

- Rock material strength parameters are also specified here, they include Rock SG, UCS, Tensile strength, P-wave velocity, Dynamic Young's modulus and Poisson's ratio.

In the Rock Structure tab, the user sets the parameter that best describes the rock mass fracturing conditions local to the ring volume. This is defined by an estimate of the average size of in situ blocks.



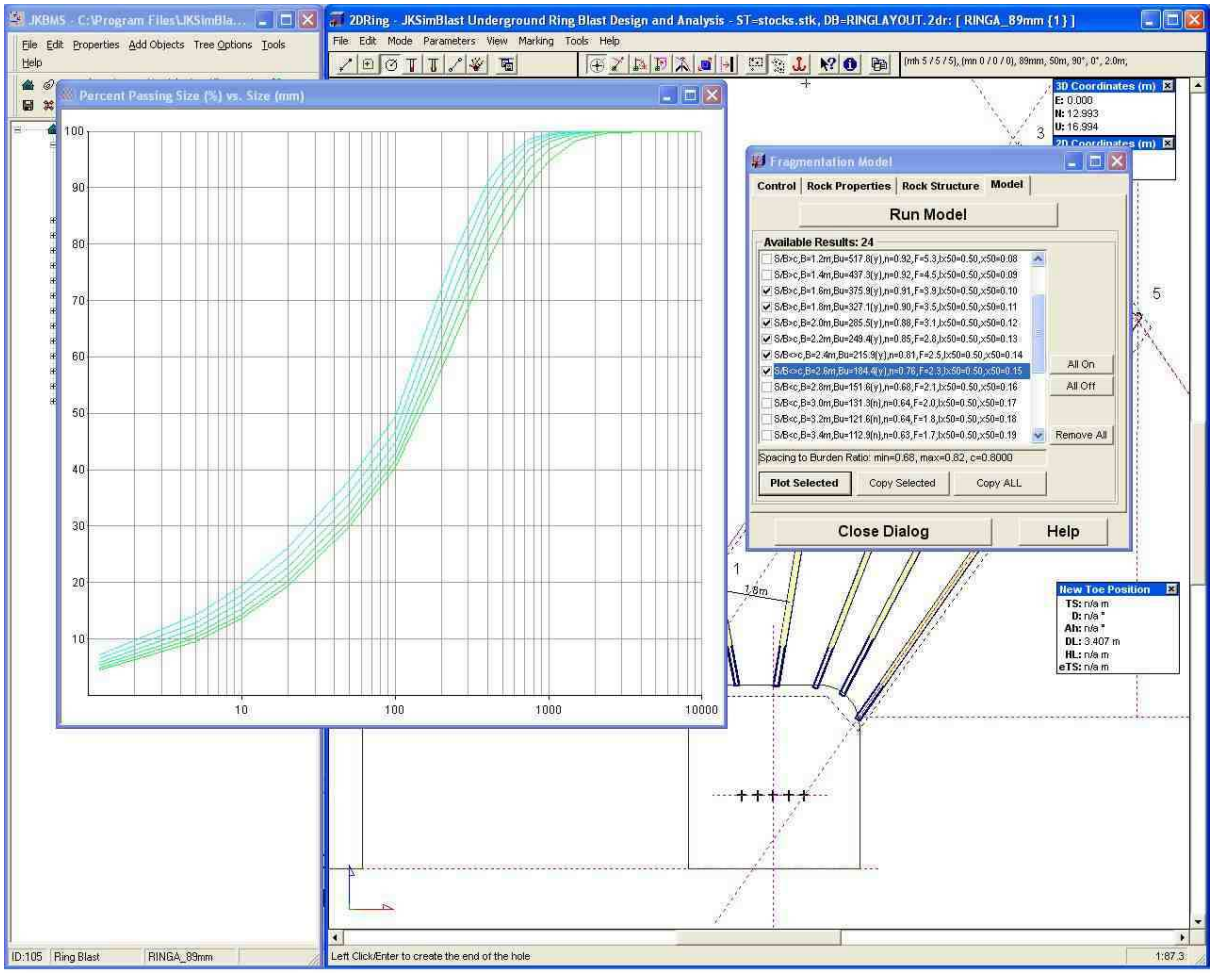
In the Model tab, the user is able to activate modelling calculations and obtain a list of output for each burden configuration set in the Control Tab. Output boxes are automatically selected when S/B ratios are greater than the value specified in the Control tab. The selected results can then be plotted or copied into Excel spreadsheets. The user is also able to select or deselect individual results at will or by using the "All On" or"All Off" buttons.

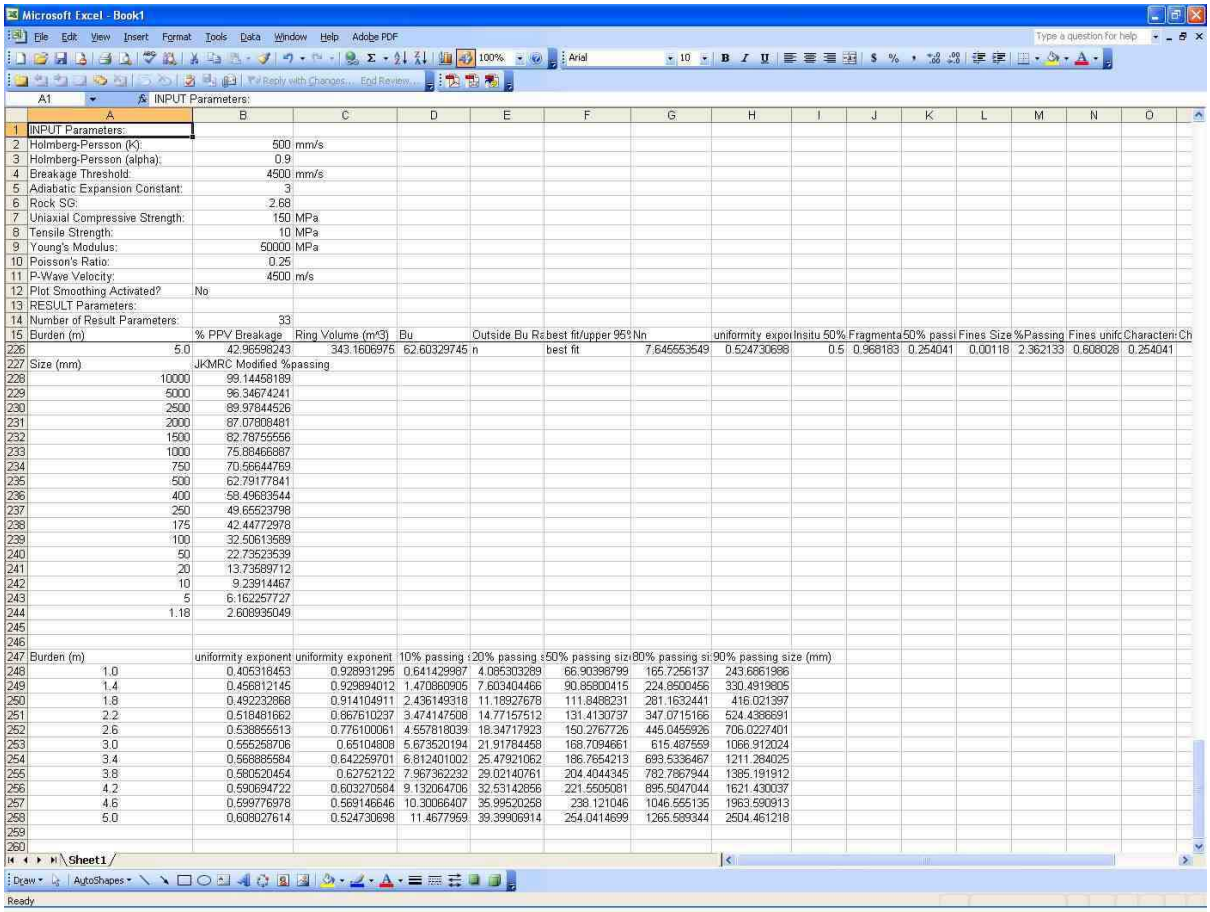


- Fragmentation distribution curves for the selected output can be automatically plotted by clicking on the "Plot Selected" button.

- To copy data into Excel, the user must click on the "Copy Selected" or "Copy All" buttons, open an Excel sheet and use the paste option from within Excel.

As discussed above, standard fragmentation curves can be plotted from within 2DRing by pressing on the “Plot Selected” button. The output dialog is illustrated below.





	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	INPUT Parameters:														
2	Holmberg-Persson (K):	500	mm/s												
3	Holmberg-Persson (alpha):	0.9													
4	Breakage Threshold:	4500	mm/s												
5	Adiabatic Expansion Constant:	3													
6	Rock SG:	2.68													
7	Uniaxial Compressive Strength:	150	MPa												
8	Tensile Strength:	10	MPa												
9	Young's Modulus:	50000	MPa												
10	Poisson's Ratio:	0.25													
11	P-Wave Velocity:	4500	m/s												
12	Plot Smoothing Activated?	No													
13	RESULT Parameters:														
14	Number of Result Parameters:	33													
15	Burden (m)	% PPV Breakage	Ring Volume (m^3)	Bu	Outside Bu Ra	best fit/upper 95%	Nn	uniformity expor	Insitu 50%	Fragmenta	50% passi	Fines Size	%Passing	Fines unifc	Characteri	Ch
226	5.0	42.96598243	343.1606975	62.60329745	n	best fit	7.645553549	0.524730698	0.5	0.968183	0.254041	0.00118	2.362133	0.608028	0.254041	
227	Size (mm)	JKMRC Modified %passing														
228	10000	99.14458189														
229	5000	96.34674241														
230	2500	89.97844526														
231	2000	87.07808481														
232	1500	82.78755556														
233	1000	75.88466887														
234	750	70.56644769														
235	500	62.79177841														
236	400	58.49683544														
237	250	49.65523798														
238	175	42.44772978														
239	100	32.50613589														
240	50	22.73523539														
241	20	13.73589712														
242	10	9.23914467														
243	5	6.162257727														
244	1.18	2.608936049														
245																
246																
247	Burden (m)	uniformity exponent	uniformity exponent	10% passing s	20% passing s	50% passing size	80% passing si	90% passing size (mm)								
248	1.0	0.405316453	0.928931295	0.641429987	4.085303289	66.90398799	165.7256137	243.6861986								
249	1.4	0.456812145	0.929894012	1.470860905	7.603404466	90.85800415	224.8500456	330.4919805								
250	1.8	0.492232868	0.914104911	2.436149318	11.18927678	111.8486231	281.1632441	416.021397								
251	2.2	0.518481662	0.867610237	3.474147508	14.77157512	131.4130737	347.0715166	524.4386691								
252	2.6	0.538855513	0.776100061	4.557818039	18.34717923	150.2767726	445.0455926	706.0227401								
253	3.0	0.555258706	0.65104808	5.673520194	21.91784458	168.7094661	615.487559	1066.912024								
254	3.4	0.568885584	0.642259701	6.812401002	25.47921062	186.7654213	693.5336467	1211.284025								
255	3.8	0.580520454	0.62752122	7.967362232	29.02140761	204.4044345	782.7867944	1385.191912								
256	4.2	0.590694722	0.603270584	9.132064706	32.53142856	221.5505081	895.5047044	1621.430037								
257	4.6	0.599776978	0.569146646	10.30066407	35.99520258	238.121046	1046.555135	1963.590913								
258	5.0	0.608027614	0.524730698	11.4677959	39.39906914	254.0414699	1265.589344	2504.461218								
259																
260																

As shown above, the output data copied into an Excel sheet contains a summary of all input parameters, modelling output parameters and fragmentation data for each burden configuration and a compiled summary of burden versus predicted uniformity, P10, P20, P50, P80 and P90 values.