Using Chip Load Calculations to Improve Cutting

One of the challenges in getting good CNC cuts is in selecting the best cutting speed (feed rate) and router/spindle RPM. Selection can be facilitated using the guidance provided by manufacturers regarding the best 'chip load' for a particular cutter. Since chip load (the size of the chunk of material taken by a tooth of the cutter) reflects the combination of how fast the cutter is moving forward into the material and how fast it is turning (Chipload = Feedrate / [RPM x number of flutes]), it gives you starting point speed values for testing to determine the most suitable parameters for any cutting situation. The ShopBot Chip Load Calculator simply provides a quick way to explore these values, and is most useful if you know the approximate desired chip load for a particular cutter and material.

The following are some *very rough* chip load ranges for cutting various materials. Keep in mind that the most effective chip load depends on the specific geometry of the cutter, so you will want to check with the maker of your specific bit, and then keep your own records on what values work best for you.

The following chip load values were abstracted from the Onsrud Cutter Catalog which is an excellent source of information relating to cutting and machining.
http://www.onsrud.com

Values in inches/flute

CHIPLOAD	¼ inch diameter	½ inch diameter
Softwood	.002-.020	.003-.030
Hardwood	.005-.020	.005-.030
MDF	.005-.020	.005-.030
Plywood	.005-.020	.005-.030
Laminated Chipboard	.008-.020	.010-.030
Soft Plastic	.004-.012	.006-.014
Hard Plastic	.006-.012	.008-.016
Aluminum	.003-.010	.004-.012

If depth of cut = 2x diameter then reduce chip load by 25%.
If depth of cut = 3x diameter then reduce chip load by 50%.

Note that there is considerable overlap in the range of parameters and this indicates that you will need to test for the best speed selection for a particular cutting or machining operation. Here's the strategy that Onsrud suggests:

1. Start off using an RPM derived for the chip load for the material you are cutting.
2. Increase the cutting speed (feed rate) until the quality of the part's finish starts to decrease or the part is starting to move. Then decrease speed by 10%.
3. Next decrease RPM until finish deteriorates again, and then bring it back up until acceptable.
4. This optimizes RPM and speed so that you are taking the largest possible chips.