I don't in any way claim to be an expert at CNC techniques and methods, but I have cut a lot of things out of a lot of sheets of plywood over the years and have developed a system that works well for me. It may not be the most efficient way to work… there are lots of resources that are focused on production and will help you become hyper-efficient. The main benefit is that it limits the things you have to think about, and works pretty well in just about every occasion.

I've toolpathed these Shelter files to cut fairly conservatively, both to make sure that people with CNC tools of varying capabilities can use them and to hopefully make it easier for anyone to have success when cutting them. You are free to make as many changes you would like, but I feel like these are a good starting point

Bits:

Since I cut mostly sheet plywood and similar manufactured panels, I don't want to have to think about what kind of bit to use or have to change bits within a file if I can avoid it. I try to pick one bit that will do everything I need it to do, and pick the largest size of that kind of bit that will cut all the features. So ALL these file can be cut with a ¼" bit, and my preference is a 2-flute straight bit. It leaves a reasonable edge and face quality, and can make shallow cuts that would be a problem with an up-cut or combination bit.

HoldDown and cutting strategy:

I have a simple Vacuum holddown system that I can't imagine doing without. If you're cutting features that are depth critical like 3d carvings or parts that have to interlock, then holding the material firmly to the table is critical. If however you cutting shapes out of sheets, holding DOWN is only a part of what it does for you. I feel like its most important job is to hold the parts AND THE REST OF THE SHEET in place. If the material moves a little in the Z-axis you might be alright, but if it moves in X or Y you are in trouble.

Here are some rules I try to follow

- Even with a vacuum holddown I always put clamps at the corners of the sheets if possible. This helps keep the waste part of the sheet from "ooching" around
- I try to cut small parts first when the holddown is the best. More surface area makes larger parts easier to hold, so do them last
- Tabs are helpful but can be a pain to remove. I generally only use them with smaller parts, and try to only use one tab at the start point. If you can place the tab so that it's in a section of grain that's parallel to the tab, it will be easier to remove.
- My exception to the one-tab-per-part rule is in long thin parts, like the door trim pieces. I tab the heck out of them because they will want to chatter, leaving a rough edge and probably breaking a bit
- I generally spend a little extra time picking the order of cut for my parts, and where the start point is for the cut. The goal is to have the parts connected to the sheet for as long as possible before finally cutting them free. Imagine slicing a loaf of bread…you want to hold the loaf at one end and start slicing at the other. As you slice, everything is firmly held until the last minute.

Ramping:

I ramp into every part that I cut…it makes bits last longer and leaves a better edge. More importantly, since it's cutting a thinner and thinner bit of material as it gets to the end of the final pass, the cutting force is reduced and the part will better stay connected until cutting is finished

For most parts I use a Smooth ramp, varying between 5-8" long depending on how aggressively I'm cutting. With small parts however I use a Spiral ramp, which along with a tab at the start/end point gives me better control of the cut.

Speeds:

I've toolpathed these files to cut at 4"/sec and 11,000 rpm spindle speed, and to cut ½" plywood in 2 passes and ¾" plywood in 3. When I cut these parts in my shop I cut ½" in 1 pass and ¾" in 2, so feel free to modify the settings in your tool database to suit your tool and cutting style

Toolpathing:

The toolpaths are organized based on the way I would cut them. There are two "types" of toolpaths…those that start with "prelim" and those that start with a number.

The ones that start with "prelim" are eventually combined into a Merged Toolpath. Their names tell you what order that are to be cut in the merged file, and what toolpath they are merged into. For instance, toolpaths "*prelim3a-*****" and "*prelim3b-*****" are merged into toolpath "*3-*****"

Toolpaths that start with a number are meant be cut in that order. You would cut toolpath "*1-*****", then "*2-*****"

Layers:

I've tried to use descriptive layer names to describe the entities contained in those entities. Entities in the "screwhole location marker" layer are meant to cut shallow dimples that indicate where to eventually drill pilot holes for screws. Wedges are on their own layers because of the way they are cut, and occasionally the holes in parts are on their own layers if they are to be cut using a different strategy that other parts.