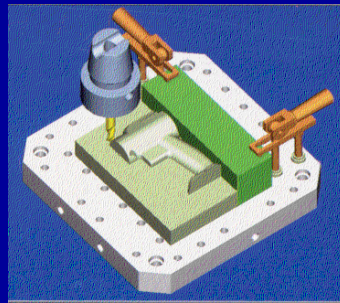


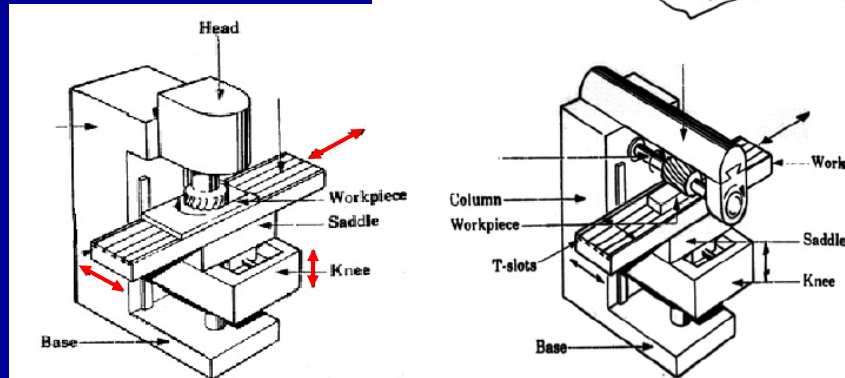
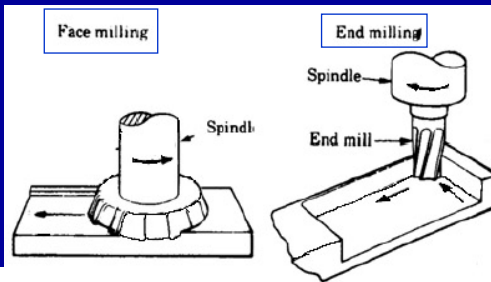
Computer Numerically Controlled (CNC) Machining and Tool Path Programming



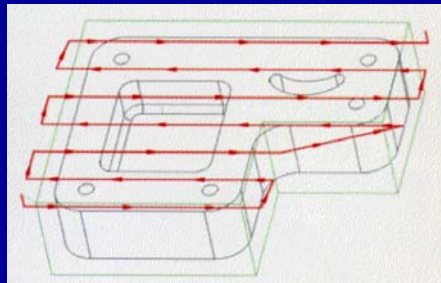
CNC Machining of Complex Surface Parts



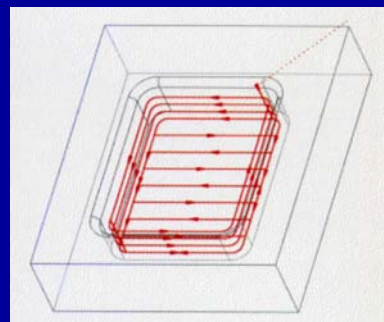
2 ½ and 3 Axis Milling



Face Milling



Pocketing



Three-Axis CNC Machines

- In 3-axis CNC vertical machine, the working table moves along x- and y-axis, and the tool along z-axis.
- In machining, tool orientation is fixed, either in vertical or horizontal direction.
- If all surfaces to be machined are accessible by the cutter in one setup, select a 3-axis CNC machine.

Synchronized Motions in 3 Axis



Five-Axis CNC Machines

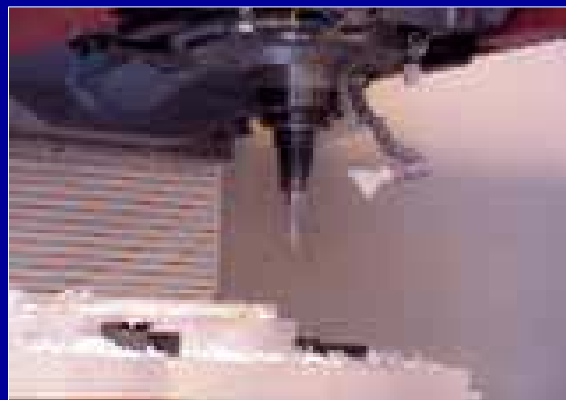
- X-, Y-, and Z- Axis Motions and A- and B- axis Rotations (**Simultaneously**)
- Tool orientation can be changed simultaneously during machining.
- If some surface patches to be machined are not accessible by the cutter in one setup, consider to use a 5-axis CNC machine.



Five-Axis CNC Machines



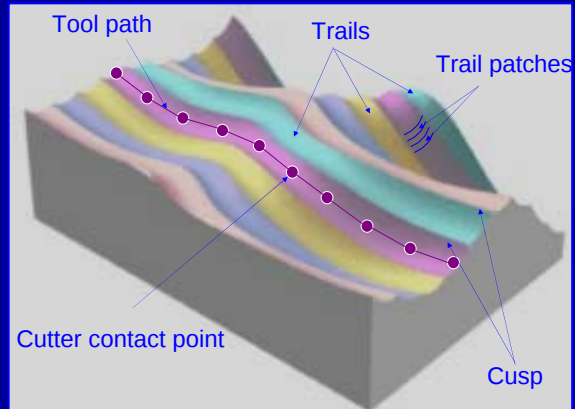
Five-Axis CNC Machining



Cincinnati V5-2000 5-Axis
CNC Machining Center

Machined Surface

- CAD Model of the Surface
- Tool Path Generation
- Simulation of Cutting
- Accuracy of the Machined Surface
- Over-cut and Over Cut Detection



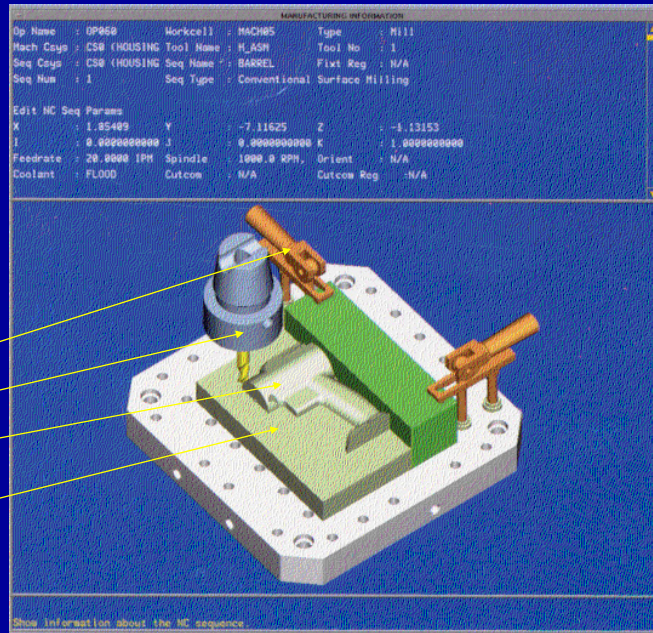
Computer-Aided Manufacturing (CAM) CNC Tool Path Programming

- ...
- Automatic Tool Paths Generation for CNC Machining from CAD Models
- Tool Path Verification and Graphical Simulation of CNC Machining
- CNC Post-Processor for Machine Dependant G-code Generation

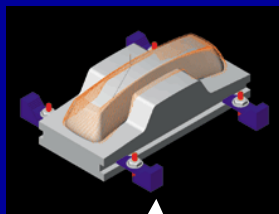
Tool Path Generation, Machining Simulation

3-Axis Milling

- Fixture
- Cutter
- Part
- Workpiece
- NC Sequence

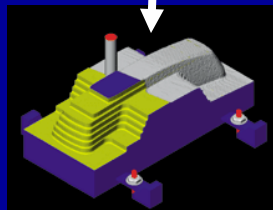


Tool Path Generation and Machining Simulation

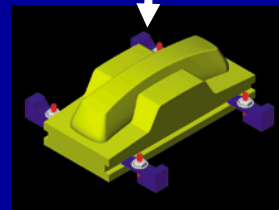


Generate 3-axis CNC tool paths for the mold of a phone handset

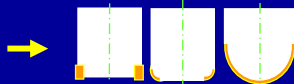
Verify the tool paths and simulate the milling process



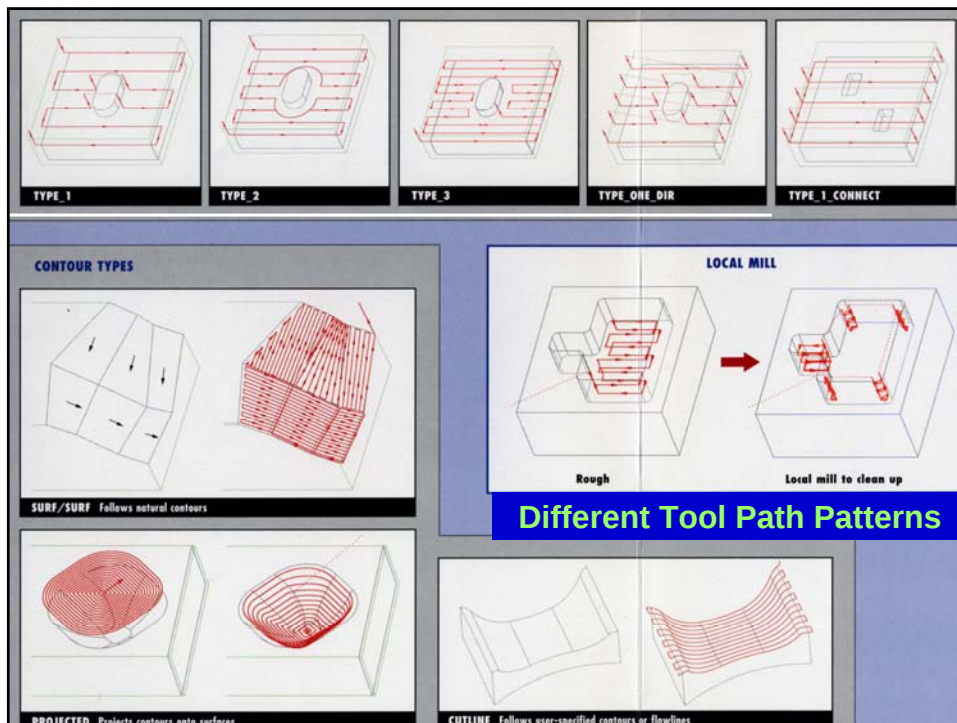
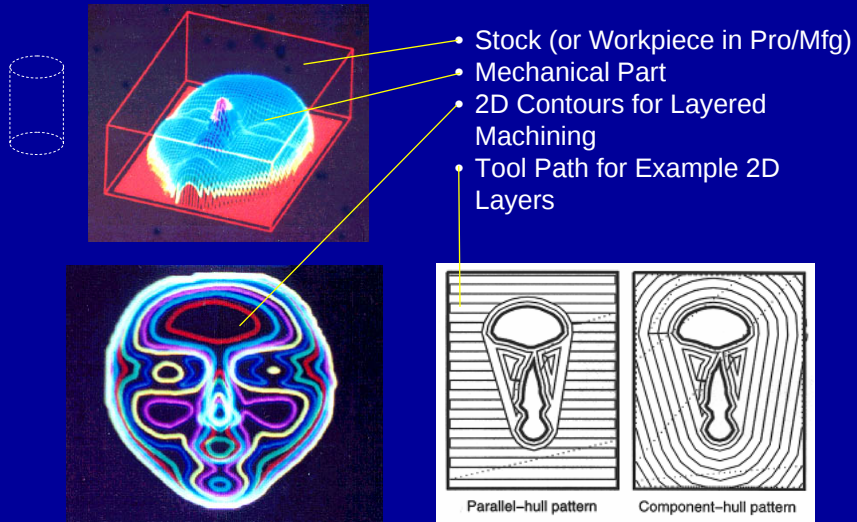
The digital result of the virtual CNC machining



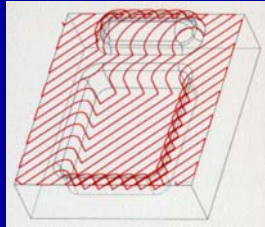
Flat, Torus and Ball End Mill



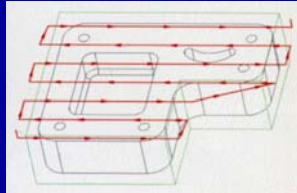
2 ½ Axis Rough Machining



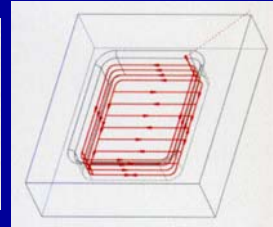
Conventional Surface



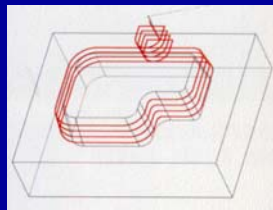
Face



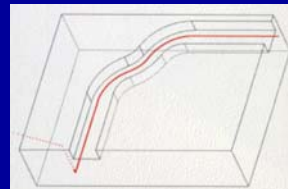
Pocket



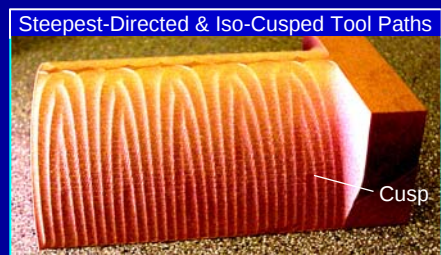
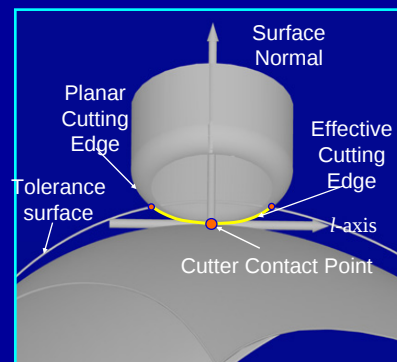
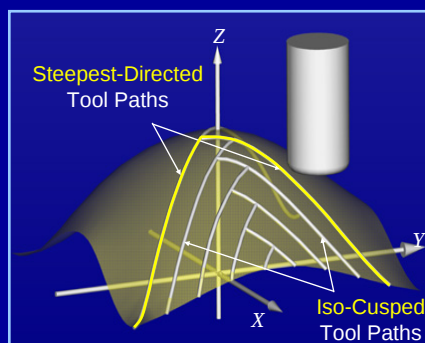
Profile



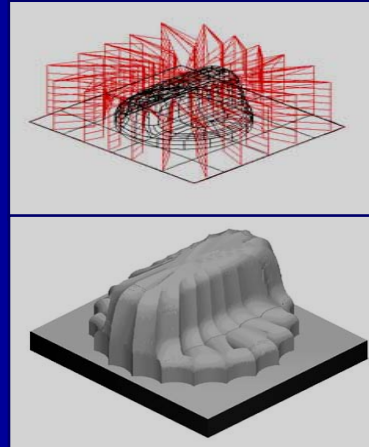
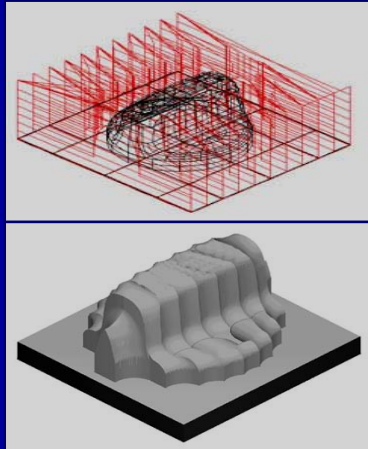
Trajectory



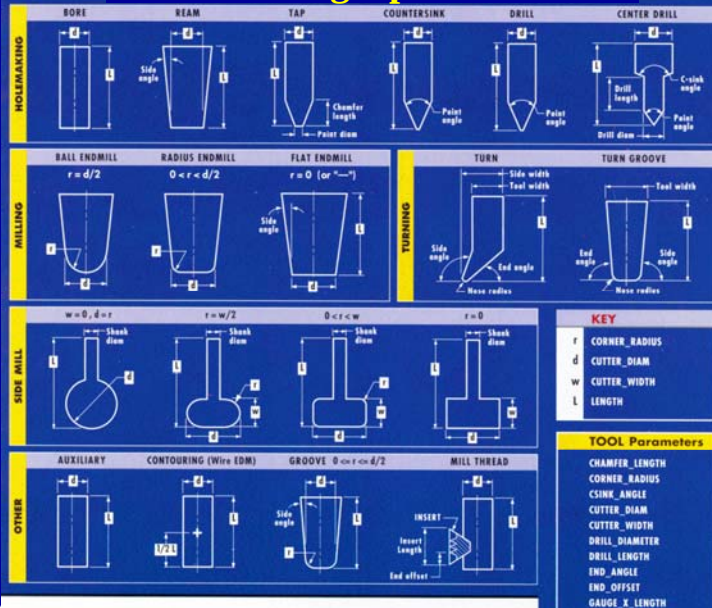
**Cutter, Part Surface,
Surface Normal,
Tolerance Surface,
Tool Path, Cusp**



Parallel-Plane-Guided and Radial Tool Paths



Setting Up Tools



Setting Up Machining Parameters

Goto Point

Specify Tool Motion Parameters:

Feed... FEEDRAT / 20.000, IPH

Spindle... SPINDL / RPM, 1000.000, CM

Coolant... COOLANT / OFF

Cutcom... CUTCOM / OFF

Specify Target Goto Point: Specify Offset Values:

Specify Point ... Specify Offset ...

Specify Axes Tool Moves Along:

☒ Simultaneous ☐ X Axis ☐ Y Axis ☐ Z Axis

☒ Z First

☐ Z Last

Define Tool Axis at Target Point:

☒ Along Z axis

☐ Use Previous

☐ Specify New Axis Specify Axis ...

OK Preview Cancel

Sets speed and machine parameters.

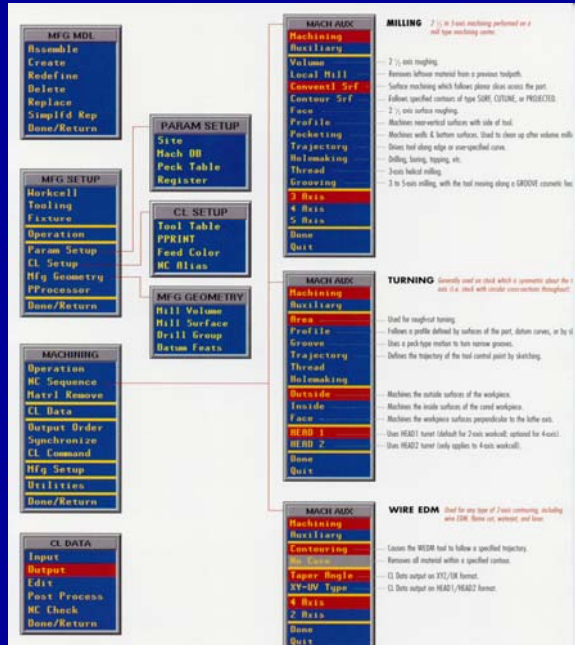
Defines location to move tool.

Controls axes of motion.

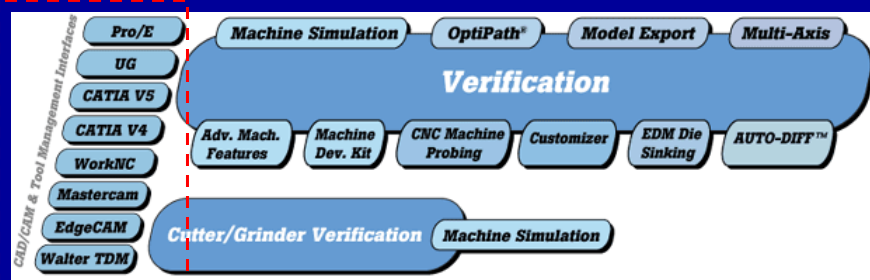
Defines tool axis orientation for the motion.

Accepts/Previews/Cancel tool motion.

Pro/Mfg Menu System

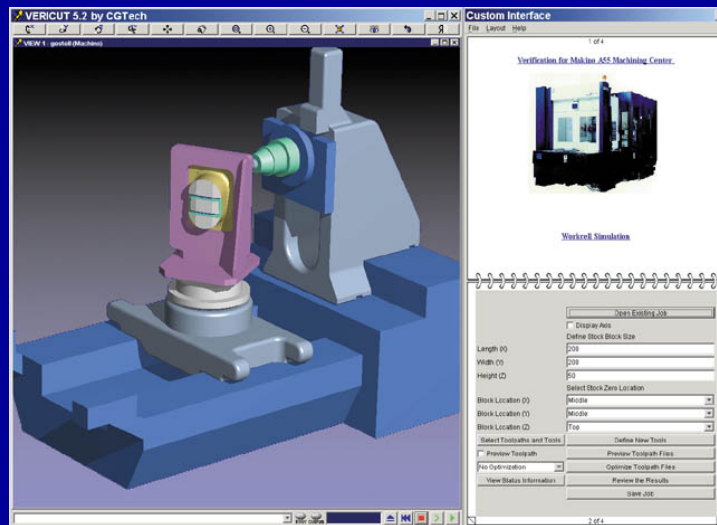


VERICUT Interface to Major CAD/CAM Systems

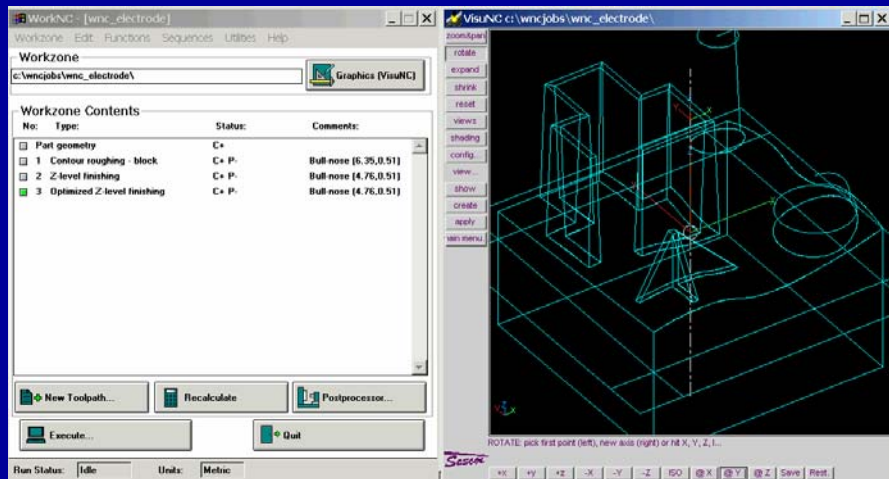


Pro/E has licensed a CNC simulation module
from VERICUT
– with no machine tool modeling capability

Simulation of CNC Machining (VERICUT)



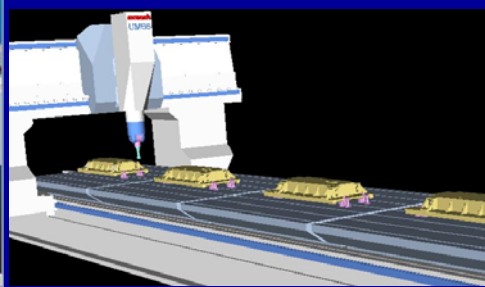
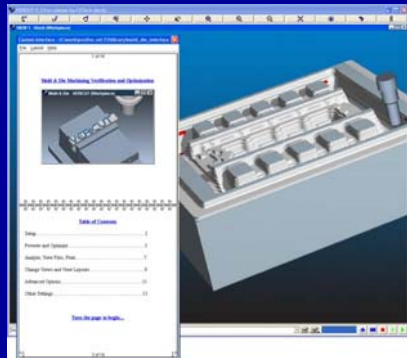
Machining Simulation and Tool Path Verification



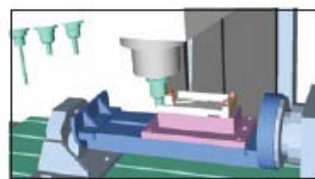
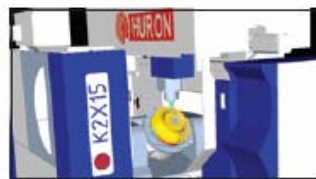
5-Axis CNC Milling Based on a CAD Model of Boat Design

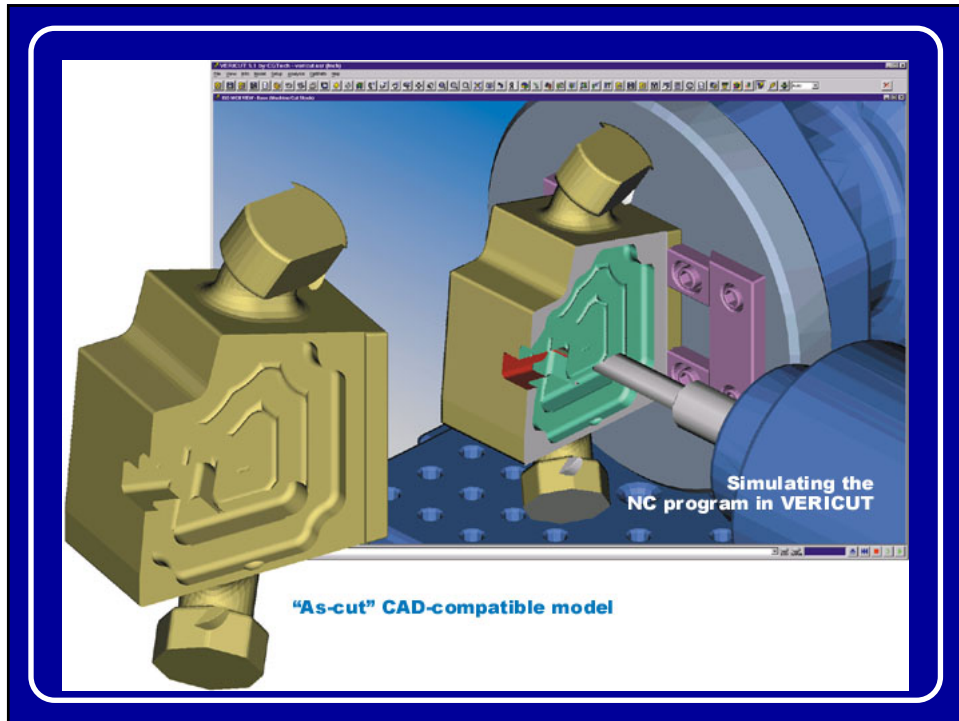


Different CNC Machines & Tasks

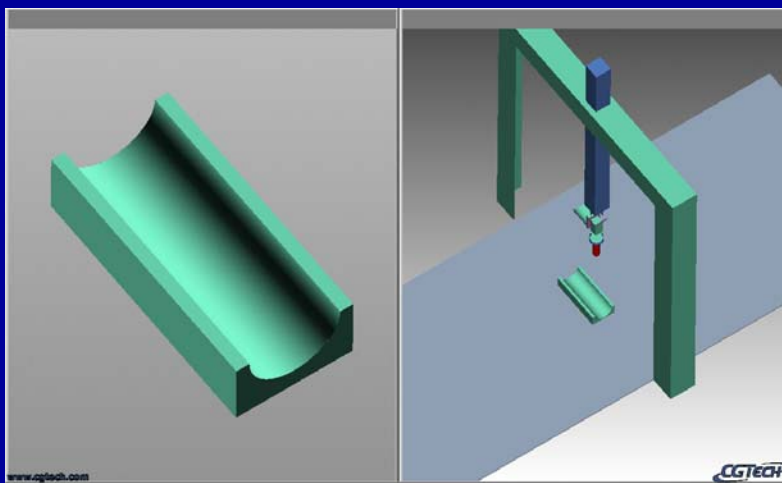


VERICUT CNC Machine Simulation

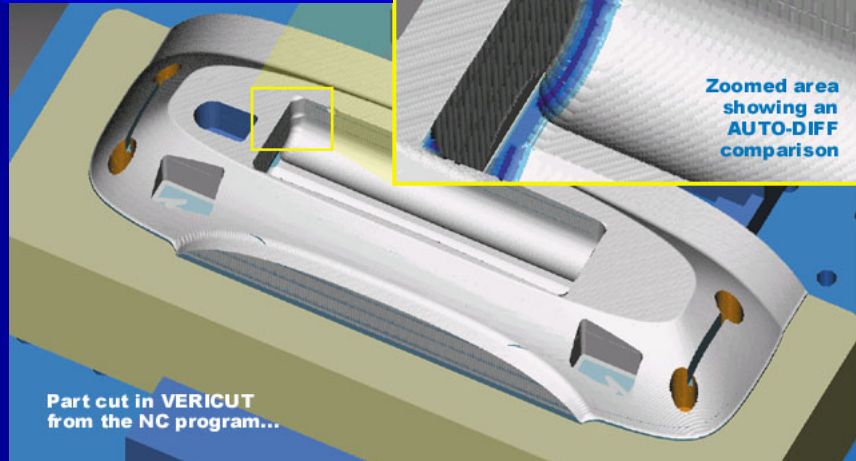




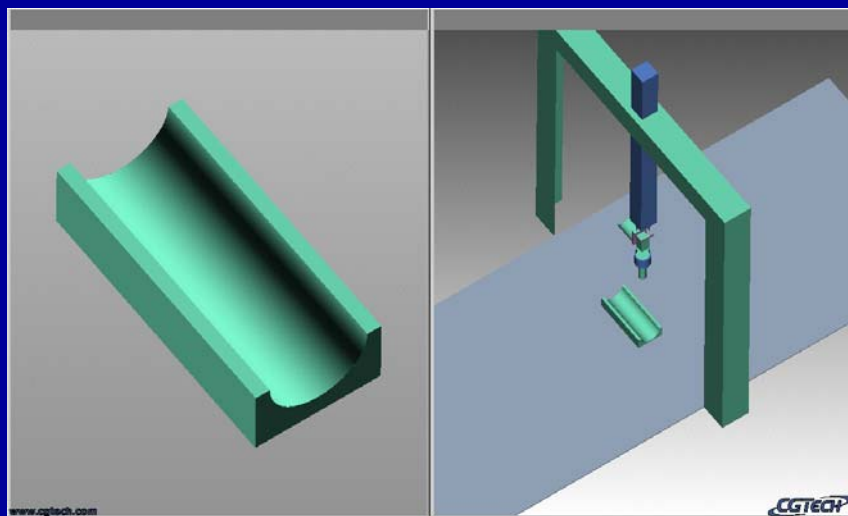
CNC Milling Simulation - CUSP



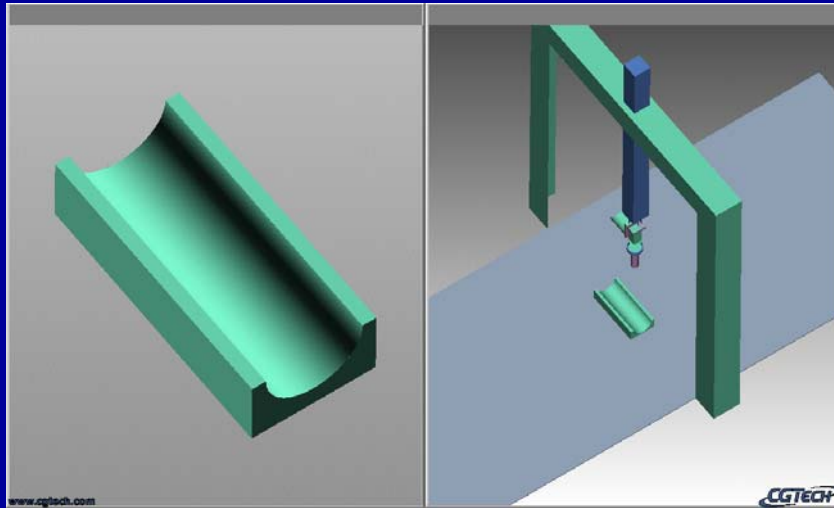
Gouge Detection



Collision and Gouge Detection - Flat End Mill



Collision and Gouge Detection - Torus End Mill



EDM CNC Simulation

