



Autodesk CAM – Overview

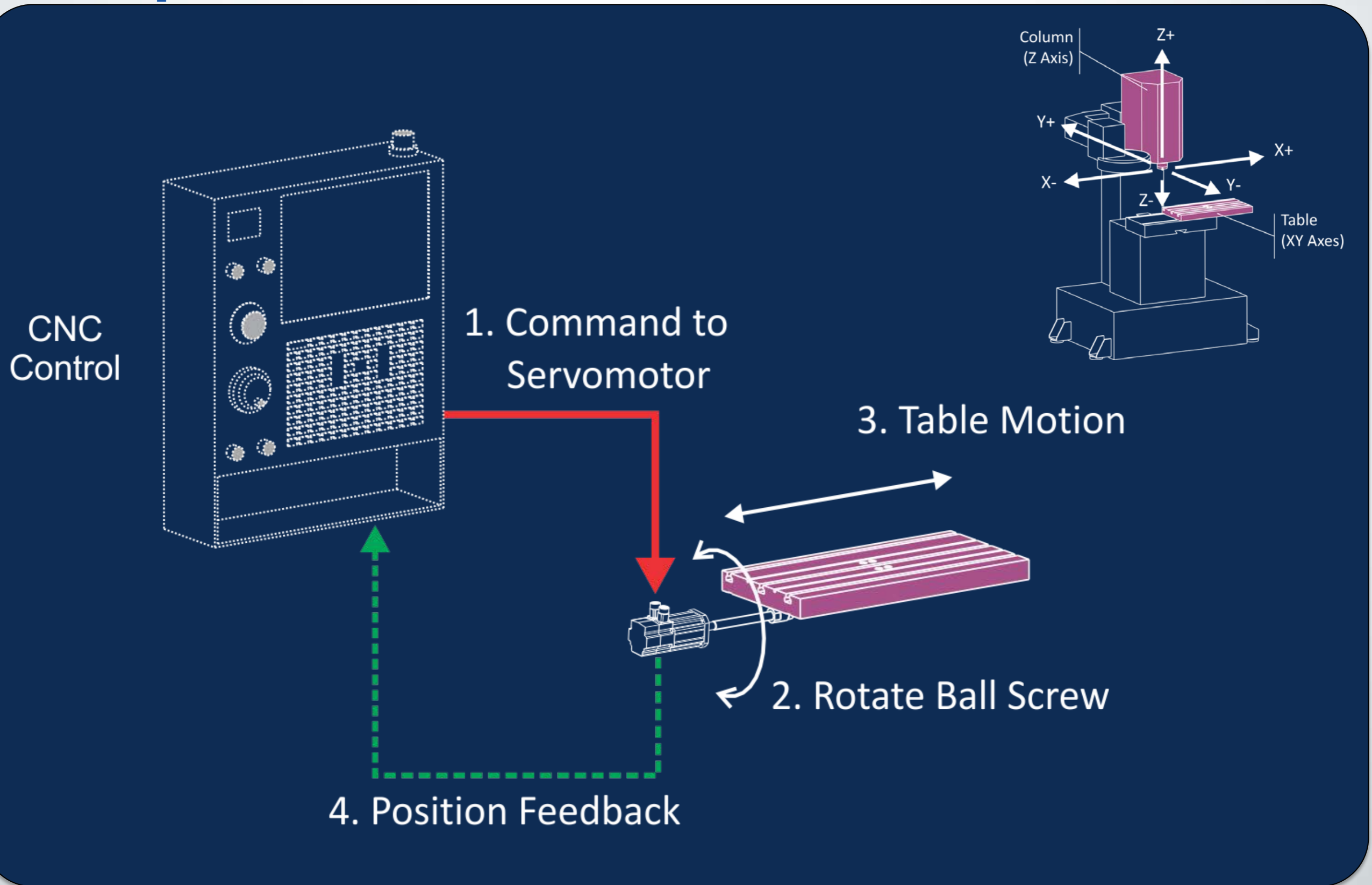


Autodesk

- **\$2.4B**
- **A world leader in 3D design and engineering software**
- **10 million+ users in more than 800,000 companies**
 - **AEC**
 - **Media & Entertainment**
 - **Manufacturing**
- **Digital Prototyping addresses solutions for engineers needing Concept THROUGH Manufacturing**



Computer Numerical Control



CNC language - GCode

- CNC Machines are accurate and powerful industrial robots.
- Language: RS-274D set by Electronics Industry Association (EIA).
- Developed in 1960's when computers had little memory.
- Slang: G-code, because many codes begin with letter "G".

```
%  
O62806 (FACE-CONTOUR)  
N10 G90 G94  
N15 G20  
N20 G28 G91 Z0.  
N25 G90  
N30 M09  
N35 T1 M06  
N40 T3  
N45 S8149 M03  
N50 G54  
N55 M08  
N60 G00 X4.495 Y-3.9294  
N65 G43 Z0.8 H01  
N70 Z0.2  
N75 G01 Z0.0425 F20.  
N80 G18 G03 X4.4575 Z0.005 I-  
0.0375
```



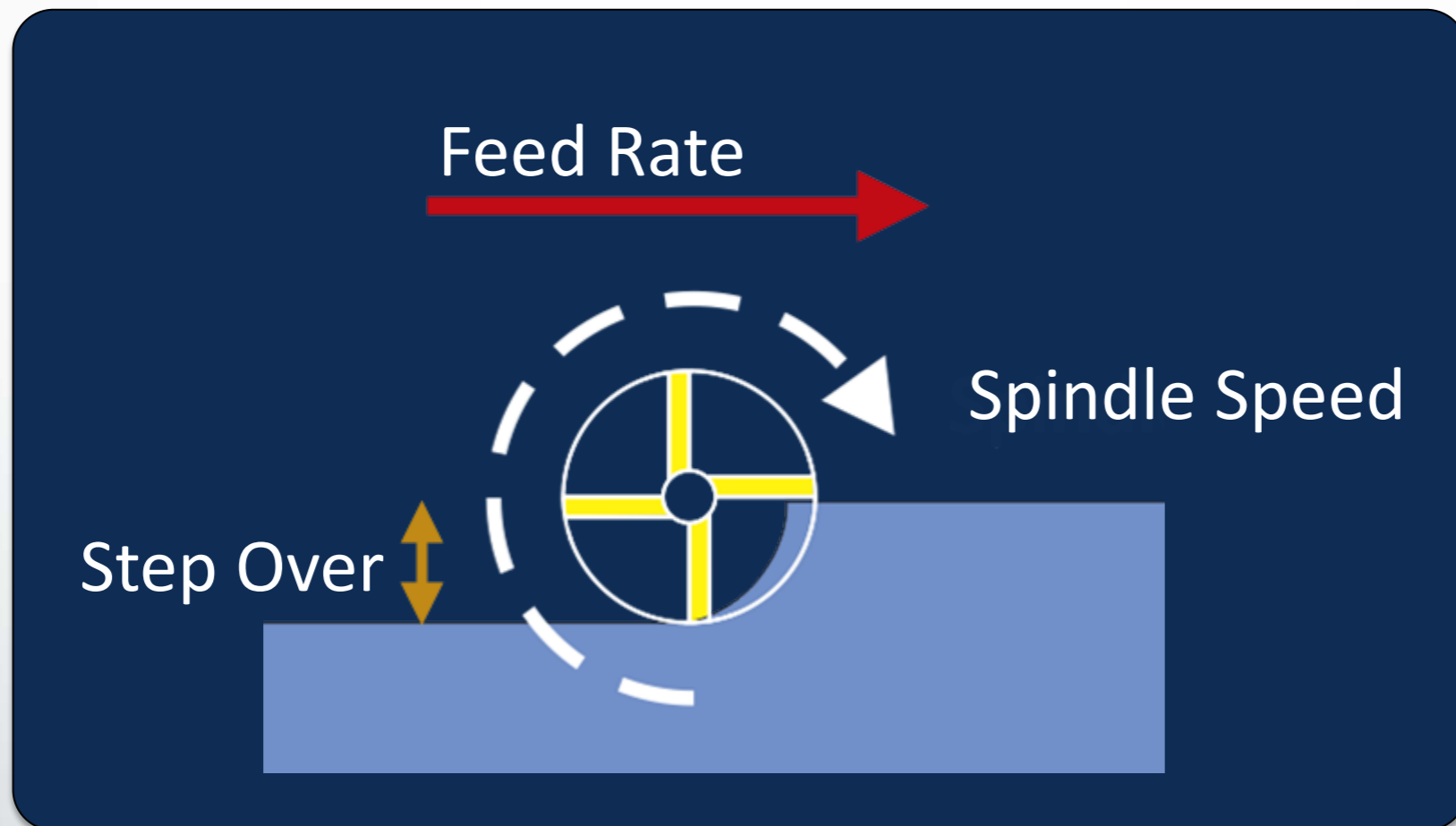
```
G3 X-.25 Y0. I-.25 J0.
```

Speeds and Feeds

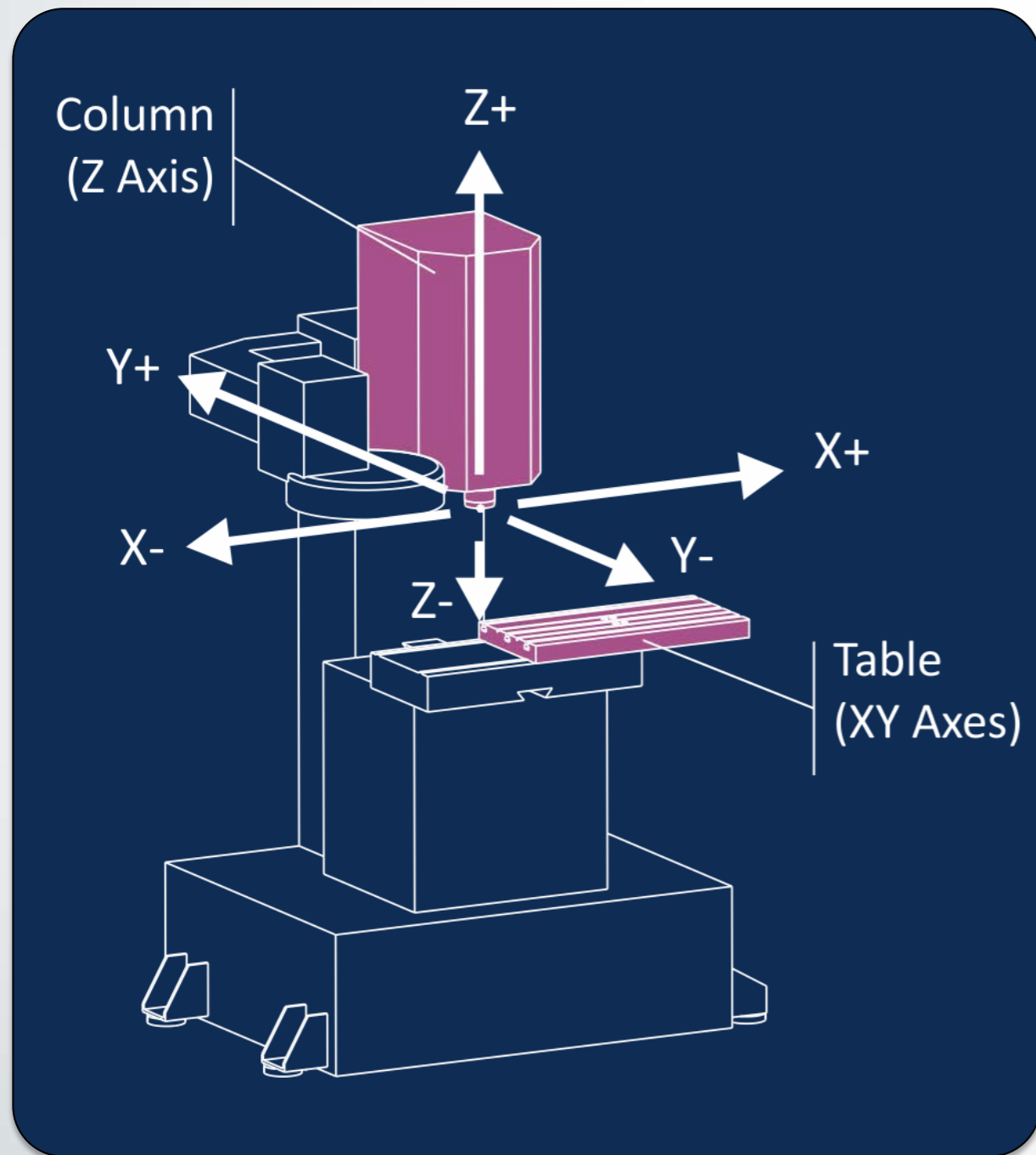
Speed = Rotational velocity of tool. Revolutions per minute (RPM).

Feed = How fast tool moves through material. Inches per minute (IPM)

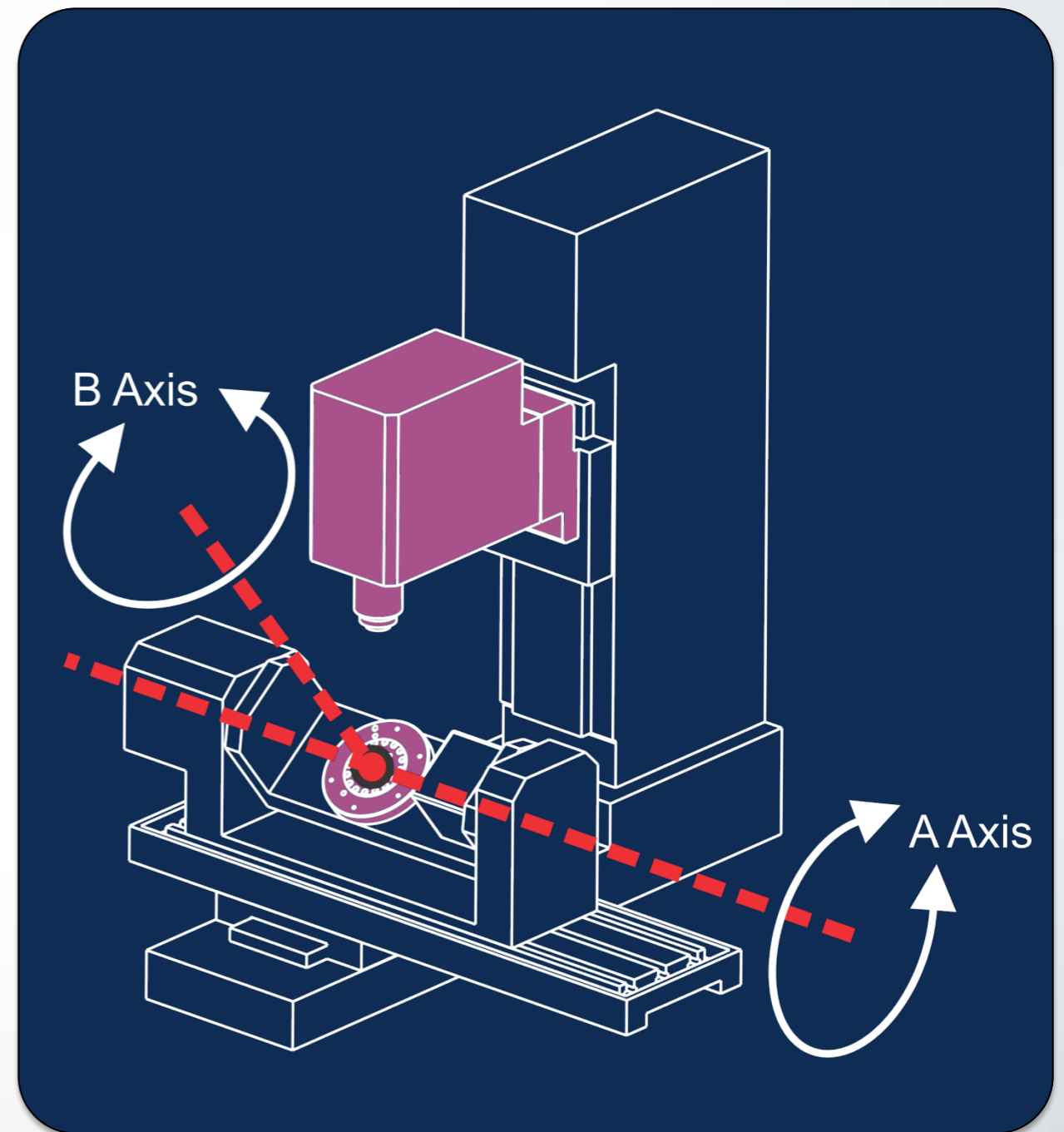
Step Over = The amount of stock the is engaged with the cutter.



Machining Centers examples



3 Axis

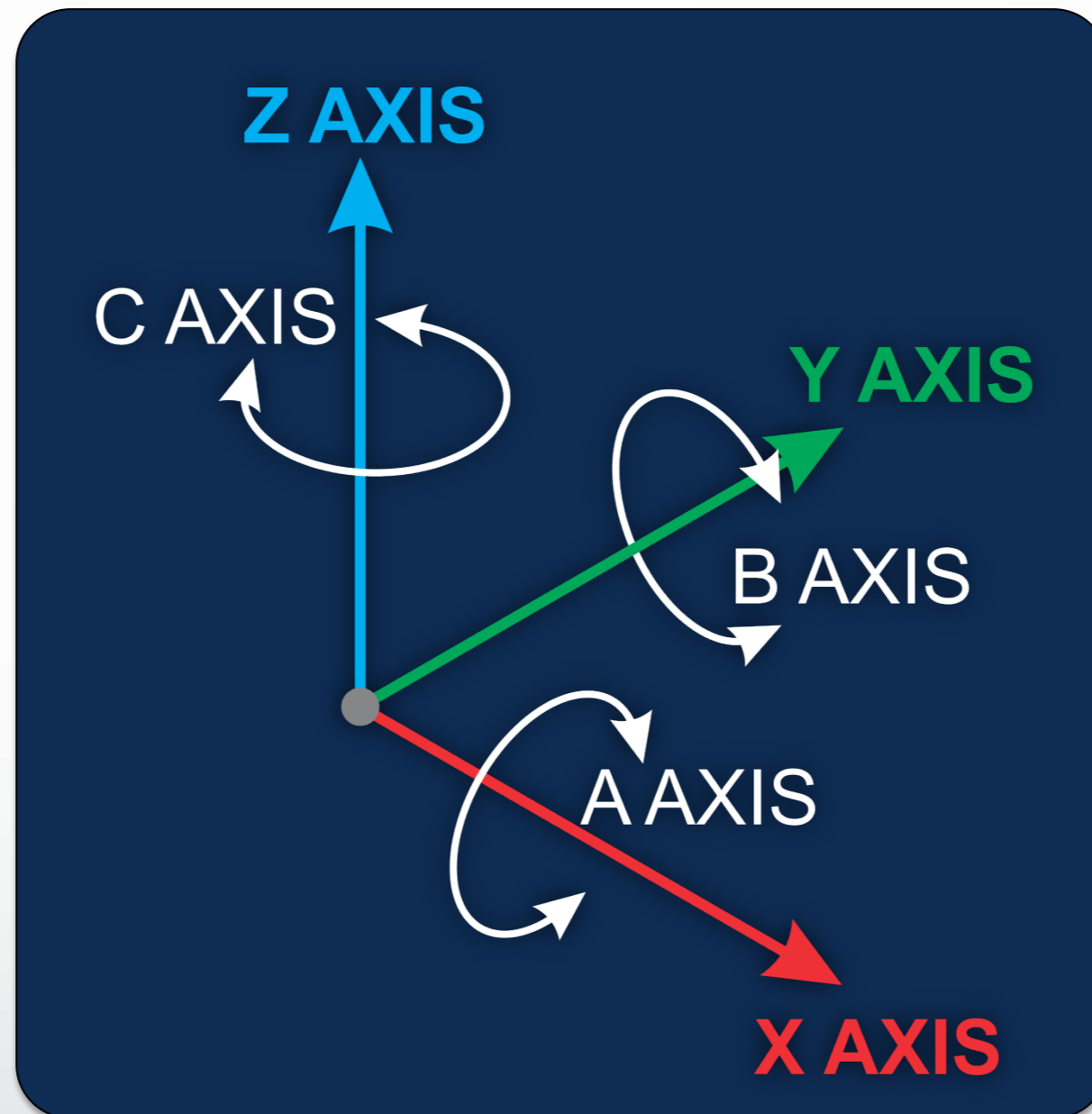


5 Axis
(Trunion type)

Coordinate Systems

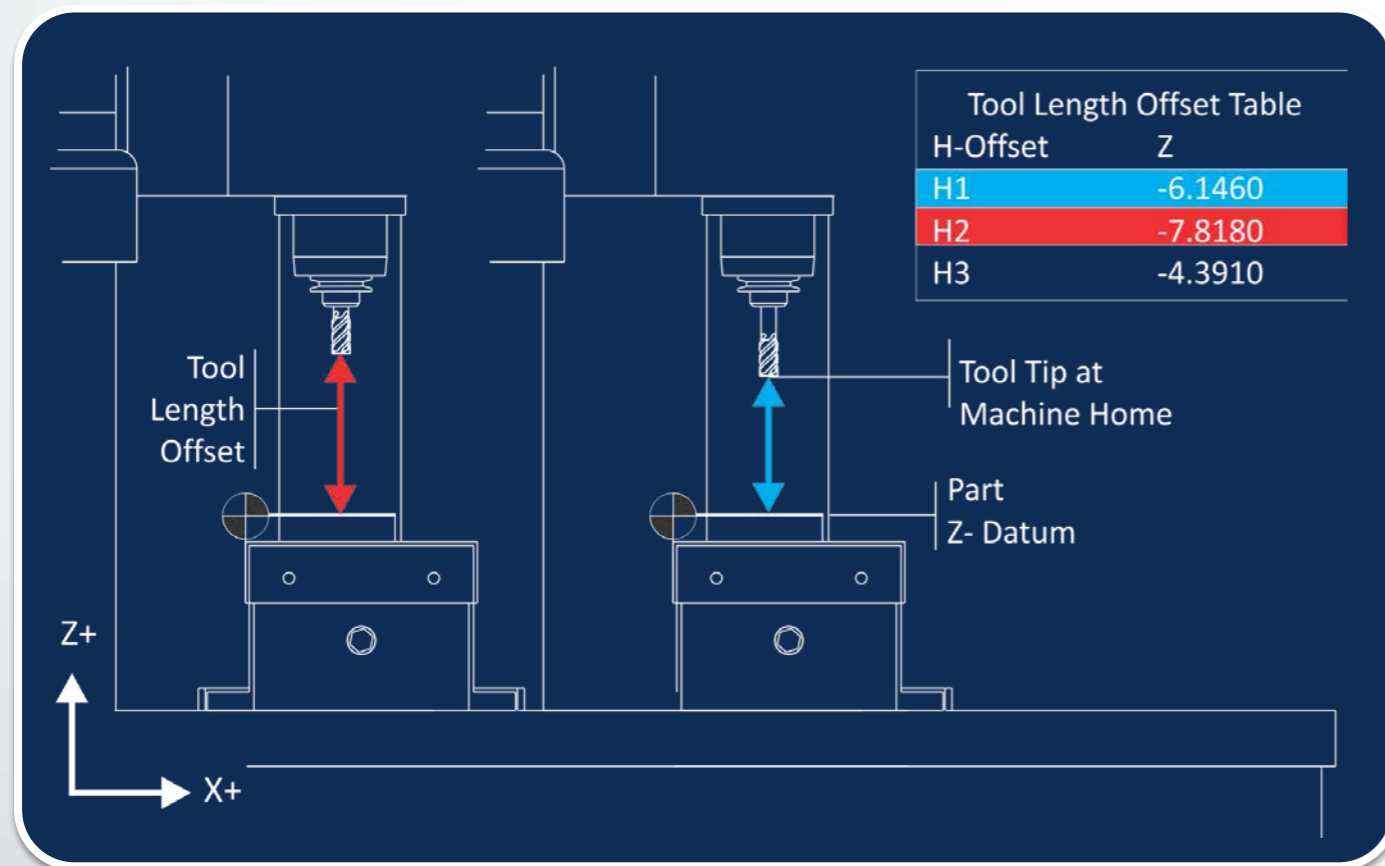
X **Y** **Z** is **R**ed **G**reen **B**lue

X **Y** **Z** is **A** **B** **C**

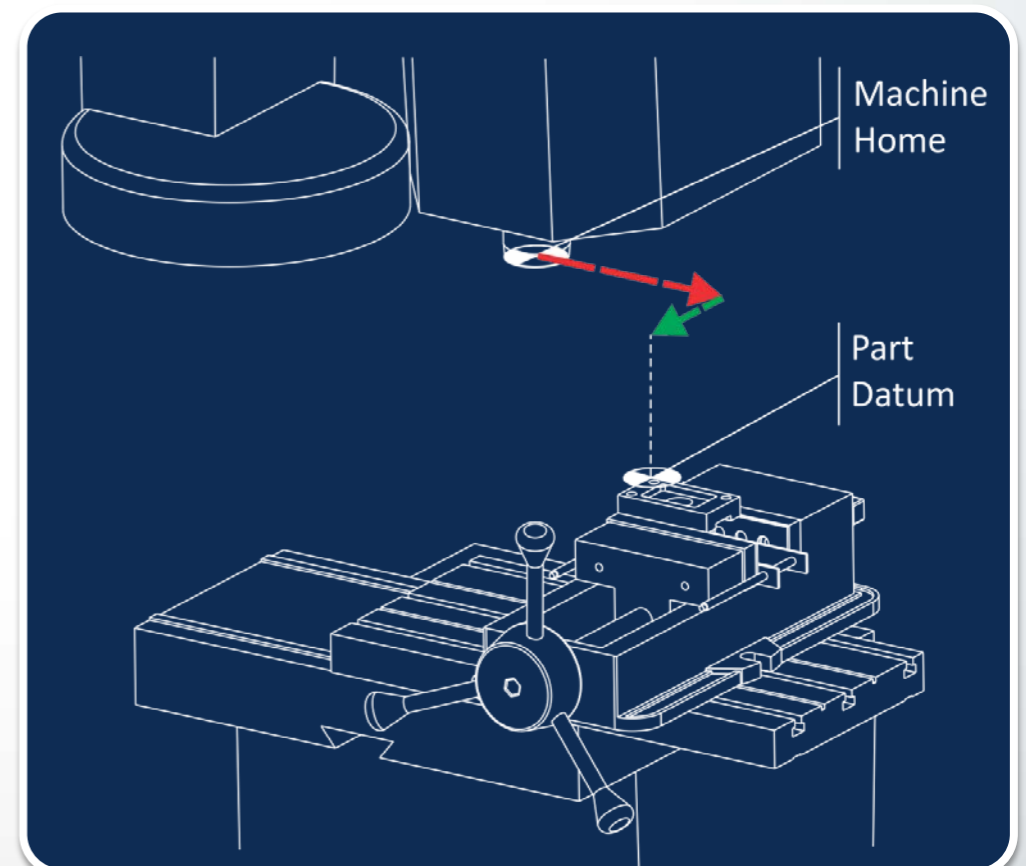


Machine and Fixture Offsets

Method for compensating for variations in tools and fixtures to link CAD Origin with machine Datum.

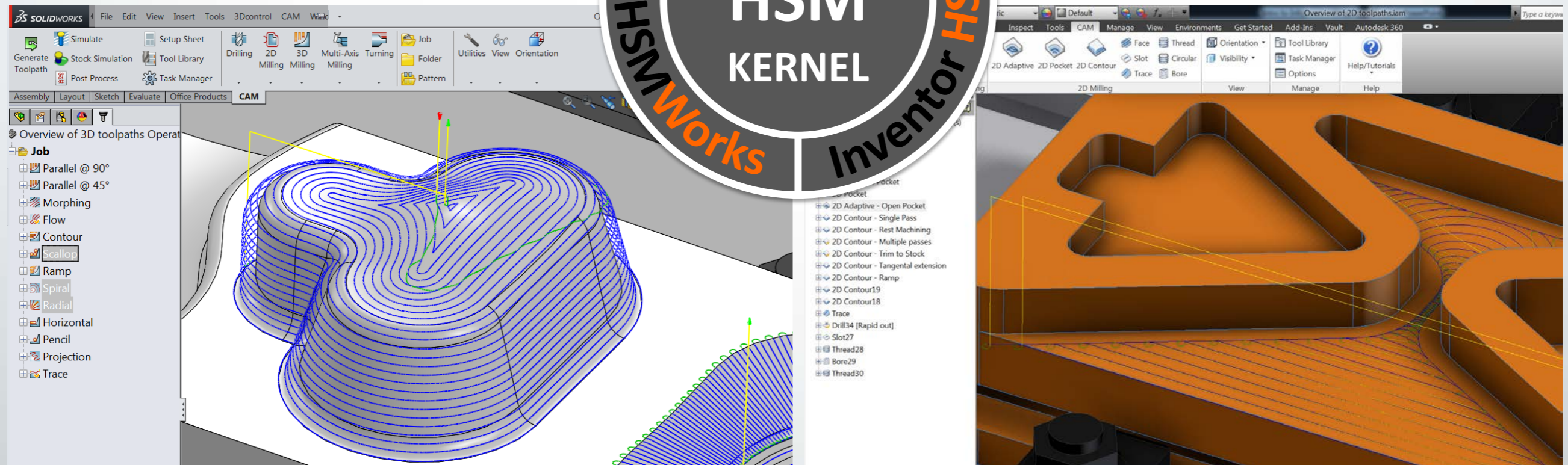
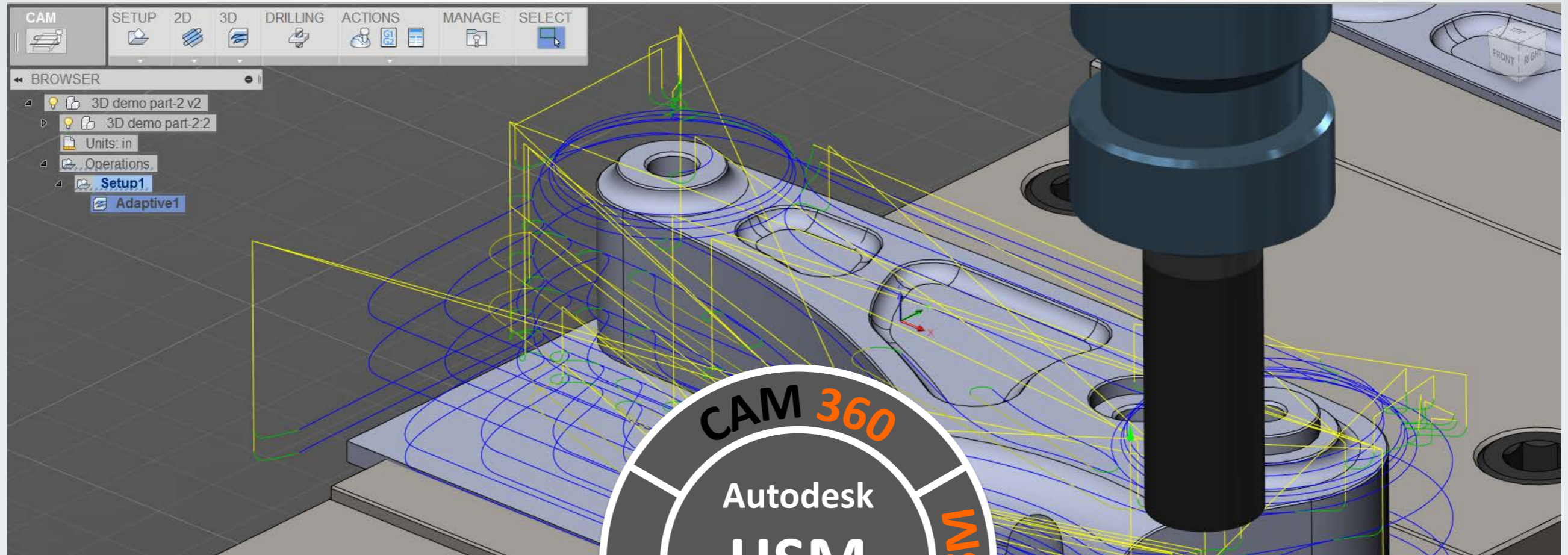


Tool Length Offsets



Fixture Offsets

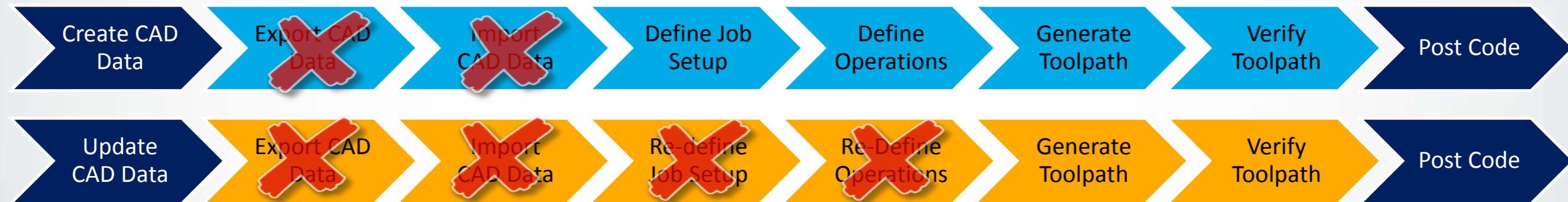
Next Generation Integrated CAM



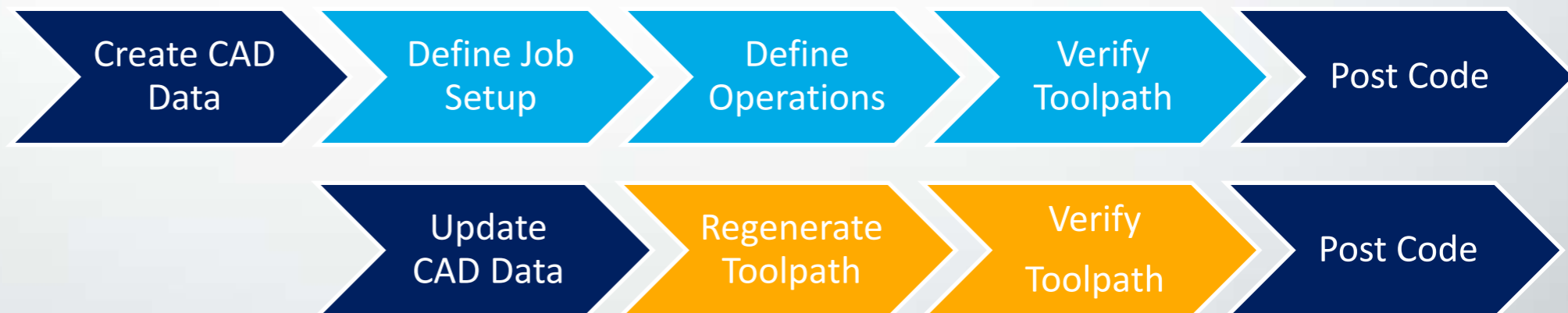
Why Integrated CAM?

- Better CAD
- Simplified data structure
- ETO Automation
- Shortened Learning curve
- Streamlined workflow

Standalone CAM



Integrated CAM





History of Innovation



- CIMCO Integration (MasterCAM Reseller)
- 1991 ● Develop custom 5X post processors
- 1992 ● CIMCO Edit & DNC Max
- Julian & Martin leave Machining Startagist after it sold to PTC and became the NCG kernal to create the MasterCAM preformance pack.
Adaptive clearing is born
- 2003 ●
- 2007 ● 64 – Bit Muli-threaded kernal is released in SolidWorks as HSMWorks
- 2009 ● Distributed CAM is released
- 2011 ● HSMXpress is released – Free 2.5 Axis CAM
- 2012 ● Autodesk Aquires HSMWorks
- 2013 ● CAM 360 - First Cloud CAD/CAM tool

Packaging

Xpress

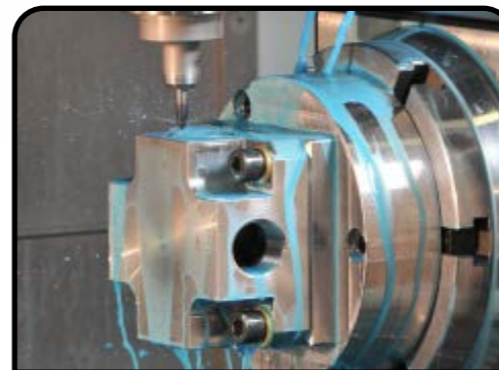


2 ½ D Milling

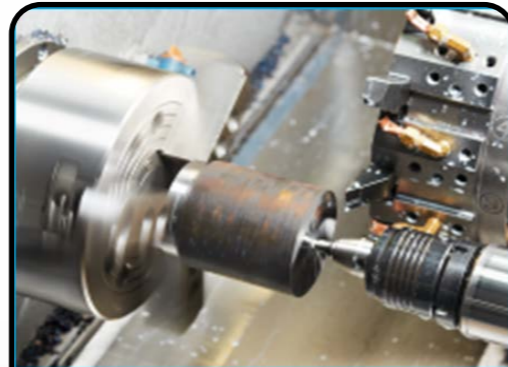
Professional



3D Milling



4X & +2 Milling



Turning



Mill/Turn

Premium

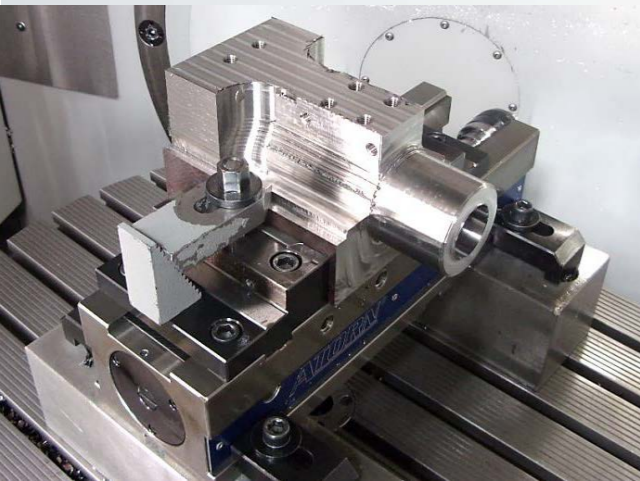


Multi-Axis
Milling

***Paid products include Inventor Standard or Fusion360 modeling*



	Xpress	Professional	Premium
Perpetual Cost	-Free-	\$7500	\$10 000
Term Cost		\$2500	\$3700
Cloud		\$75	\$150
Native 64 Bit / Multithread CAM Kernal – Utilize all the cores and RAM on your PC	✓	✓	✓
CAD Integrations for SolidWorks – Streamline workflows and reduce training time	Requires SolidWorks		
75+ Stock Post processors -Fanuc, Haas, Heidenhain, Seimens, Okuma, Thermwood, Yasnac, Roland...	✓	✓	✓
Customizable Setup sheets – HTML, PDF, Excel, CSV	✓	✓	✓
API – Automate Design through manufacturing with a robust API	✓	✓	✓
5 Axis Machine Simulation – Leveraging native assemblies (.ISM, .sldasm)	✓	✓	✓
High Speed Machining – Smooth linking moves, Feed optimization and Arc fitting	✓	✓	✓
Adaptive Clearing – Cut faster and deeper by maintaining consistent load on the tool	✓	✓	✓
Manual NC Functions – Open doors, start chip auger, add operator comments etc.	✓	✓	✓
Tool Libraries – Create and share tool libraries with co-workers	✓	✓	✓
Toolpath templates – Save and re-use best practices	✓	✓	✓
Optimize tool changes – Run multiple parts at multiple work offsets, nest setups together & Pattern toolpaths	✓	✓	✓
2D Toolpaths – From 2D adaptive clearing to contouring & Thread milling	✓	✓	✓
Distributed CAM – Distribute toolpath calculations across a Local Area Network		✓	✓
Automatic Collision Avoidance – Take tool shaft and holder into account to automatically avoid collisions		✓	✓
3D Toolpaths – Best in class quality, unsurpassed calculation speed.		✓	✓
4 Axis Wrapped toolpaths – Wrap 3D toolpaths around an Axis		✓	✓
Indexing (3+2) – Preform multi axis positioning from a single work coordinate system		✓	✓
Turn/Mill – Preform turning and milling operations in a single setup		✓	✓
Multi-axis Toolpaths – Swarf, Multi-Axis contour, flow and morph			✓
5 Axis Tilting for 3D Toolpaths – Automatically tilt 3D toolpaths to avoid collisions			✓



Gramatec GmbH

“HSMWorks was absolutely the right decision! HSMWorks allowed us to improve our competitive edge and win new customer segments.”

Liquid Trucks

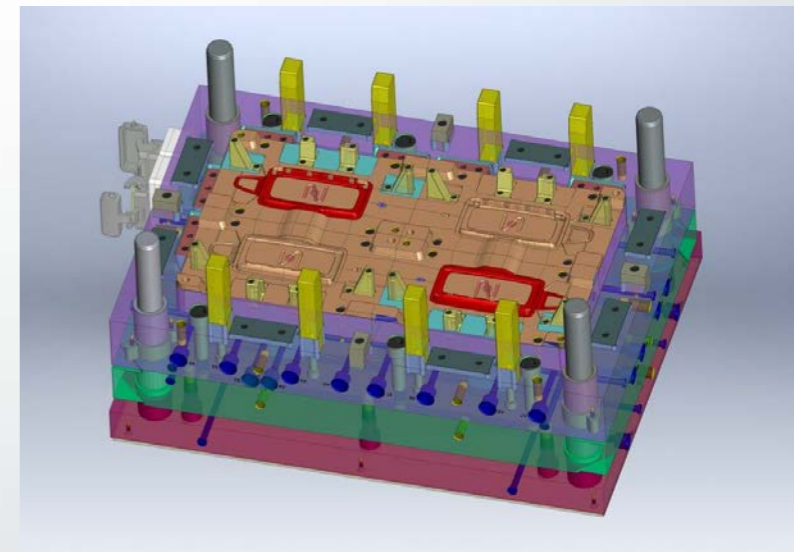
“We started to use HSMWorks and couldn’t believe how easy it was to create the professional results we were looking for. The clean UI and seamless integration with SolidWorks allowed us to significantly increase our ability to revise our design and produce the best possible trucks for skaters.”



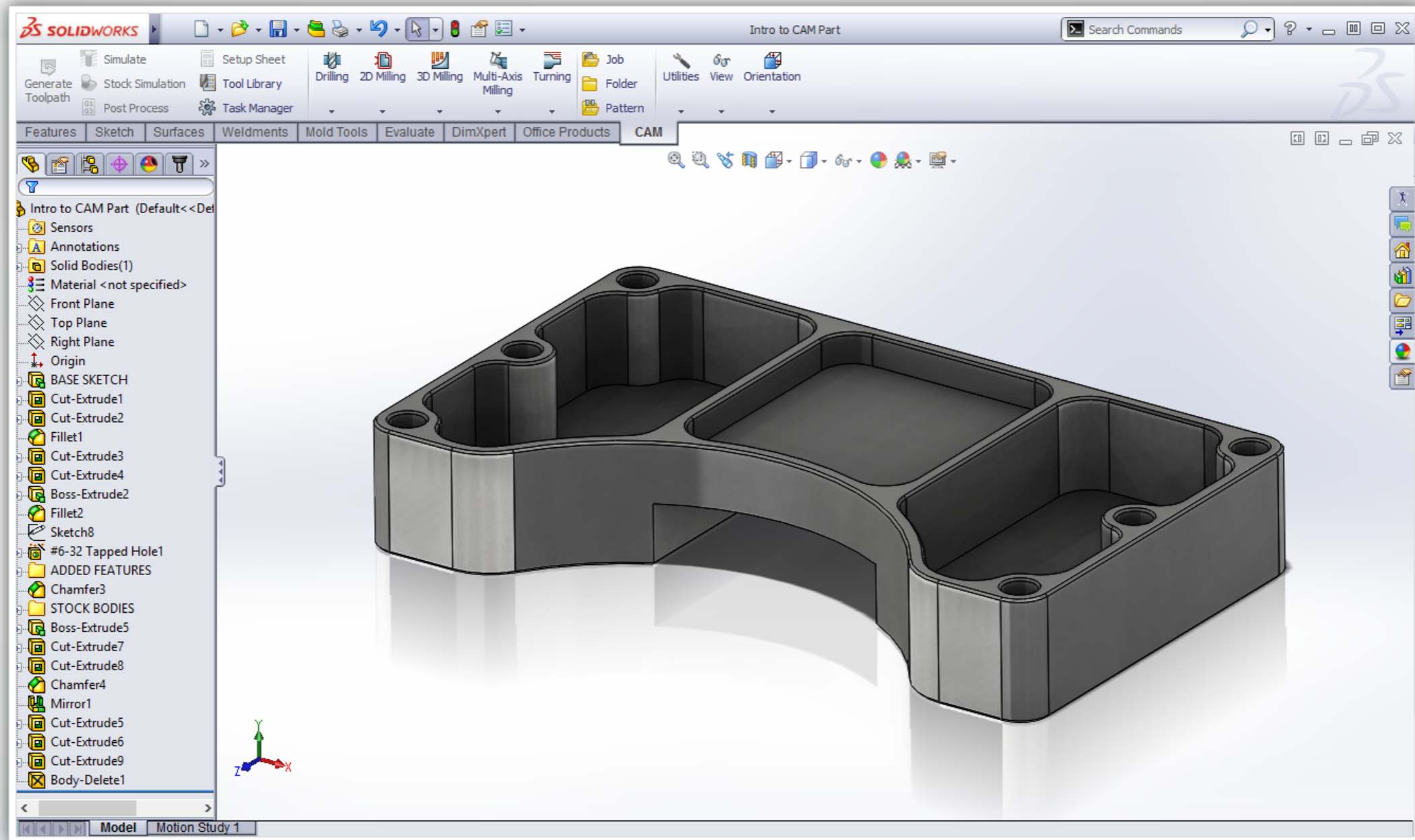
“After one hour with the software I was posting programs and making good parts.”

Pohl GmbH & Co. KG

“With HSMWorks we were able to significantly shorten lead times, substantially improve the surface qualities coupled with lower tool wear compared to our previous CAM system”



CAM – Create/Open model



Create/Open
CAD Data

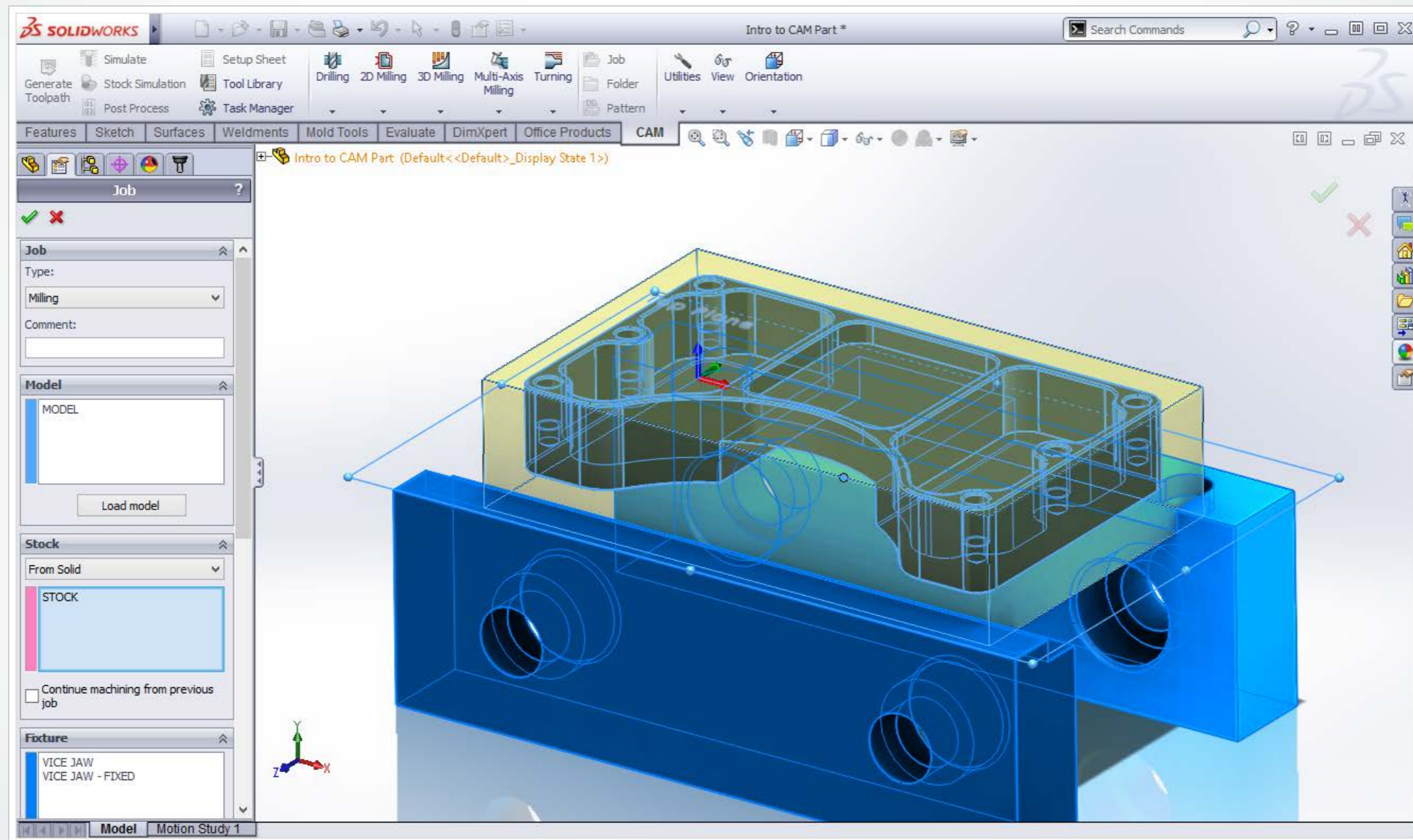
Define Job
Setup

Define
Operations

Simulate
Toolpath

Post Code

CAM – Define job setup



Create/Open
CAD Data

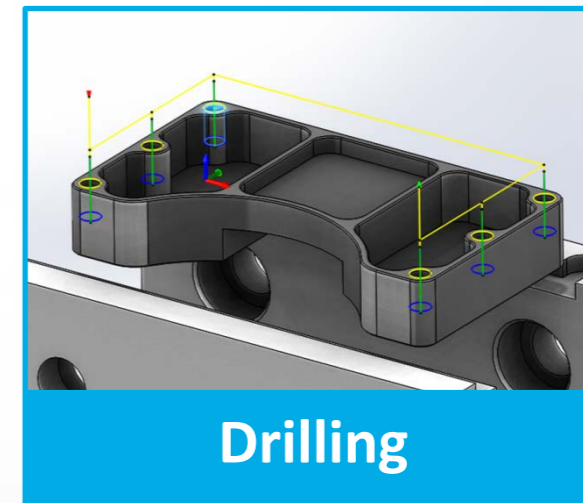
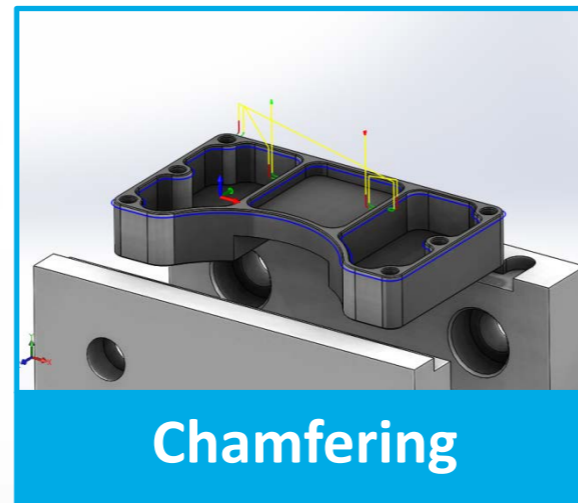
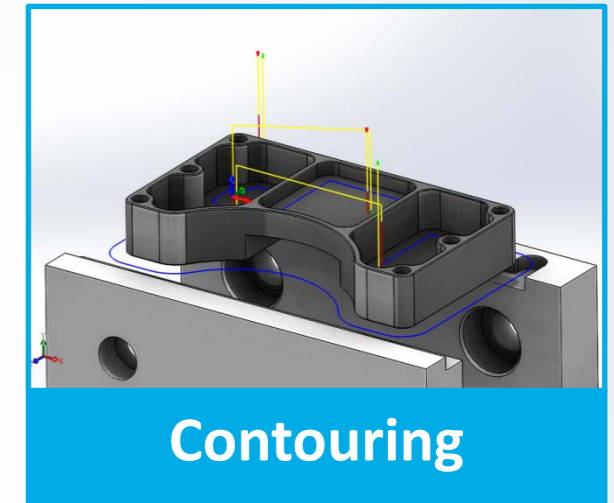
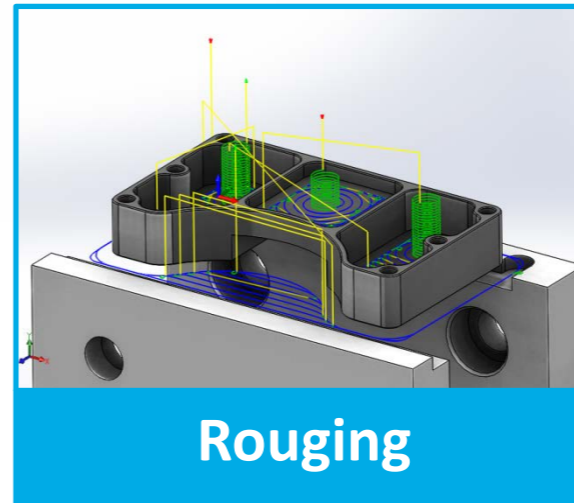
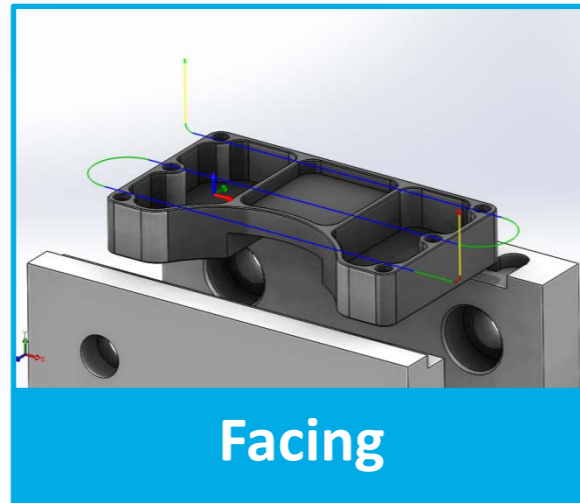
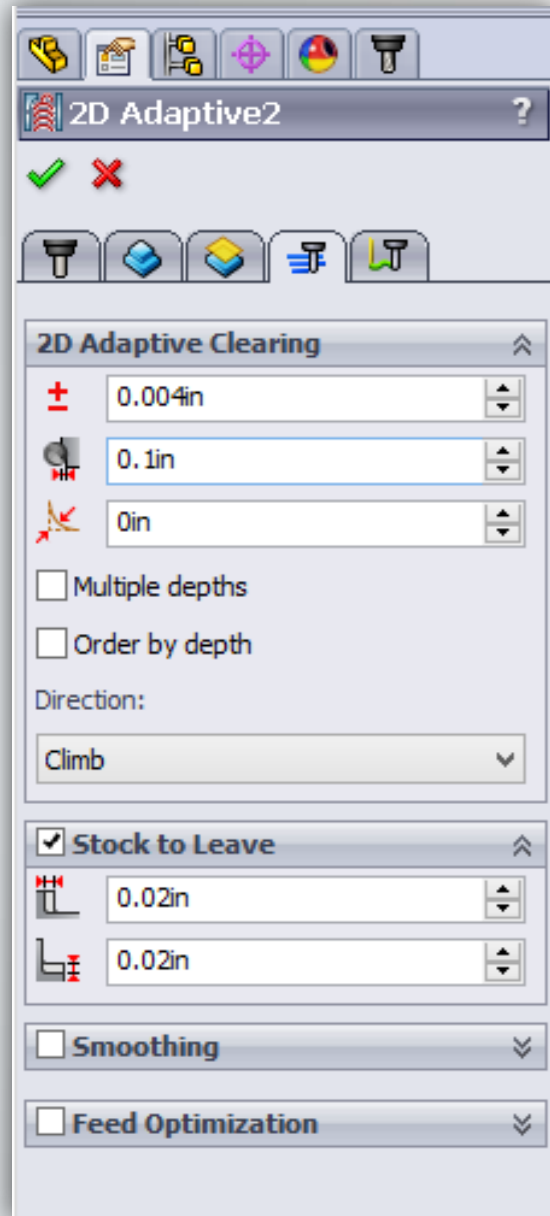
Define Job
Setup

Define
Operations

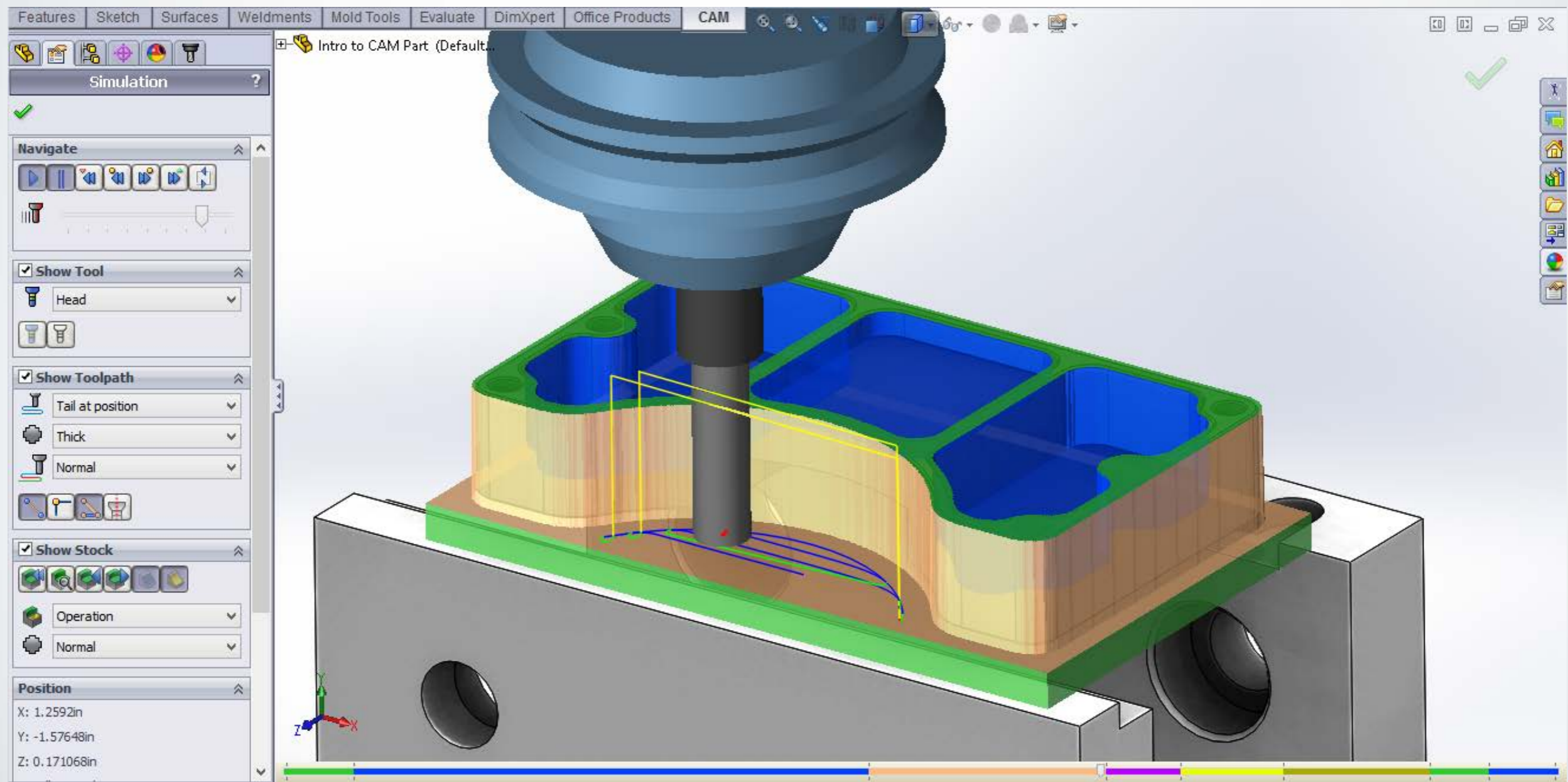
Simulate
Toolpath

Post Code

CAM – Define operations



CAM – Verify toolpath



Create/Open
CAD Data

Define Job
Setup

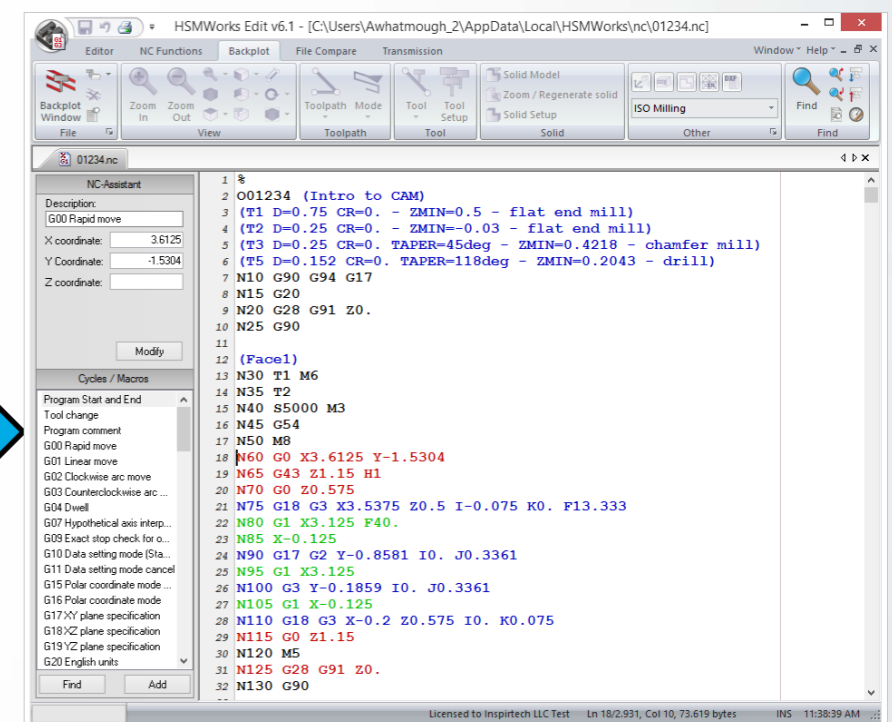
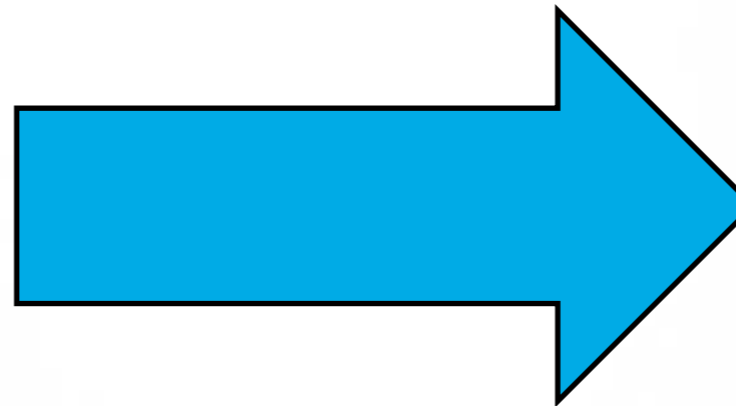
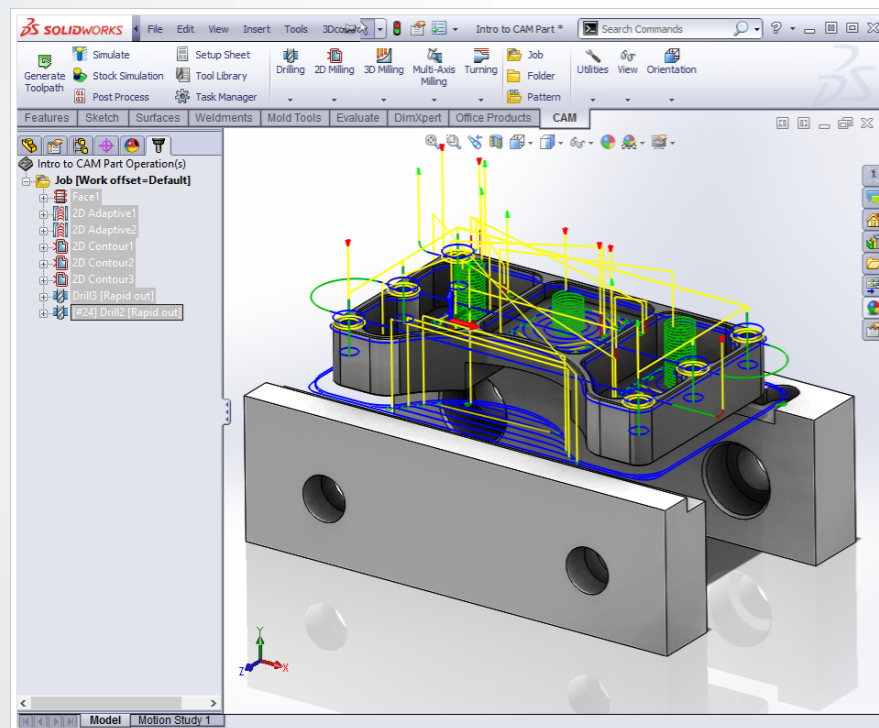
Define
Operations

Simulate
Toolpath

Post Code

CAM – Post Processing

Post Processing converts native toolpath data into “G-CODE” formatted correctly for the given CNC machine.



Create/Open
CAD Data

Define Job
Setup

Define
Operations

Simulate
Toolpath

Post Code

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