STEP-NC Edition 2
Digital Manufacturing

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Old style machining uses codes

The standard for 40 years!

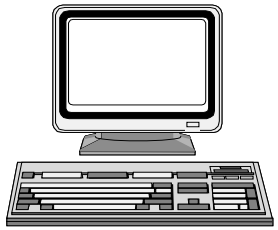
machine-specific part program with axis data generated by a postprocessor

vendor-specific extensions of the original standard

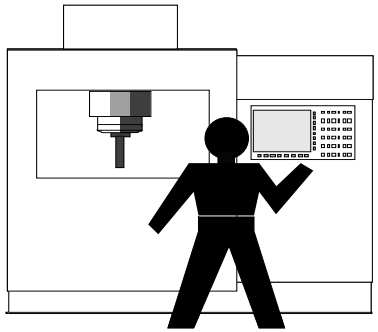
only primitive motion and switch commands

no standardized data format for spline processing and sophisticated NC technology

```
%
N05    G54
N10    G00 Z10.000
N15    G91 G0 Z200
N20    T5 D1 WW
N30    G90 M5
N35    G00 X0.000  Y-150.000
N40    G00 Z5.000
N45    M08
N50    S3183.000
N55    M03
N60    F1477.000
N65    G00 X60.000  Y-150.000
N70    G00 Z5.000
N75    G00 X60.000  Y-150.000
N80    G01 Z-0.500
...
```



Ideal for Paper Tape!

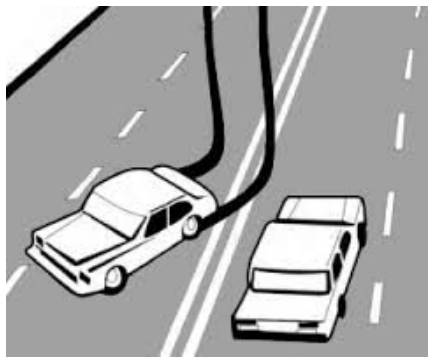


STEP-NC replaces this with a rich, integrated data format

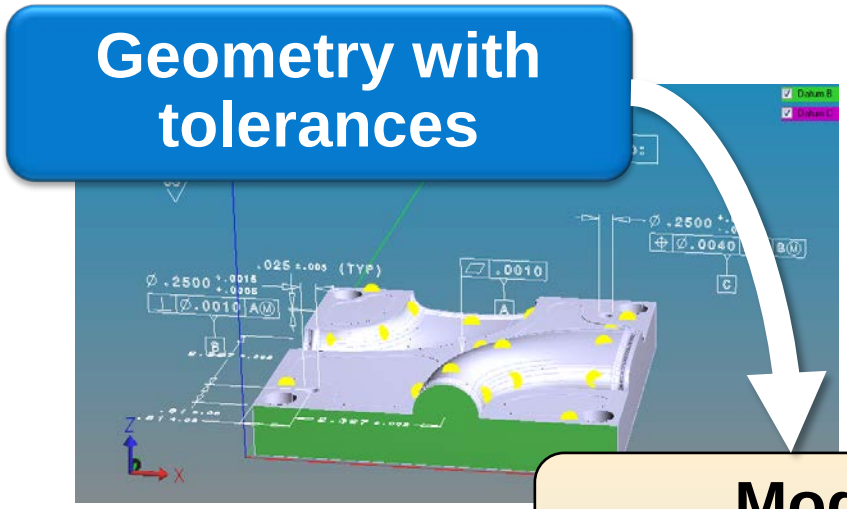
Courtesy WZL RWTH Aachen

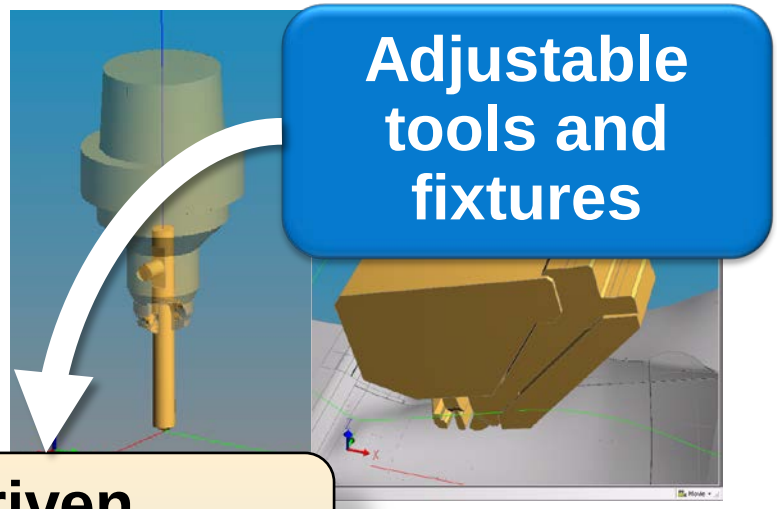
Imagine driving using codes

- **Driving from Albany to Washington DC**
  - **Drive as fast as possible**
  - **Drive again with minimal gas and engine wear**
  - **The two results will be very different!**
- **Now do it with your eyes closed**
  - **Drive for 2 minutes 16 seconds at 69.1 mph**
  - **Turn left by 35 degrees and slow down to 55.4 mph**
  - **Etc. and enjoy! We never make mistakes!**

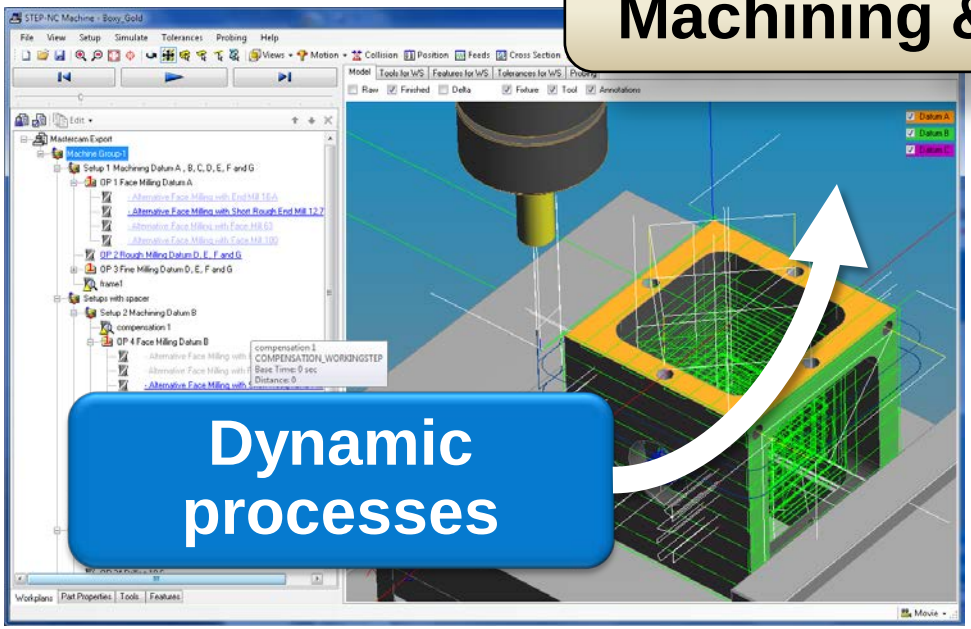


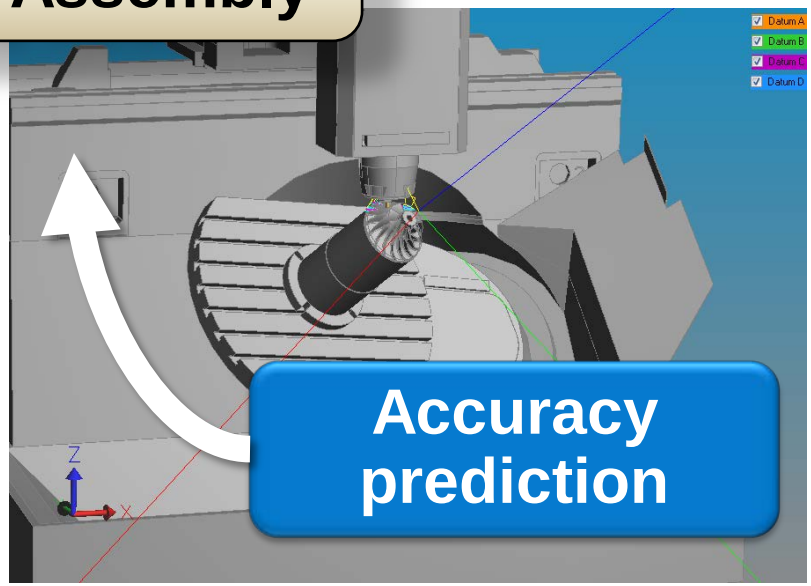
New style machining uses models



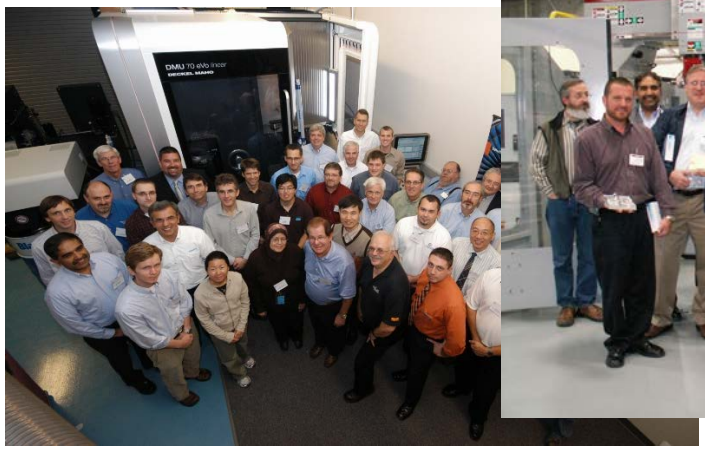


Model Driven Machining & Assembly





10 years of testing shows it works



And produces 15% process savings

- We asked Sandvik and Iscar to optimize a Boeing machining program
- We sent them STEP-NC files for selected operations
- They read the files into their CAM systems and selected the best available tooling
- They returned an optimized process to Boeing as STEP-NC

- Tests at Boeing and KTH (Sweden) confirmed our savings estimates
  - Profiling time 2,680 sec reduced to 859 sec
  - Pocketing time 1,104 sec reduced to 726 sec

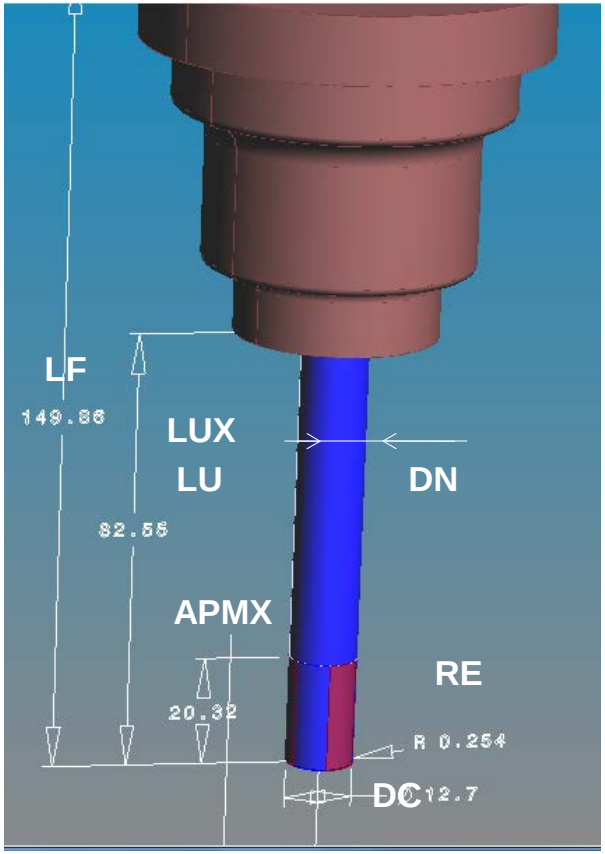
Edition 2 plans

Edition 1

Fixed scope AP

Each parameter mapped to aim by long series of constraints

Definitions for subtractive machining



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Edition 2

Extensible scope AP

Each parameter associated to definition by EXPRESS constant

Modules for manufacturing processes

Enhancements determined during testing

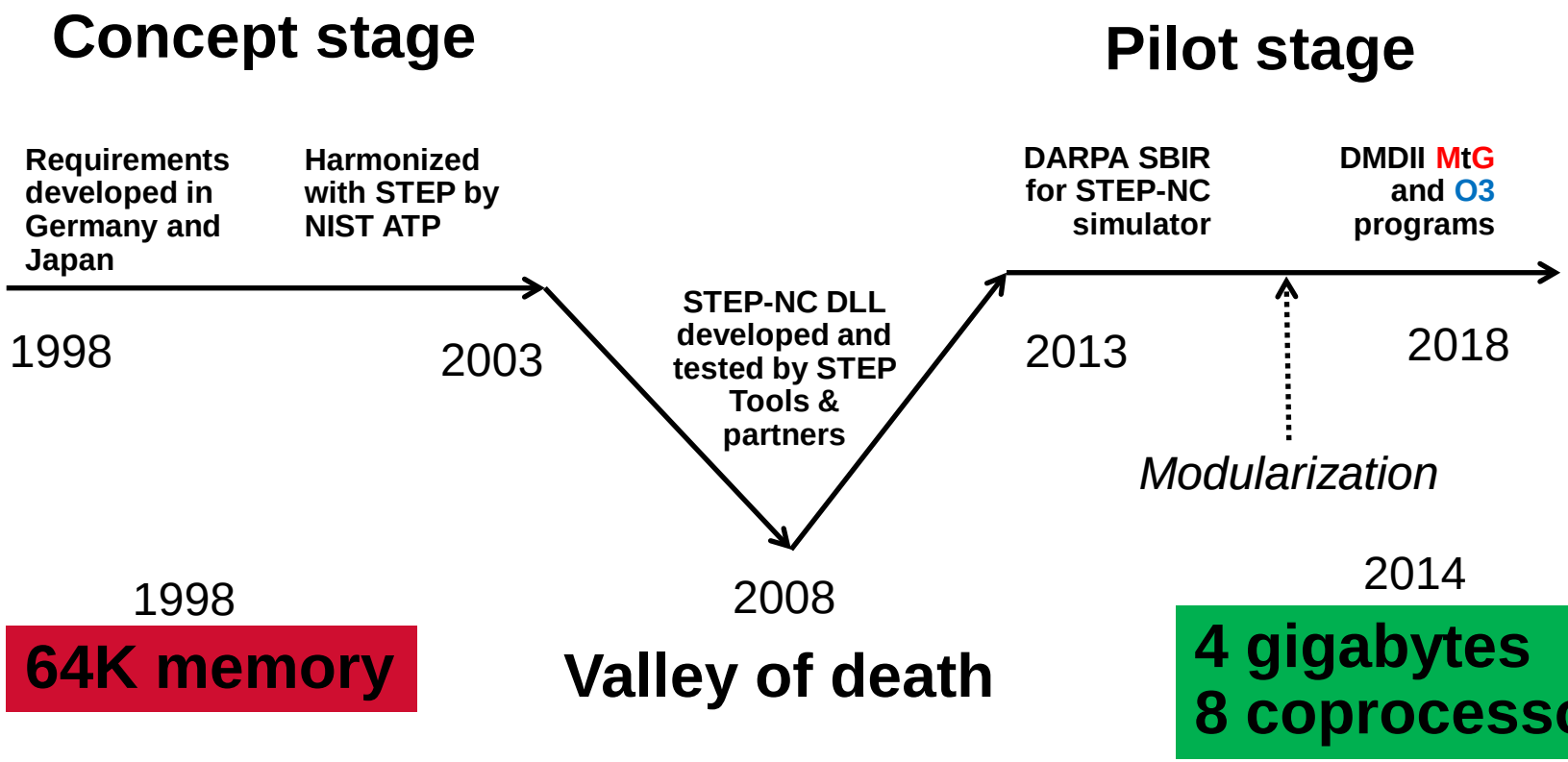
- **Documented**
  - Toolpath Reference Direction
  - Gage placement for simulation
  - Toolpath placement on Workplan
  - Enable/Disable Executable
  - Via points for better High-Speed Machining support.
  - Cross section parameters for Feed Speed optimization.
  - Touch_probe as a real tool.
  - Datum and Datum_target reference to workpiece
  - Full workpieces for In-process geometry
  - Improved AP203 compatibility

- **Not yet formally documented**
  - Ordering of items in pattern features.
  - Simplify rawpiece/finished piece
  - Adopt presentation UOFs from AP214/AP203e2
  - Curve probing operation and flexible setup extensions

4D Facets for process simulation

STEP-NC History

During this time CNC machines have grown

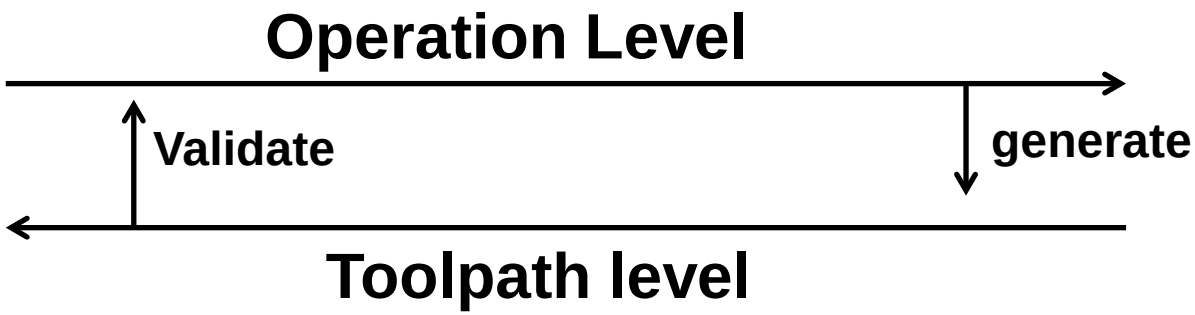


First deployment planned for December 2016

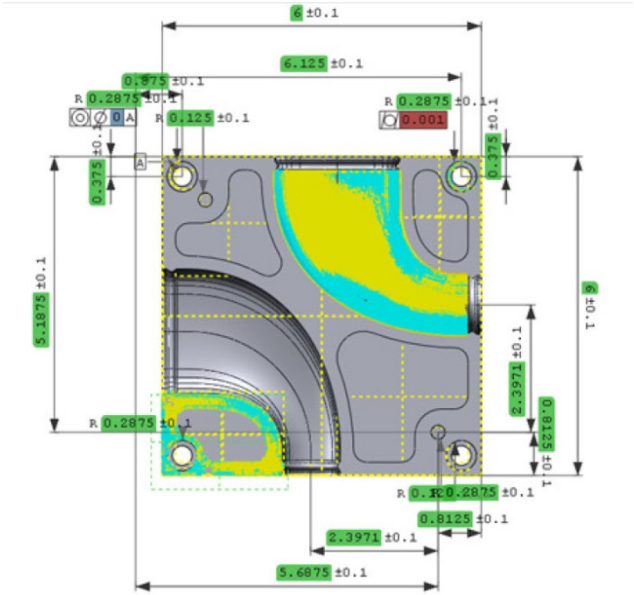
What is STEP-NC

- **Workingsteps apply operations to features**
  - **Can be collected into workplans**
  - **Each step uses one tool**
  - **Feature and operation description is optional**

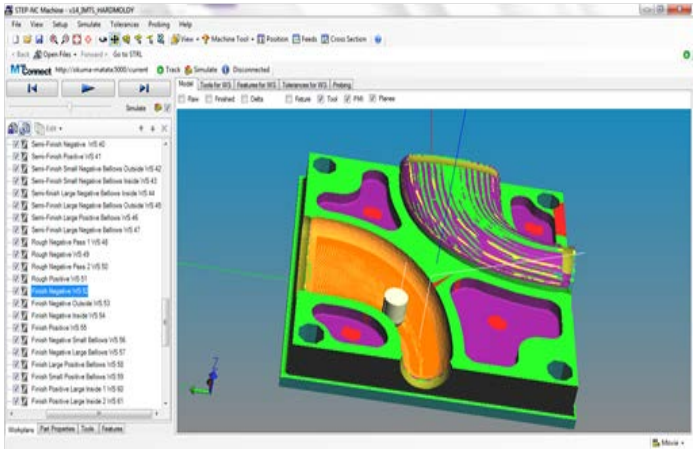
- **Process data is organized into tool paths**
  - **Each path describes a process (add or subtract)**
  - **Each path carries many curves**



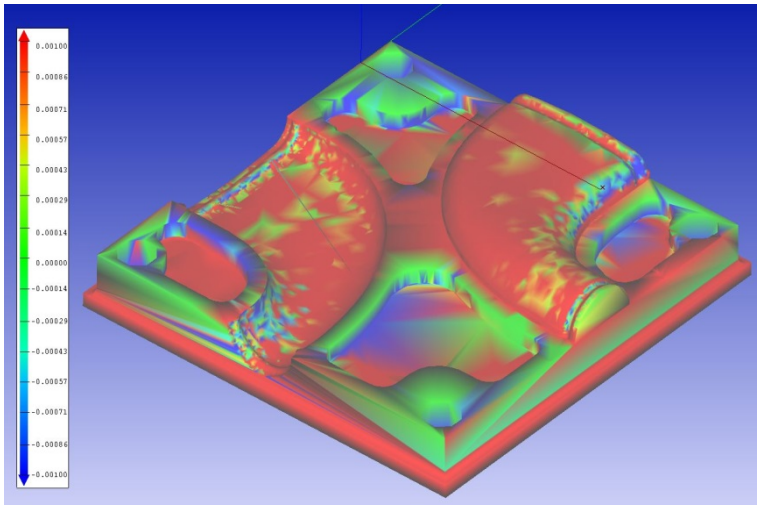
STEP-NC and GD&T



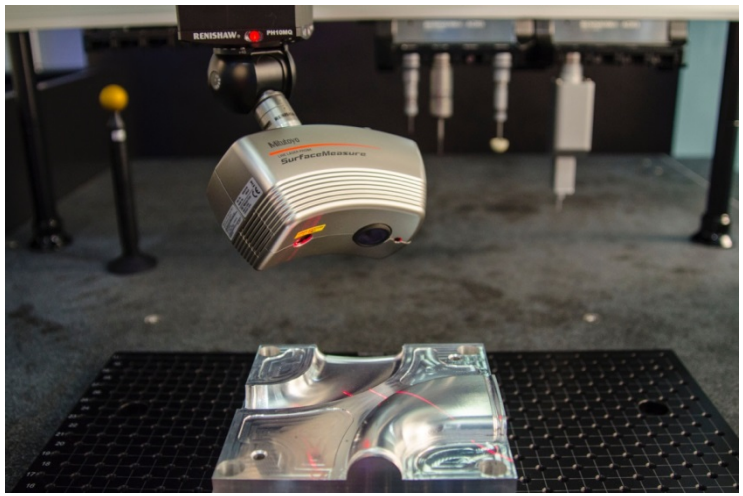
Part with GD&T



Mesh generation



Virtual Metrology



Real Metrology

Getting started - the STEP-NC DLL

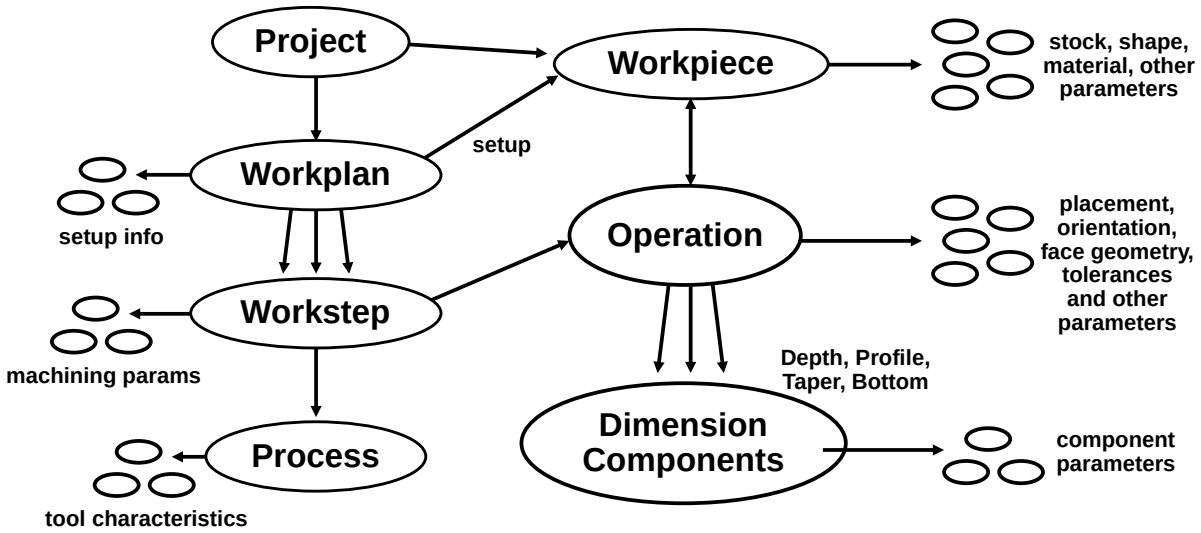
APT 18,275 LOC

- **Tolerance** 25,316 LOC
- **Process** 9,606 LOC

Finder 23,426 LOC

Feature 2,349 LOC

Services 35,078 LOC



Extensive object orientation with functions distributed between objects as appropriate

http://www.steptools.com/products/stepncmachine/