ENGT 3652 Project 5:
CNC Lathe-Bishop

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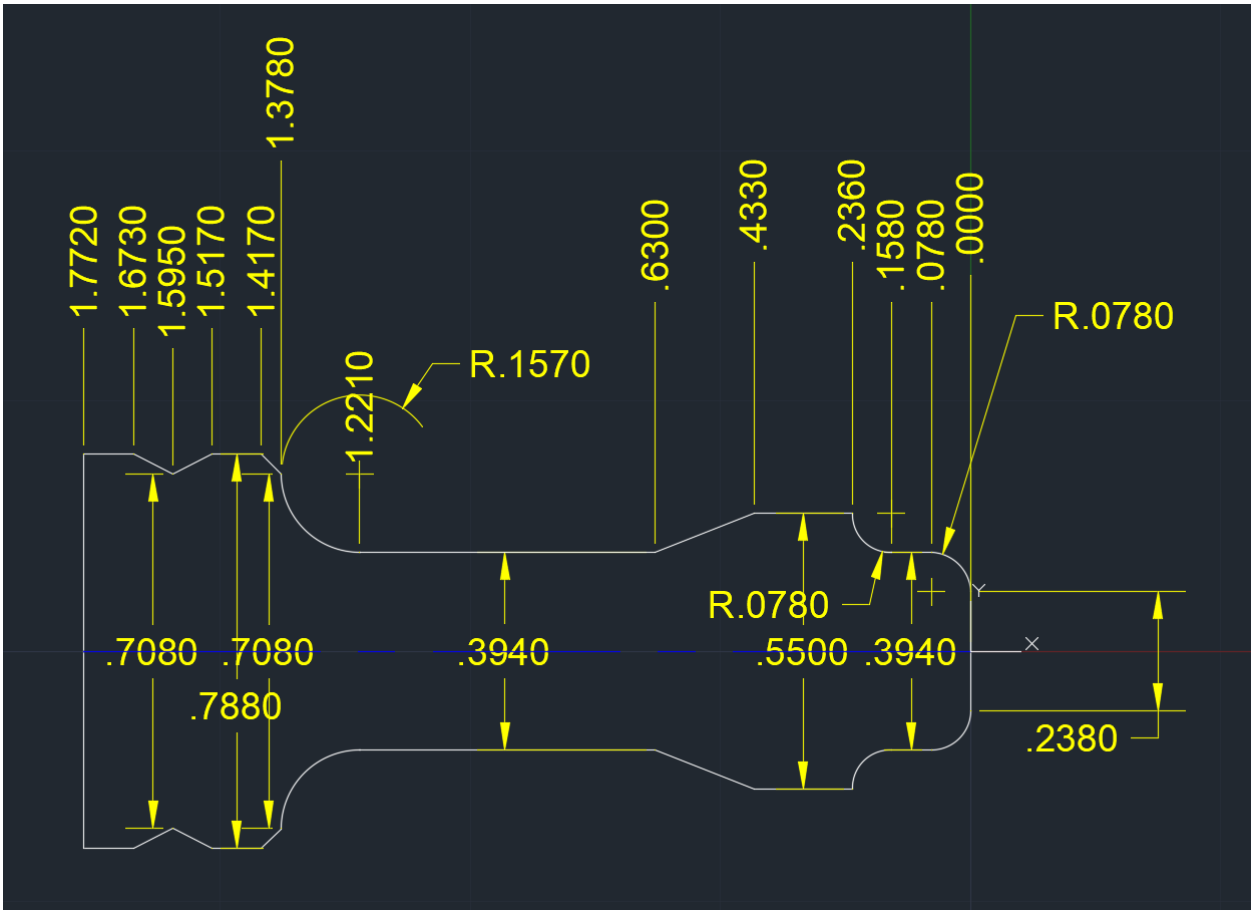
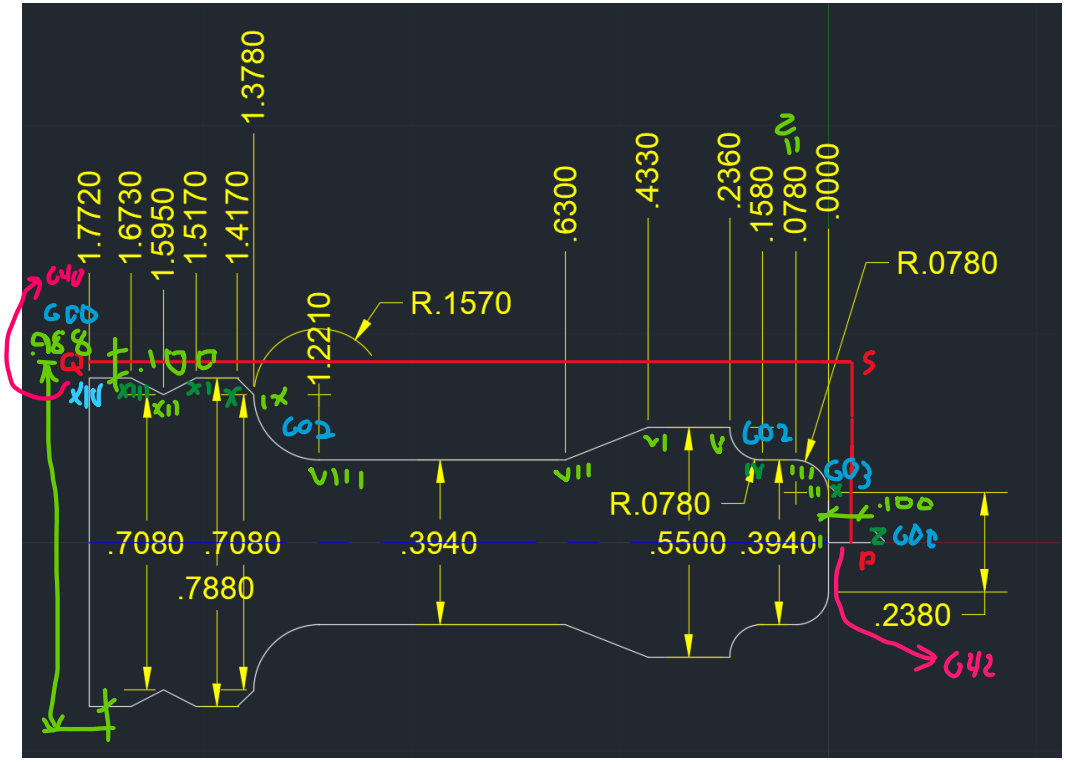
Chapter 1

Original drawing



The path



All cuts by G01 unless otherwise specified

Chapter 3

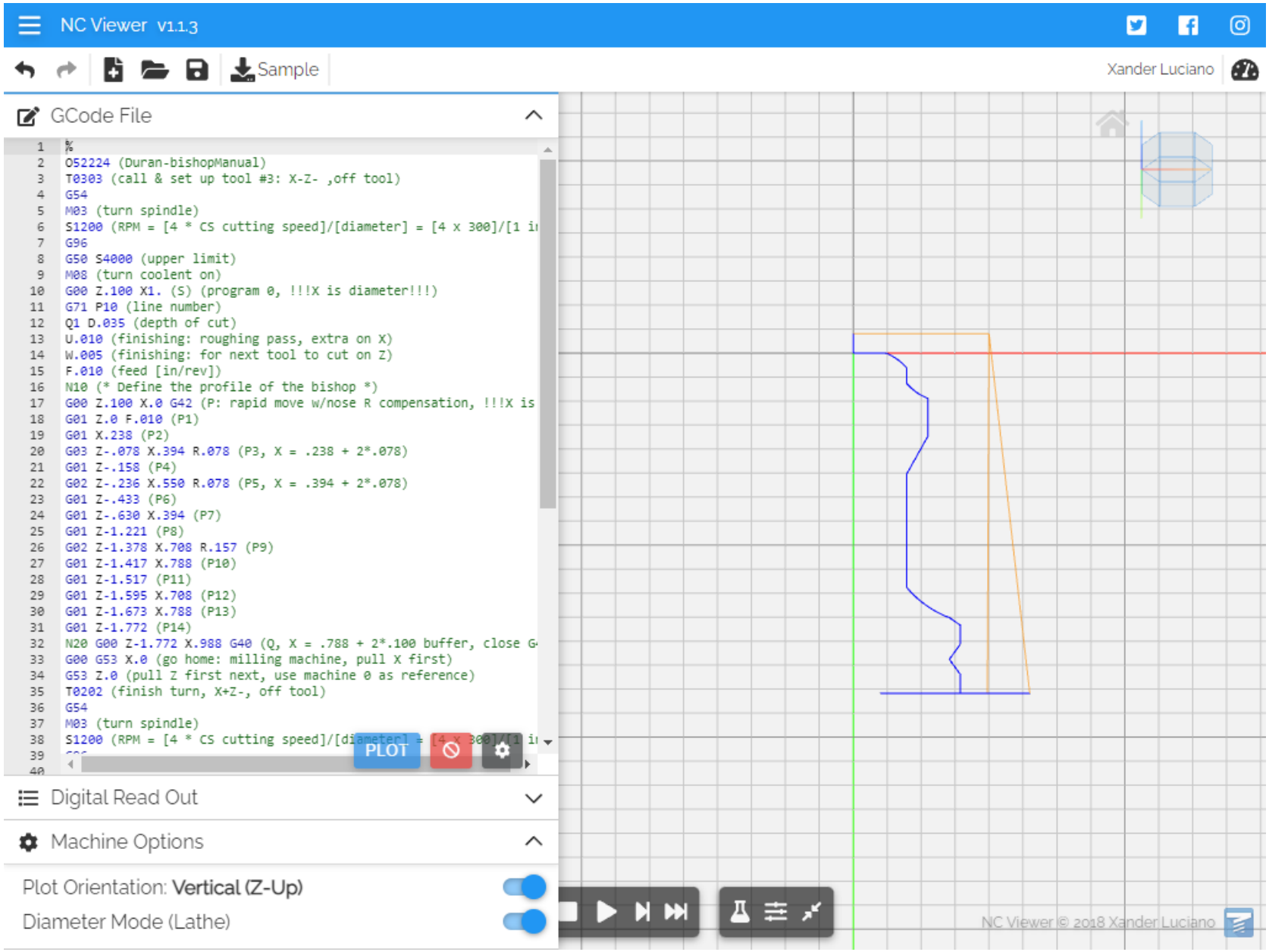
Manual Gcode

```
%
O52224 (Duran-bishopManual)
T0303 (call & set up tool #3: X-Z- ,off
↪  tool)
G54
M03 (turn spindle)
S1200 (RPM = [4 * CS cutting
↪  speed]/[diameter] = [4 x 300]/[1 in] =
↪  1200)
G96
G50 S4000 (upper limit)
M08 (turn coolent on)
G00 Z.100 X1. (S) (program 0, !!!X is
↪  diameter!!!)
G71 P10 (line number)
Q1 D.035 (depth of cut)
U.010 (finishing: roughing pass, extra on
↪  X)
W.005 (finishing: for next tool to cut on
↪  Z)
F.010 (feed [in/rev])
N10 (* Define the profile of the bishop *)
G00 Z.100 X.0 G42 (P: rapid move w/nose R
↪  compensation, !!!X is diameter!!!)
G01 Z.0 F.010 (P1)
G01 X.238 (P2)
G03 Z-.078 X.394 R.078 (P3, X = .238 +
↪  2*.078)
G01 Z-.158 (P4)
G02 Z-.236 X.550 R.078 (P5, X = .394 +
↪  2*.078)
G01 Z-.433 (P6)
G01 Z-.630 X.394 (P7)
G01 Z-1.221 (P8)
G02 Z-1.378 X.708 R.157 (P9)
G01 Z-1.417 X.788 (P10)
G01 Z-1.517 (P11)
G01 Z-1.595 X.708 (P12)
G01 Z-1.673 X.788 (P13)
G01 Z-1.772 (P14)
N20 G00 Z-1.772 X.988 G40 (Q, X = .788 +
↪  2*.100 buffer, close G42)
G00 G53 X.0 (go home: milling machine, pull
↪  X first)
G53 Z.0 (pull Z first next, use machine 0
↪  as reference)
T0202 (finish turn, X+Z-, off tool)
G54
M03 (turn spindle)
S1200 (RPM = [4 * CS cutting
↪  speed]/[diameter] = [4 x 300]/[1 in] =
↪  1200)
G96
G50 S4000 (upper limit)
M08 (turn coolent on)
G00 Z.100 X1. (S) (!!!X is diameter!!!)
G70 P10 Q2
G00 X1.
G00 G53 X.0 (go home: milling machine, pull
↪  X first)
G53 Z.0 (pull Z first next, use machine 0
↪  as reference)
T0707 (parting tool for drilling, Z-, tool
↪  edge)
G54
M03 (turn spindle)
S1200 (RPM = [4 * CS cutting
↪  speed]/[diameter] = [4 x 300]/[1 in] =
↪  1200)
G96
G50 S4000 (upper limit)
M08 (turn coolent on)
G00 Z-1.772 X1.3 (S) (!!!X is diameter!!!)
G01 X.200 F.002 (parts catcher: go slow -
↪  small feed)
M36 (call parts catcher ON)
G04 P1.5 (devolved delay [s])
M37 (parts catcher OFF)
M09 (turn off coolent)
G00 G53 X.0 (go home: milling machine, pull
↪  X first)
```

```
G53 Z.0 (pull Z first next, use machine 0
↪  as reference, which will shut off
↪  coolent)
M30 (end of program)
%
```

Chapter 4

Plot of manual Gcode in NCViewer


NC Viewer v1.1.3
Sample
Xander Luciano
GCode File
%
O52224 (Duran-bishopManual)
T0303 (call & set up tool #3: X-Z- ,off tool)
G54
M03 (turn spindle)
S1200 (RPM = [4 * CS cutting speed]/[diameter] = [4 x 300]/[1 i
G96
G50 S4000 (upper limit)
M08 (turn coolent on)
G00 Z.100 X1. (S) (program 0, !!!X is diameter!!!)
G71 P10 (line number)
Q1 D.035 (depth of cut)
U.010 (finishing: roughing pass, extra on X)
W.005 (finishing: for next tool to cut on Z)
F.010 (feed [in/rev])
N10 (* Define the profile of the bishop *)
G00 Z.100 X.0 G42 (P: rapid move w/nose R compensation, !!!X is
G01 Z.0 F.010 (P1)
G01 X.238 (P2)
G03 Z-.078 X.394 R.078 (P3, X = .238 + 2*.078)
G01 Z-.158 (P4)
G02 Z-.236 X.550 R.078 (P5, X = .394 + 2*.078)
G01 Z-.433 (P6)
G01 Z-.630 X.394 (P7)
G01 Z-1.221 (P8)
G02 Z-1.378 X.708 R.157 (P9)
G01 Z-1.417 X.788 (P10)
G01 Z-1.517 (P11)
G01 Z-1.595 X.708 (P12)
G01 Z-1.673 X.788 (P13)
G01 Z-1.772 (P14)
N20 G00 Z-1.772 X.988 G40 (Q, X = .788 + 2*.100 buffer, close G
G00 G53 X.0 (go home: milling machine, pull X first)
G53 Z.0 (pull Z first next, use machine 0 as reference)
T0202 (finish turn, X+Z-, off tool)
G54
M03 (turn spindle)
S1200 (RPM = [4 * CS cutting speed]/[diameter] = [4 x 300]/[1 i
PLOT
Digital Read Out
Machine Options
Plot Orientation: Vertical (Z-Up)
Diameter Mode (Lathe)
NC Viewer © 2018 Xander Luciano

Chapter 5

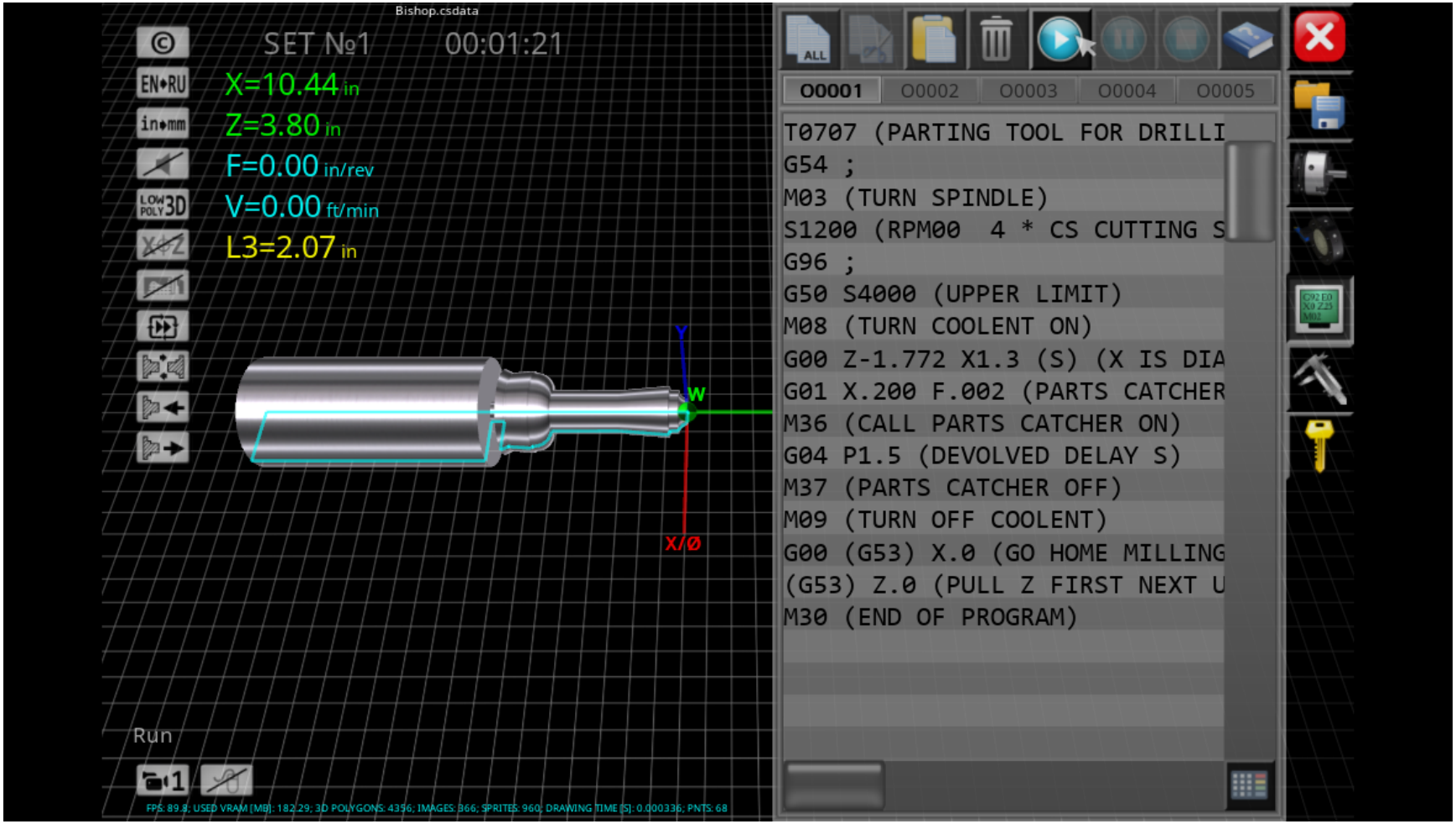
Manual Gcode, edited for CNC Simulator

```
%
O94688 (Duran-bishopManualForCncSim)
T0303 (call & set up tool #3: X-Z- ,off
↪  tool)
G54
M03 (turn spindle)
S1200 (RPM = [4 * CS cutting
↪  speed]/[diameter] = [4 x 300]/[1 in] =
↪  1200)
G96
G50 S4000 (upper limit)
M08 (turn coolent on)
G00 Z.100 X1. (S) (program 0, !!!X is
↪  diameter!!!)
G71 P10 (line number)
Q1 D.035 (depth of cut)
U.010 (finishing: roughing pass, extra on
↪  X)
W.005 (finishing: for next tool to cut on
↪  Z)
F.010 (feed [in/rev])
N10 (* Define the profile of the bishop *)
M03 S1200 (turn spindle at 1200 RPM
↪  initially)
G00 Z.100 X.0 G42 (P: rapid move w/nose R
↪  compensation, !!!X is diameter!!!)
G01 Z.0 F.010 (P1)
G01 X.238 (P2)
G03 Z-.078 X.394 R.078 (P3, X = .238 +
↪  2*.078)
G01 Z-.158 (P4)
G02 Z-.236 X.550 R.078 (P5, X = .394 +
↪  2*.078)
G01 Z-.433 (P6)
G01 Z-.630 X.394 (P7)
G01 Z-1.221 (P8)
G02 Z-1.378 X.708 R.157 (P9)
G01 Z-1.417 X.788 (P10)
G01 Z-1.517 (P11)
G01 Z-1.595 X.708 (P12)
G01 Z-1.673 X.788 (P13)
G01 Z-1.772 (P14)
N20 G00 Z-1.772 X.988 G40 (Q, X = .788 +
↪  2*.100 buffer, close G42)
G00 (G53) X.0 (go home: milling machine,
↪  pull X first)
(G53) Z.0 (pull Z first next, use machine 0
↪  as reference)
T0202 (finish turn, X+Z-, off tool)
G54
M03 (turn spindle)
S1200 (RPM = [4 * CS cutting
↪  speed]/[diameter] = [4 x 300]/[1 in] =
↪  1200)
G96
G50 S4000 (upper limit)
M08 (turn coolent on)
G00 Z.100 X1. (S) (!!!X is diameter!!!)
G70 P10 Q2
G00 X1.
G00 (G53) X.0 (go home: milling machine,
↪  pull X first)
(G53) Z.0 (pull Z first next, use machine 0
↪  as reference)
T0707 (parting tool for drilling, Z-, tool
↪  edge)
G54
M03 (turn spindle)
S1200 (RPM = [4 * CS cutting
↪  speed]/[diameter] = [4 x 300]/[1 in] =
↪  1200)
G96
G50 S4000 (upper limit)
M08 (turn coolent on)
G00 Z-1.772 X1.3 (S) (!!!X is diameter!!!)
G01 X.200 F.002 (parts catcher: go slow -
↪  small feed)
M36 (call parts catcher ON)
```

```
G04 P1.5 (devolved delay [s])
M37 (parts catcher OFF)
M09 (turn off coolent)
G00 (G53) X.0 (go home: milling machine,
↪  pull X first)
(G53) Z.0 (pull Z first next, use machine 0
↪  as reference, which will shut off
↪  coolent)
M30 (end of program)
%
```

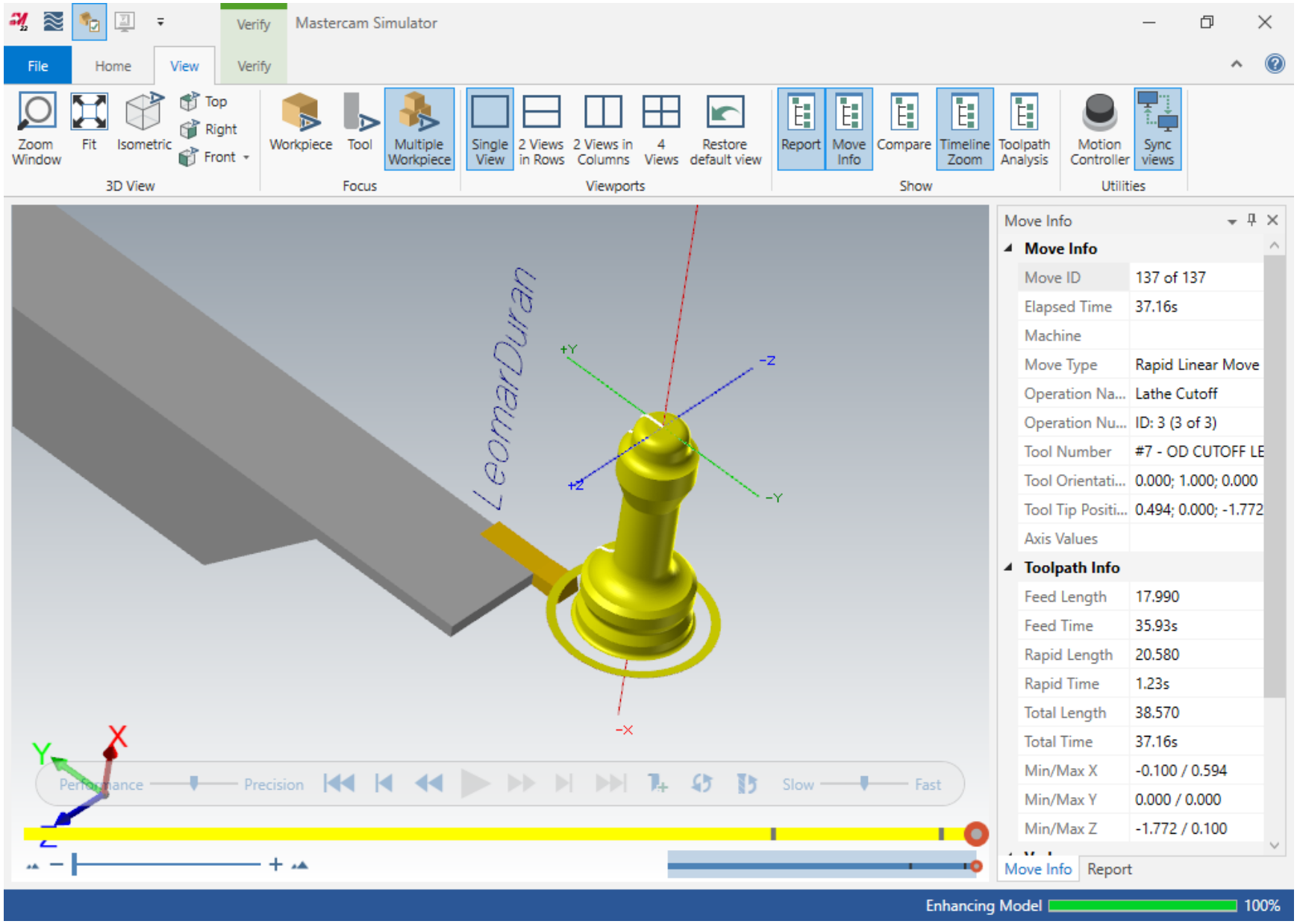
Chapter 6

Result of manual Gcode for CNC Simulator


Bishop.csdata
SET №1
00:01:21
X=10.44 in
Z=3.80 in
F=0.00 in/rev
V=0.00 ft/min
L3=2.07 in
EN•RU
in•mm
LOW POLY 3D
W
X/Ø
Run
ALL
O0001
O0002
O0003
O0004
O0005
T0707 (PARTING TOOL FOR DRILLI
G54 ;
M03 (TURN SPINDLE)
S1200 (RPM00 4 * CS CUTTING S
G96 ;
G50 S4000 (UPPER LIMIT)
M08 (TURN COOLENT ON)
G00 Z-1.772 X1.3 (S) (X IS DIA
G01 X.200 F.002 (PARTS CATCHER
M36 (CALL PARTS CATCHER ON)
G04 P1.5 (DEVOLVED DELAY S)
M37 (PARTS CATCHER OFF)
M09 (TURN OFF COOLENT)
G00 (G53) X.0 (GO HOME MILLING
(G53) Z.0 (PULL Z FIRST NEXT U
M30 (END OF PROGRAM)

Chapter 7

Verification of operations in Mastercam


Mastercam Simulator
Verify
File
Home
View
Verify
Zoom Window
Fit
Isometric
Top
Right
Front
3D View
Workpiece
Tool
Multiple Workpiece
Focus
Single View
2 Views in Rows
2 Views in Columns
4 Views
Restore default view
Viewports
Report
Move Info
Compare
Timeline Zoom
Toolpath Analysis
Show
Motion Controller
Sync views
Utilities
LeomarDuran
+Y
-Z
+Z
-Y
-X
X
Y
Z
Performance
Precision
Slow
Fast
Move Info
Move Info
Move ID 137 of 137
Elapsed Time 37.16s
Machine
Move Type Rapid Linear Move
Operation Na... Lathe Cutoff
Operation Nu... ID: 3 (3 of 3)
Tool Number #7 - OD CUTOFF LE
Tool Orientati... 0.000; 1.000; 0.000
Tool Tip Positi... 0.494; 0.000; -1.772
Axis Values
Toolpath Info
Feed Length 17.990
Feed Time 35.93s
Rapid Length 20.580
Rapid Time 1.23s
Total Length 38.570
Total Time 37.16s
Min/Max X -0.100 / 0.594
Min/Max Y 0.000 / 0.000
Min/Max Z -1.772 / 0.100
Move Info
Report
Enhancing Model
100%

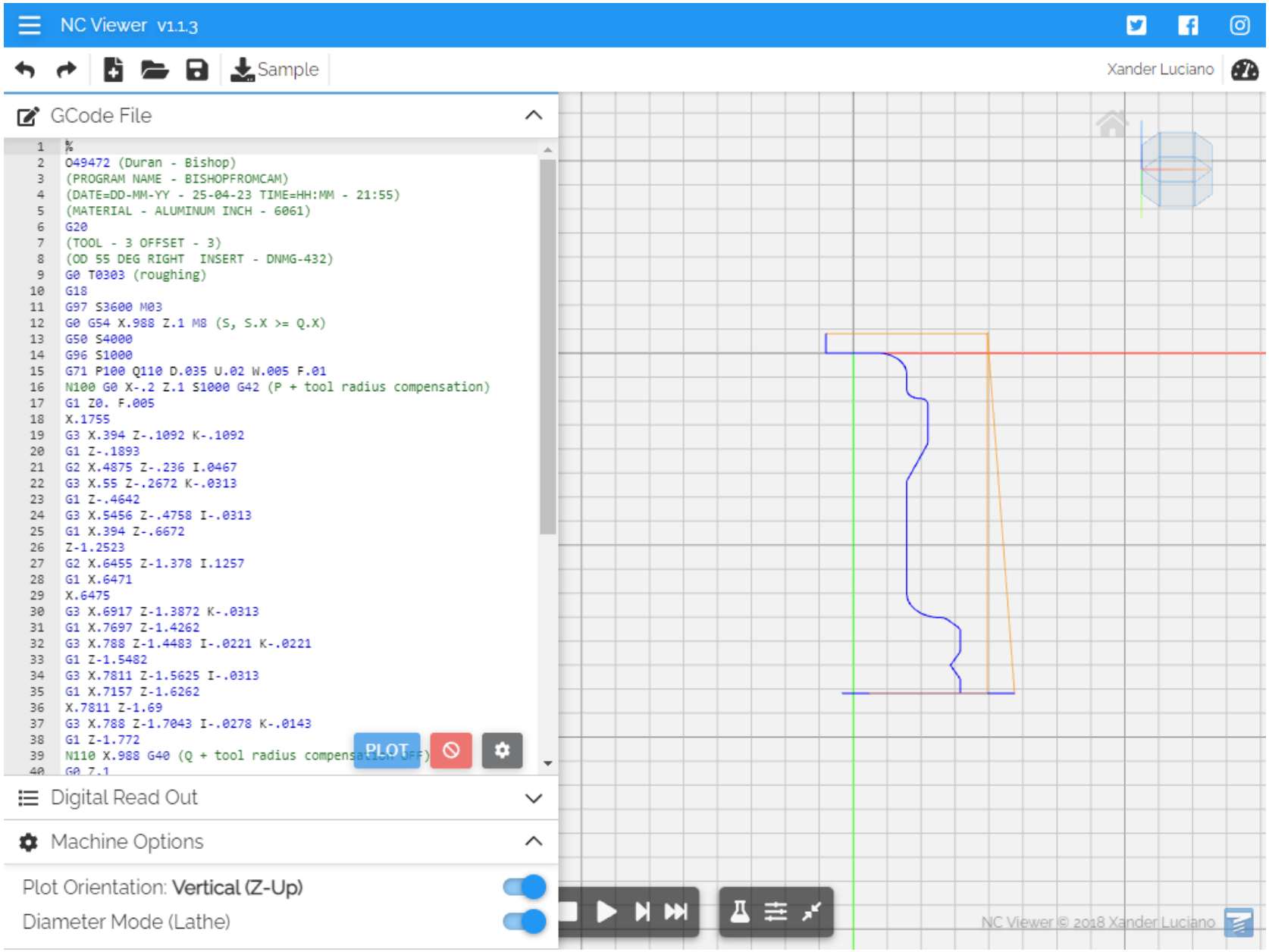
Chapter 8

The MasterCAM generated Gcode

```
%
O49472 (Duran - Bishop)
(PROGRAM NAME - BISHOPFROMCAM)
(DATE=DD-MM-YY - 25-04-23 TIME=HH:MM -
↪  21:55)
(MATERIAL - ALUMINUM INCH - 6061)
G20
(TOOL - 3 OFFSET - 3)
(OD 55 DEG RIGHT  INSERT - DNMG-432)
G0 T0303 (roughing)
G18
G97 S3600 M03
G0 G54 X.988 Z.1 M8 (S, S.X >= Q.X)
G50 S4000
G96 S1000
G71 P100 Q110 D.035 U.02 W.005 F.01
N100 G0 X-.2 Z.1 S1000 G42 (P + tool radius
↪  compensation)
G1 Z0. F.005
X.1755
G3 X.394 Z-.1092 K-.1092
G1 Z-.1893
G2 X.4875 Z-.236 I.0467
G3 X.55 Z-.2672 K-.0313
G1 Z-.4642
G3 X.5456 Z-.4758 I-.0313
G1 X.394 Z-.6672
Z-1.2523
G2 X.6455 Z-1.378 I.1257
G1 X.6471
X.6475
G3 X.6917 Z-1.3872 K-.0313
G1 X.7697 Z-1.4262
G3 X.788 Z-1.4483 I-.0221 K-.0221
G1 Z-1.5482
G3 X.7811 Z-1.5625 I-.0313
G1 X.7157 Z-1.6262
X.7811 Z-1.69
G3 X.788 Z-1.7043 I-.0278 K-.0143
G1 Z-1.772
N110 X.988 G40 (Q + tool radius
↪  compensation OFF)
G0 Z.1
G18
G70 P100 Q110
G0 Z.1
G28 U0. W0. M05 (V0. is in y, which the
↪  lathe does not have)
T0300 (resets tool 03 to value saved in
↪  memory)
M01
(TOOL - 7 OFFSET - 7)
(OD CUTOFF LEFT  INSERT - NONE)
G0 T0707
G18
G97 S3215 M03
G0 G54 X1.188 Z-1.772
G50 S4000
G96 S1000
G1 X.988 F.0025
X-.0818
X.1182
G0 X.988
G28 U0. W0. M05
T0700
M30
%
```

Chapter 9

Plot of MasterCAM-generated Gcode in NCViewer


NC Viewer v1.1.3
Sample
Xander Luciano
GCode File
%
O49472 (Duran - Bishop)
(PROGRAM NAME - BISHOPFROMCAM)
(DATE=DD-MM-YY - 25-04-23 TIME=HH:MM - 21:55)
(MATERIAL - ALUMINUM INCH - 6061)
G20
(TOOL - 3 OFFSET - 3)
(OD 55 DEG RIGHT INSERT - DNMG-432)
G0 T0303 (roughing)
G18
G97 S3600 M03
G0 G54 X.988 Z.1 M8 (S, S.X >= Q.X)
G50 S4000
G96 S1000
G71 P100 Q110 D.035 U.02 W.005 F.01
N100 G0 X-.2 Z.1 S1000 G42 (P + tool radius compensation)
G1 Z0. F.005
X.1755
G3 X.394 Z-.1092 K-.1092
G1 Z-.1893
G2 X.4875 Z-.236 I.0467
G3 X.55 Z-.2672 K-.0313
G1 Z-.4642
G3 X.5456 Z-.4758 I-.0313
G1 X.394 Z-.6672
Z-1.2523
G2 X.6455 Z-1.378 I.1257
G1 X.6471
X.6475
G3 X.6917 Z-1.3872 K-.0313
G1 X.7697 Z-1.4262
G3 X.788 Z-1.4483 I-.0221 K-.0221
G1 Z-1.5482
G3 X.7811 Z-1.5625 I-.0313
G1 X.7157 Z-1.6262
X.7811 Z-1.69
G3 X.788 Z-1.7043 I-.0278 K-.0143
G1 Z-1.772
N110 X.988 G40 (Q + tool radius compensation OFF)
G0 Z.1
PLOT
Digital Read Out
Machine Options
Plot Orientation: Vertical (Z-Up)
Diameter Mode (Lathe)
NC Viewer © 2018 Xander Luciano

Chapter 10

The machined part