



Clamping pyramid

TNC 640

Set up and programming



WEBINAR



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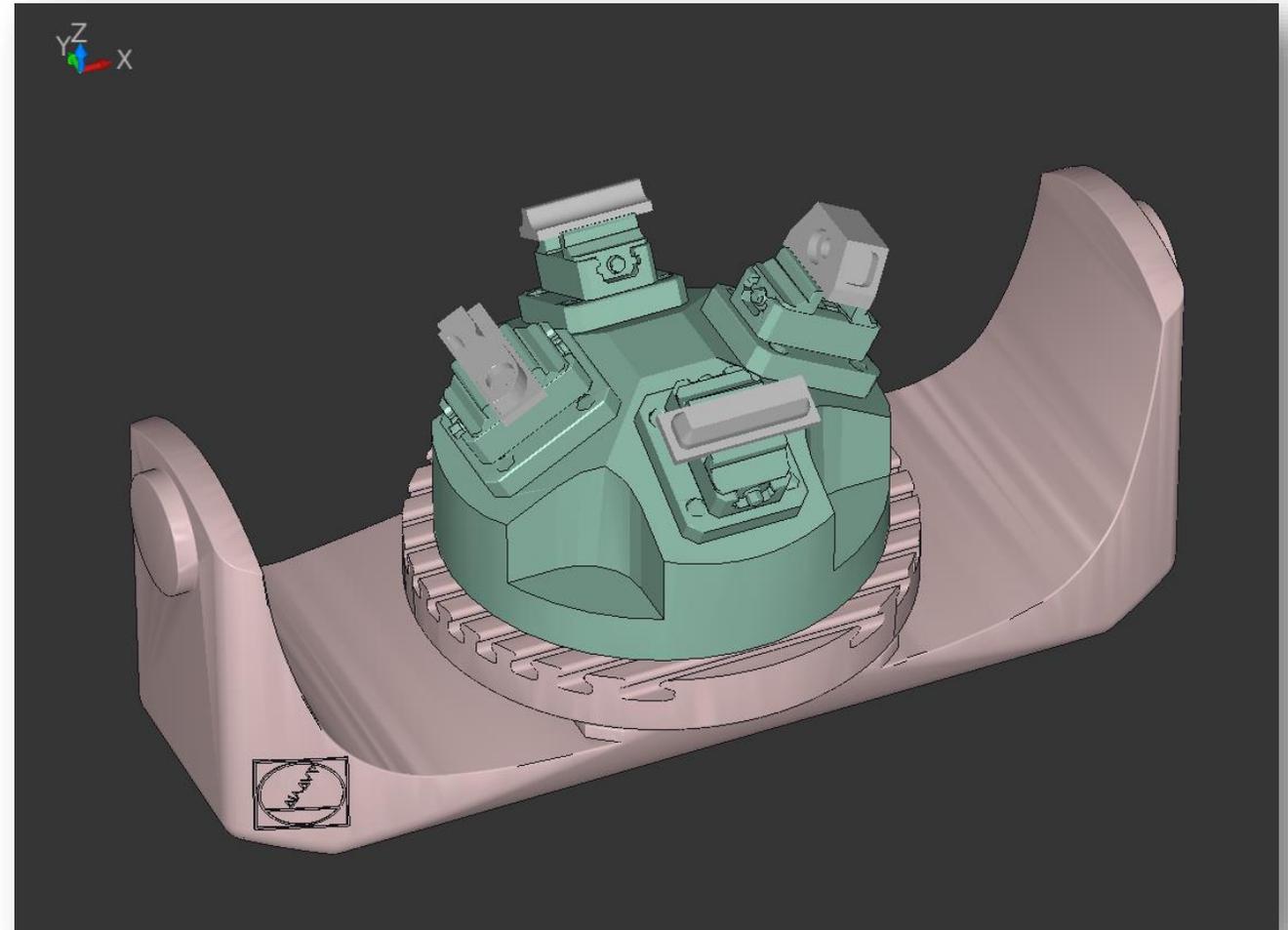


1 Possible applications at a glance



Possible applications At a glance

- Limited mechanical working space can be increased by clamping pyramid
- 3-axis, 3+2-swivel machining up to 5-axis simultaneous possible
- More unmanned runtime, by increasing the number of pieces per production run
- Combination with tool-oriented machining





2 **Setting up a clamping pyramid**

Reference point management



Set up a Clamping pyramid

- 3D base rotation as basis for reference point
- Entry in table:
 - SPA
 - SPB
 - SPC
 - Combination with C-OFFS possible
- Each datum can work with its own 3D basic rotation.

Manual operation

Manual operation

Programming

NO	DOC	X	Y	Z	SPC	SPB	SPA	LOCKED
2		+100	+50	+250	+0	+0	+0	
3		+0	-110	+230	+0	+0	+0	
4		+0	+110	+230	+0	+0	+0	
5		+160	+0	+220	+0	+0	+0	
6		-160	+0	+260	+0	+0	+0	
7		+100	+50	+250	+0	+0	+0	
8		+100	+50	+250	+0	+0	+0	
9		+100	+50	+250	+0	+0	+0	
10		+100	+50	+250	+0	+10	+10	
11		+100	+50	+250	+0	+0	+0	
12		+100	+50	+250	+0	+0	+0	
13		+100	+50	+250	+0	+0	+0	
14		+100	+50	+250	+0	+0	+0	

DOC	X	Y	Z	SPC	SPB	SPA
FRONT	+0	-192.29	+272.74	+0	+0	+29
RIGHT	+201.99	+0	+290.23	+90	+0	+29
BACK	+0	+187.44	+263.99	+180	+0	+29
LEFT	-187.44	+0	+263.99	+270	+0	+29

DOC Text width 16 TNC:\table\preset.pr

100% S-OVR

100% F-OVR S1 LIMIT 1

X +287.297 A +0.000 S1 +104.415

Y +0.000 C +0.000

Z +519.342

Mode: ACTL. 0 T 3 Z S 8999 F 0mm/min Ovr 100% M 5/9

CHANGE PRESET BASE TRANSFORM. OFFSET ACTIVATE PRESET END



Set up a Clamping pyramid

- How does the controller calculate?
- Entry in table:
 - Reference point with 3D basic rotation
- NC program:
 - PLANE SPATIAL SPA0 SPB0 SPC0
- Control calculates the programmed spatial angle with the 3D basic rotation and positions the NC rotary axes to match it

Positioning w/ Manual Data Input
Positioning with mdi

Programming

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M

S

S100% OFF ON

F100% OFF ON

```

->$mdi.h
0 BEGIN PGM $MDI MM
1 CYCL DEF 247 PRESETTING
  Q339=+20 ;PRESET NUMBER
2 FIXTURE SELECT
  "TNC:\Webinar_Pyramide\Pyramide.m3d"
3 ;
4 BLK FORM 0.1 Z X-75 Y-25 Z-30
5 BLK FORM 0.2 X+75 Y+25 Z+1
6 ;
7 PLANE SPATIAL SPA+0 SPB+0 SPC+0 TURN FMAX SYM-
8 ;
9 L X+0 Y+0 Z+30 R0 FMAX
10 END PGM $MDI MM
  
```

LEFT -187.44 +0 +263.99 +270 +0 +29

X	+0.000	A	-29.000	S1	+104.415
Y	+0.000	C	+90.000		
Z	+30.000				

Mode: ACTL. 20: LEFT T 3 Z S 8999 F 0mm/min Ovr 100% M 5/9

SELECT BLOCK CUT OUT BLOCK INSERT BLOCK COPY BLOCK HIDE ON OFF INSERT LAST NC BLOCK



Set up a Clamping pyramid

- How does the controller calculate?
- Entry in table:
 - Reference point with 3D basic rotation
- NC program:
 - PLANE SPATIAL SPA90 SPB0 SPC0
- Control calculates the programmed spatial angle with the 3D basic rotation and positions the NC rotary axes to match it

Positioning w/ Manual Data Input
Positioning with mdi

Programming

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```

→$mdi.h
0 BEGIN PGM $MDI MM
1 CYCL DEF 247 PRESETTING
  Q339=+20 ;PRESET NUMBER
2 FIXTURE SELECT
  "TNC:\Webinar_Pyramide\Pyramide.m3d"
3 ;
4 BLK FORM 0.1 Z X-75 Y-25 Z-30
5 BLK FORM 0.2 X+75 Y+25 Z+1
6 ;
7 PLANE SPATIAL SPA+0 SPB+0 SPC+0 TURN FMAX SYM-
8 ;
9 L X+0 Y+0 Z+30 R0 FMAX
10 ;
11 PLANE SPATIAL SPA+90 SPB+0 SPC+0 TURN MB MAX
  FMAX SYM-
12 ;
13 L X+0 Y+0 Z+50 R0 FMAX
14 END PGM $MDI MM
  
```

XYZ . . . +

XYZ . . . -

OFF ON

LEFT -187.44 +0 +263.99 +270 +0 +29

X	+0.000	A	-119.000	S1	+104.415
Y	+0.000	C	+90.000		
Z	+50.000				

Mode: ACTL. 20: LEFT T 3 Z S 8999 F 0mm/min Ovr 100% M 5/9

SELECT BLOCK CUT OUT BLOCK INSERT BLOCK COPY BLOCK HIDE ON OFF INSERT LAST NC BLOCK



Set up a Clamping pyramid

- Position display
 - Only the mechanical result from the calculation:

- 3D basic rotation



PLUS



- Solid angle



Positioning w/ Manual Data Input
Positioning with mdi

Programming

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HEIDENHAIN

```

→$mdi.h
0 BEGIN PGM $MDI MM
1 CYCL DEF 247 PRESETTING
  Q339=+20 ;PRESET NUMBER
2 FIXTURE SELECT
  "TNC:\Webinar_Pyramide\Pyramide.m3d"
3 ;
4 BLK FORM 0.1 Z X-75 Y-25 Z-30
5 BLK FORM 0.2 X+75 Y+25 Z+1
6 ;
7 PLANE SPATIAL SPA+0 SPB+0 SPC+0 TURN FMAX SYM-
8 ;
9 L X+0 Y+0 Z+30 R0 FMAX
10 ;
11 PLANE SPATIAL SPA+90 SPB+0 SPC+0 TURN MB MAX
  FMAX SYM-
12 ;
13 L X+0 Y+0 Z+50 R0 FMAX
14 END PGM $MDI MM
  
```

XYZ.. +

XYZ.. -

OFF ON

X +0.000 A -119.000

Y +0.000 C +90.000

Z +50.000

Y +0.000 C +90.000

Z +50.000

Mode: ACTL. 20: LEFT T 3 Z S 8999 F 0mm/min Ovr 100% M 5/9

SELECT BLOCK CUT OUT BLOCK INSERT BLOCK COPY BLOCK HIDE ON OFF INSERT LAST NC BLOCK



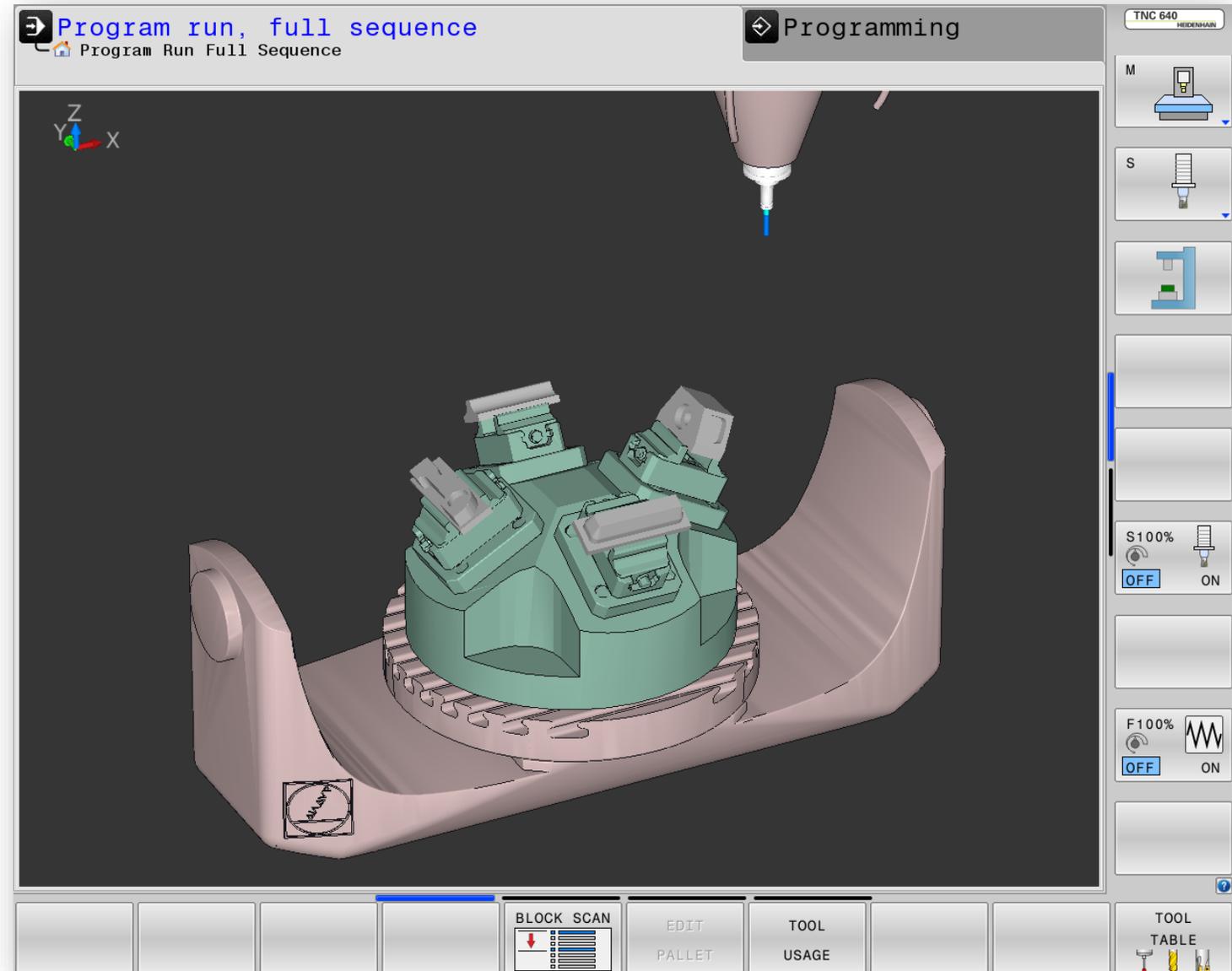
3 Programming



Programming

Use of solid angle

- ▶ **3-axis machining:** Activate plane before each machining operation
- ▶ **3+2 axis machining:** all PLANE functions are possible (except PLANE AXIAL)
- ▶ **3+1 to 3+2 axis salaried machining:**
M128/TCPM use only in spatial angle
- ▶ **5-axis simultaneous machining:**
M128/TCPM use only in spatial angle





Programming 3-axis machining

- ▶ Activate layer before each edit:
- ▶ **PLANE SPATIAL SPA+0 SPB+0 SPC+0**
TURN/MOVE/STAY
- ▶ Subsequently, editing can be carried out as
can be carried out as usual.
- ▶ PLANE RESET
- TURN/MOVE/STAY rotates the
rotary axes to 0.

Program Run Full S... Test Run

TNC: \Webinar_Pyramide\PART4_3Achs.h

```

31 ;
32 CALL PGM TNC:\SAFE.H
33 PLANE RESET TURN FMAX
34 M30
35 * - LBL 300
36 LBL 300
37 PLANE RESET STAY
38 CYCL DEF 7.0 DATUM SHIFT
39 CYCL DEF 7.1 X+0
40 CYCL DEF 7.2 Y+0
41 CYCL DEF 7.3 Z+0
42 CALL PGM TNC:\SAFE.H
43 PLANE SPATIAL SPA+0 SPB+0 SPC+0 TURN FMAX SYM-
44 LBL 0
45 * - LBL 100 - Rahmen
46 LBL 100
47 ;* origin_file = "Part4_3Achs.STEP"
48 ; FUNCTION MODE MILL
49 ;* origin = X+0.0000 Y+0.0000 Z+0.0000
50 ; PLANE RESET STAY
51 ; TRANS DATUM AXIS X+0.0000 Y+0.0000 Z+0.0000
52 ; 1 + 4 line(s) + 0 arc(s) + 0 gap-filler(s)
53 ; sel_blk_form from selection
54 ; BLK FORM 0.1 Z X-75.0000 Y-25.0000 Z-0.0250
55 ; BLK FORM 0.2 X+75.0000 Y+25.0000 Z+0.0250
56 L X-75 Y-25
57 L X-75 Y+25
58 L X+75 Y+25
59 L X+75 Y-25
60 L X-75 Y-25
61 ;* end contours
62 LBL 0
63 * - LBL 101 - Inse1
64 LBL 101
  
```

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00:01:32 F MAX

VIEW OPTIONS OFF ON OFF ON STOP AT START START SINGLE RESET + START



Programming 3+2 axis machining

- ▶ Programming with **PLANE** functions
- ▶ The editing can be
be carried out as usual.
- ▶ PLANE RESET
TURN/MOVE/STAY rotates the
rotary axes to 0.
- ▶ **PLANE AXIAL** does not calculate the basic 3D
rotation.

Program Run Full S... Test Run
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```
TNC:\Webinar_Pyramide\PART2_Geschwenkt.h
89 PLANE RESET STAY
90 TRANS DATUM AXIS X-50 Y+25 Z-45
91 CALL PGM TNC:\SAFE.H
92 PLANE SPATIAL SPA+70 SPB+0 SPC-90 TURN FMAX
93 LBL 0
94 ;
95 * - LBL 302 RECHTS
96 LBL 302
97 CALL PGM TNC:\SAFE.H
98 PLANE RESET STAY
99 TRANS DATUM AXIS X+50 Y-25 Z-45
100 PLANE SPATIAL SPA+70 SPB+0 SPC+90 TURN FMAX
101 LBL 0
102 ;
103 * - LBL 303 HINTEN
104 LBL 303
105 CALL PGM TNC:\SAFE.H
106 PLANE RESET STAY
107 TRANS DATUM AXIS X+50 Y+25 Z-60
108 PLANE SPATIAL SPA+90 SPB+0 SPC-180 TURN FMAX
109 LBL 0
110 ;
111 * - LBL 304 VORNE
112 LBL 304
113 CALL PGM TNC:\SAFE.H
114 PLANE RESET STAY
115 TRANS DATUM AXIS X-50 Y-25 Z-60
116 PLANE SPATIAL SPA+90 SPB+0 SPC+0 TURN FMAX
117 LBL 0
118 ;
119 * - LBL 100 - Rahmen
120 LBL 100
121 ;* origin_file = "Part2_Geschwenkt.STEP"
122 ; FUNCTION MODE MILL
```

00:02:11 F MAX

VIEW OPTIONS OFF ON OFF ON STOP AT START START SINGLE RESET + START



Programming

3+1 to 3+2 axis inclined machining

- ▶ Use of spatial angles
- ▶ **TCPM AXIS SPAT** in combination with LA, B or C
- ▶ **TCPM AXIS POS / M128** in combination with LN X Y Z NX NY NZ TX TY TZ
- ▶ **Axis angle does not offset the 3D basic rotation!**
- ▶ **TCPM AXIS POS / M128** in conjunction with LA, B or C

Program Run Full S... Test Run

TNC: \Webinar_Pyramide\PART3_ABZEILEN.H

5907	L	X-27.7466	Y+18.9908	Z-37.3628
5908	L	X-27.791	Y+19.3238	Z-37.5423
5909	L	X-27.839	Y+19.7356	Z-37.7363
5910	L	X-27.8807	Y+20.1579	Z-37.9047
5911	L	X-27.9154	Y+20.5866	Z-38.0452
5912	L	X-27.9432	Y+21.0204	Z-38.1574
5913	L	X-27.9638	Y+21.4577	Z-38.2408
5914	L	X-27.9763	Y+21.853	Z-38.291
5915	L	X-27.9828	Y+22.2432	Z-38.3174
5916	L	X-27.984	Y+25	Z-38.3224
5917	L	X-27.9802	Y+25.067	Z-38.3203
5918	L	X-27.9686	Y+25.125	Z-38.3137
5919	L	X-27.9493	Y+25.1742	Z-38.3026
5920	L	X-27.9222	Y+25.2143	Z-38.287
5921	L	X-27.8874	Y+25.2456	Z-38.267
5922	L	X-27.8449	Y+25.2679	Z-38.2425
5923	L	X-27.7946	Y+25.2813	Z-38.2135
5924	L	X-27.7366	Y+25.2858	Z-38.18
5925	L	X-27.6786	Y+25.2813	Z-38.1465
5926	L	X-27.6284	Y+25.2679	Z-38.1175
5927	L	X-27.5858	Y+25.2456	Z-38.0929
5928	L	X-27.551	Y+25.2143	Z-38.0727
5929	L	X-27.5239	Y+25.1742	Z-38.057
5930	L	X-27.5045	Y+25.125	Z-38.0458
5931	L	X-27.4929	Y+25.067	Z-38.0389
5932	L	X-27.489	Y+25	Z-38.0366
5933	L	X-27.4878	Y+22.2432	Z-38.0317
5934	L	X-27.4813	Y+21.853	Z-38.0052
5935	L	X-27.4688	Y+21.4577	Z-37.955
5936	L	X-27.4482	Y+21.0204	Z-37.8716
5937	L	X-27.4204	Y+20.5866	Z-37.7594
5938	L	X-27.3857	Y+20.1579	Z-37.6189
5939	L	X-27.344	Y+19.7356	Z-37.4505
5940	L	X-27.296	Y+19.3238	Z-37.2565

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00:02:49 1.0*T

VIEW OPTIONS OFF ON OFF ON STOP AT START START SINGLE RESET + START



Programming

5-axis simultaneous machining

- ▶ Use of spatial angles
- ▶ **TCPM AXIS SPAT** in combination with LA, B or C
- ▶ **TCPM AXIS POS / M128** in combination with LN X Y Z NX NY NZ TX TY TZ
- ▶ **Axis angle does not offset the 3D basic rotation: TCPM AXIS POS / M128 in conjunction with LA, B or C**

Program Run Full S... Test Run

TNC: \Webinar_Pyramide\PART1_SIMULTAN.H

```

NX-0.9396926 NY+0 NZ+0.3420201 TX+0.3420201 TY+0
TZ+0.9396994
2659 LN X-75.3326 Y-0.9229 Z-18.041
NX-0.9396926 NY+0 NZ+0.3420201 TX+0.3420201 TY+0
TZ+0.9396994
2660 LN X-75.3327 Y+0 Z-18.041 NX-0.9396926
NY+0 NZ+0.3420201 TX+0.3420201 TY+0.9396994
2661 LN X-75.3326 Y+0.9927 Z-18.041
NX-0.9396926 NY+0 NZ+0.3420201 TX+0.3420201 TY+0
TZ+0.9396994
2662 LN X-75.3324 Y+1.9086 Z-18.0404
NX-0.9396926 NY+0 NZ+0.3420201 TX+0.3420201 TY+0
TZ+0.9396994
2663 LN X-75.3321 Y+2.7538 Z-18.0396
NX-0.9396926 NY+0 NZ+0.3420201 TX+0.3420201 TY+0
TZ+0.9396994
2664 LN X-75.3317 Y+3.5336 Z-18.0386
NX-0.9396926 NY+0 NZ+0.3420201 TX+0.3420201 TY+0
TZ+0.9396994
2665 LN X-75.3311 Y+4.2531 Z-18.0369
NX-0.9396926 NY+0 NZ+0.3420201 TX+0.3420201 TY+0
TZ+0.9396994
2666 LN X-75.3303 Y+4.917 Z-18.0347
NX-0.9396926 NY+0 NZ+0.3420201 TX+0.3420201 TY+0
TZ+0.9396994
2667 LN X-75.3292 Y+5.5296 Z-18.0316
NX-0.9396926 NY+0 NZ+0.3420201 TX+0.3420201 TY+0
TZ+0.9396994
2668 LN X-75.3278 Y+6.0948 Z-18.0278
NX-0.9396926 NY+0 NZ+0.3420201 TX+0.3420201 TY+0
TZ+0.9396994
2669 LN X-75.3262 Y+6.6164 Z-18.0234
NX-0.9396926 NY+0 NZ+0.3420201 TX+0.3420201 TY+0
TZ+0.9396994

```

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00:02:26 0.50*T

VIEW OPTIONS OFF ON OFF ON STOP AT START START SINGLE RESET + START

HEIDENHAIN

Webinar



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WEBINAR

