Workshop

Hinting

FDK

What is hinting?

The display of digital outlines on screen is a challenge, and often a problem. The issue is converting vector outlines to the pixel grid of the sceen.

Hinting is data in the font, which aims at helping with that. *Hinting* can also refer to the exciting activity of adding hints to a font.

Hinting data consists of various elements that may be font-wide settings, or applied to individual glyphs.

Most important hinting parameters:

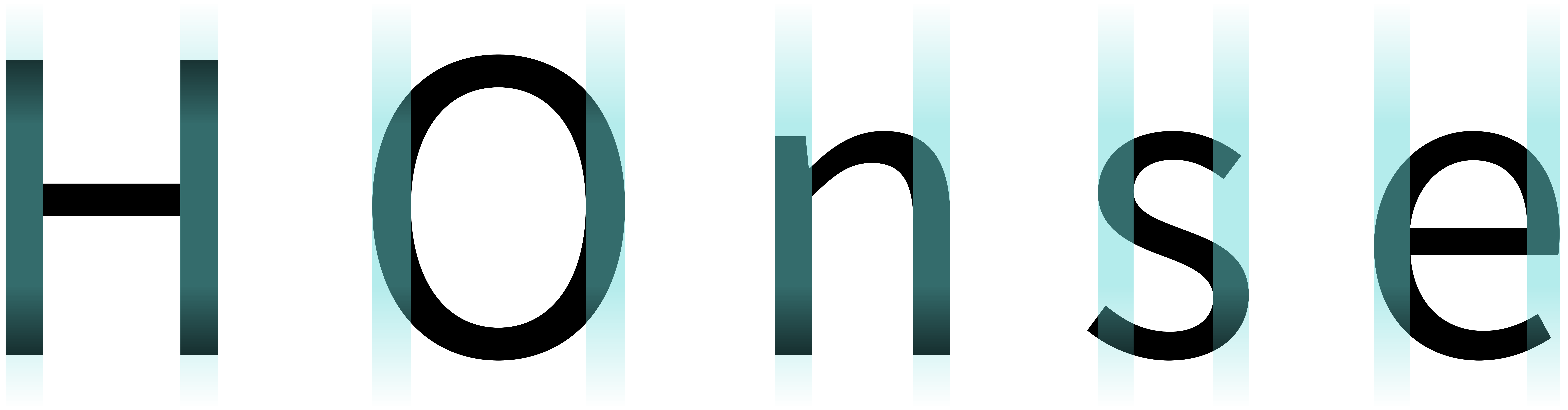
Zones and **Stems**

What is hinting?

CFF Hinting	TTF Hinting
cubic curves, counter-clockwise (T1 fonts, CFF-OTF, CFF-WOFF)	quadratic curves, clockwise (TTF, TTF-OTF, TTF-WOFF)
generalistic approach	glyph-by-glyph control
fine-grained control not possible	very fine-grained control
intelligence in rasterizer	intelligence in font
time spent on hinting: minutes	time spent on hinting: days
	better in older (Windows) environments

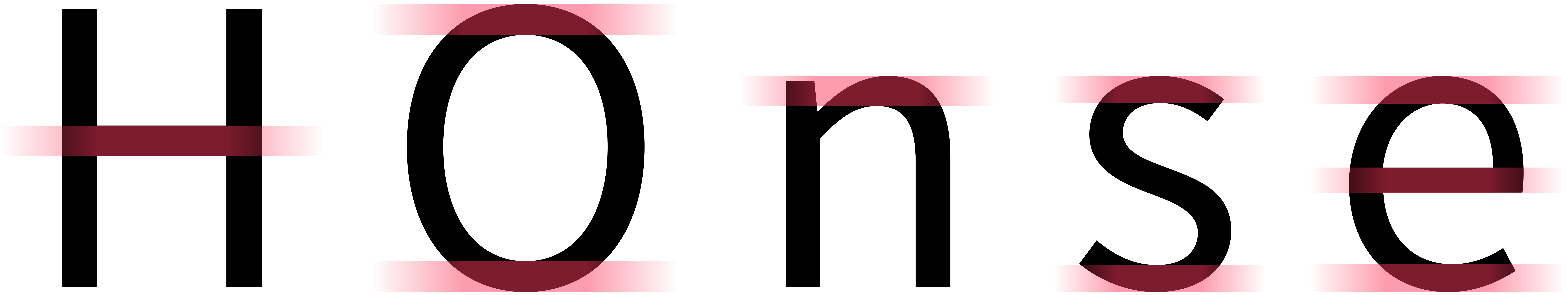
Hinting: Stems

Stems values tell the rasterizer which parts of the letter should have equal width. Vertical stems are also called *StemSnapV*.



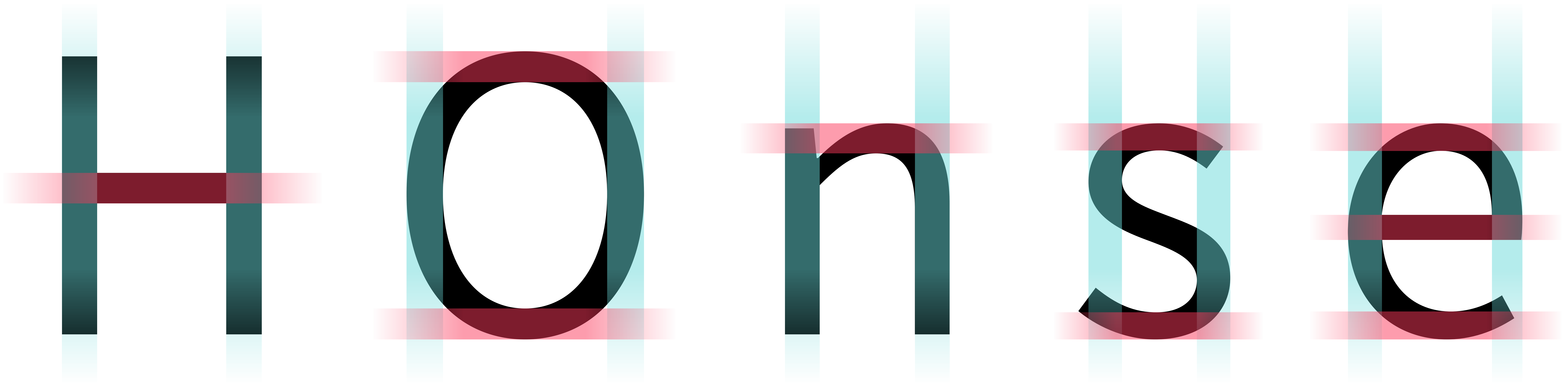
Hinting: Stems

Horizontal stems are also called *StemSnapH*.



Hinting: Stems

Keeping points at extremes, and consistent stem distances in the drawing are the best way to get a properly rasterizing font.



Hinting: Stems

Vertical stems (*StdVW*, *StemSnapV*)

– The first value is the overall dominant vertical stem width. Usually this value will match the width of the straight lowercase stems.

– The remaining values are the other most frequent vertical stem widths. Typically, these values will match the width of the straight stems of the uppercase letters

Horizontal stems (*StdHW*, *StemSnapH*)

– First value is the dominant horizontal stem width
– Remaining values are the other most frequent horizontal stem widths.

Hinting: Stems

- Stem values are a single list of numbers, with the dominant stem first, and the remaining stems sorted in increasing order (This means that the first value might be larger than the following numbers.)
- At least one value, and up to 12 values per direction must be specified.
- Amount and difference of stem values depend on the design.

Example StemSnapV for Source Sans Pro Regular: `84 95`

Example StemSnapH for Source Sans Pro Regular: `67 78`

FDK tools: stemHist

stemHist

A tool to help defining hinting parameters (stems).
Its result are two text files, that list all vertical and horizontal stems in order of occurrence. Can suggest alignment zones.

```
stemHist font.ufo
```

List all straight stems found, for all glyphs.

```
stemHist -all font.ufo
```

Also include round stems.

```
stemHist -g A-Z,a-z,zero-nine font.ufo
```

List stems for all glyphs between A and Z, between a and z, between zero and nine.

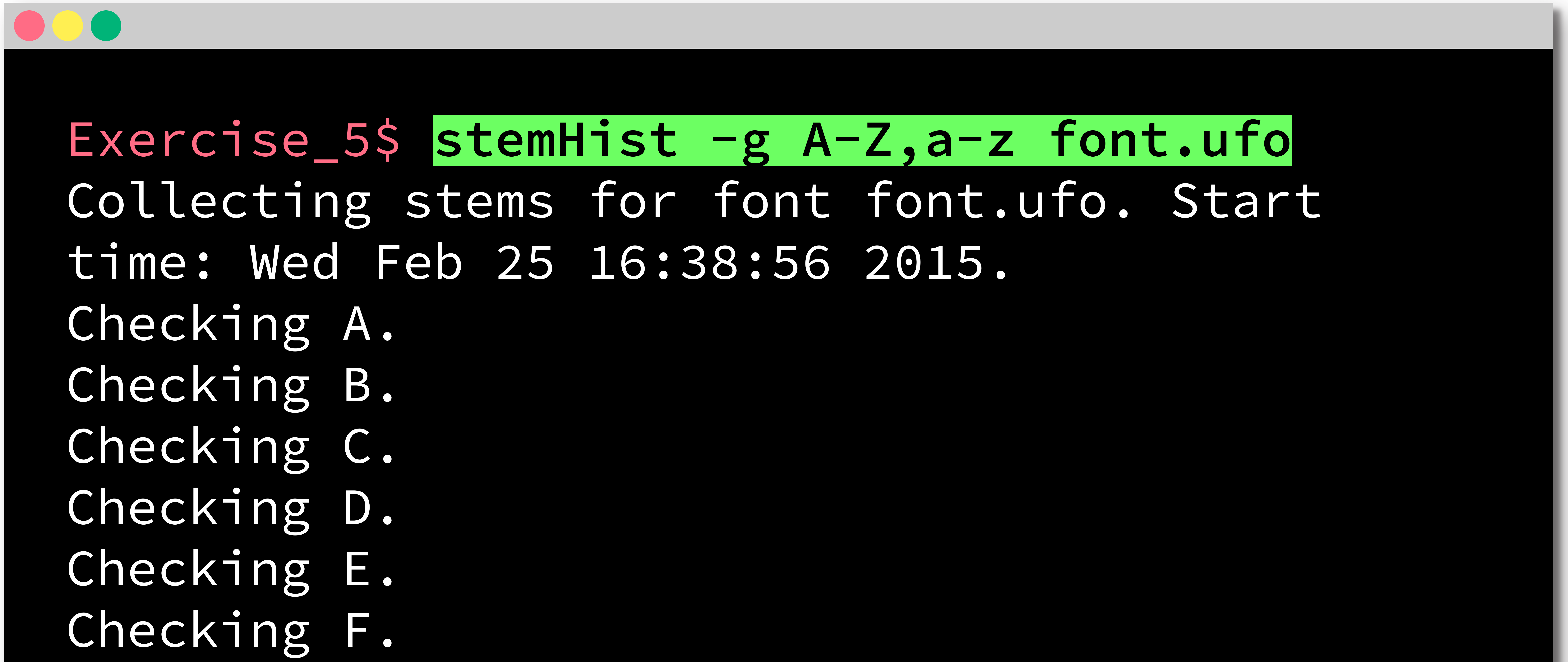
```
stemHist -a -g zero-nine font.ufo
```

List suggested alignment zone values for the figures of this font.

stemHist will run follow the internal glyph order of the font.

Exercise 5: Run stemHist!

In this case, we run stemHist only on the upper- and lowercase alphabet. We don’t need to redirect to a text file, two text files are created automatically.



```
Exercise_5$ stemHist -g A-Z,a-z font.ufo
Collecting stems for font font.ufo. Start
time: Wed Feb 25 16:38:56 2015.
Checking A.
Checking B.
Checking C.
Checking D.
Checking E.
Checking F.
```

Exercise 5: Analyze stemHist!

This is an example output for stemHist, we can analyze it together.

```
Vertical Stem List for font.ufo on Thu Mar 27 16:38:57 2014
Count  Width   Glyph List
15     88      ['a', 'd', 'g', 'h', 'i', 'j', 'l', 'm', 'n', 'p', 'q',]
11     87      ['M', 'N', 'b', 'f', 'h', 'k', 'm', 'n', 'r']
11     93      ['B', 'D', 'E', 'F', 'H', 'I', 'J', 'L', 'P', 'R', 'T']
3      94      ['H', 'K', 'Y']
1      388     ['z']
1      360     ['z']
1      404     ['Z']
1      441     ['Z']
1      90      ['G']
1      91      ['U']
1      92      ['U']
```

```
Horizontal Stem List for font.ufo on Thu Mar 27 16:38:57 2014
Count  Width   Glyph List
12     65      ['B', 'D', 'E', 'F', 'G', 'H', 'P', 'R', 'T', 'Z']
9      66      ['A', 'B', 'D', 'E', 'L', 'P', 'Z']
4      540     ['k', 'n', 'u', 'x']
4      59      ['f', 't', 'z']
4      738     ['d', 'h', 'k', 'l']
4      719     ['I', 'K', 'X', 'Y']
2      56      ['p', 'q']
2      70      ['M', 'W']
2      90      ['i', 'j']
1      48      ['g']
```

Hinting: Alignment Zones

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Hinting: Alignment Zones

Alignment Zones are narrow stripes, containing the overshoot of a particular glyph range.

Hinting: Alignment Zones

The zones at the top of glyphs are called *Blue Values*.

Note the exception: the baseline zone is also a Blue Value.

Hinting: Alignment Zones

The zones at the bottom of glyphs are called *Other Blues*.

Note the baseline zone of three.superior is also an Other Blue.

Hinting: Alignment Zones

Alignment Zones may shift and move across weights, but the amount of zones usually stays the same (they interpolate).

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Hinting: Alignment Zones

FamilyBlues and *FamilyOtherBlues* equal the zone values of the Regular weight. *FamilyBlues* are used instead of *BlueValues* in any situation in which the difference is less than one pixel.

Blue Values of SSP-Black   FamilyBlues of SSP

Hinting: Alignment Zones

– Alignment Zones cannot overlap.
The minimum distance between consecutive zones is 1 unit.
(This is assuming that BlueFuzz is set to 0; more on that below.)

– Each zone is declared by a pair of integer values, in ascending order.

BlueValues, FamilyBlues:

– the first zone must be the baseline zone,
up to 7 zones may be defined

OtherBlues, FamilyOtherBlues:

– up to 5 zones may be defined

Hinting: Alignment Zones

Example BlueValues *for Source Sans Pro Regular:*

```
-12 0 486 498 518 530 574 586 638 650 656 668 712 724
```

-12	0:	Baseline overshoot
486	498:	x-height overshoot
518	530:	small caps overshoot
574	586:	old style figures overshoot
638	650:	lining figures overshoot
656	668:	cap overshoot
712	724:	ascender overshoot

Example OtherBlues *for Source Sans Pro Regular:*

-217	-205:	descender overshoot

Other hinting settings

BlueScale

– controls point size for overshoot to occur
– calculation of Medium BlueScale Value:

$$\frac{3}{4 \times \mathrm{MaxZoneSize}}$$

BlueShift

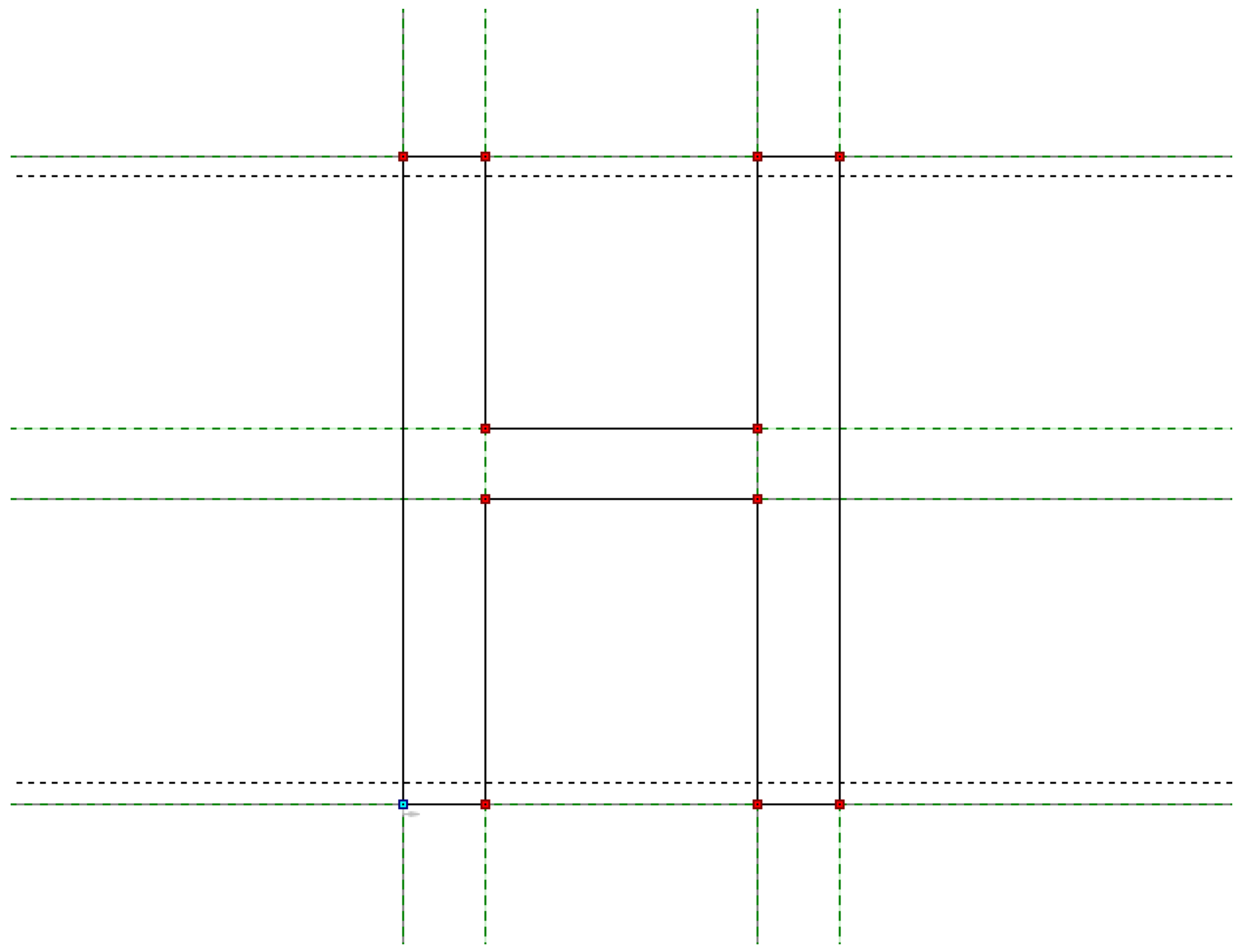
– Additional overshoot control.
  Defines the minimum overshoot distance to become visible.
  Default: 7 (@ 1000 UPM)

BlueFuzz

– Extends the zones in both directions.
  Don’t use it, set to 0.

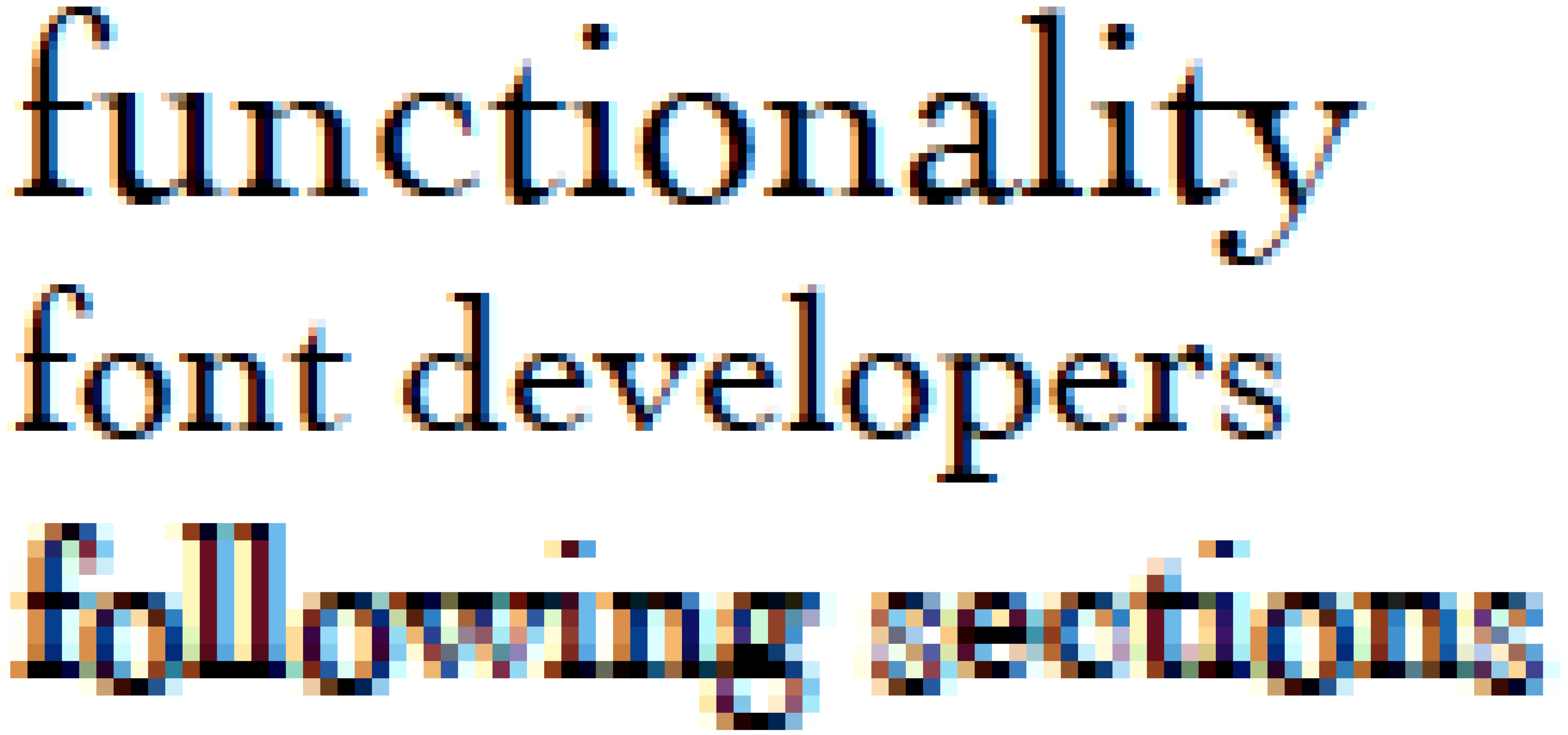
PostScript/CFF hinting

Spending some time on those those values will make your fonts look better. *Autohint* will be able to create hints that are very good, and don't need further attention.



Not hinting

“I don’t care about this stuff:”



This could have been avoided with just two alignment zones.

PostScript/CFF hinting

The effects of PostScript hinting depend on the rasterizer, and are most visible in Adobe Acrobat, or InDesign. In Apple Preview, you likely won’t see a difference, because it uses a different rasterizer.

In general, hinting will improve the display of type in smaller sizes. This does not mean that a font for large sizes needs no hinting – zooming out of a document will force a font into small display on screen, no matter what the intended usage size is.

BlueScale formulas

Minimum BlueScale:
(biggest zone equals half pixel)

$$\frac{1}{2 \times \text{MaxZoneSize}}$$

Medium BlueScale:
(value stored in font file)

$$\frac{3}{4 \times \text{MaxZoneSize}}$$

Maximum BlueScale:
(biggest zone equals whole pixel)

$$\frac{1}{\text{MaxZoneSize}}$$

BlueScale formulas

Overshoot threshold
(point size)

$$\frac{\text{BlueScale} \times 72 \times \text{UPM}}{\text{ppi}}$$

The overshoot threshold is the point size at which the overshoot starts happening.

ppi is the pixels per inch resolution of a specific rasterization environment (for instance, the MBP 15″ with Retina Display has 220 ppi). Rasterization however also occurs in most modern printing processes.

72 is a magic number, beause 1 inch is exactly 72 dtp points.

Exercise: Test overshoot settings in Acrobat

We can observe the effects of BlueScale values directly in Acrobat:

– autohint the PFA file

– create a waterfall PDF (low-res or Retina versions):

```
waterfallplot -wfr 48,49,50,51,52 -g x,o,x,o,x font.pfa
```

```
waterfallplot -wfr 23,24,25,26,27 -g x,o,x,o,x font.pfa
```

– open the PDF in Adobe Reader or Acrobat

– in the Preferences dialog, select the *Page Display* section.
Set the *Custom Resolution* to 72 pixels/inch.
Set *Smooth Text* to *For Laptop/LCD screens*

– set the zoom to 100%

What is TrueType Hinting?

TrueType Hinting is **not** magic!
Rather, it is the most boring thing on earth.
For TT Hinting, a font must be converted to TT outlines (clockwise, quadratic curves). Don’t even think about TT hinting while still in the design phase!

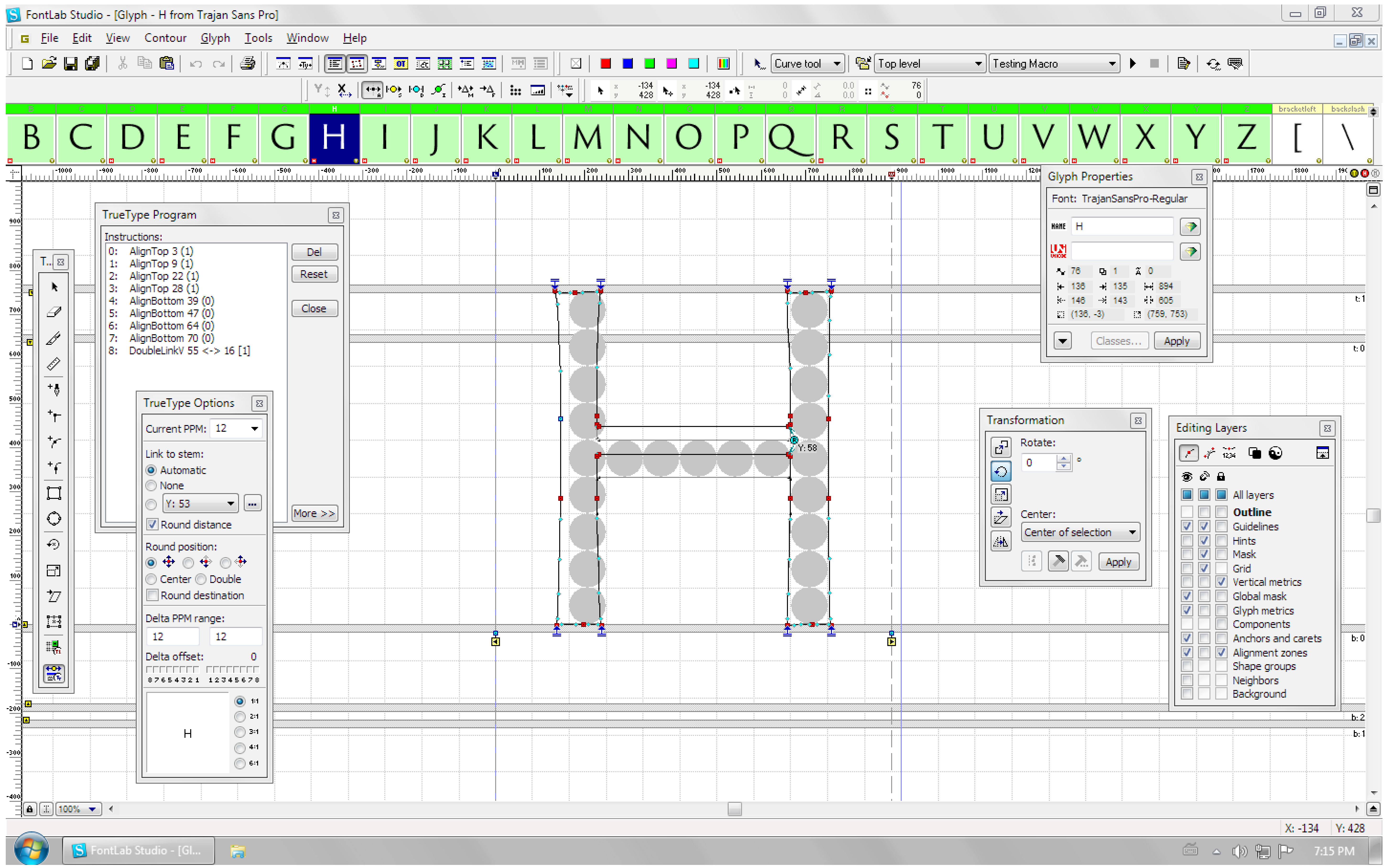
TT Hinting makes use of the following values:

Stems

Alignment Zones

PPMs

TrueType Hinting


FontLab Studio - [Glyph - H from Trajan Sans Pro]
File Edit View Contour Glyph Tools Window Help
Curve tool
Top level
Testing Macro
B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\
Del
Reset
Close
More >>
Classes...
Apply
Y: 58
t: 1
t: 0
b: 0
b: 2
b: 1

TrueType Program

Instructions:

```
0:  AlignTop 3 (1)
1:  AlignTop 9 (1)
2:  AlignTop 22 (1)
3:  AlignTop 28 (1)
4:  AlignBottom 39 (0)
5:  AlignBottom 47 (0)
6:  AlignBottom 64 (0)
7:  AlignBottom 70 (0)
8:  DoubleLinkV 55 <-> 16 [1]
```

TrueType Options

Current PPM: 12

Link to stem: [✓ Automatic] None Y: 53

[✓ Round distance]

Round position: Center Double

Round destination

Delta PPM range: 12 12

Delta offset: 0

Glyph Properties

Font: TrajanSansPro-Regular

Name: H

76 1 0
136 135 894
146 143 605
(136, -3) (759, 753)

Transformation

Rotate: 0 °

Center: Center of selection

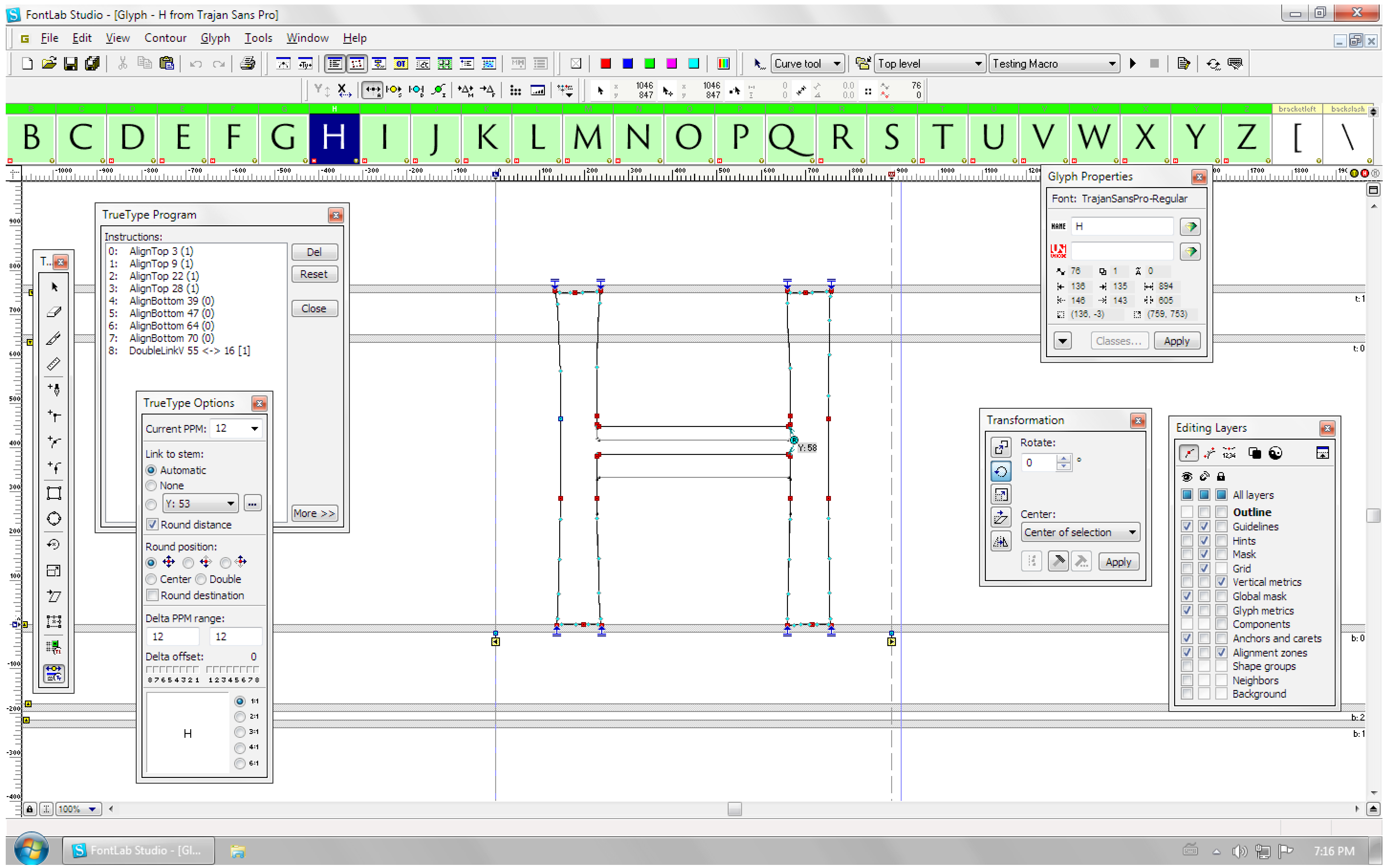
Editing Layers

All layers
Outline
[✓ Guidelines]
[✓ Hints]
[✓ Mask]
[✓ Grid]
[✓ Vertical metrics]
[✓ Global mask]
[✓ Glyph metrics]
Components
[✓ Anchors and carets]
[✓ Alignment zones]
Shape groups
Neighbors
Background

X: -134 Y: 428

7:15 PM

TrueType Hinting



FontLab Studio - [Glyph - H from Trajan Sans Pro]

TrueType Program

Instructions:

```
0:   AlignTop 3 (1)
1:   AlignTop 9 (1)
2:   AlignTop 22 (1)
3:   AlignTop 28 (1)
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TrueType Options

Current PPM: 12

Link to stem: [✓ Automatic] None Y: 53

[✓ Round distance]

Round position:

Center Double

Round destination

Delta PPM range: 12 12

Delta offset: 0

[✓ 1:1] 2:1 3:1 4:1 6:1

Glyph Properties

Font: TrajanSansPro-Regular

NAME H

76 1 0
136 135 894
146 143 605
(136, -3) (759, 753)

Transformation

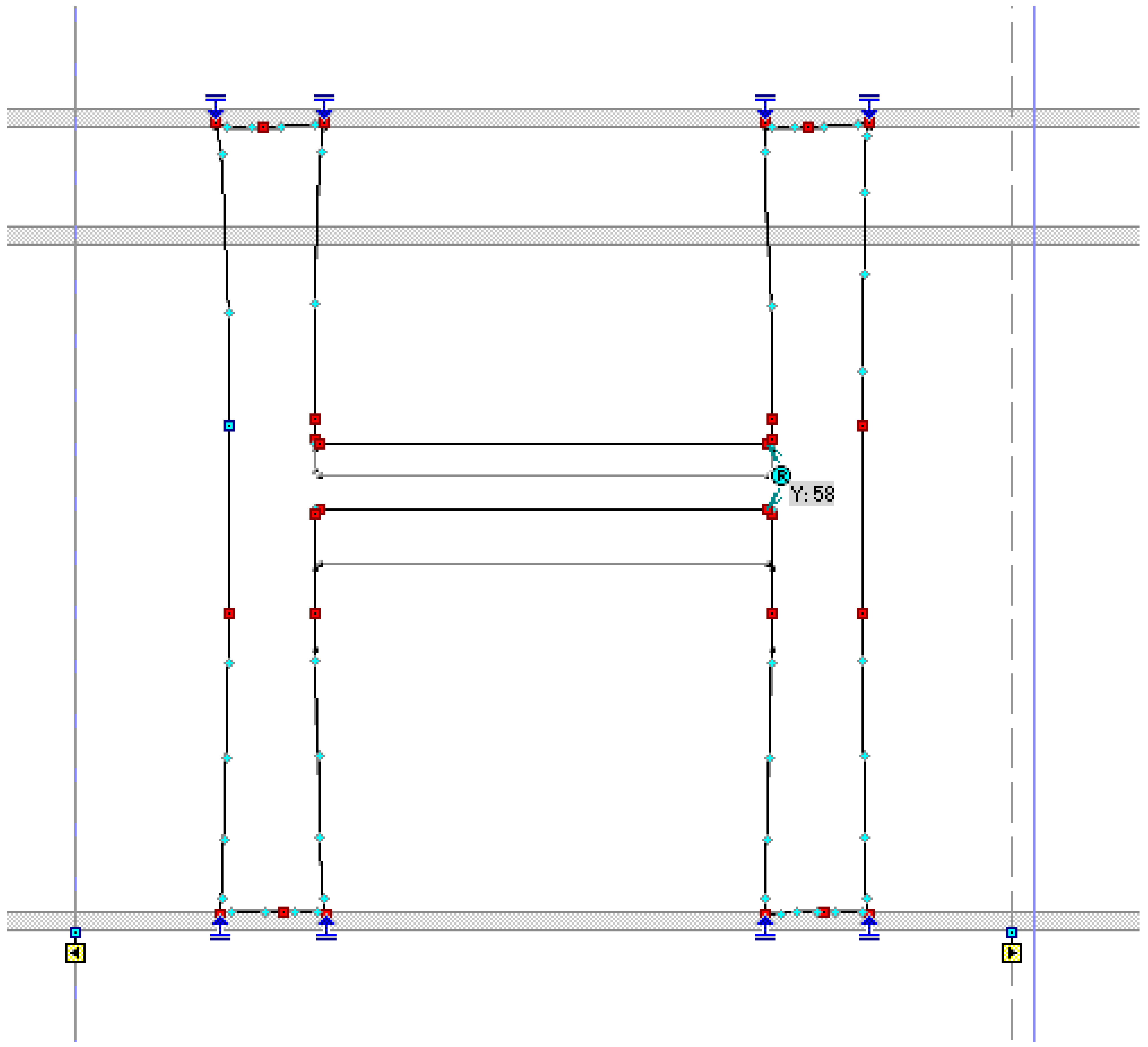
Rotate: 0 °

Center: Center of selection

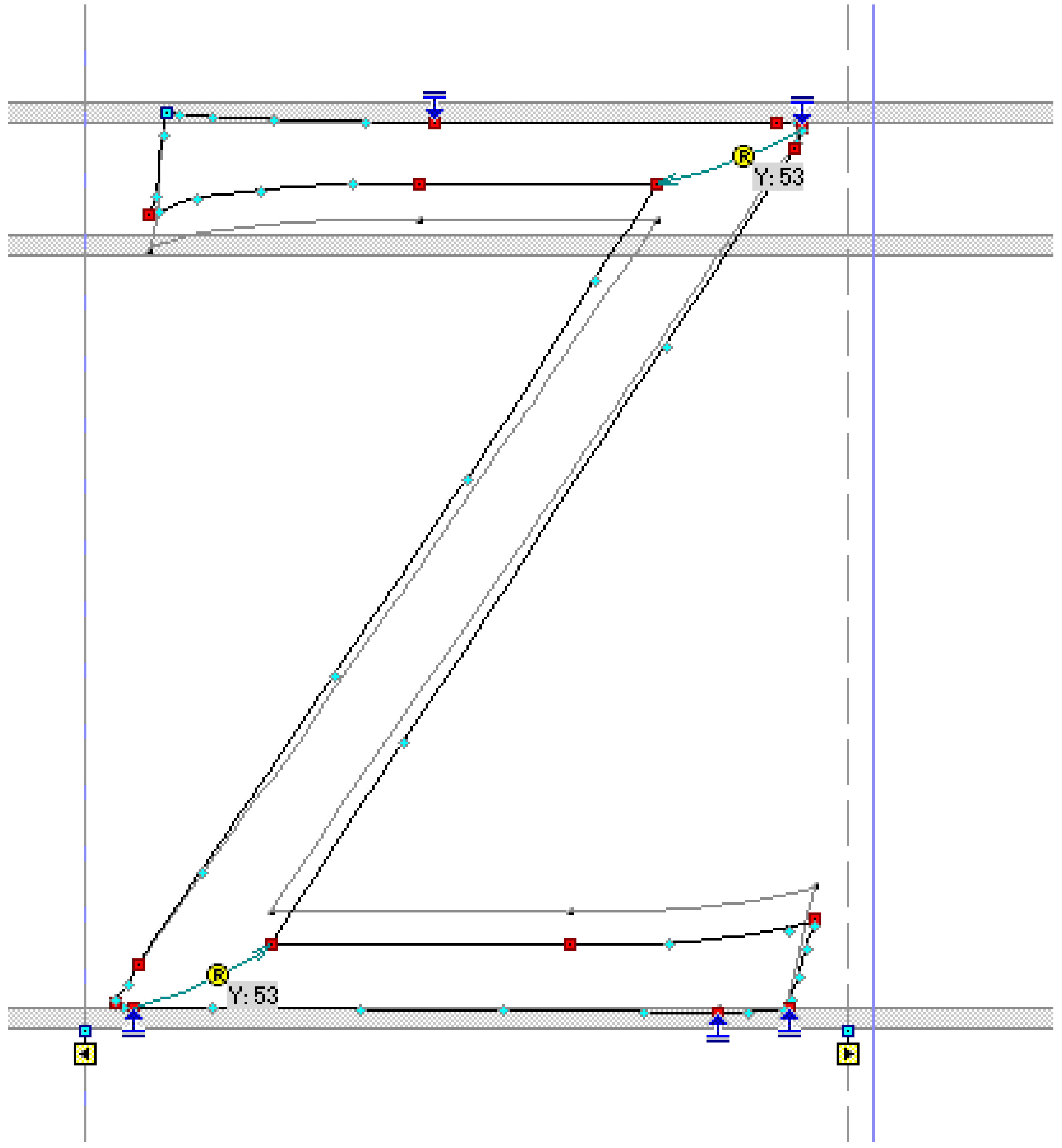
Editing Layers

			All layers
			Outline
✓	✓		Guidelines
	✓		Hints
	✓		Mask
	✓		Grid
		✓	Vertical metrics
✓			Global mask
✓			Glyph metrics
			Components
✓			Anchors and carets
✓		✓	Alignment zones
			Shape groups
			Neighbors
			Background

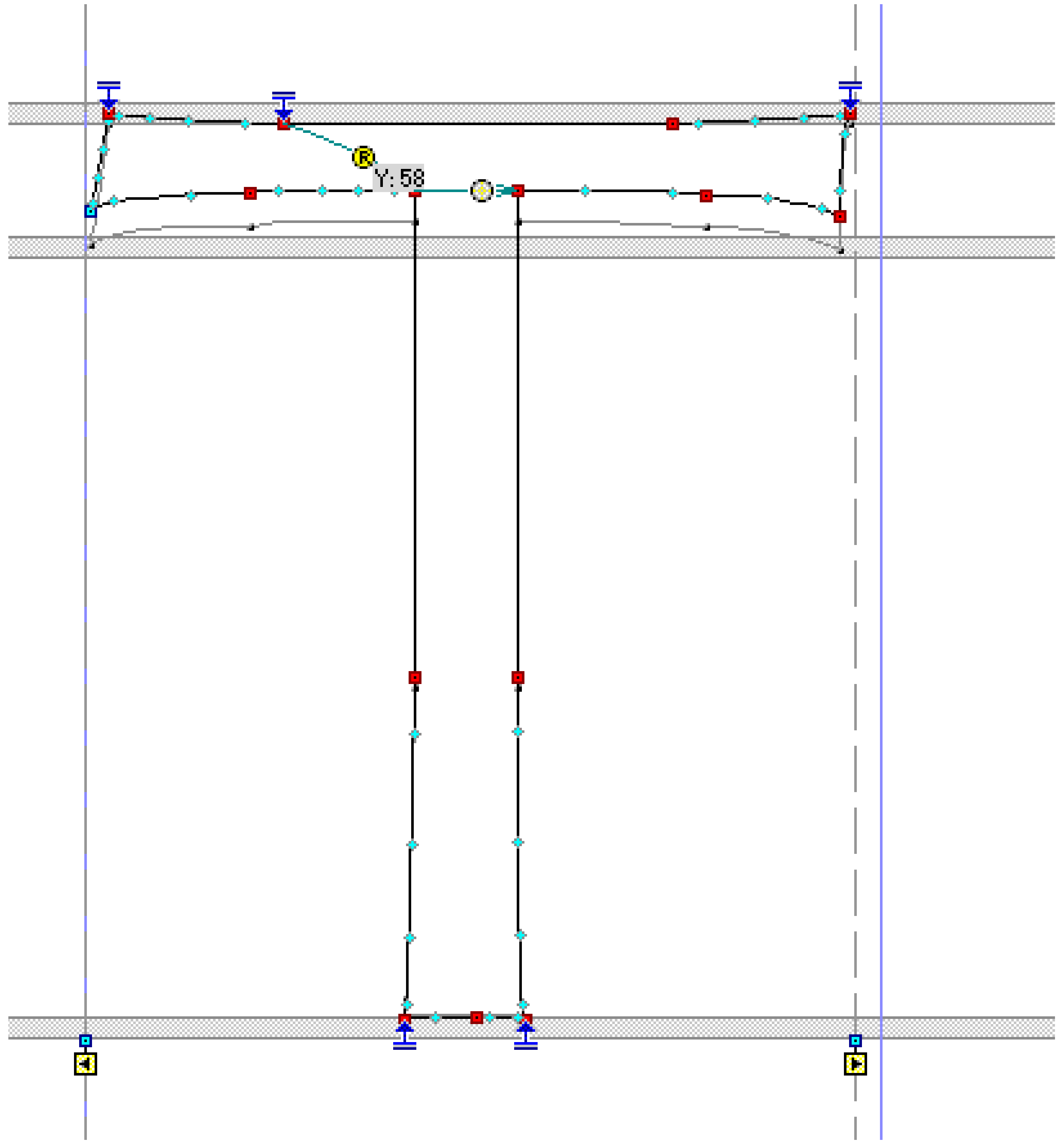
TrueType Hinting



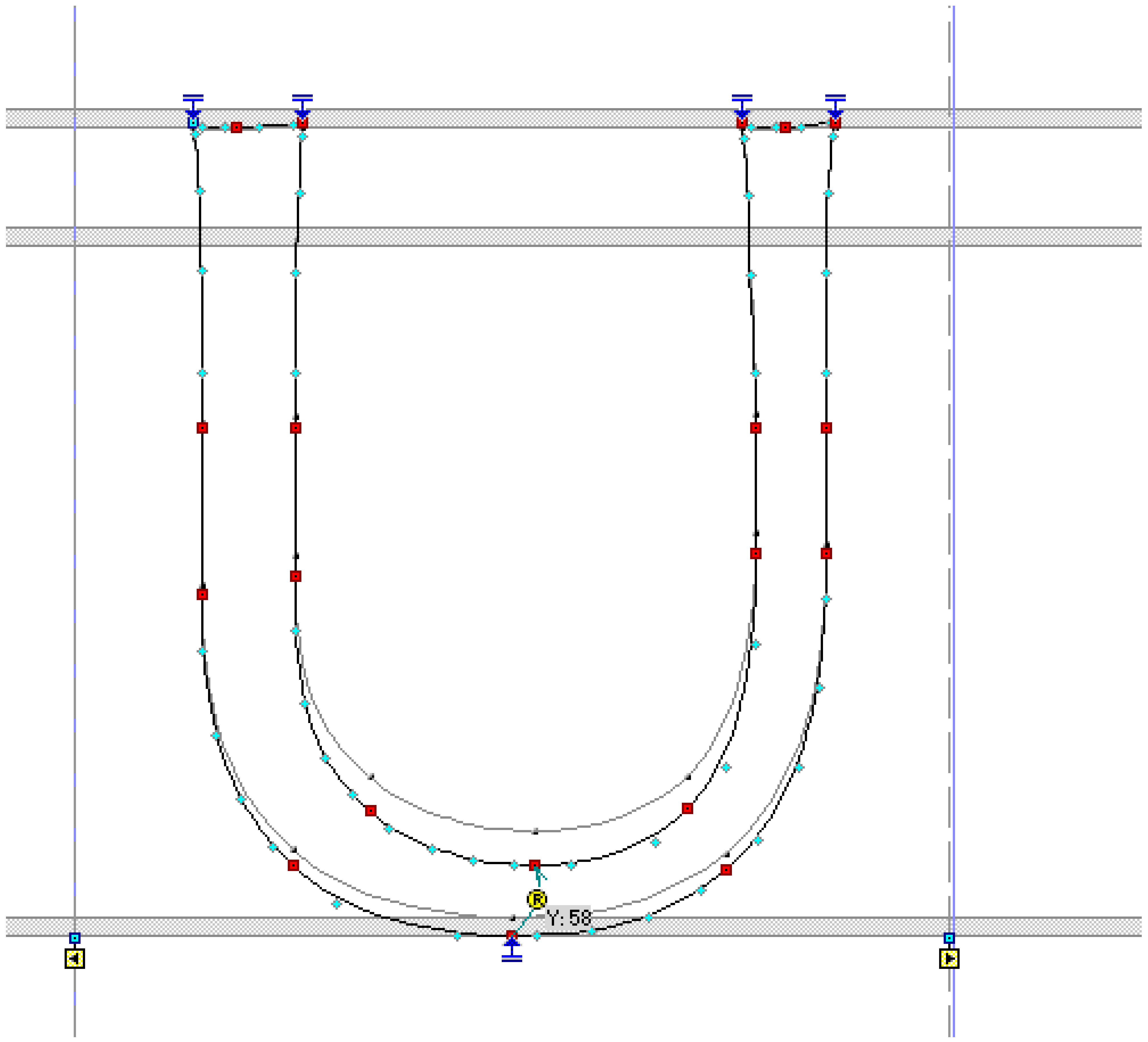
TrueType Hinting



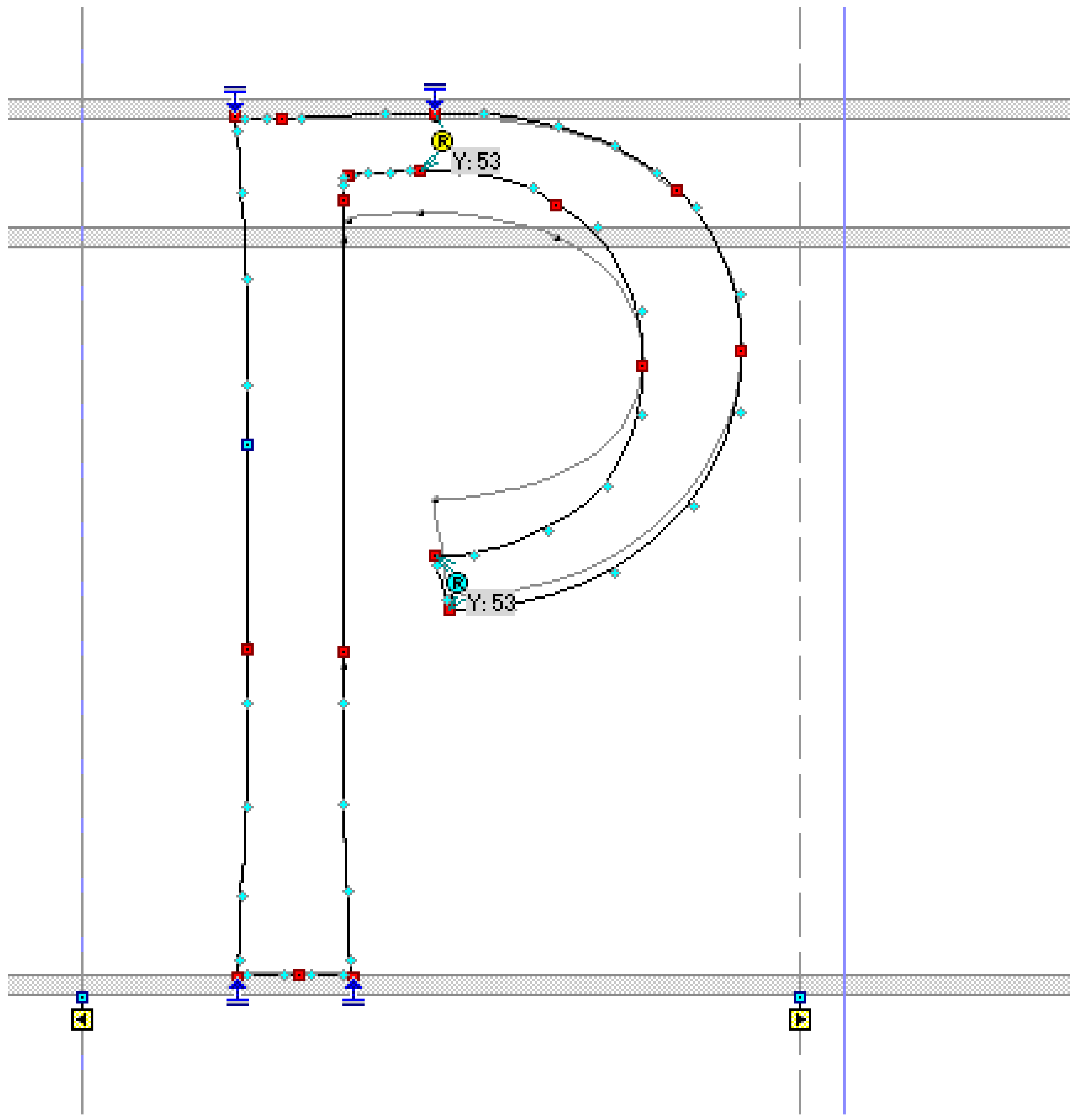
TrueType Hinting



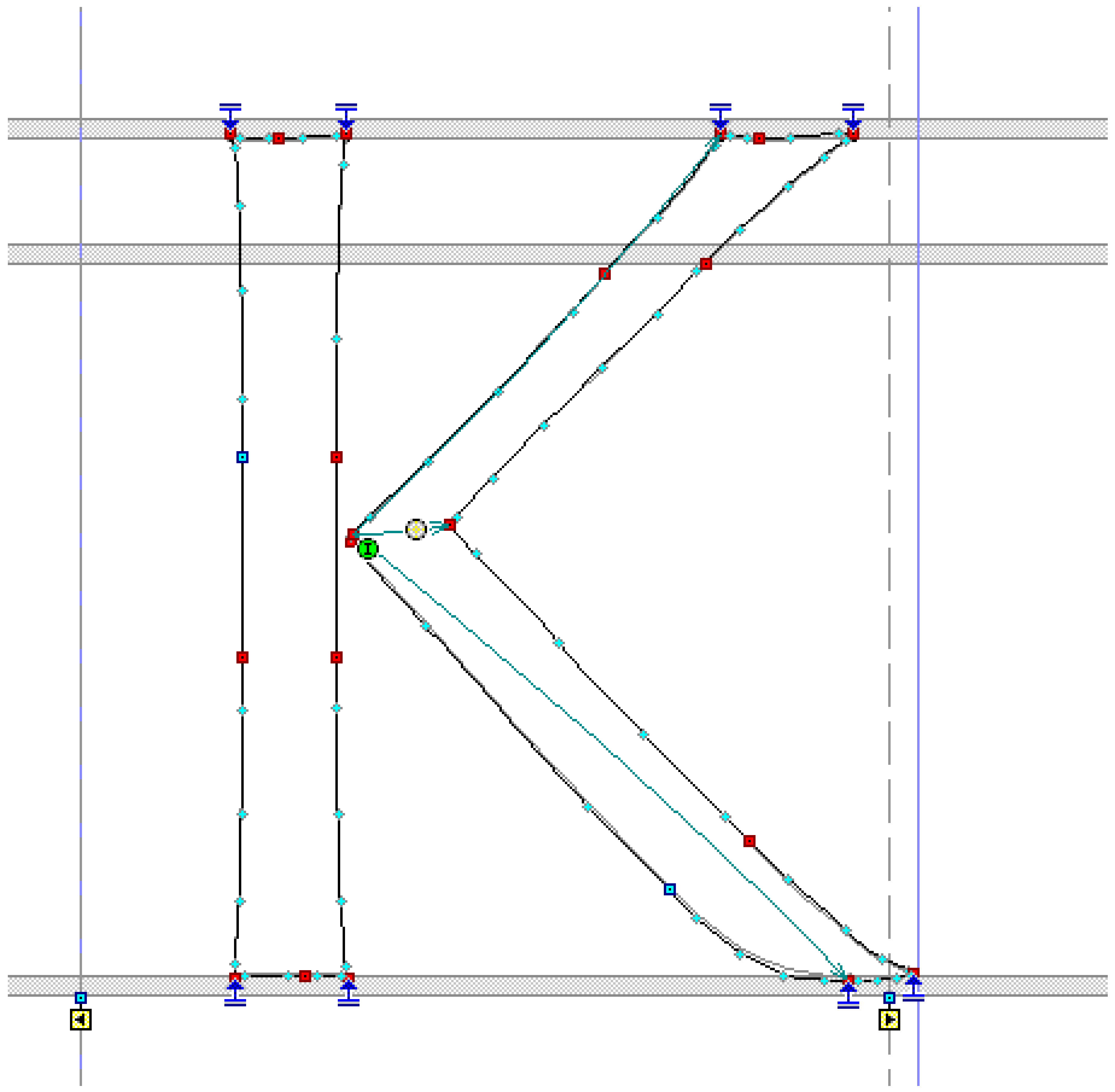
TrueType Hinting



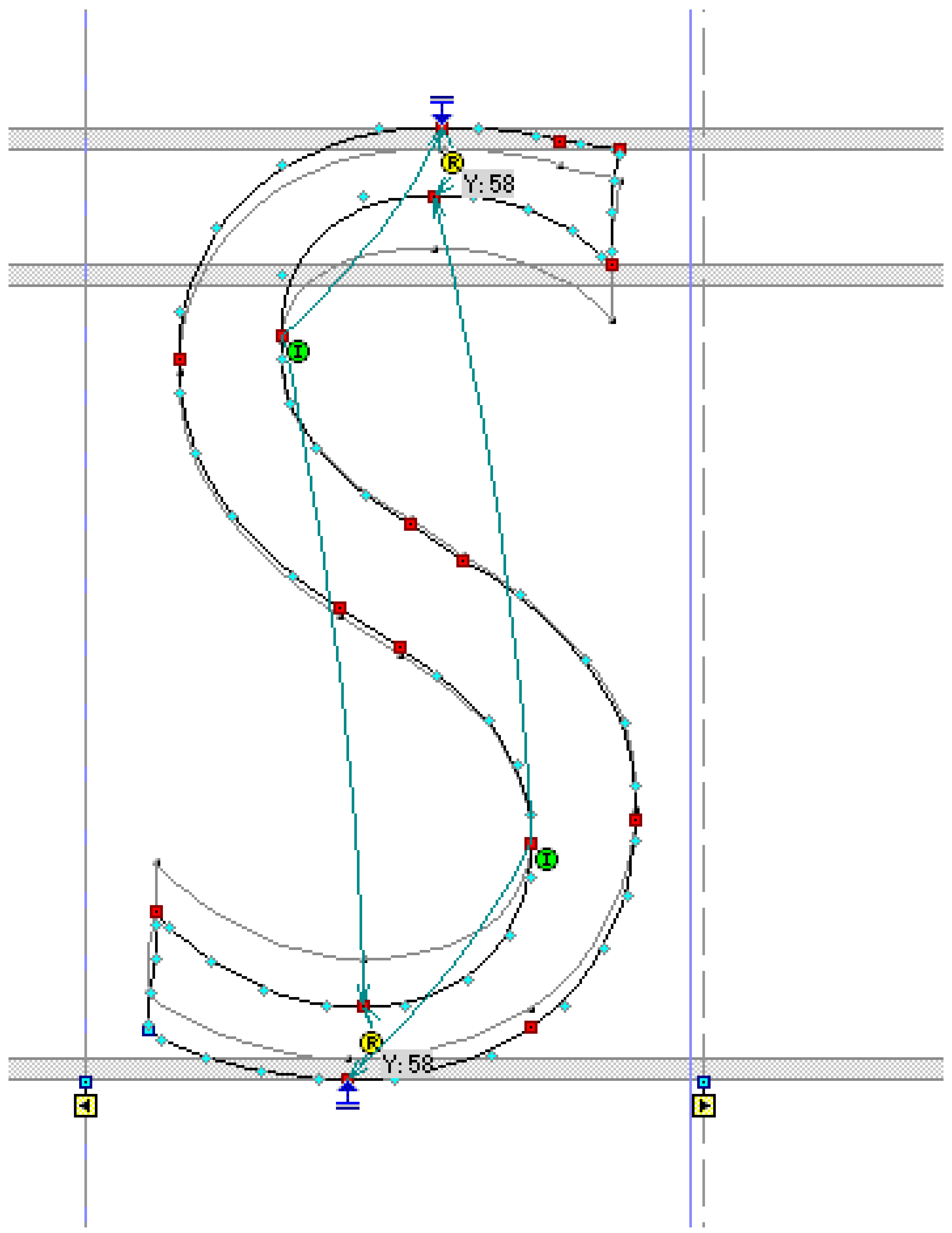
TrueType Hinting



TrueType Hinting



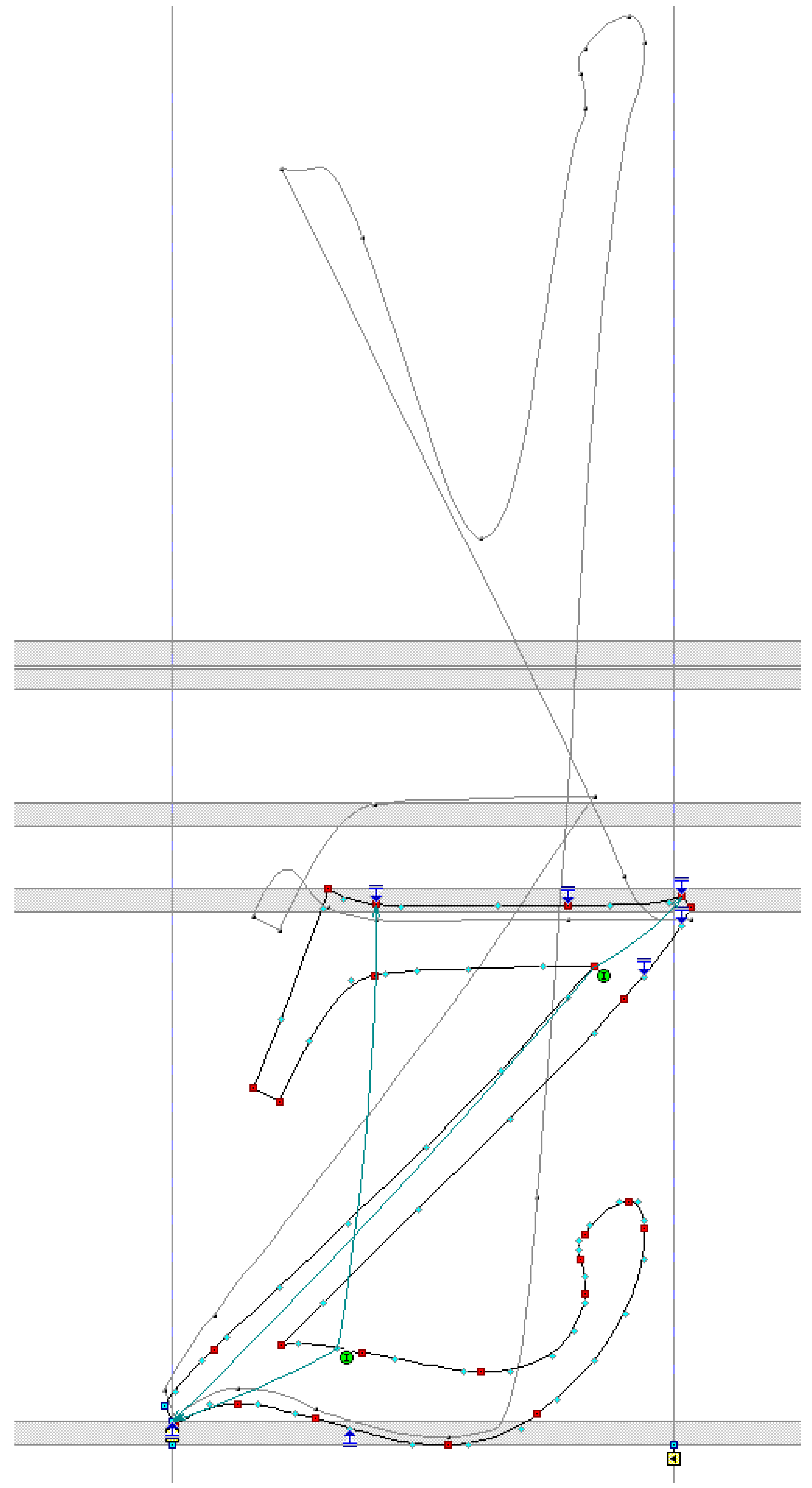
TrueType Hinting

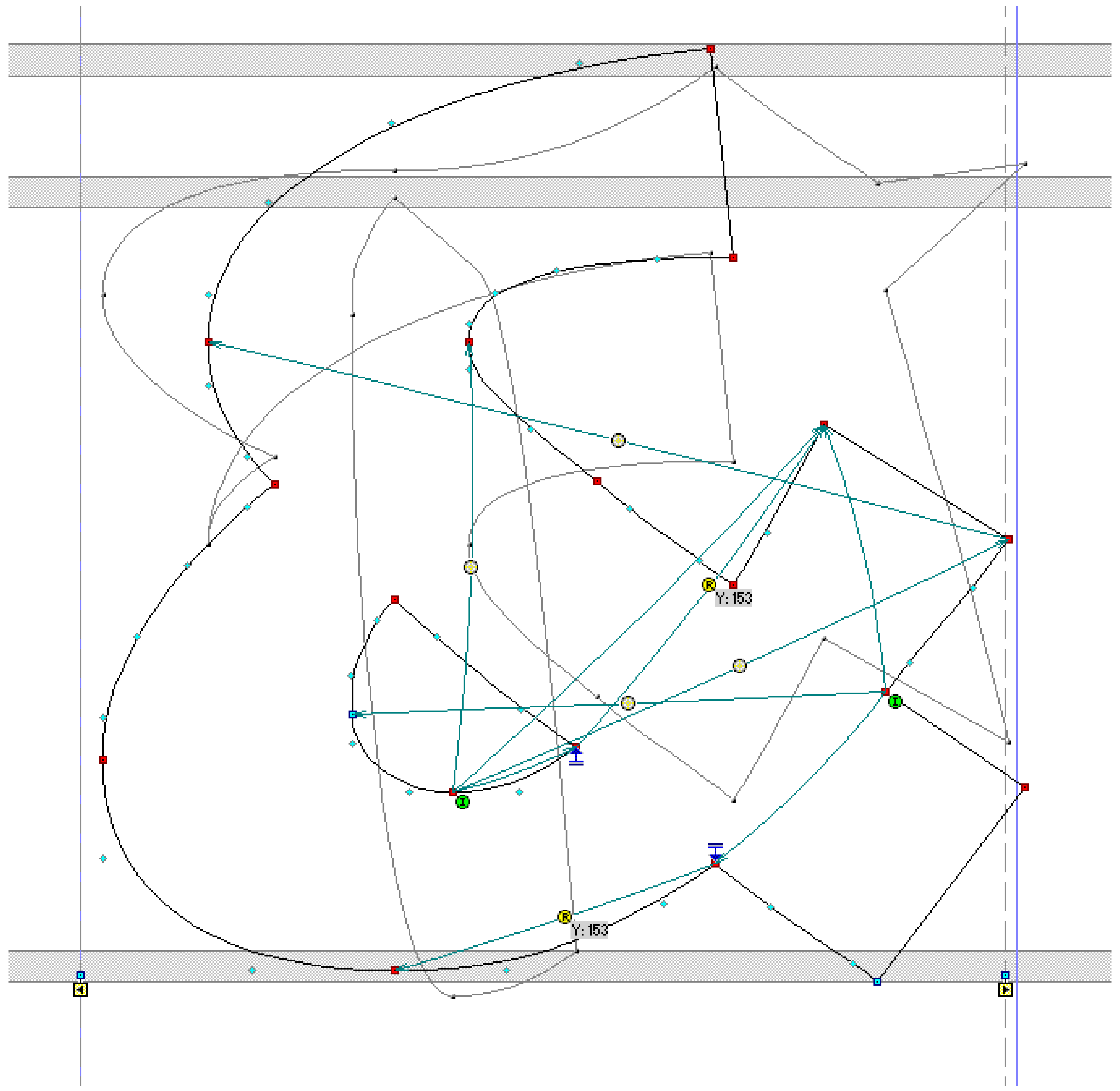


TrueType Hinting

anchor	Attaches a point to an alignment zone.
single link	Defines a stem width, must be attached to anchor or previous single-link, or interpolation.
double link	Defines a stem width without attachment to any kind of other hint.
interpolation	Connects three points; makes clear that the relation of the middle point to the outer two points is important.
delta	Can modify the position of a single point at one particular size. Avoid when possible.

TrueType Hinting gone bad!

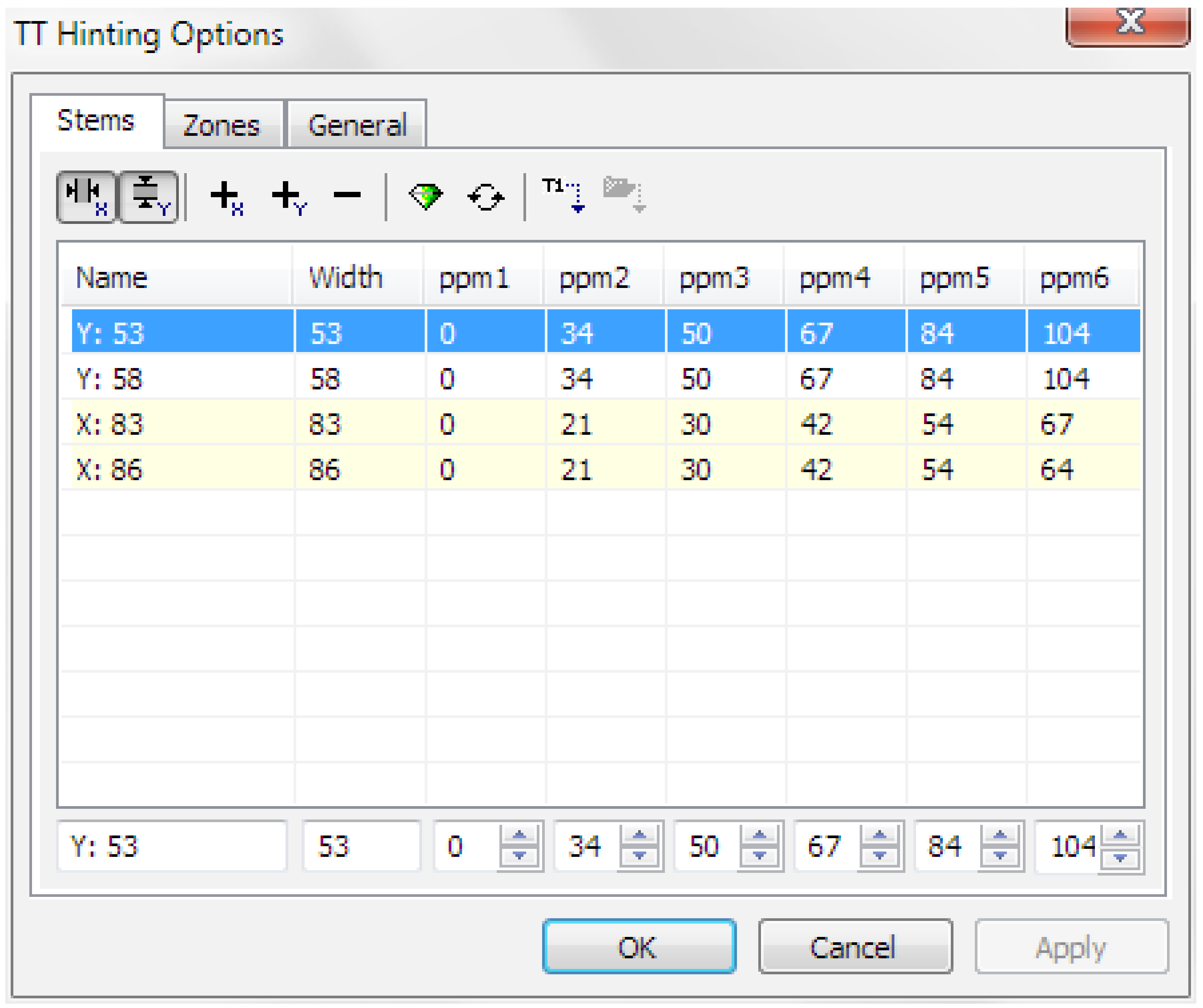




The superior level of possible control comes with a superior chance for possbile screw-up.

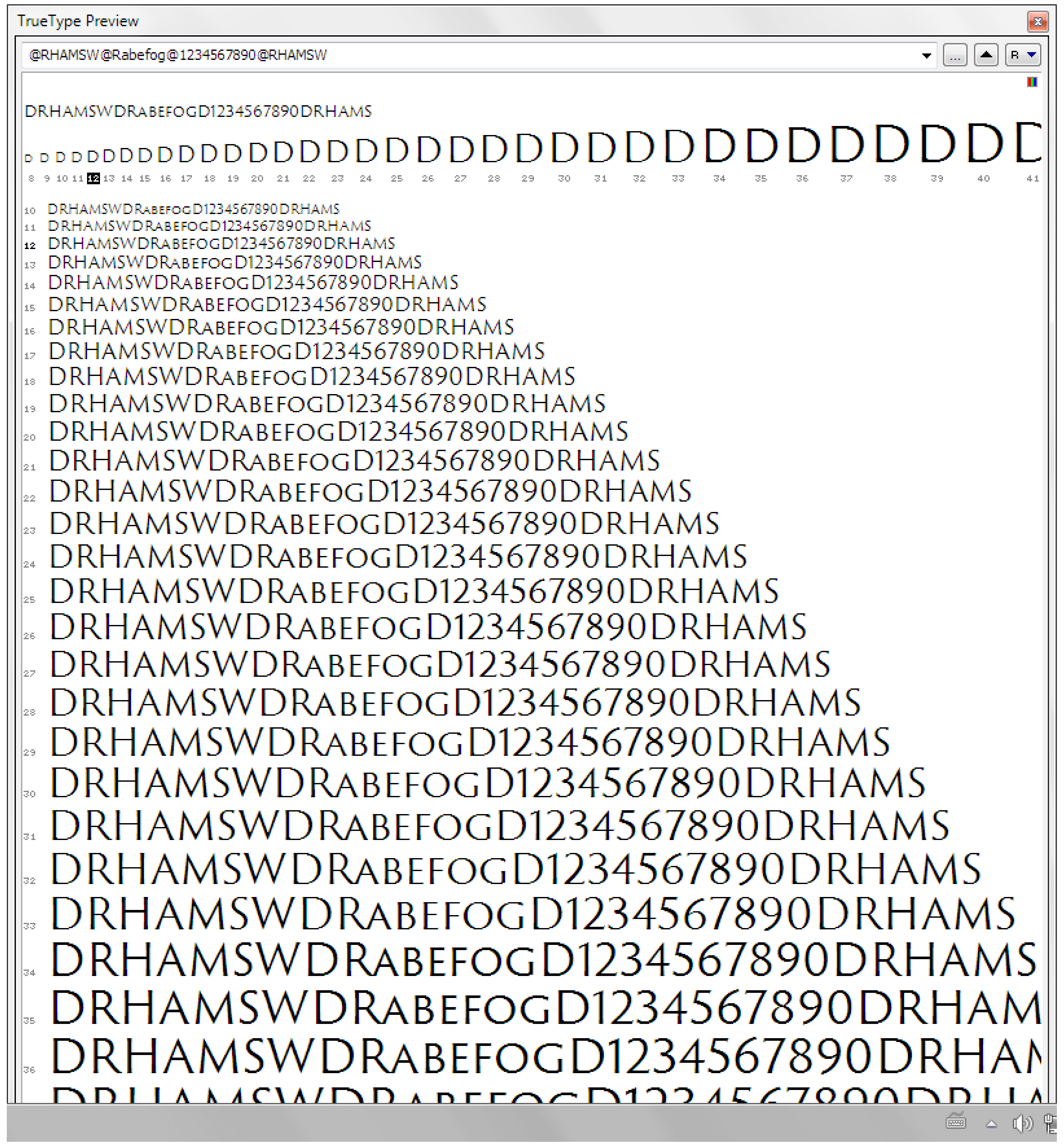
TrueType Hinting: PPM values

PPM values are responsible for the decision when a particular stem gets to be 2,3,4 … pixels wide.



Name	Width	ppm1	ppm2	ppm3	ppm4	ppm5	ppm6
Y: 53	53	0	34	50	67	84	104
Y: 58	58	0	34	50	67	84	104
X: 83	83	0	21	30	42	54	67
X: 86	86	0	21	30	42	54	64

Y: 53 | 53 | 0 | 34 | 50 | 67 | 84 | 104


TrueType Preview
@RHAMSW@Rabefog@1234567890@RHAMSW
DRHAMSWDRABEFOGD1234567890DRHAMS
8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41
10 DRHAMSWDRABEFOGD1234567890DRHAMS
11 DRHAMSWDRABEFOGD1234567890DRHAMS
12 DRHAMSWDRABEFOGD1234567890DRHAMS
13 DRHAMSWDRABEFOGD1234567890DRHAMS
14 DRHAMSWDRABEFOGD1234567890DRHAMS
15 DRHAMSWDRABEFOGD1234567890DRHAMS
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26 DRHAMSWDRABEFOGD1234567890DRHAMS
27 DRHAMSWDRABEFOGD1234567890DRHAMS
28 DRHAMSWDRABEFOGD1234567890DRHAMS
29 DRHAMSWDRABEFOGD1234567890DRHAMS
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31 DRHAMSWDRABEFOGD1234567890DRHAMS
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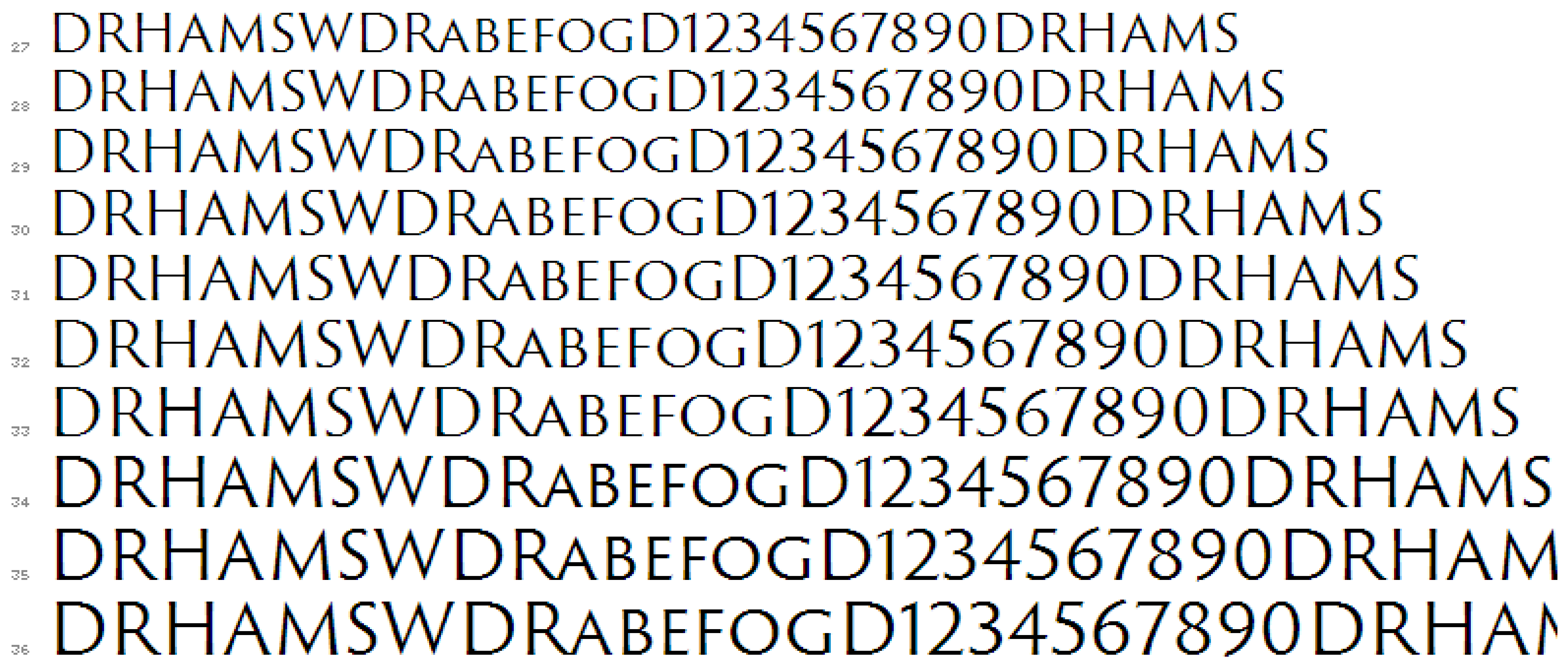
34 DRHAMSWDRABEFOGD1234567890DRHAMS
35 DRHAMSWDRABEFOGD1234567890DRHAM
36 DRHAMSWDRABEFOGD1234567890DRHAM

TrueType Hinting: PPM values



27 DRHAMSWDRABEFOGD1234567890DRHAMS

28 DRHAMSWDRABEFOGD1234567890DRHAMS

29 DRHAMSWDRABEFOGD1234567890DRHAMS

30 DRHAMSWDRABEFOGD1234567890DRHAMS

31 DRHAMSWDRABEFOGD1234567890DRHAMS

32 DRHAMSWDRABEFOGD1234567890DRHAMS

33 DRHAMSWDRABEFOGD1234567890DRHAMS

34 DRHAMSWDRABEFOGD1234567890DRHAMS

35 DRHAMSWDRABEFOGD1234567890DRHAM

36 DRHAMSWDRABEFOGD1234567890DRHA

Note the horizontal stem change from 1 to 2 pixels at 34 pt.

TrueType Hinting: Not magic!

Note:

All TrueType hinting examples show the approach of only hinting in direction of the y-axis, which means only taking care of fine-tuning the horizontal stems.

This is a common workflow today, which is supported by Windows' *ClearType* rasterizer. *ClearType* takes care of the vertical stems itself through sub-pixel rendering.

Of course, TrueType Hinting is also possible in the x-direction.