

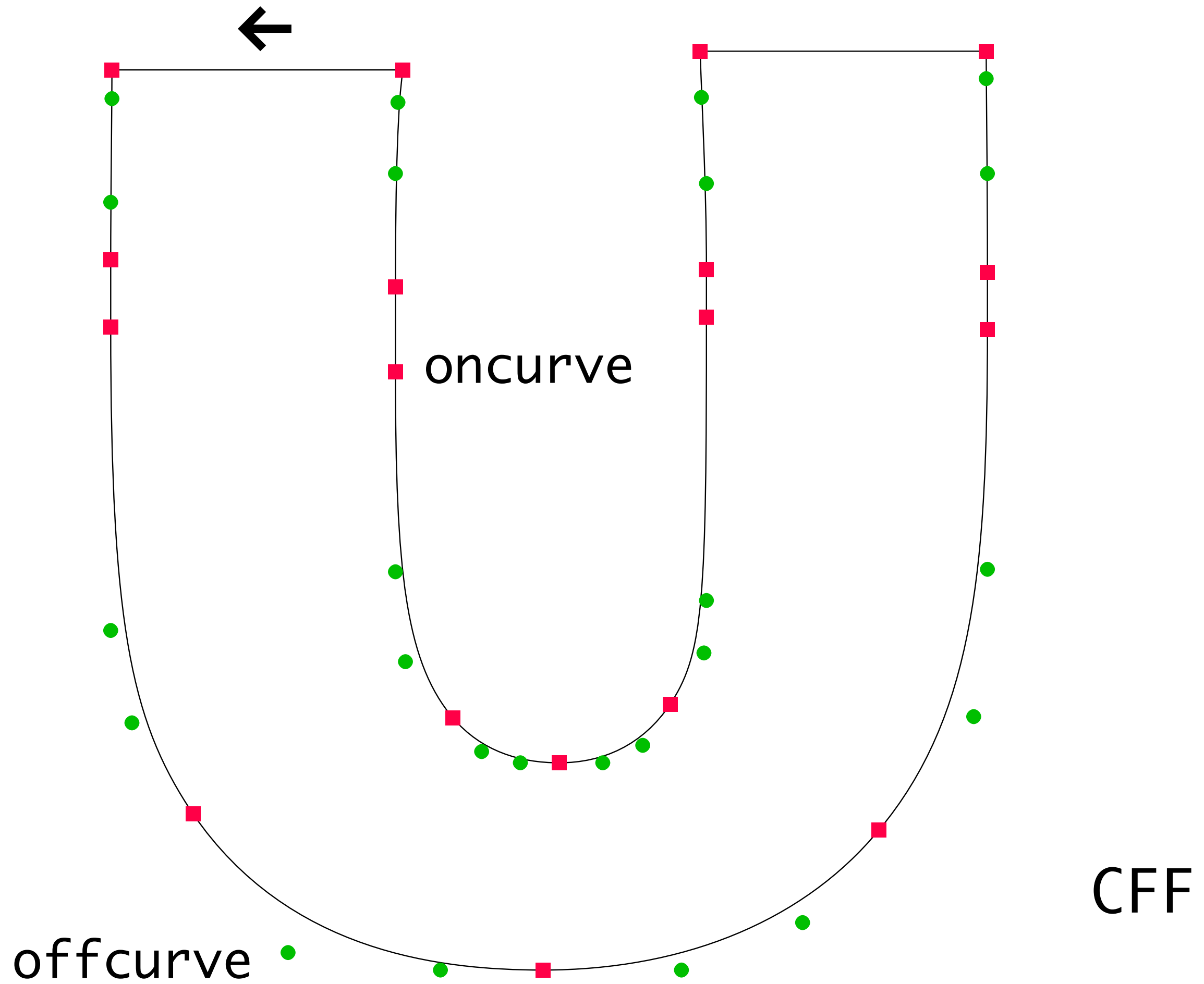
# How to make TrueType hinting less boring

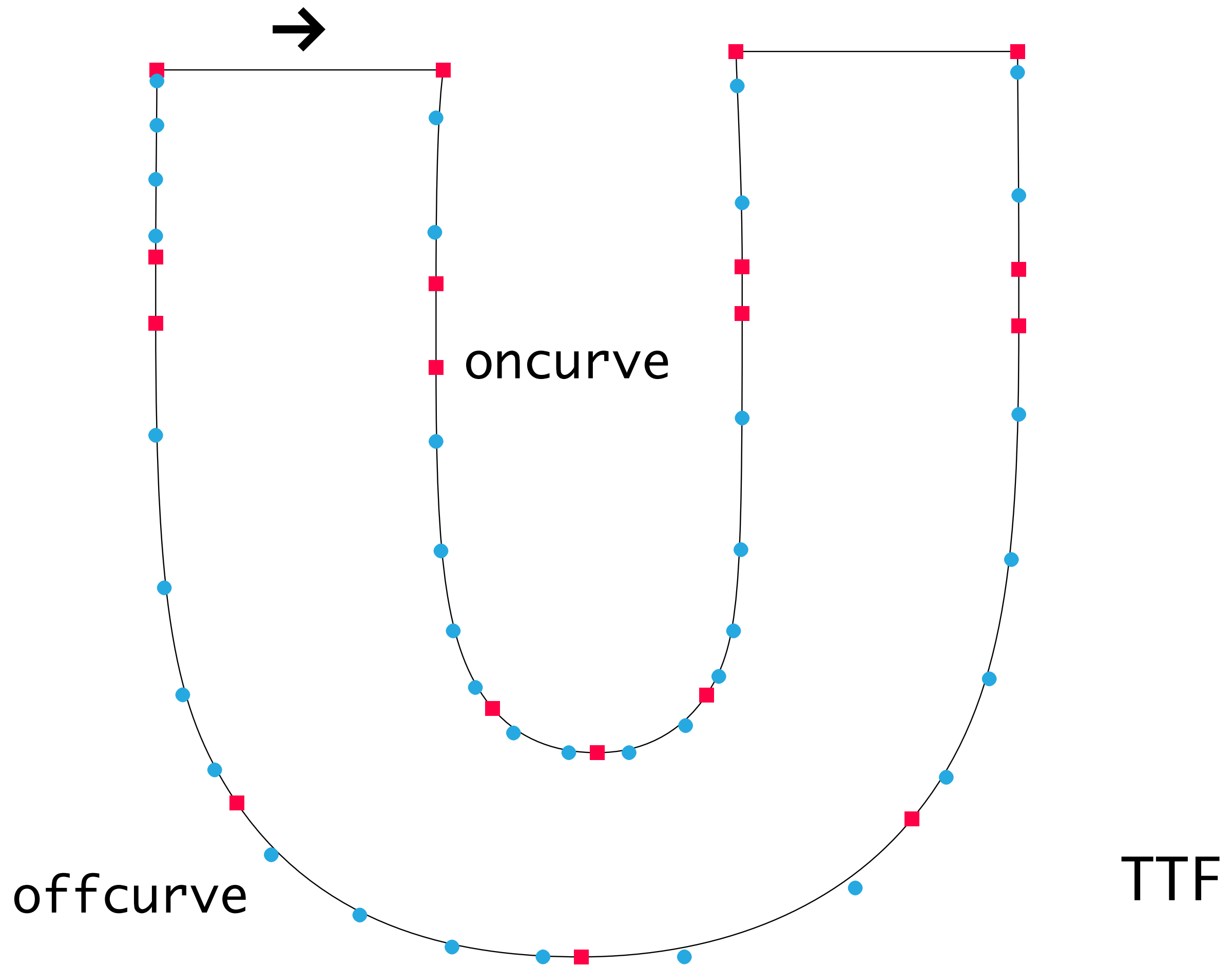
Robothon 2012, KABK Den Haag.  
Frank Grießhammer, Adobe Systems

@KombinatType:

First day of TrueType hinting  
at FontShop was so much fun.  
Why do people play video games  
if you can hint?

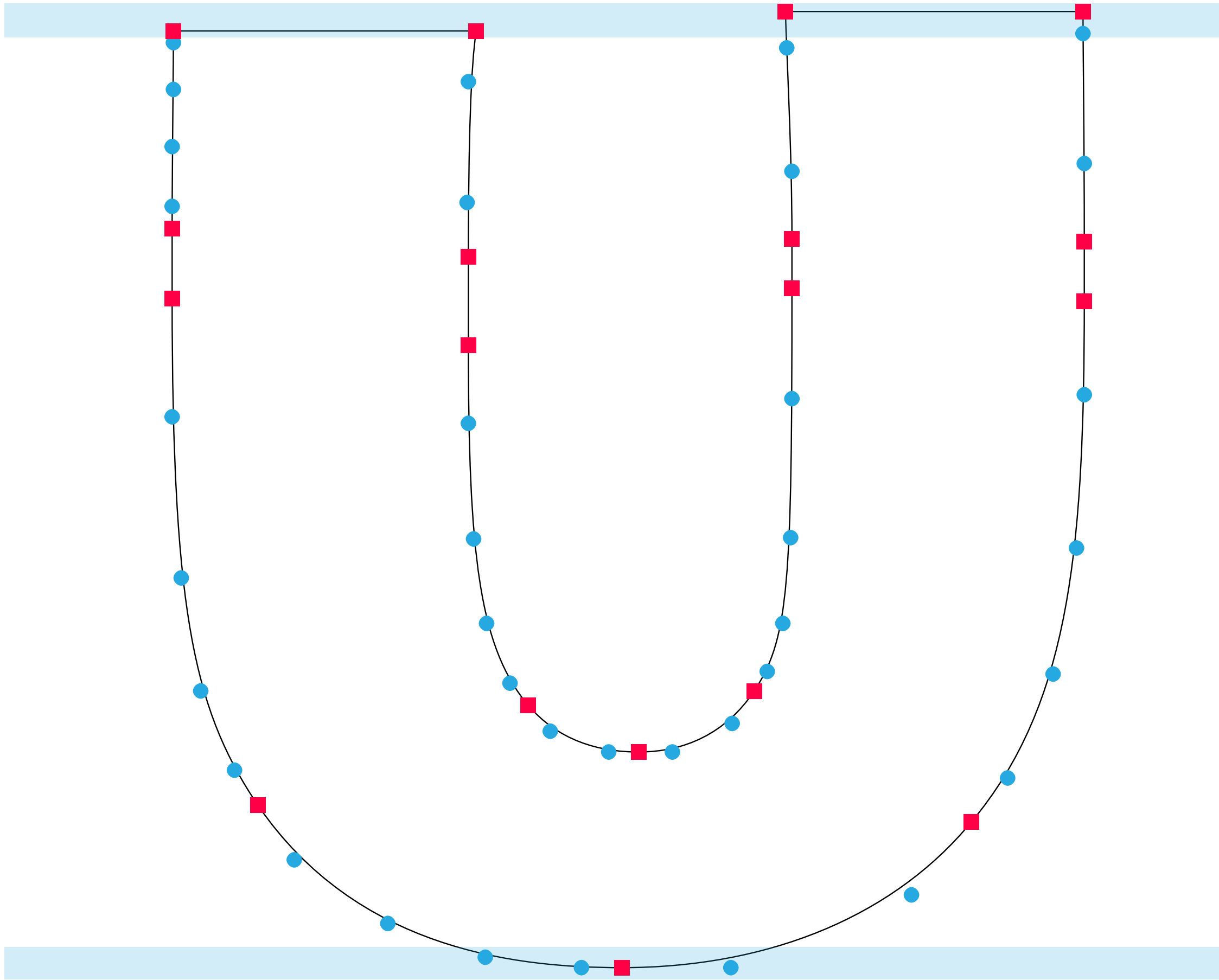
5:40 AM - 11 Aug 10 via web

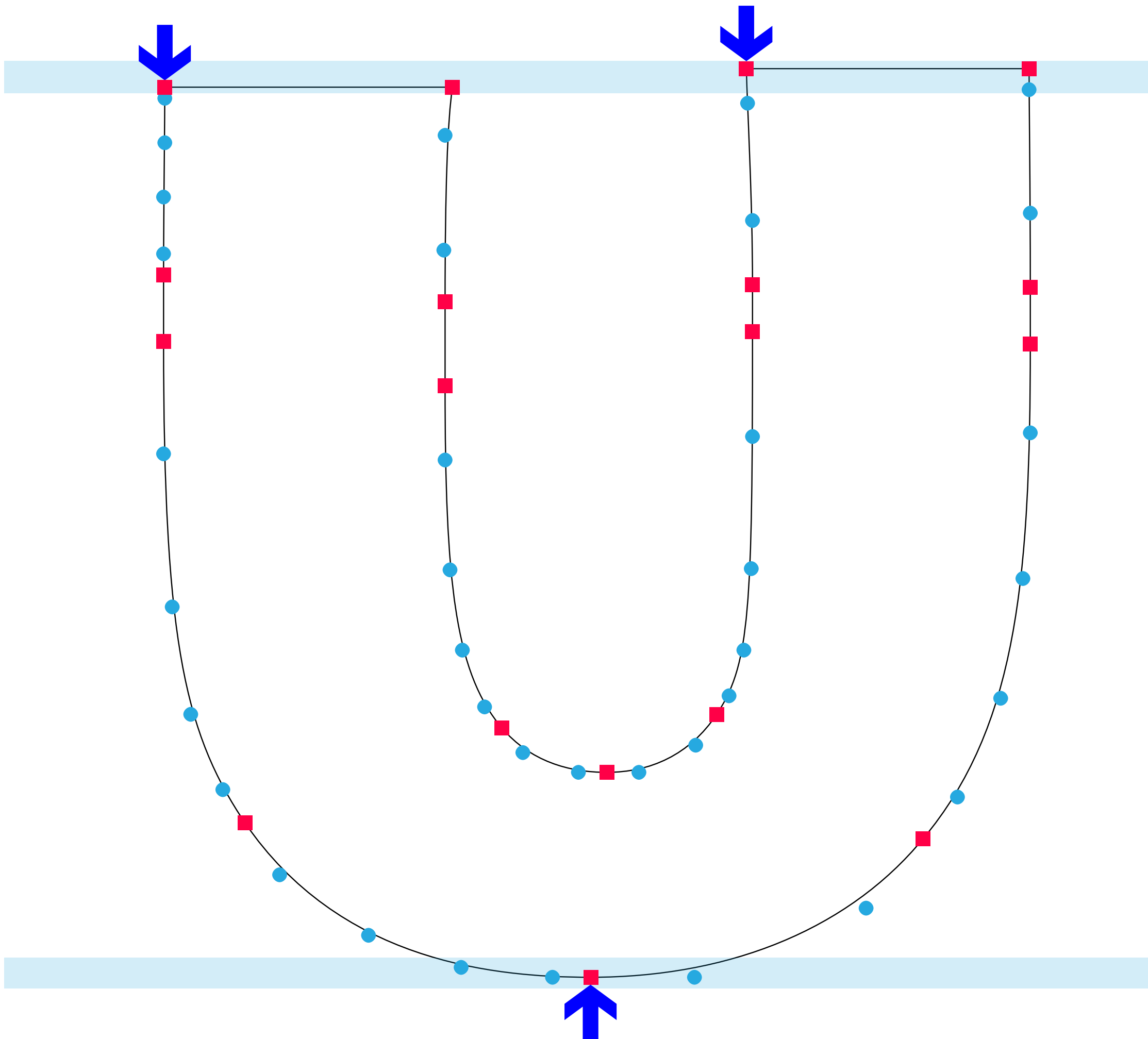


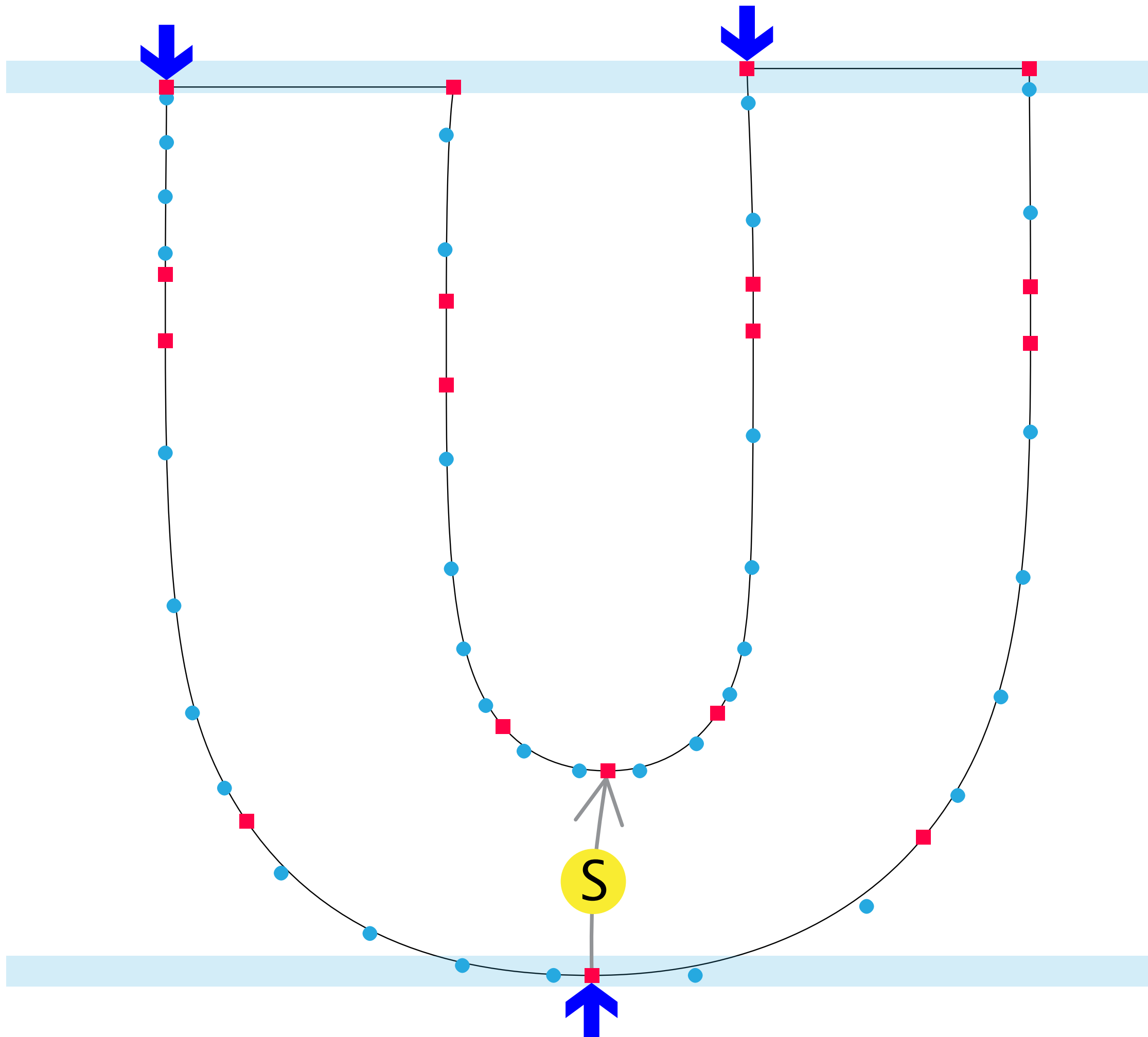


U

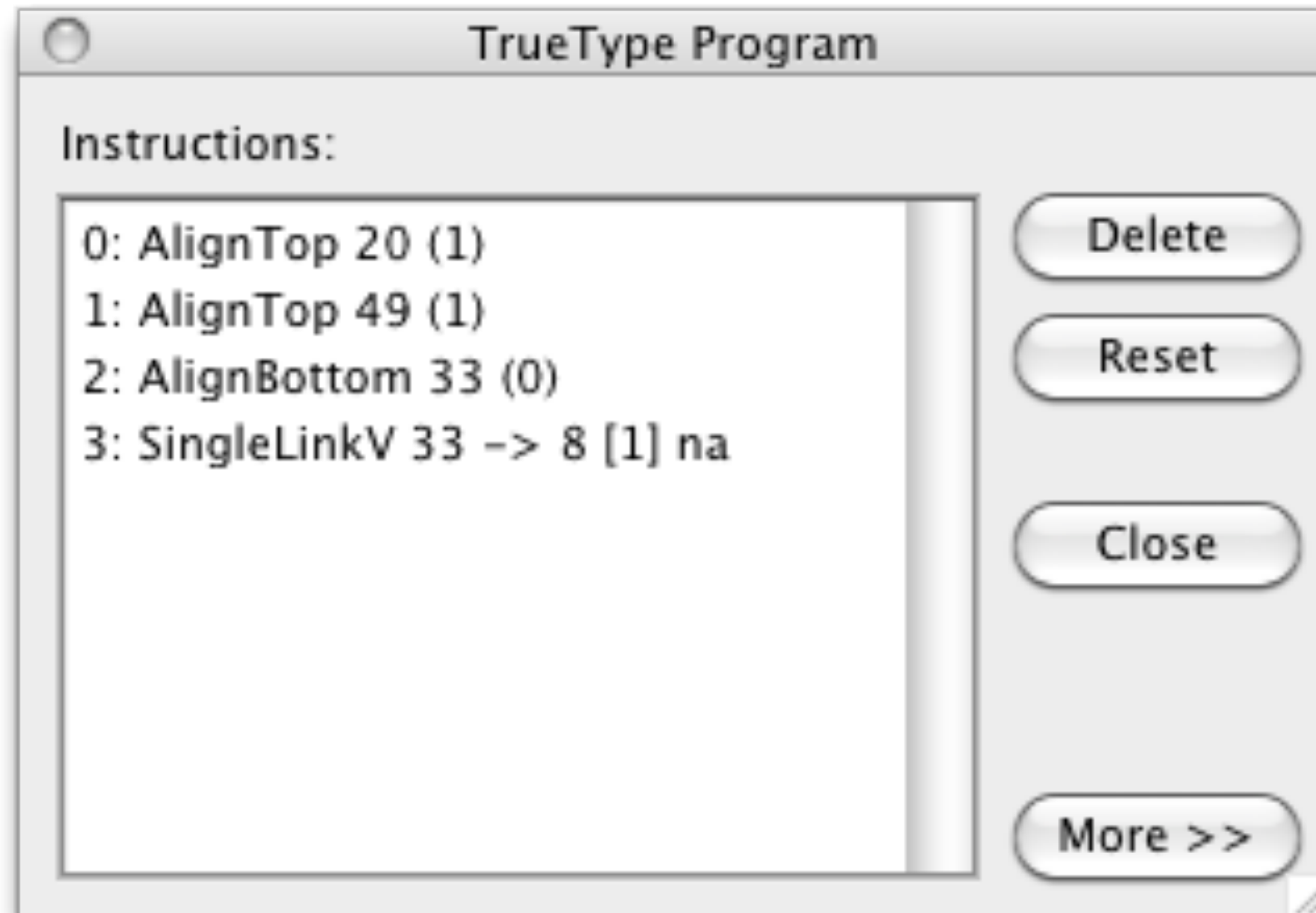










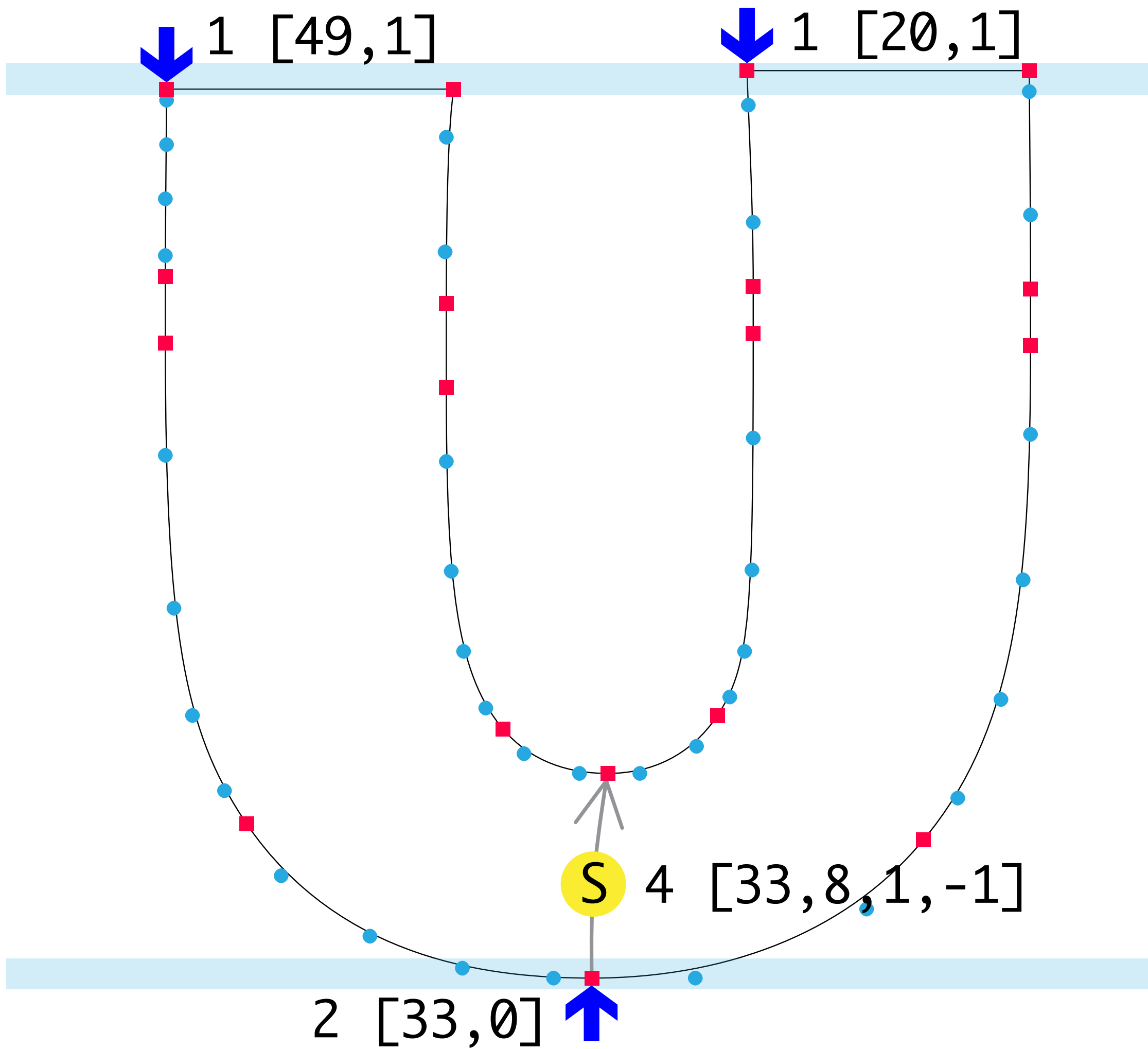


```
tth = TTH(fl.glyph)
tth.LoadProgram()
```

```
for hint in tth.commands:
    print hint.code, hint.params
```

1 [20, 1]  
1 [49, 1]  
2 [33, 0]  
4 [33, 8, 1, -1]





```
4 [33, 8, 1, -1] # single link
1 [20, 1] # top anchor
1 [49, 1] # top anchor
2 [33, 0] # bottom anchor
```

command ID

point index

alignment direction

stem id

U 1,20,1;1,49,1;2,33,0;4,33,8,1,-1


command ID

point index

alignment direction

stem id

U 1, 20, 1; 1, 49, 1; 2, 33, 0; 4, 33, 8, 1, -1

S 1,20,1;2,41,0;4,41,0,1,-1;4,20,21,1,-1;14,5,21,41,  
T 1,19,1;1,12,1;1,27,1;2,0,0;4,19,6,0,-1;4,6,35,-1,-  
U 1,20,1;1,49,1;2,33,0;4,33,8,1,-1  
V 1,18,1;1,32,1;2,9,0;14,25,9,32,-1  
W 1,33,1;1,58,1;2,24,0;2,9,0;14,17,9,33,-1;14,40,9,3  
X 1,30,1;1,42,1;2,0,0;2,14,0;14,7,14,30,-1;4,7,22,-1  
Y 1,15,1;1,28,1;2,0,0;4,15,14,1,-1;14,22,0,15,-1;4,2  
Z 1,0,1;1,7,1;2,25,0;2,34,0;4,25,24,1,-1;4,24,17,-1,  
a 8,8,0;2,16,0;2,23,0;6,18,34,0;4,18,17,-1,-1;4,34,2  
b 1,5,0;2,29,0;6,46,47,0;14,19,46,47,-1;4,29,38,0,-1  
c 1,13,0;2,0,0;2,3,0;4,13,14,1,-1;4,3,24,1,-1  
d 1,7,0;2,22,0;4,22,30,1,-1;4,7,40,1,-1  
e 1,29,0;1,22,0;2,7,0;2,0,0;6,47,36,0;4,22,35,0,-1;4  
f 1,22,0;1,15,0;2,0,0;6,32,25,0;4,15,24,0,-1  
g 8,38,0;1,20,0;2,10,0;4,20,21,1,-1;4,10,31,0,-1  
h 1,15,0;1,31,0;2,0,0;2,47,0;6,54,25,0;4,25,24, , -1  
i 1,21,0;2,5,0



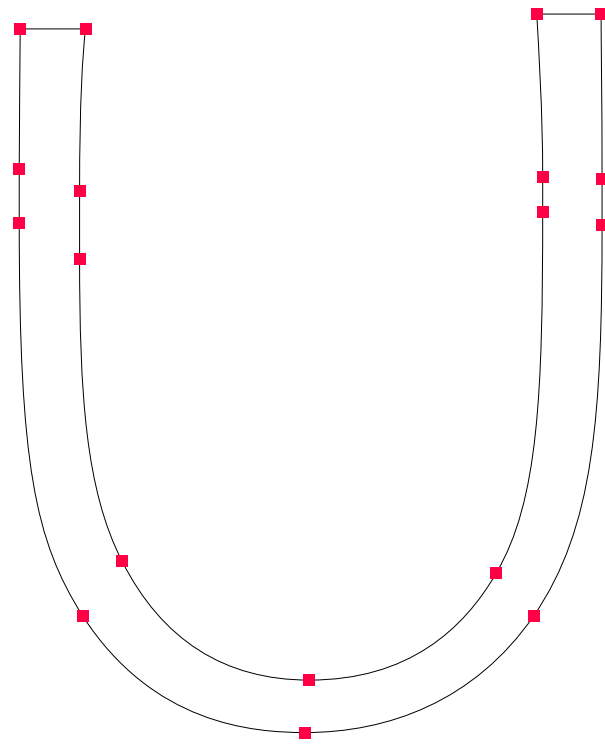
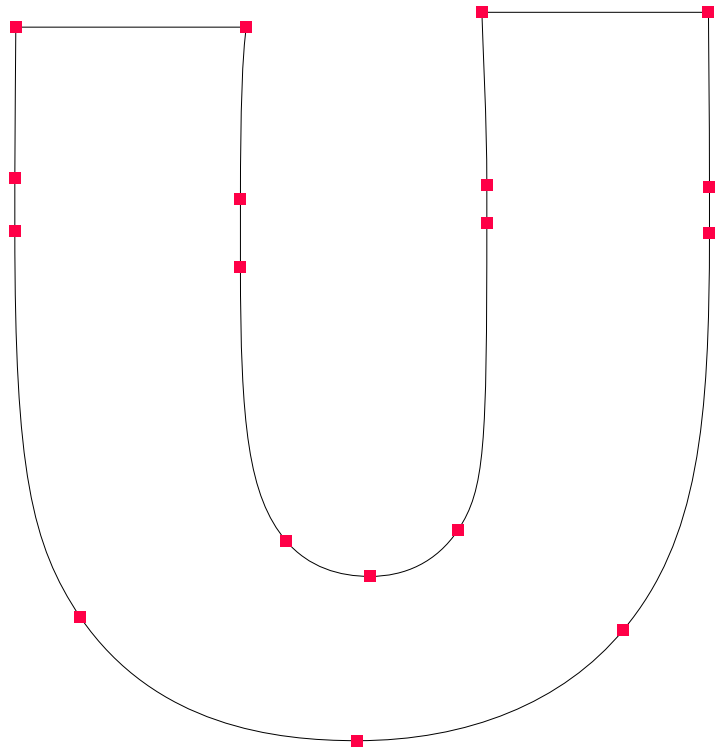
U ✓

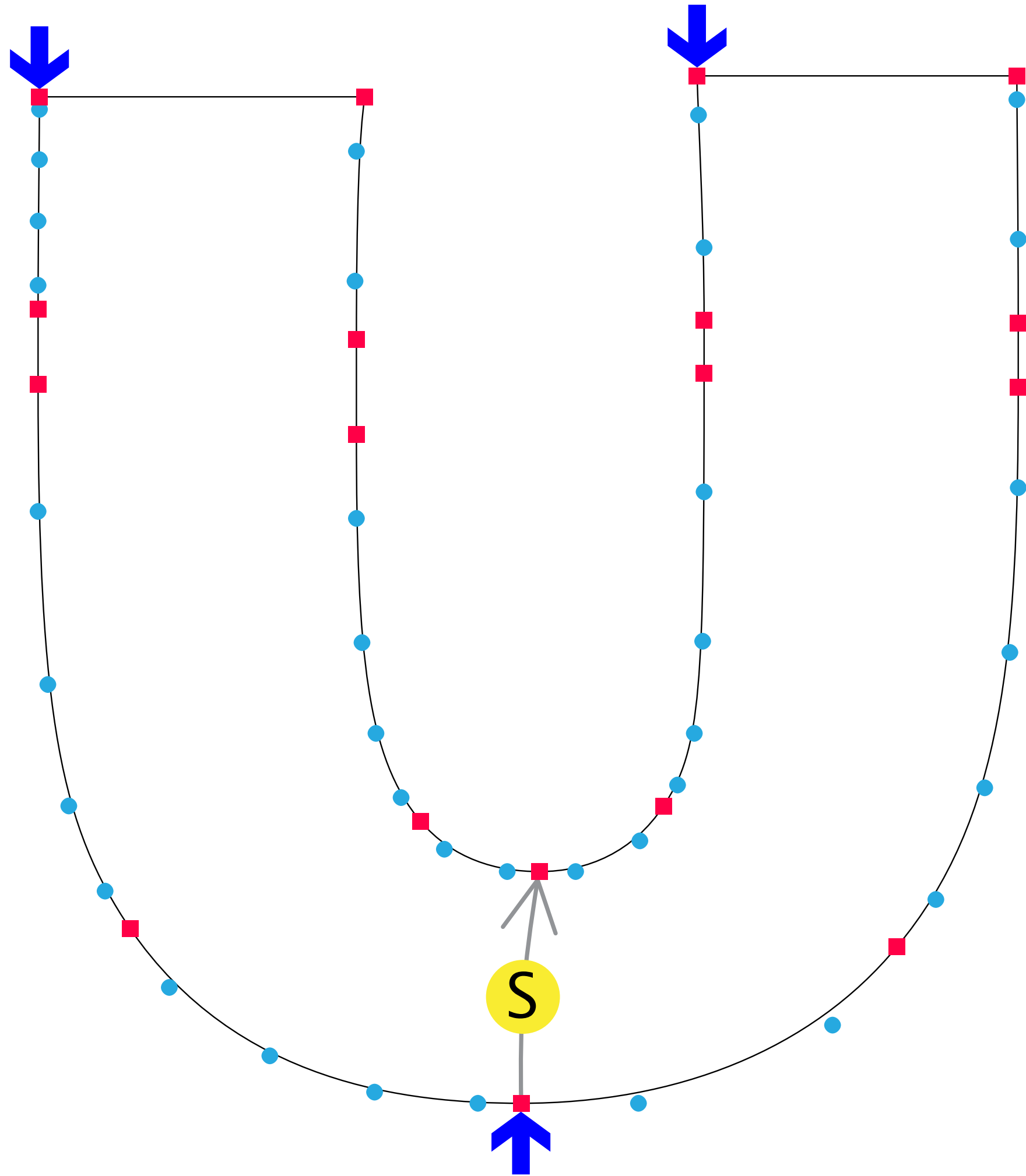
U

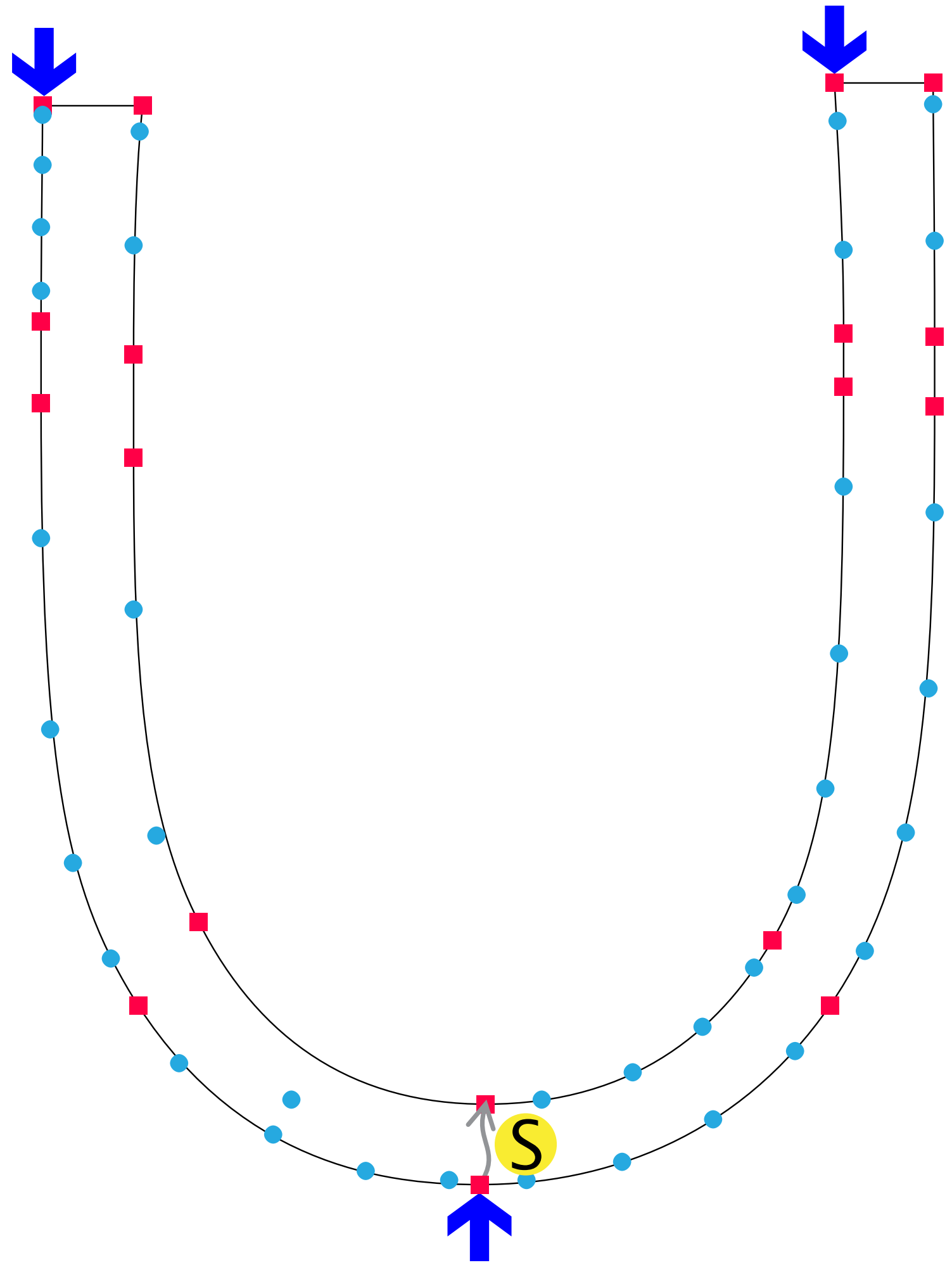
U


U

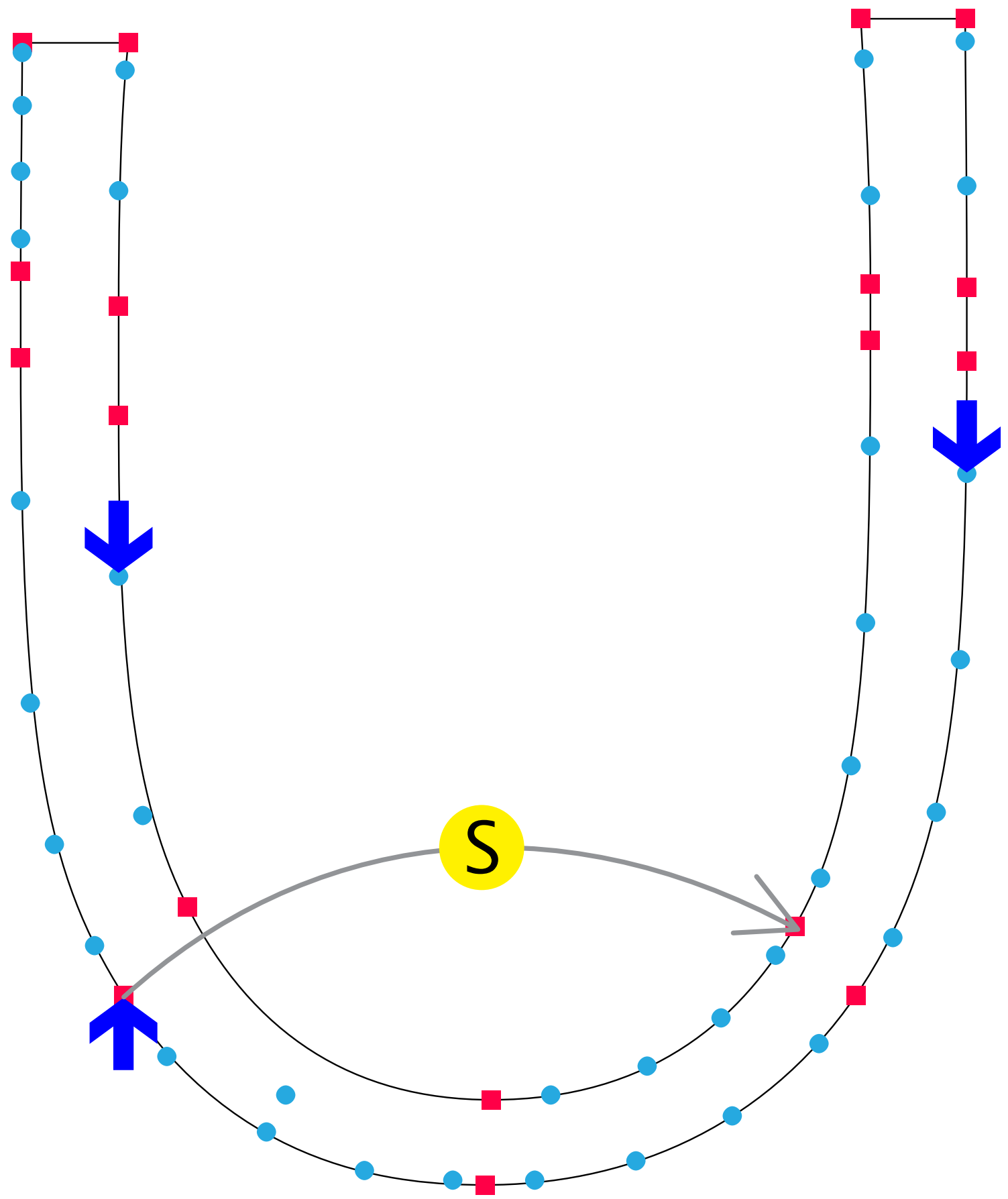
U

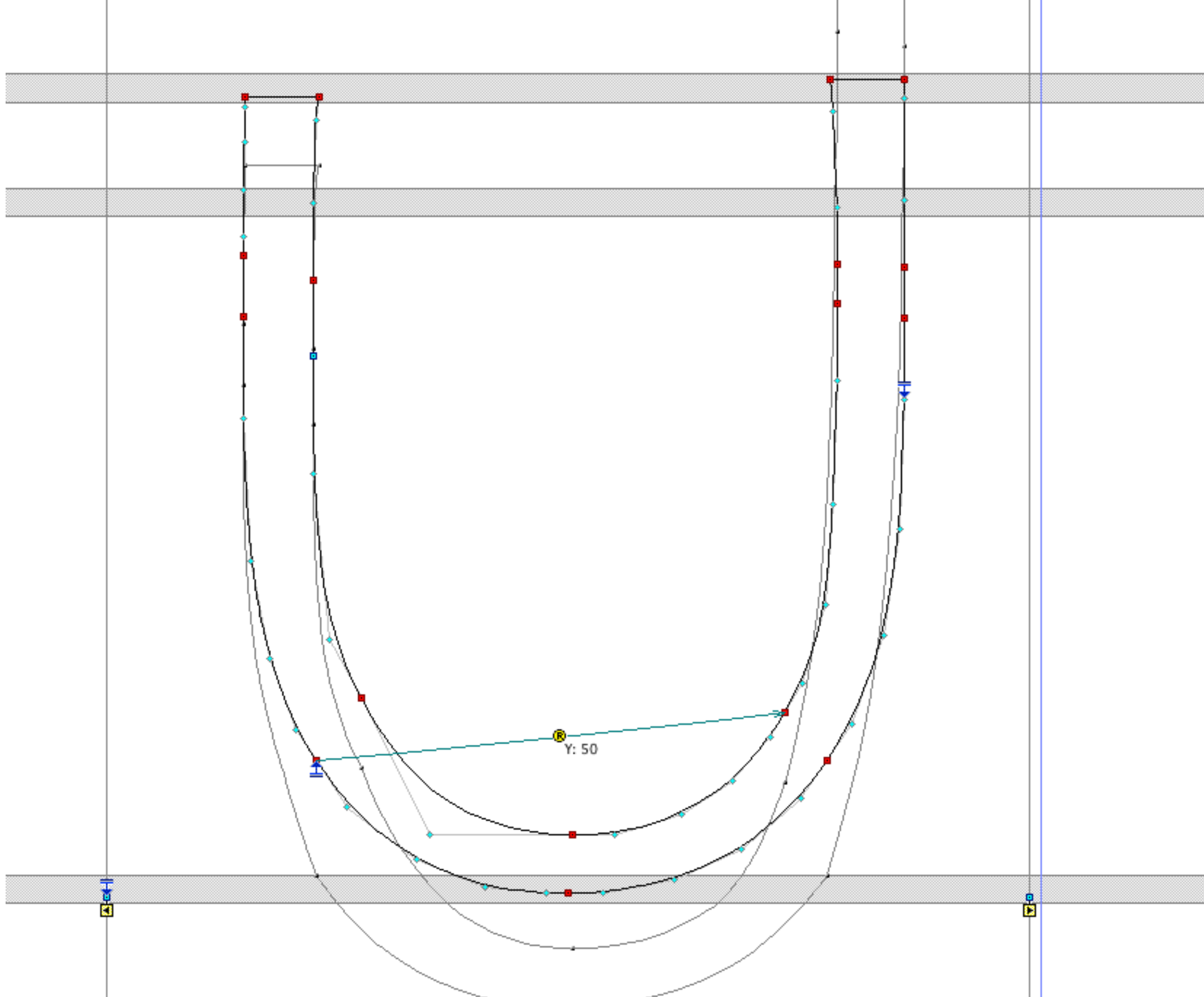


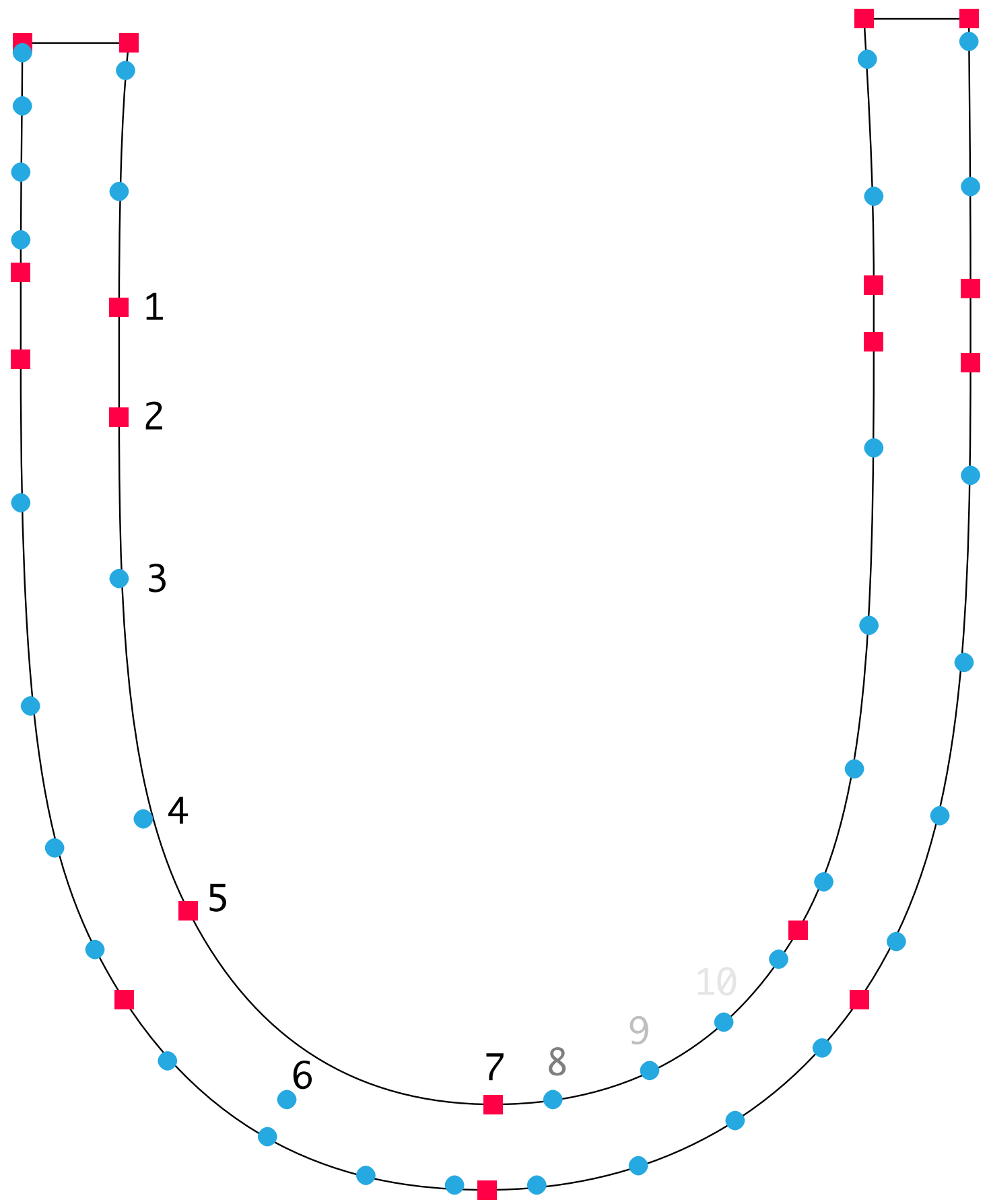




S 1,20,1;2,41,0;4,41,0,1,-1;4,20,21,1,-1;14,5,21,41,  
T 1,19,1;1,12,1;1,27,1;2,0,0;4,19,6,0,-1;4,6,35,-1,  
U 1,20,1;1,49,1;2,33,0;4,33,8,1,-1  
V 1,18,1;1,32,1;2,9,0;14,25,9,32,-1  
W 1,33,1;1,58,1;2,24,0;2,9,0;14,17,9,33,-1;14,40,9,3  
X 1,30,1;1,42,1;2,0,0;2,14,0;14,7,14,30,-1;4,7,22,-1  
Y 1,15,1;1,28,1;2,0,0;4,15,14,1,-1;14,22,0,15,-1;4,2  
Z 1,0,1;1,7,1;2,25,0;2,34,0;4,25,24,1,-1;4,24,17,-1,  
a 8,8,0;2,16,0;2,23,0;6,18,34,0;4,18,17,-1,-1;4,34,2  
b 1,5,0;2,29,0;6,46,47,0;14,19,46,47,-1;4,29,38,0,-1  
c 1,13,0;2,0,0;2,3,0;4,13,14,1,-1;4,3,24,1,-1  
d 1,7,0;2,22,0;4,22,30,1,-1;4,7,40,1,-1  
e 1,29,0;1,22,0;2,7,0;2,0,0;6,47,36,0;4,22,35,0,-1;4  
f 1,22,0;1,15,0;2,0,0;6,32,25,0;4,15,24,0,-1  
g 8,38,0;1,20,0;2,10,0;4,20,21,1,-1;4,10,31,0,-1  
h 1,15,0;1,31,0;2,0,0;2,47,0;6,54,25,0;4,25,24, , -1  
i 1,21,0;2,5,0

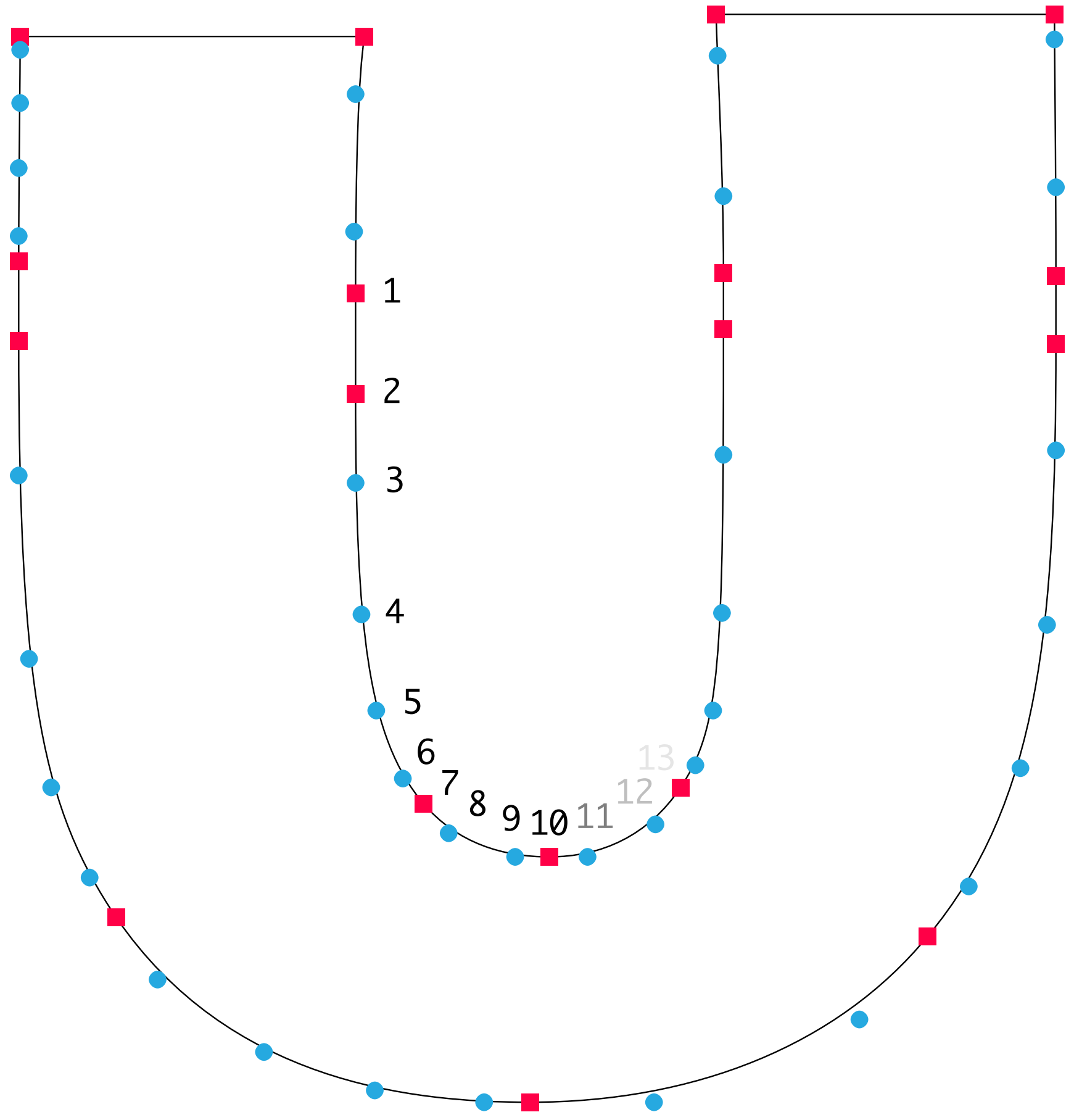




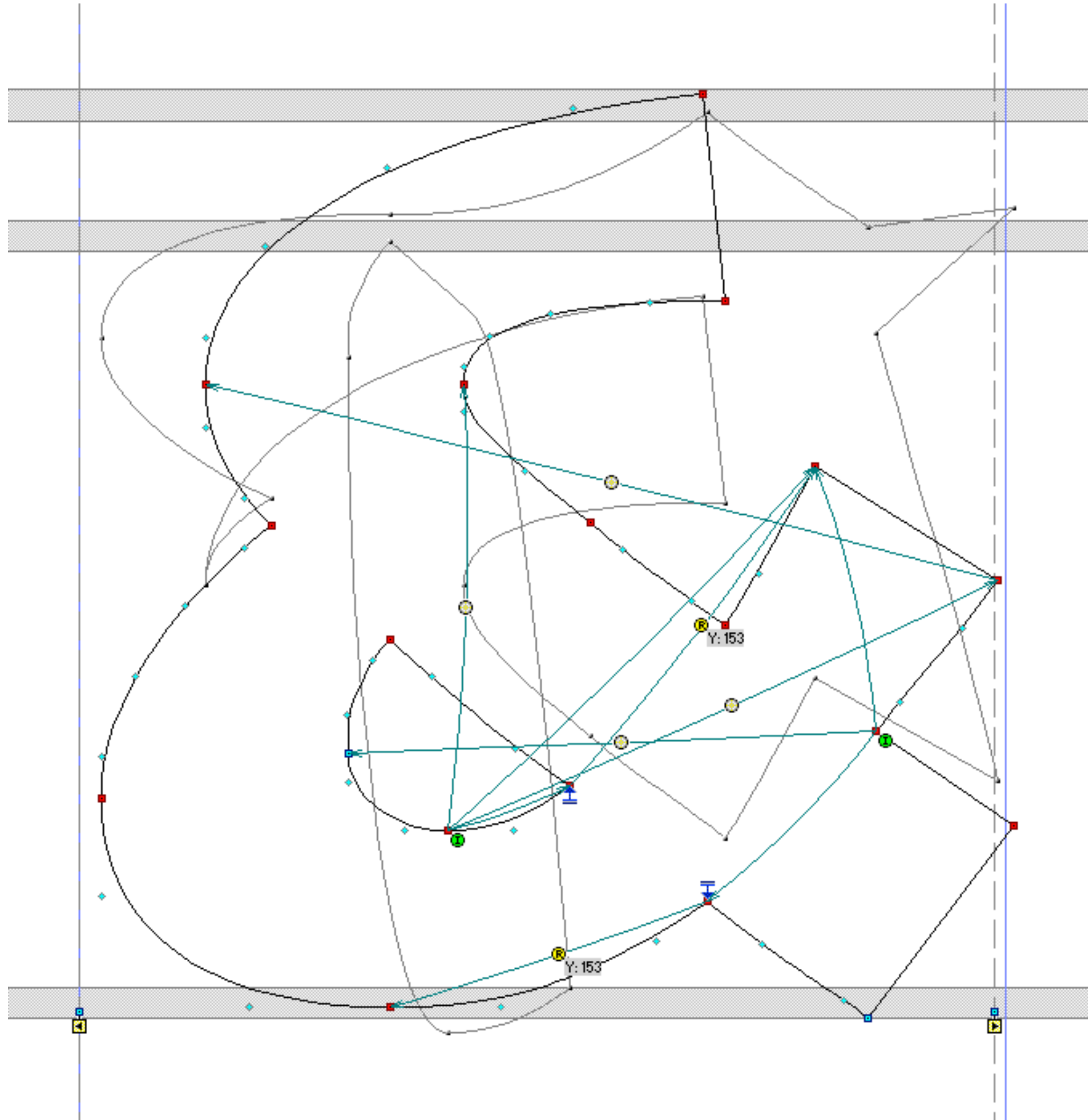


TTF





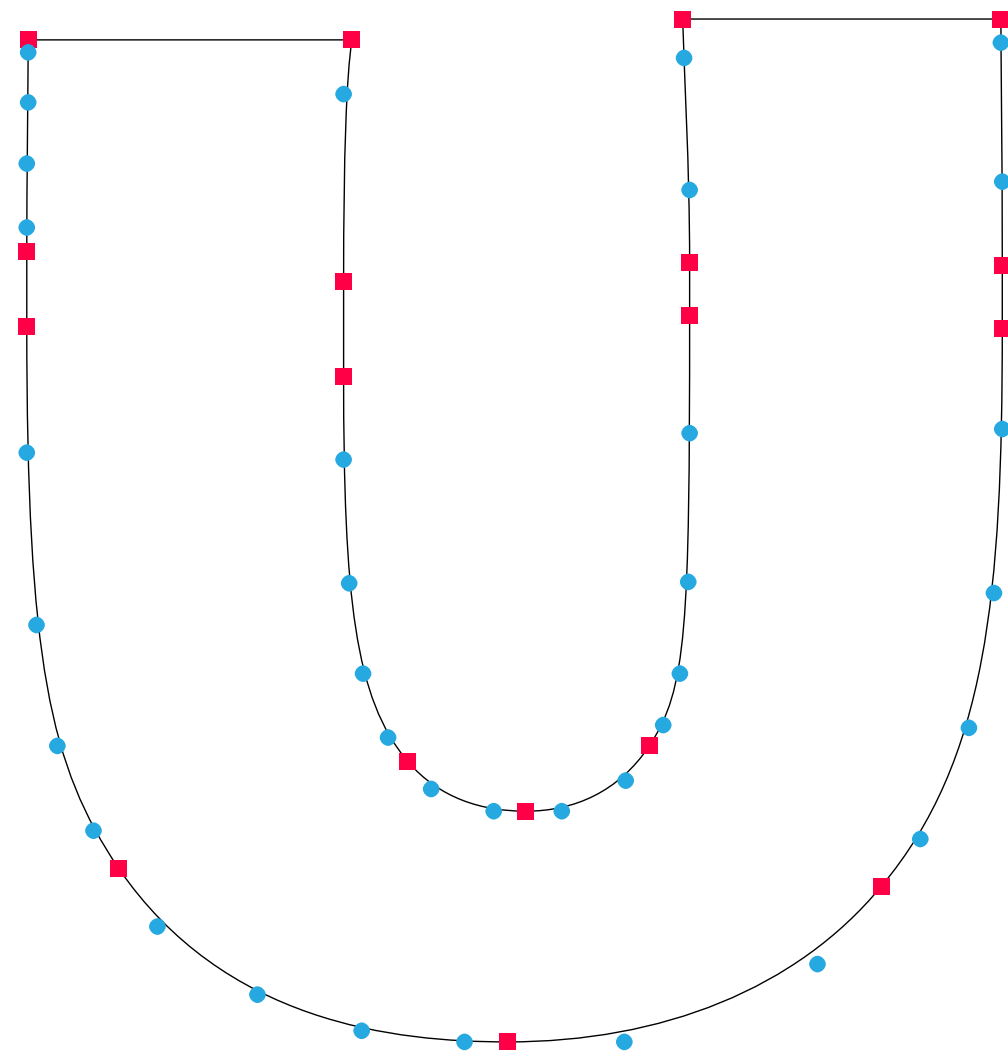
TTF



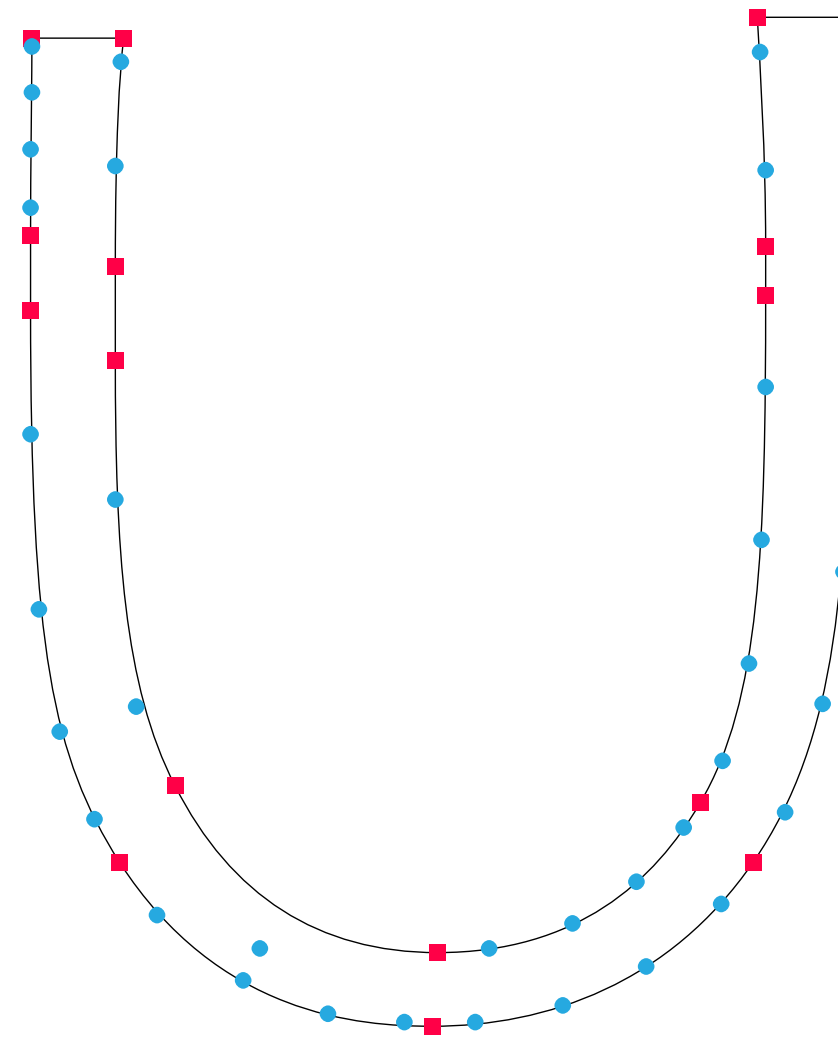
Constants:

-----

→ compatible on-curve points in TTF



19

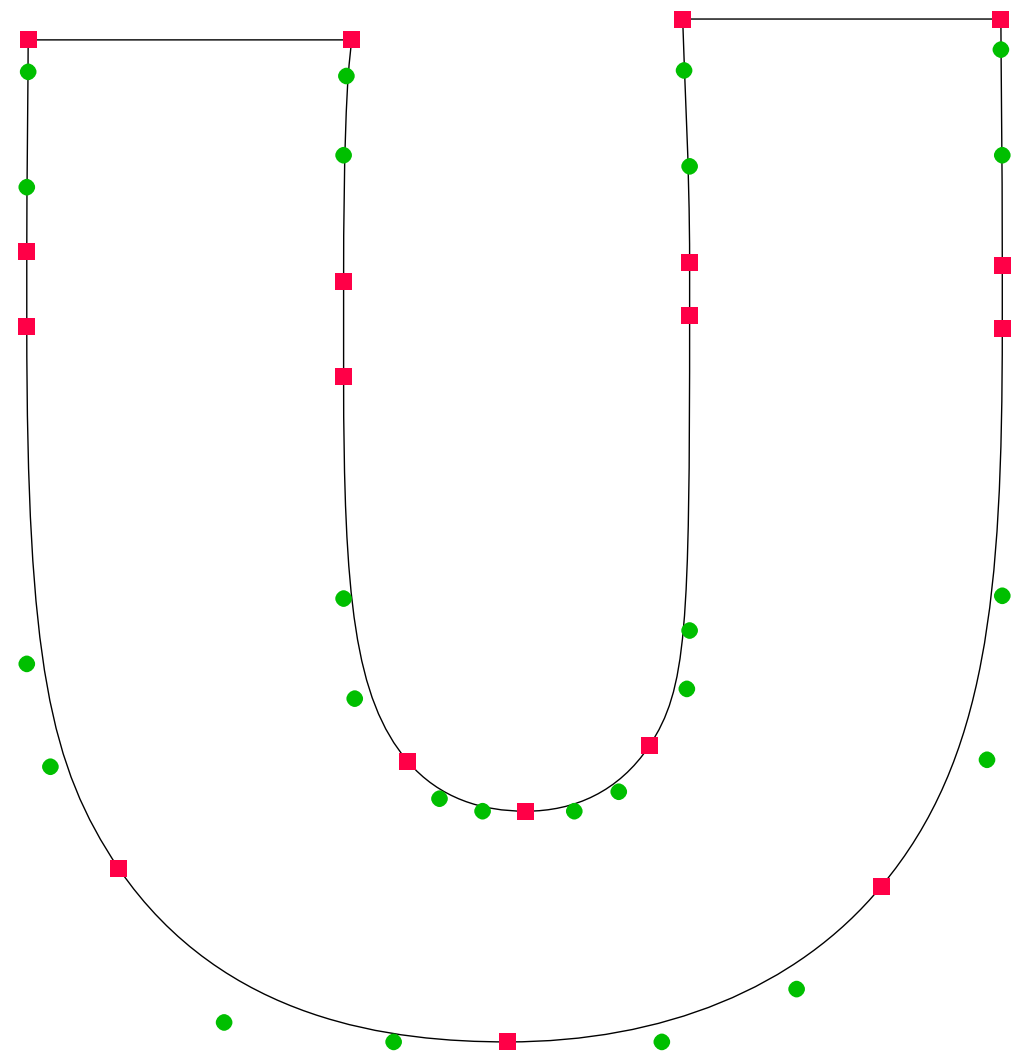


19

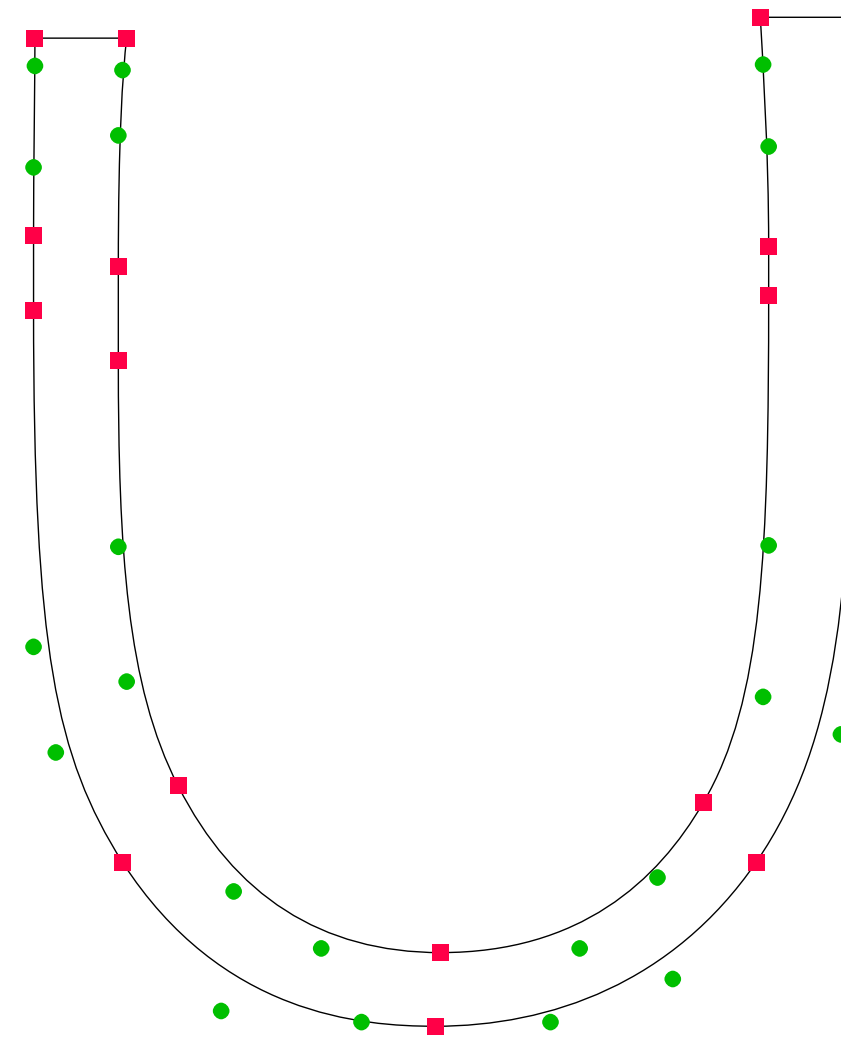
# Constants:

-----

- compatible on-curve points in TTF
- correspondence to CFF outline



19



19

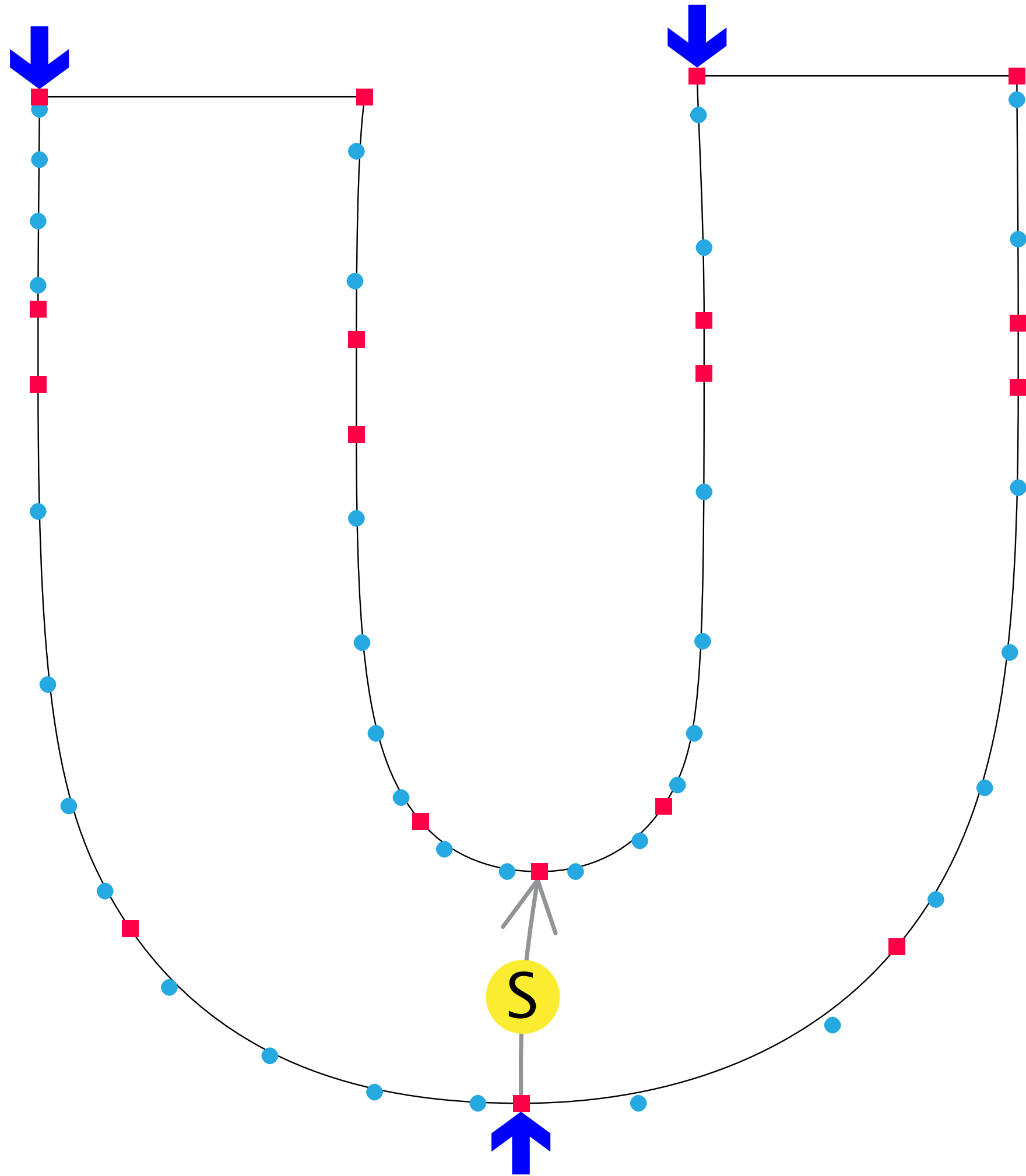
Solution:

-----

→ point structure translation  
via roundtrip to CFF

# How?

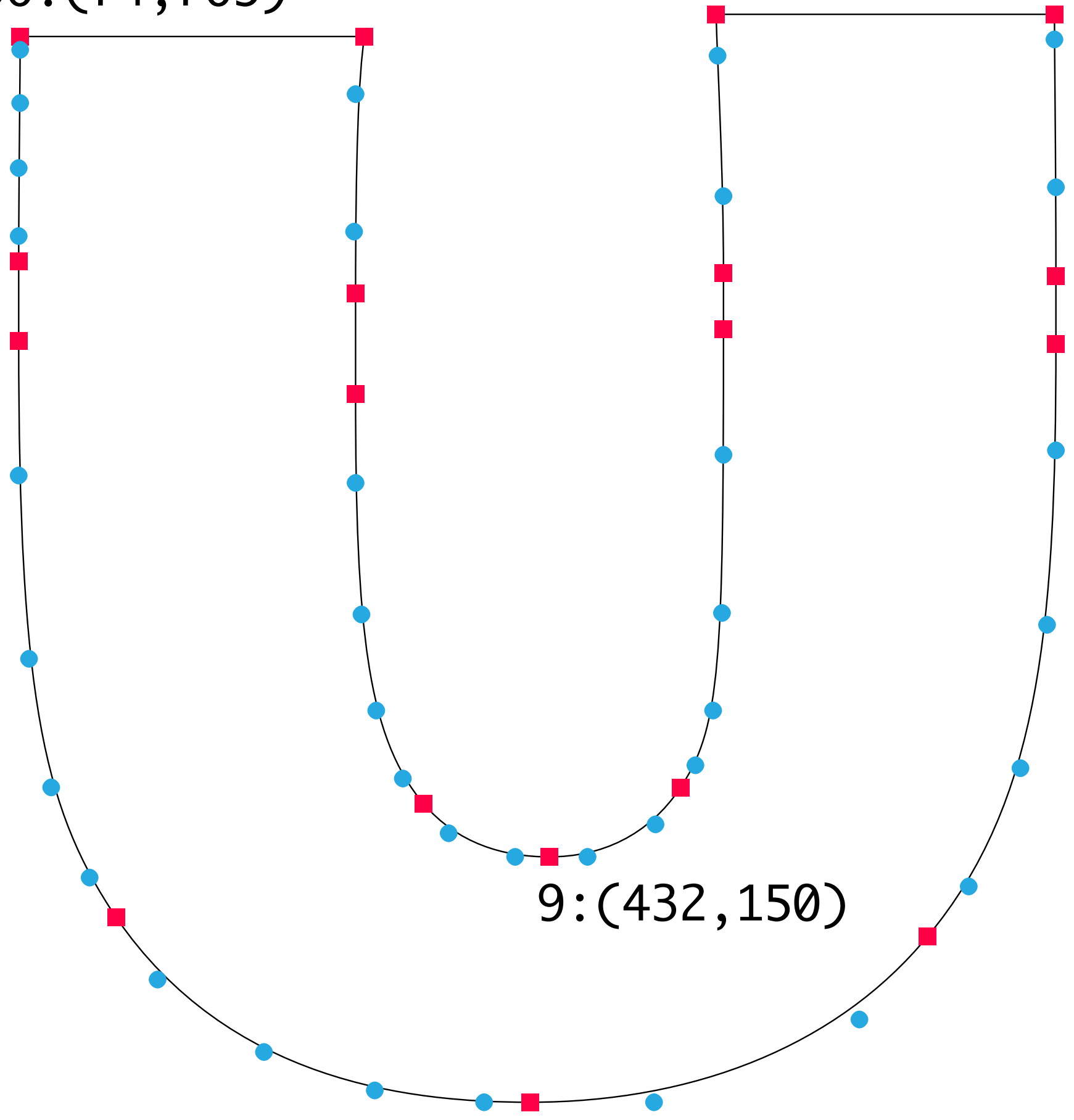
-----



TTF

50:(74, 705)

21:(545, 720)

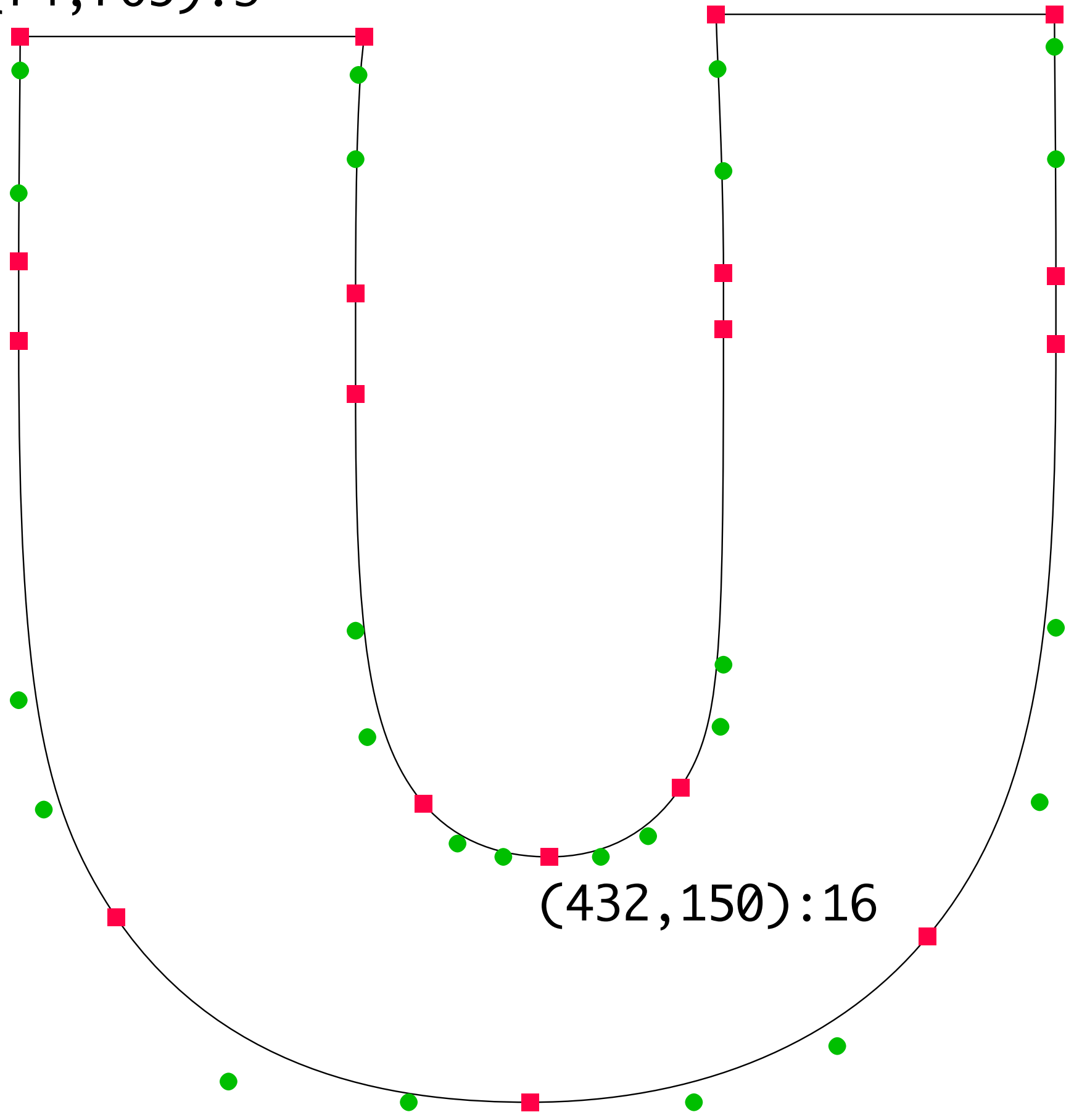


TTF



$(74, 705):3$

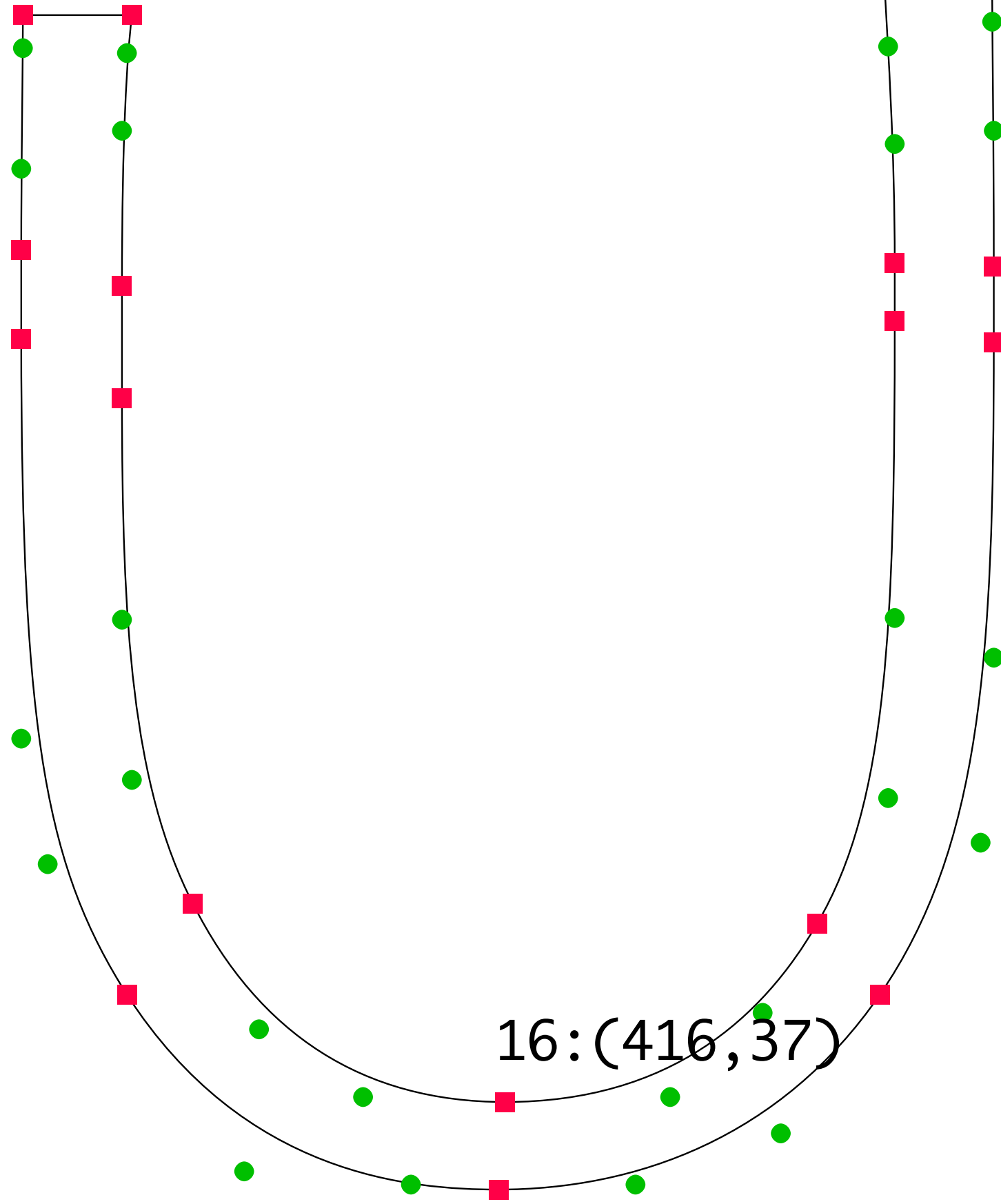
$(545, 720):12$



CFF

3:(124,695)

12:(646,710)



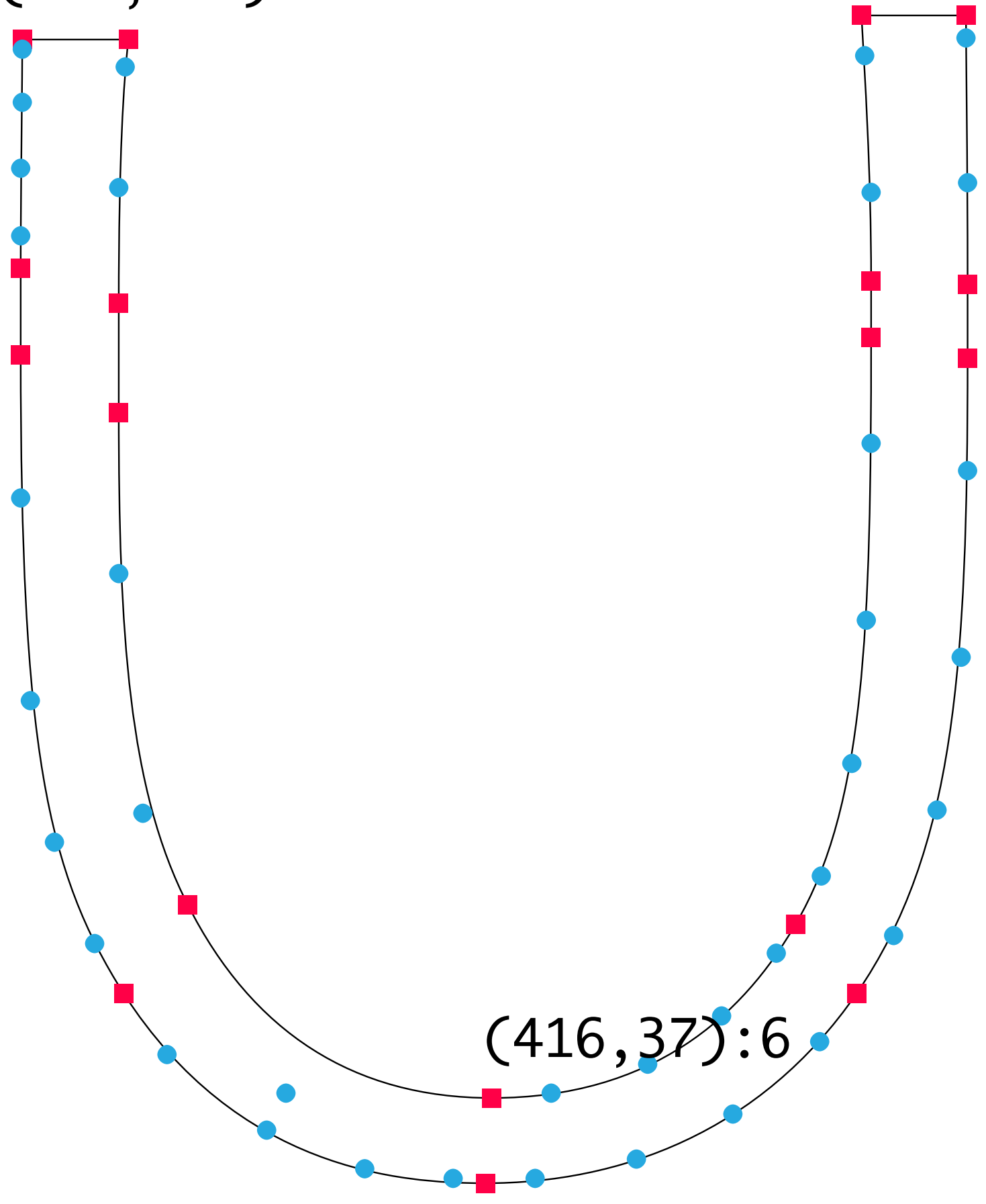
16:(416,37)

7:(412,-16)

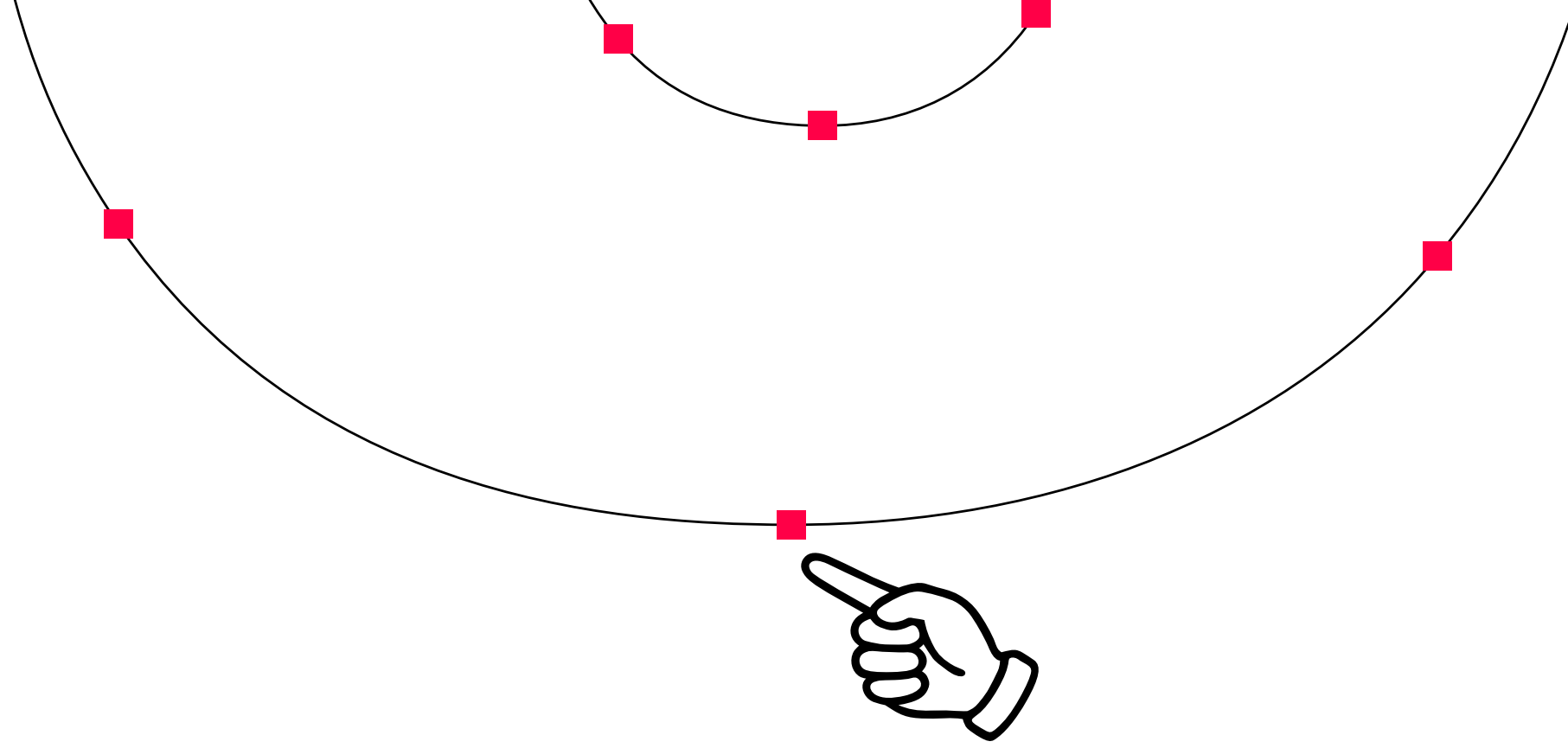
CFF

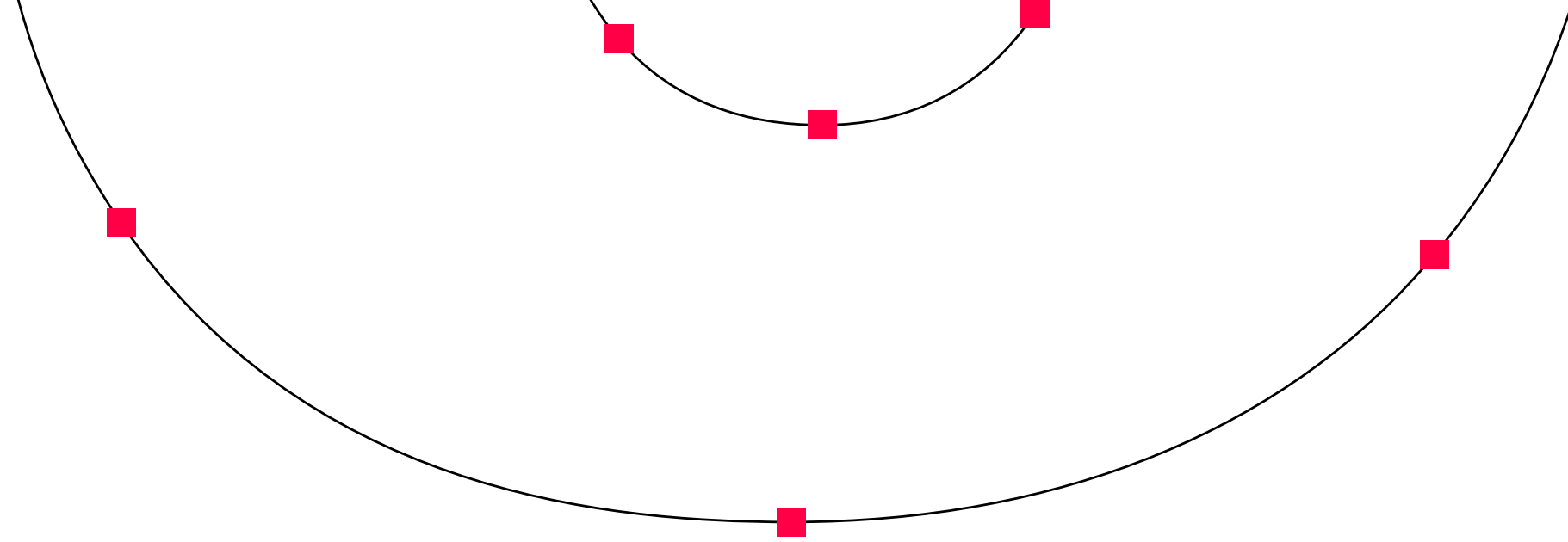
(124, 695):51

(646, 710):20



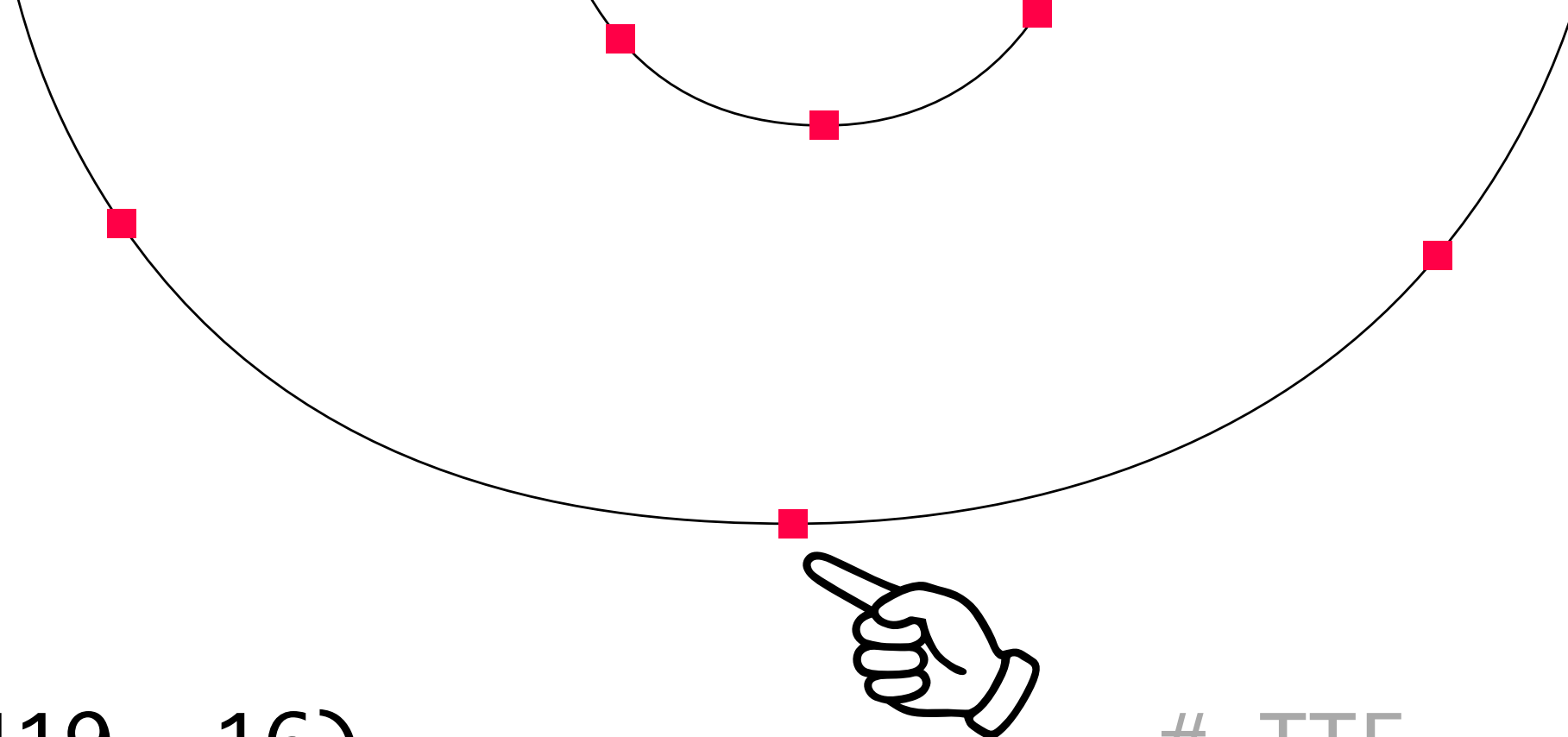
TTF





1. 34:(419, -16)

# TTF

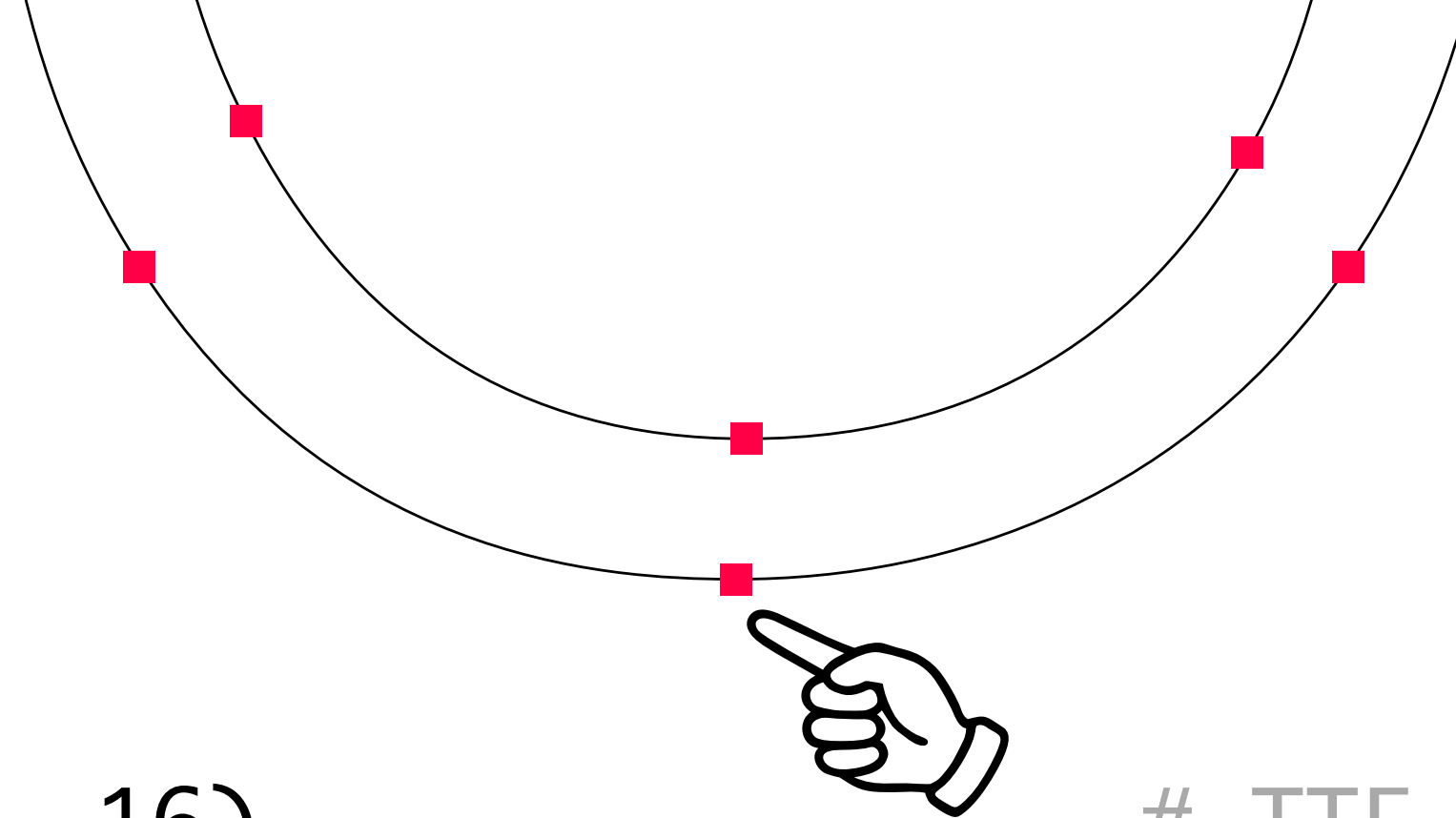


1. 34:(419, -16)

2. (419, -16):7

# TTF

# CFF

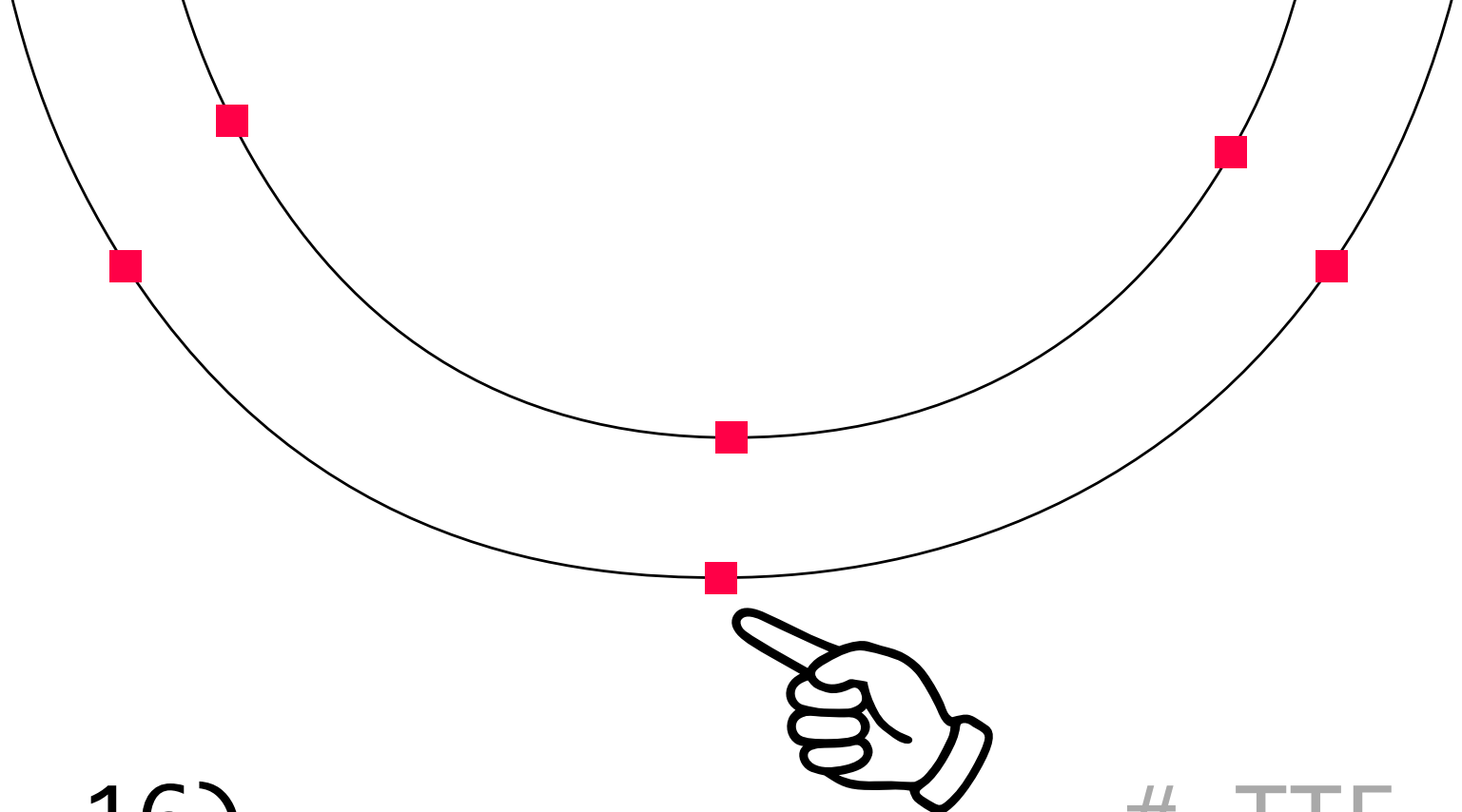


1. 34:(419, -16)

2. (419, -16):7

# TTF

# CFF



1. 34:(419, -16)

2. (419, -16):7

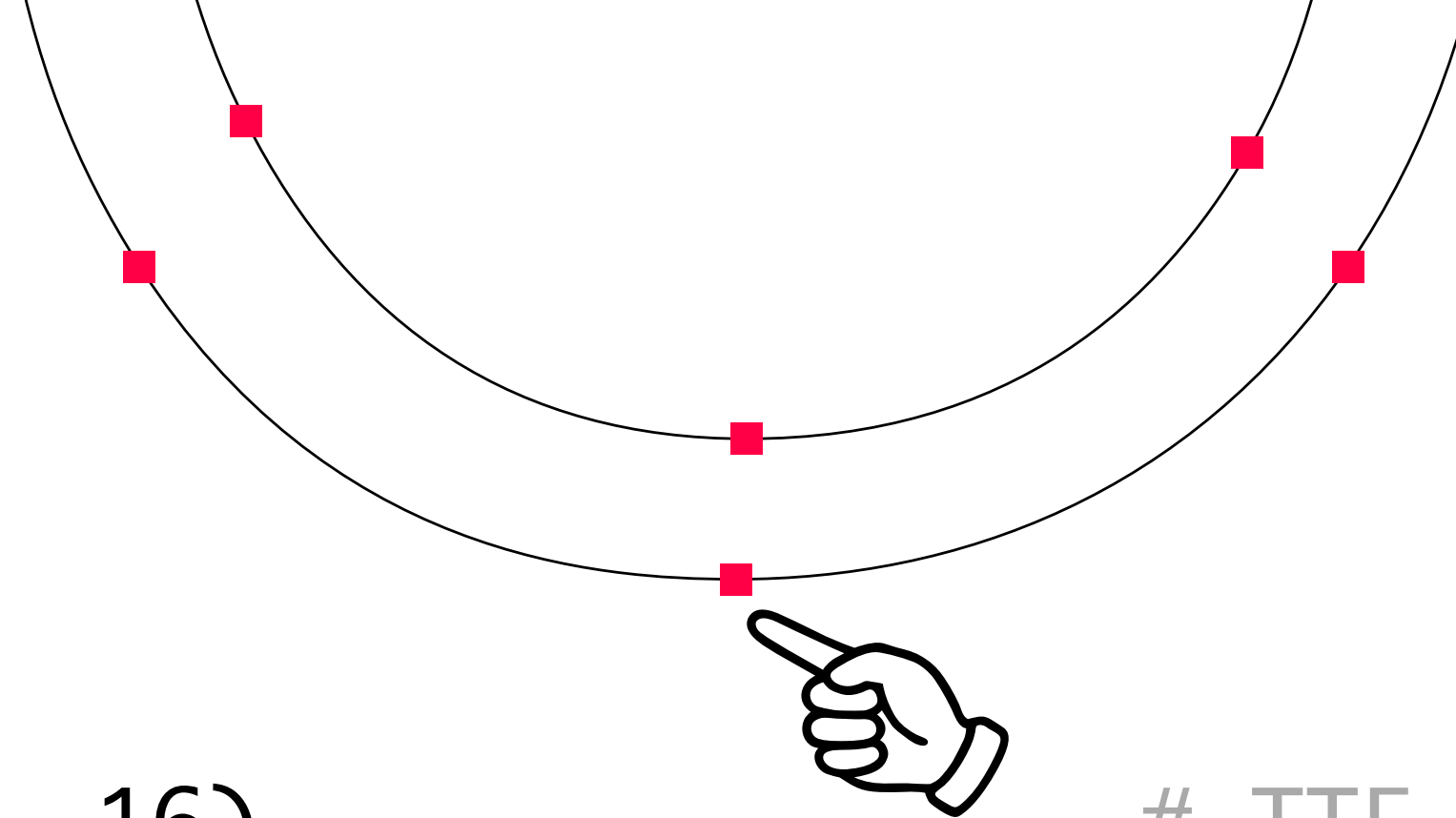
3. 7:(412, -16)

# TTF

# CFF

# CFF





1. 34:(419, -16) # TTF
2. (419, -16):7 # CFF
3. 7:(412, -16) # CFF
4. (412, -16):35 # TTF

O 1, 10, 1; 2, 0, 0; 4, 0, 22, 1; 1, 1, 10, 20, 1, 1  
P 1, 15, 1; 2, 0, 0; 6, 28, 35, 1; 4, 15, 45, 1, -1  
Q 1, 19, 1; 2, 6, 0; 6, 0, 33, 1; 4, 6, 34, 1, -1; 14, 30, 34, 6, -1; 4,  
R 1, 23, 1; 2, 40, 0; 2, 7, 0; 14, 47, 7, 23, -1; 4, 47, 34, -1, -1; 4,  
S 1, 20, 1; 2, 36, 0; 4, 36, 0, 1, -1; 4, 20, 21, 1, -1; 14, 5, 21, 36,  
T 1, 19, 1; 1, 12, 1; 1, 27, 1; 2, 0, 0; 4, 19, 6, 0, -1; 4, 6, 35, -1, -  
U 1, 20, 1; 1, 49, 1; 2, 33, 0; 4, 33, 8, 1, -1  
V 1, 18, 1; 1, 32, 1; 2, 9, 0; 14, 25, 9, 32, -1  
W 1, 29, 1; 1, 52, 1; 2, 20, 0; 2, 9, 0; 14, 15, 9, 29, -1; 14, 36, 9, 2  
X 1, 30, 1; 1, 42, 1; 2, 0, 0; 2, 14, 0; 14, 7, 14, 30, -1; 4, 7, 22, -1  
Y 1, 15, 1; 1, 28, 1; 2, 0, 0; 4, 15, 14, 1, -1; 14, 22, 0, 15, -1; 4, 2  
Z 1, 0, 1; 1, 9, 1; 2, 27, 0; 2, 36, 0; 4, 27, 26, 1, -1; 4, 26, 19, -1.  
a 8, 8, 0; 2, 16, 0; 2, 27, 0; 6, 22, 36, 0; 4, 22, 21, -1, -1; 4, 36, 2  
b 1, 5, 0; 2, 31, 0; 6, 48, 49, 0; 14, 21, 48, 49, -1; 4, 31, 40, 0, -1  
c 1, 13, 0; 2, 0, 0; 2, 3, 0; 4, 13, 14, 1, -1; 4, 3, 22, 1, -1  
d 1, 7, 0; 2, 24, 0; 4, 24, 32, 1, -1; 4, 7, 42, 1, -1  
e 1, 29, 0; 1, 22, 0; 2, 7, 0; 2, 0, 0; 6, 47, 36, 0; 4, 22, 35, 0, 1; 4  
f 1, 20, 0; 1, 15, 0; 2, 0, 0; 6, 20, 22, 0; 4, 15, 22, 0, 1



O 1, 10, 1; 2, 0, 0; 4, 0, 22, 1; 1, 4, 10, 32, 1, 1  
P 1, 15, 1; 2, 0, 0; 6, 28, 35, 1; 4, 15, 43, 1, -1  
Q 1, 21, 1; 2, 8, 0; 6, 0, 35, 1; 4, 8, 36, 1, -1; 14, 32, 36, 8, -1; 4  
R 1, 23, 1; 2, 40, 0; 2, 7, 0; 14, 41, 7, 23, -1; 4, 41, 32, -1, -1; 4  
S 1, 18, 1; 2, 39, 0; 4, 39, 0, 1, -1; 4, 18, 19, 1, -1; 14, 5, 19, 39  
T 1, 21, 1; 1, 14, 1; 1, 29, 1; 2, 0, 0; 4, 21, 8, 0, -1; 4, 8, 35, -1, -1  
U 1, 19, 1; 1, 50, 1; 2, 34, 0; 4, 34, 5, 1, -1  
V 1, 20, 1; 1, 38, 1; 2, 9, 0; 14, 29, 9, 38, -1  
W 1, 33, 1; 1, 60, 1; 2, 24, 0; 2, 9, 0; 14, 17, 9, 33, -1; 14, 40, 9, 3  
X 1, 30, 1; 1, 44, 1; 2, 0, 0; 2, 14, 0; 14, 7, 14, 30, -1; 4, 7, 22, -1  
Y 1, 13, 1; 1, 32, 1; 2, 0, 0; 4, 13, 12, 1, -1; 14, 24, 0, 13, -1; 4, 3  
Z 1, 0, 1; 1, 7, 1; 2, 25, 0; 2, 32, 0; 4, 25, 24, 1, -1; 4, 24, 17, -1  
a 8, 8, 0; 2, 16, 0; 2, 29, 0; 6, 24, 44, 0; 4, 24, 23, -1, -1; 4, 44, 3  
b 1, 5, 0; 2, 31, 0; 6, 48, 49, 0; 14, 21, 48, 49, -1; 4, 31, 40, 0, -1  
c 1, 13, 0; 2, 0, 0; 2, 3, 0; 4, 13, 14, 1, -1; 4, 3, 24, 1, -1  
d 1, 7, 0; 2, 24, 0; 4, 24, 32, 1, -1; 4, 7, 40, 1, -1  
e 1, 29, 0; 1, 22, 0; 2, 7, 0; 2, 0, 0; 6, 47, 36, 0; 4, 29, 30, 1, 1; 4  
f 1, 22, 0; 1, 15, 0; 2, 0, 0; 6, 22, 25, 0; 4, 22, 22, 0; 1, 4, 15, 0



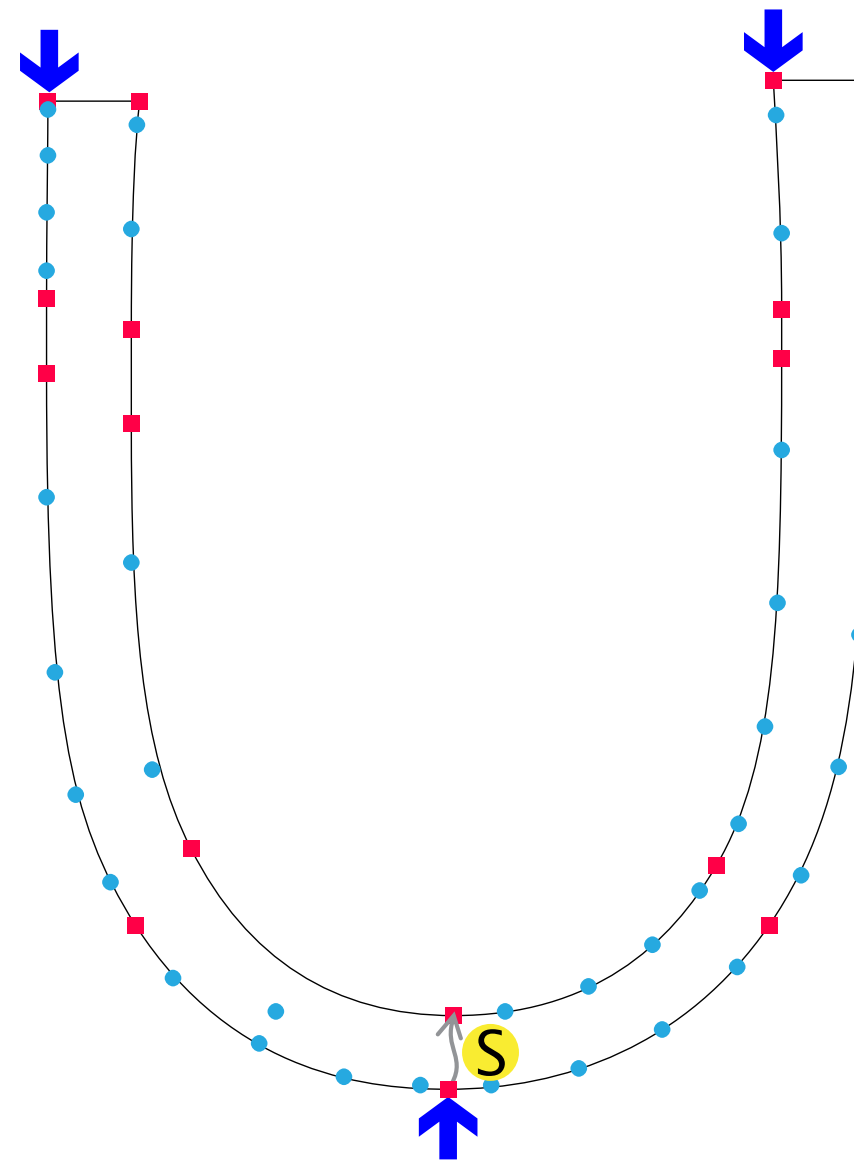
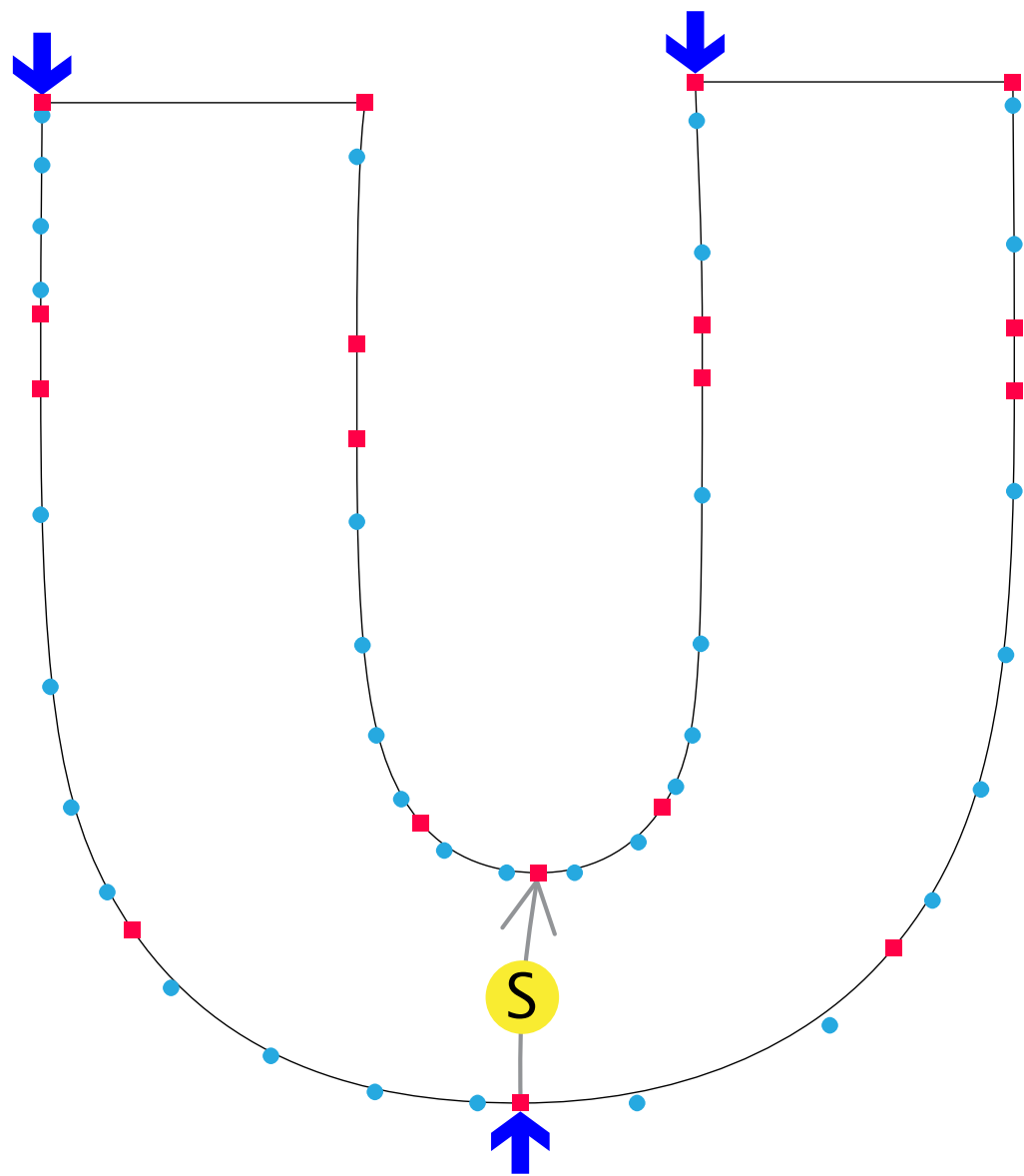
Result:

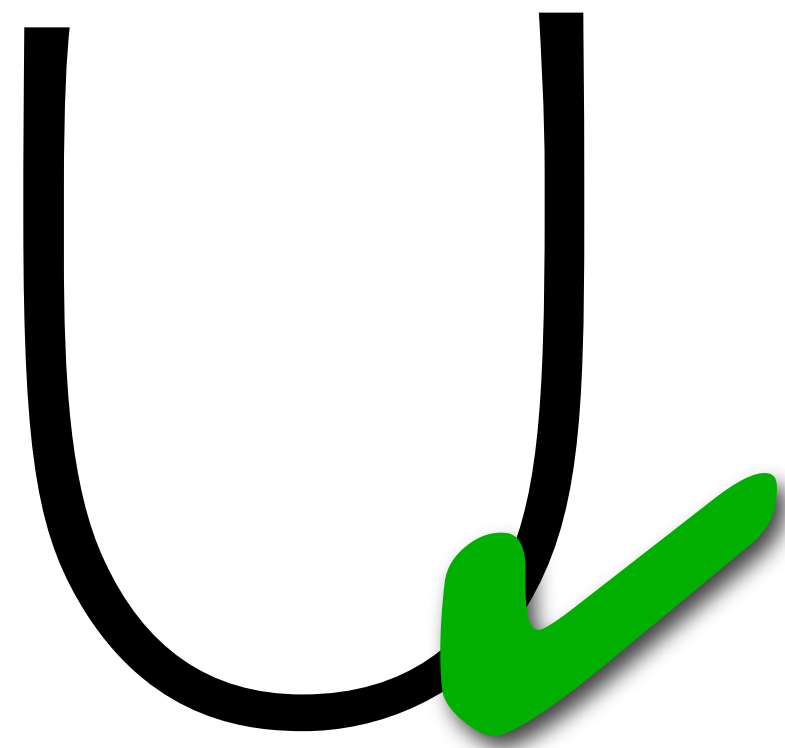
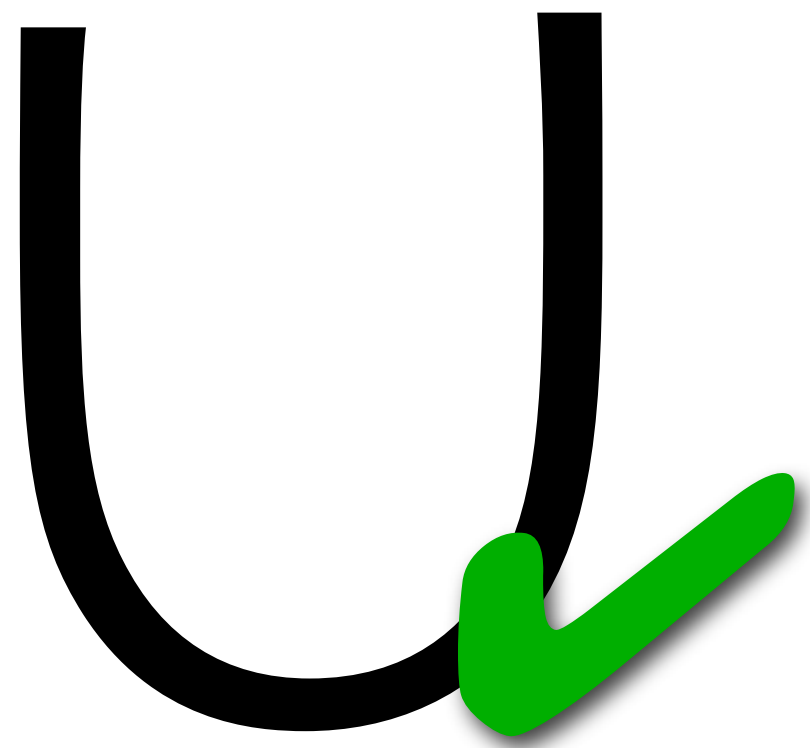
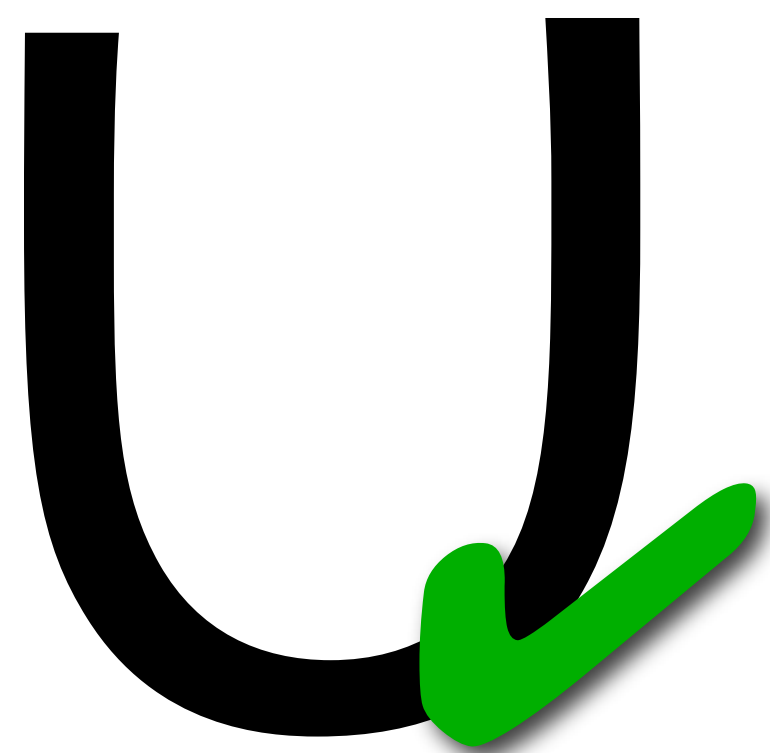
-----

Result:

-----

Hurray!





Workflow:

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Hint one style, then:

- 1: collect on-curve point coordinates and node indexes in TTF
- 2: match those coordinates to indexes in the equivalent CFF outline
- 3: match CFF node indexes to coordinates in the target weight
- 4: get to the relevant TTF node indexes via their coordinates

U 1, 19, 1; 1, 50, 1; 2, 34, 0; 4, 34, 5, 1, -1



```
U 1,19,1;1,50,1;2,34,0;4,34,5,1,-1
```

```
gHints = [  
'1,19,1',  
'1,50,1',  
'2,34,0',  
'4,34,5,1,-1'  
]
```

```
tth = TTH(fl.glyph)

for item in gHints:
    itemList = item.split(",")

    ttc = TTHCommand(int(itemList[0]))

    del(itemList[0])
    for i in range(len(itemList)):
        ttc.params[i] = int(itemList[i])
    tth.commands.append(ttc)
tth.SaveProgram(glyph)
```

```
tth = TTH(fl.glyph)
```

```
# access TrueType information
```

```
# for current glyph
```

```
tth = TTH(fl.glyph)
```

```
for item in gHints:
```

```
# for each of the items in the  
# previously created list:
```

```
tth = TTH(fl.glyph)

for item in gHints:
    itemList = item.split(",")

    ttc = TTHCommand(int(itemList[0]))

# make another list for each
# instruction, and assign the command
# code per instruction
```

```
# assign hint parameters per instruction  
# and finally save the program.
```

```
    ttc = TTHCommand(int(itemList[0]))
```

```
del(itemList[0])
```

```
for i in range(len(itemList)):
```

```
    ttc.params[i] = int(itemList[i])
```

```
tth.commands.append(ttc)
```

```
tth.SaveProgram(glyph)
```

```
tth = TTH(fl.glyph)

for item in gHints:
    itemList = item.split(",")

    ttc = TTHCommand(int(itemList[0]))

    del(itemList[0])
    for i in range(len(itemList)):
        ttc.params[i] = int(itemList[i])
    tth.commands.append(ttc)
tth.SaveProgram(glyph)
```

## Advantages:

-----

- hinting is more consistent throughout weights
- lots of time saved for more exciting things (like kerning).
- good, often even perfect translation of hinting information from one weight to another  
(given the styles are compatible)
- no “black box” involved



Take-aways:

-----

- try it yourself!
- save time!
- **hint only on-curve points!**

U U U U U U U U U U  
U U U U U U U U U U  
U U U U U U U U U U  
U U U U U U U U U U  
U U U U U U U U U U  
U U U U U U U U U U



