

# Natch, Euclide, Stelvio

## Comparing the orthodox SPG solvers

As the author of Stelvio, it has always interested me how Stelvio stacks up against the other SPG solvers. I recently tested a significant number of random SPGs, namely those orthodox SPGs in the PDB which contain '23' or '24' in their ID. There are currently 132 SPGs which meet this condition. Four of them (P1235533, P0004247, P0004246, P0000245) are massacre SPGs which none of these programs can solve in a useful amount of time. So 128 SPGs remain.

## The setup

As for the hardware, I used my mid-class notebook. I launched Natch 3.3 using the `-t10000` parameter for reasonable hash table size (I don't know what is best here). Euclide 1.11 cannot be parametrized as far as I know. As for Stelvio 2.21 (the current unofficial version), there are lots of parameters, but I used the default setup. I let Stelvio run with 3 seekers, 1 player and 16G of RAM. The 2.21 version can solve  $n$  problems in succession, a feature which I used (this speeds up solving, since the JVM is warmed up after the first problem). I aborted the solving process quite a few times: 27 times for Natch, 36 times for Euclide and twice for Stelvio. I did this in the case a program was a lot slower than the others or the absolute solving times were very long. For the two SPGs for which I aborted Stelvio, I know Stelvio can solve these problems each in around 3 days. But I was not willing to wait that long.

## The results

Apart from exceptions, Stelvio outperforms the other programs, and usually by quite some margin. In about 50% of the cases, Stelvio is at least one order of magnitude faster than the other programs, which I find quite astonishing. Natch and Euclide are quite similar in solving performance, Natch having the upper hand on average. Some stats:

### Natch 3.3 vs Euclide 1.11

Only comparing those problems which at least one program was able to solve (107 SPGs).

- Euclide slower than Natch by at least a factor 100: 4 SPGs = 4%
- Euclide slower than Natch by at least a factor 10: 21 SPGs = 20%
- Euclide slower than Natch by at least a factor 5: 29 SPGs = 27%
- Euclide slower than Natch by at least a factor 2: 41 SPGs = 38%
- Euclide slower than Natch: 49 SPGs = 45%
- Euclide faster than Natch: 39 SPGs = 36%
- Euclide faster than Natch by at least a factor 2: 10 SPGs = 9%
- Euclide faster than Natch by at least a factor 5: 24 SPGs = 22%
- Euclide faster than Natch by at least a factor 10: 17 SPGs = 16%

- Euclide faster than Natch by at least a factor 100: 1 SPGs = 1%
- Euclide solved but Natch did not: 6 SPGs
- Natch solved but Euclide did not: 15 SPGs

### **Natch 3.3 vs Stelvio 2.21**

Only comparing those problems which at least one program was able to solve (127 SPGs).

- Stelvio is slower than Natch by at least a factor 10: 2 SPGs = 2%
- Stelvio is slower than Natch : 5 SPGs = 4%
- Stelvio is faster than Natch : 99 SPGs = 79%
- Stelvio is faster than Natch by at least a factor 2: 94 SPGs = 75%
- Stelvio is faster than Natch by at least a factor 5: 73 SPGs = 58%
- Stelvio is faster than Natch by at least a factor 10: 63 SPGs = 50%
- Stelvio is faster than Natch by at least a factor 100: 29 SPGs = 23%
- Stelvio is faster than Natch by at least a factor 1000: 6 SPGs = 5%
- Stelvio solved but Natch did not: 26 SPGs
- Natch solved but Stelvio did not: 1 SPG (Stelvio solves but needs 3 days)

### **Euclide 1.11 vs Stelvio 2.21**

Only comparing those problems which at least one program was able to solve (126 SPGs).

- Stelvio is slower than Euclide by at least a factor 10: 1 SPGs = 1%
- Stelvio is slower than Euclide : 3 SPGs = 2%
- Stelvio is faster than Euclide: 94 SPGs = 75%
- Stelvio is faster than Euclide by at least a factor 2: 91 SPGs = 72%
- Stelvio is faster than Euclide by at least a factor 5: 80 SPGs = 63%
- Stelvio is faster than Euclide by at least a factor 10: 69 SPGs = 55%
- Stelvio is faster than Euclide by at least a factor 100: 35 SPGs = 28%
- Stelvio is faster than Euclide by at least a factor 1000: 9 SPGs = 7%
- Stelvio solved but Euclide did not: 34 SPGs
- Euclide solved but Stelvio did not: 0 SPGs

## **Conclusion**

Using Stelvio is advantageous most of the time. And the stats are even distorted in favor of Natch/Euclide. Because in the cases I aborted Natch/Euclide, it usually seemed evident that these programs were getting nowhere and actual solving times would approach infinity. But for the comparison, I only counted the time spent until I called it quits.

As an exception, in case the SPG contains cross captures, Stelvio is still quite slow at times. Cross captures are a weakness in Stelvio that I could not get rid of so far.

For all the details, you can check the table with solving times in second below. An asterisk (\*) after the solving time means that I aborted the solving process.

<b>PID</b>	<b>Natch 3.3</b>	<b>Euclide 1.11</b>	<b>Stelvio 2.21</b>
P0000231	240	4800 (*)	1
P0002234	1	1	1
P0002235	1	42	1
P0002237	1	2	1
P0002238	28800 (*)	15000 (*)	106
P0002239	251	743	21
P0002240	2	2	1
P0002241	4200 (*)	36000 (*)	10
P0002243	126	733	17
P0002245	28800 (*)	330	3960
P0002246	2	102	1
P0002247	2380	6023	3
P0002248	361	42	22
P0002249	1	1	1
P0002300	34	110	1
P0002302	20400 (*)	4800 (*)	16
P0002305	1	1	1
P0002310	100	187	179
P0002311	2	1	2
P0002315	1201	7500 (*)	1
P0002326	413	33	1
P0002328	710	482	6
P0002331	1	1	1
P0002332	2	1	1
P0002333	40	36000 (*)	1
P0002334	8	7	1
P0002335	11	7	1
P0002336	1	2	1
P0002337	36000 (*)	36000 (*)	8280

<b>PID</b>	<b>Natch 3.3</b>	<b>Euclide 1.11</b>	<b>Stelvio 2.21</b>
P0002371	1	1	1
P0002373	120	901	257
P0002374	1	1	1
P0002823	1	1	1
P0005923	5	1	1
P0006245	93	4000 (*)	28
P0006246	2	1	1
P0006247	1	1	1
P0009124	585	36000 (*)	318
P1000230	21000 (*)	25600 (*)	6060
P1000234	18	10	1
P1000235	710	16	1
P1000244	1	1	1
P1000245	24	1	1
P1000246	5000 (*)	520	1
P1000524	3	19	1
P1001230	1440	4000 (*)	13
P1001236	3	130	1
P1001241	1	1	1
P1004234	580	39	25
P1004242	141	22	1
P1011923	451	40	5
P1011924	27	39	1
P1013024	1	10	1
P1013124	3	1	1
P1017624	2	1	1
P1066723	7200 (*)	930	19
P1066724	3600 (*)	3600 (*)	17
P1067230	40000 (*)	45400 (*)	21600
P1067231	1	390	1
P1067232	970	523	3
P1067233	480	38	8
P1067241	3	1	1

<b>PID</b>	<b>Natch 3.3</b>	<b>Euclide 1.11</b>	<b>Stelvio 2.21</b>
P1067243	91	2370	148
P1067246	2	1	1
P1067247	5	4	1
P1067248	2	4	1
P1067423	3	445	1
P1068230	14400 (*)	12500 (*)	1240
P1068424	47	1420	39
P1068523	1	1	1
P1070023	44	6	1
P1070024	7200 (*)	7200 (*)	462
P1080424	312	4800 (*)	22
P1080523	57	1440	3
P1080524	940	100	20
P1080623	109	260	2
P1080624	4800 (*)	4800 (*)	393
P1084240	7	63	1
P1084241	182	95	10
P1084242	185	1	1
P1084243	4	1	1
P1084244	4200 (*)	4200 (*)	326
P1084245	7200 (*)	10800 (*)	362
P1094231	1800 (*)	105	5
P1094233	1200 (*)	5100	1
P1106924	3545	3600 (*)	24
P1204223	2	1	1
P1230074	10800 (*)	3600 (*)	1
P1230075	798	3800 (*)	4
P1230076	130	241	1
P1232421	352	2730	43
P1232422	26000 (*)	10800 (*)	1020
P1232433	57	82	9
P1232434	822	3121	229
P1240487	26	34	4

<b>PID</b>	<b>Natch 3.3</b>	<b>Euclide 1.11</b>	<b>Stelvio 2.21</b>
P1240488	2	1	1
P1240507	25	2	2
P1240531	1	1	1
P1240540	590	3005	85
P1240545	322	1030 (*)	1
P1240559	8	8	1
P1240561	51	240	2
P1240562	2	5	1
P1240665	32	9	1
P1240667	1	1	1
P1240671	165	2300	10
P1240679	1	1	1
P1240683	32	3600 (*)	24
P1240688	36000 (*)	36000 (*)	2180
P1240689	3600 (*)	3600 (*)	15
P1240690	217	3600 (*)	1
P1240724	36000 (*)	36000 (*)	36000 (*)
P1240730	10	22	1
P1243395	2870	781	6
P1246051	5	89	413
P1246053	10000 (*)	7880	94
P1255249	1240	201	6
P1257230	5400 (*)	5400 (*)	5
P1257231	1	1	1
P1257232	133	3600 (*)	111
P1257233	137	3600 (*)	41
P1257234	4800 (*)	4800 (*)	71
P1257240	1	1	1
P1257242	27	281	1
P1257243	3600 (*)	3600 (*)	200
P1257244	28800 (*)	10800 (*)	2205
P1257248	34	13	1
P1347824	14420	36000 (*)	36000 (*)