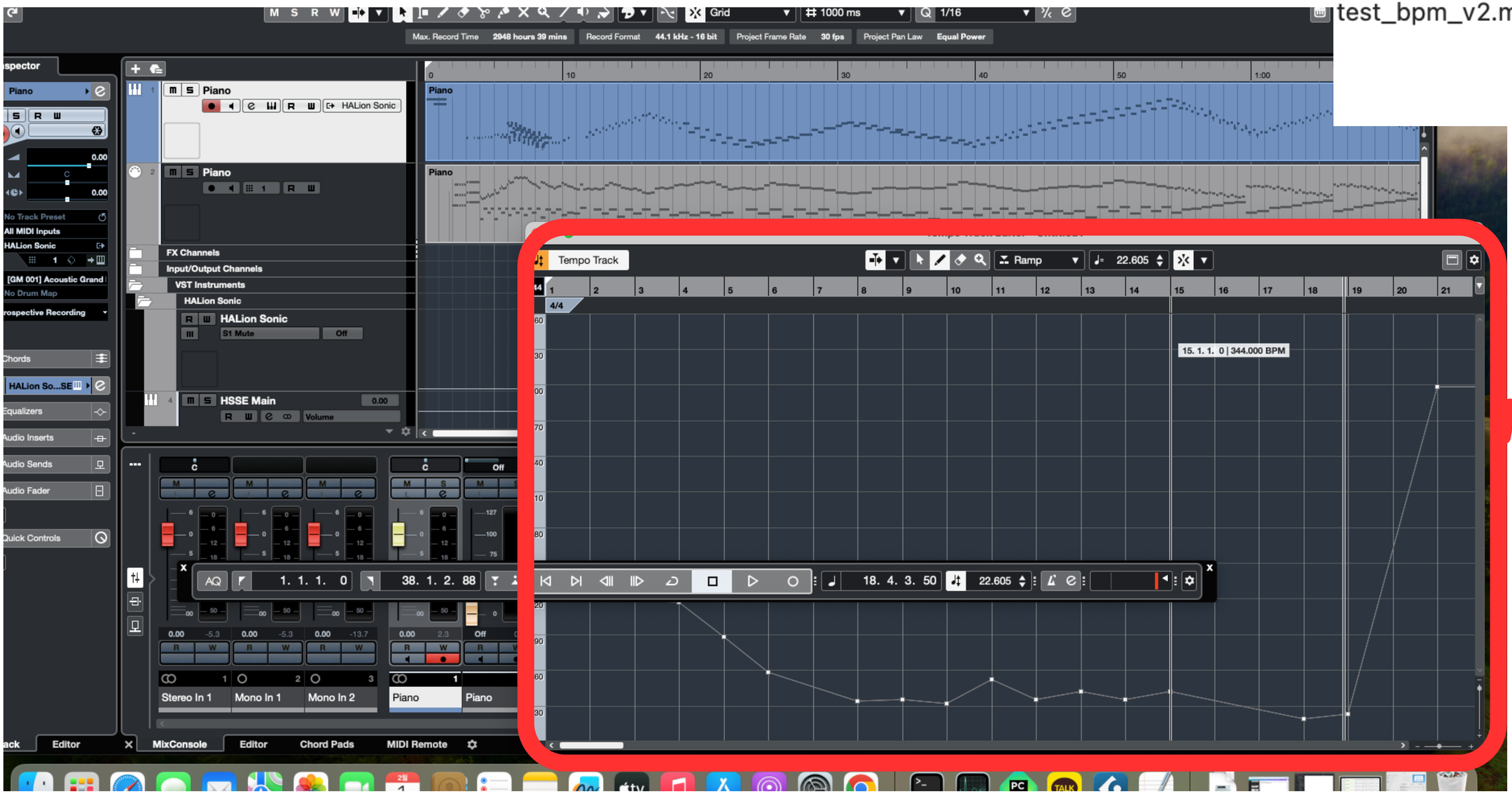
CUBASE 에서 데이터를 추출 하는 과정 -
TEMPO 관련 MID 데이터



test_bpm_v2.mid

test_bpm_origin_v2.mid

TEMPO
조절하는 곳

MIDO 라이브러리를 이용해 set_tempo Meta_Message를 추가 후 현재 데이터 추출 알고리즘 ([Mido] MIDI Data Combination V4.ipynb) 로 추출 후 비교 데이터 비교 해 보기

[6]:
```
import mido

mid = mido.MidiFile('test_bpm_v2.mid')
```

[7]:
```
mid.tracks
```

[7]:
```
[MidiTrack([
   MetaMessage('track_name', name='butterfly', time=0),
   MetaMessage('time_signature', numerator=4, denominator=4, clocks_per_click=24, notated_32nd_notes_per_beat=8, time=0),
   MetaMessage('set_tempo', tempo=500521, time=0),
   MetaMessage('set_tempo', tempo=501567, time=480),
   MetaMessage('set_tempo', tempo=502618, time=480),
   MetaMessage('set_tempo', tempo=503672, time=480),
   MetaMessage('set_tempo', tempo=504732, time=480),
   MetaMessage('set_tempo', tempo=505795, time=480),
   MetaMessage('set_tempo', tempo=506863, time=480),
   MetaMessage('set_tempo', tempo=507936, time=480),
   MetaMessage('set_tempo', tempo=509014, time=480),
   MetaMessage('set_tempo', tempo=510095, time=480),
   MetaMessage('set_tempo', tempo=511182, time=480),
   MetaMessage('set_tempo', tempo=512273, time=480),
   MetaMessage('set_tempo', tempo=529397, time=480),
   MetaMessage('set_tempo', tempo=565591, time=480),
   MetaMessage('set_tempo', tempo=607098, time=480),
```

기존 MID 파일에 set_tempo를 추가하는 코드

```
import mido
from mido import MidiFile, MidiTrack, MetaMessage

# MIDI 파일 로드
midi_file = MidiFile('test_bpm_v2.mid')

bpm = 120
tempo = mido.bpm2tempo(bpm)

set_tempo_message = MetaMessage('set_tempo', tempo=tempo, time=480)

weight = 0

for i in range(10):
    midi_file.tracks[0].insert(i+weight, set_tempo_message)
    weight+=1

midi_file.save('modified_midi_file.mid')
```

[12]:
```
import mido

mid = mido.MidiFile('modified_midi_file.mid')

mid.tracks
```

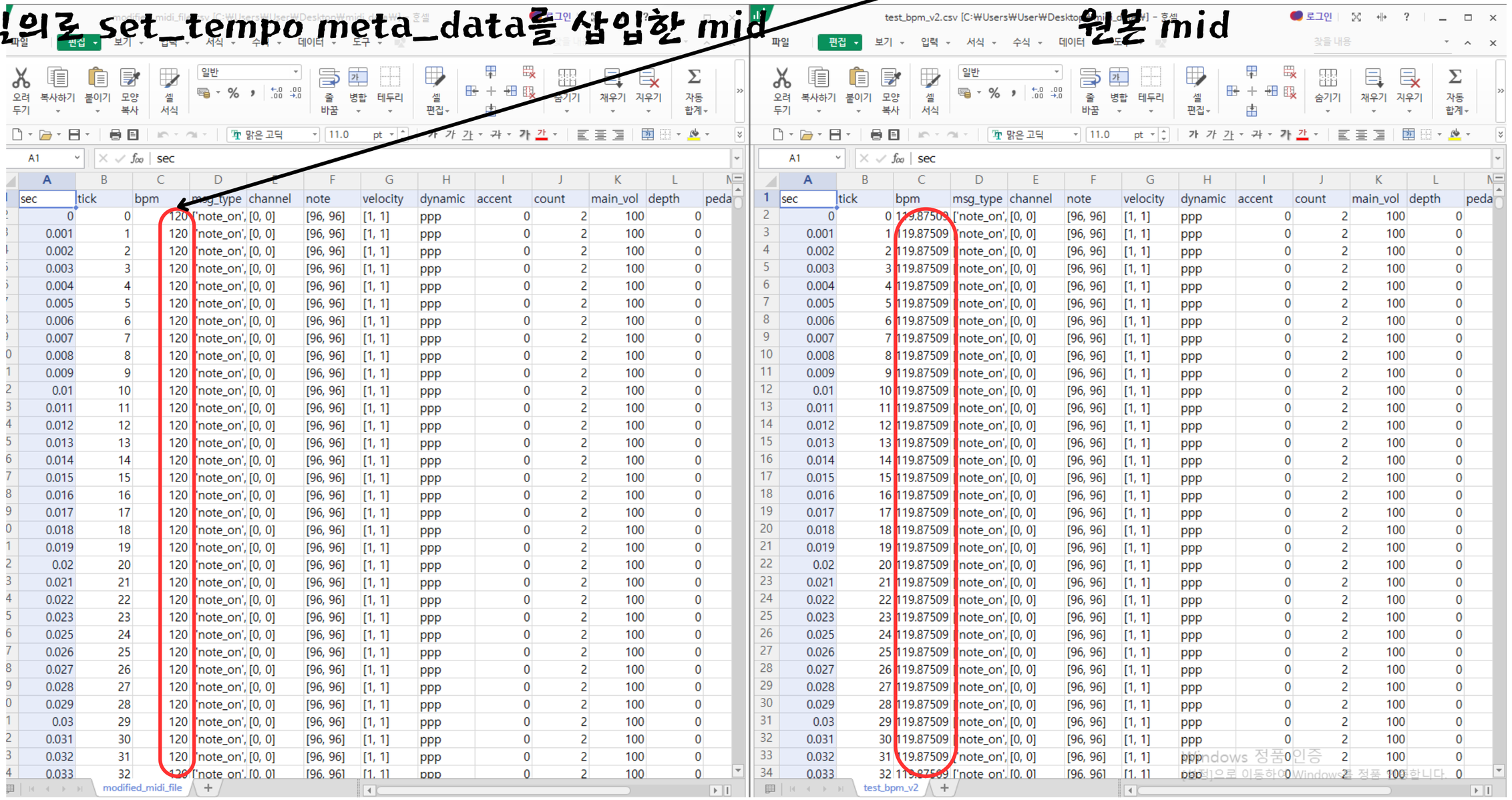
[12]:
```
[MidiTrack([
   MetaMessage('set_tempo', tempo=500000, time=0),
   MetaMessage('track_name', name='butterfly', time=0),
   MetaMessage('set_tempo', tempo=500000, time=0),
   MetaMessage('time_signature', numerator=4, denominator=4, clocks_per_click=24, notated_32nd_notes_per_beat=8, time=0),
   MetaMessage('set_tempo', tempo=500000, time=0),
   MetaMessage('set_tempo', tempo=500521, time=0),
   MetaMessage('set_tempo', tempo=500000, time=0),
   MetaMessage('set_tempo', tempo=501567, time=480),
   MetaMessage('set_tempo', tempo=500000, time=0),
   MetaMessage('set_tempo', tempo=502618, time=480),
   MetaMessage('set_tempo', tempo=500000, time=0),
   MetaMessage('set_tempo', tempo=503672, time=480),
   MetaMessage('set_tempo', tempo=500000, time=0),
   MetaMessage('set_tempo', tempo=504732, time=480),
   MetaMessage('set_tempo', tempo=500000, time=0),
   MetaMessage('set_tempo', tempo=505795, time=480),
   MetaMessage('set_tempo', tempo=500000, time=0),
```

[ ]:

MetaMessage('set_tempo', tempo=mido.bpm2tempo(120))

임의로 set_tempo meta_data를 삽입한 mid

원본 mid



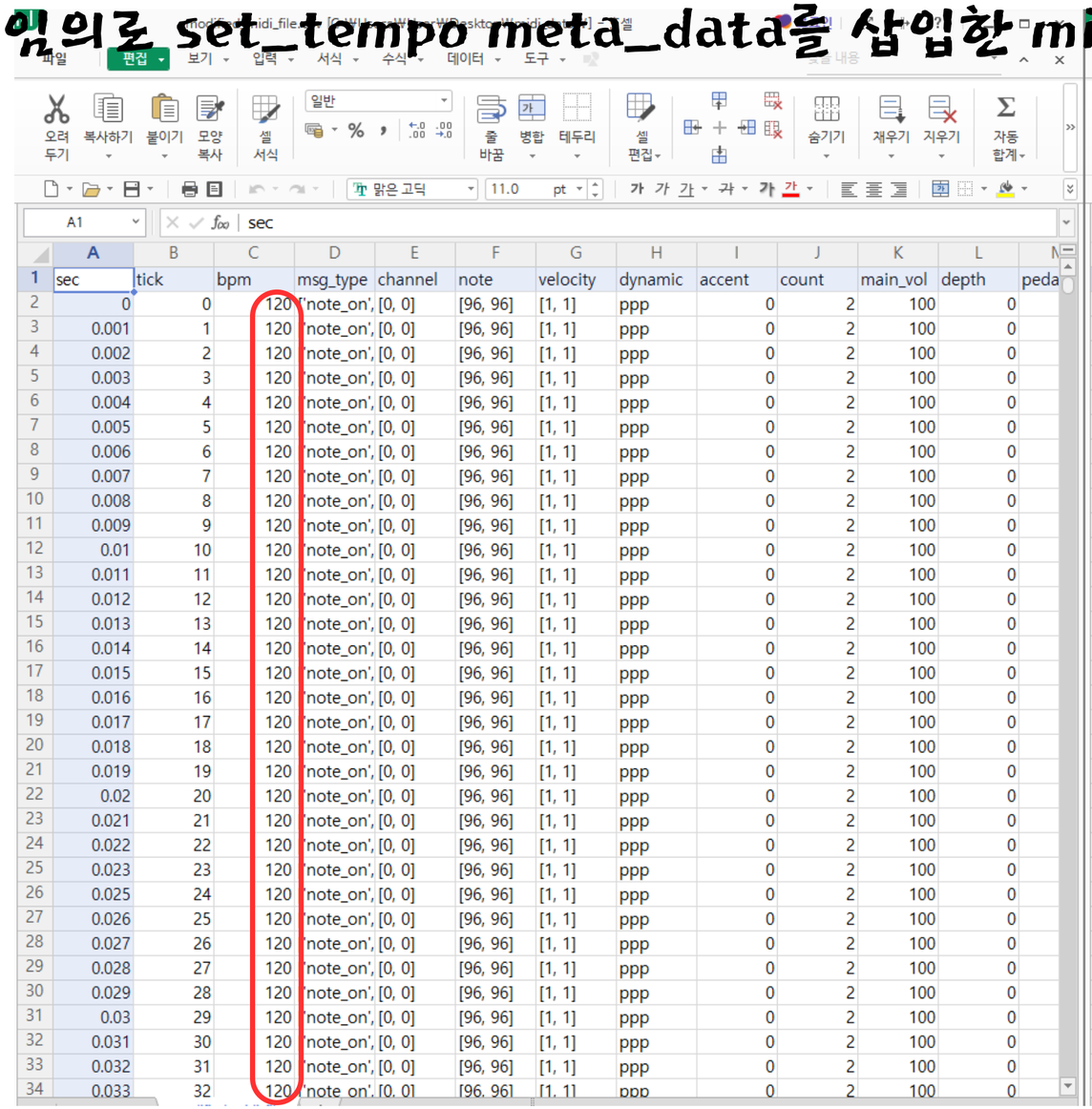
sec	tick	bpm	msg_type	channel	note	velocity	dynamic	accent	count	main_vol	depth	peda
0	0	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.001	1	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.002	2	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.003	3	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.004	4	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.005	5	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.006	6	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.007	7	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.008	8	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.009	9	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.01	10	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.011	11	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.012	12	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.013	13	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.014	14	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.015	15	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.016	16	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.017	17	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.018	18	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.019	19	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.02	20	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.021	21	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.022	22	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.023	23	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.025	24	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.026	25	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.027	26	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.028	27	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.029	28	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.03	29	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.031	30	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.032	31	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.033	32	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	

sec	tick	bpm	msg_type	channel	note	velocity	dynamic	accent	count	main_vol	depth	peda
0	0	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.001	1	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.002	2	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.003	3	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.004	4	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.005	5	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.006	6	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.007	7	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.008	8	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.009	9	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.01	10	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.011	11	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.012	12	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.013	13	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.014	14	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.015	15	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.016	16	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.017	17	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.018	18	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.019	19	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.02	20	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.021	21	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.022	22	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.023	23	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.025	24	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.026	25	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.027	26	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.028	27	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.029	28	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.03	29	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.031	30	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.032	31	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
0.033	32	119.87509	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	

확인 결과 행간 개수가 동일 + 임의로 mido 라이브러리를 사용해 넣어준 BPM 값이 변하는 것을 확인

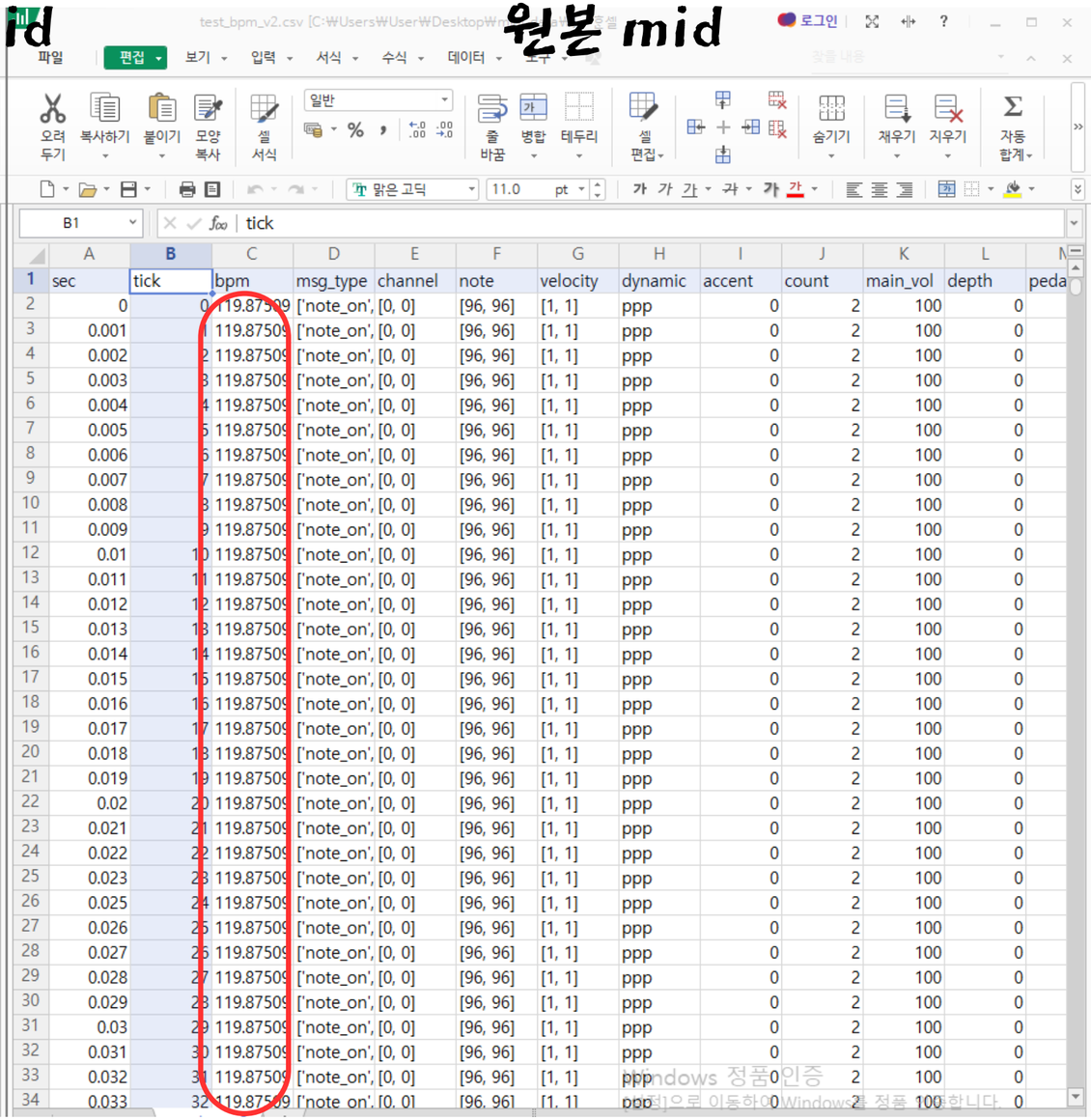
MetaMessage('set_tempo', tempo=mido.bpm2tempo(120), time=480)

임의로 set_tempo meta_data를 삽입한 mid



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	sec	tick	bpm	msg_type	channel	note	velocity	dynamic	accent	count	main_vol	depth	peda
2	0	0	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
3	0.001	1	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
4	0.002	2	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
5	0.003	3	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
6	0.004	4	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
7	0.005	5	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
8	0.006	6	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
9	0.007	7	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
10	0.008	8	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
11	0.009	9	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
12	0.01	10	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
13	0.011	11	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
14	0.012	12	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
15	0.013	13	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
16	0.014	14	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
17	0.015	15	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
18	0.016	16	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
19	0.017	17	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
20	0.018	18	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
21	0.019	19	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
22	0.02	20	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
23	0.021	21	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
24	0.022	22	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
25	0.023	23	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
26	0.025	24	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
27	0.026	25	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
28	0.027	26	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
29	0.028	27	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
30	0.029	28	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
31	0.03	29	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
32	0.031	30	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
33	0.032	31	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
34	0.033	32	120	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	

원본 mid



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	sec	tick	bpm	msg_type	channel	note	velocity	dynamic	accent	count	main_vol	depth	peda
2	0	0	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
3	0.001	1	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
4	0.002	2	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
5	0.003	3	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
6	0.004	4	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
7	0.005	5	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
8	0.006	6	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
9	0.007	7	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
10	0.008	8	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
11	0.009	9	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
12	0.01	10	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
13	0.011	11	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
14	0.012	12	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
15	0.013	13	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
16	0.014	14	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
17	0.015	15	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
18	0.016	16	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
19	0.017	17	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
20	0.018	18	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
21	0.019	19	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
22	0.02	20	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
23	0.021	21	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
24	0.022	22	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
25	0.023	23	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
26	0.025	24	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
27	0.026	25	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
28	0.027	26	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
29	0.028	27	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
30	0.029	28	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
31	0.03	29	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
32	0.031	30	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
33	0.032	31	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	
34	0.033	32	119.8750	'note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0	

다음 장 이어서

똑같은 부분에서 tempo의 값이 변경되었다.

92	1.552	1490	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1491	1.555	1489	119.62509	['r
93	1.553	1491	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1492	1.556	1490	119.62509	['r
94	1.554	1492	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1493	1.557	1491	119.62509	['r
95	1.555	1493	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1494	1.559	1492	119.62509	['r
96	1.556	1494	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1495	1.56	1493	119.62509	['r
97	1.557	1495	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1496	1.561	1494	119.62509	['r
98	1.558	1496	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1497	1.562	1495	119.62509	['r
99	1.559	1497	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1498	1.563	1496	119.62509	['r
00	1.56	1498	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1499	1.564	1497	119.62509	['r
01	1.561	1499	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1500	1.565	1498	119.62509	['r
02	1.562	1500	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1501	1.566	1499	119.62509	['r
03	1.563	1501	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1502	1.567	1500	119.62509	['r
04	1.564	1502	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1503	1.568	1501	119.62509	['r
05	1.565	1503	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0	1504	1.569	1502	119.62509	['r
06	1.568	1504	119.87509	['note_off']	[0]	[96]	[0]	ppp	0	1	0	0	**1505**	1.57	1503	119.62509	['r
07	1.569	1505	119.87509	['note_off',	[0, 0, 0]	[96, 92, 92	[0, 0, 0]	ppp	0	3	0	0	1506	1.578	1504	119.12514	['r
08	1.57	1506	119.87509	['note_off',	[0, 0, 0]	[96, 92, 92	[0, 0, 0]	ppp	0	3	0	0	1507	1.579	1505	119.12514	['r
09	1.571	1507	119.87509	['note_off',	[0, 0, 0]	[96, 92, 92	[0, 0, 0]	ppp	0	3	0	0	1508	1.58	1506	119.12514	['r
10	1.572	1508	119.87509	['note_off',	[0, 0, 0]	[96, 92, 92	[0, 0, 0]	ppp	0	3	0	0	1509	1.581	1507	119.12514	['r

	A	B	C	D	E	F	G	H	I	J	K	L
595	0.618	593	119.8750902	['note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0
596	0.618	594	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
597	0.619	595	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
598	0.62	596	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
599	0.621	597	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
600	0.622	598	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
601	0.623	599	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
602	0.625	600	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
603	0.626	601	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
604	0.627	602	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
605	0.628	603	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
606	0.629	604	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
607	0.63	605	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
608	0.631	606	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
609	0.632	607	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
610	0.633	608	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
611	0.634	609	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
612	0.635	610	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
613	0.636	611	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
614	0.637	612	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
615	0.638	613	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
616	0.639	614	120	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0

	A	B	C	D	E	F	G	H	I	J	K	L
592	0.615	590	119.8750902	['note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0
593	0.616	591	119.8750902	['note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0
594	0.617	592	119.8750902	['note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0
595	0.618	593	119.8750902	['note_on',	[0, 0]	[96, 96]	[1, 1]	ppp	0	2	100	0
596	0.62	594	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
597	0.621	595	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
598	0.622	596	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
599	0.623	597	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
600	0.624	598	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
601	0.625	599	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
602	0.626	600	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
603	0.628	601	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
604	0.629	602	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
605	0.63	603	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
606	0.631	604	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
607	0.632	605	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
608	0.633	606	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
609	0.634	607	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
610	0.635	608	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
611	0.636	609	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
612	0.637	610	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0
613	0.638	611	119.625095	['note_on']	[0]	[92]	[1]	ppp	0	1	0	0

행의 수는 변함이 없지만, set_tempo를 임의로 넣어주게 되면 기존의 set_tempo의 값이 밀려 사라지는 것을 확인함.

	A	B	C	D	E	F	G	H	I	J	K	L
34446	167.552	34444	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34447	167.557	34445	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34448	167.562	34446	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34449	167.567	34447	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34450	167.571	34448	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34451	167.576	34449	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34452	167.581	34450	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34453	167.586	34451	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34454	167.591	34452	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34455	167.596	34453	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34456	167.601	34454	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34457	167.605	34455	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34458	167.61	34456	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34459	167.615	34457	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34460	167.62	34458	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34461	167.625	34459	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34462	167.63	34460	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34463	167.635	34461	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34464	167.64	34462	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34465	167.644	34463	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34466	167.649	34464	25.6964267	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34467	167.654	34465	25.6964267	['note_off',	[0, 0, 0, 0,	[95, 95, 93	[0, 0, 0, 0,	ppp	0	8	0	0
34468												
34469												

	A	B	C	D	E	F	G	H	I	J	K	L
34446	191.387	34444	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34447	191.392	34445	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34448	191.398	34446	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34449	191.403	34447	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34450	191.409	34448	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34451	191.414	34449	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34452	191.42	34450	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34453	191.425	34451	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34454	191.431	34452	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34455	191.437	34453	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34456	191.442	34454	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34457	191.448	34455	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34458	191.453	34456	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34459	191.459	34457	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34460	191.464	34458	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34461	191.47	34459	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34462	191.475	34460	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34463	191.481	34461	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34464	191.487	34462	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34465	191.492	34463	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34466	191.498	34464	22.49630217	['note_on',	[0, 0]	[94, 94]	[7, 7]	ppp	0	2	0	0
34467	191.503	34465	22.49630217	['note_off',	[0, 0, 0, 0,	[95, 95, 93	[0, 0, 0, 0,	ppp	0	8	0	0
34468												
34469												

cubase 상 bpm의 값을 변경하면,

bpm = 120 , tempo = 500000
tick의 개수 = 2295, sec = 2.391
1tick 당 0.001 초

bpm = 120, tempo = 500000
tick 4803 - 4405 = 398 , sec: 5.003 - 4.588 = 0.445
1tick 당 0.001 초

bpm = 27.613, tempo = 2172817
tick 34164- 33606 = 558 , sec = 154.65 - 152.124 = 2.562

1tick 당 0.00459 초

따라서 곡의 길이가 길어 짐.

구간 bpm 설정을 통해서 구간별 1tick당 초가 변경되는 것을 확인함. 이에 데이터를 추출할 때 tempo를 미리 설정해 원하는 구간의 속도(곡의 빠르기)를 미리 설정 해주어야함.

결론 - 곡의 빠르기

midi 데이터에 mido 라이브러리로 MetaMessage 클래스를 이용해서 set_tempo를 넣어줄 수 있다.
-> 이 방법을 통해 원본 데이터와 인풋 데이터의 구간 별 tempo를 맞춰줄 수 있다.

- CUBASE로도 tempo_tracker를 이용해 사전에 맞춰서 연주하면 정답 데이터와 INPUT 데이터의 tempo를 맞춰줄 수 있다. (빠르기 동일하게 맞출 수 있음)
- 따라서 곡 연주자는 tempo가 미리 설정된 midi 파일에 대해 연주를 해야만 한다. (따로 평가 해줄 것이 없어 보임.)

결론 - 곡의 빠르기의 변화

이 또한 곡의 빠르기를 미리 설정을 해주므로, 원본 데이터와 INPUT 데이터의 BPM 부분이 같을 수 밖에 없으므로 변화 구간도 마찬가지로 정확히 일치할 수 밖에 없으므로, 평가 할 수가 없어보임.

	A	B	C	D	E
31	6.577	6229	118.3751822	['note_off',	[0, 0]
32	6.578	6230	118.3751822	'note_off',	[0, 0]
33	6.579	6231	118.3751822	'note_off',	[0, 0]
34	6.58	6232	118.3751822	'note_off',	[0, 0]
35	6.581	6233	118.3751822	'note_off',	[0, 0]
36	6.582	6234	118.3751822	'note_off',	[0, 0]
37	6.583	6235	118.3751822	'note_off',	[0, 0]
38	6.584	6236	118.3751822	'note_off',	[0, 0]
39	6.586	6237	118.3751822	'note_off',	[0, 0]
40	6.587	6238	118.3751822	'note_off',	[0, 0]
41	6.588	6239	118.3751822	'note_off',	[0, 0]
42	6.589	6240	118.3751822	'note_off',	[0, 0]
43	6.59	6241	118.3751822	'note_off',	[0, 0]
44	6.591	6242	118.3751822	'note_off',	[0, 0]
45	6.592	6243	118.3751822	'note_off',	[0, 0]
46	6.593	6244	118.3751822	'note_off',	[0, 0]
47	6.594	6245	118.3751822	'note_off',	[0, 0]
48	6.595	6246	118.3751822	'note_off',	[0, 0]
49	6.507	6247	120	'note_off',	[0, 0]
50	6.508	6248	120	'note_off',	[0, 0]
51	6.509	6249	120	'note_off',	[0, 0]
52	6.51	6250	120	'note_off',	[0, 0]
53	6.511	6251	120	'note_off',	[0, 0]
54	6.512	6252	120	'note_off',	[0, 0]
55	6.513	6253	120	'note_off',	[0, 0]
56	6.514	6254	120	'note_off',	[0, 0]
57	6.515	6255	120	'note_off',	[0, 0]
58	6.516	6256	120	'note_off',	[0, 0]
59	6.517	6257	120	['note_off',	[0, 0]
60	6.518	6258	120	['note_off',	[0, 0]
61	6.519	6259	120	['note_off',	[0, 0]
62	6.52	6260	120	['note_off',	[0, 0]