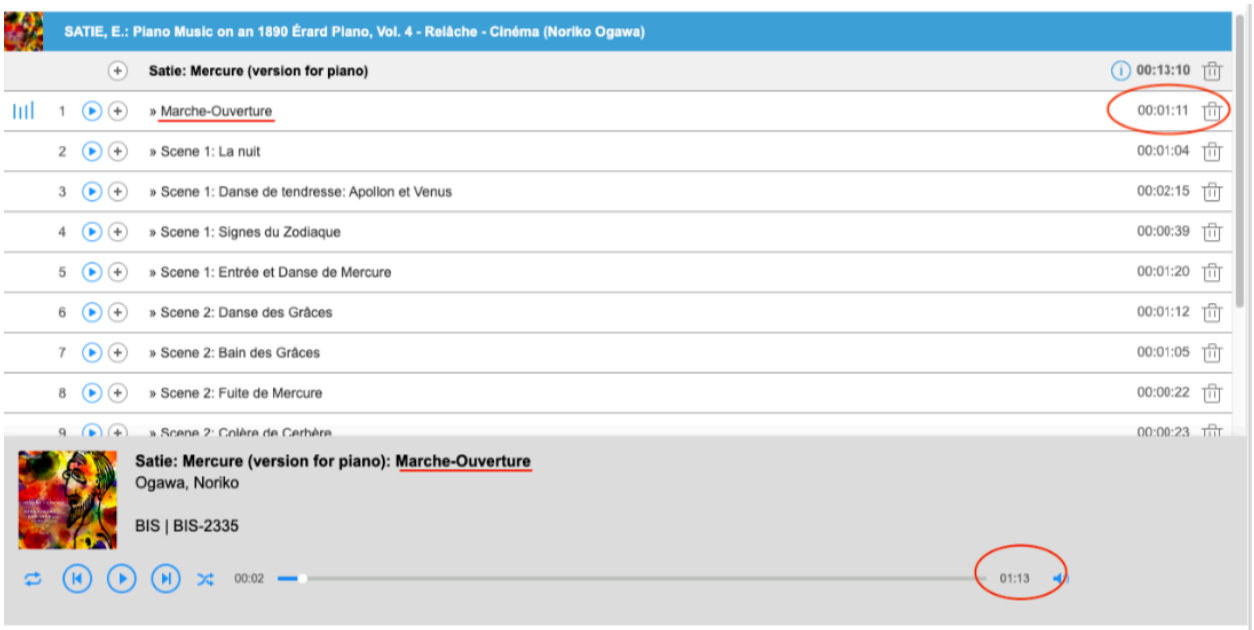
Protocol for Naxos Tempo Calculations

In the following cases, naxos tempo calculations made based on master metadata spreadsheet information were not accurate enough for audio generation:

- **Inaccurate timing information:**
- *In these cases, the calculated tempo is inaccurate, and a more precise tempo measurement is preferable for both audio generation and data analysis purposes*\.
    - The audio example length as calculated in the master spreadsheet is determined by subtracting the start time from the end time. As both of these numbers are only displayed in the Naxos player to the nearest second, rounding or truncation errors can occur on both ends. The actual extracted audio example doesn't start and end at those exact timestamps, but rather starts and ends at the precise moment in the music that the example does, and can therefore be up to several seconds longer or shorter than the length indicated on the master spreadsheet (T193 and 200 for example).
    - For longer examples, this is usually not an issue, even when it does occur, but this can lead to calculated tempos for very short examples being significantly different than the actual tempo on the naxos recording.
    - As I was rendering audio, I determined examples with inaccurate tempo by ear, by comparing the playback of the sibelius audio with the initial calculated tempo to the naxos audio. In cases where the tempo was noticeably different I calculated a more accurate tempo. In most cases I simply used a metronome and tapped the tempo in the naxos audio, this is not precisely accurate, but is significantly closer than the calculated tempo.
        - A more precise calculation could easily be achieved by calculating the tempo based not on the calculated length of the naxos audio, but by using the actual length of the audio file down to tenths of a second. To get this more accurate timing information, the naxos audio file would need to be opened in an audio editor such as audacity.
        - This tempo could instead be made more accurate by calculating a tempo based on a much longer sample of the audio on naxos, i.e. determine the length and number of beats in a larger (maybe 15 seconds or more) portion of the naxos audio including the example
    - This inaccurate timing also pertains to SWFU durations, as timing information included on the main track list is not always accurate to the actual duration of the track as shown in the player. (see image below for an example)



- **Tempo changes:**
- *In these cases, the information needed for audio generation and the information needed for computational analysis may not be the same.*
    - The calculated tempo is by definition an average tempo over the duration of the example. If an example contains tempo changes, this average tempo will not accurately represent the tempo of the example, and cannot be used for audio generation. This average tempo may be preferable for computational analysis, however.
    - In most cases, this presents as an example with a ritardando or accel at the end of the example. The tempo can simply be calculated by using the length in seconds and number of beats contained in the portion of the example where the tempo is static (although if this portion is too small, issues can arise similar to very short examples, as above)
    - For examples with multiple distinct tempos, I calculated each one individually based on length and beats of just that portion. (I believe all such examples had metronome information in the score, however) *The tempo listed in the audio spreadsheet is always the tempo used at the very start of the example.*
    - In cases where a gradual tempo change occurs for the entire example, I approximated the tempo at the beginning of the example and at the end of the example by tapping a metronome, and then used these as start and end points of an accel/rit in sibelius. *The tempo listed in the audio spreadsheet is always the tempo used at the very start of the example*. Unless the exact rate of tempo change is somehow determined, I don't know of a way to accurately calculate tempo in these cases.
    - In a few cases, the tempo has many fluctuations, but if I recall correctly these all contained metronome markings in the score. When this was simply rubato, as in many Debussey examples, I simply used the average tempo throughout.