

Bisecting Beat Speed Windows  
Temperament Sequences  
using Aurally Measured Inharmonicity

designed by

Mark Cerisano, RPT, B.Sc.(Mech.Eng.), Dip.Ed.(Music)

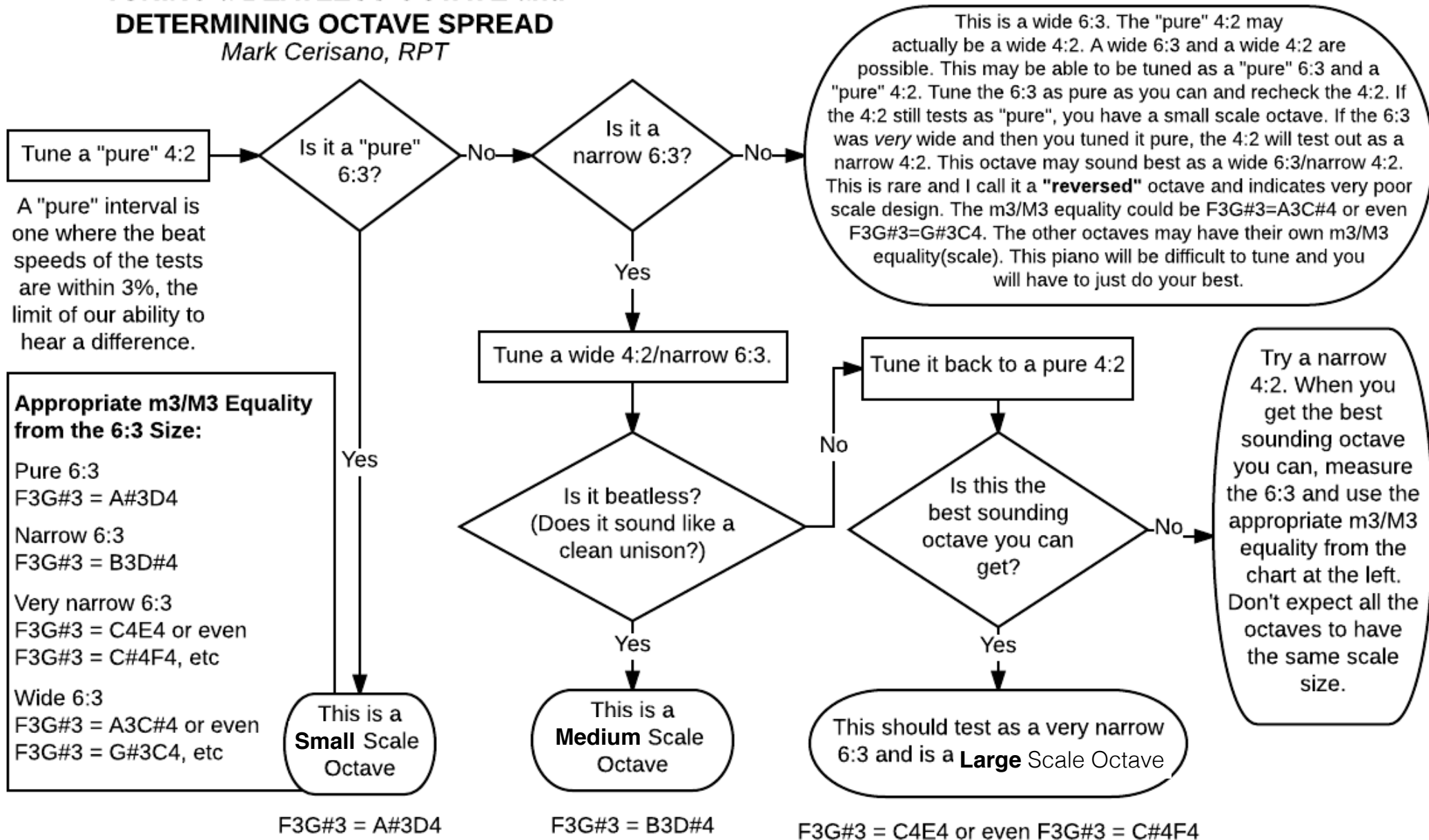
August 6, 2015

514-978-8637 ext 002

# Use this flow chart to tune A3A4 and F3F4 and measure the inharmonicity of the piano.

## TUNING a BEATLESS OCTAVE and DETERMINING OCTAVE SPREAD

Mark Cerisano, RPT



# COMMON START

Tune	From	Test	Beating Partials
A4	Fork	$F2A4 = F2Fork$	A4
A3	A4	Use Octave Flow Chart	A5,E6
F3	A3	$F3A3 \cong 7bps$	A5
F4	F3	Use Octave Flow Chart	F5,C6
<b>SKELETON (F3, A3, C#4, F4, A4)</b>			
<b>LOWER SKELETON</b>			
C#4	F3,A3,C#4,F4	F3A3,A3C#4,C#4F4 all change smoothly <i>slow/med/fast, fast/med/slow, or med/med/med</i> There is only one possible outcome based on F3	A5,C#6,F6
<b>UPPER SKELETON</b>			
F4	A3,C#4,F4,A4	$A3C\#4 < C\#4F4 < F4A4$	C#6,F6,A6
<b>FINISH SKELETON</b>			
F3	F4	Use Octave Flow Chart	F5,C6
<b>CHECK SKELETON</b>			
$F3A3 < A3C\#4 < C\#4F4 < F4A4$			A5,C#6,F6,A6
D4	$F3A3 < A3C\#4$	$F3A3 < F3\mathbf{D4} < A3C\#4$	A5,A5,C#6

Now use the proper following sequence to tune F#3A#3.  
The correct scaling for your piano was found when you tuned a3a4 and f3f4.

## Small Octave Scale

Tune	From	Test	Beating Partial
<b>F#3</b>	A3C#4<C#4F4	A3C#4< <b>F#3</b> A3<C#4F4	C#6,C#6,F6
<b>A#3</b>	C#4F4<F4A4	C#4F4< <b>A#3</b> C#4<F4A4	F6,F6,A6
<b>Check</b>	F3A3<F#3A#3<F3D4		A5,A#5,A5
<b>Check</b>	A3C#4<A#3D4<F#3A3		C#6,D6,C#6
<b>Check</b>	F3A3<F3D4<A3C#4<F#3A3<C#4F4<A#3C#4<F4A4		A5,A5,C#6,C#6,F6,F6,A6

*Now, go to the “Finish It Up” sequence.*

# Medium Octave Scale

Tune	From	Test	Beating Partial
<b>G#3</b>	A3C#4<C#4F4	A3C#4<F3 <b>G#3</b> <C#4F4	C#6, C6, F6
<b>C4</b>	C#4F4<F4A4	C#4F4<A3 <b>C4</b> <F4A4	F6, E6, A6
<b>Check</b>	F3D4<G#3C4<A3C#4		A5, C6, C#6
<b>A#3</b>	A3C#4<F3G#3	A3C#4< <b>A#3</b> D4<F3G#3	C#6, D6, C6
<b>F#3</b>	F3A3<F3D4	F3A3< <b>F#3</b> A#3<F3D4	A5, A#5, A5
<b>Check</b>	F3A3<F#3A#3<F3D4		A5, A#5, A5
<b>Check</b>	A3C#4<A#3D4<F3G#3		C#6, D6, C6
<b>Check</b>	F3A3<F#3A#3<F3D4<G#3C4<A3C#4<A#3D4<F3G#3<F#3A3<C#4F4<C4A4<A3C4<A#3C#4<F4A4		
<b>Beating</b>	A5, A#5, A5, C6, C#6, D6, C6, C#6, F6, E6, E6, F6, A6		

*Now, go to the "Finish It Up" sequence.*

# Large Octave Scale

Tune	From	Test	Beating Partial
<b>F#3</b>	C#4F4	<b>F#3</b> A3=C#4F4	C#6, F6
<b>A#3</b>	F4A4	<b>A#3</b> C#4=F4A4	F6, F6, A6
<b>Check</b>	F3A3<F#3A#3<F3D4		A5, A#5, A5

*Now, go to the “Finish It Up” sequence.*

# Finish It Up

Tune	From	Test	Beating Partial
<b>D#4</b>	F#3A#3<A#3D4	F#3A#3<F#3 <b>D#4</b> <A#3D4	A#5,A#5,D6
<b>B3</b>	A3C#4<C#4F4	A3C#4< <b>B3</b> D#4<C#4F4	C#6,D#6,F6
<b>G3</b>	F3A3<A3C#4	F3A3< <b>G3</b> B3<A3C#4	A5,B5,C#6
<b>Check</b>	F3A3<G3B3<A3C#4<B3D#4<C#4F4		A5,B5,C#6,D#6,F6
<b>E4</b>	G3B3<B3D#4	G3B3<G3 <b>E4</b> <B3D#4	B5,B5,D#6
	Next two steps not needed for medium octave sequence		
<b>C4</b>	B3D#4<C#4F4	B3D#4< <b>C4</b> E4<C#4F4	D#6,E6,F6
<b>G#3</b>	G3B3<A3C#4	G3B3< <b>G#3</b> C4<A3C#4	B5,C6,C#6

# Temperament Refinement

*Now that the temperament sequence is finished, check the M3 and the P4.*

Chromatic M3:

$F_3A_3 < F\#_3A\#_3 < G_3B_3 < G\#_3C_4 < A_3C\#_4 < A\#_3D_4 < B_3D\#_4 < C_4E_4 < C\#_4F_4$

Chromatic P4:

$F\#_3A\#_3 = F\#_3B_3 = G_3C_4 = G\#_3C\#_4 = A_3D_4 = A\#_3D\#_4 = B_3E_4 = C_4F_4 = 1\text{bps}$

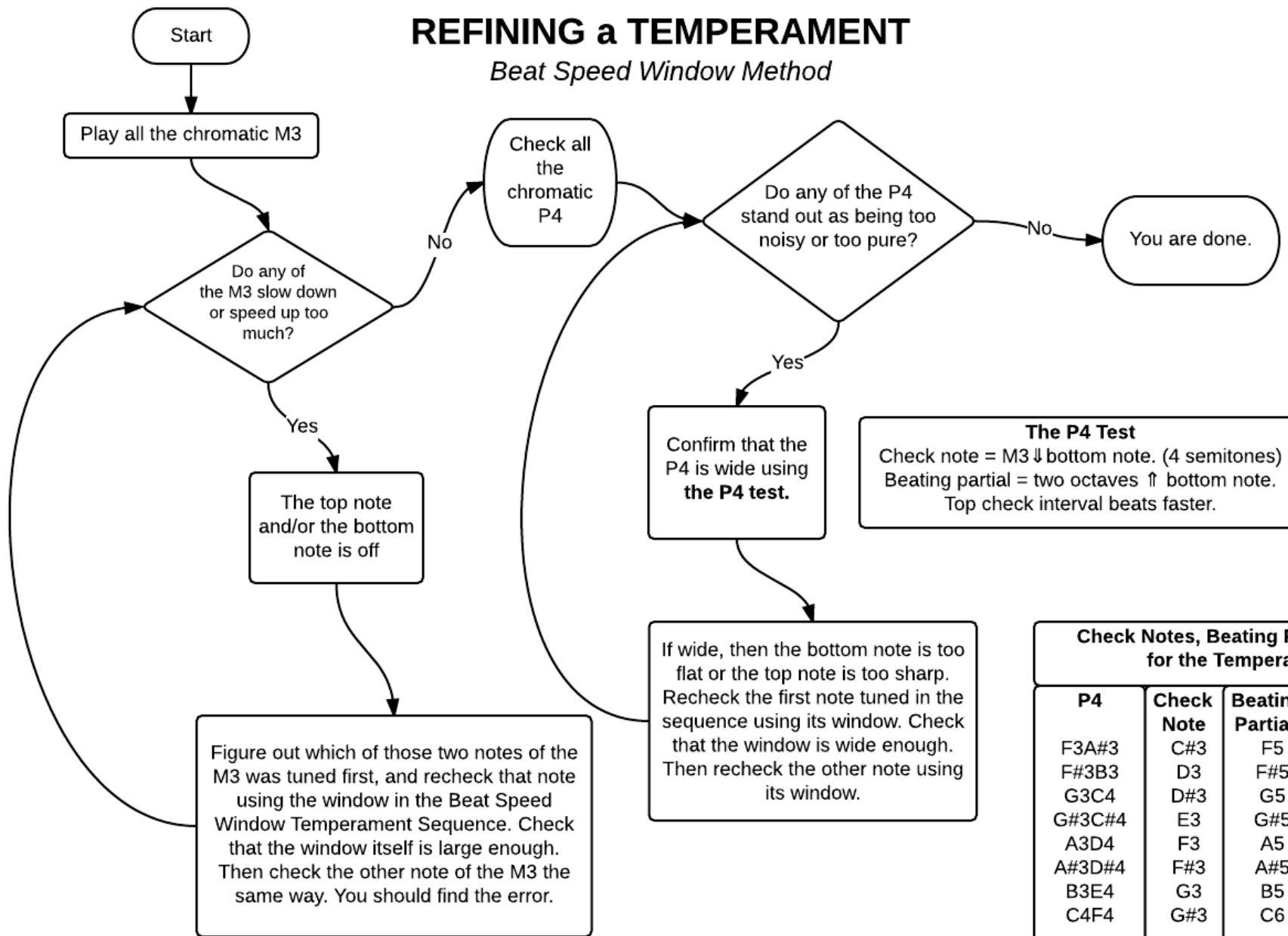
*Here we are not looking for exactly 1 bps, but rather, trying to find P4 that stand out; are not close enough to 1bps.*

*You can use the flow chart on the next page*



# REFINING a TEMPERAMENT

## Beat Speed Window Method



Check Notes, Beating Partial, and Tests for the Temperament P4's			
P4	Check Note	Beating Partial	P4 Test
F#3A#3	C#3	F5	C#3F3 < C#3A#3
F#3B3	D3	F#5	D3F#3 < D3B3
G3C4	D#3	G5	D#3G3 < D#3C4
G#3C#4	E3	G#5	E3G#3 < E3C#4
A3D4	F3	A5	F3A3 < F3D4
A#3D#4	F#3	A#5	F#3A#3 < F#3D#4
B3E4	G3	B5	G3B3 < G3E4
C4F4	G#3	C6	G#3C4 < G#3F4