going from a UK standard 220K pot to a US standard 250K pot doesn't help.

What you need to do is protect both Q2 and Q3 from getting destructively reverse biased by adding diodes from the emitter to the base of both of these parts (the bar of the diode will be proximal to the base for the MPSA42, and will be proximal to the emitter for the MPSA92).

The second issue was a problem with HF oscillation in the tracking circuit. The cure for this, sugested by Merlin, is to add a 220pF cap from base to collector of the NPN pass device in the tracker

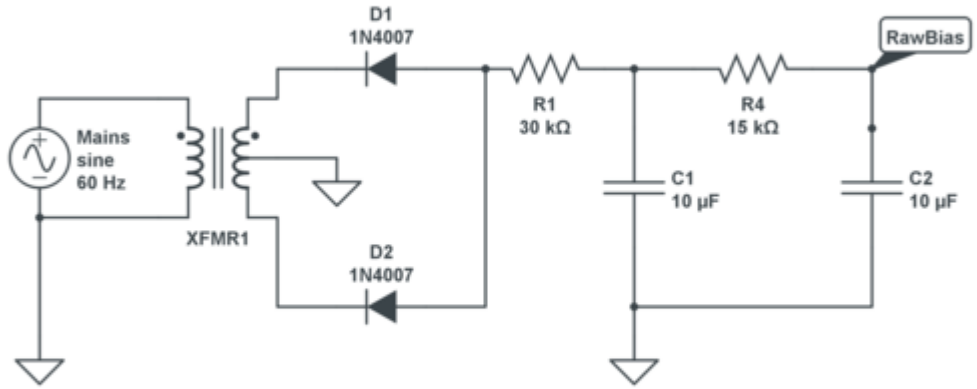
Oh. I'm virtually certain that the output impedance of that raw bias supply is simply way too high. You see, the tracking regulator is going to require something like 4 or maybe even 5 mA of current (2 or 2.5 mA through each of the two dividers), and if you try and pull that current through that 220K resistor, you just aren't going to have any negative voltage left.

So, you're going to need to reduce that 220K resistor to something like 33K or so (some fooling around will be required, but it needs to be much smaller). Now, the problem is that you could possibly run into voltage rating issues on those 10uF caps.. I'd go for at least 160V rated parts, though 100V might work in a pinch.

Given the higher than usual current requirement, I strongly advise changing the rectifier to a full-wave rather than just a half-wave.. you need only add one more diode feeding off the other leg of the transformer, so it's an easy patch.

Once you get it sorted out, you might even consider using a carefully chosen Zener in parallel with the first 10uF cap to ensure that the voltage is always clamped to something reasonable for the caps.

Also, make sure to ditch the 47K/25K bias adjust resistor/pot, you don't need those any more.



From the simulation it looks like this will give me just over 4 mA current @ -33V. I'll use my 1W 10K resistors, which I have plenty of, and like you suggested I'll need to acquire some higher rated 10uF caps as the voltage on C1 is a little too close to 100V for comfort.

I think there's still a bit of confusion here we need to clear up. It looks to me like you've added the 8.2K resistor in order to ensure that about 4 or so mA of current will be sunk through the 30K resistance (note that since this is a negative supply the rectifier is essentially the sink instead of the source). But you don't need that resistance!! We are not really trying to "provide" current instead of voltage.

To understand what's going on, look for a moment at the first divider in the tracking regulator. You see that at the top, it's seeing something like (say) 420V. But the base of Q1 is held at ground. This means that the emitters of Q1 & Q2 have to be nearly at ground (about 0.7V higher, corresponding to one diode drop from the emitter to base). By Ohm, this tells us immediately that 420V/300Kohm = 1.4 mA of current is flowing down that divider. Now, a tiny bit of that current normally is flows out the base, but almost all of it (this is a transistor after all), will flow from emitter to collector (of Q2 in normal operation). We can make a similar argument for the other divider (in fact, the tracking regulator will, to a first approximation, effectively equalize the current through these two).

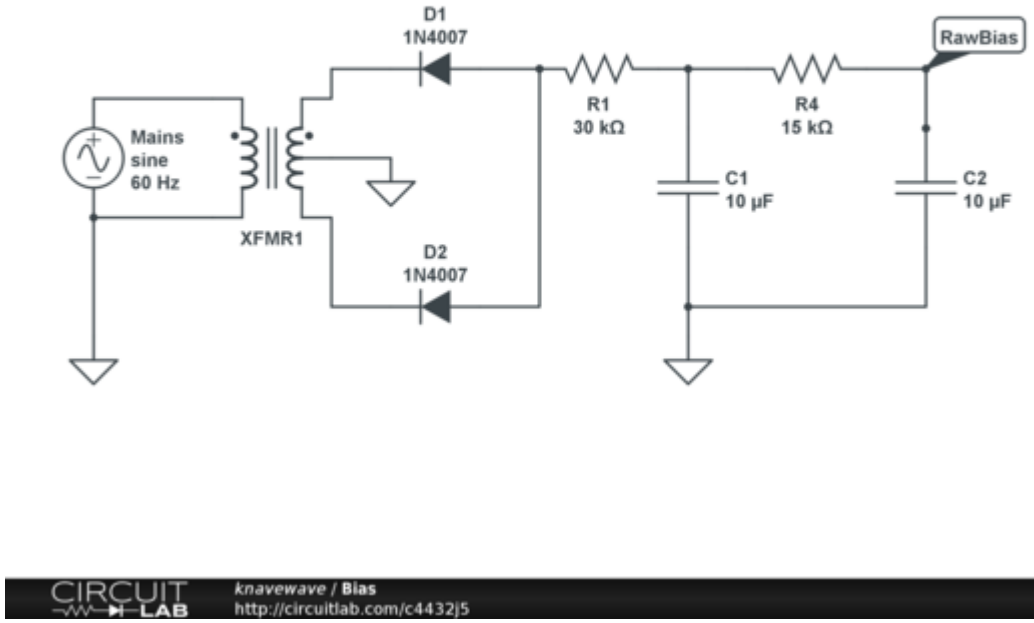
Now, that current has to go *somewhere*. But it's obviously not through the tube grids. So the only path is out through the rectifier. That is, the current from the divider has to be sunk by the 30K resistor.

Now perhaps you see the problem we had before with the original 220K resistor. Imagine that we *tried* to sink 3mA through 220K (this won't actually happen in this circuit, most but imagine). The ohmic principle again demands that there be a voltage differential across the resistor -- since we are sinking current, higher on the regulator side than on the rectifier side. 3mA through 220K would correspond to a differential of 660V, which greatly exceeds our available negative voltage!

In reality can't pull it higher than ground however. So the negative voltage we started with from the regulator would be pulled all the way up to something close to ground, and the actual amount of current flowing through the resistor would level out at whatever amount maintained this situation. In this very abnormal mode of operation, most of the current from the dividers would have no choice but to flow out of the base of Q1, and through D1. This is what you saw -- we had no negative bias voltage left to work with.

However, with a lower resistance, we can successfully sink the divider current without losing too much of our negative voltage across that resistor. Does this make sense now?

Incidentally, looking at your situation a bit more carefully, it seems like 30K is unnecessarily low. I think in your case 56K or so should about do it, and this would be a more friendly value for your 10uF/100V caps. Anyway, I'd give that a try, and then lower it if you can't get a sufficiently negative value. When you get things going, I'd also consider messing R8, probably increasing it's value. There's no point in having available settings on the bias adjust pot that will be so hot that it would burn up any tube. You want to have enough range to accomodate the full spectrum of tubes you might encounter, but I like to adjust the range of control on these things so that you can't get yourself into *too* much trouble.



The new raw bias circuit looks OK, but with one proviso. With the circuit exactly the way that it's drawn there, everything will be OK with the filtering capacitors so long as this supply is sinking current as it should. But imagine that something goes wrong with the tracking circuit and there is effectively no current drawn through your 30K R1. With no current, there would be no voltage increase across RA, and as a the voltage across the filter capacitors will become extremely negative (like -400V) and they would doubtless self destruct. Now, I'm not suggesting exactly that this has happened, just that if you are having trouble elsewhere with the regulator (or even if you just disconnected this bias supply from the tracker for testing without first modifying it!), bad things could potentially happen to these caps. This is one of the reasons why in an earlier post, I mentioned putting a Zener (100V, say) parallel to one of the filter caps in order to keep the voltage clamped to something safe.

As to the other issues relating to observed voltages, it's difficult for me to speculate, except to say that D1 is critical for keeping Q2 safe. If D1 is installed in the wrong orientation or not functional, Q2 will die during startup. While the indicated 1N4148 should be fine, if you are nervous, you can use a beefier rectifier diode.

Ah, no wonder. Those PNP parts only have max Vce(Vce0) of 100V.

Unfortunately, this value will be very easy to exceed unless you are exceedingly careful. In my build, I used MPSA92 transistors, which have a Vceo of 300V.

The problem is that with an un-clamped raw -Ve supply that can go lower than -100V, the collector to emitter voltage will often exceed that. Remember, the emitter on Q1 these is stuck at one diode rise above ground, while the collectors will go down pretty much to the raw negative supply. Note also that the voltage differential from collector to emitter will get larger also as the VVR is turned down, which is why it might survive at one setting, but zorch as you fool with the knob.

If you clamp the raw supply with a Zener to something just a bit higher than -100V as I recommended before, you can (barely) get away with using those parts, but I don't recommend it. I suggest you BOTH clamp the raw supply AND get some appropriately rated parts, such as MPSA92. While you're at it, you might as well put in an MPSA42 for the NPN pass device.

I think fixing this will resolve your troubles.

That was it!!! I'm getting a nice negative BIAS, which appears to be tracking with the regulator correctly. Now its time to get those zeners ordered.

Many many thanks!!!