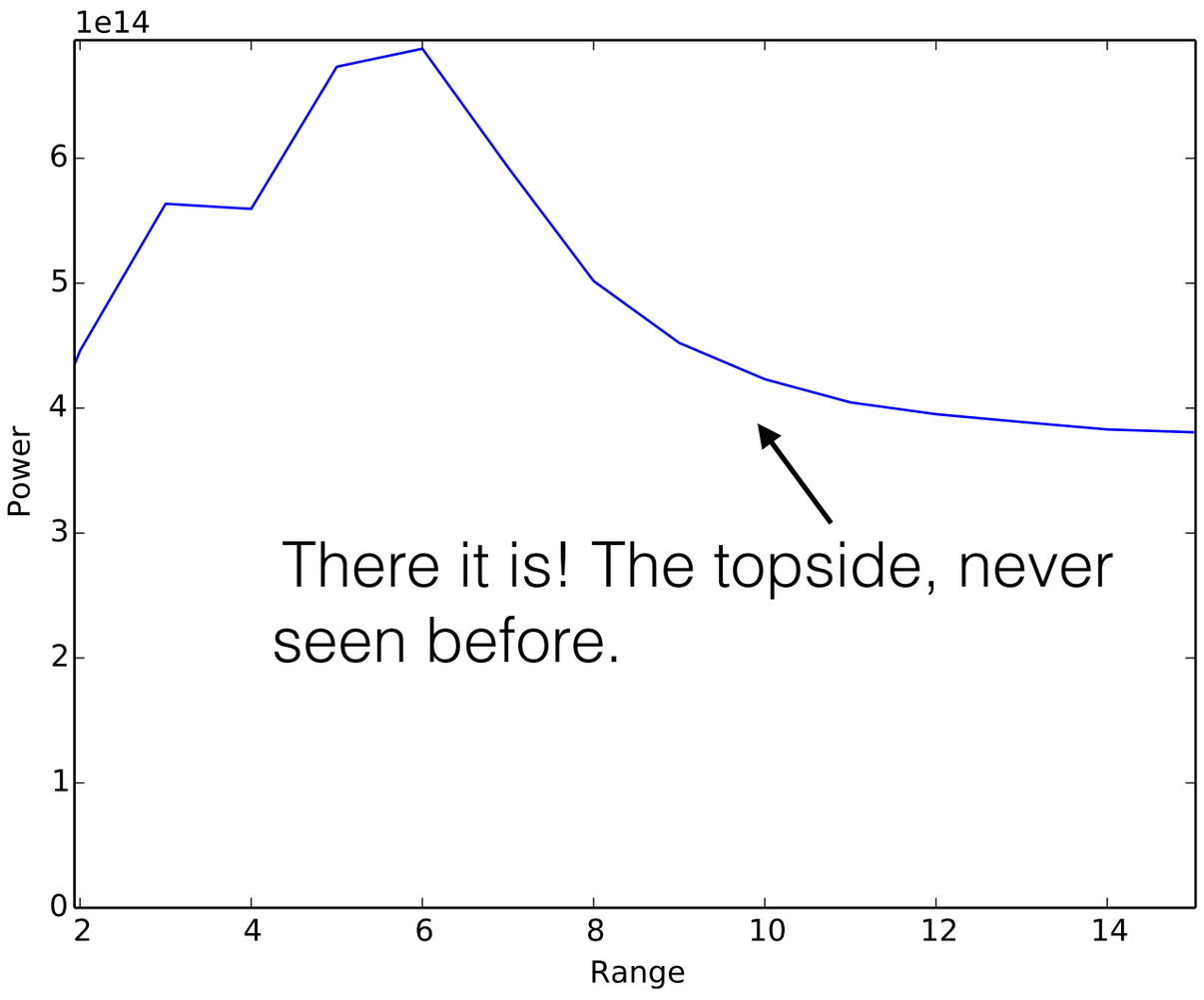
Ionosphere Radar Examples

And the questions that arise

1. Power profile (related to electron density)
2. ion line spectra (temperatures, composition, etc.
3. Plasma Line (very accurate plasma frequency measurements for various purposes.

An imaginary power profile: As Bill Gordon might have seen according to his original expectations

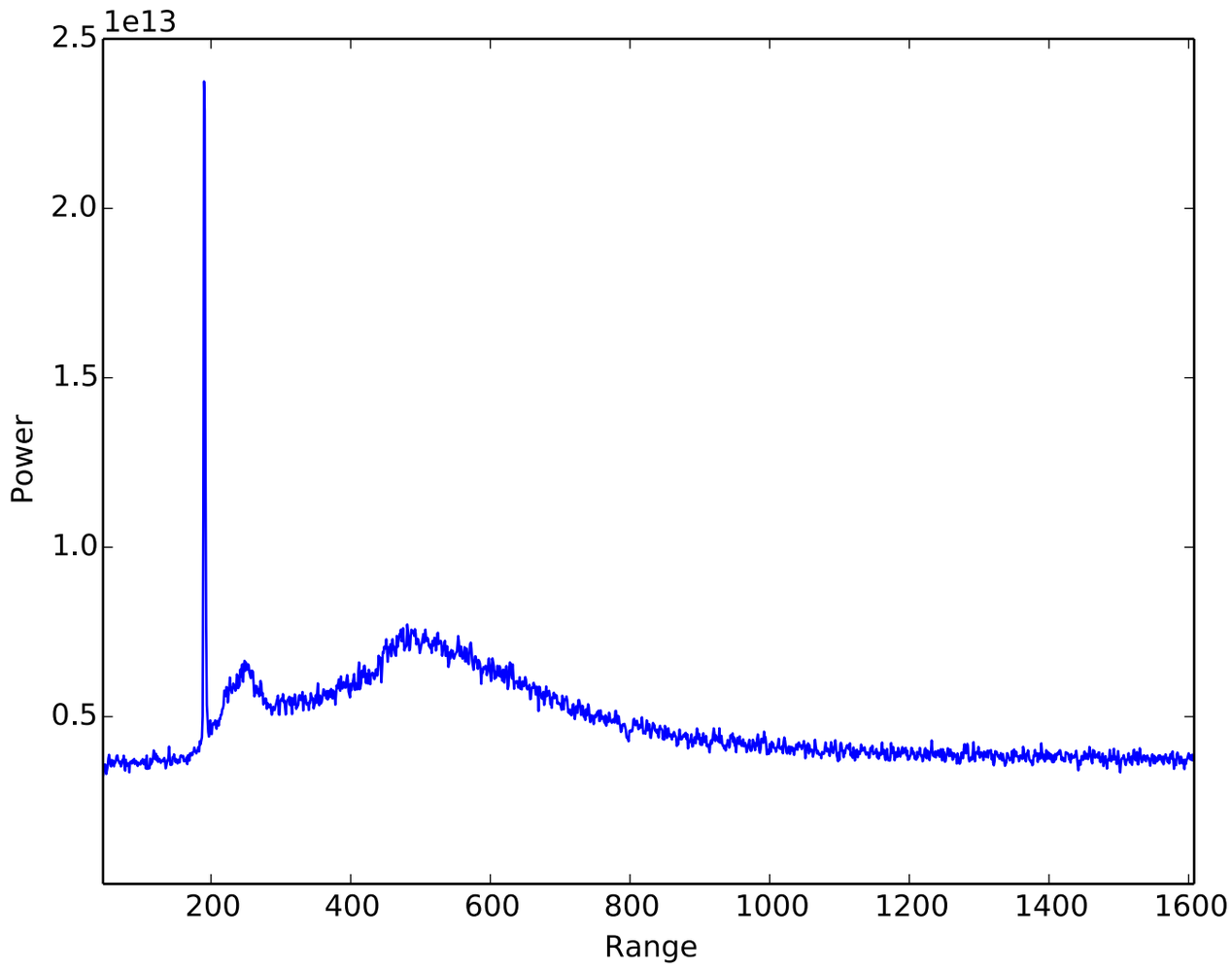


Bill initially expected return from a gas of electrons, not a plasma. The bandwidth would have been about 1 MHz, not 10 KHz. It would have looked something like the plot to the left.

Question: How would do you replace the arbitrary numbers on the range scale with actual range?

More advanced question for later in the week:
How would the radar technique in the imaginary profile differ from what is used with actual profiles?

The actual profile that was degraded to make the one in the previous slide

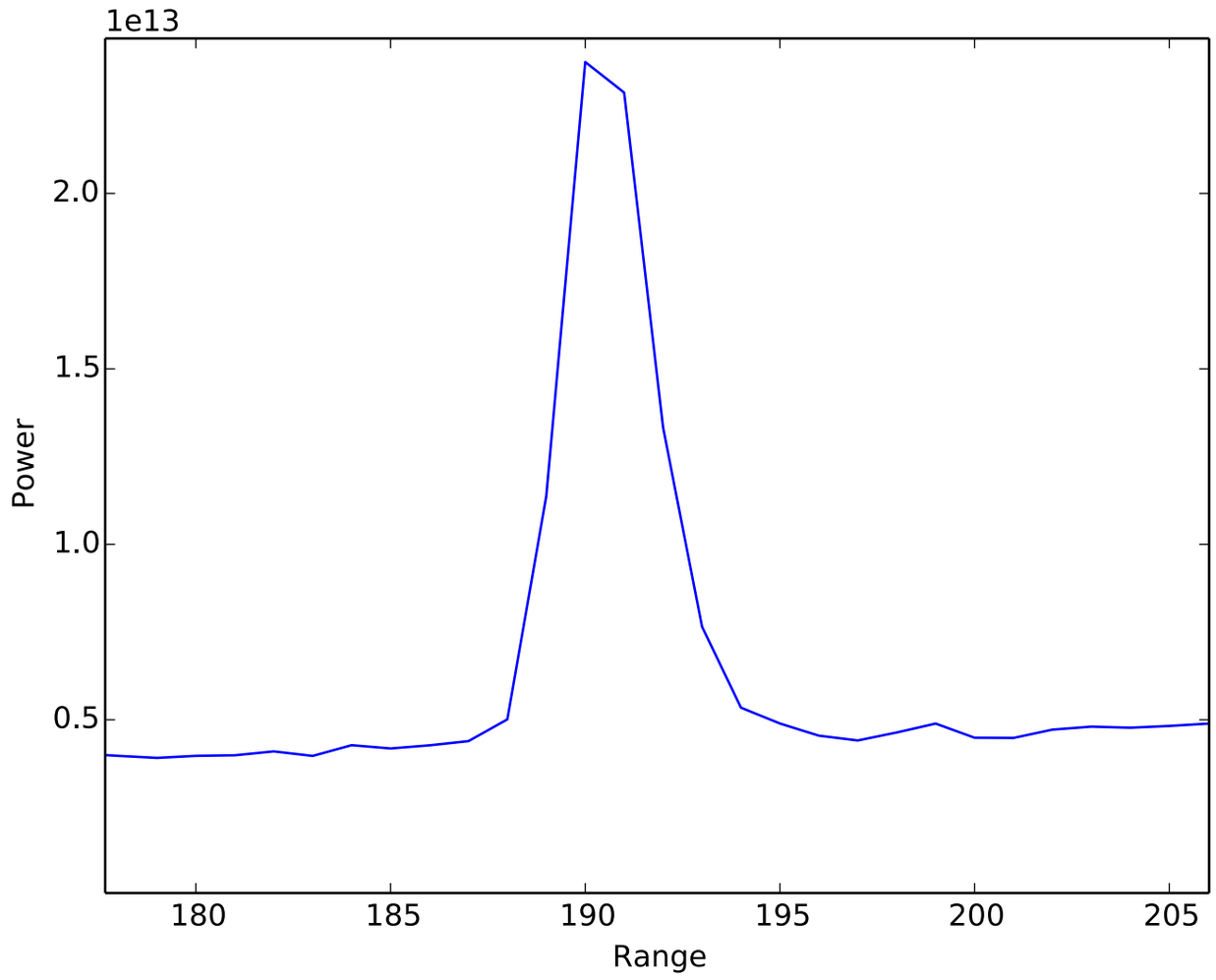


How would you turn this raw power profile into electron density?

What is that narrow spike? Is it from the ionosphere or might it be a ship on the ocean? Hint: it is apparently located in the E region.

More advanced question: How can you keep the average power reasonably high, but still get good range resolution?

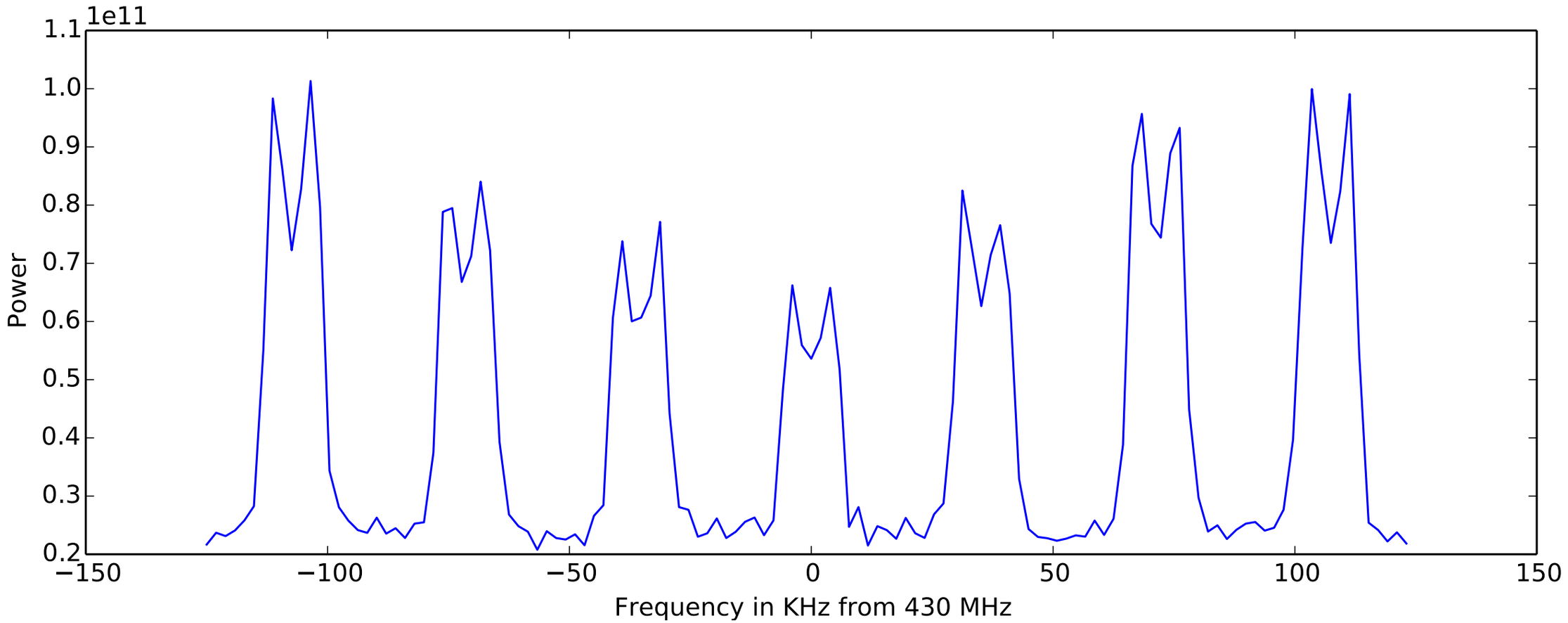
A blow up of the spike



If the effective radar pulse width is 600m and the samples occur every 300m, what is the half power width of the target? Hint: what would you see if the target was much narrower than the pulse?

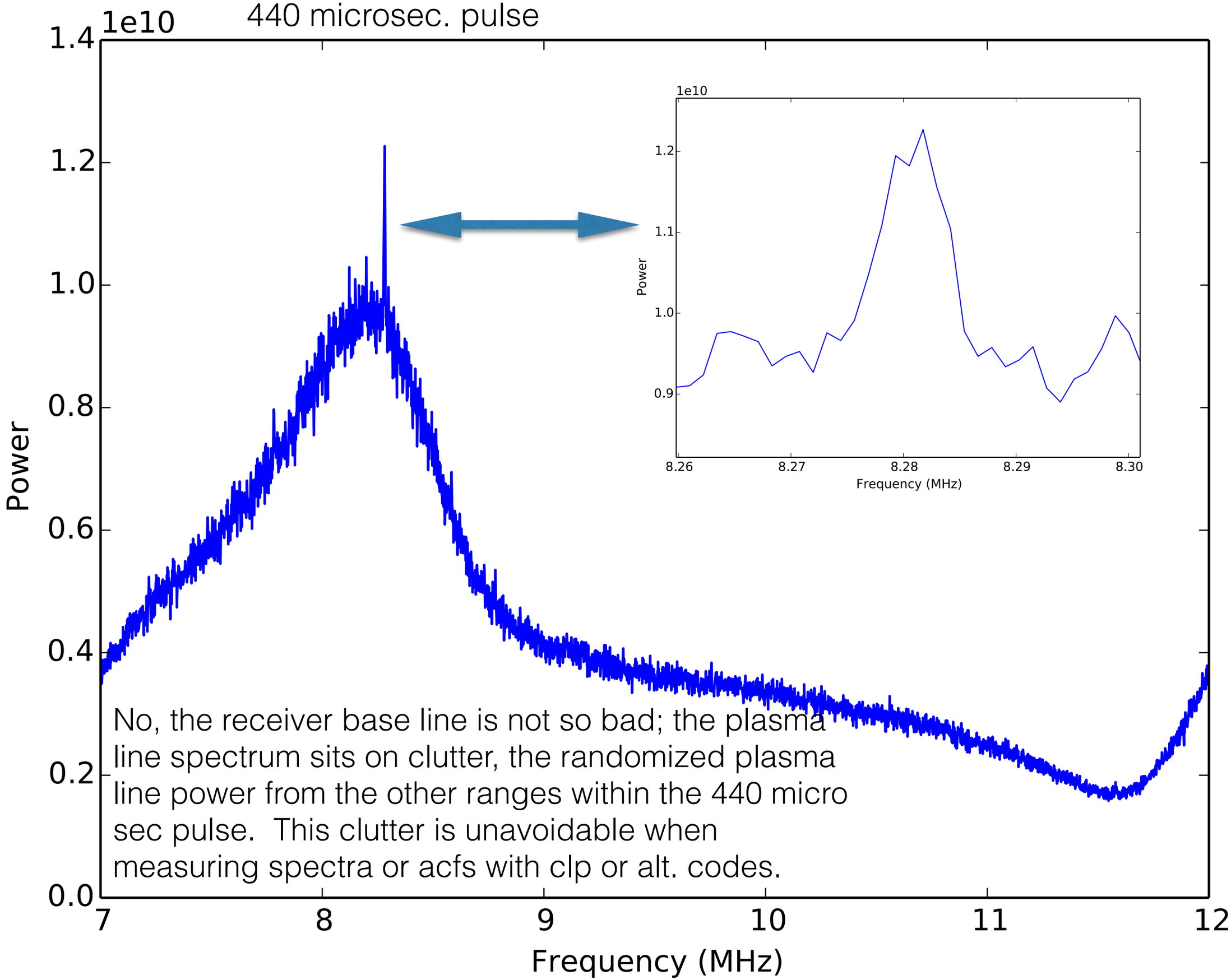
More advanced question:
Could you get a better estimate of the target width by modeling the measurement process and using an inversion technique? How would you plan the measurement so that you could do this?

F region ion line spectra from a height near the peak



Seven frequencies are transmitted near 430 MHz. What are the advantages of doing this when the signal to noise ratio is good?

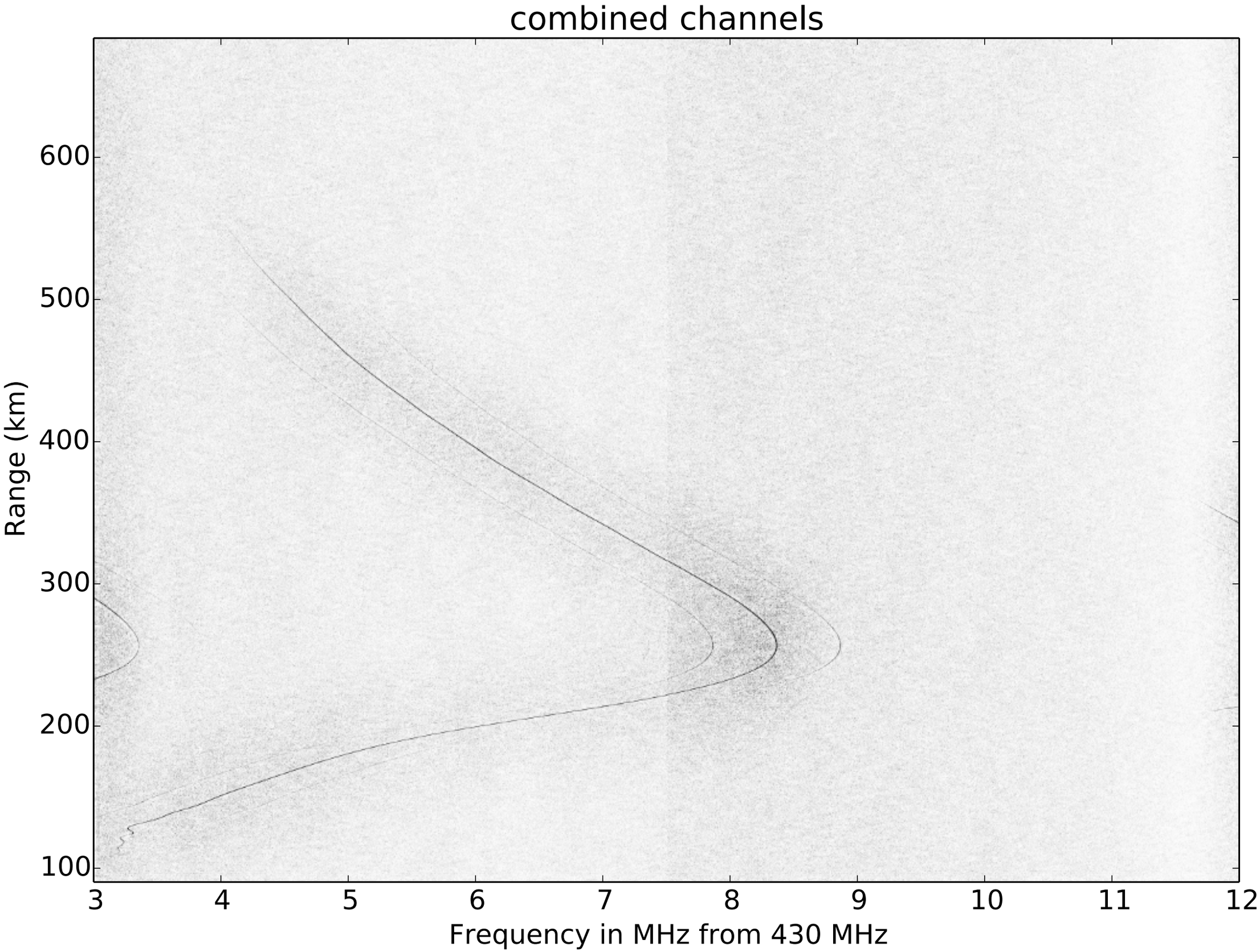
Plasma line spectrum, 2 micro sec resolution (300m) resolution, 440 microsec. pulse



No, the receiver base line is not so bad; the plasma line spectrum sits on clutter, the randomized plasma line power from the other ranges within the 440 micro sec pulse. This clutter is unavoidable when measuring spectra or acfs with clp or alt. codes.

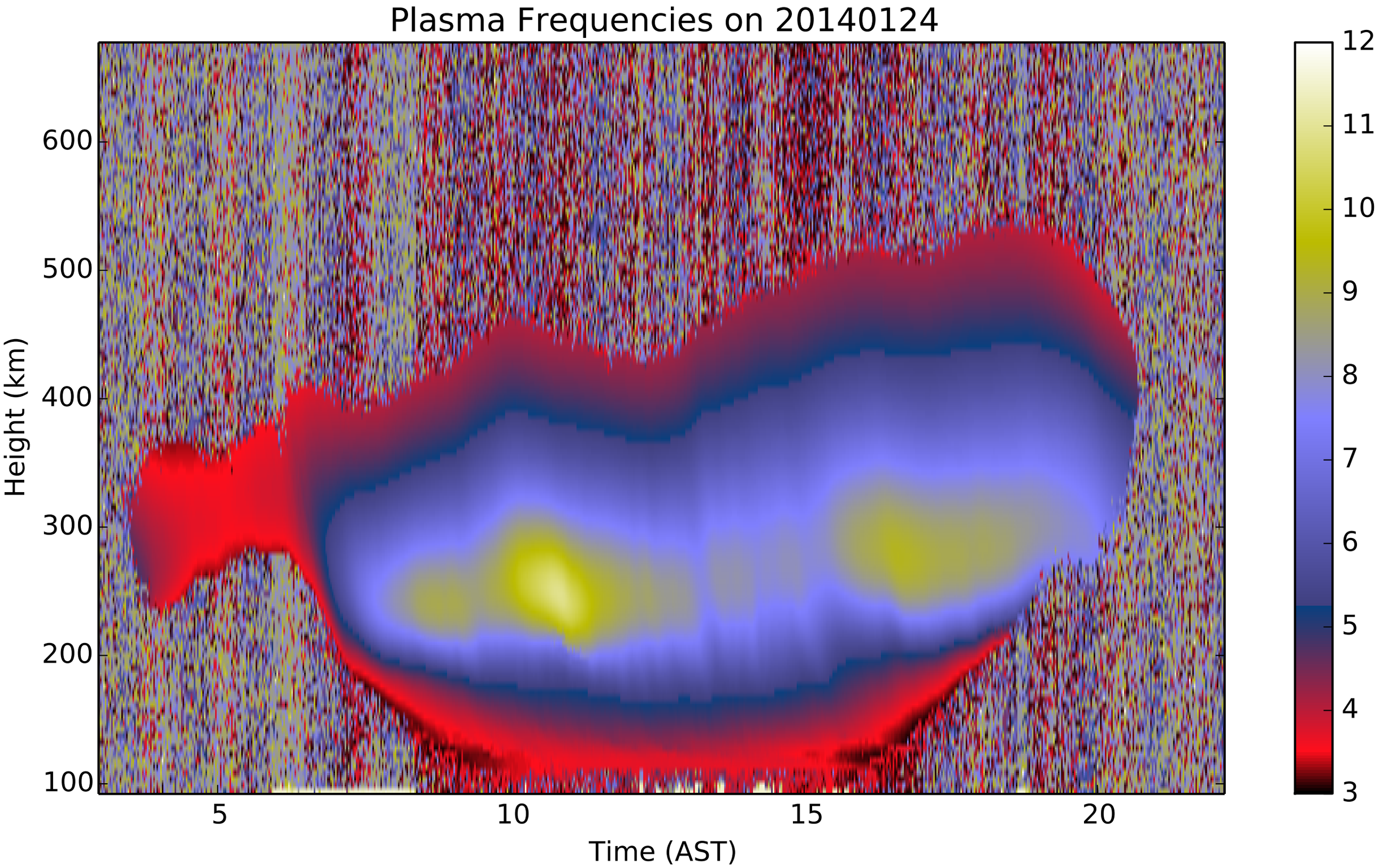
Image of several thousand plasma line spectra

Date:2014189 Time (UT):115923 Az:149.2 ZaG: 8.5 ZaC: 5.6 file#: 70 profile#: 1



The plasma line is seen when:

1. The plasma frequency is high enough so that the line is narrow.
2. There are sufficient fast electrons to enhance it.
3. What features of this plot relate to Anita's talk?



The previous plot shows some dynamic effects.
The higher frequencies can be emphasized by subtracting successive height profiles. What effects does this plot show?