

ARDMS Topic:
Ultrasound Instrumentation

Unit 15b: Resolution #4
(Spatial & Contrast)

Sononerds Ultrasound Physics
Workbook & Lectures

Unit 15b: Resolution #4 (Spatial & Contrast)

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Unit 15a: Image Processing & Contemporary Features

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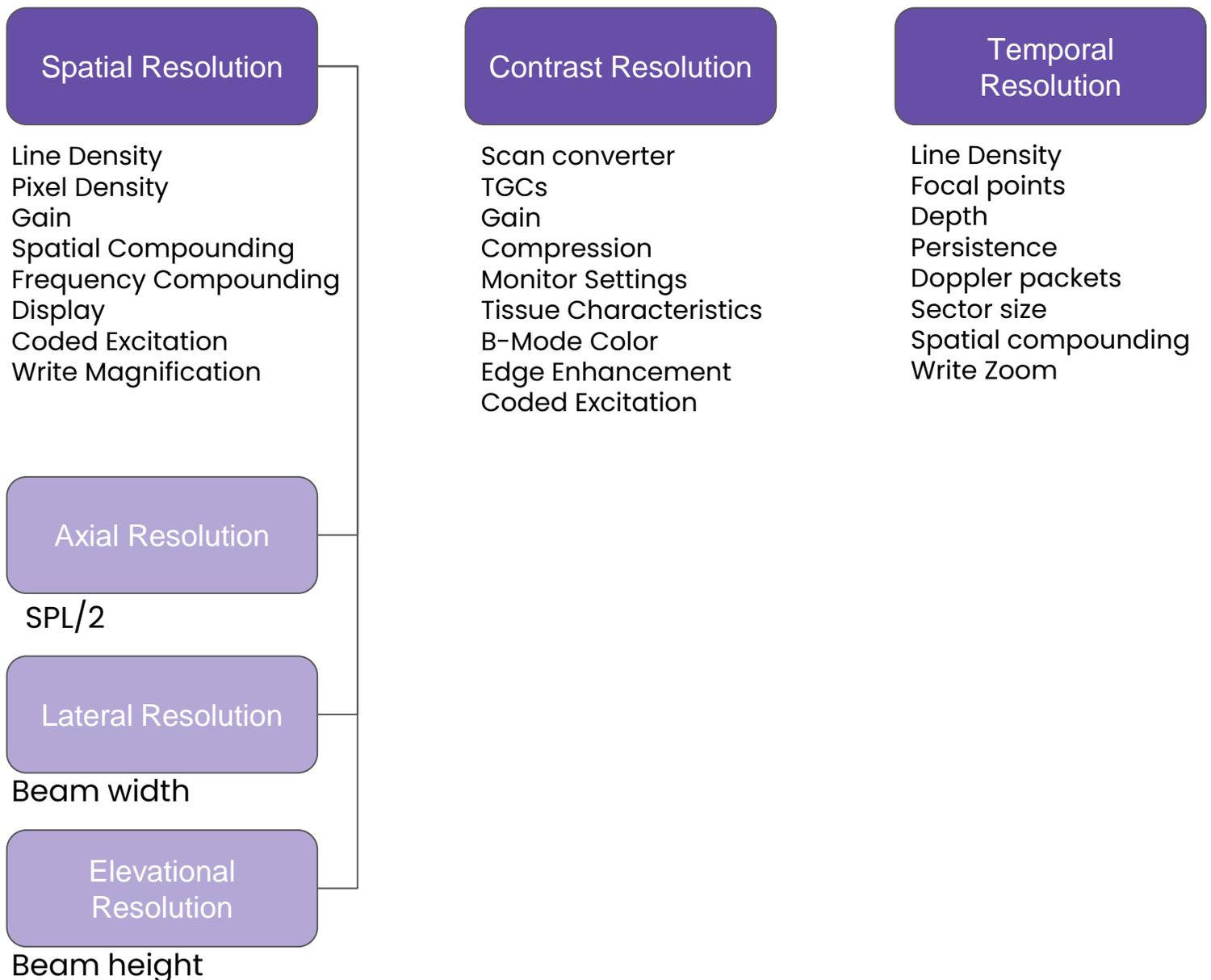


Did you know you can time jump to each section by using the “chapters” in the YouTube video playbar OR timestamps in the video description?

Unit 15b: Resolution #4 (Spatial & Contrast)

Now that we have learned a little more about different types of image processing, we can formally discuss spatial and contrast resolution.

While this probably won't be the last reference to resolution, it will be the last dedicated discussion surrounding resolution. There are still a few more concepts we'll learn about that affect different resolutions, but after this unit, the basics are covered and we can keep adding to our resolution knowledge.



Section 15b.1 Spatial Resolution

Spatial resolution is the machine's ability to display the detail of the anatomy correctly, so sometimes it is also referred to as detail resolution.

Spatial resolution includes the 3 scanning planes that a transducer creates (axial, lateral & elevational) as well as some tools of the machine.

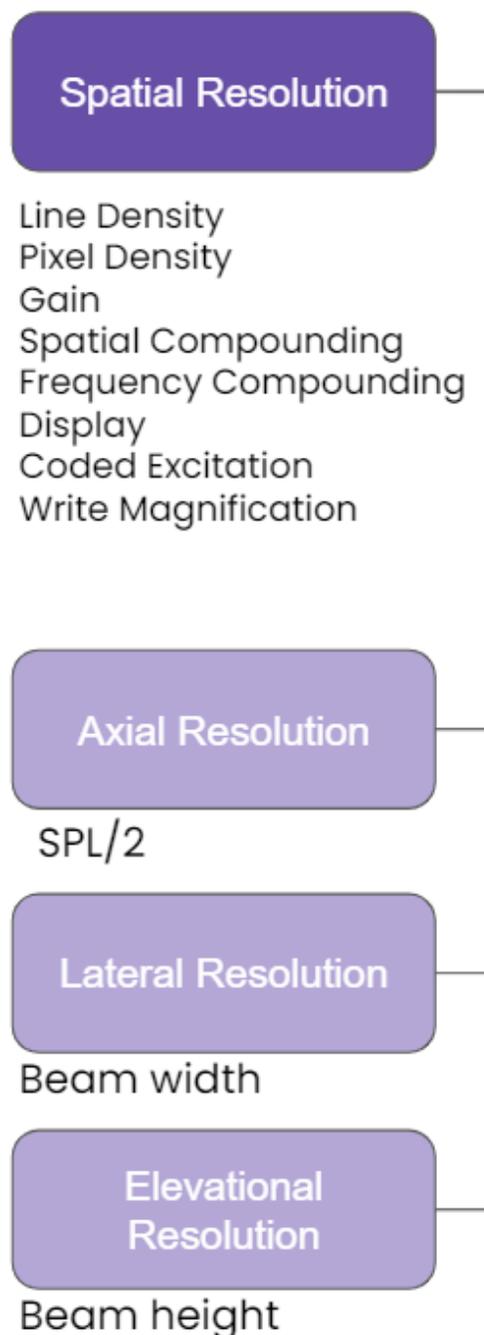
Anything - tools or transducers, that change the accuracy of the image affects the spatial resolution.

When we think back on the things we've learned to this point, there are a lot of circumstances that we have control over, as a sonographer, that can affect the spatial resolution.

When you are scanning, pay attention to the choices you make and how they affect your image. This most often comes back to your choice of transducer and frequency.

However other tools on the machine can affect the spatial resolution too, including the monitor itself. If the monitor is of poor quality, the pixels from the scan converter may get "converted" so that the information can be scaled up for the monitor, making the image blurry.

Or, the system might not be able to create a small enough difference in phased delays to create enough scan lines to return superior anatomical detail.



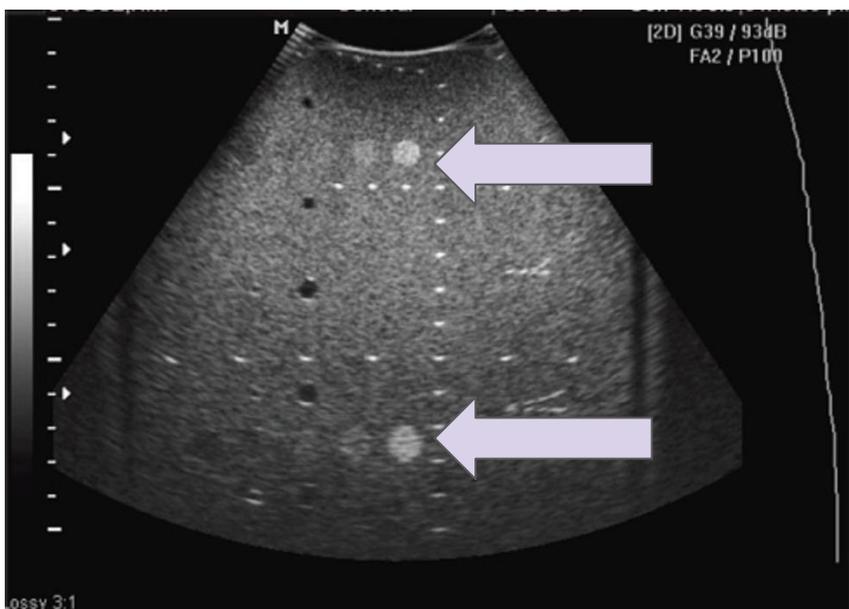
Section 15b.2 Contrast Resolution

Contrast resolution is the system's ability to display different grays. When we have enough contrast resolution we can see the borders between structures very clearly without losing detail in the image.

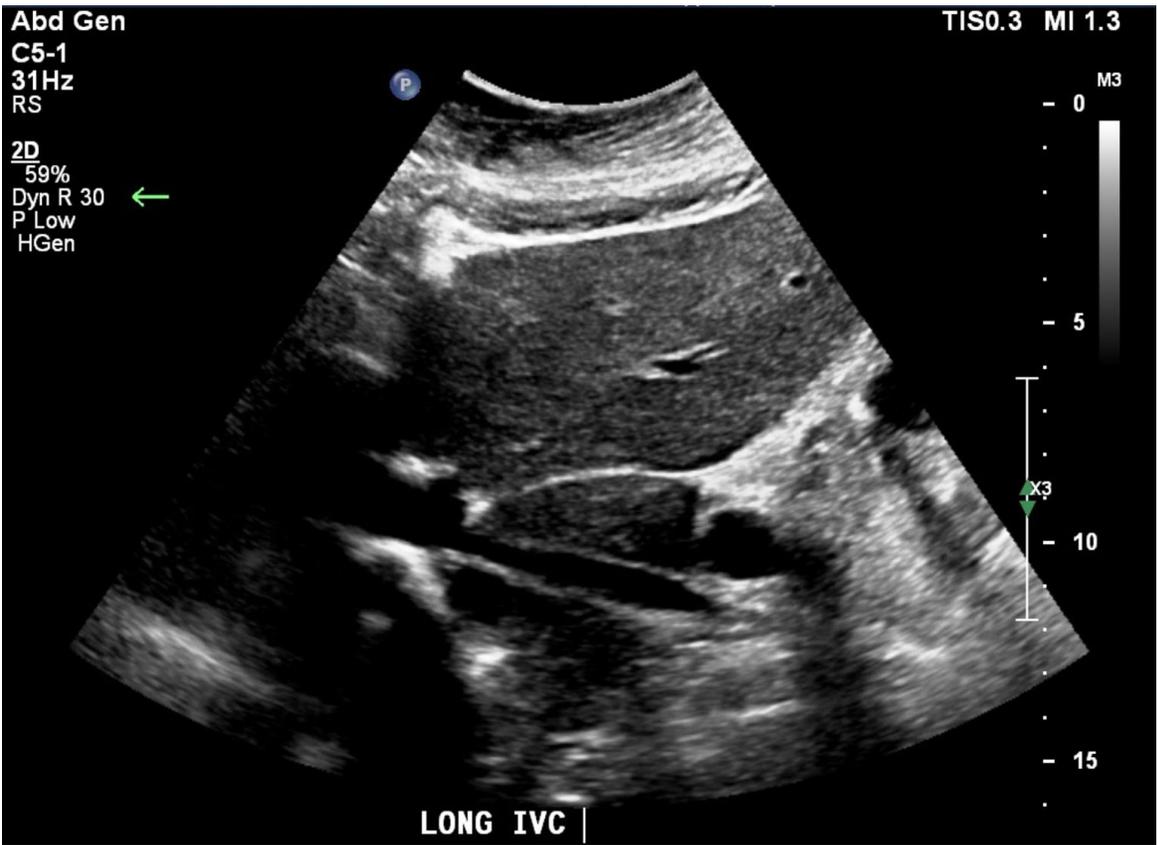
Contrast resolution is sometimes included under the umbrella of spatial resolution. Detail resolution is very transducer dependent, where contrast resolution is more system dependent. Contrast resolution was determined by the scan converter because the amount of bits per pixel determined how many grays the system can process.

Now that most systems use 8 bits and can display 256 shades, we are limited to seeing super subtle differences in gray because of our own eyes. To improve the contrast resolution, we need to bring the amount of grays choices down (by reducing the dynamic range). This will allow our eye see more subtle differences in the soft tissue.

Note in this image below the arrows are pointing at a row of different echogenic circles. There is good contrast resolution when the echoes are bright, but poorer resolution at the more hypoechoic echoes. To improve this, the sonographer could reduce the dynamic range, telling the machine to display those reflectors with different grays so they don't blend into one another.



Number of Bits of Memory	Number of Grays
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256



These two images have reduced dynamic range. The bottom image appears to have more contrast than the “washed out” image above that has more grays in use.