

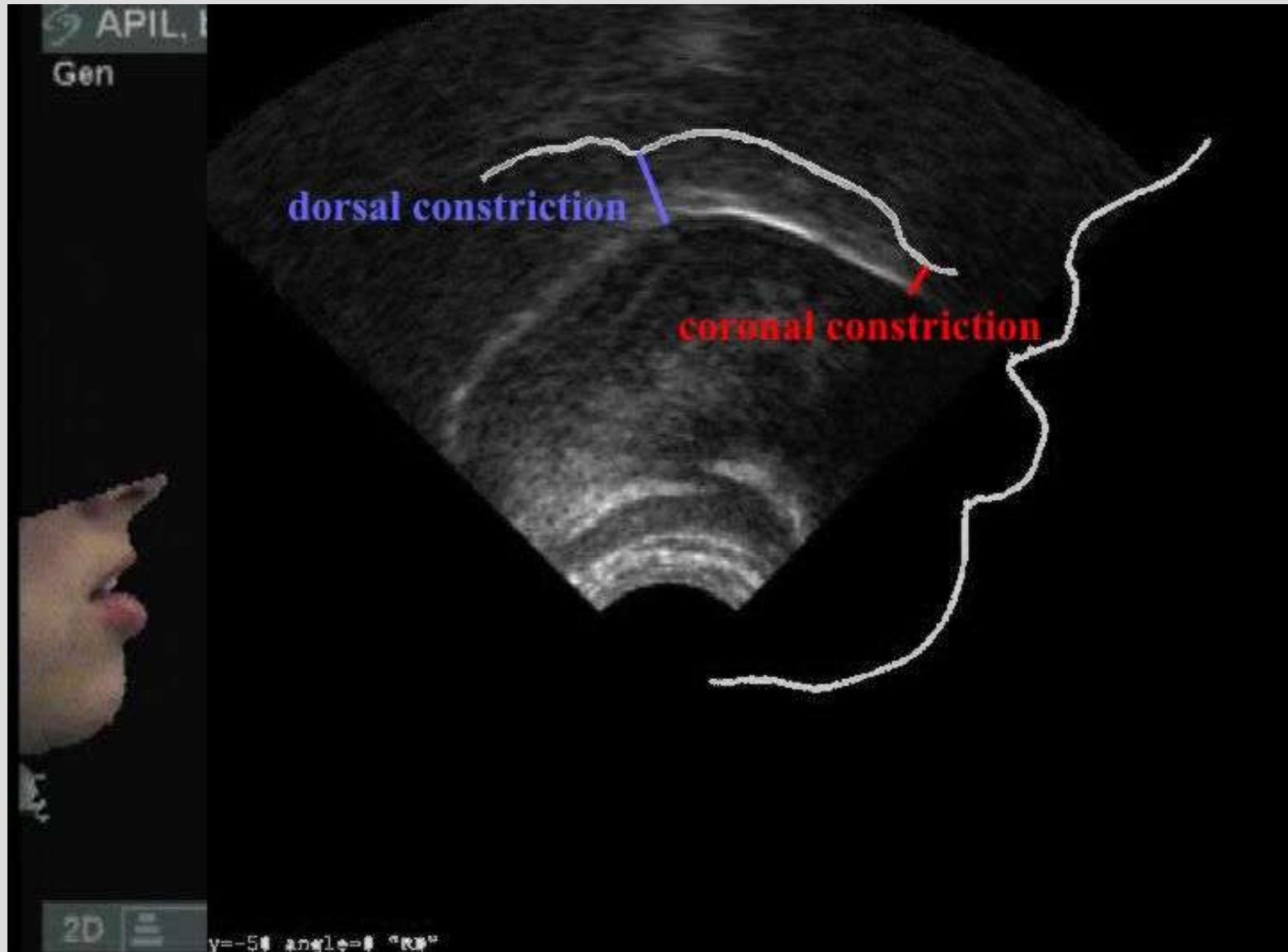
Using scan lines to make accurate time measurements

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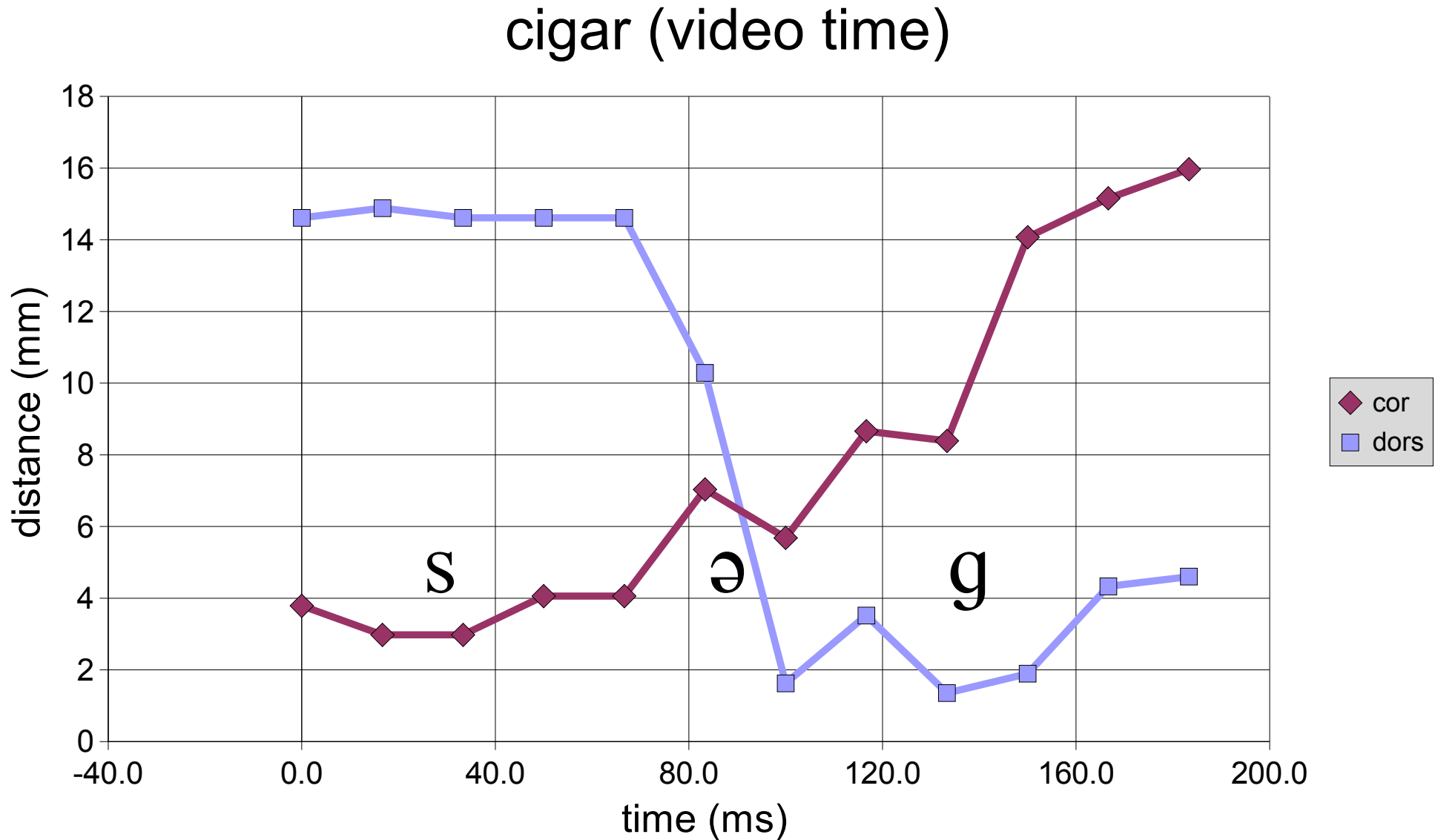
University of Arizona

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Timing measurements



Timing data: constriction size

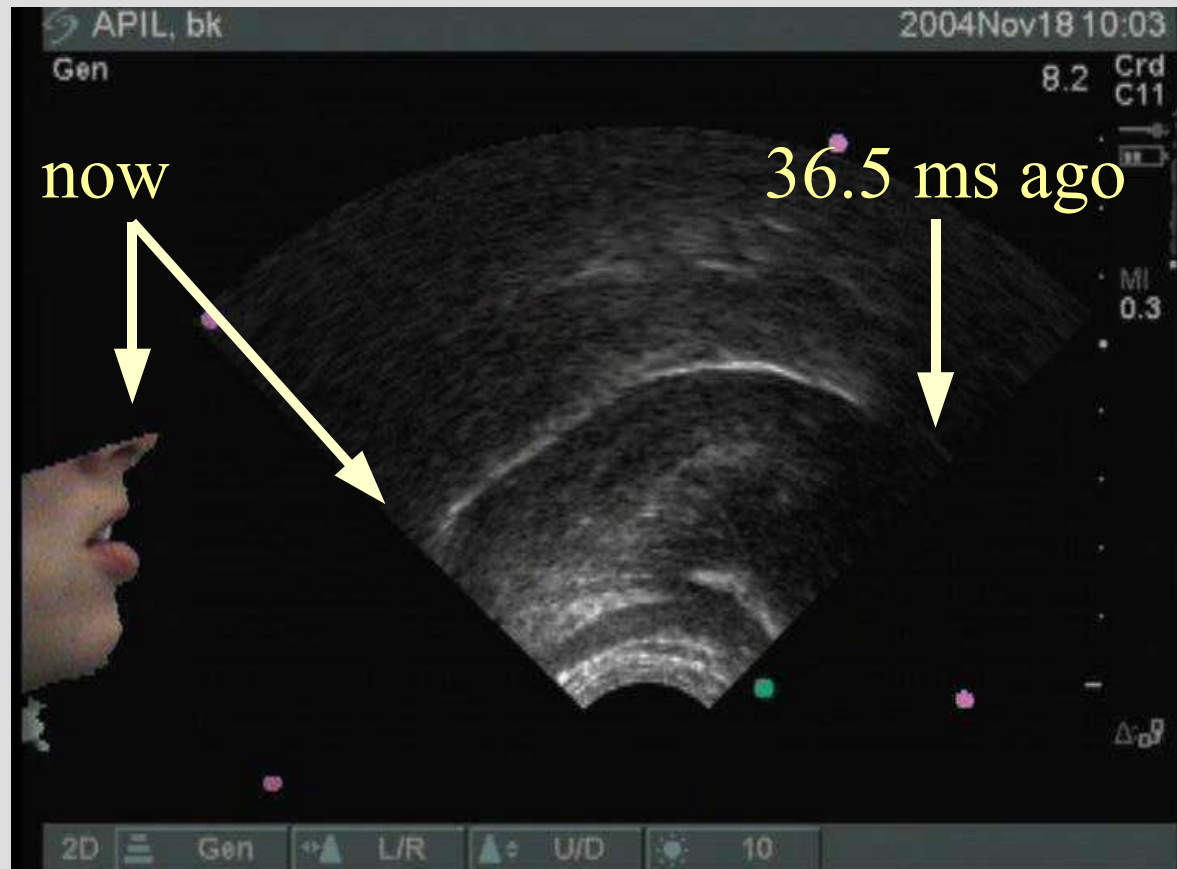


The problem

- Our SonoSite TITAN™ ultrasound unit with C-11/7-4 11-mm broadband curved array transducer takes 36.5 ms to complete a scan.
- Events which appear simultaneous may have occurred at different times.
- Events which appear asynchronous may have occurred at the same time.

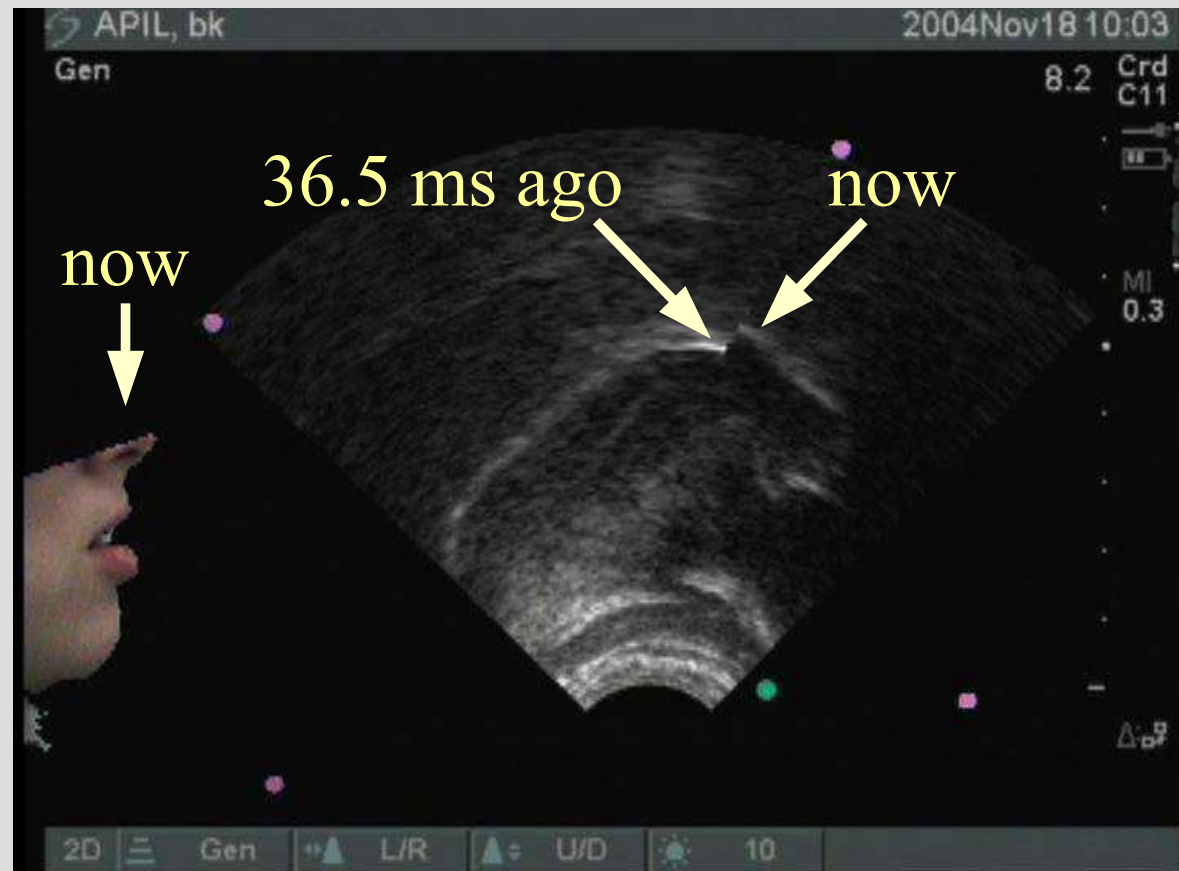
New/old information

- After a scan, the right edge is 36.5 ms older than the left.
- The alveolar constriction is about 30° behind the velar.
- $30^\circ \sim 12$ ms.



New/old information

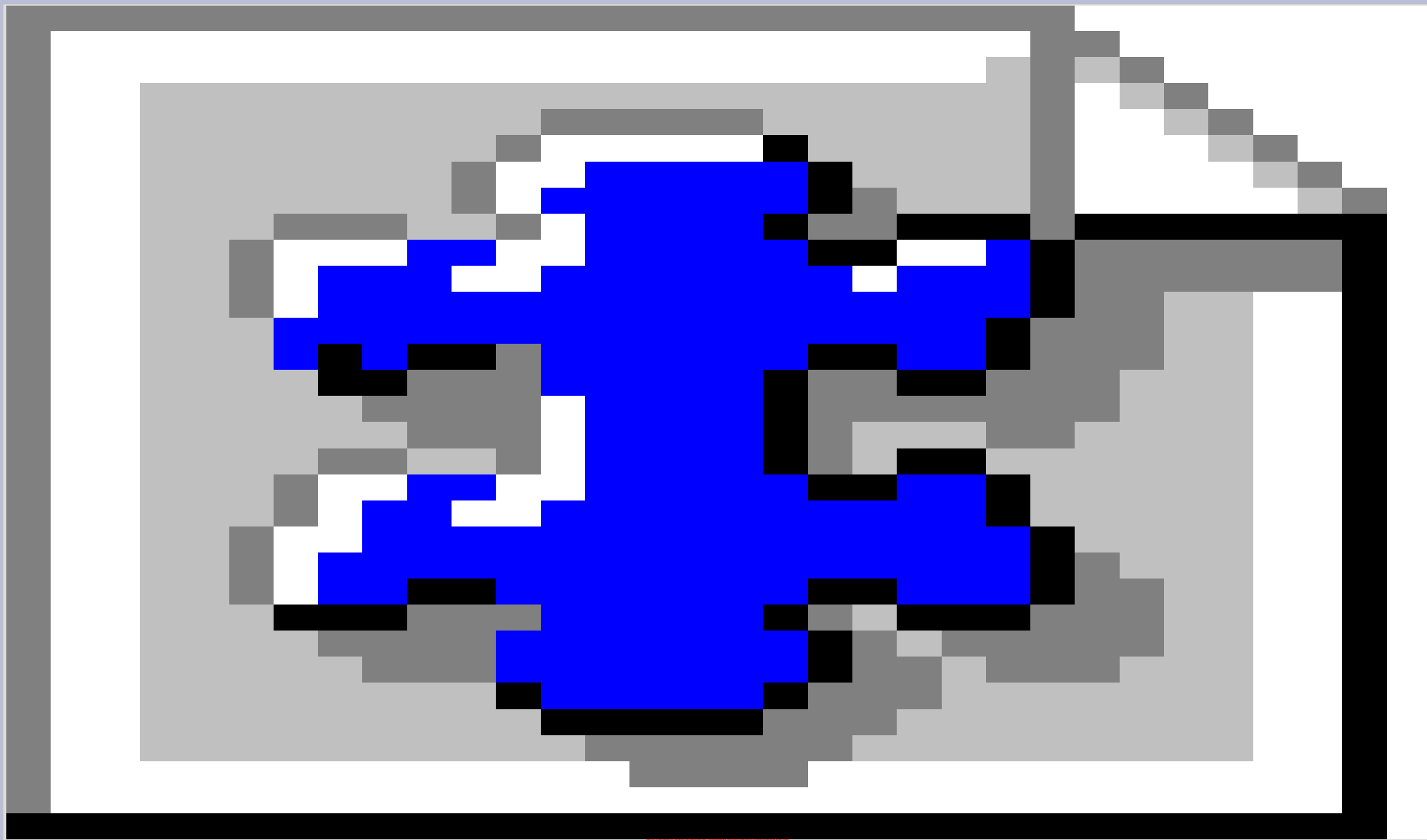
- The left side of a scan line is 36.5 behind the right side.
- The velar constriction is about 60° behind the alveolar.
- $60^\circ \sim 24$ ms.



Scan line facts

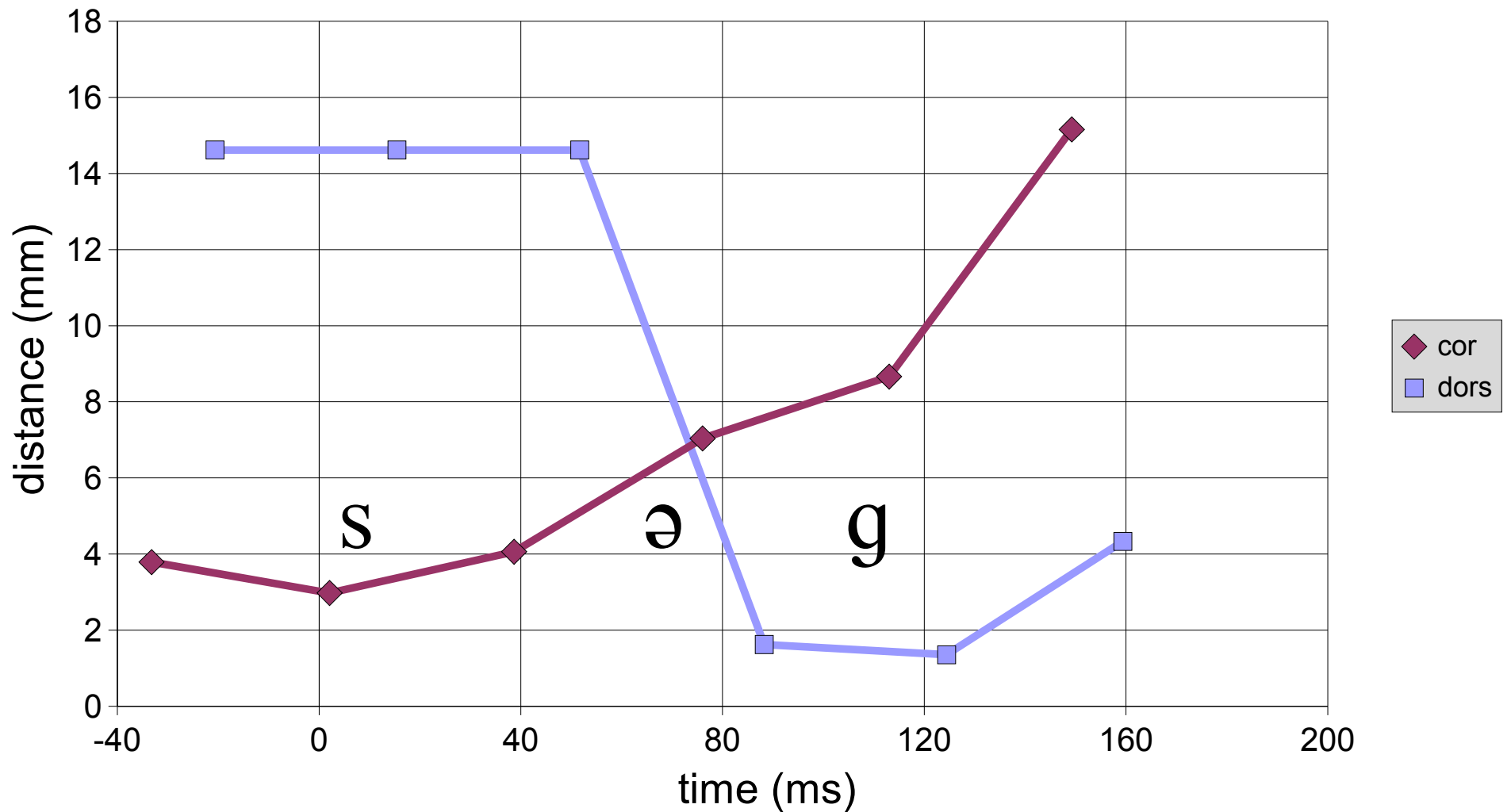
- Scan lines are most noticeable in the middle of the image, but every image has one.
- Scan lines are curved because echoes from farther away take longer to get back.
- Our video is 60 fps (after deinterlacing), so the scan line travels about 42° per frame.

Scan lines in action



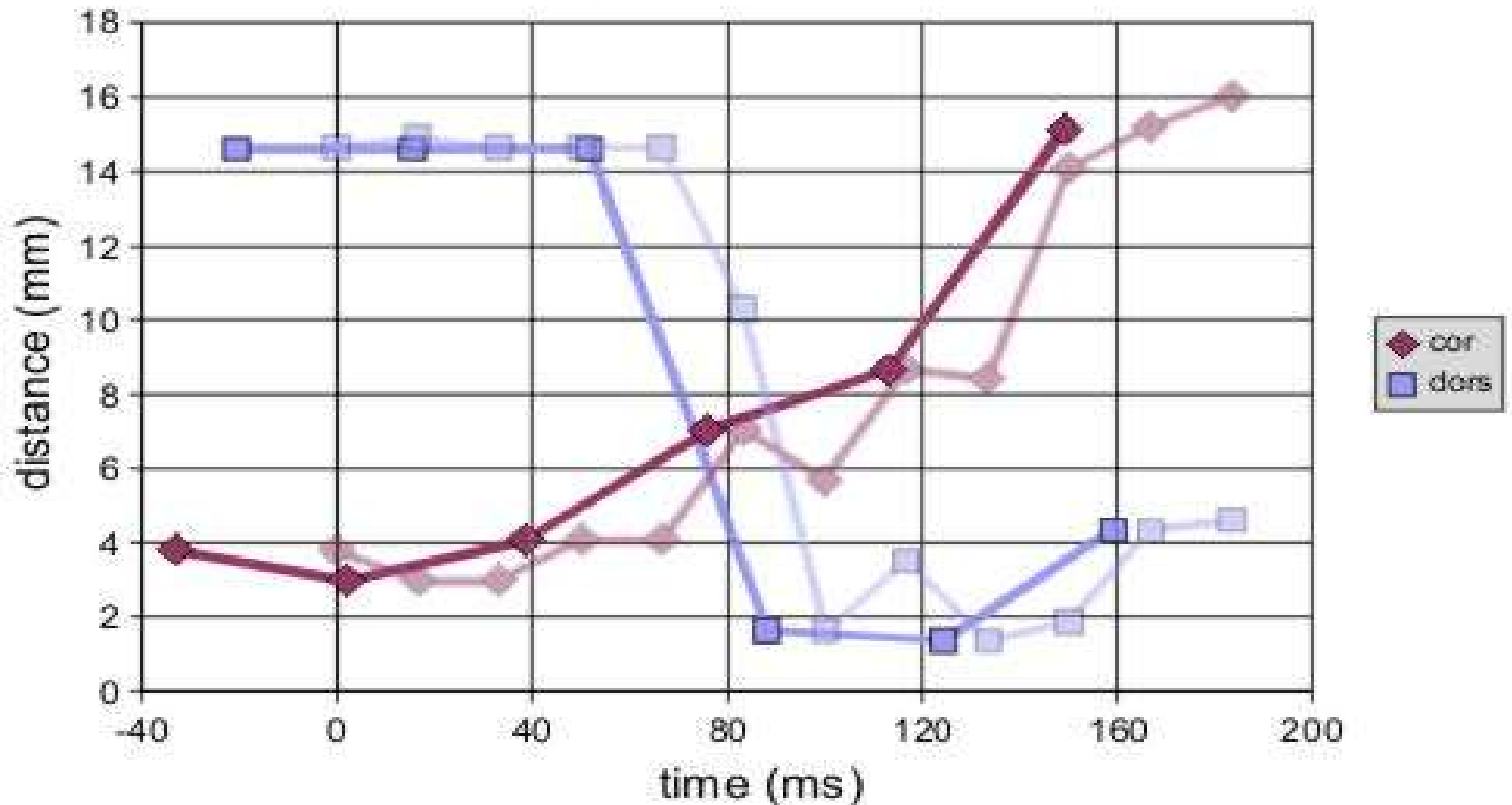
Timing data: reprise

cigar (scan time)



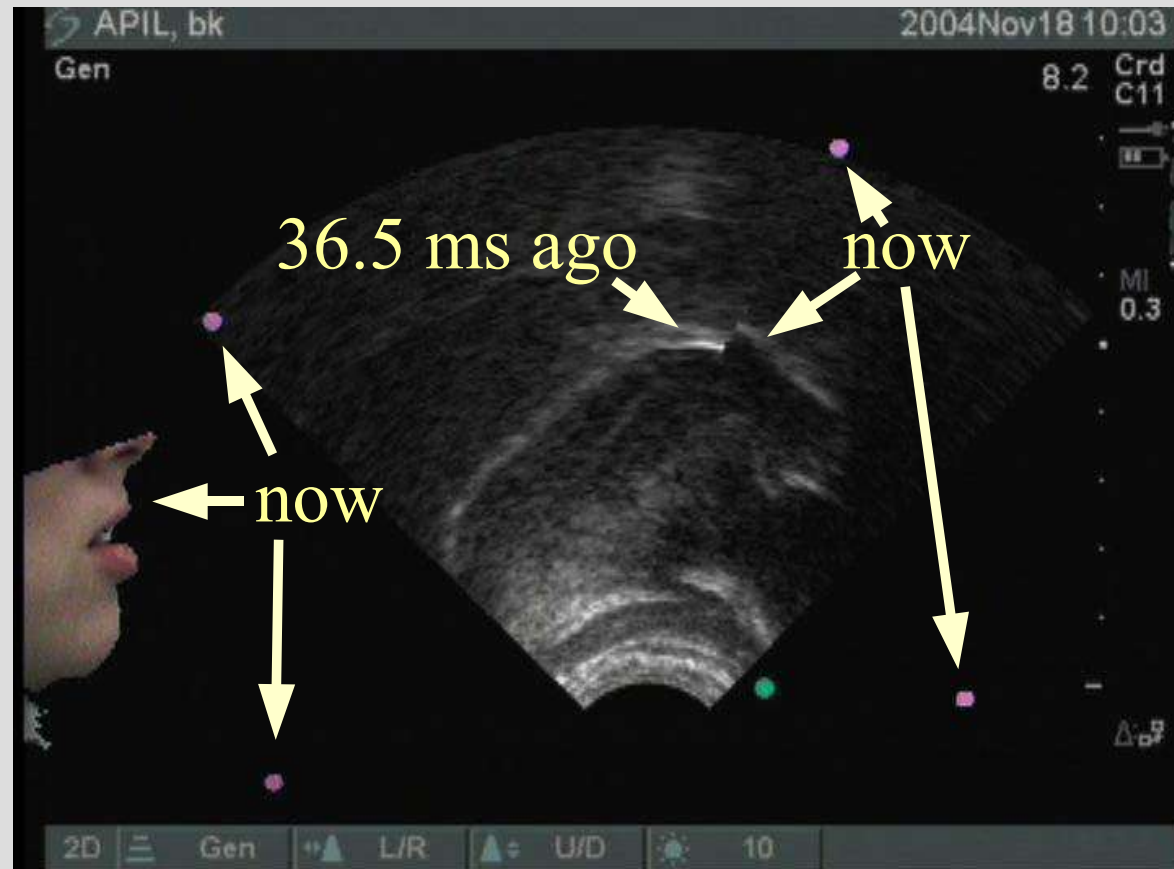
Timing data: reprise

cigar (scan time)



New/old information

- Information used to locate the palate is newer than most of the image.
- Previous frames contain the relevant head/transducer info.



Discussion

- Event time is a function of time and angles:

$$t_{event} = t_{video} - .405 (\alpha_{scan} - \alpha_{event})$$

- Compensation for head/transducer movement should consider video at time of event (usually 1 or 2 frames back).
- Easier to take into account info from other frames when analyzing sequences of frames (this is also when it is most helpful).