Research Proposal
Ultrasonic Image Format

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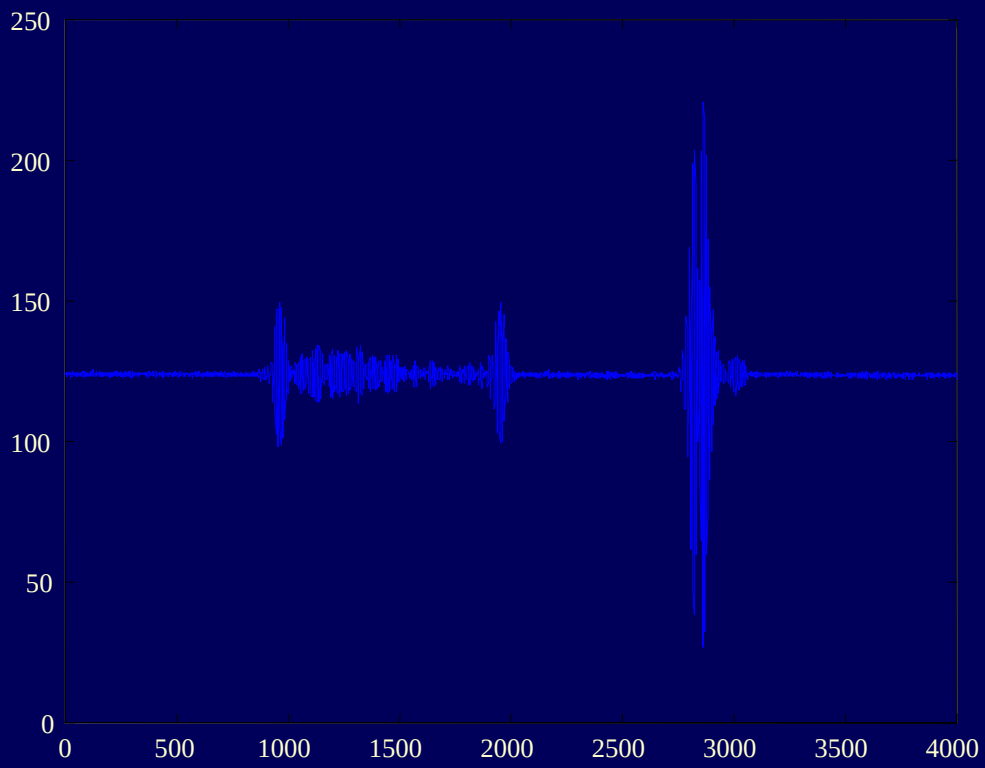
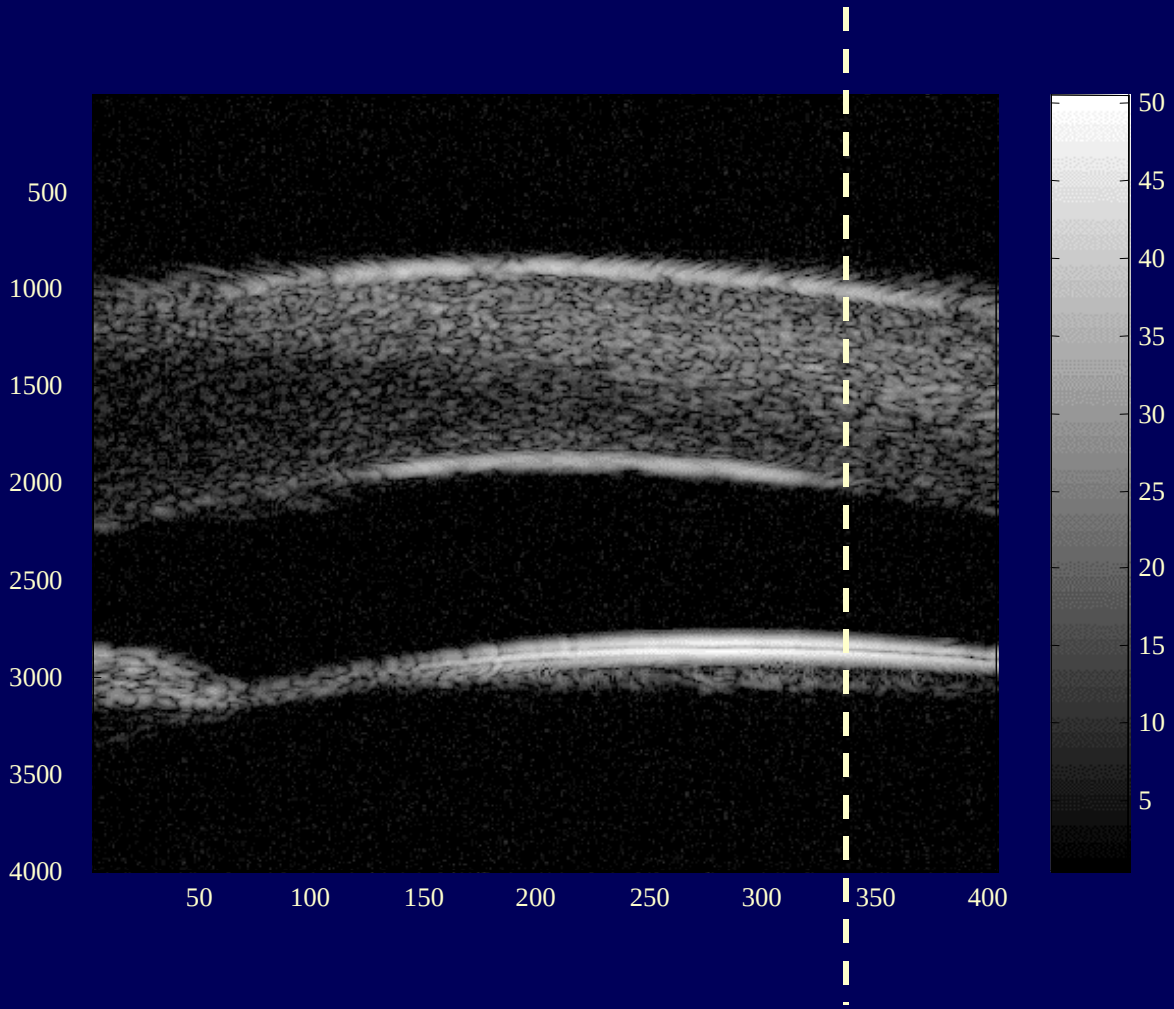
Image format

- A-mode (Amplitude)
- B-mode (Brightness)
  → B'-mode (1985 O'Donnell)
- C-mode (Constant Depth)
- D-mode (Depth)
- M-mode (Motion)
- Color Flow mode
- 3-D mode
- Tissue Harmonic Imaging

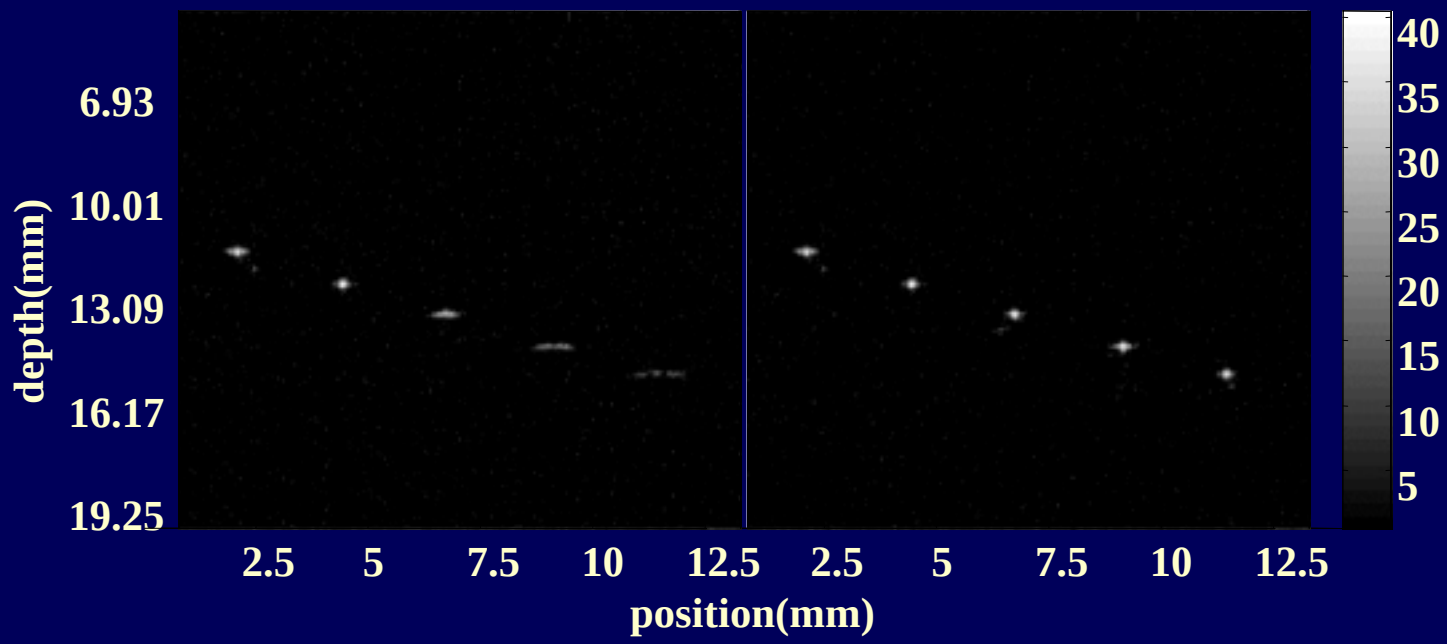
Amplitude-mode



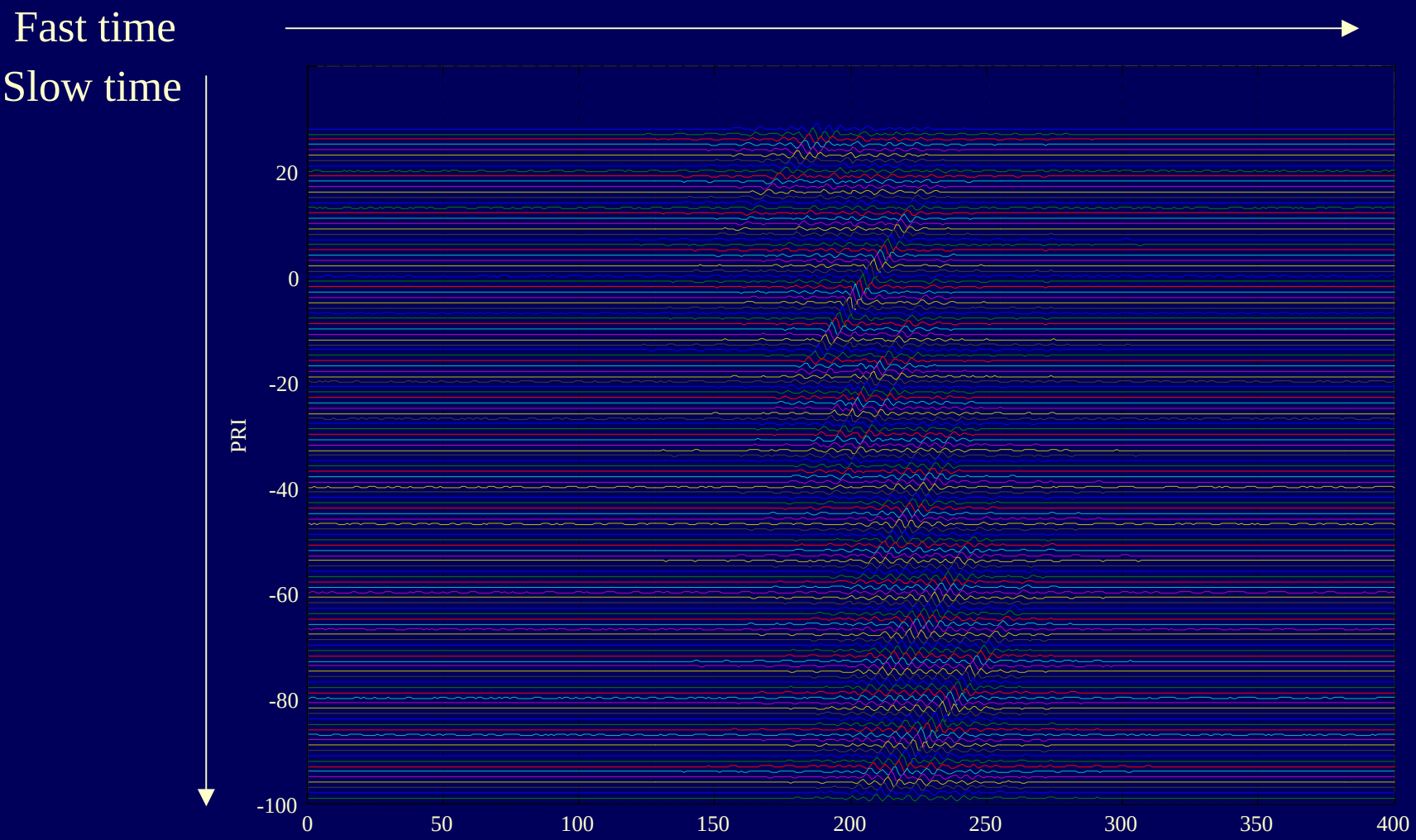
Brightness-mode



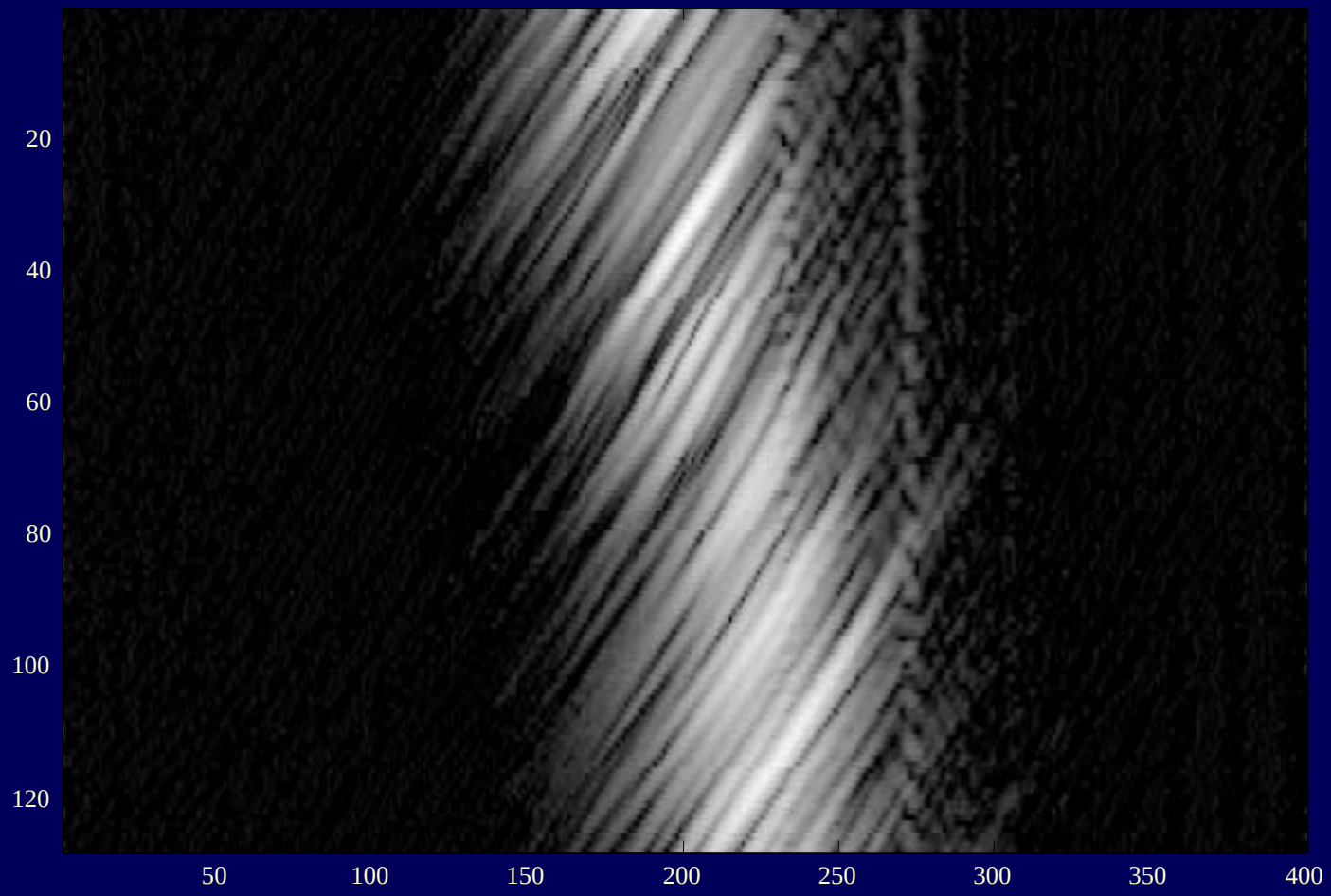
Depth-mode


depth(mm)
6.93
10.01
13.09
16.17
19.25
2.5
5
7.5
10
12.5
2.5
5
7.5
10
12.5
position(mm)
40
35
30
25
20
15
10
5

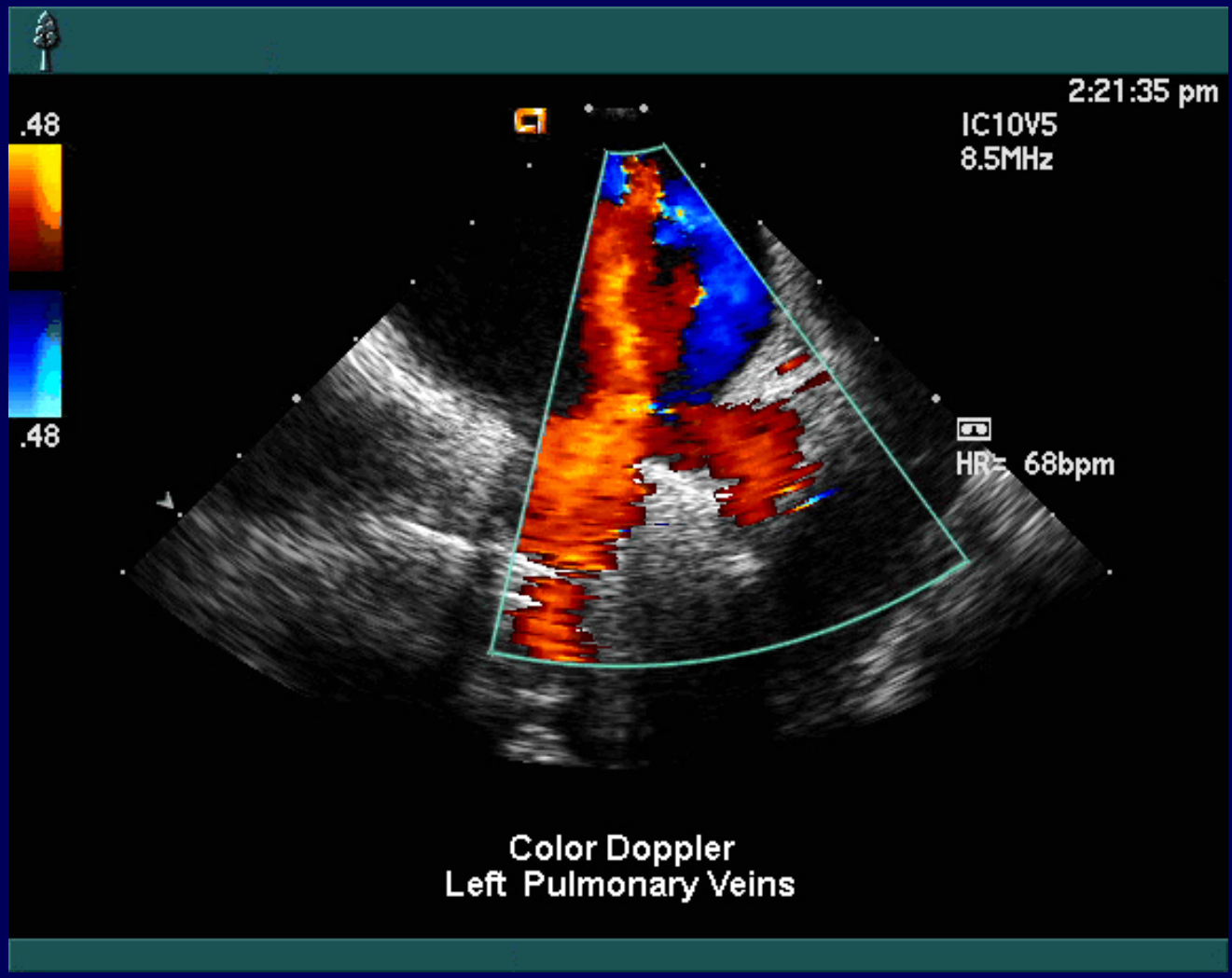
Motion-mode


Fast time
Slow time
PRI
20
0
-20
-40
-60
-80
-100
0
50
100
150
200
250
300
350
400

Motion-mode

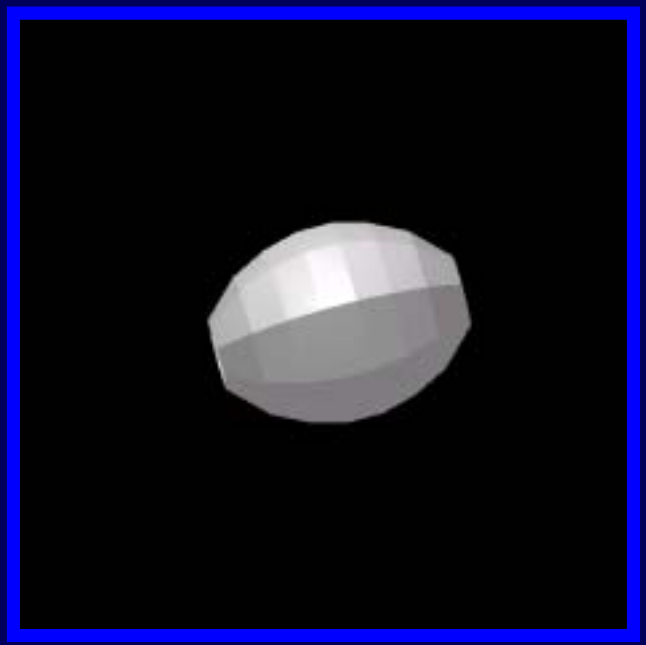


Color Flow mode

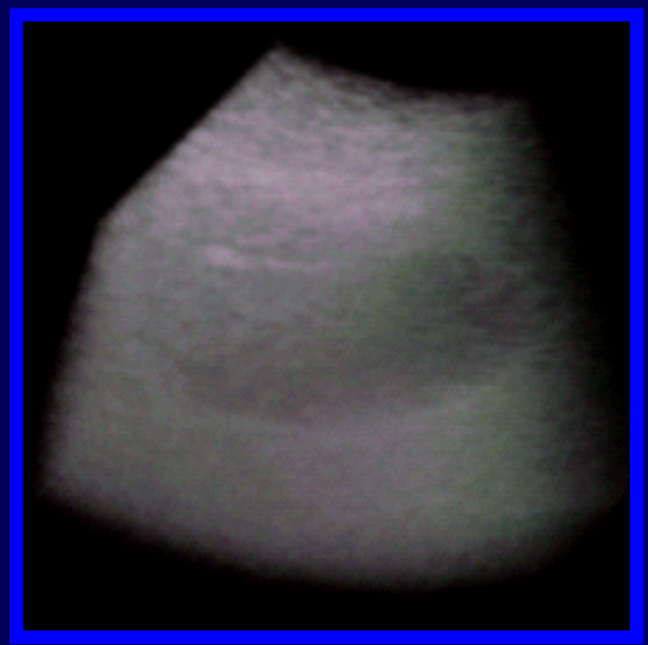


3-D mode

Surface Rendering



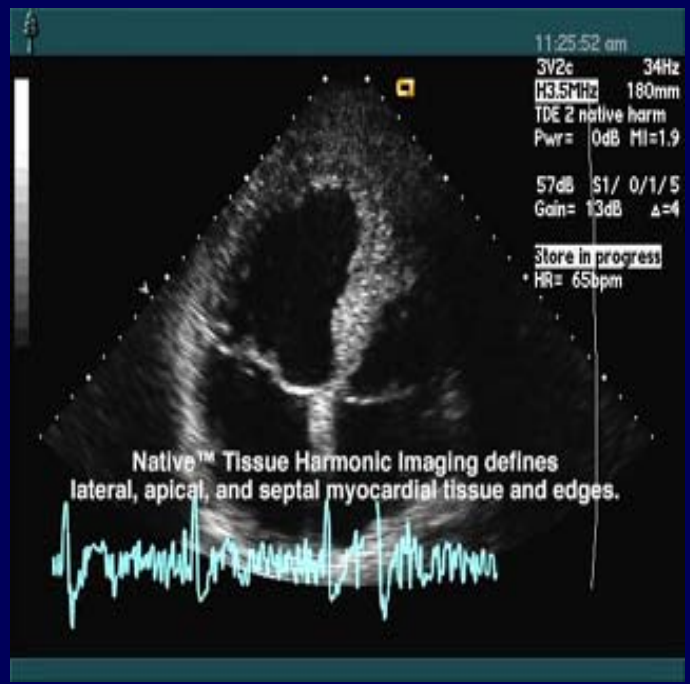
Volume Rendering



Tissue Harmonic Imaging

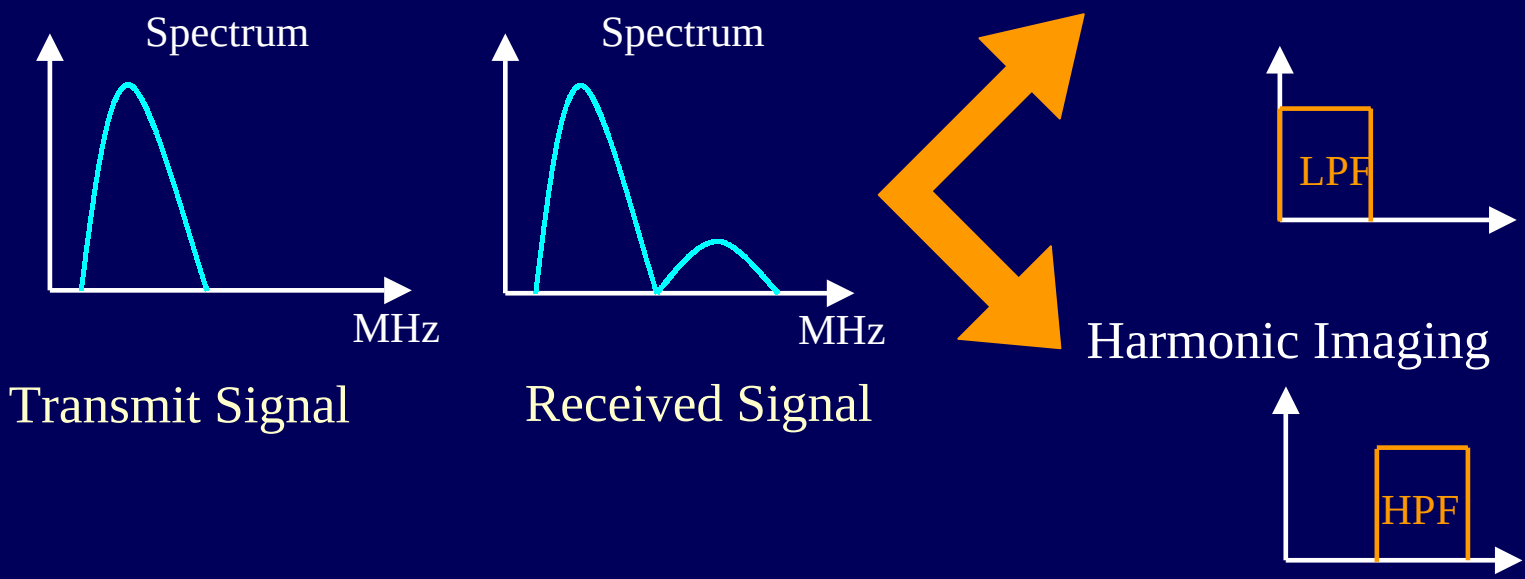
Fundamental image

Harmonic image



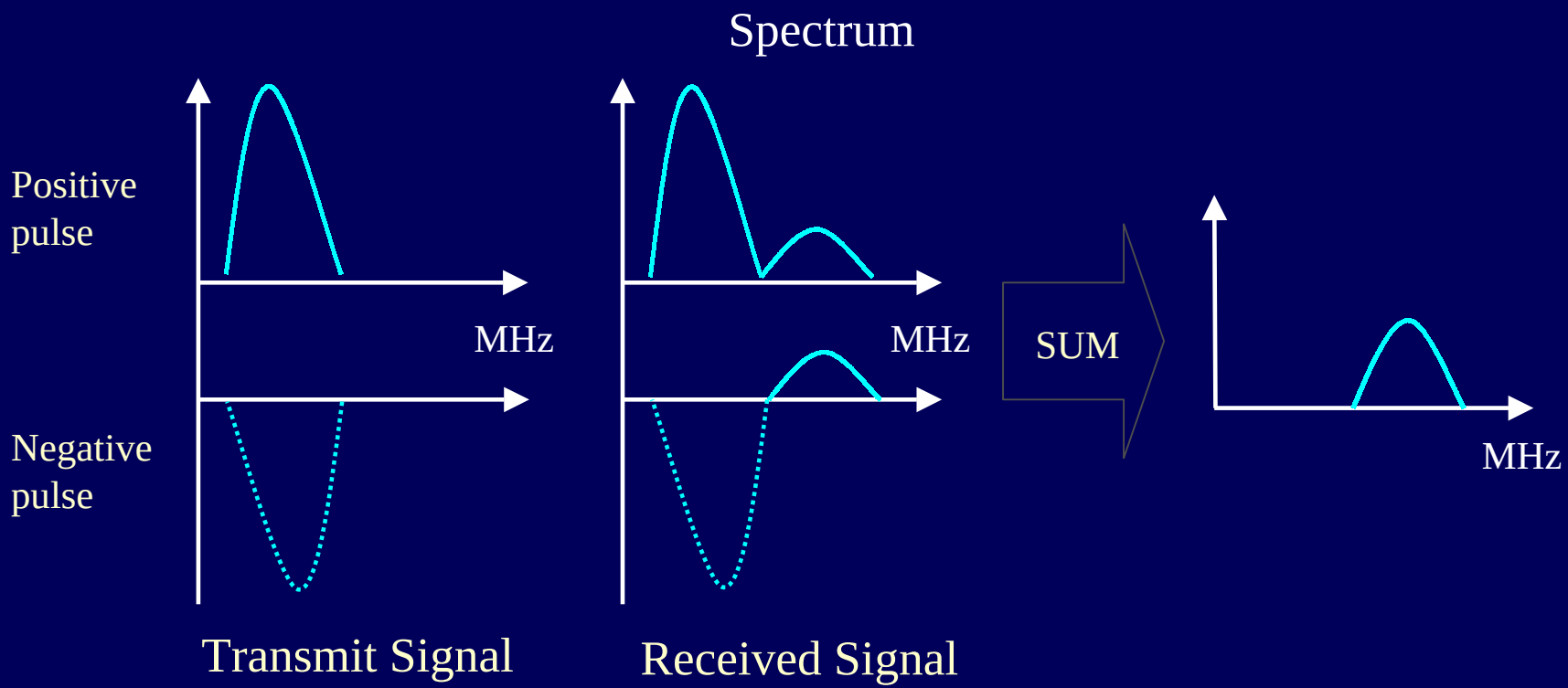
Tissue Harmonic Imaging

Traditional Filtering Method :



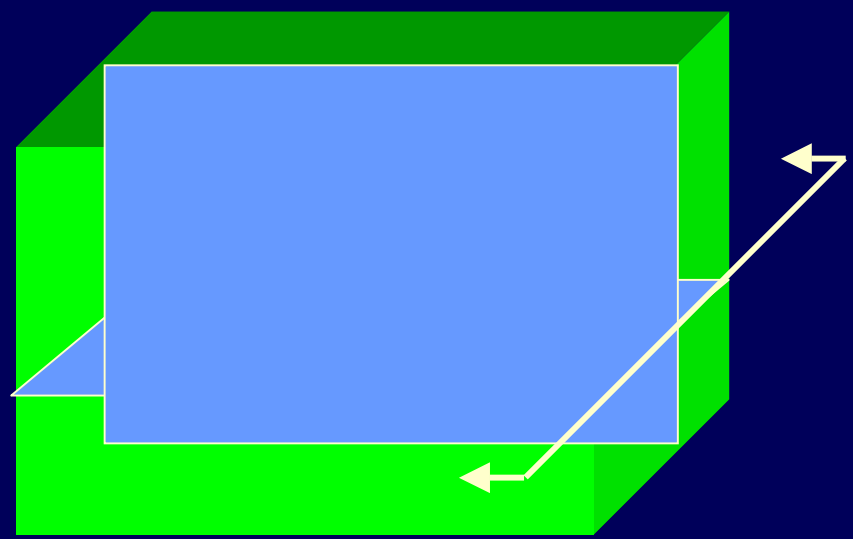
Tissue Harmonic Imaging

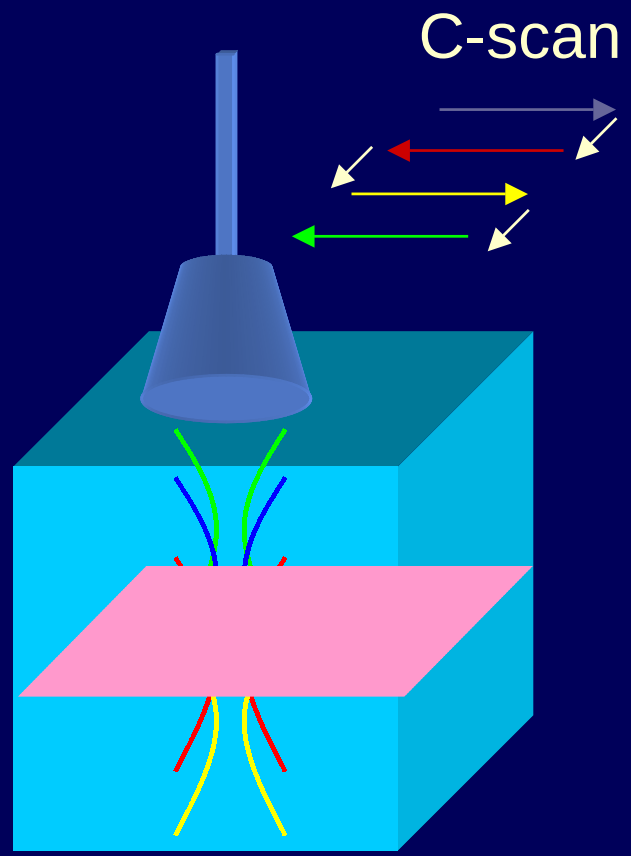
Pulse Inversion Technique :



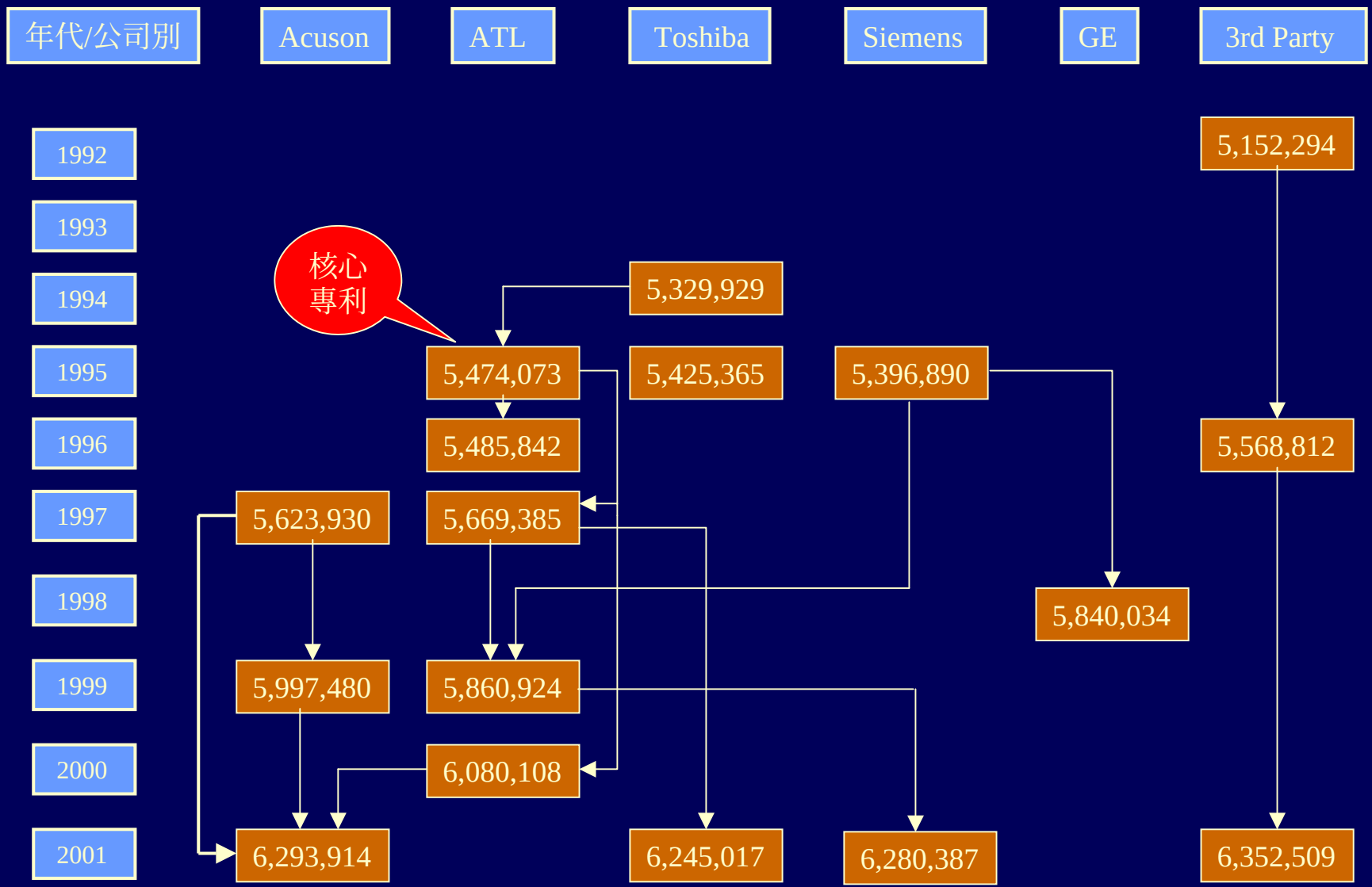
Constant depth-mode

- Constant depth scan
- Holography
- Tomography





Patent map


年代/公司別
Acuson
ATL
Toshiba
Siemens
GE
3rd Party
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
核心
專利
5,152,294
5,329,929
5,474,073
5,425,365
5,396,890
5,485,842
5,568,812
5,623,930
5,669,385
5,840,034
5,997,480
5,860,924
6,080,108
6,293,914
6,245,017
6,280,387
6,352,509

Patent map

	Method/ Process	Device/ Apparatus	System	合計
Flaw Detection	4	1	1	6
Multi-dimensional Blood Flow Imaging	4	1	5	10
3D Imaging	4	10	7	21
合計	12	12	13	37

Core patent

- PN：5,474,073， ATL (Advanced Technology Laboratories, Inc.)， Dec. 1995， being sited by 54 patents
- An ultrasonic diagnostic system and scanning technique for producing three dimensional ultrasonic image displays

Core technique

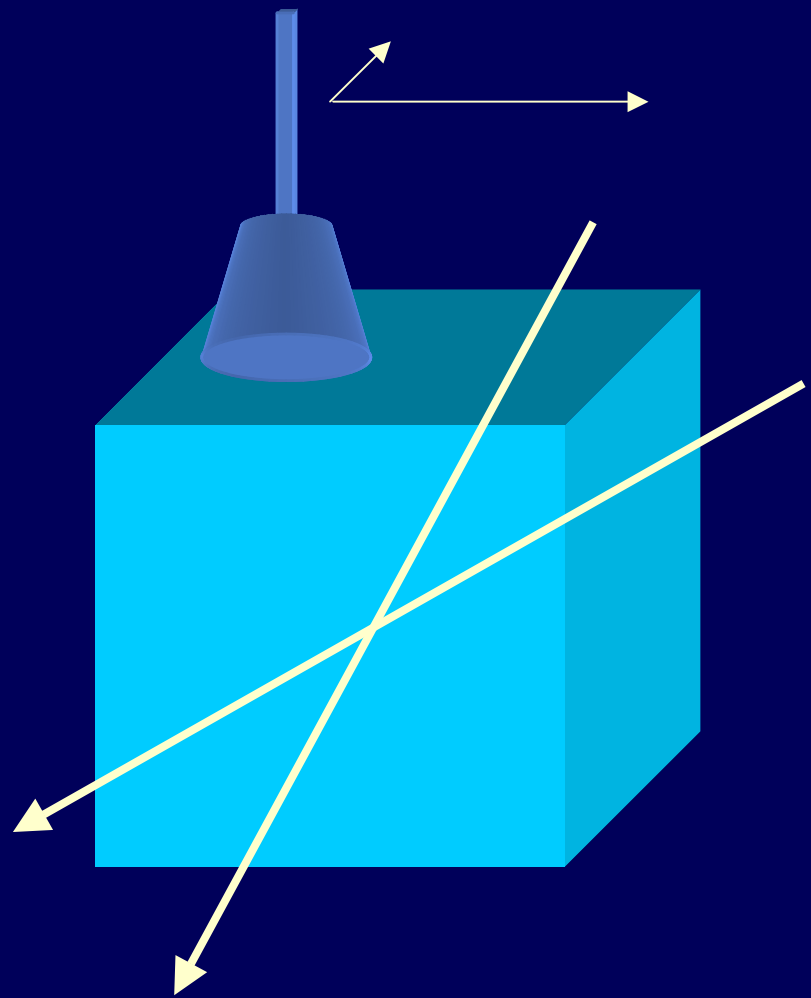
- Three dimensional ultrasonic diagnostic image rendering
- Combining B-scan & C-scan → 2D to 3D scan conversion (ATL & Toshiba)
- C-scan method with a linear transducer for measuring the volume flow of fluid in an enclosed structure (Acuson)
- Three-dimensional tissue/flow ultrasound imaging system (Siemens)

Research method

- Combine several linear scans to a C-scan
- Find what spacing is the optimal choice of considering timing and space resolution
- Combine 2-D images to depth dependant tomography image or a 3-D image.
- Using filters to Volume definition

3-D flow image

- Air and Bone
- Flow estimation
  in non image plane (X,Z)
- 2-D array or C-scan



Expect results

- Tomography and holography presentation.
- Find out 3-D flow calculation possibility