Federal Highway Administration's Perspective on NDT for Pavements

H. Thomas Yu

Office of Pavement Technology

Background

- Deployment of innovative technologies is an important mission of the Office of Pavement Technology
  - Identify needs and opportunities
  - Develop and implement promising technologies
  - Develop specifications and guidelines
- Focused on available (near market-ready) technology
- Emphasis areas
  - Pavement surface characteristics
  - Pavement evaluation

Surface characteristics

- Pavement smoothness had been the measure of pavement performance until now
- Key activities
  - Measurement of surface characteristics
    - Smoothness
    - Surface texture
    - Friction
    - Noise
    - Splash and spray
  - Develop guidelines and specifications
  - Develop a unified model that links texture to response

NDT for pavement evaluation

- Applicable to
  - Structural evaluation for rehabilitation design
  - Construction quality assurance
  - Pavement performance monitoring
- Objective
  - Provide tools that would help identify the nature of any existing problems
  - Quantify structural integrity of in-service pavements
  - Improve reliability of pavement rehabilitation designs

Technologies for pavement evaluation

- Step-frequency, ground-penetrating radar (SF-GPR)
- Ultrasonic testing device (MIRA)
- Rolling deflection measurement

Step-Frequency GPR

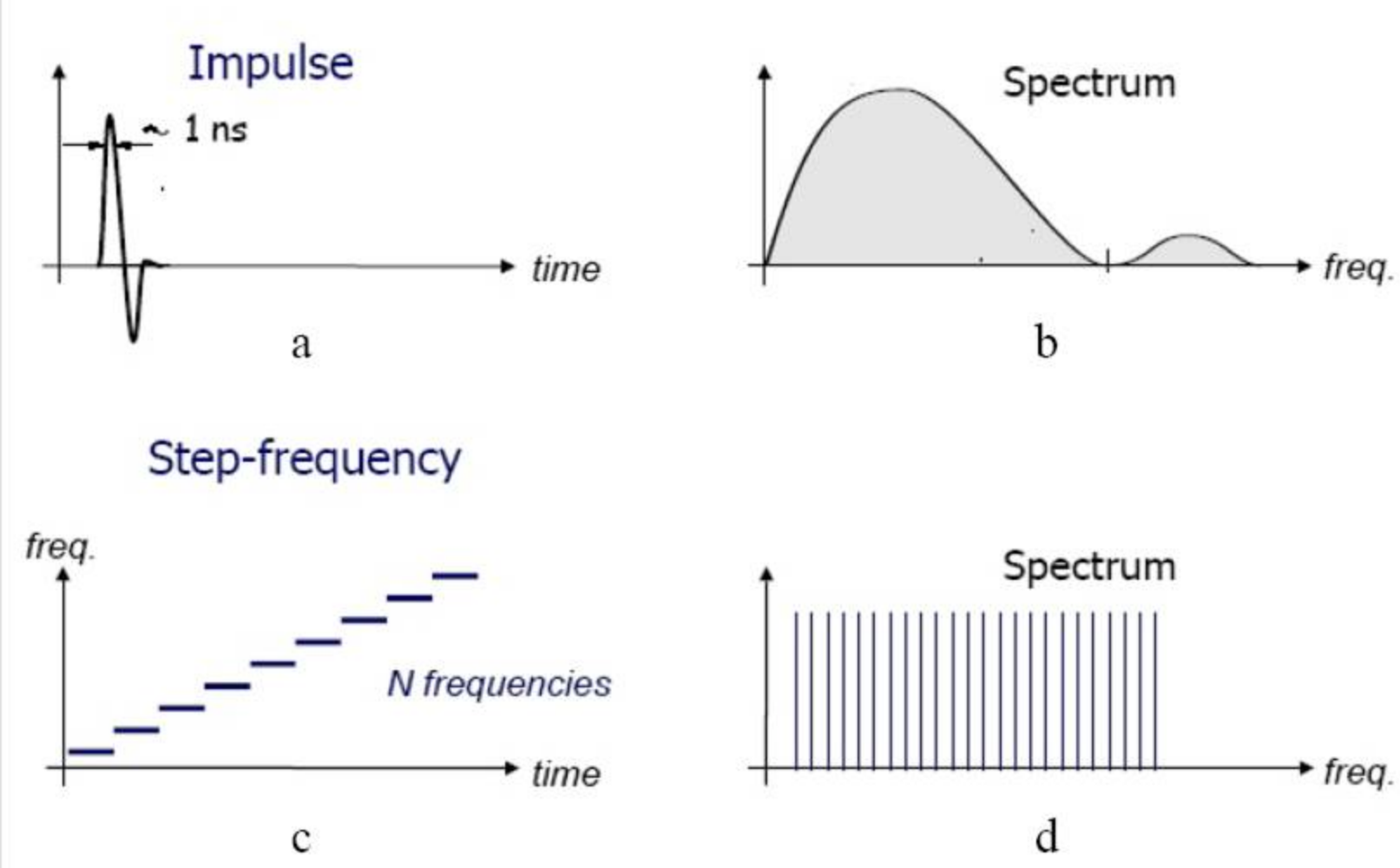
- Specific advantages of 3d-Radar Geoscope
  - Full coverage of the entire lane in 2 passes
  - 2-D and 3-D imaging capability
  - Continuous calibration
  - Wide detection range
- Potential applications of SF-GPR
  - Pavement layer thickness
  - Moisture detection
  - Void detection
  - Rutting evaluation (2-D & 3-D imaging)
  - Variations in material properties (AC density)
  - AC stripping and layer debonding
  - Detection and quantification of cracking
  - Depth of dowel bars, tie bars, and reinforcing steel

Step-Frequency GPR

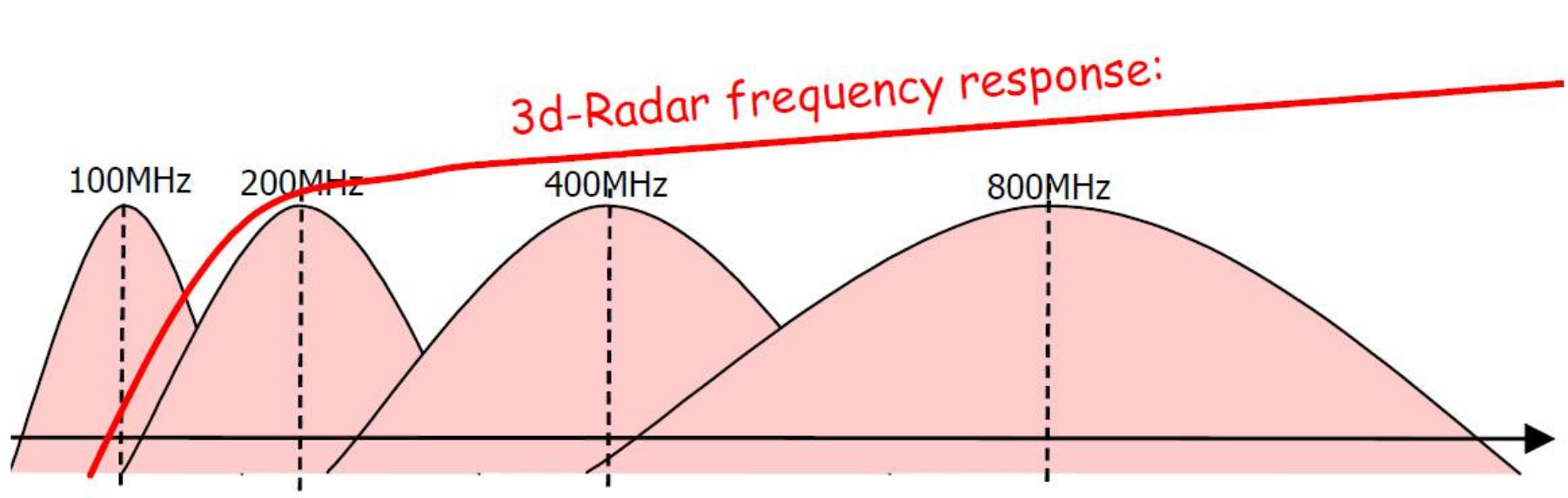
- Implementation strategy
  - Start with easy applications
  - Add other applications as they become implementation-ready

A Brief Description of SF-GPR

Impulse vs. Step-Frequency GPR

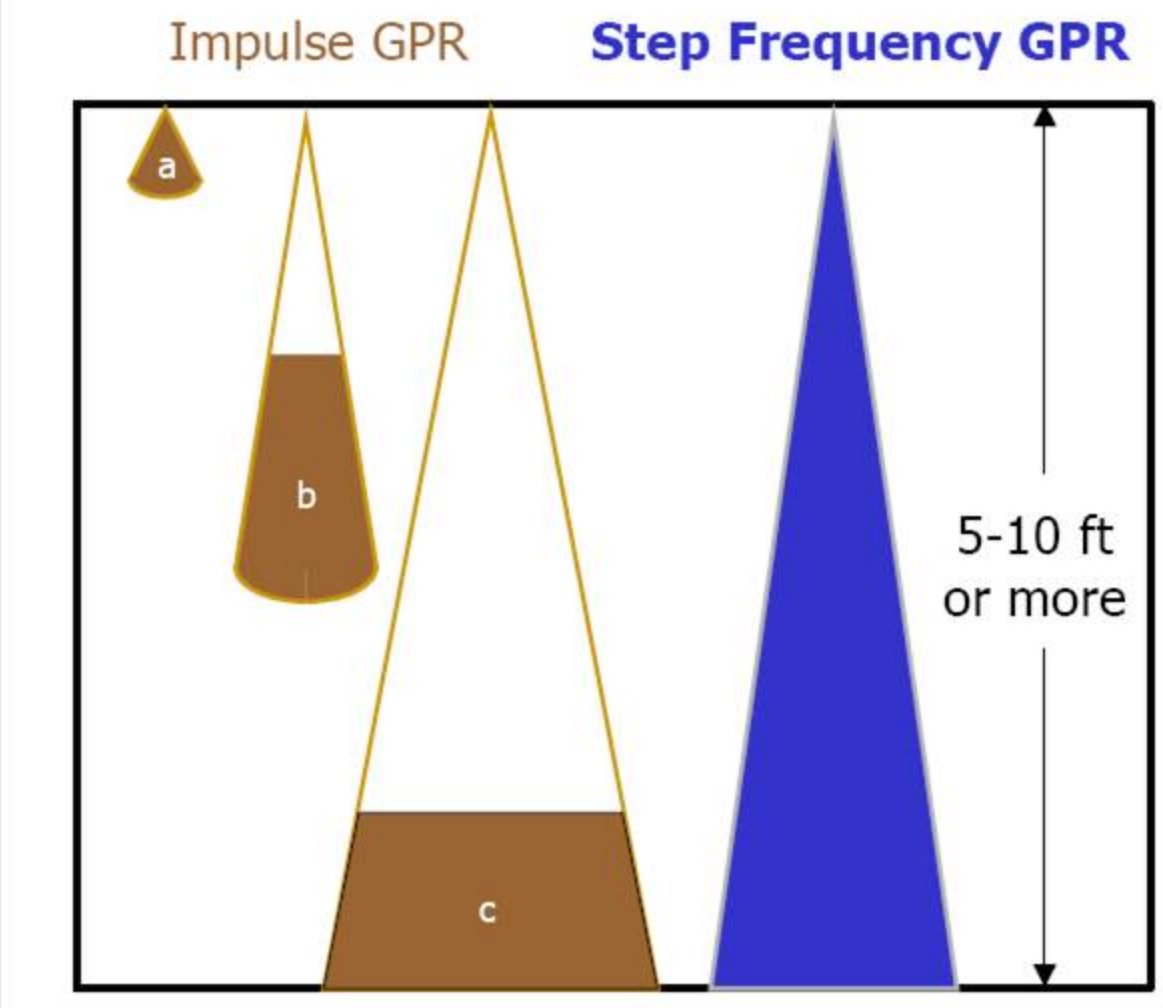


Impulse vs. Step-Frequency GPR

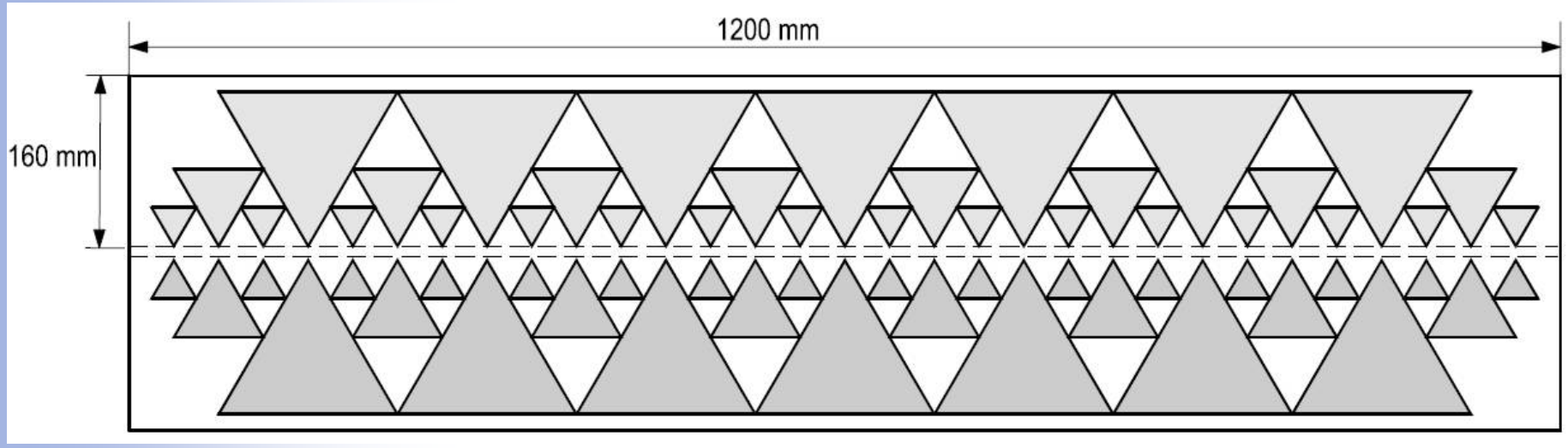


Impulse radar frequency response

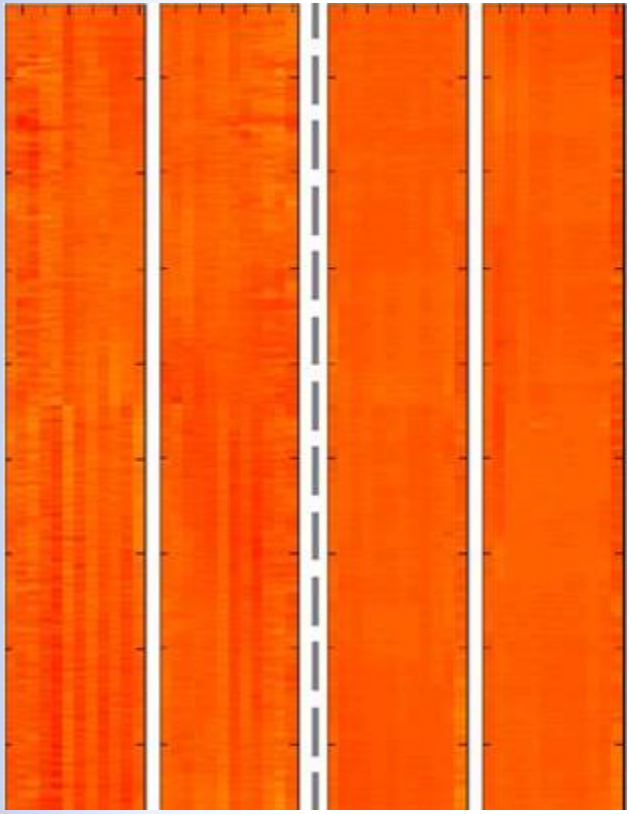
Impulse vs. Step-Frequency GPR



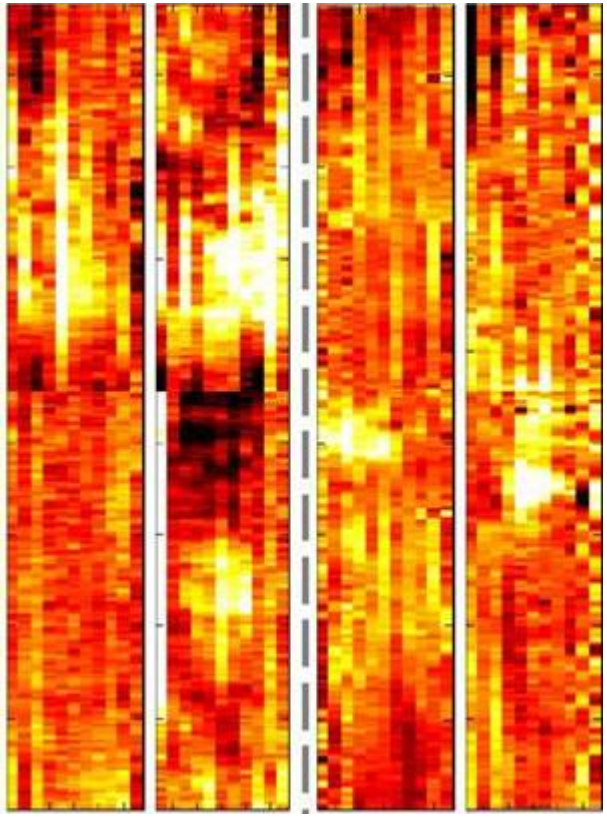
SF-GPR antenna array



SF-GPR – scan images

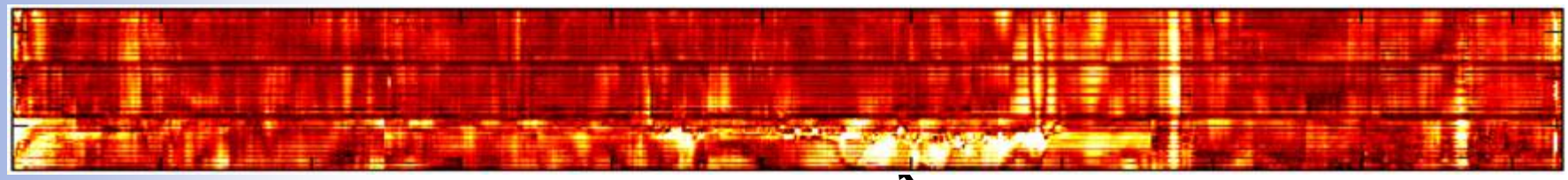


Surface – no distress



Layer interface showing inconsistent condition and presence of water

Voids under composite pavement



135+40

144+00

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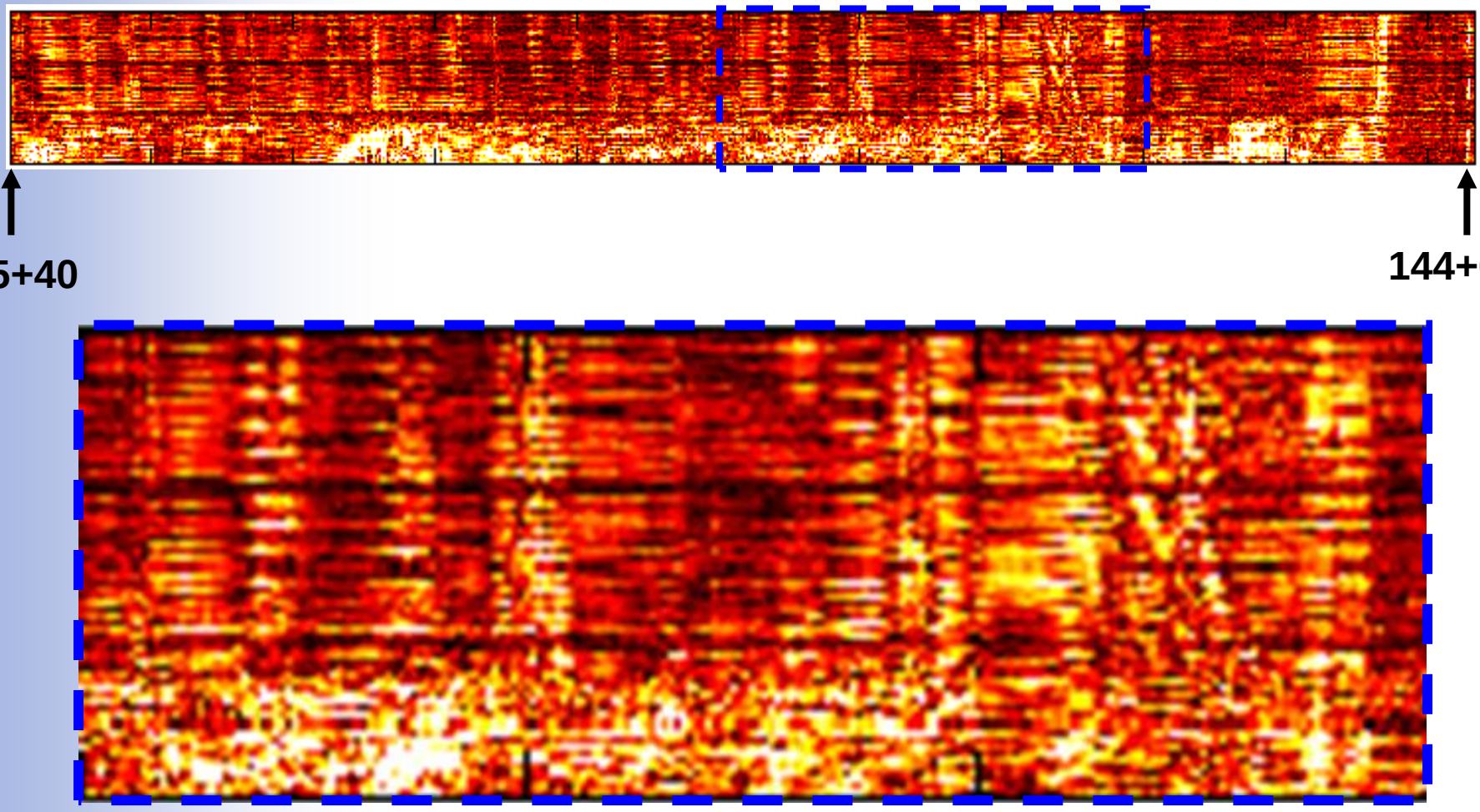
2 ft. Depth Zoom



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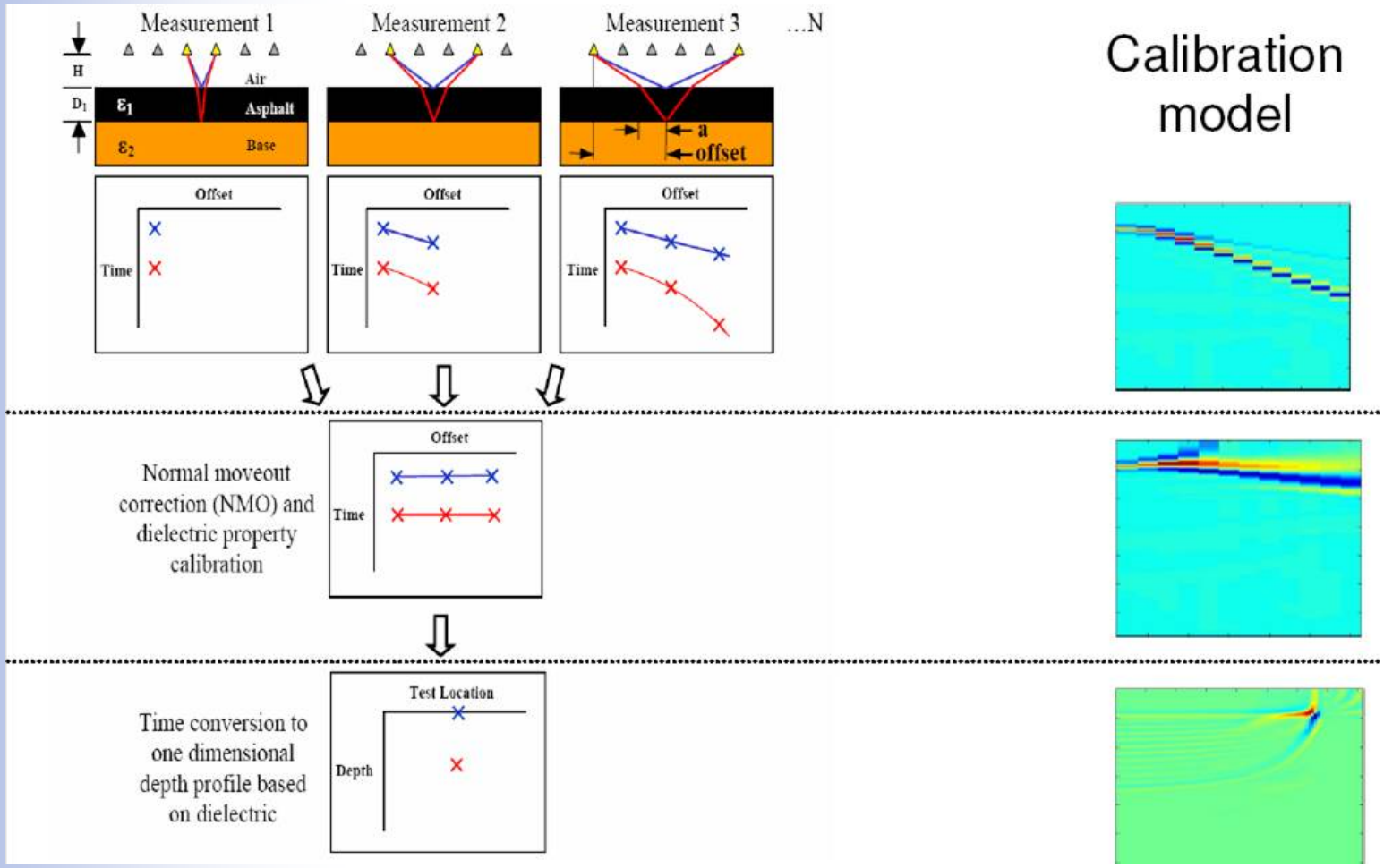
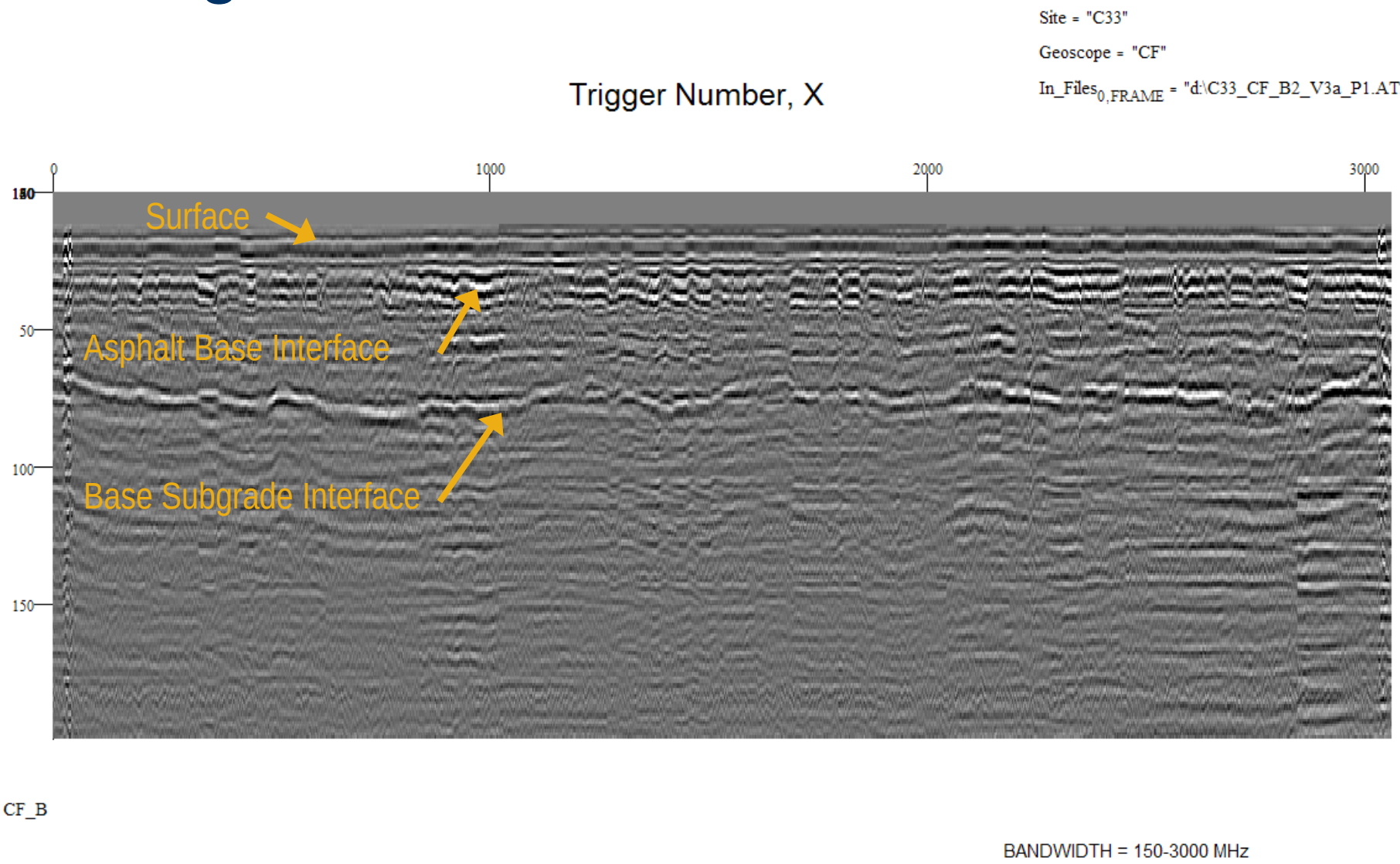
Continuous calibration

Continuous calibration by common midpoint (CMP) method without coring



Radargram from APE Software



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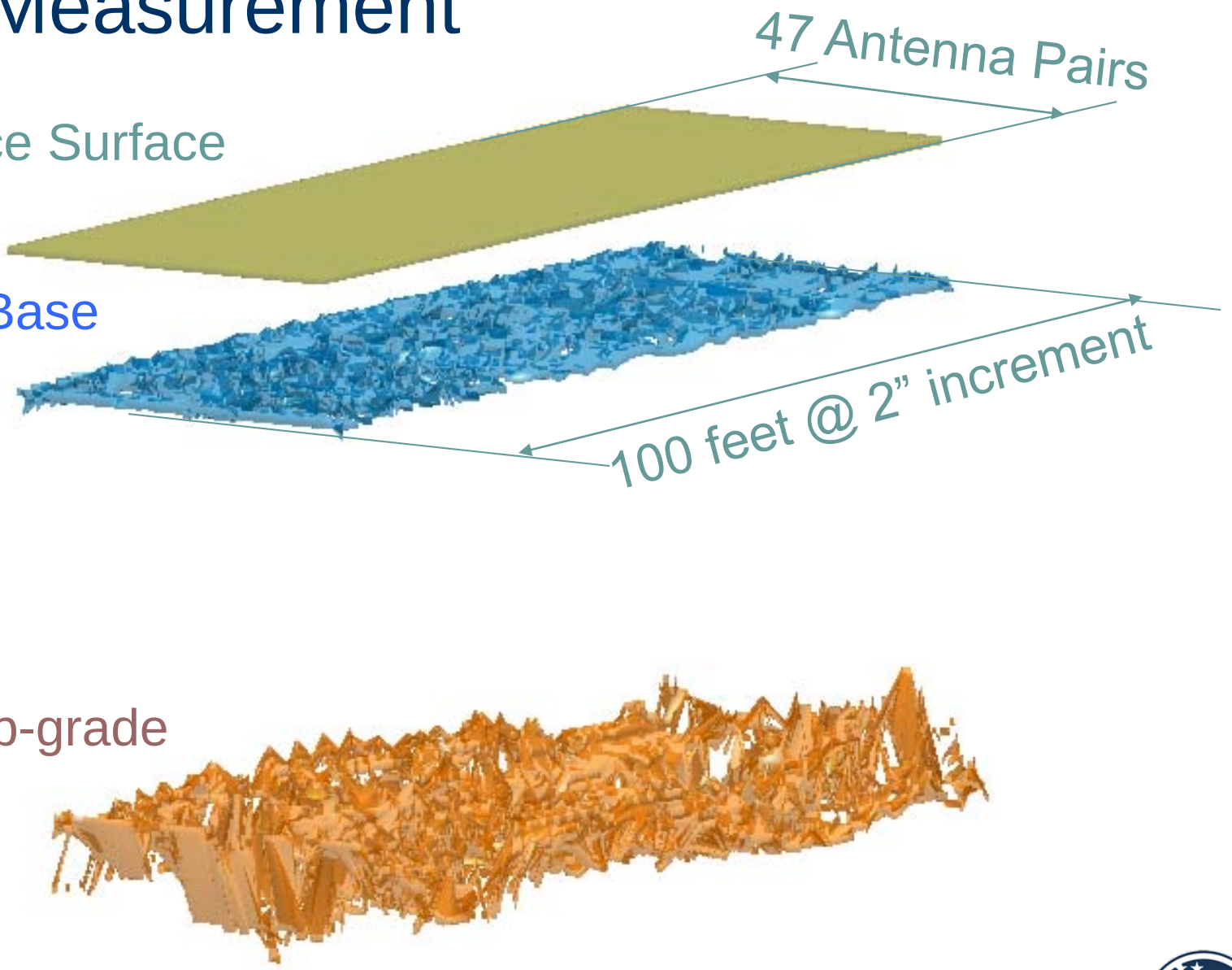
Source: APE Software

Layer Measurement

Reference Surface

Asphalt/Base Interface

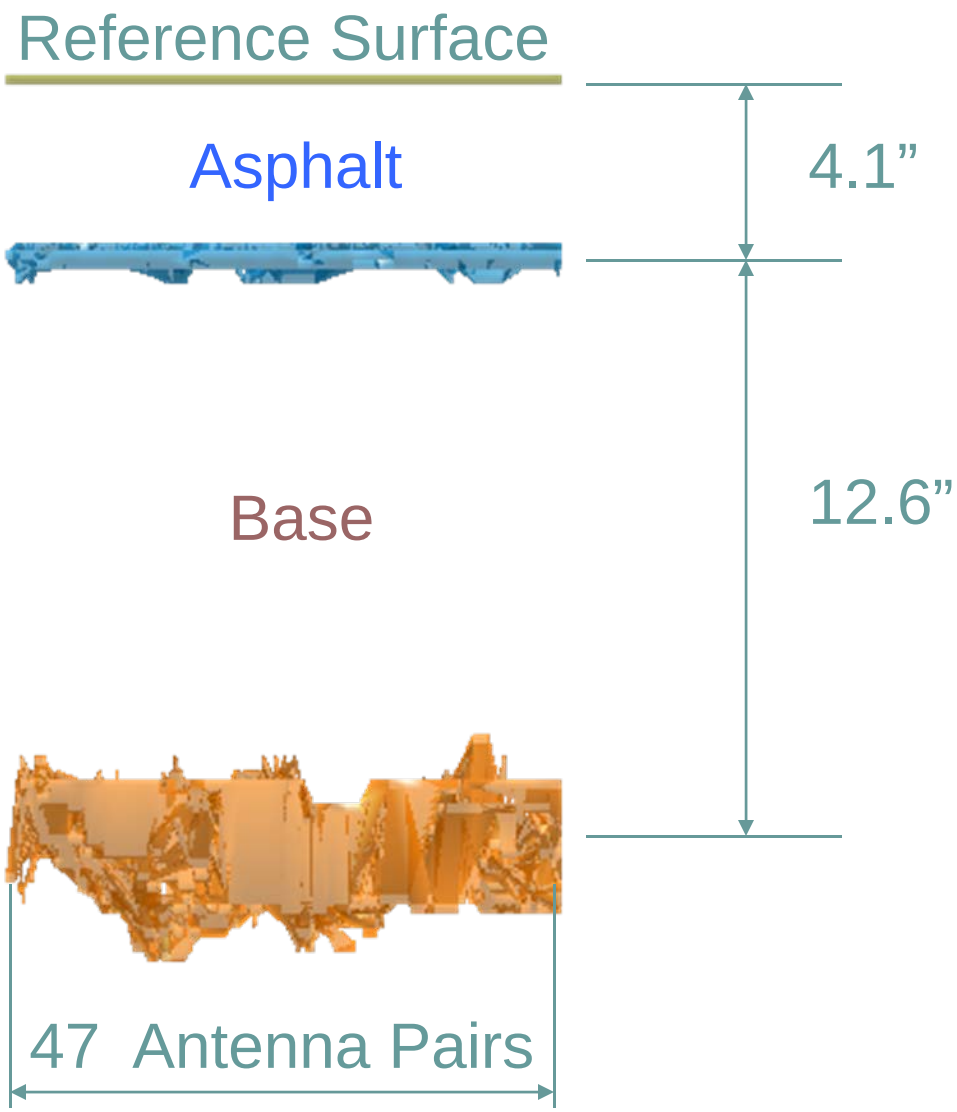
Base/Sub-grade Interface



Cell 33

Orthotropic View

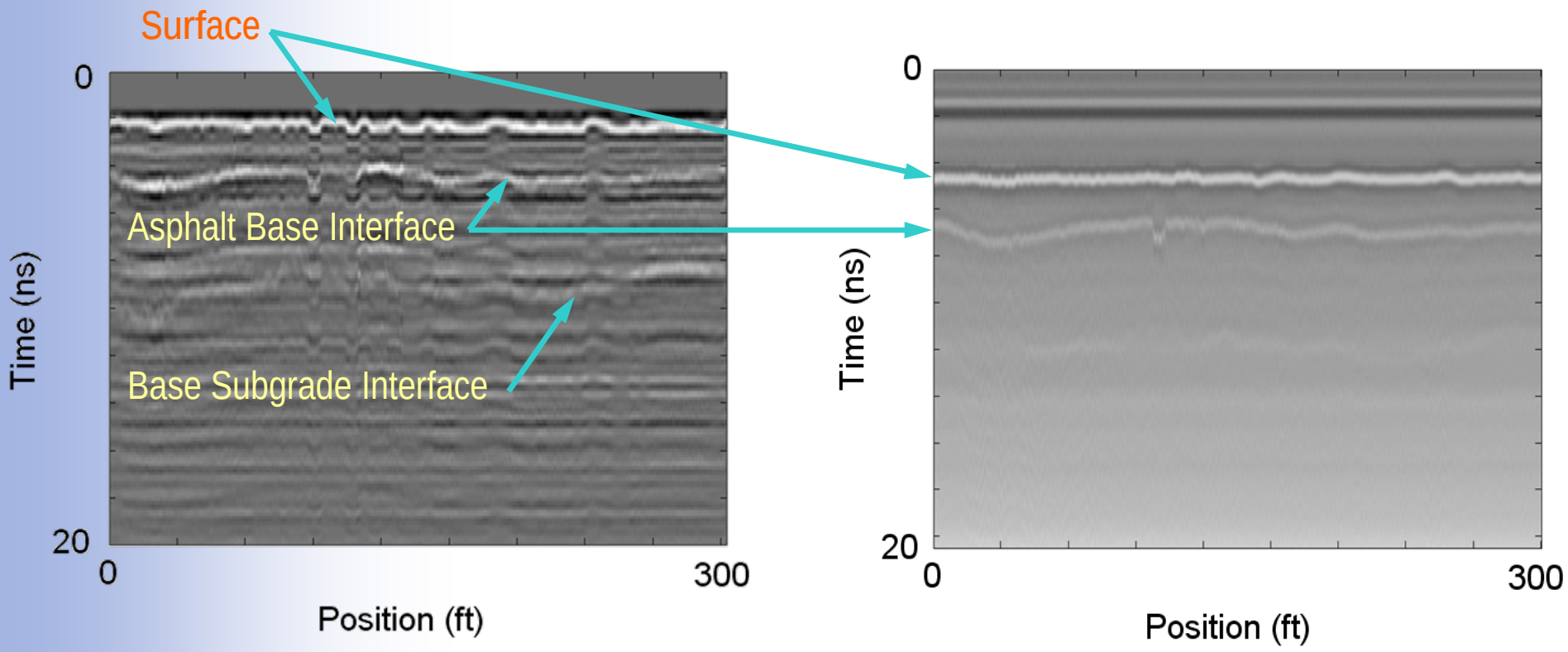
Layer Measurement



Cell 33

Cross-Sectional View

Comparison of SG-GPR and GSSI results



APE System (Single Antenna)

1 GHz GSSI

Current status

- Some of the basic SF-GPR applications will be ready for pilot implementation in FY10
  - Pavement layer thickness
  - Moisture detection
  - Void detection
  - Rutting evaluation (2-D & 3-D imaging)
- Scope of work on MIRA will be broadened
  - Some applications may be ready for pilot implementation in FY10
- Additional cooperative studies are planned
  - Curling and warping measurement