地雷検知用SAR-GPRの開発

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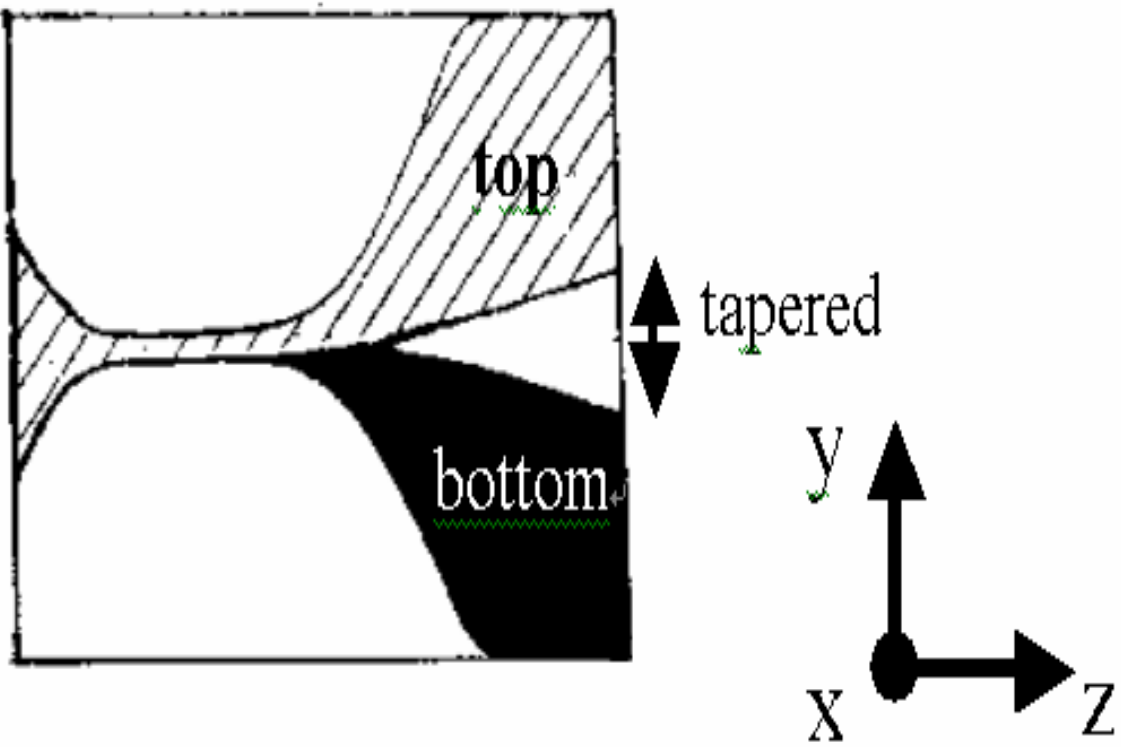
Tohoku University

概要

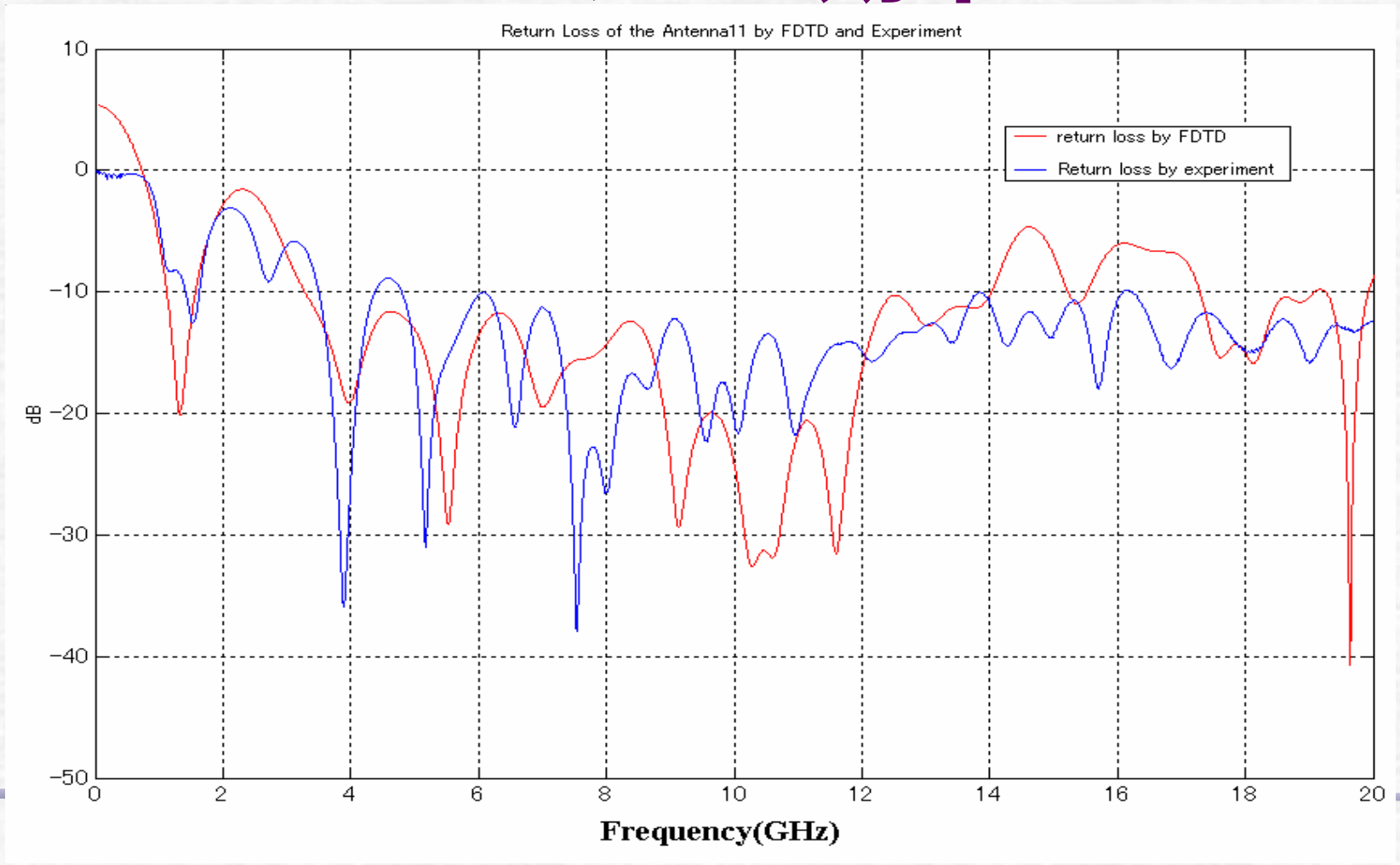
1. イントロダクション
2. GPR用アンテナ設計
3. 簡易なモデルでの実験
4. 信号処理
5. 現実的なモデルでの実験
6. 結論

ビバルディ　アンテナ

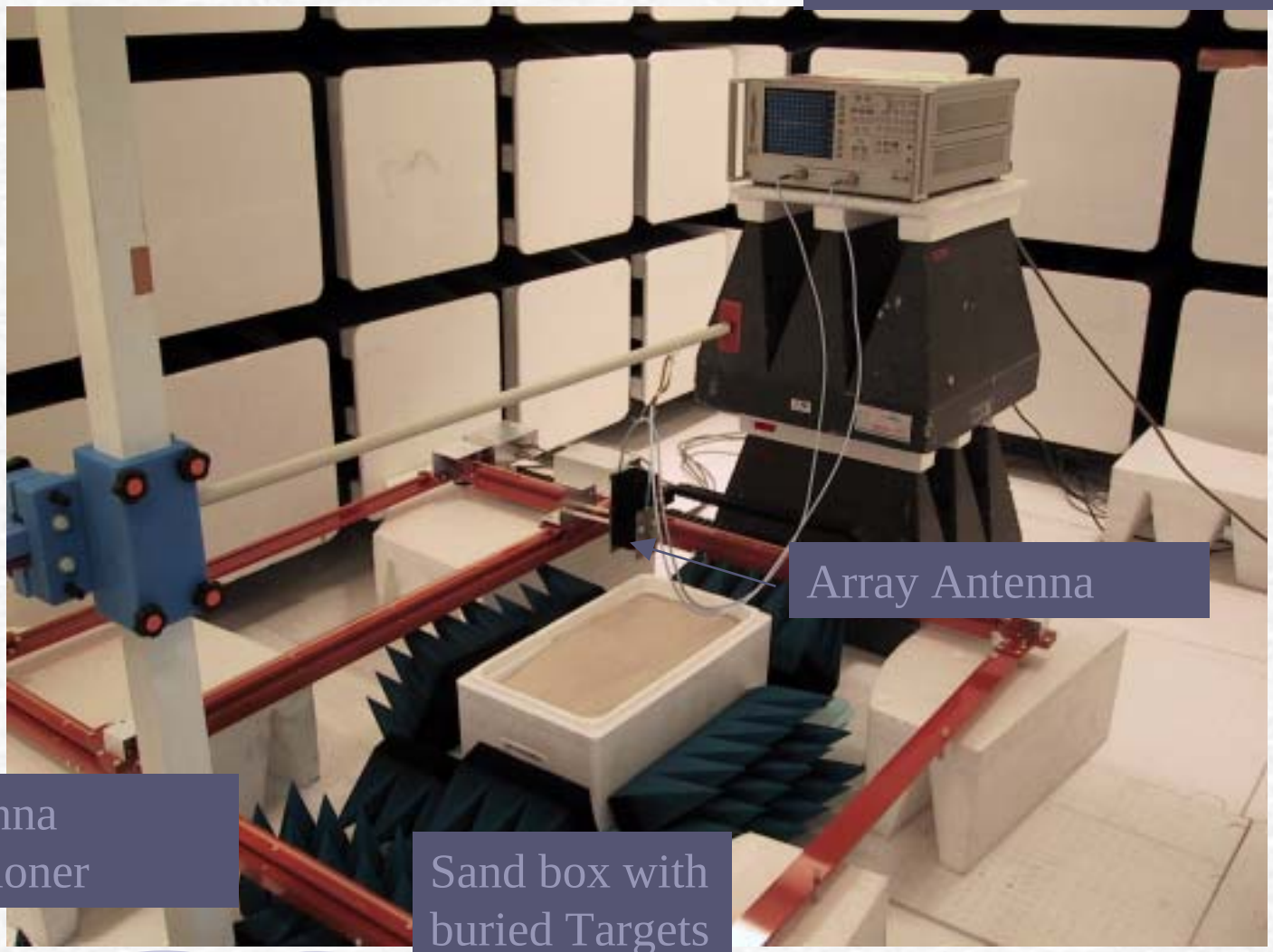


- Broadband
- Small Size
- Endfire Radiation Easy to manufacture

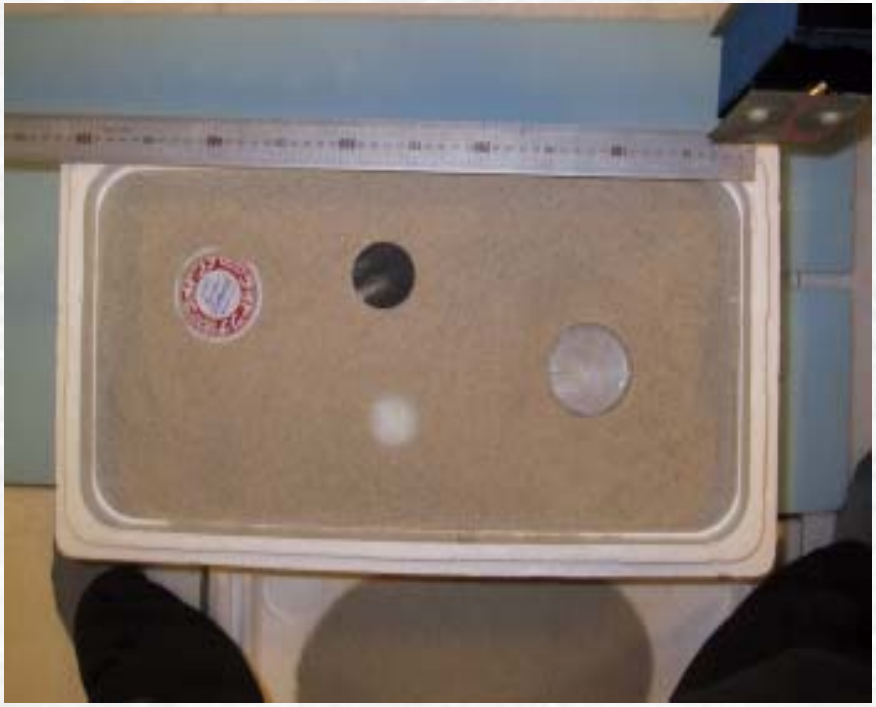
アンテナ　効率


Return Loss of the Antenna11 by FDTD and Experiment
return loss by FDTD
Return loss by experiment
dB
10
0
−10
−20
−30
−40
−50
0
2
4
6
8
10
12
14
16
18
20
Frequency(GHz)

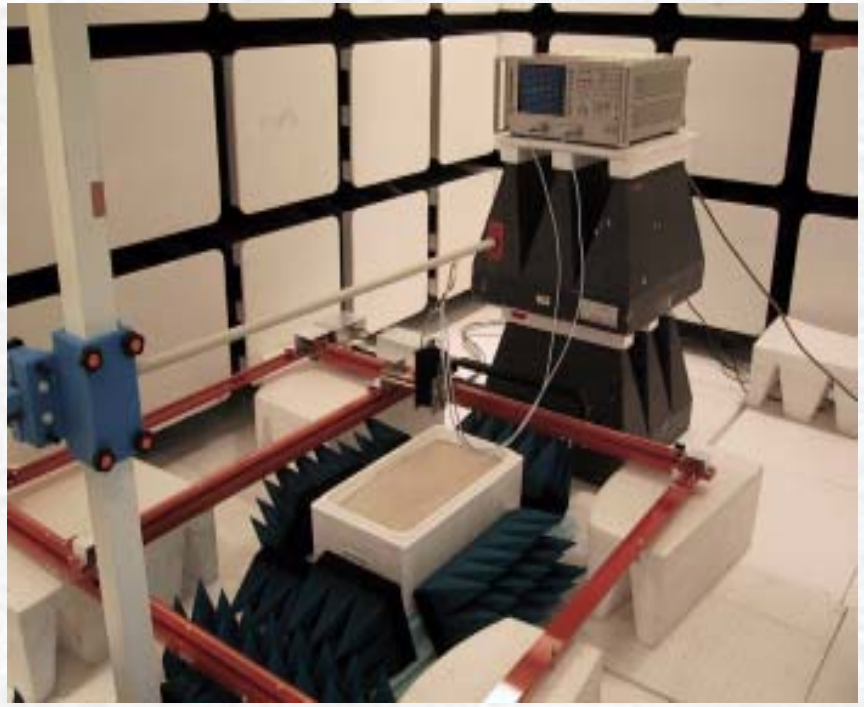
実験装置


Vector Network Analyzer
Array Antenna
Antenna Positioner
Sand box with buried Targets

基礎実験

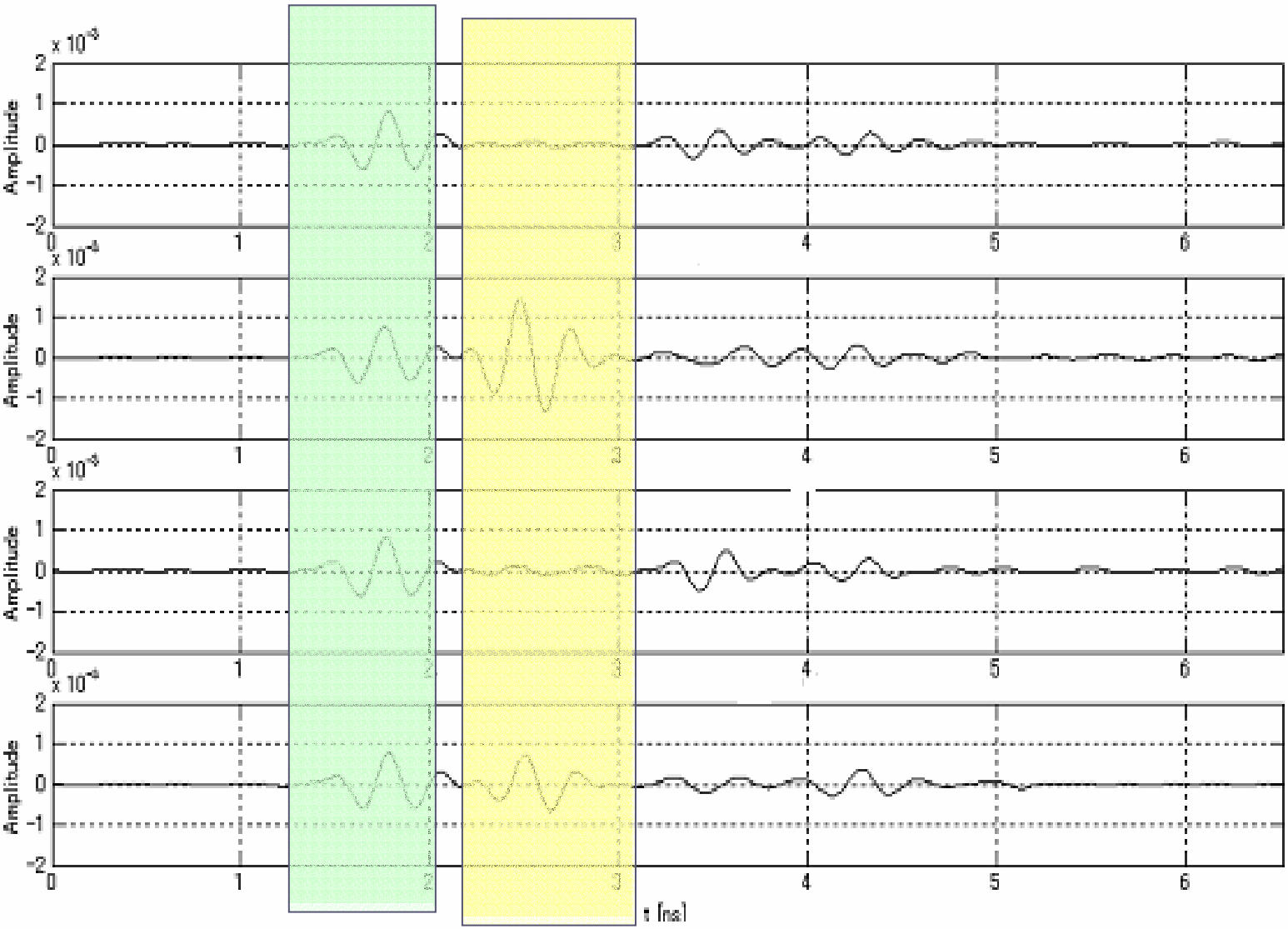


Targets Location

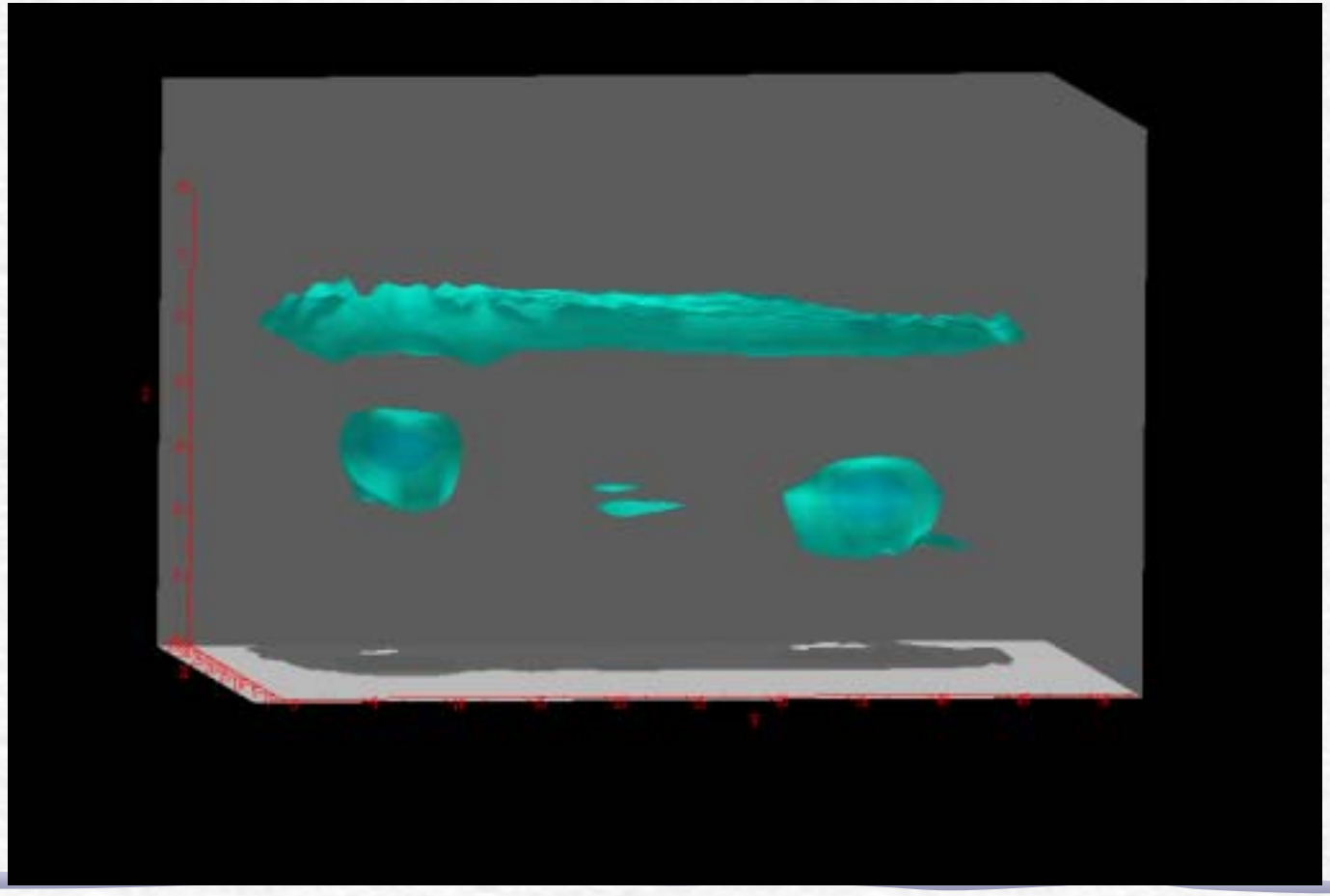


Experiment Configuration

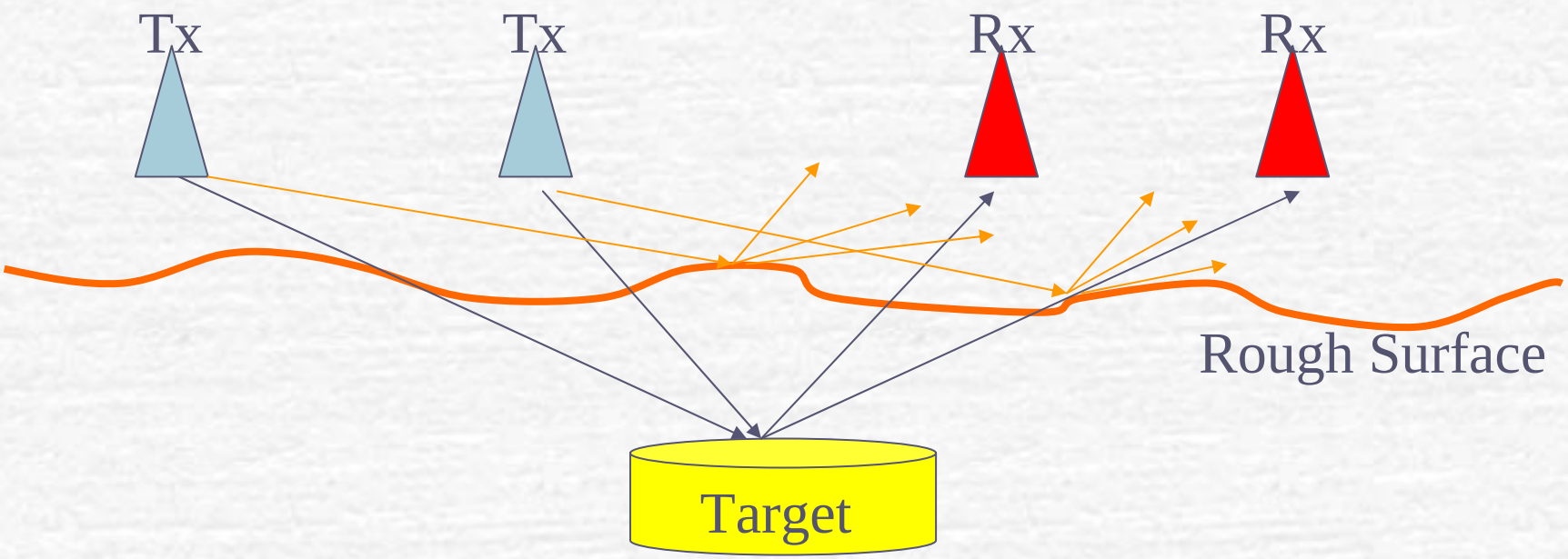
Ground Surface Buried Target

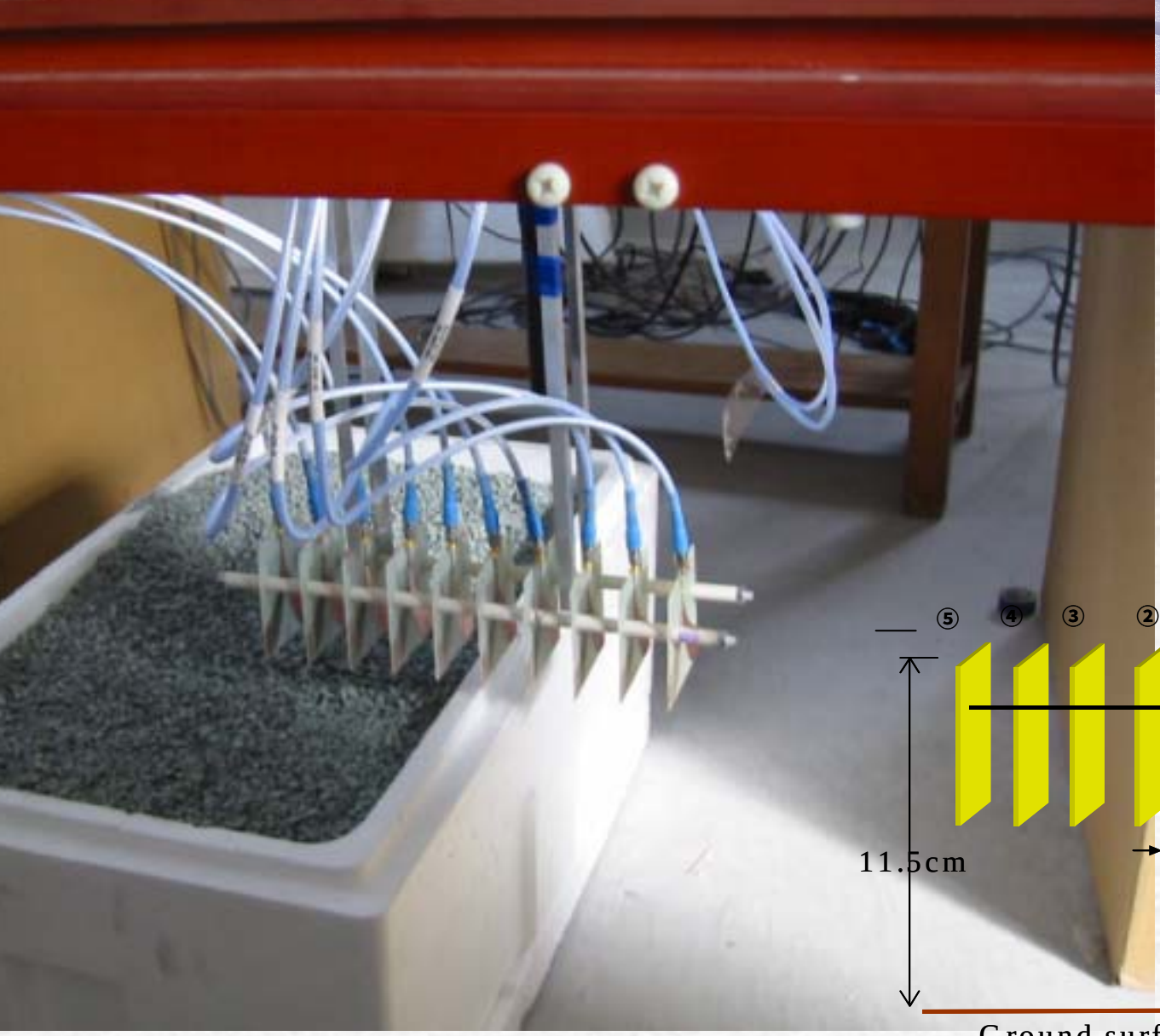


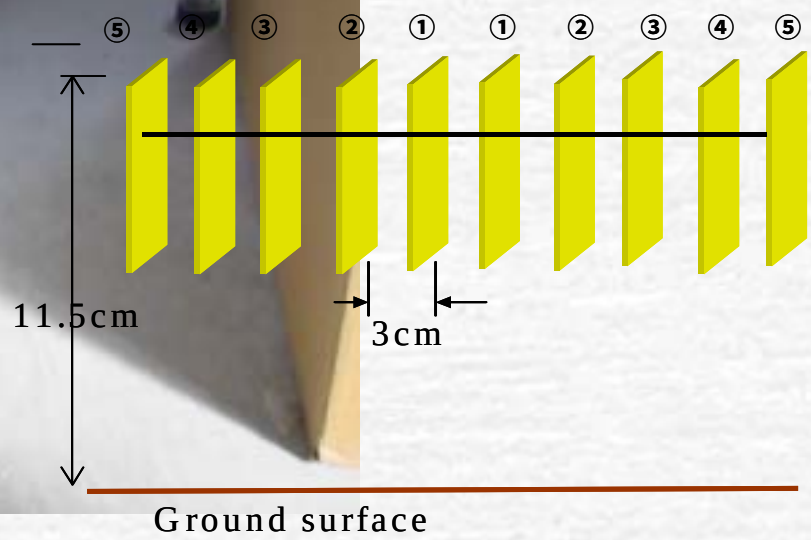
3-D 再合成画像



アレイアンテナ利用と空間相関性





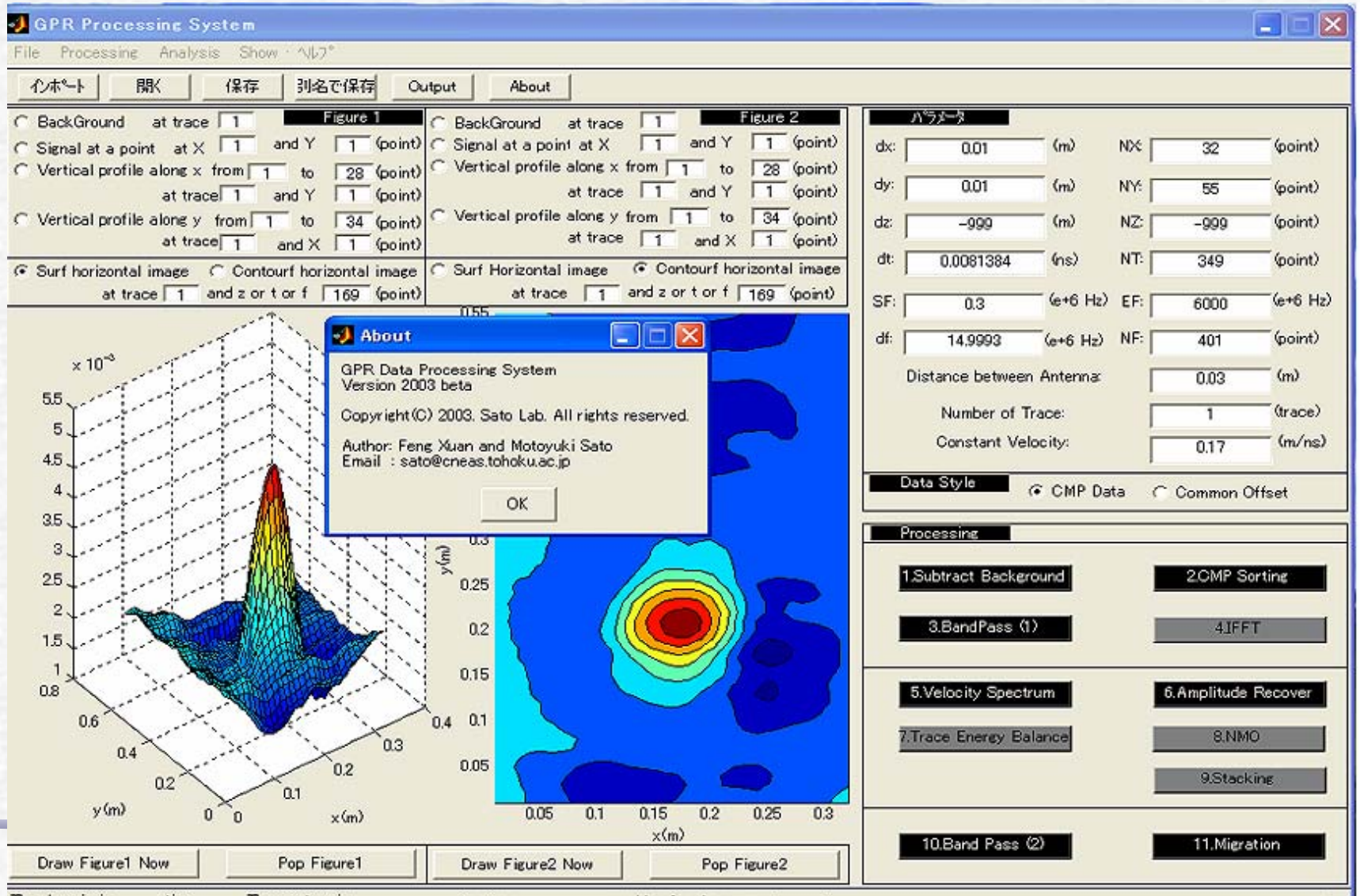

⑤ ④ ③ ② ① ① ② ③ ④ ⑤
11.5cm
3cm
Ground surface

System Setup

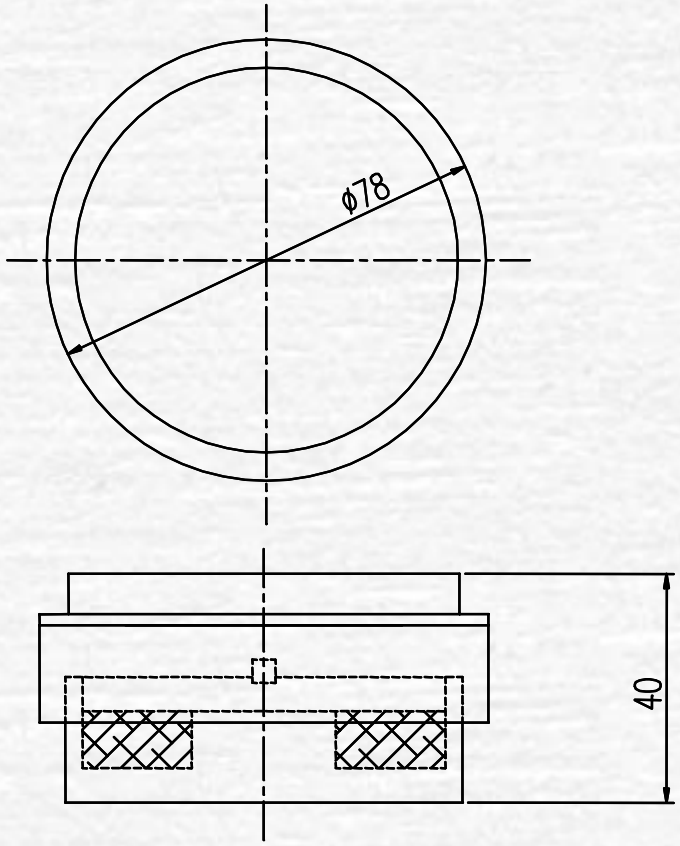
Array Antenna and Switch

MATLAB GUI

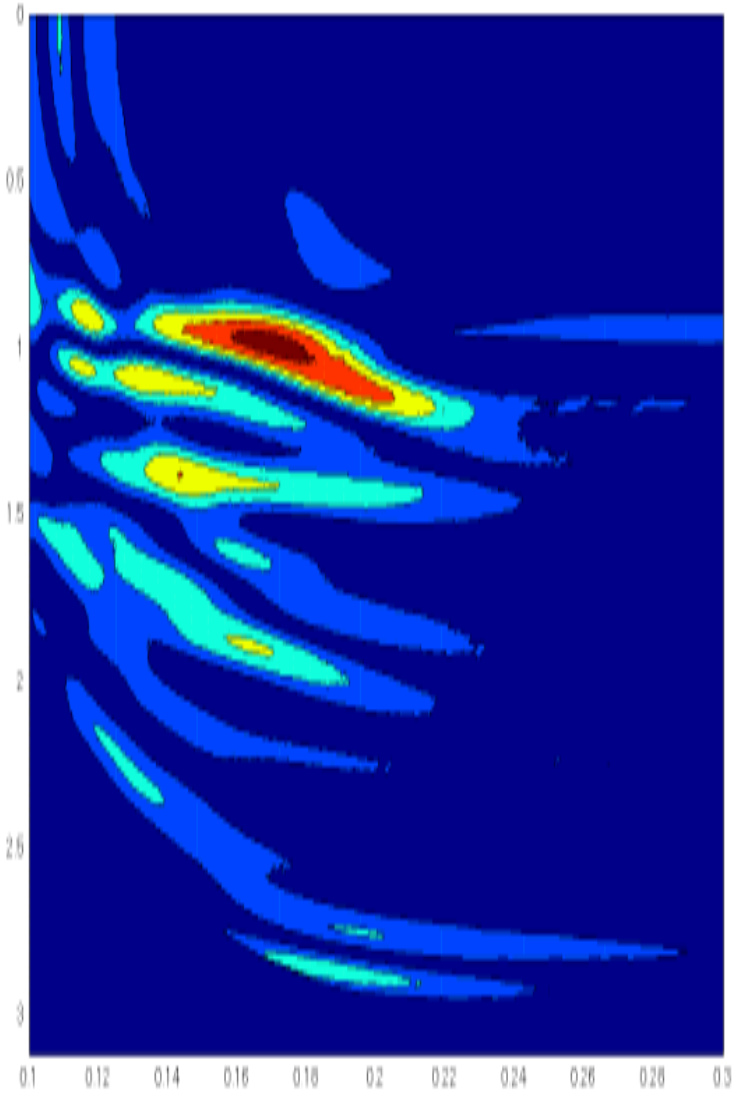
Tohoku University



Type72 Landmine Model



平滑表面モデル



Velocity spectrum

Horizontal image (flat ground)

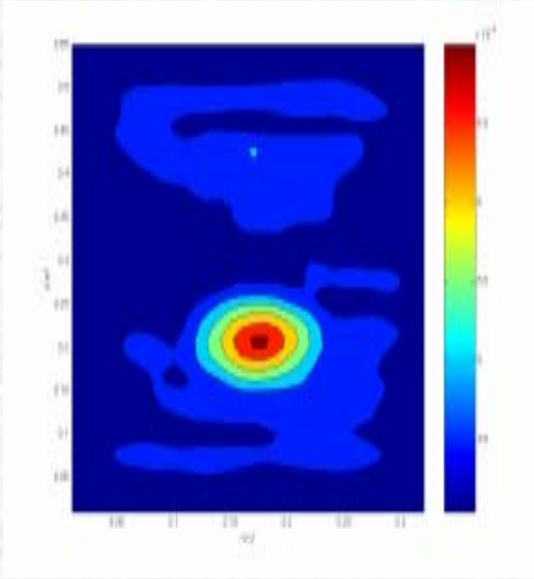


Image at the Z=0.1244m

Common offset

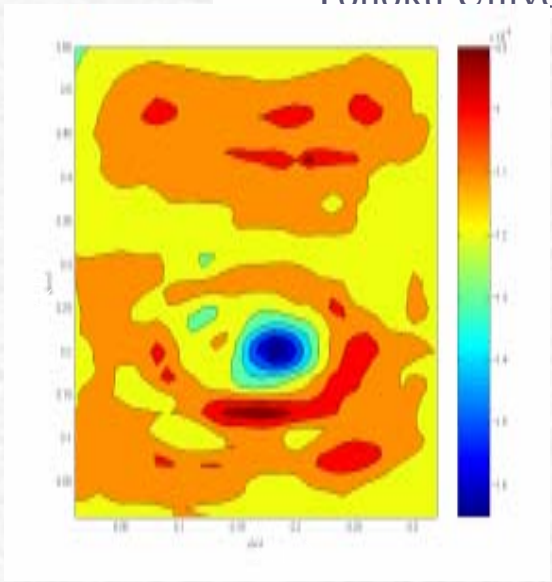
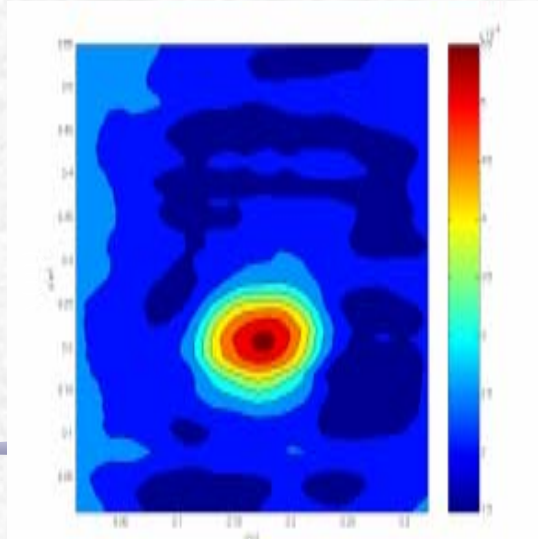
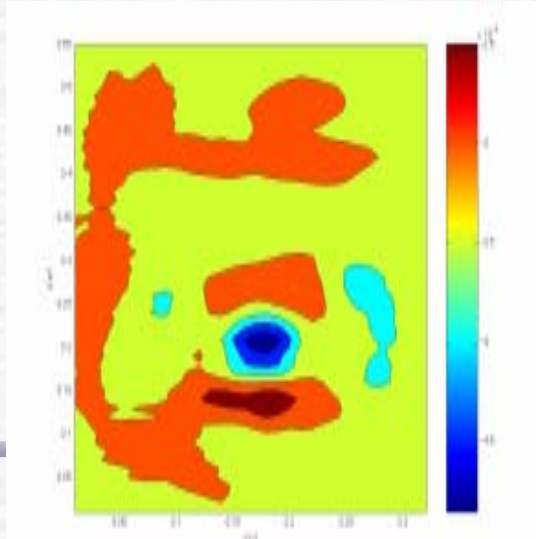


Image at the Z=0.1675m



CMP



Horizontal Image (rough ground)

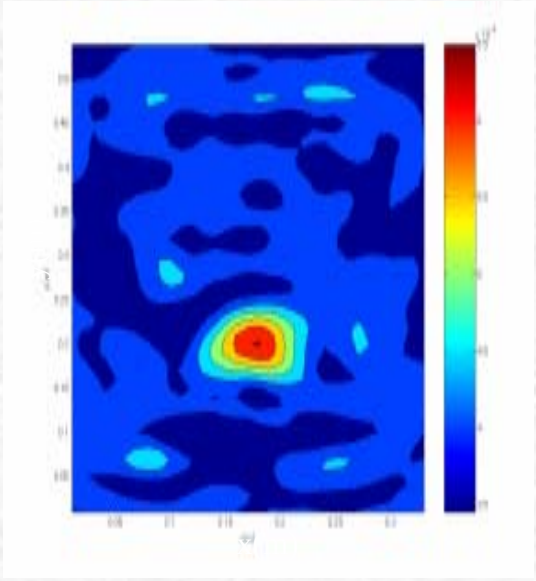


Image at the Z=0.1194m

Common offset

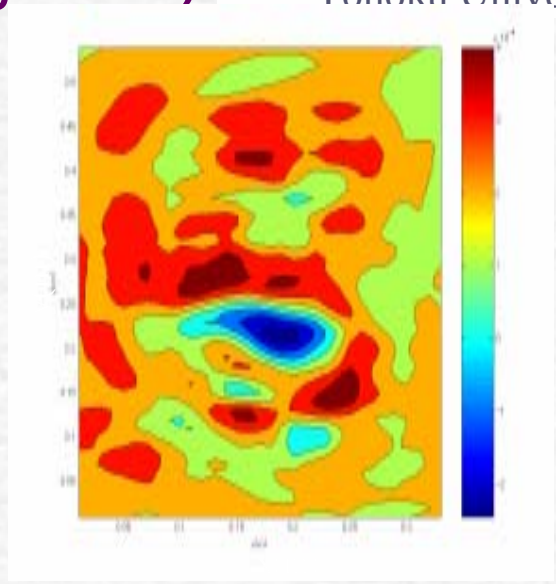
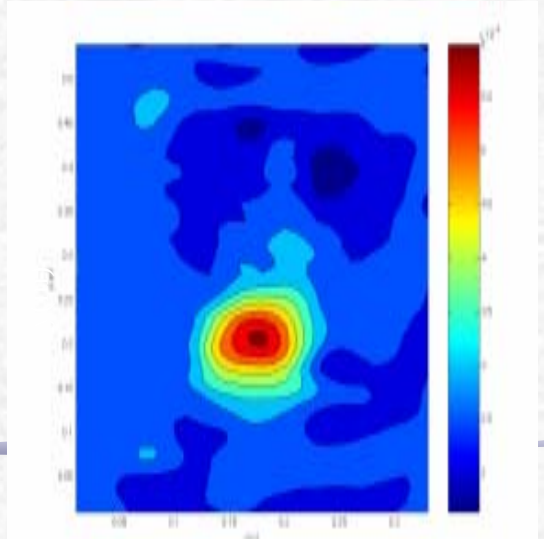
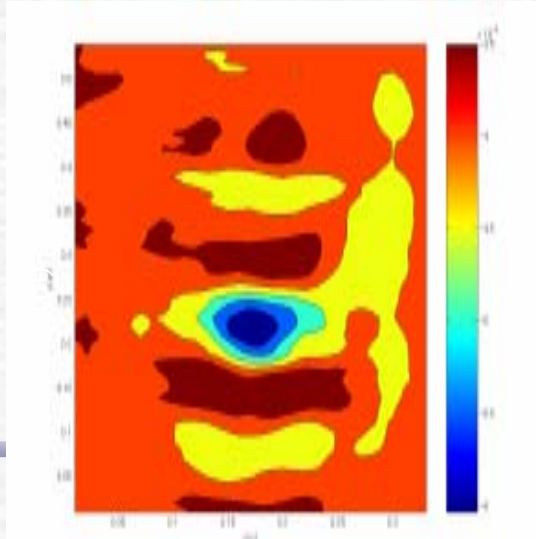


Image at the Z=0.1634m



CMP



粗い表面モデル

Rough Surface and Landmine Model

tal image (covered

Common offset

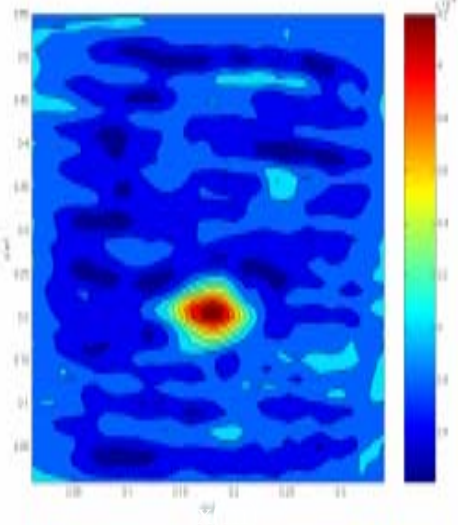


Image at the Z=0.1208m

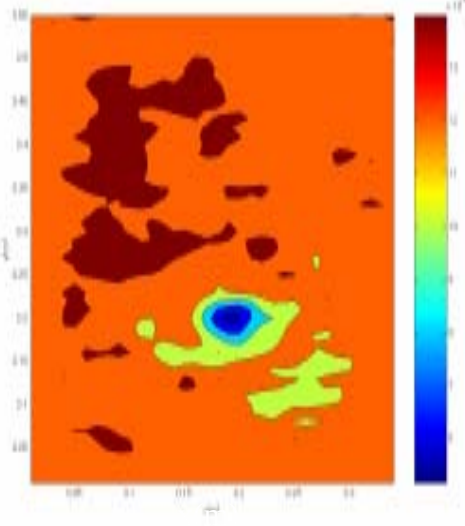
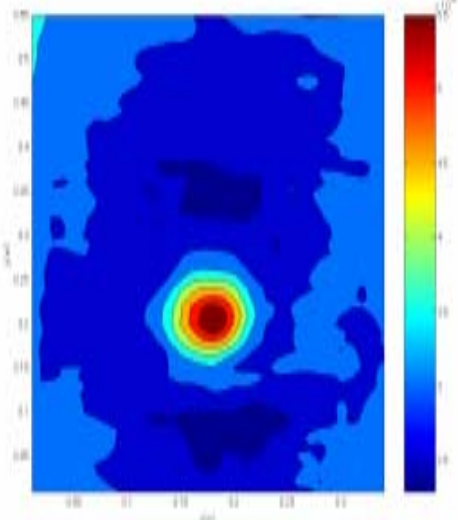
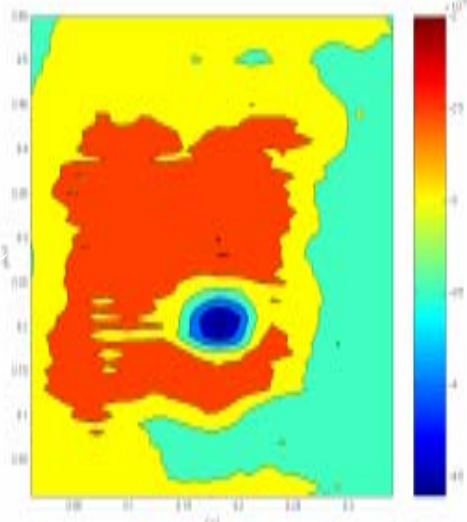


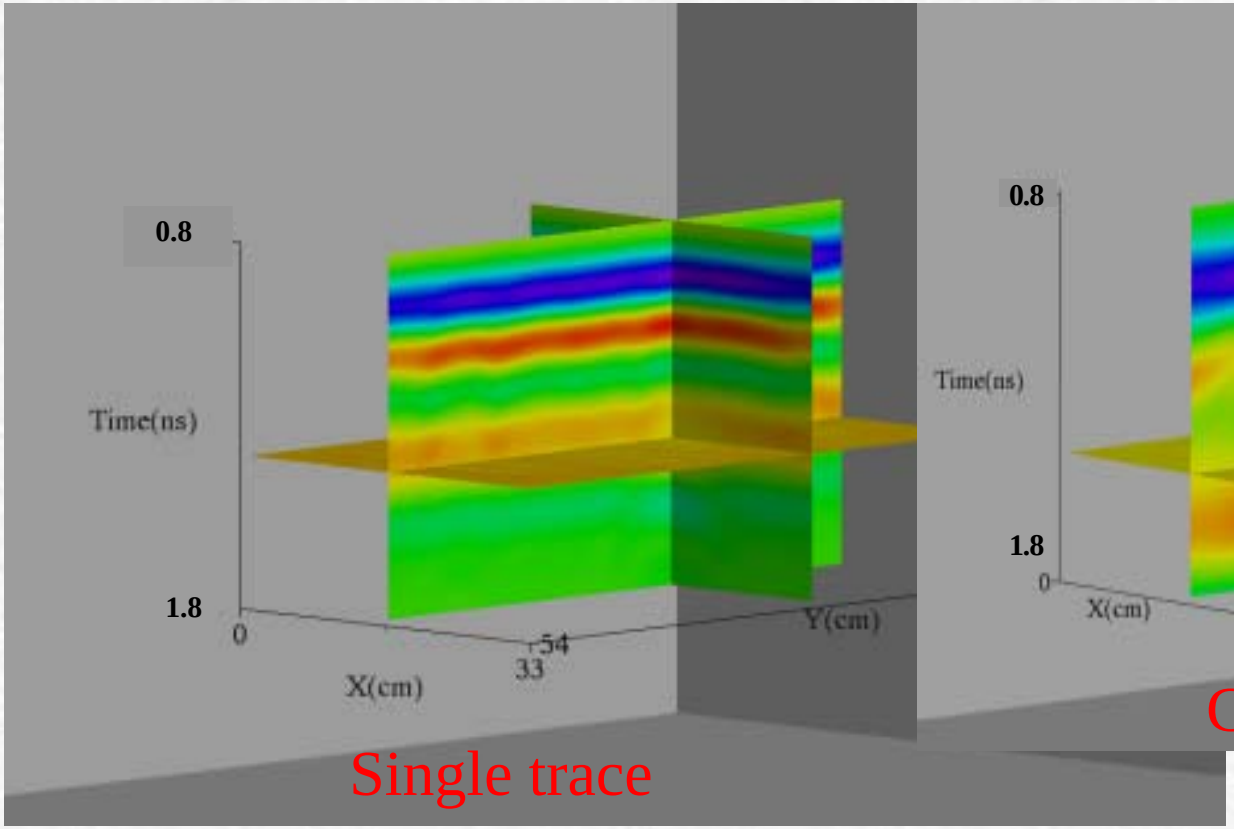
Image at the Z=0.1672m

CMP

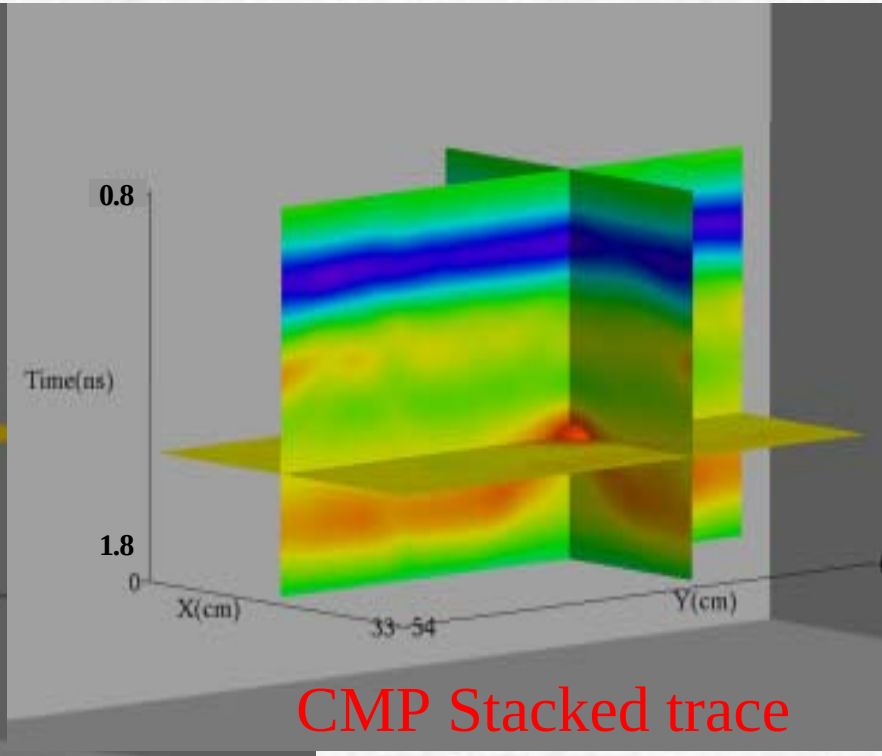




3D Image of GPR under a rough ground surface



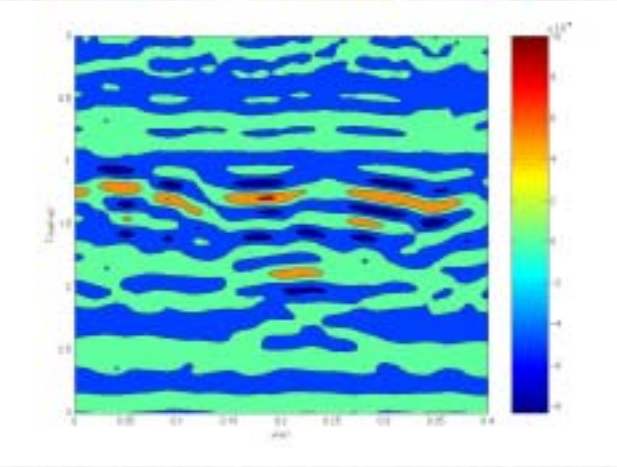
Single trace



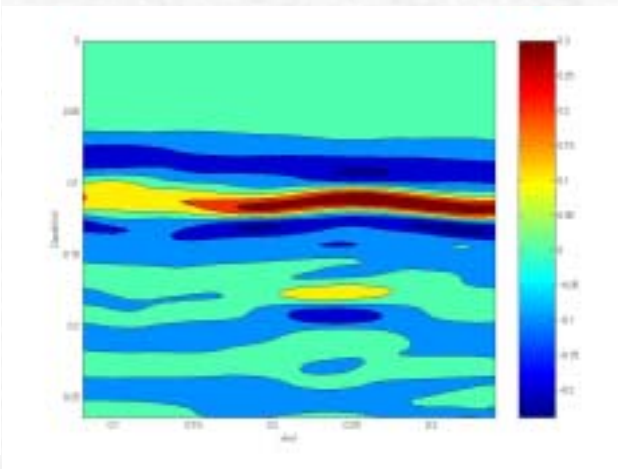
CMP Stacked trace

非常に粗い表面モデル

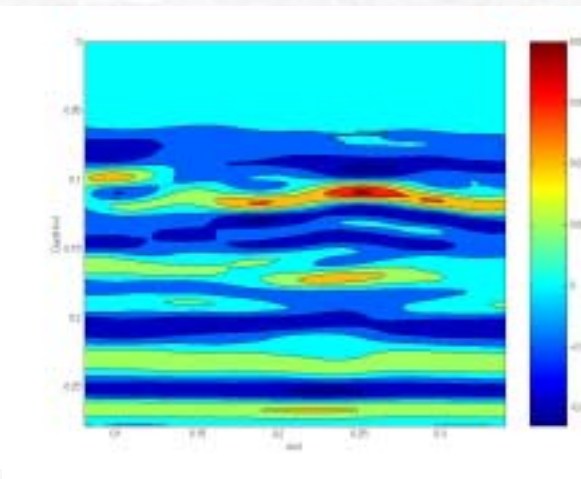
Vertical Slice



Common Offset

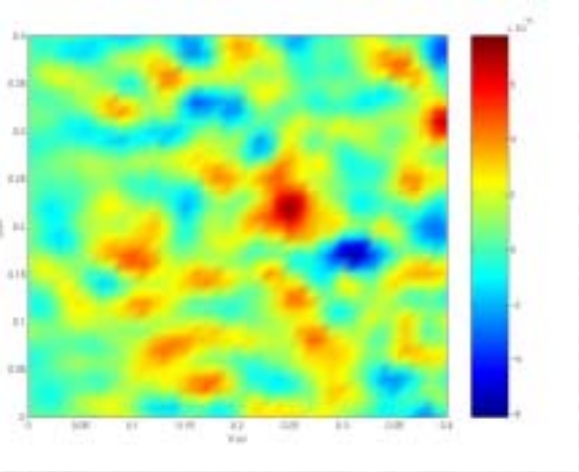


Common Offset +SAR

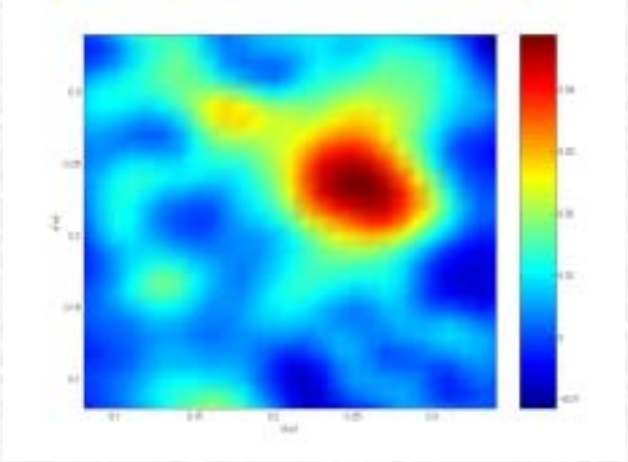


CMP+SAR

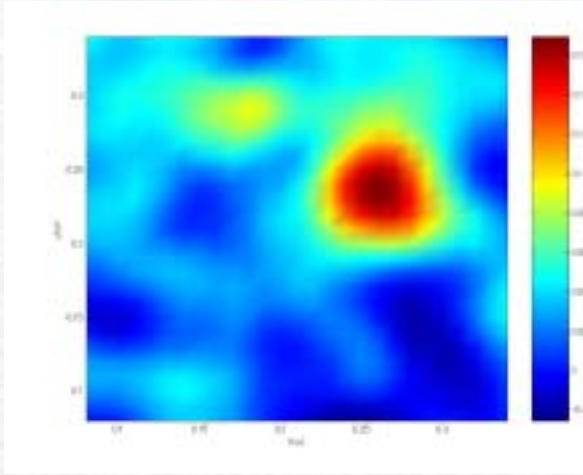
Horizontal Slice



Common Offset



Common Offset +SAR



CMP+SAR

結論

- アレイアンテナの有効性
- 最適周波数：2-10GHz
- CMP と合成開口処理の有効性確認