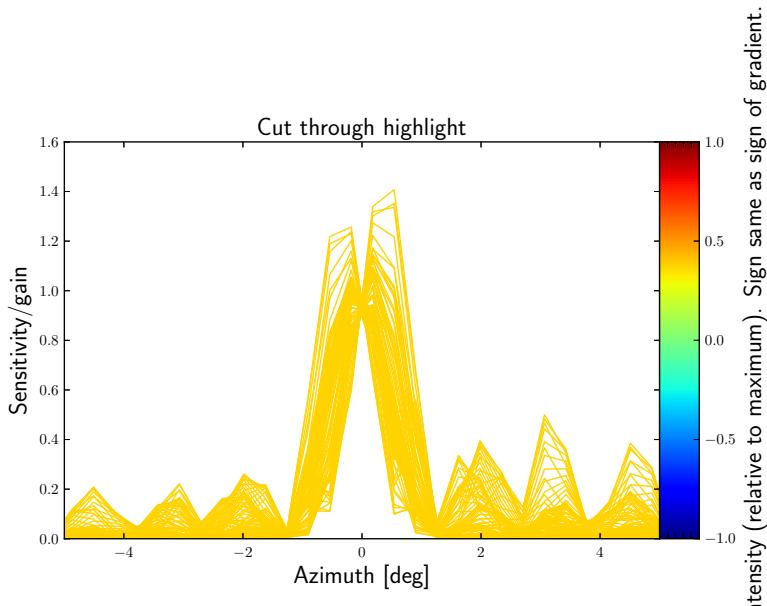
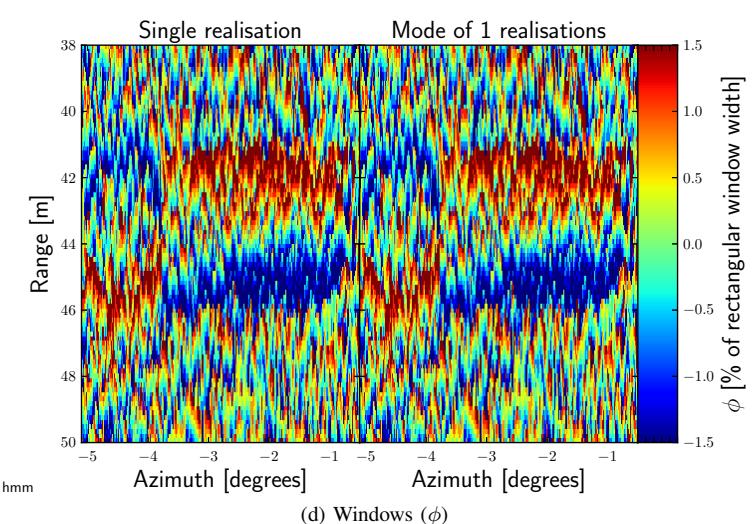
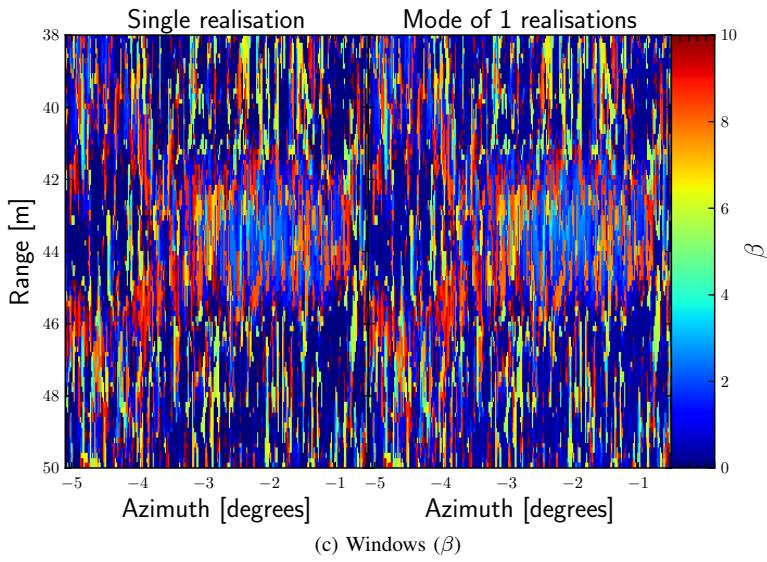
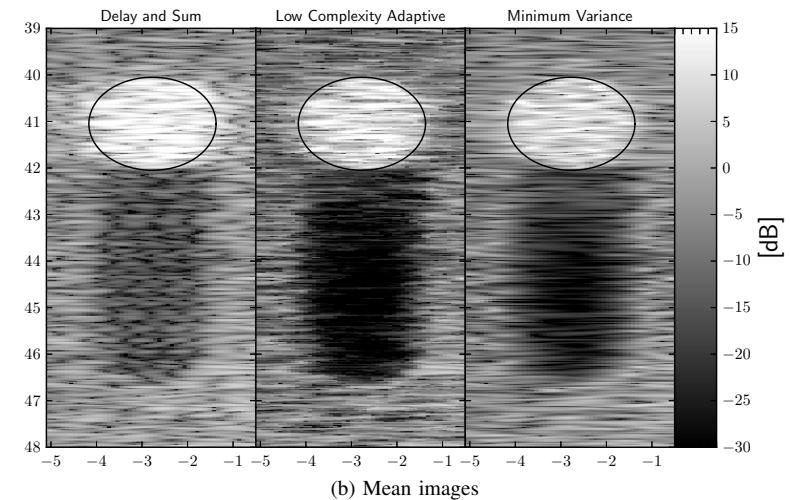
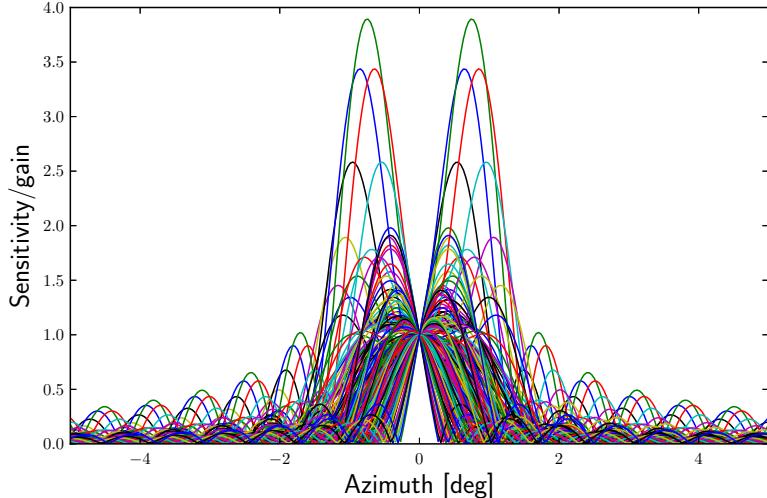
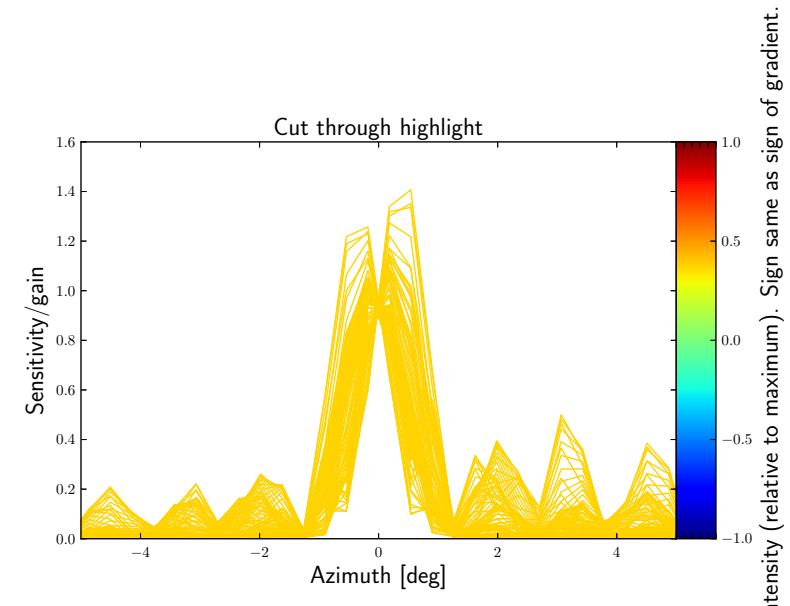


LCA with trigonometric and Kaiser windows - Capon shining
General $M = 32$ $\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$ $\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$ **LCA** $\beta \in [0, 10] \text{ (9 values)}$ $\phi \in [-1.07, 1.07] \text{ deg (9 values)}$ $\text{Navg} = 3$ **Capon** $\Delta = 0.01$ $L = 16$ $\text{Navg} = 3$ 

Pixel intensity (relative to maximum). Sign same as sign of gradient.



(e) Capon win. resp. through shadow

(f) Capon win. resp. through highlight

Capon: Tuning regularisation.
General $M = 32$

$$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$$

$$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$$

LCA $\beta \in [0, 10]$ (9 values)

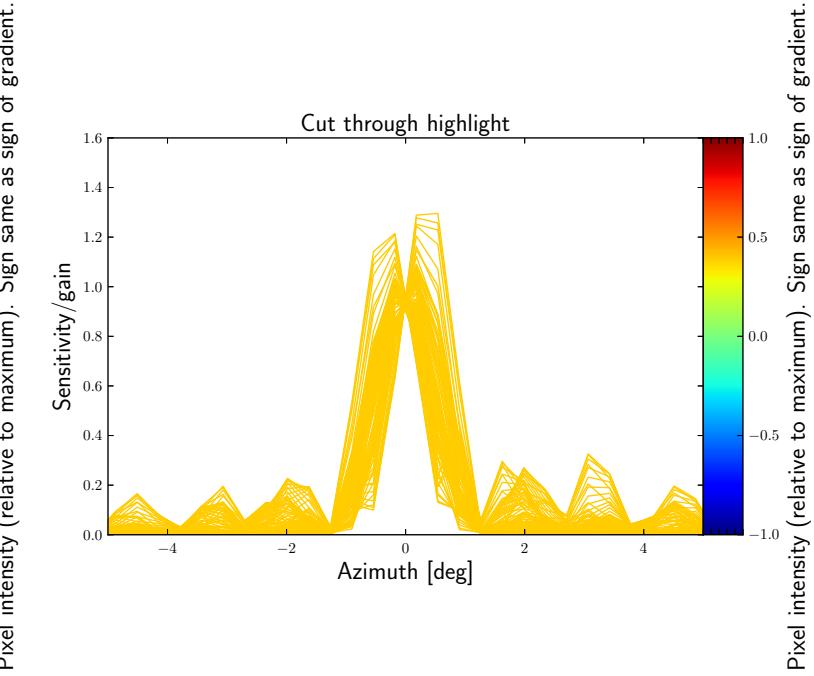
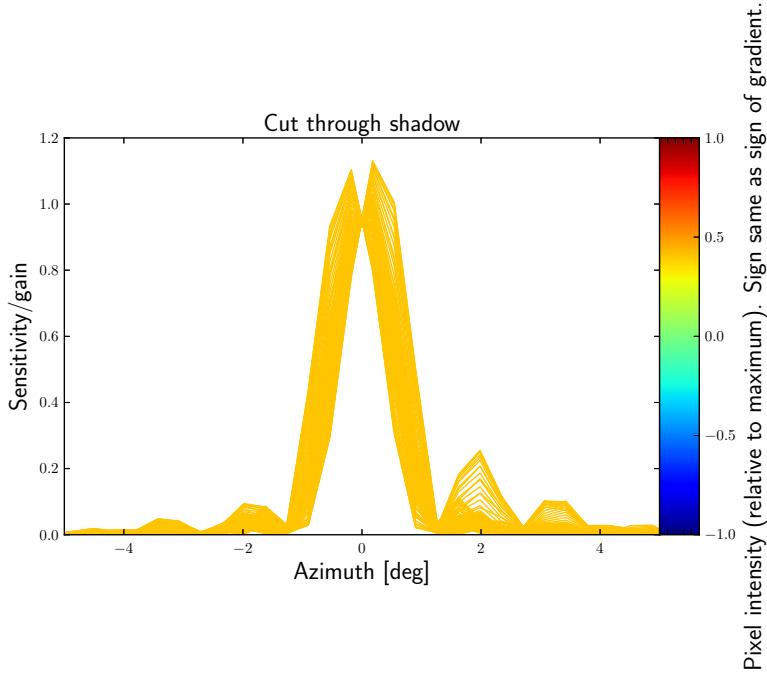
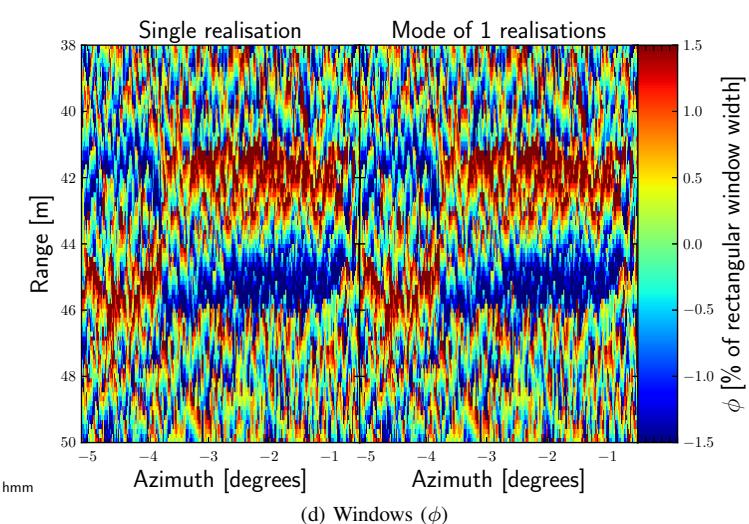
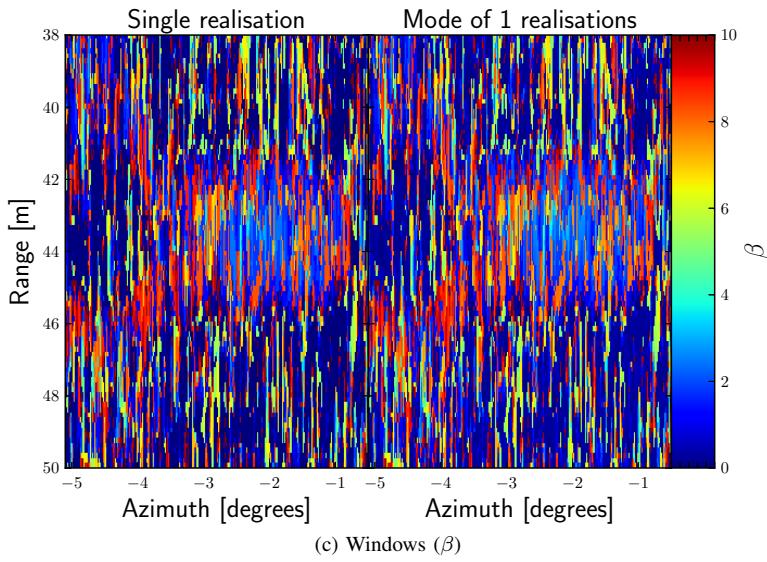
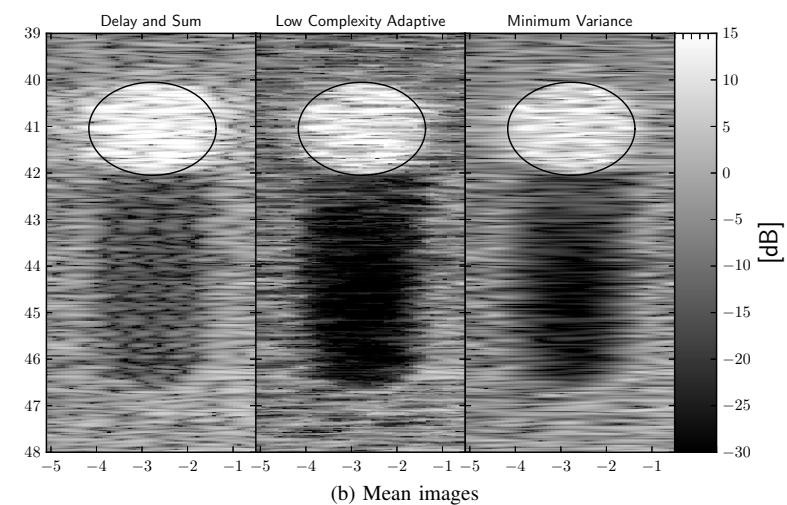
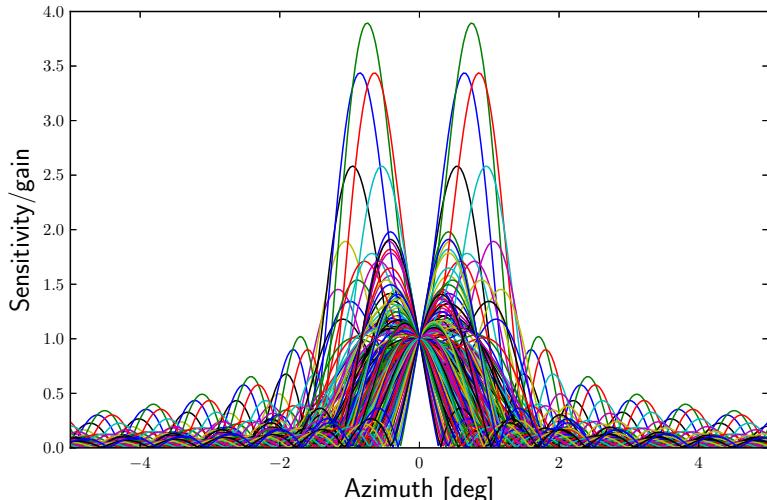
$$\phi \in [-1.07, 1.07] \text{ deg}$$
 (9 values)

$$\text{Navg} = 3$$

Capon $\Delta = 0.05$

$$L = 16$$

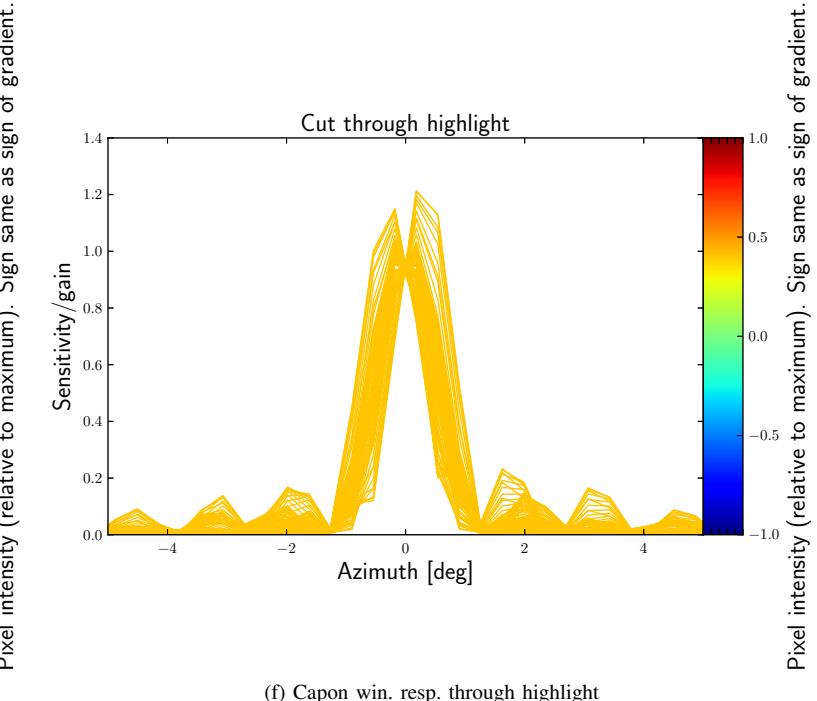
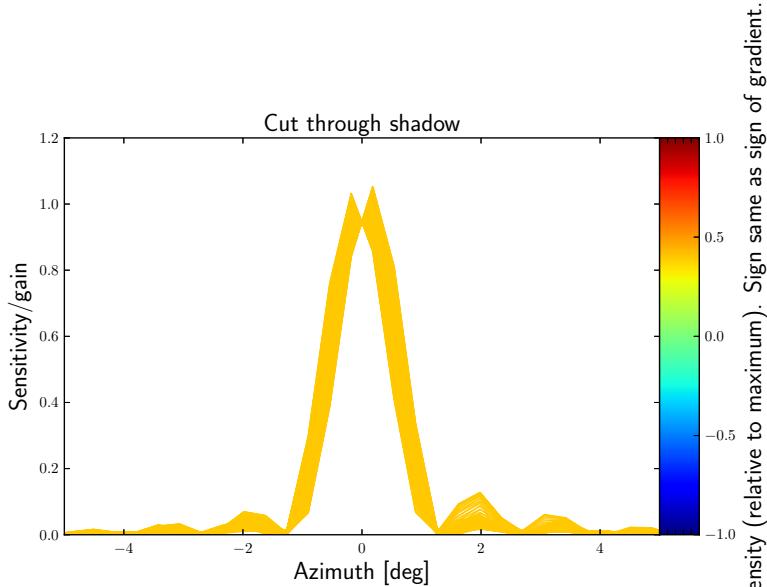
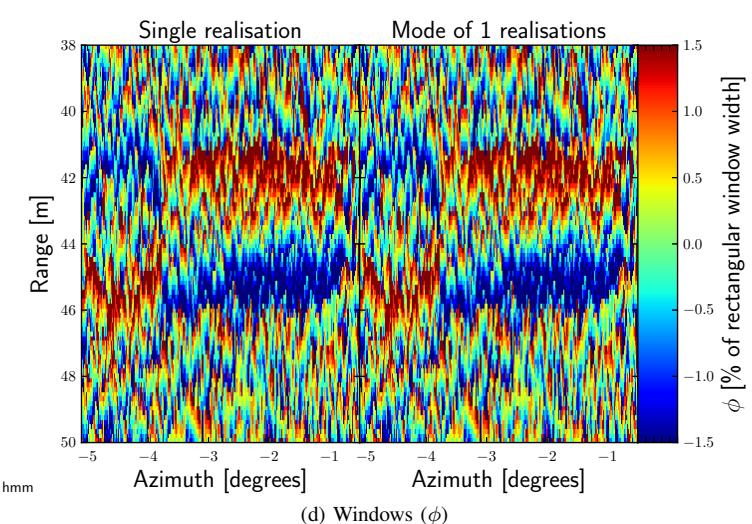
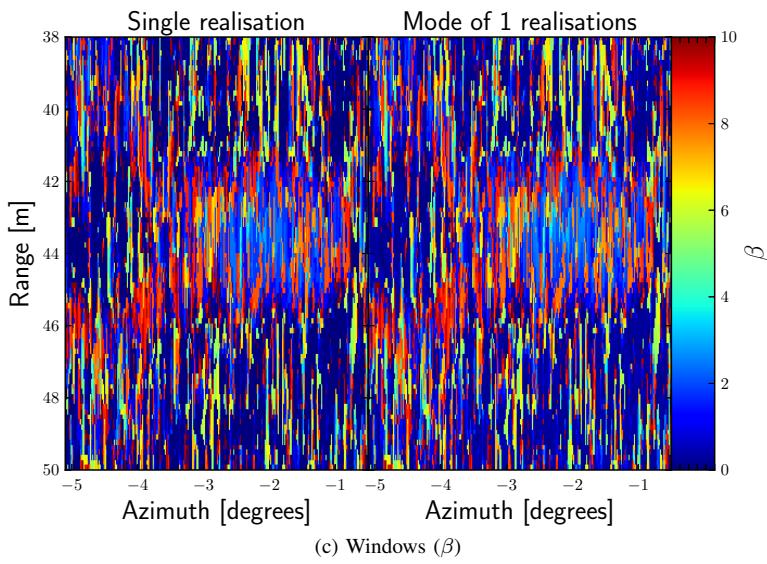
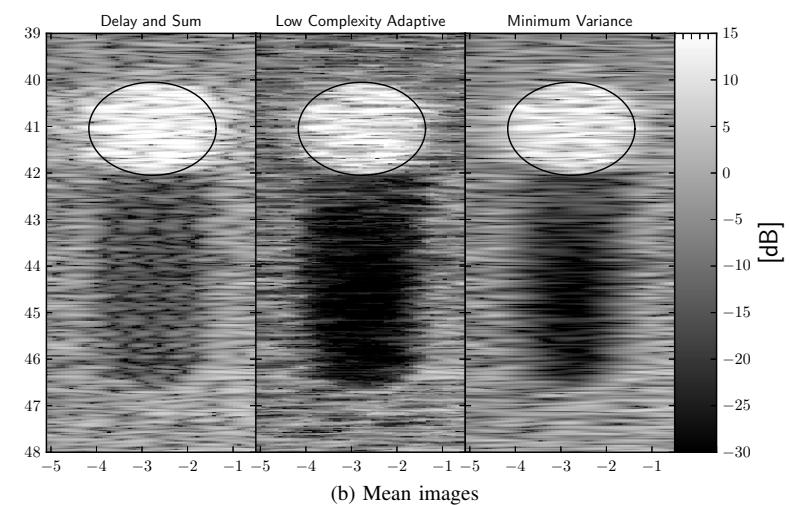
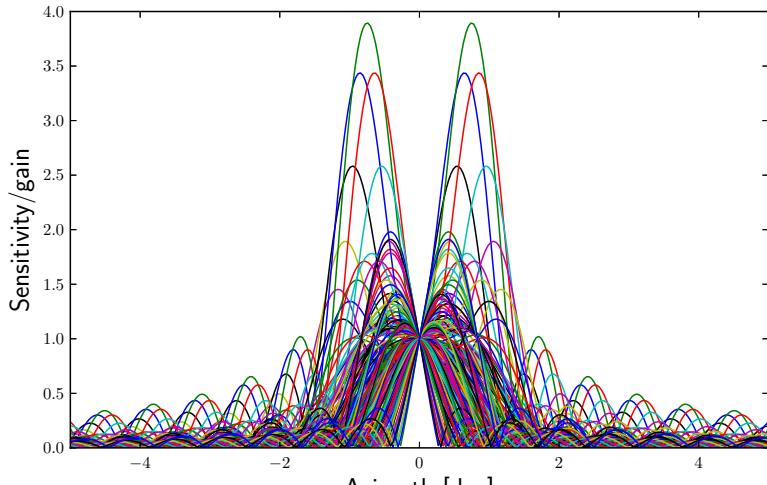
$$\text{Navg} = 3$$



(e) Capon win. resp. through shadow

(f) Capon win. resp. through highlight

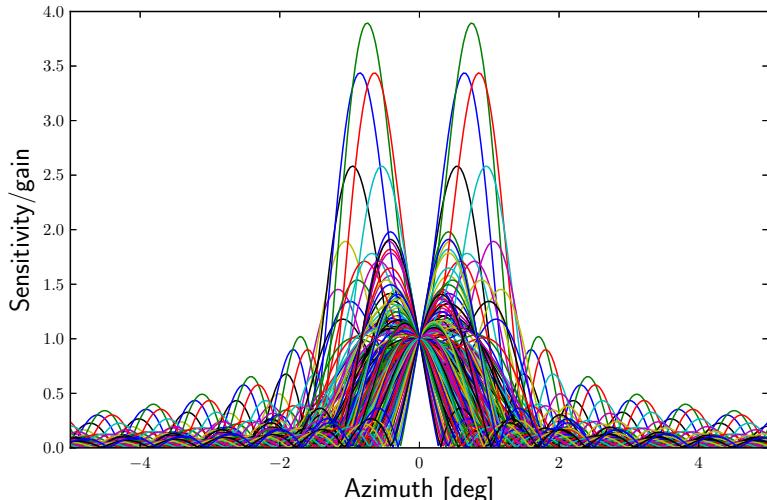
Capon: Tuning regularisation.					
General	$M = 32$	$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$	$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$		
LCA	$\beta \in [0, 10] \text{ (9 values)}$	$\phi \in [-1.07, 1.07] \text{ deg (9 values)}$	$\text{Navg} = 3$		
Capon	$\Delta = 0.20$	$L = 16$	$\text{Navg} = 3$		



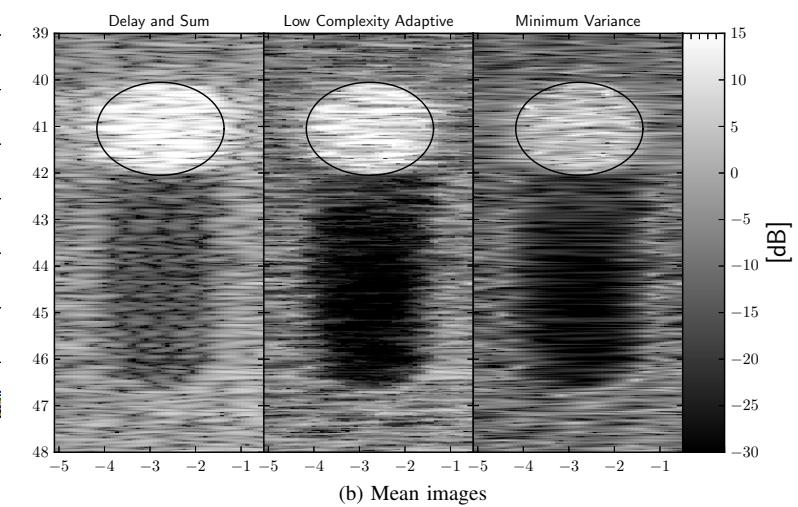
(e) Capon win. resp. through shadow

(f) Capon win. resp. through highlight

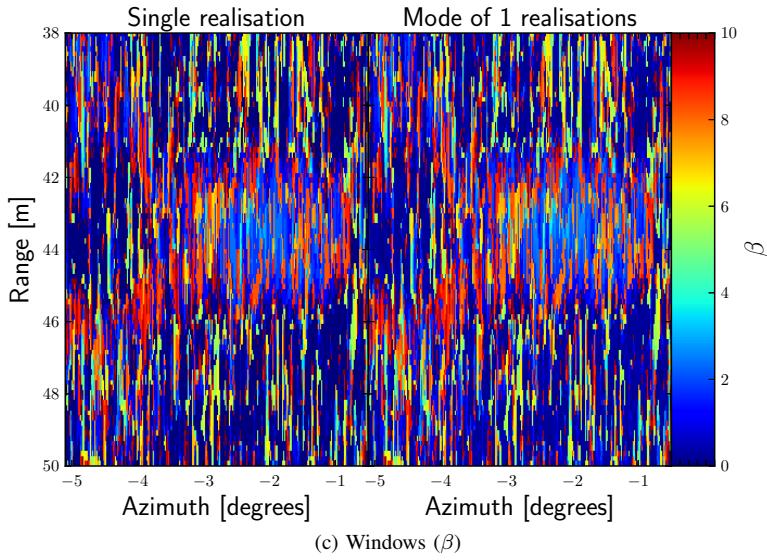
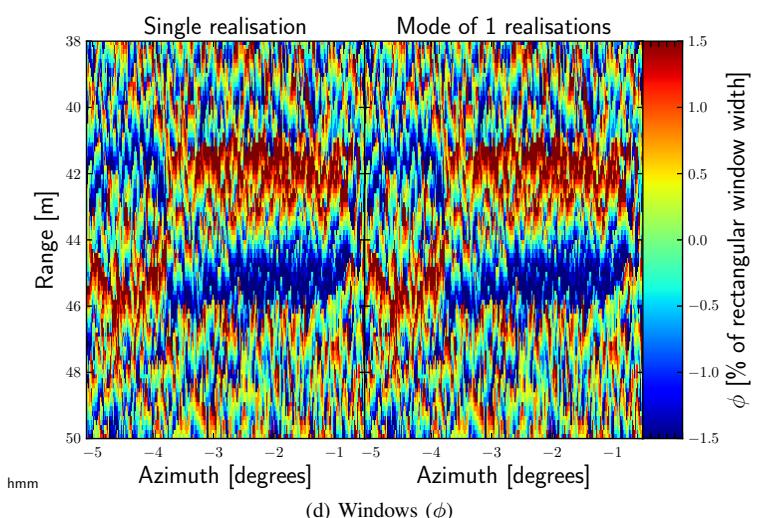
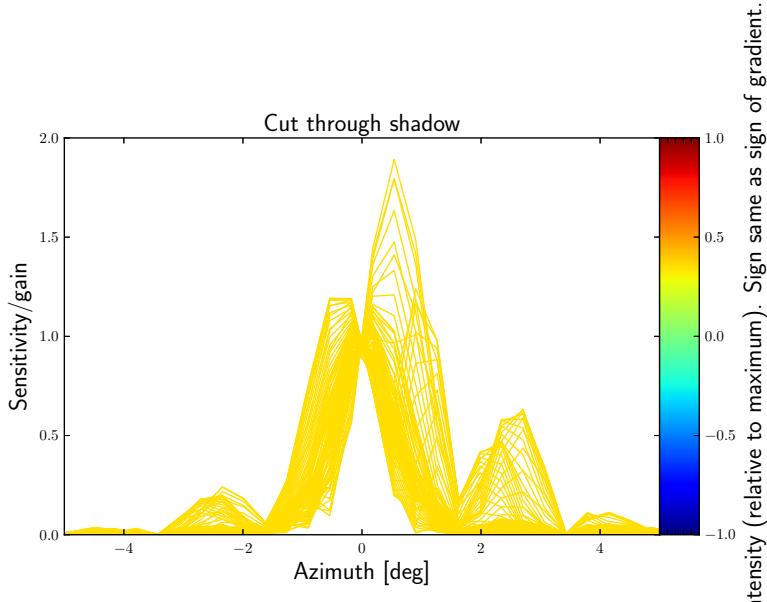
General	$M = 32$	$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$	$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$
LCA	$\beta \in [0, 10] \text{ (9 values)}$	$\phi \in [-1.07, 1.07] \text{ deg (9 values)}$	$\text{Navg} = 3$
Capon	$\Delta = 0.01$	$L = 20$	$\text{Navg} = 3$



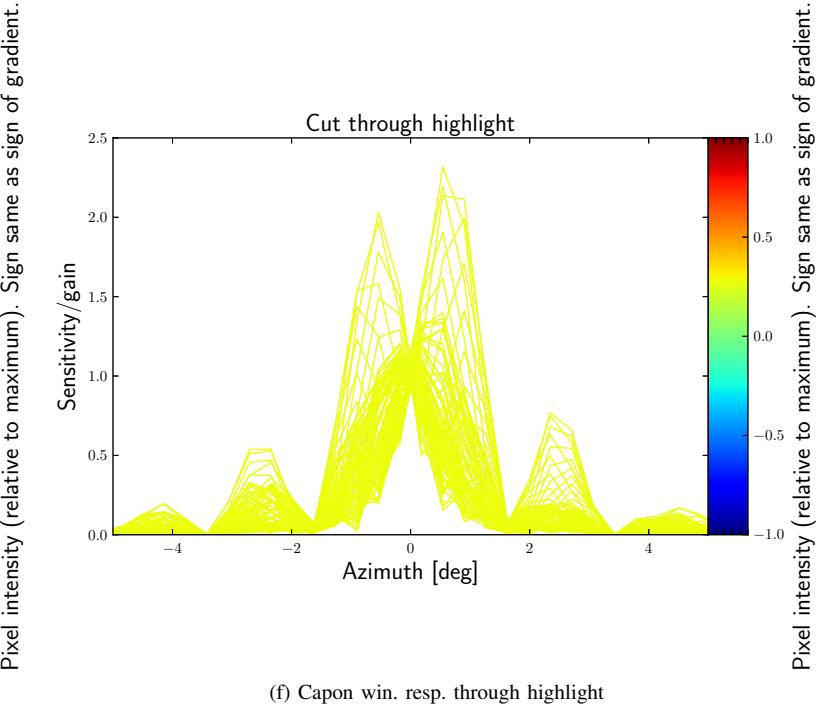
(a) LCA Window Response



(b) Mean images

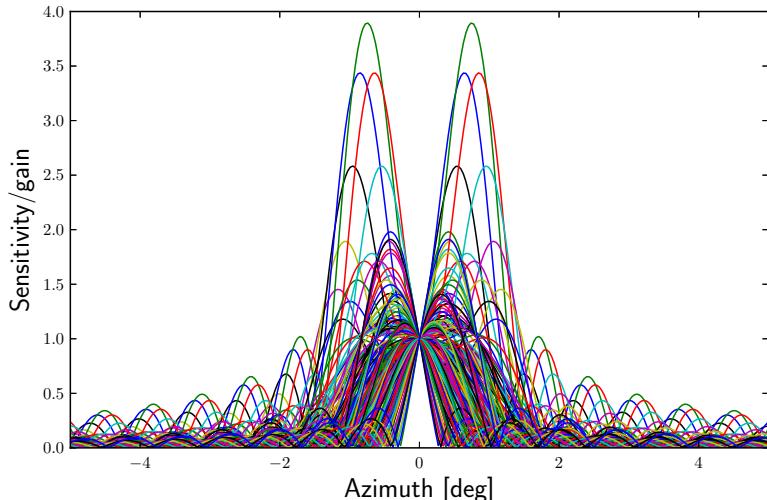
(c) Windows (β)(d) Windows (ϕ)

(e) Capon win. resp. through shadow

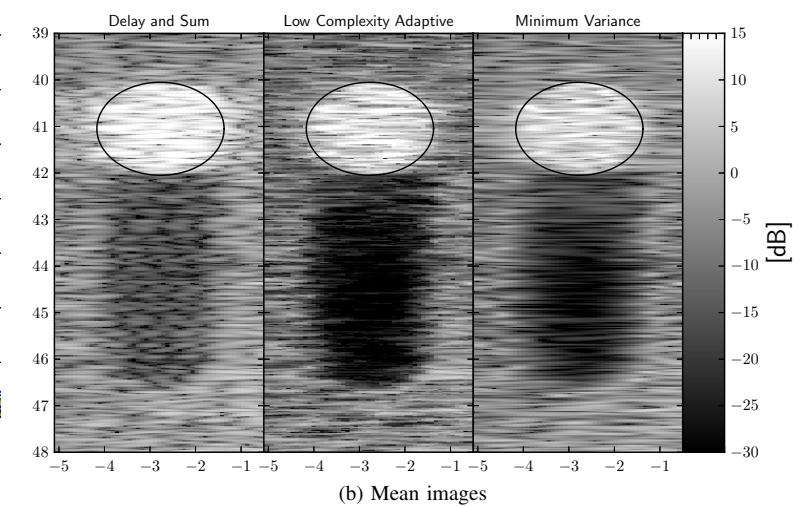


(f) Capon win. resp. through highlight

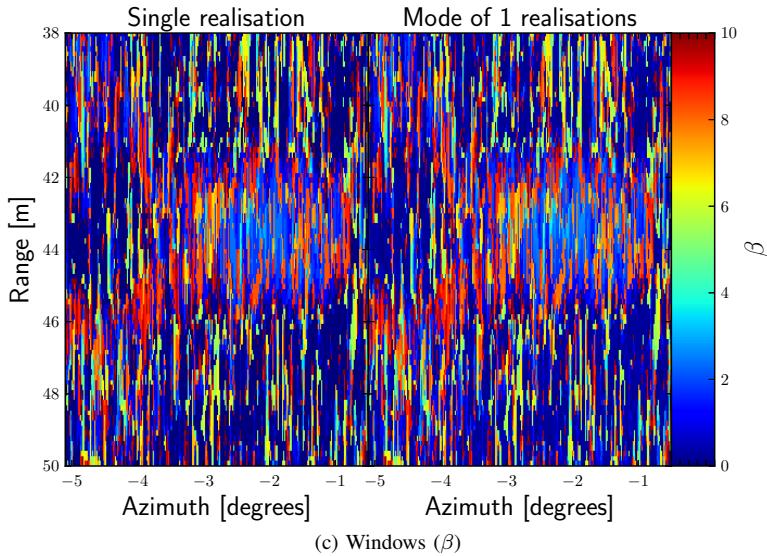
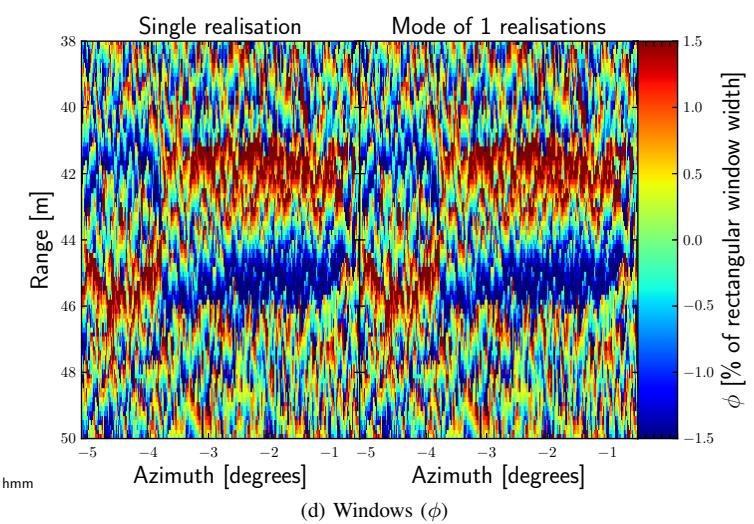
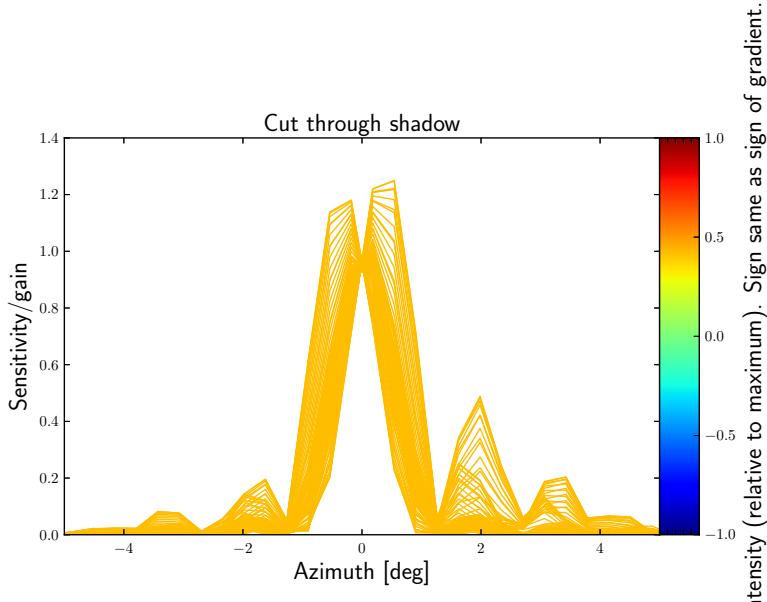
General	$M = 32$	$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$	$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$
LCA	$\beta \in [0, 10] \text{ (9 values)}$	$\phi \in [-1.07, 1.07] \text{ deg (9 values)}$	$\text{Navg} = 3$
Capon	$\Delta = 0.01$	$L = 16$	$\text{Navg} = 3$



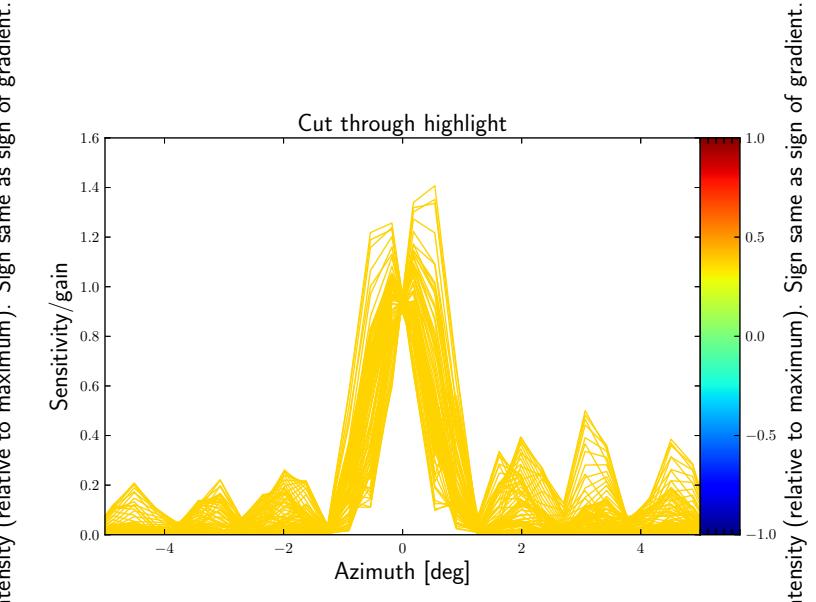
(a) LCA Window Response



(b) Mean images

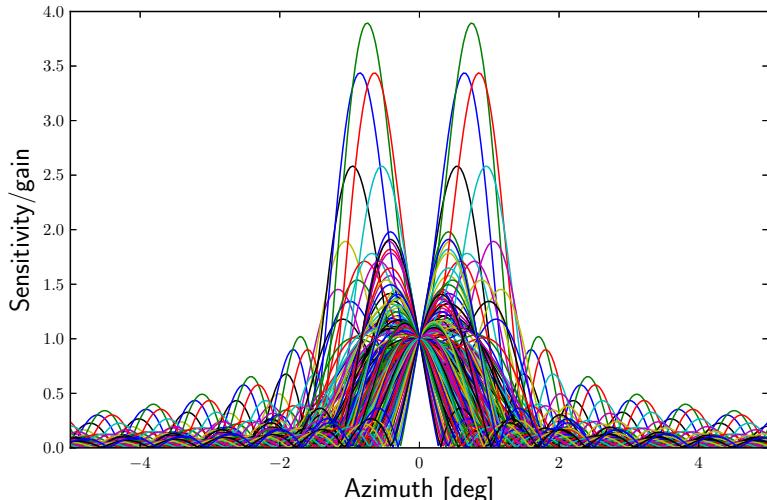
(c) Windows (β)(d) Windows (ϕ)

(e) Capon win. resp. through shadow

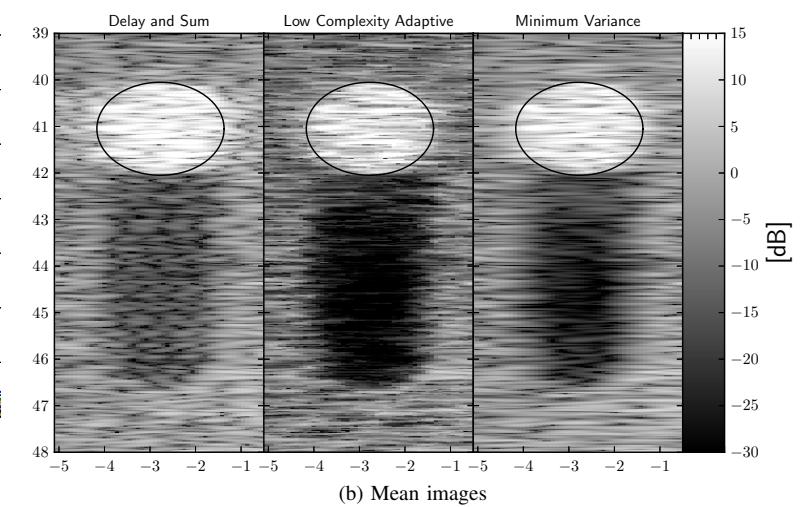


(f) Capon win. resp. through highlight

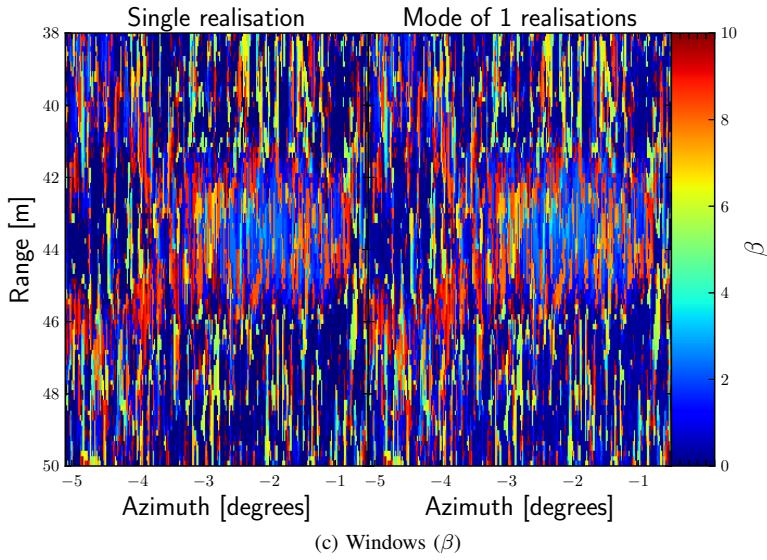
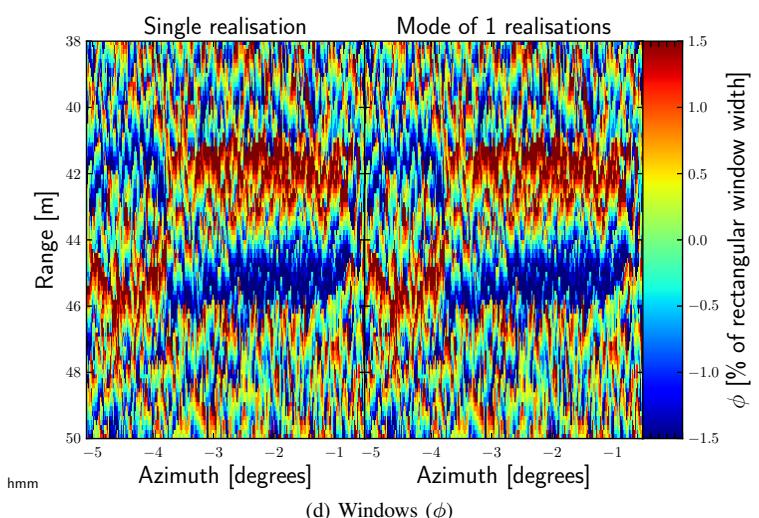
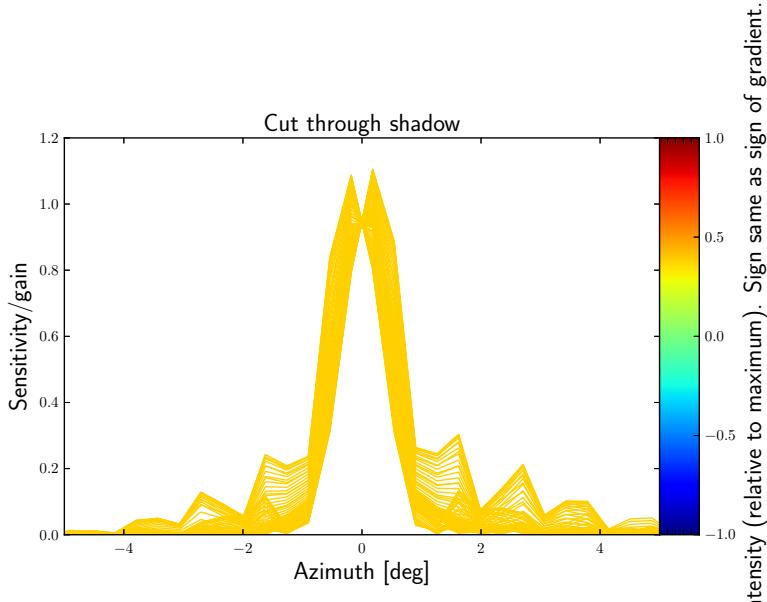
General	$M = 32$	$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$	$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$
LCA	$\beta \in [0, 10] \text{ (9 values)}$	$\phi \in [-1.07, 1.07] \text{ deg (9 values)}$	$\text{Navg} = 3$
Capon	$\Delta = 0.01$	$L = 12$	$\text{Navg} = 3$



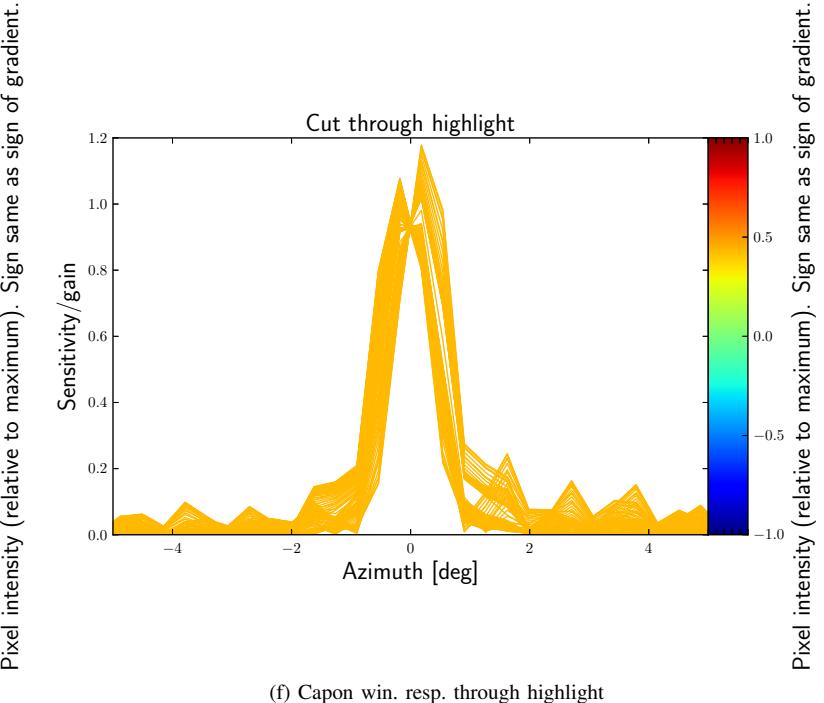
(a) LCA Window Response



(b) Mean images

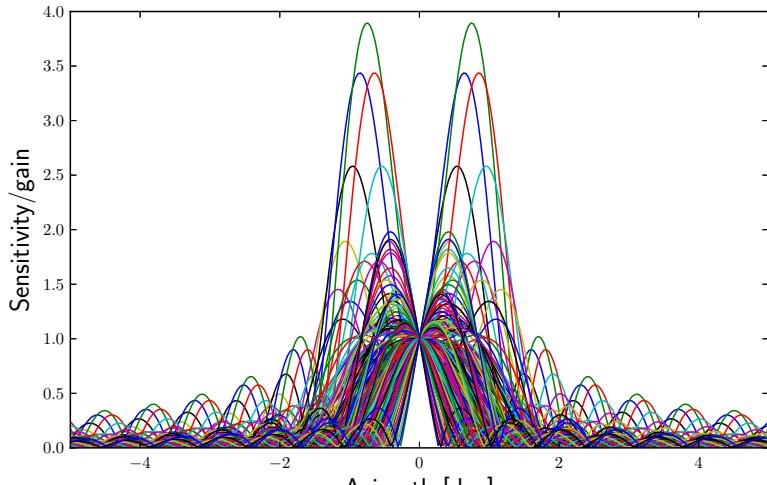
(c) Windows (β)(d) Windows (ϕ)

(e) Capon win. resp. through shadow

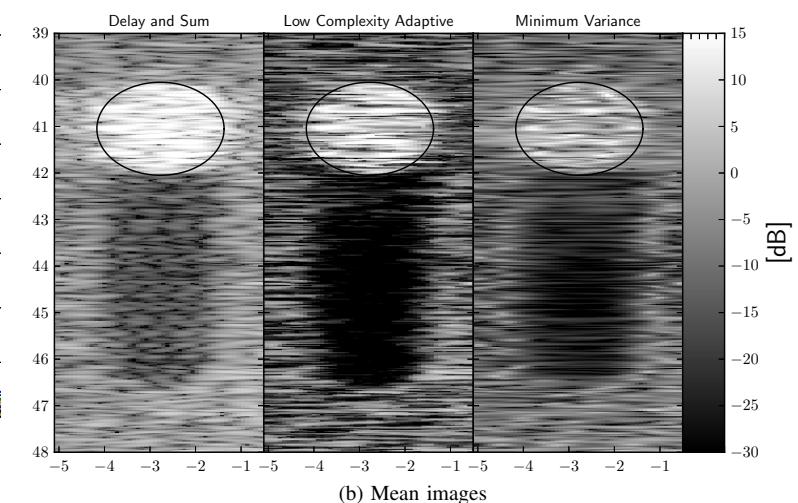


(f) Capon win. resp. through highlight

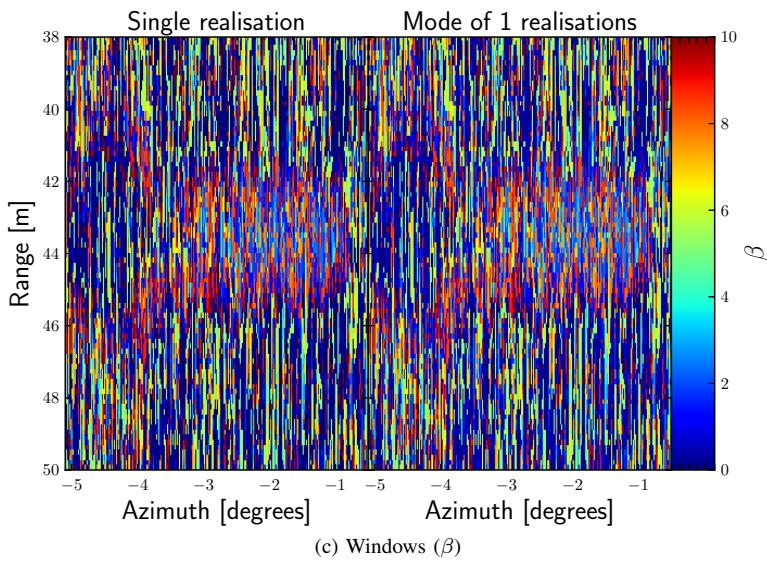
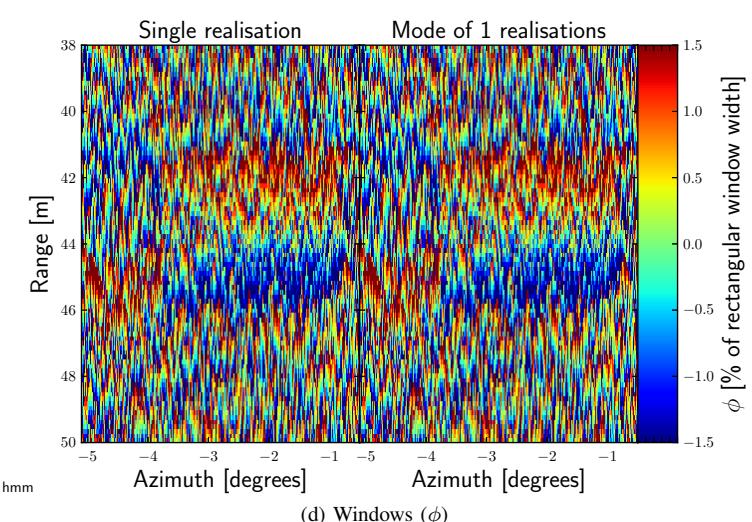
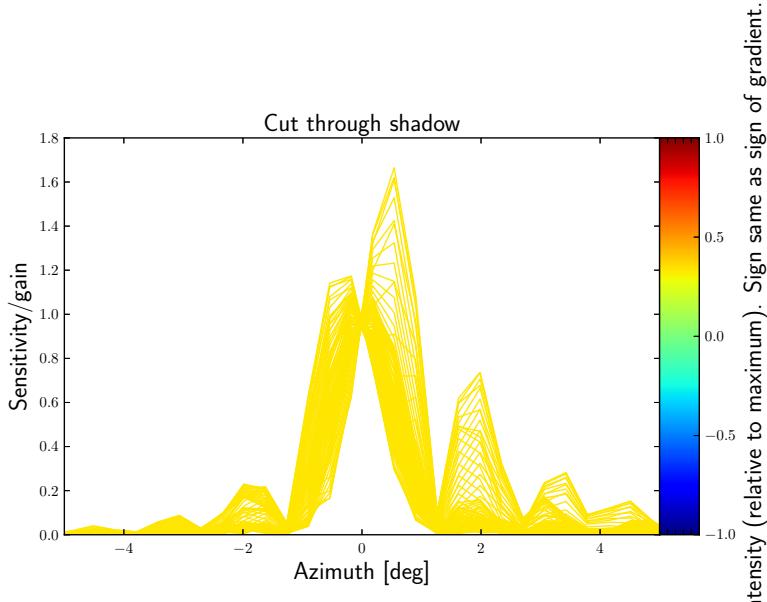
Capon: Tuning time averaging.			
General	$M = 32$	$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$	$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$
LCA	$\beta \in [0, 10] \text{ (9 values)}$	$\phi \in [-1.07, 1.07] \text{ deg (9 values)}$	$\text{Navg} = 1$
Capon	$\Delta = 0.01$	$L = 16$	$\text{Navg} = 1$



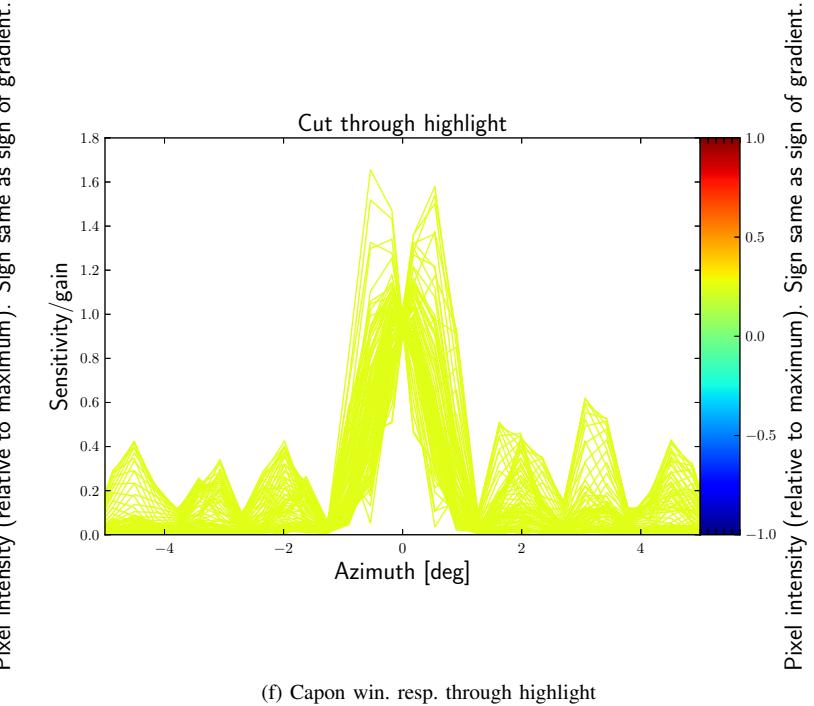
(a) LCA Window Response



(b) Mean images

(c) Windows (β)(d) Windows (ϕ)

(e) Capon win. resp. through shadow



(f) Capon win. resp. through highlight

Capon: Tuning time averaging.**General** $M = 32$

$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$

$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$

LCA $\beta \in [0, 10] \text{ (9 values)}$

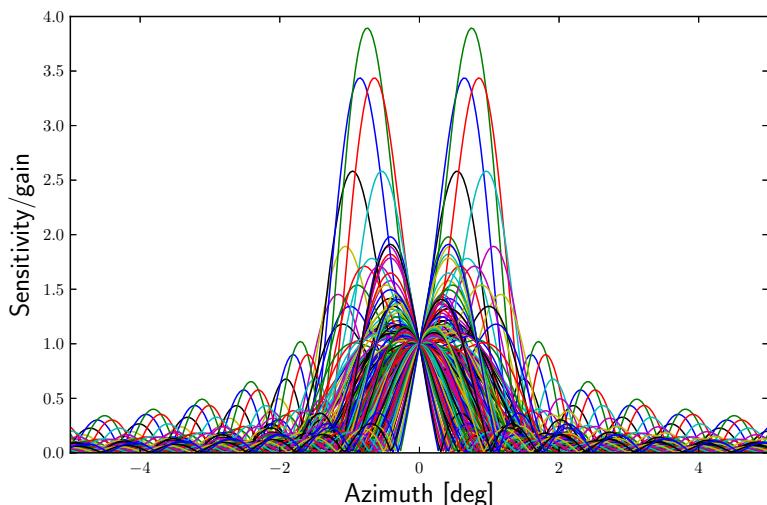
$\phi \in [-1.07, 1.07] \text{ deg (9 values)}$

$\text{Navg} = 3$

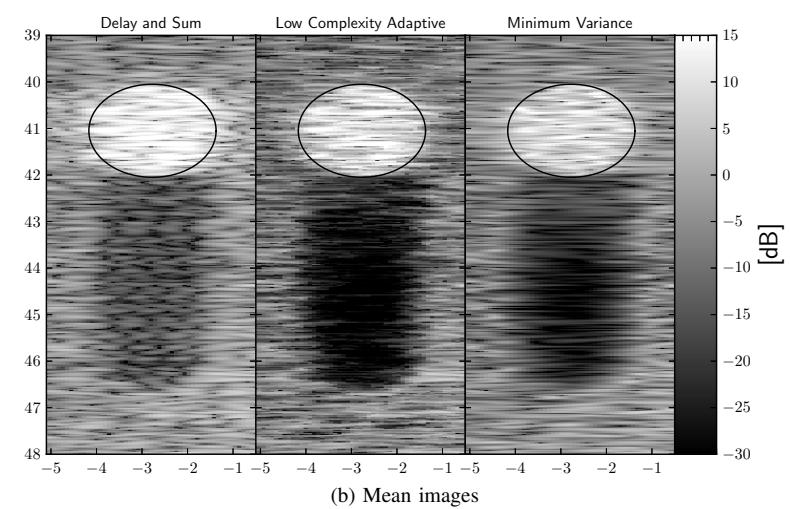
Capon $\Delta = 0.01$

$L = 16$

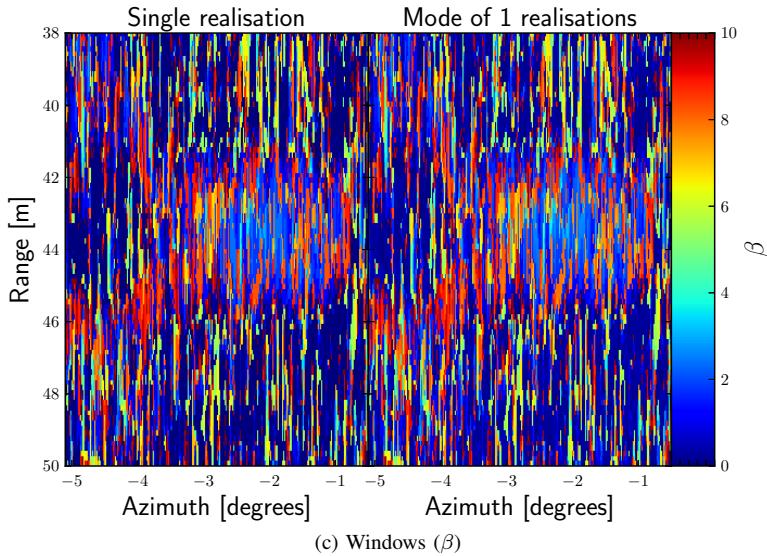
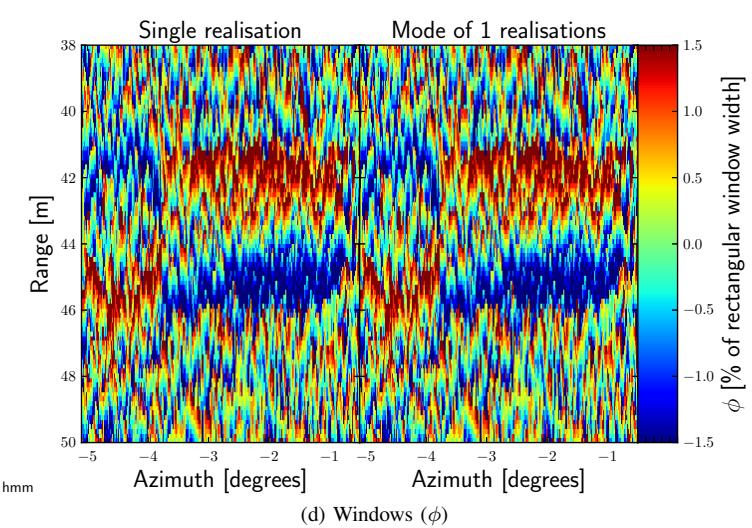
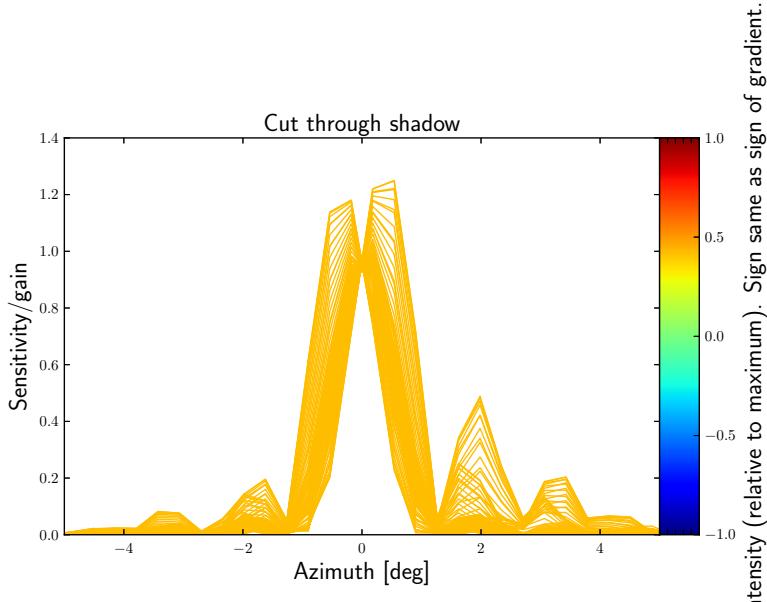
$\text{Navg} = 3$



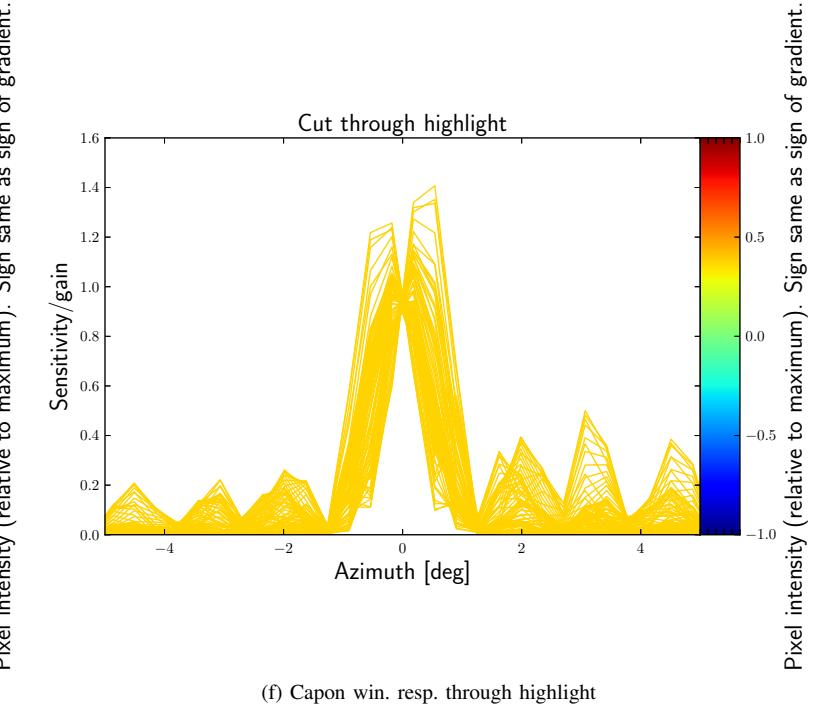
(a) LCA Window Response



(b) Mean images

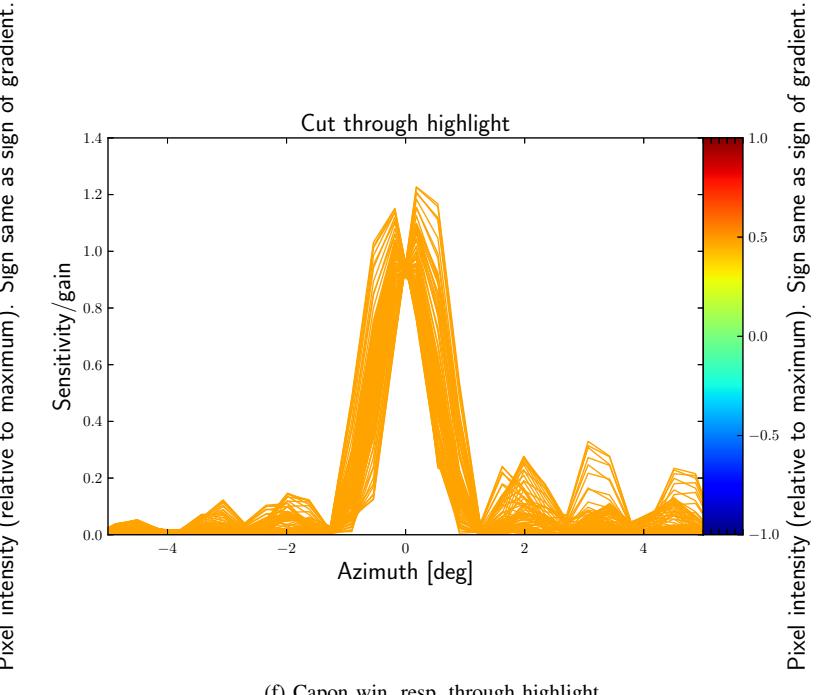
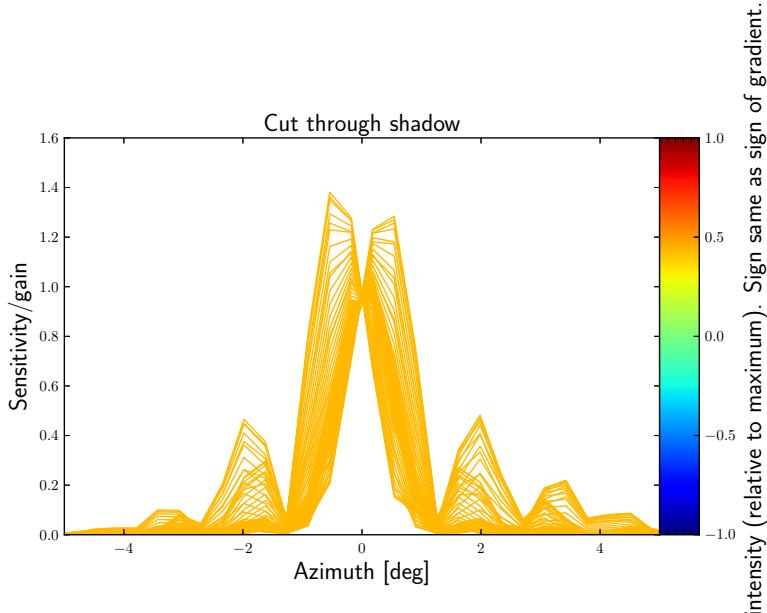
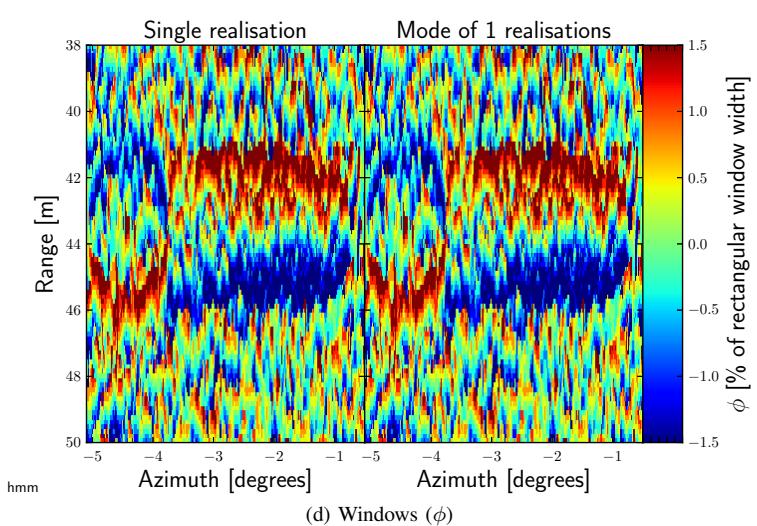
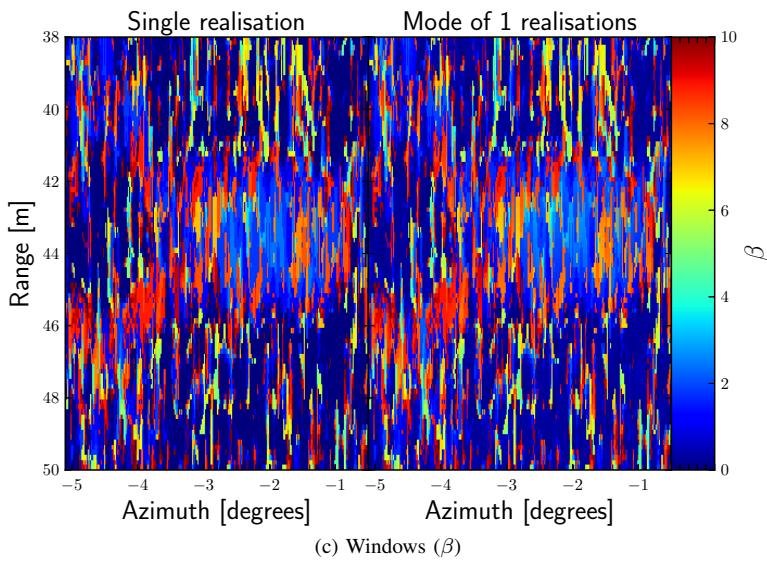
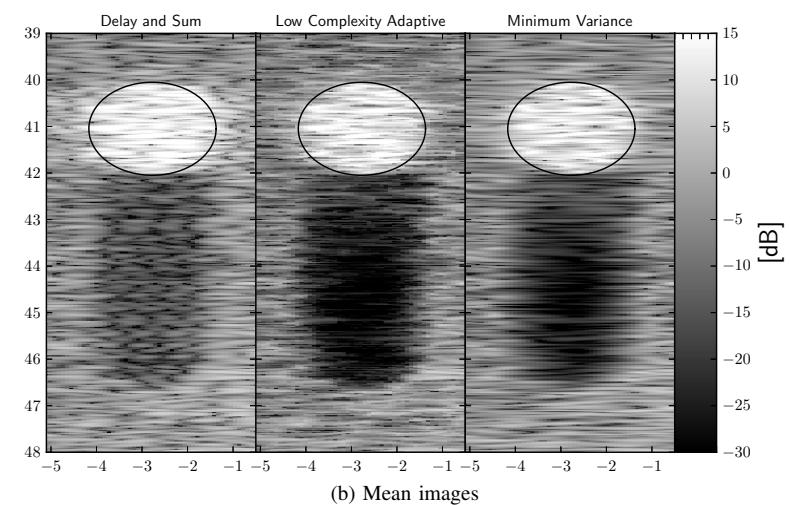
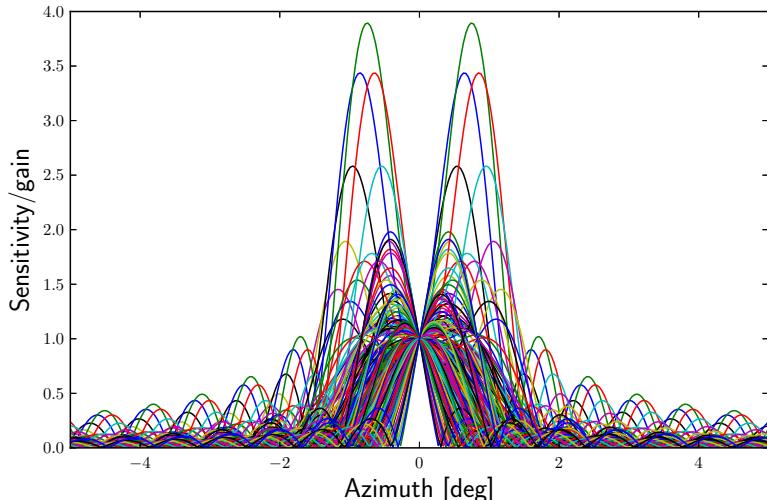
(c) Windows (β)(d) Windows (ϕ)

(e) Capon win. resp. through shadow



(f) Capon win. resp. through highlight

General	$M = 32$	$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$	$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$
LCA	$\beta \in [0, 10] \text{ (9 values)}$	$\phi \in [-1.07, 1.07] \text{ deg (9 values)}$	$\text{Navg} = 5$
Capon	$\Delta = 0.01$	$L = 16$	$\text{Navg} = 5$



Capon: Tuning time averaging.

10

General $M = 32$

$$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$$

$$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$$

LCA $\beta \in [0, 10]$ (9 values)

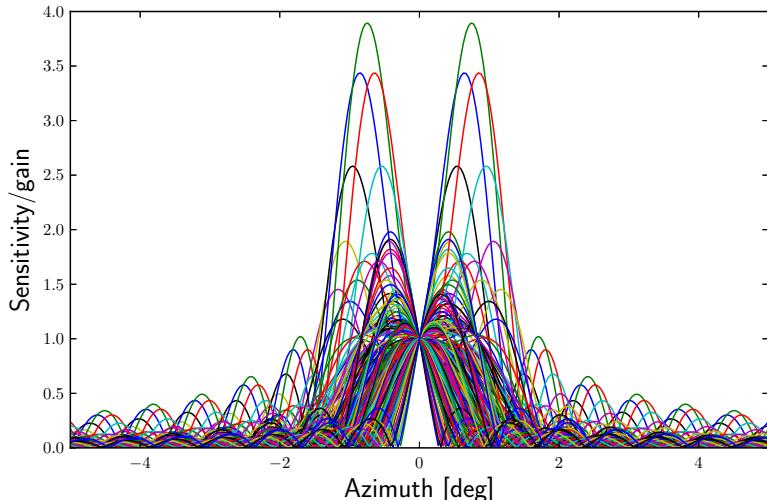
$$\phi \in [-1.07, 1.07] \text{ deg} \text{ (9 values)}$$

$$\text{Navg} = 7$$

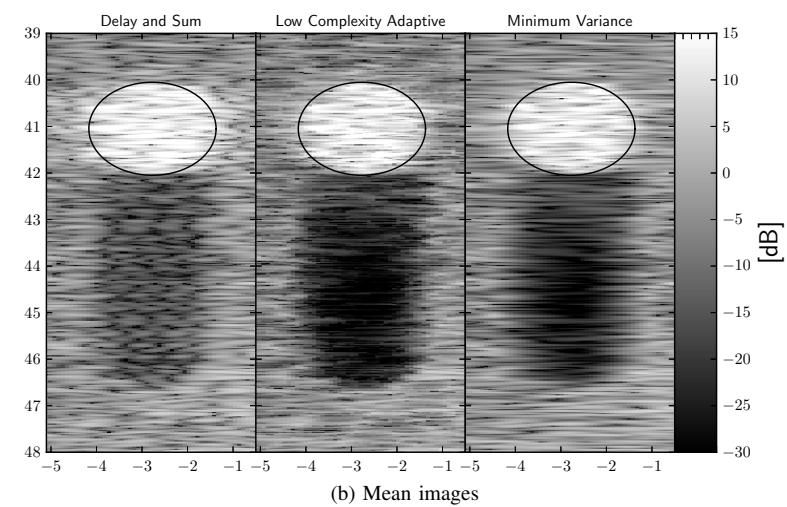
Capon $\Delta = 0.01$

$$L = 16$$

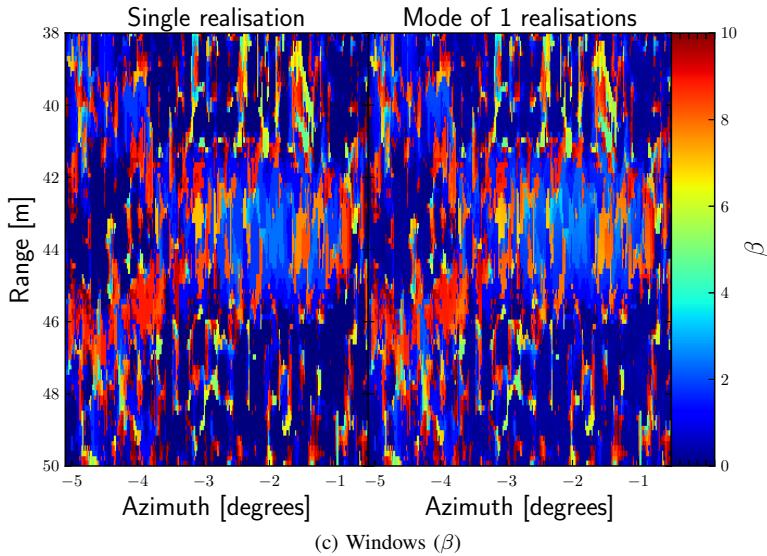
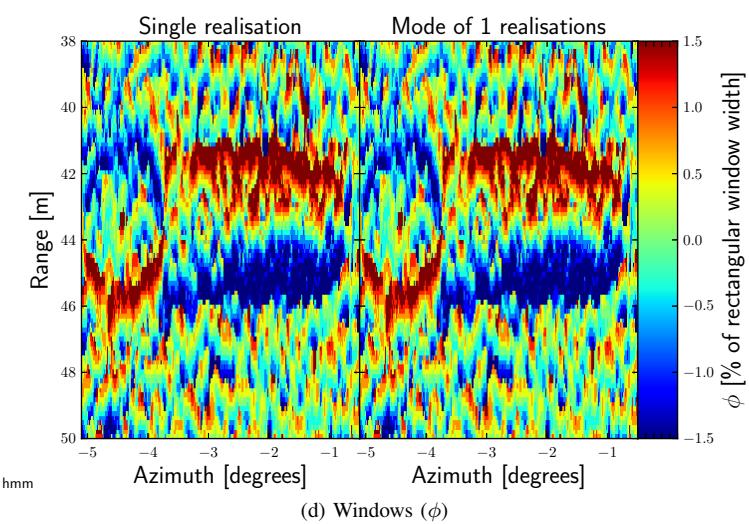
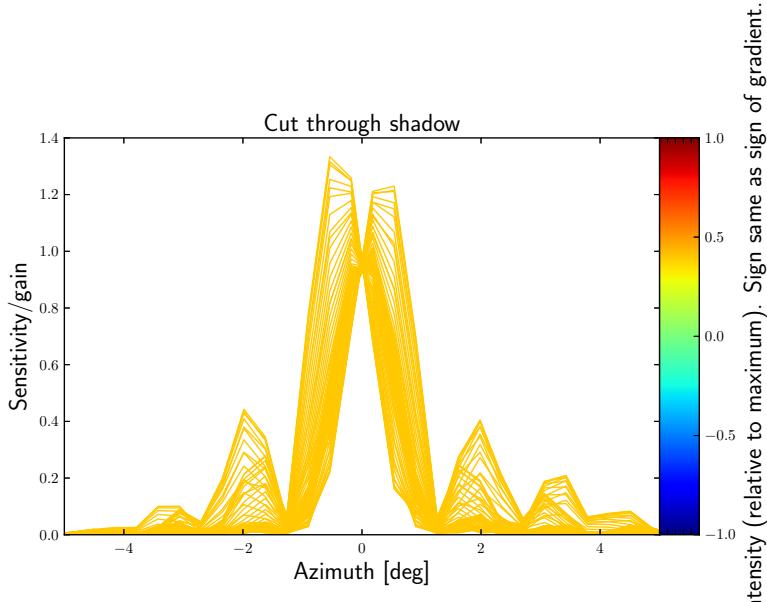
$$\text{Navg} = 7$$



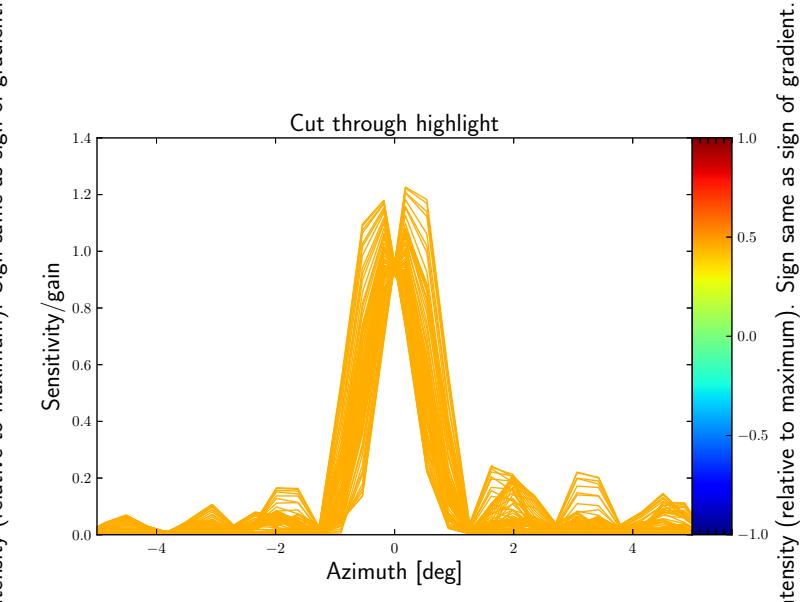
(a) LCA Window Response



(b) Mean images

(c) Windows (β)(d) Windows (ϕ)

(e) Capon win. resp. through shadow



(f) Capon win. resp. through highlight

LCA: Reasonable settings.**General** $M = 32$

$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$

$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$

LCA $\beta \in [0, 10] \text{ (9 values)}$

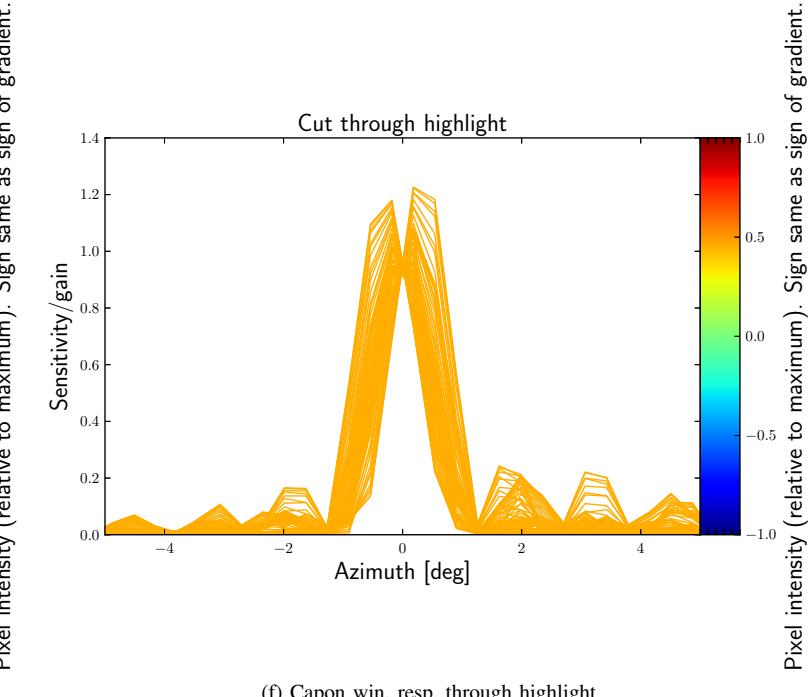
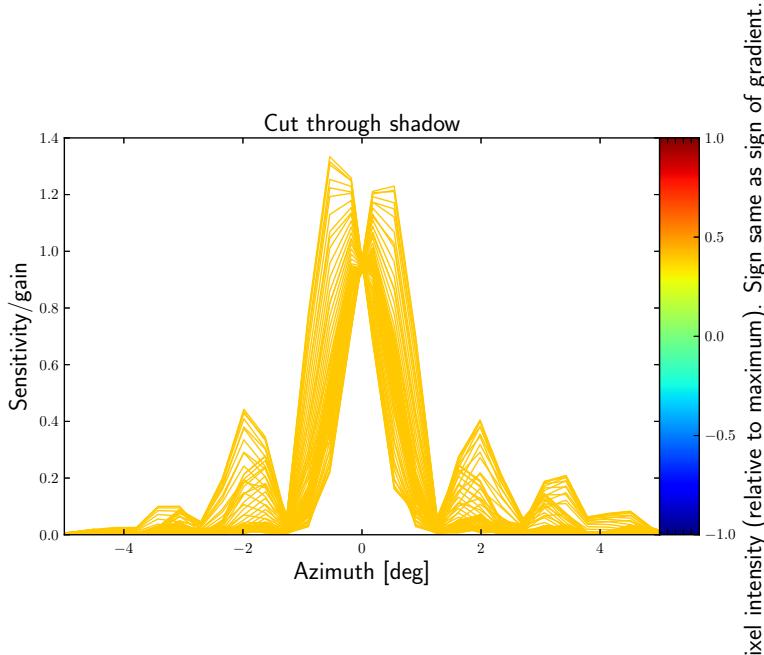
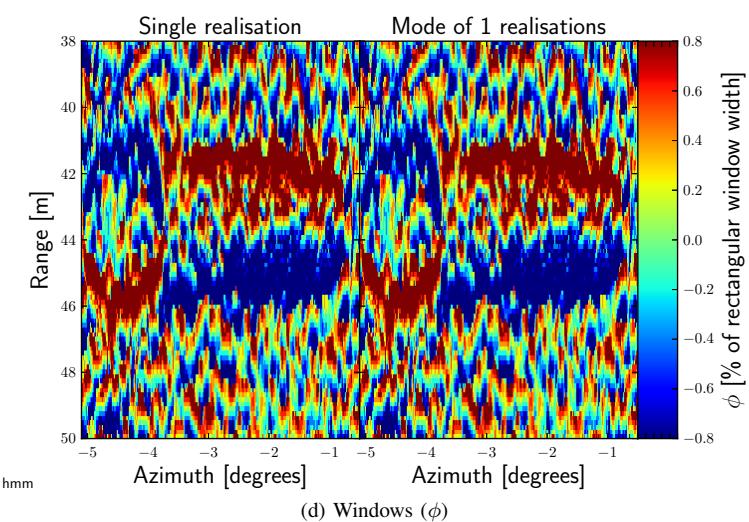
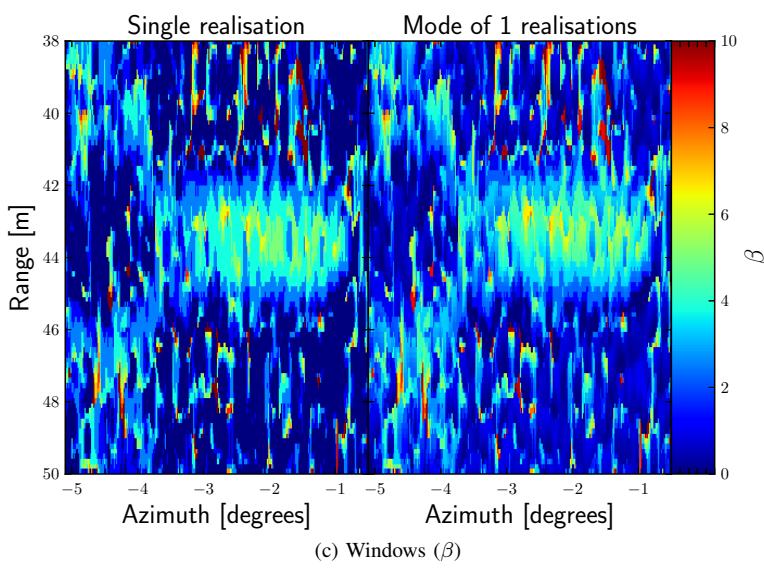
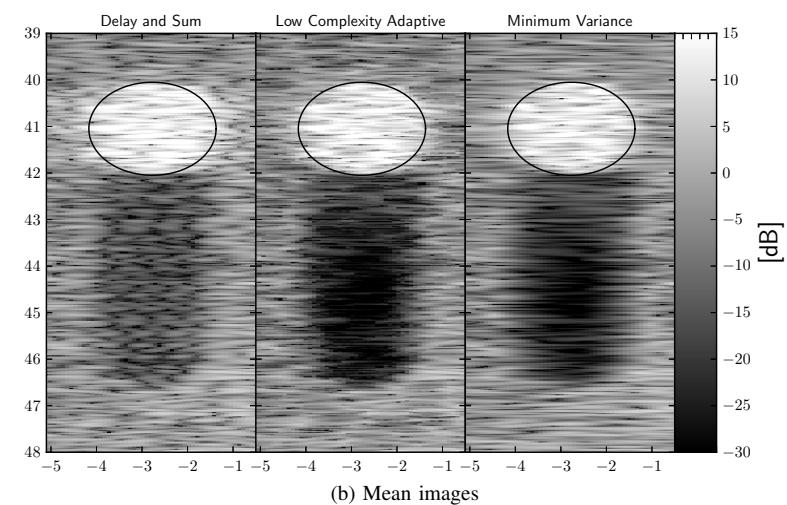
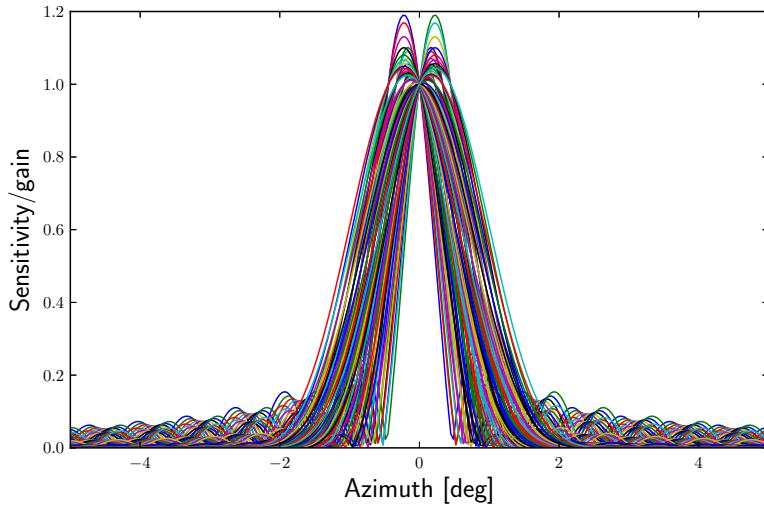
$\phi \in [-0.57, 0.57] \text{ deg (9 values)}$

$\text{Navg} = 7$

Capon $\Delta = 0.01$

$L = 16$

$\text{Navg} = 7$



(e) Capon win. resp. through shadow

(f) Capon win. resp. through highlight

LCA: Lots of Kaiser windows - wide span.

12

General $M = 32$

LCA $\beta \in [0, 20]$ (19 values)

Capon $\Delta = 0.01$

$\Delta r = \frac{c}{2B} = 2.5$ cm

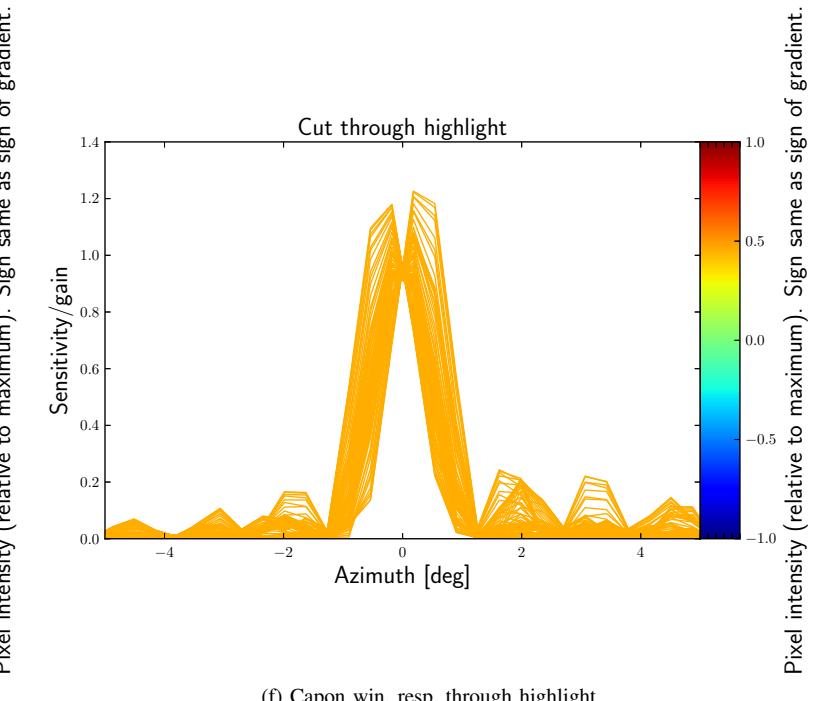
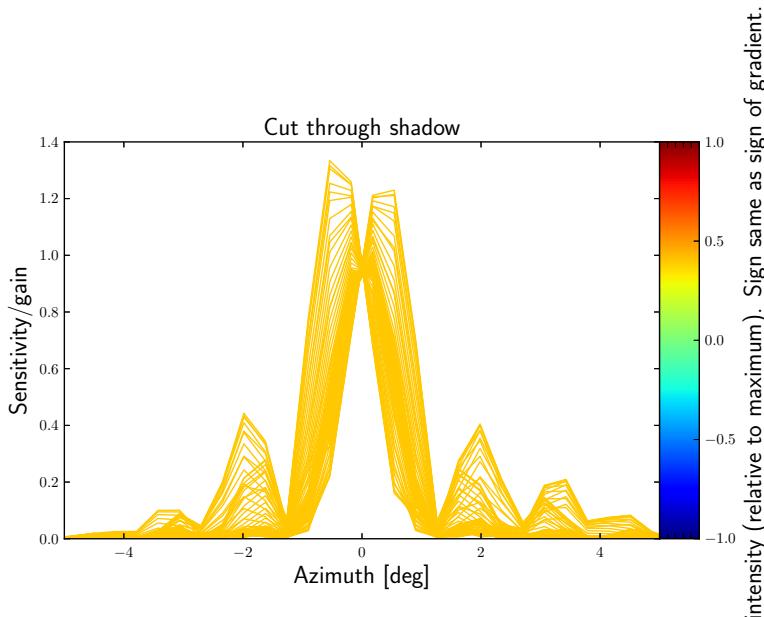
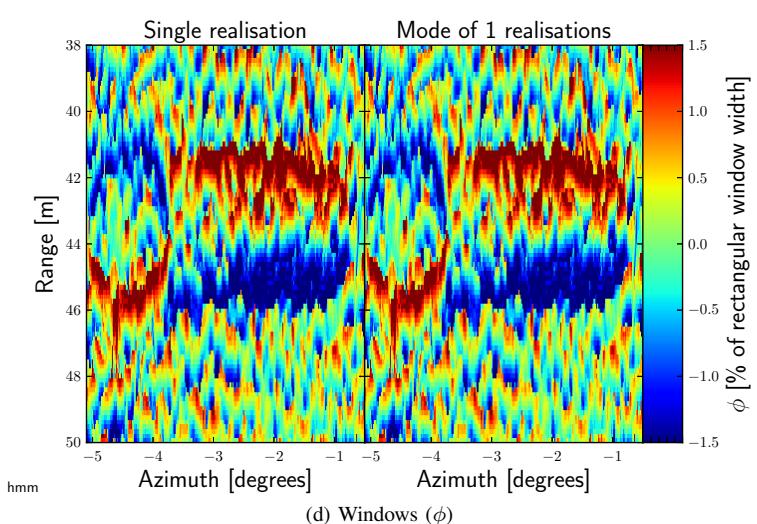
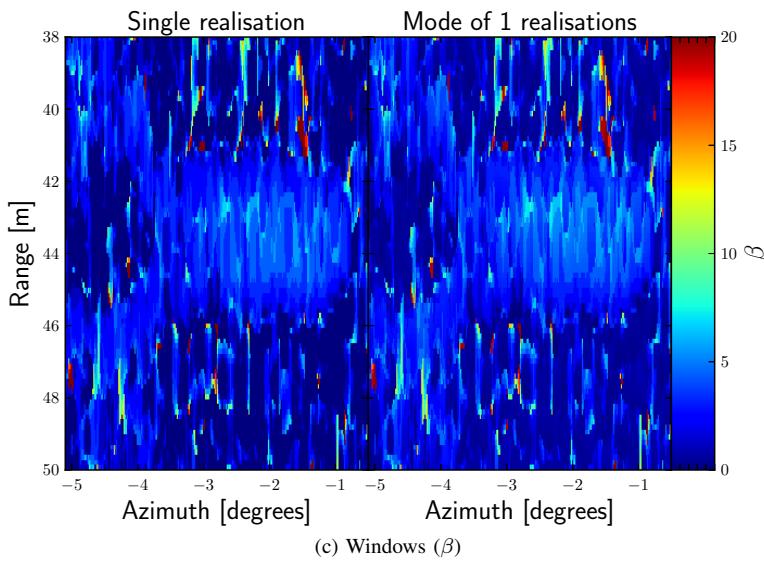
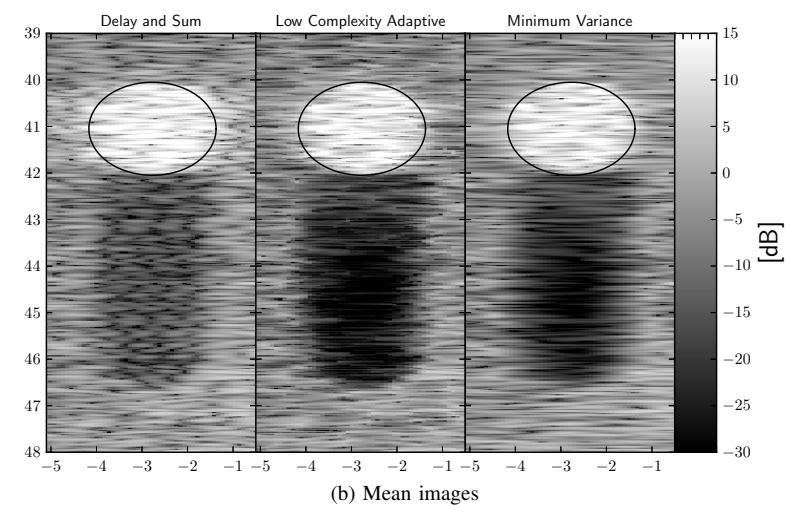
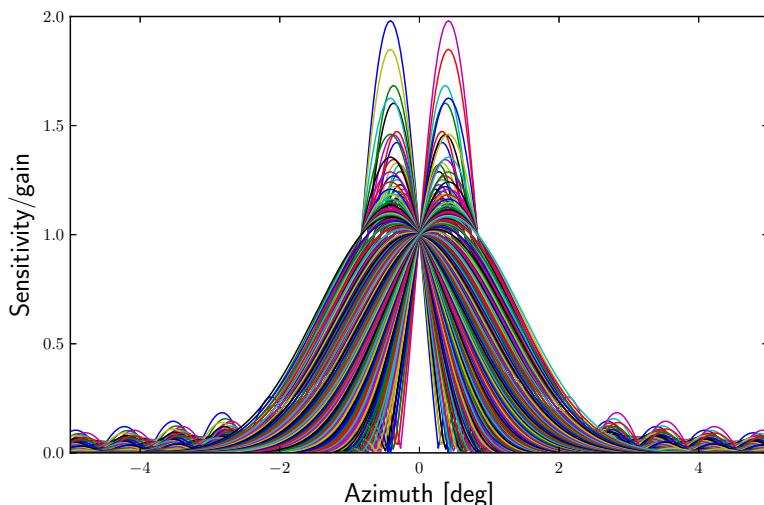
$\phi \in [-1.07, 1.07]$ deg (19 values)

$L = 16$

$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$

Navg = 7

Navg = 7



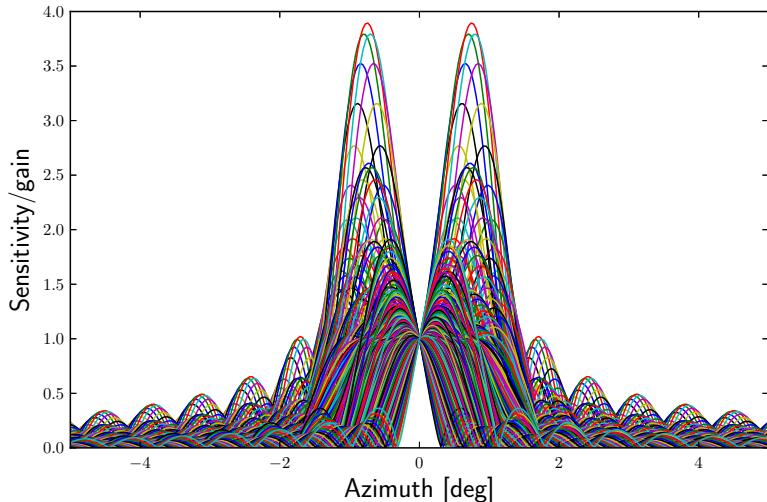
(e) Capon win. resp. through shadow

(f) Capon win. resp. through highlight

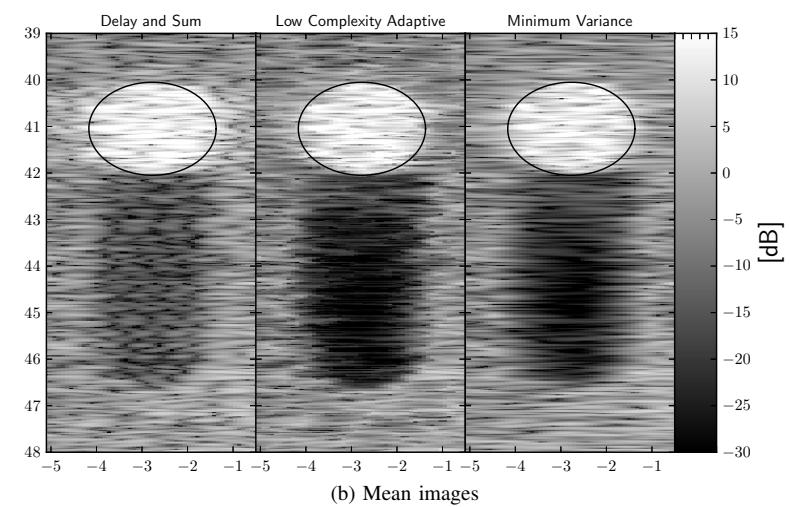
LCA: Lots of trigonometric windows - wide span.

13

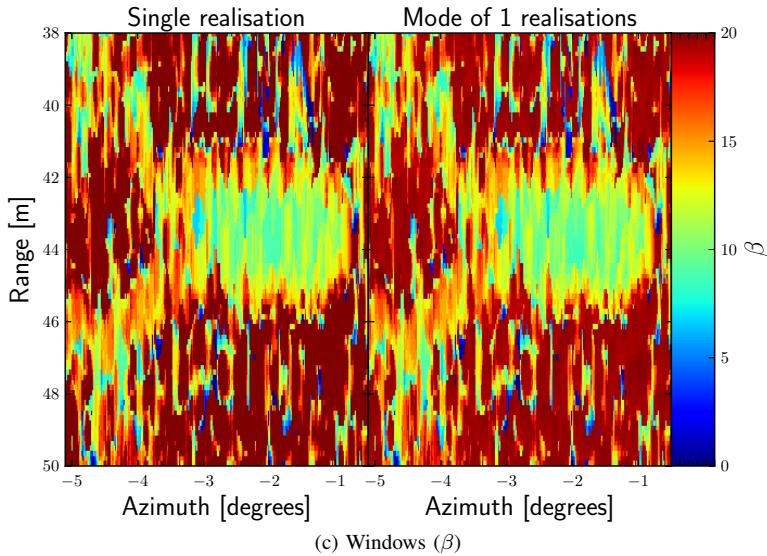
General	$M = 32$	$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$	$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$
LCA	$\beta \in [0, 20] \text{ (19 values)}$	$\phi \in [-1.07, 1.07] \text{ deg (19 values)}$	$\text{Navg} = 7$
Capon	$\Delta = 0.01$	$L = 16$	$\text{Navg} = 7$



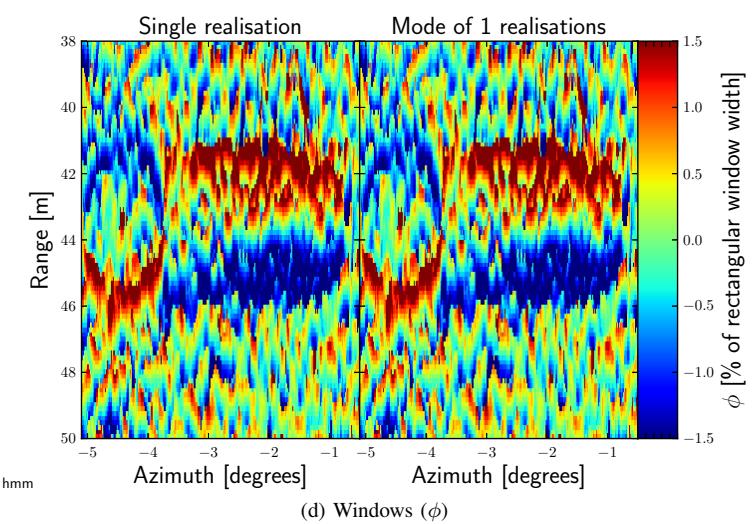
(a) LCA Window Response



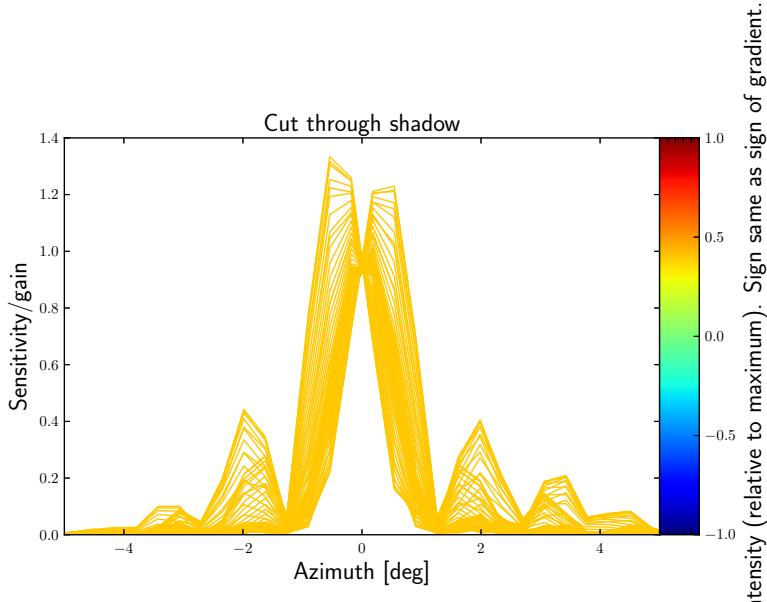
(b) Mean images



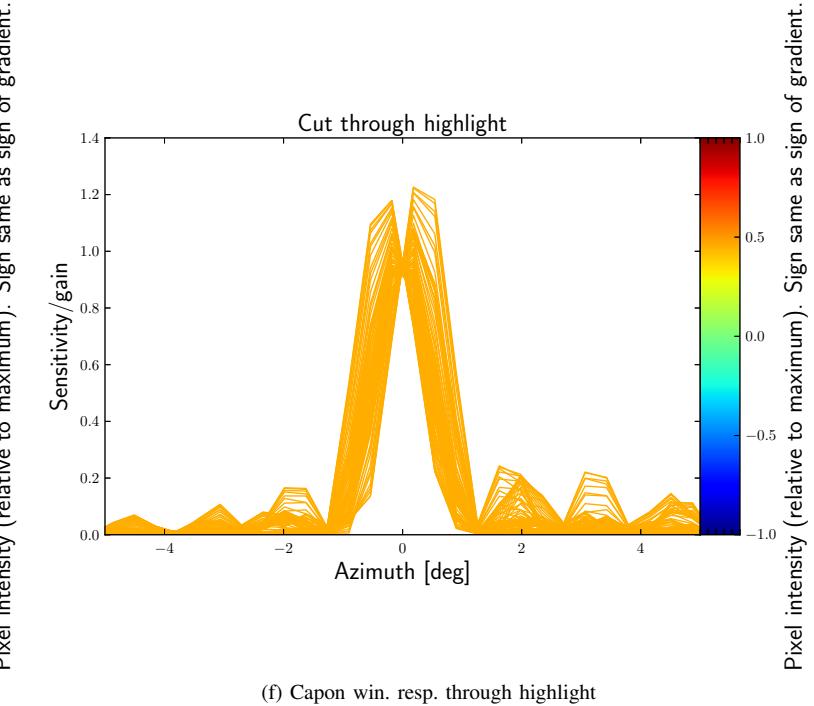
(c) Windows (β)



(d) Windows (ϕ)



(e) Capon win. resp. through shadow

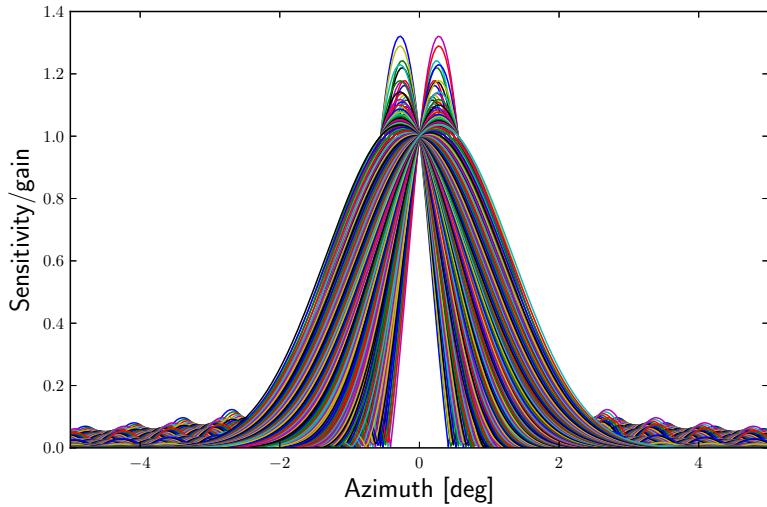


(f) Capon win. resp. through highlight

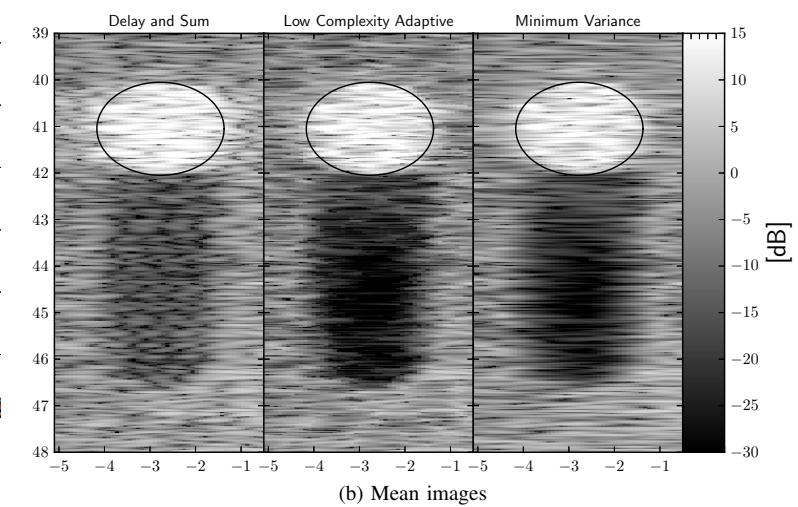
LCA: Back on Kaiser - reducing steering span.

14

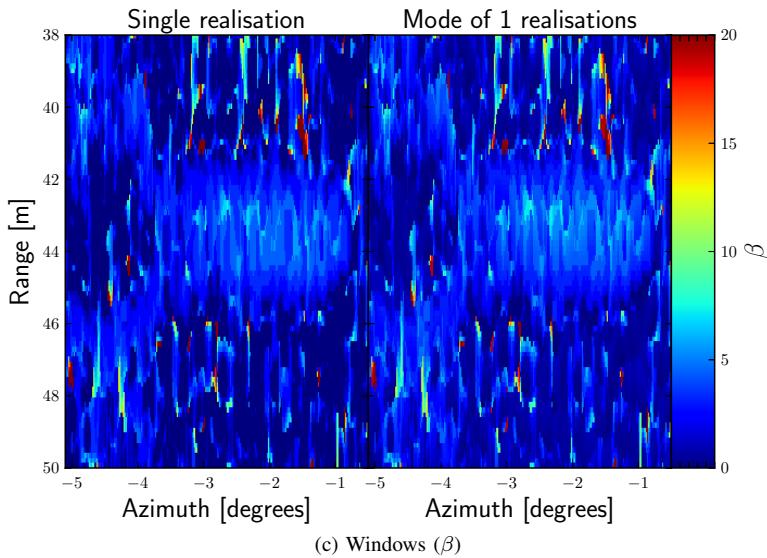
General	$M = 32$	$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$	$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$
LCA	$\beta \in [0, 20] \text{ (19 values)}$	$\phi \in [-0.72, 0.72] \text{ deg (19 values)}$	$\text{Navg} = 7$
Capon	$\Delta = 0.01$	$L = 16$	$\text{Navg} = 7$



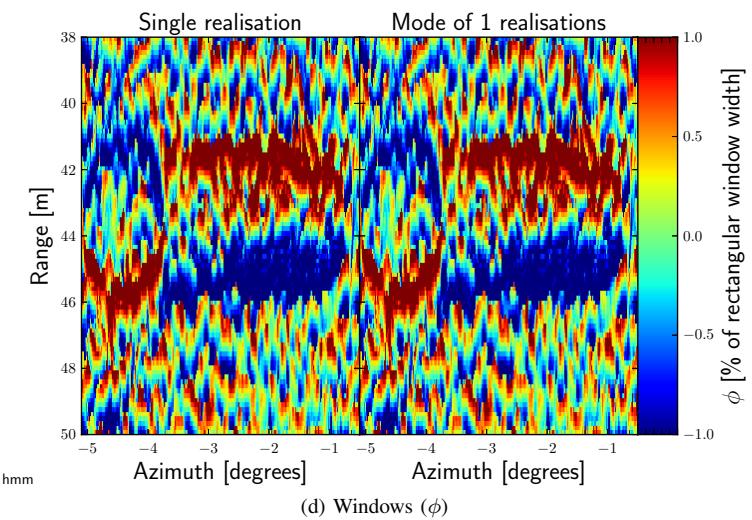
(a) LCA Window Response



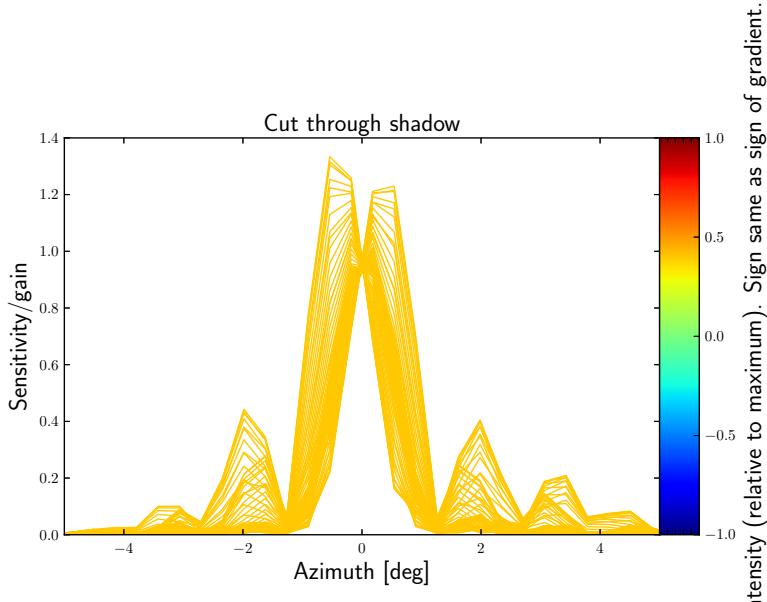
(b) Mean images



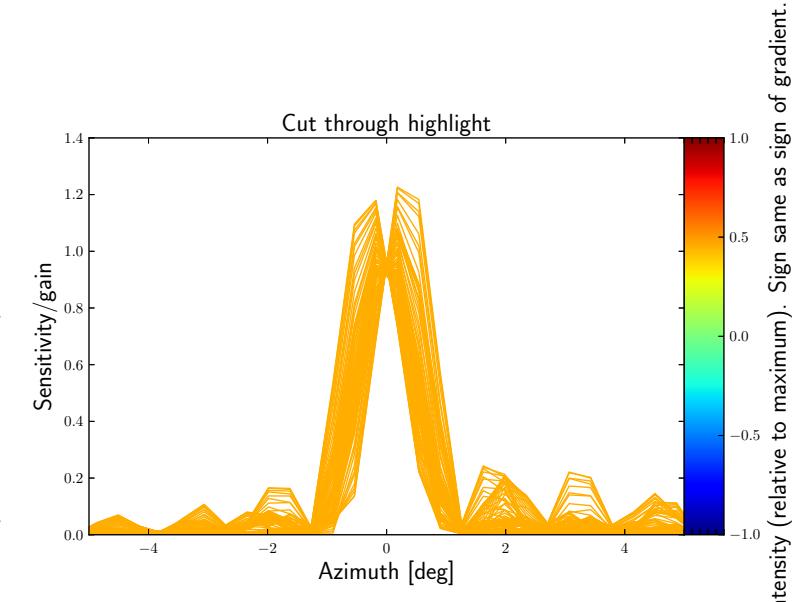
(c) Windows (β)



(d) Windows (ϕ)



(e) Capon win. resp. through shadow



(f) Capon win. resp. through highlight

Pixel intensity (relative to maximum). Sign same as sign of gradient.

LCA: Reducing steering span.**General** $M = 32$

$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$

$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$

LCA $\beta \in [0, 20]$ (19 values)

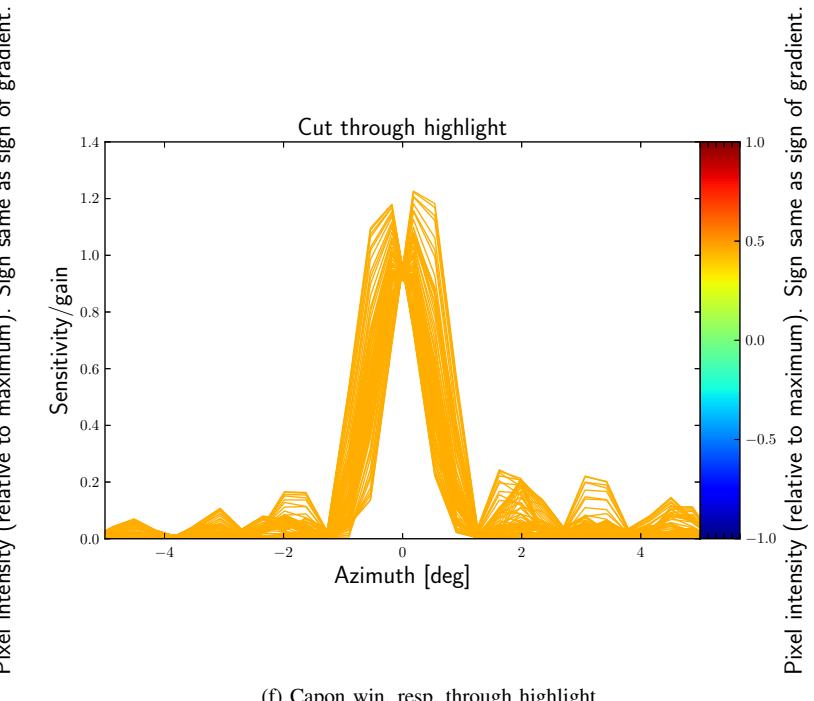
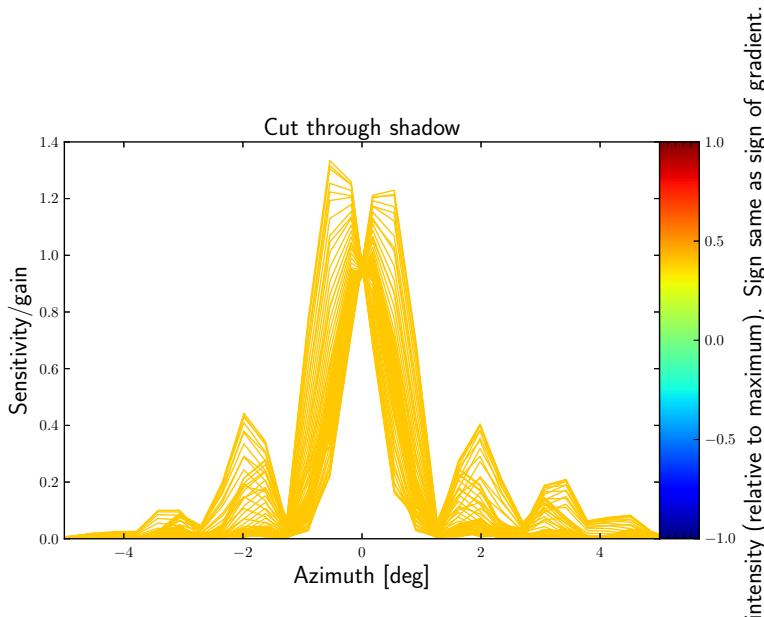
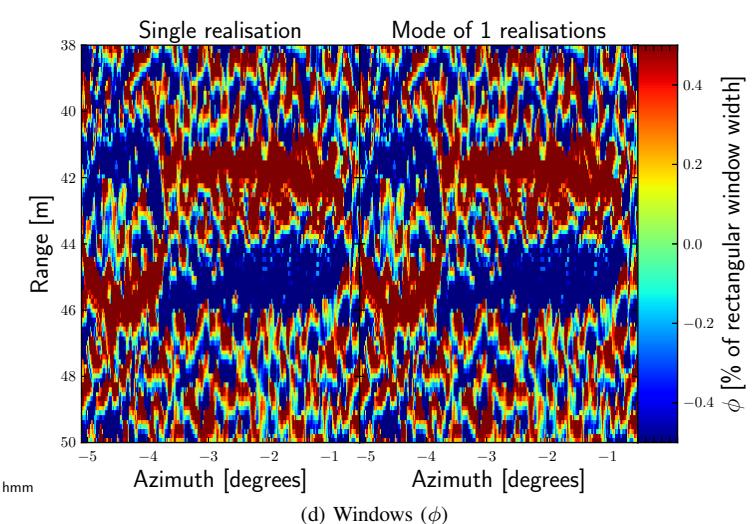
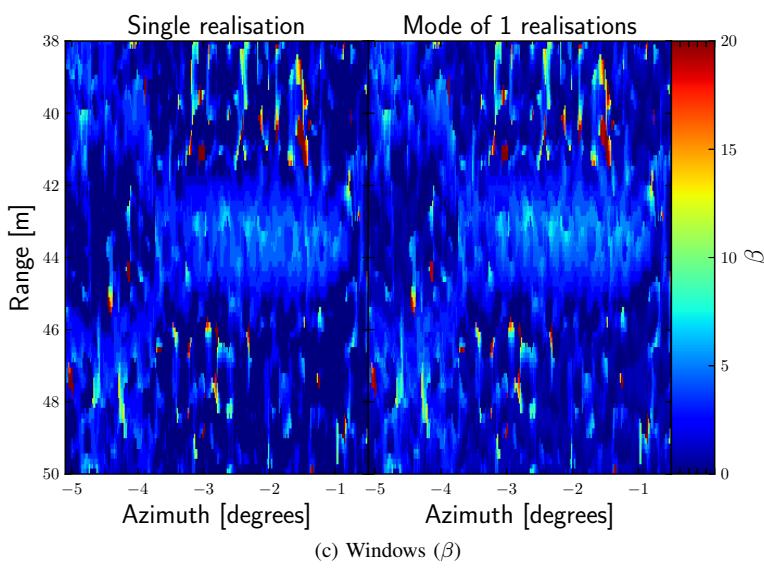
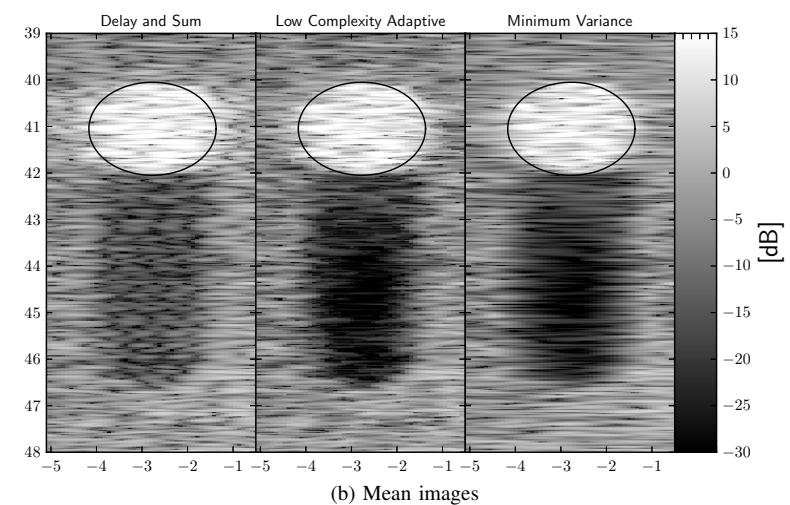
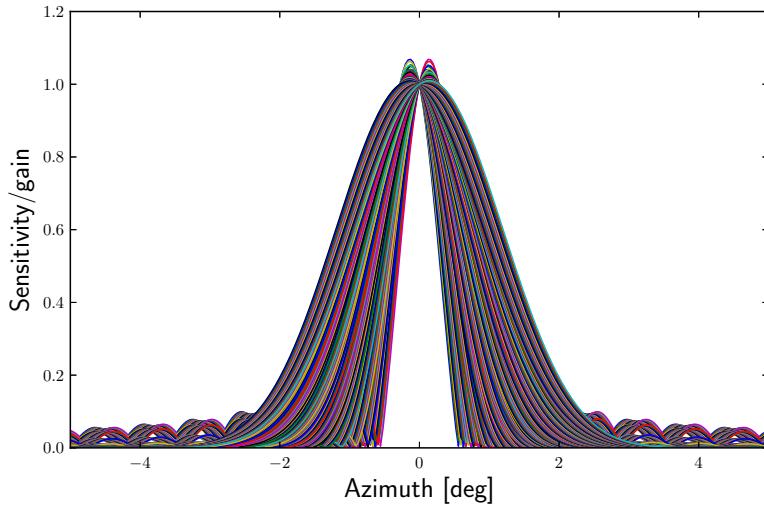
$\phi \in [-0.36, 0.36] \text{ deg}$ (19 values)

$\text{Navg} = 7$

Capon $\Delta = 0.01$

$L = 16$

$\text{Navg} = 7$



(e) Capon win. resp. through shadow

LCA: Adjusting resolution/SNR.**General** $M = 32$ **LCA** $\beta \in [0, 5]$ (19 values)**Capon** $\Delta = 0.01$

$$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$$

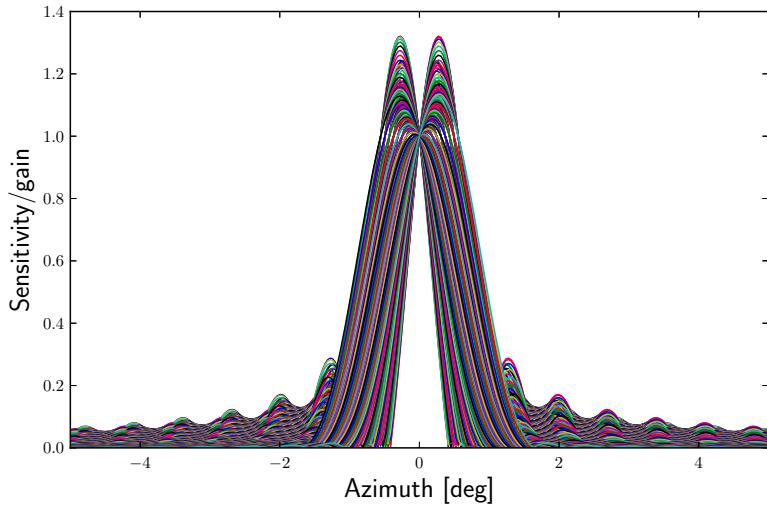
$$\phi \in [-0.72, 0.72] \text{ deg (19 values)}$$

$$L = 16$$

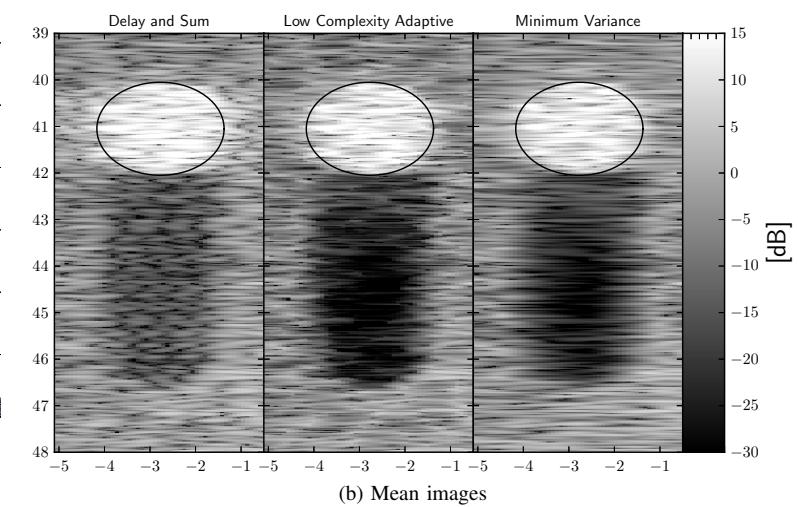
$$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$$

$$\text{Navg} = 7$$

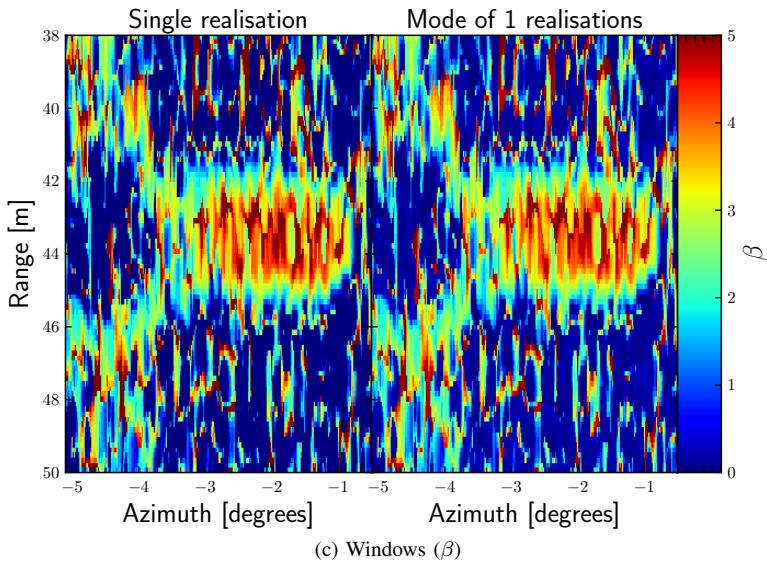
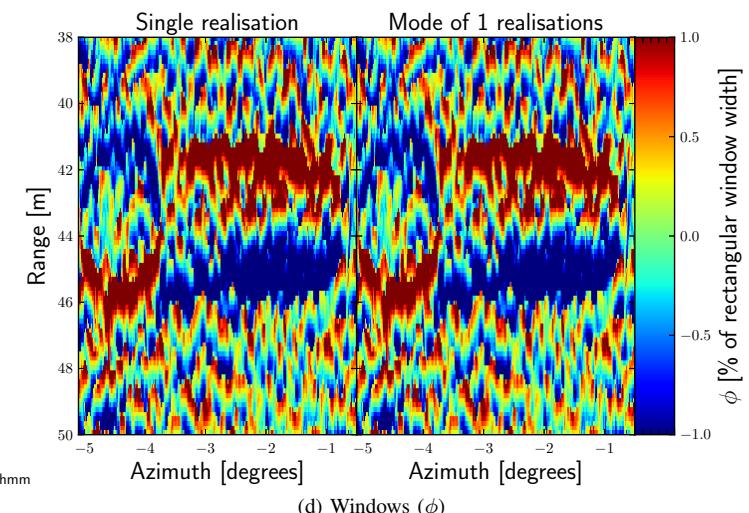
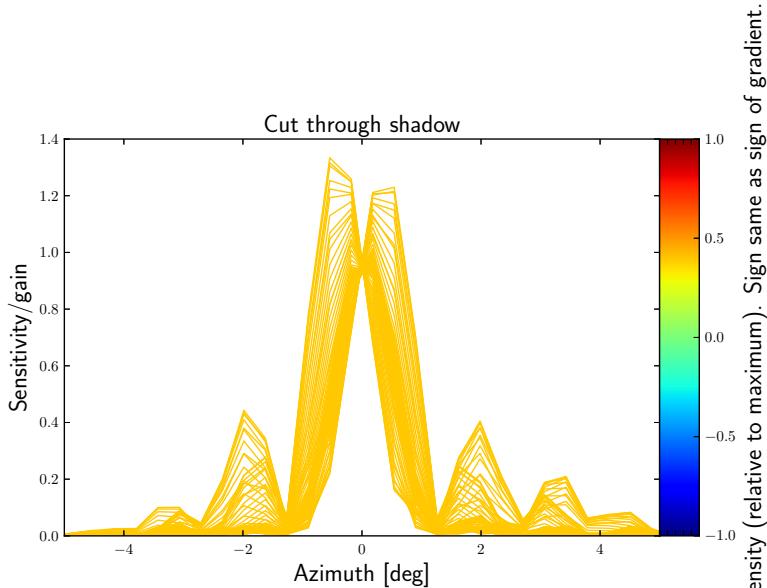
$$\text{Navg} = 7$$



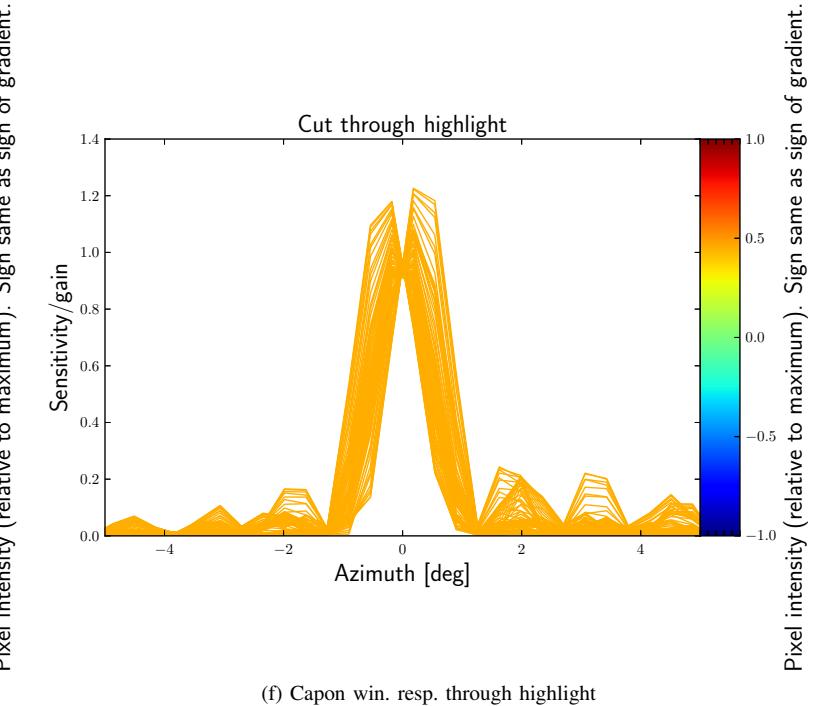
(a) LCA Window Response



(b) Mean images

(c) Windows (β)(d) Windows (ϕ)

(e) Capon win. resp. through shadow



(f) Capon win. resp. through highlight

LCA: Adjusting resolution/SNR.

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General $M = 32$

$$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$$

$$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$$

LCA $\beta \in [5, 20]$ (19 values)

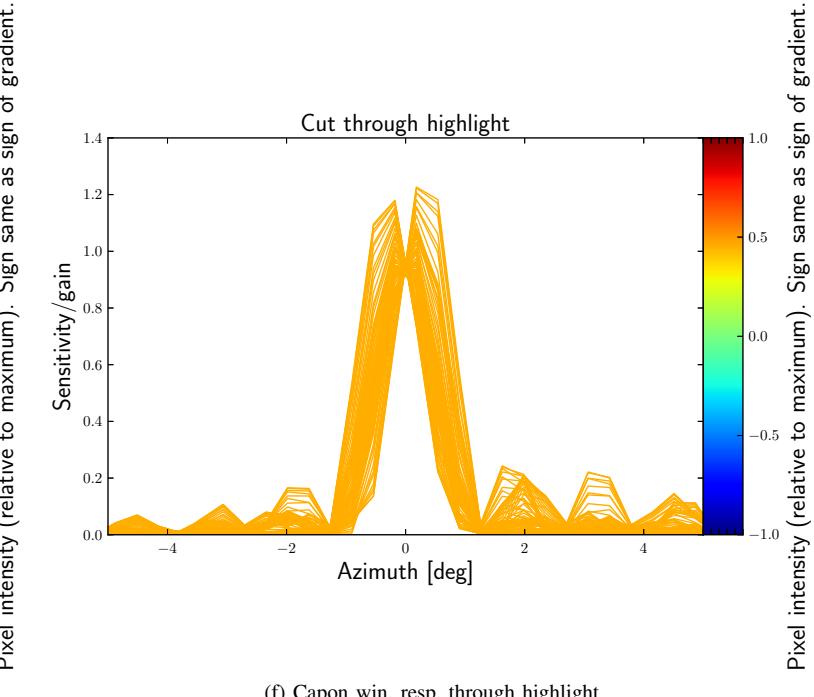
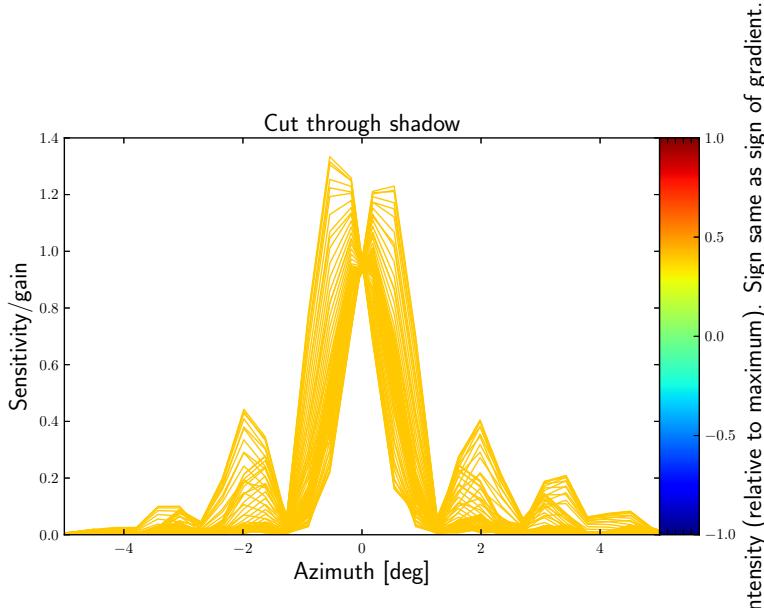
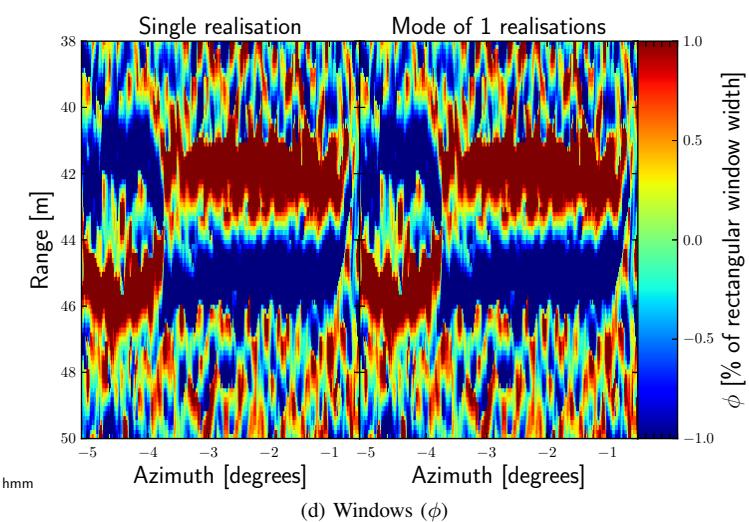
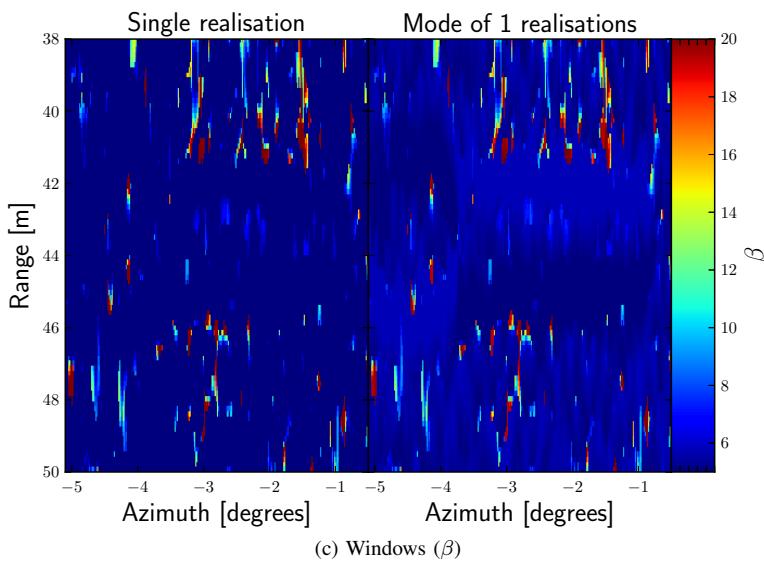
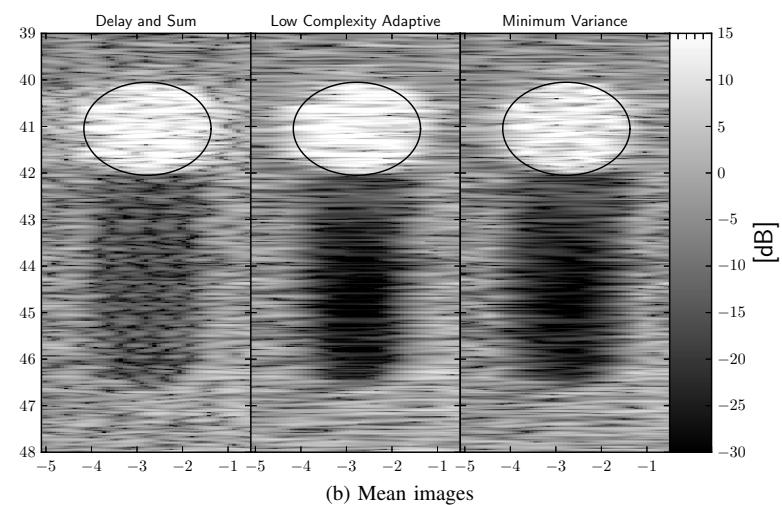
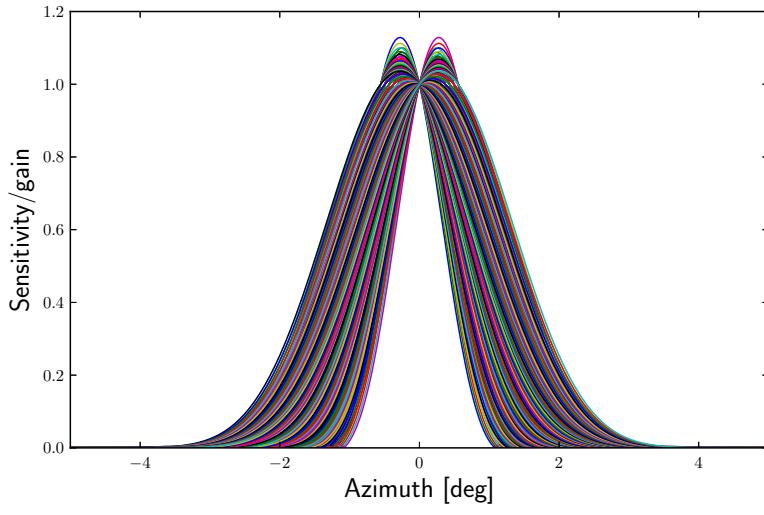
$$\phi \in [-0.72, 0.72] \text{ deg (19 values)}$$

$$\text{Navg} = 7$$

Capon $\Delta = 0.01$

$$L = 16$$

$$\text{Navg} = 7$$



(e) Capon win. resp. through shadow

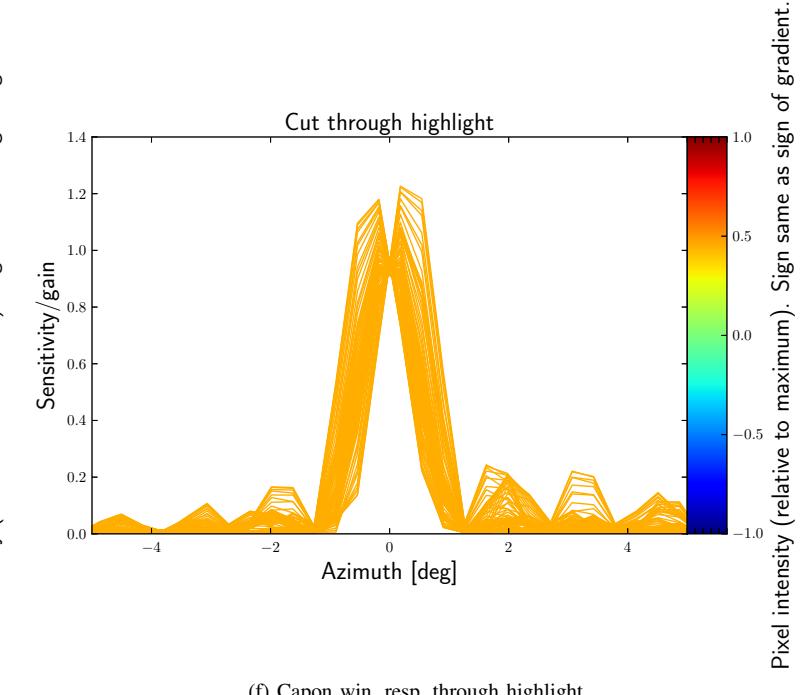
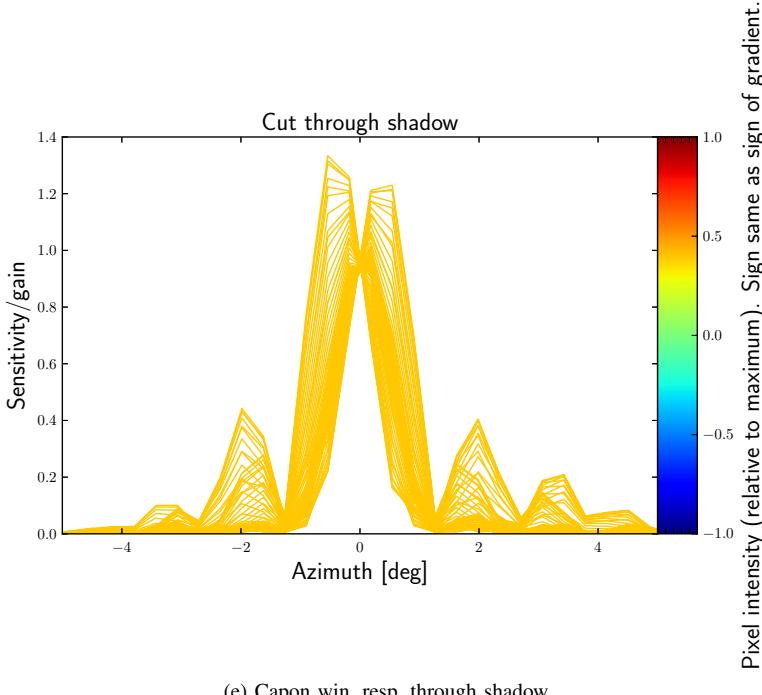
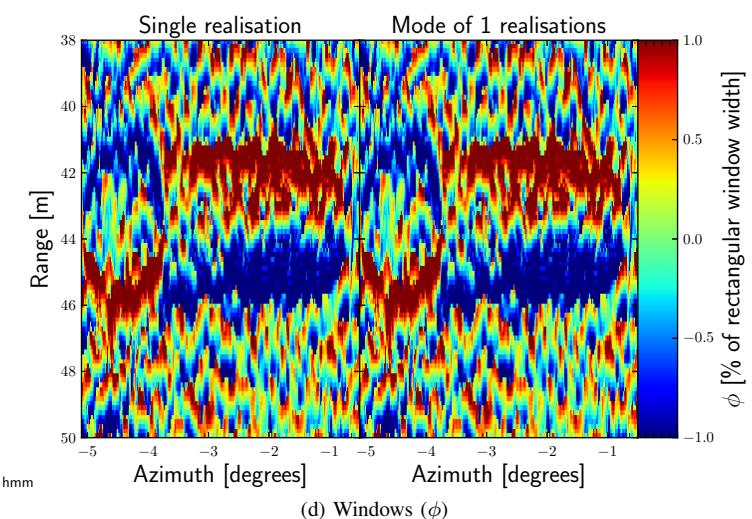
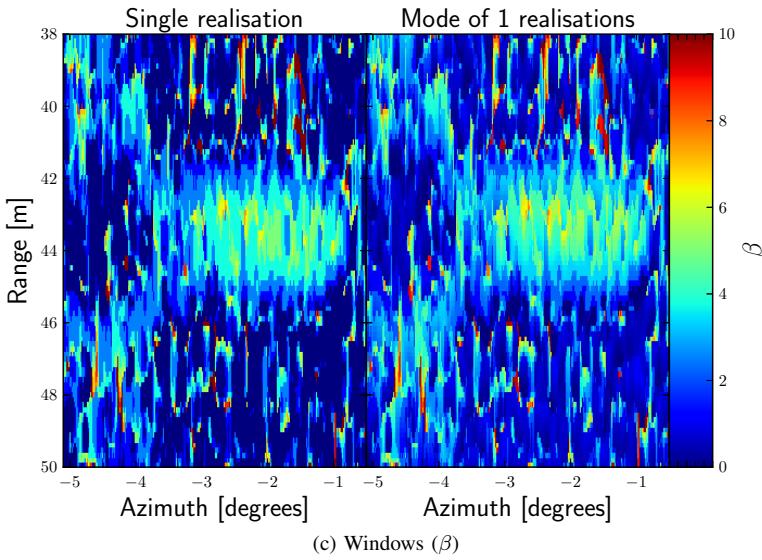
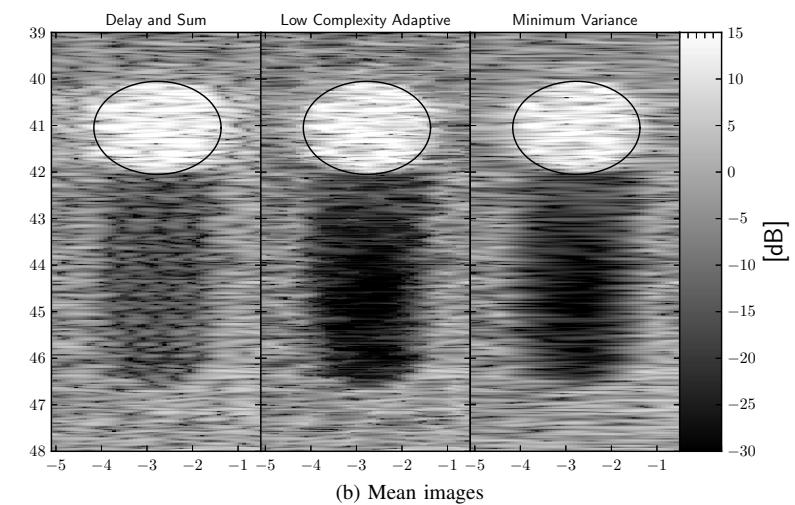
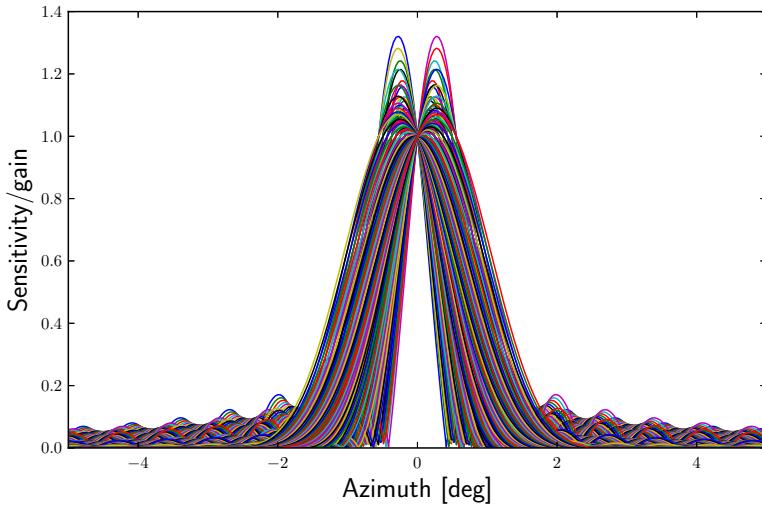
(f) Capon win. resp. through highlight

General $M = 32$
LCA $\beta \in [0, 10]$ (9 values)
Capon $\Delta = 0.01$

LCA: Fewer windows.

$\Delta r = \frac{c}{2B} = 2.5$ cm
 $\phi \in [-0.72, 0.72]$ deg (19 values)
 $L = 16$

$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$
 $\text{Navg} = 7$
 $\text{Navg} = 7$



LCA: Fewer steering angles.**General** $M = 32$ **LCA** $\beta \in [0, 10]$ (19 values)**Capon** $\Delta = 0.01$

$$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$$

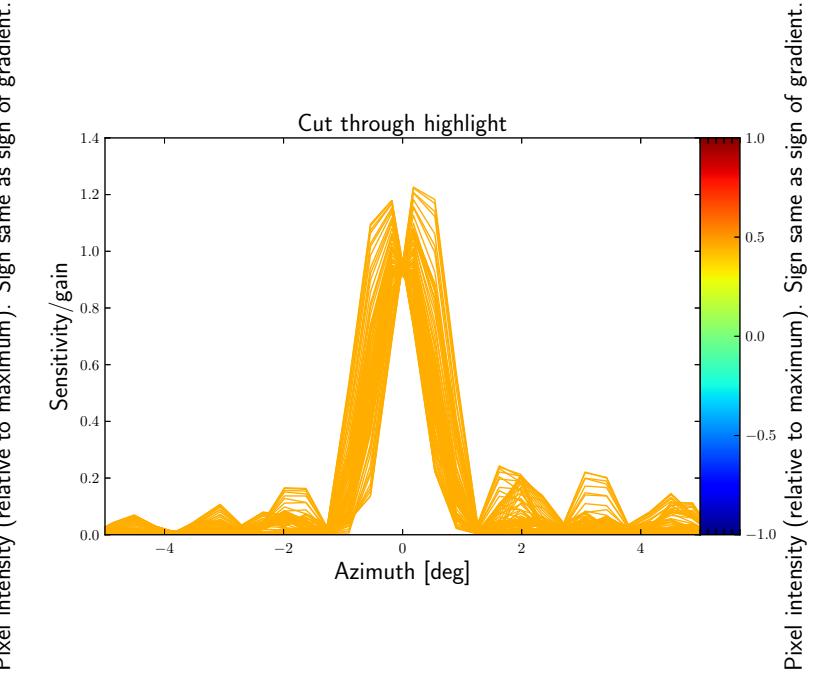
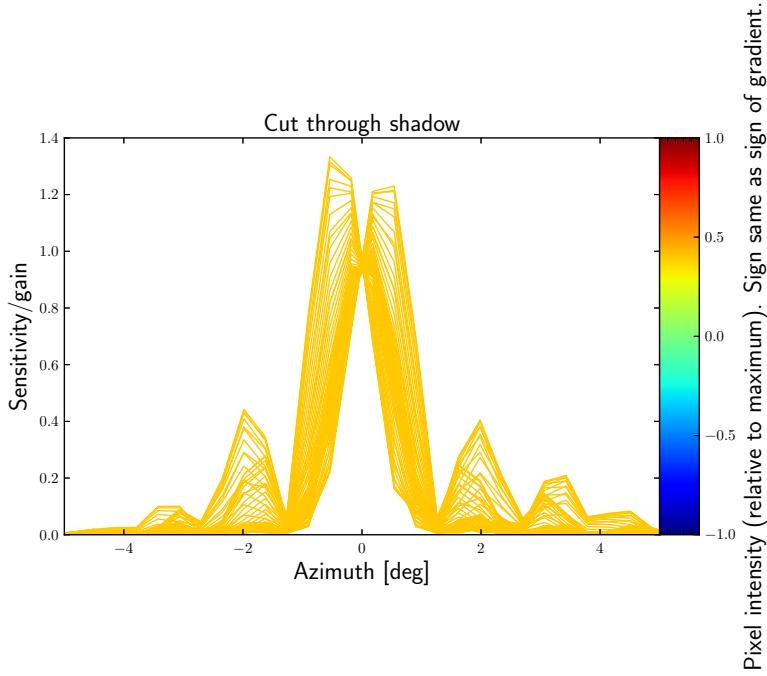
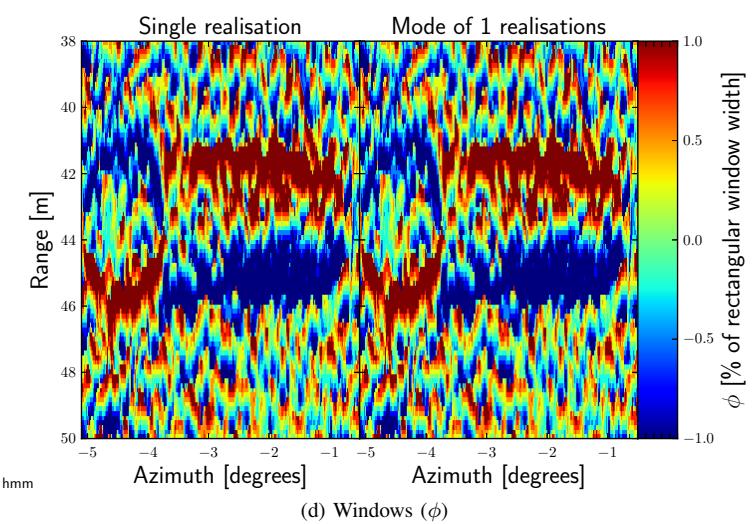
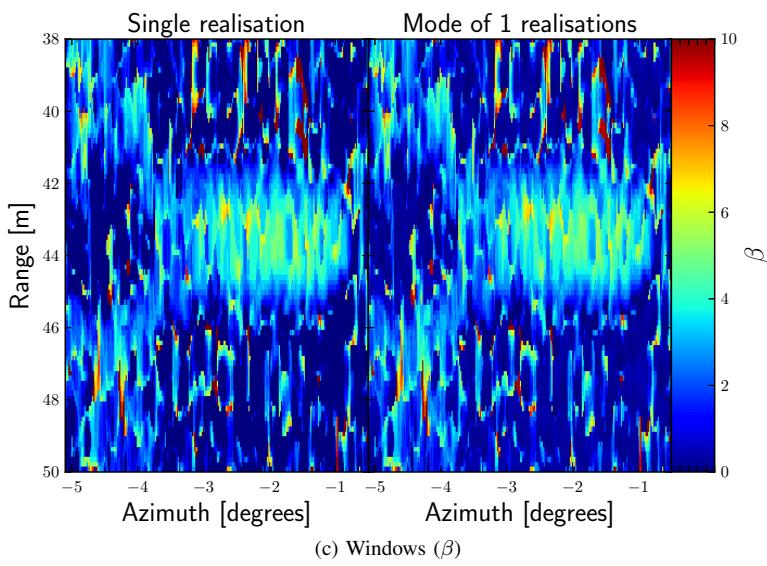
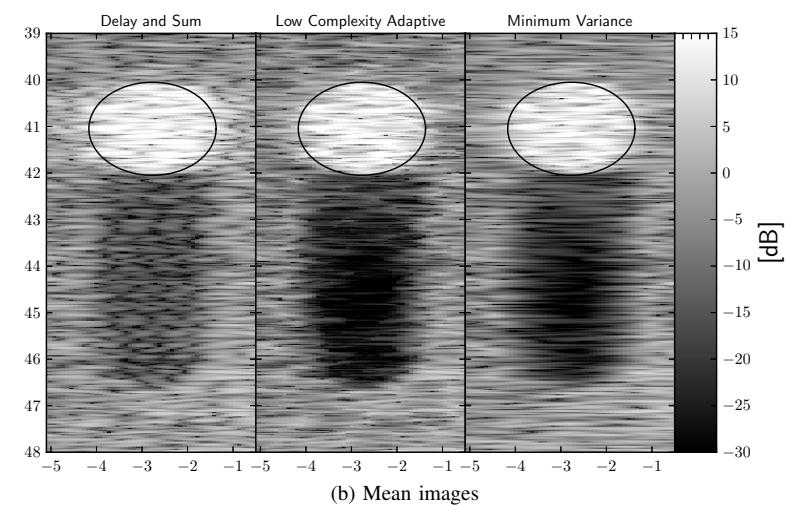
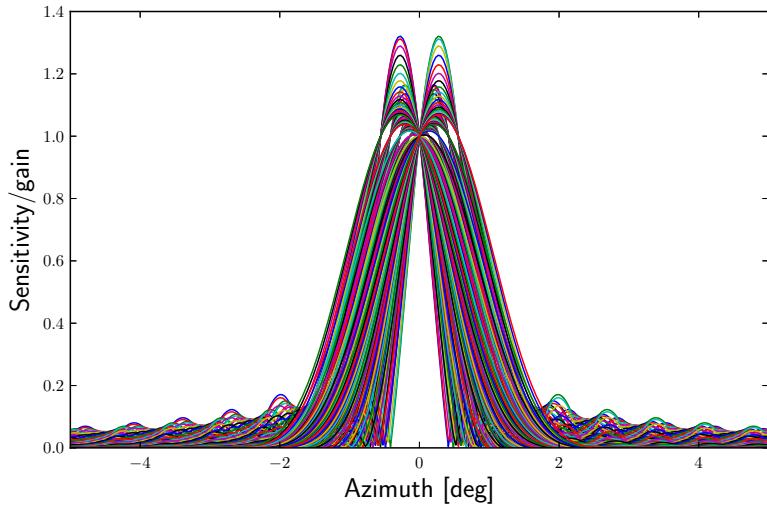
$$\phi \in [-0.72, 0.72] \text{ deg (9 values)}$$

$$L = 16$$

$$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$$

$$\text{Navg} = 7$$

$$\text{Navg} = 7$$



Pixel intensity (relative to maximum). Sign same as sign of gradient.

Pixel intensity (relative to maximum). Sign same as sign of gradient.

General $M = 32$
LCA $\beta \in [0, 10]$ (9 values)
Capon $\Delta = 0.01$

LCA: Fewer both.

$$\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$$

$$\phi \in [-0.72, 0.72] \text{ deg (9 values)}$$

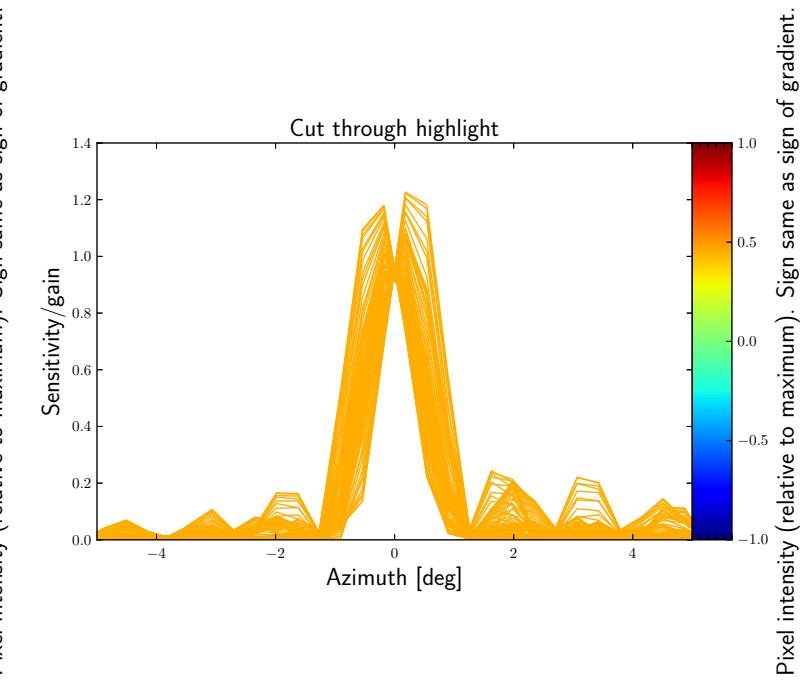
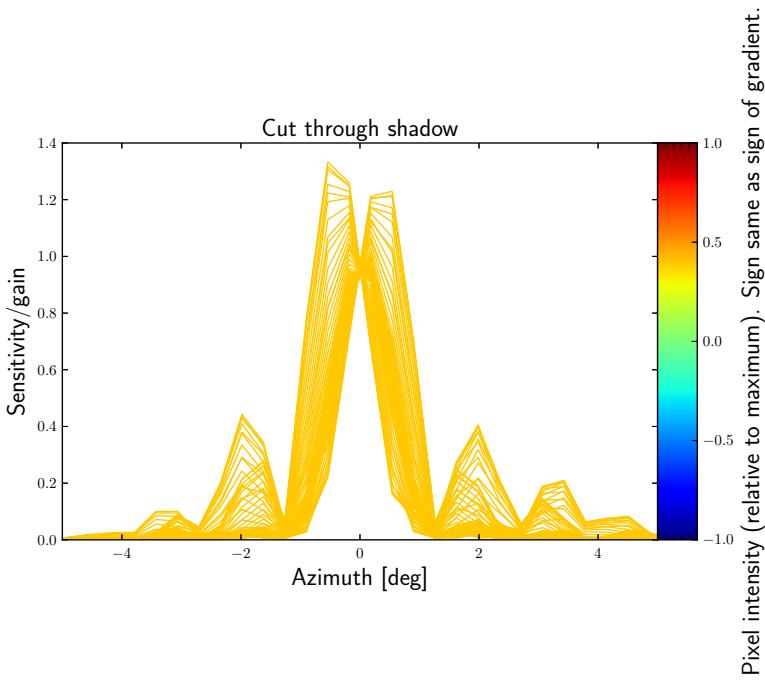
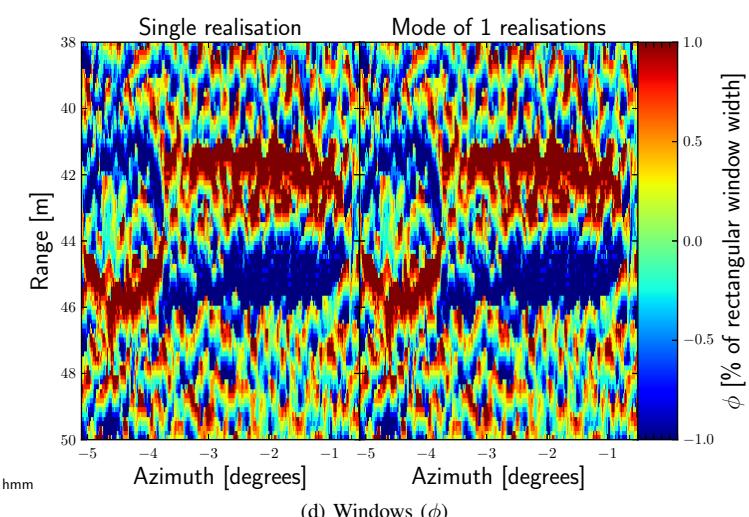
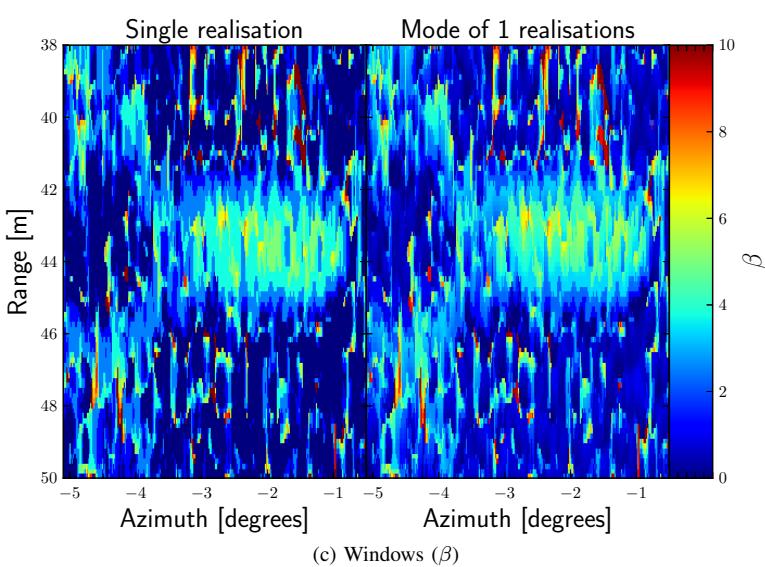
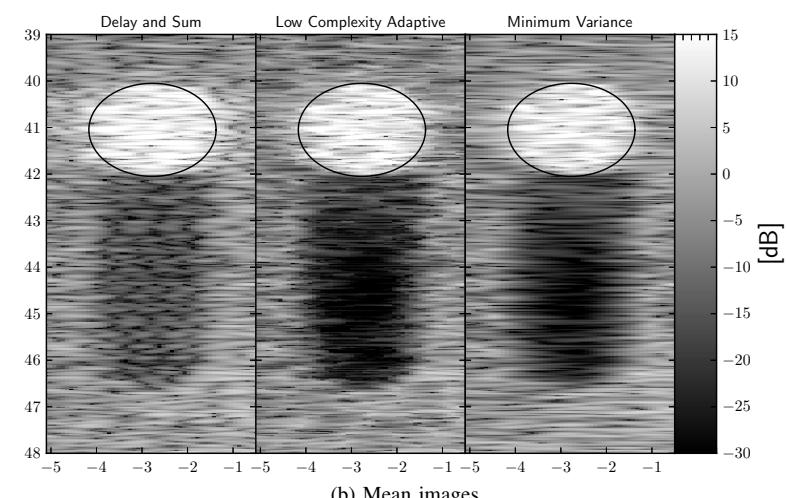
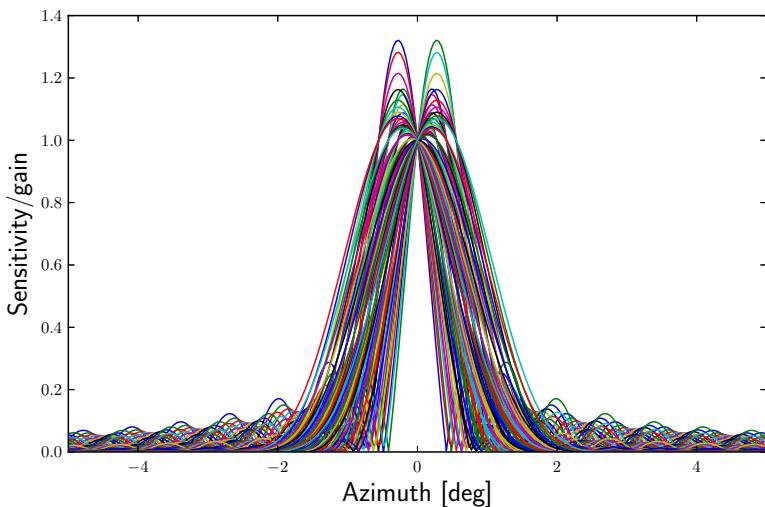
$$L = 16$$

$$\frac{640 \text{ pixels}}{\Delta r} = \frac{4}{3}$$

$$\text{Navg} = 7$$

$$\text{Navg} = 7$$

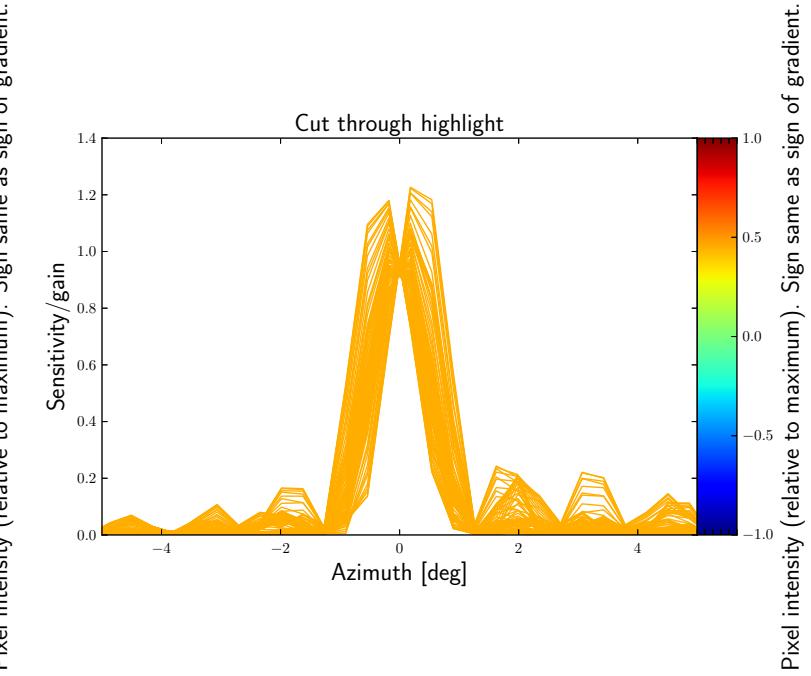
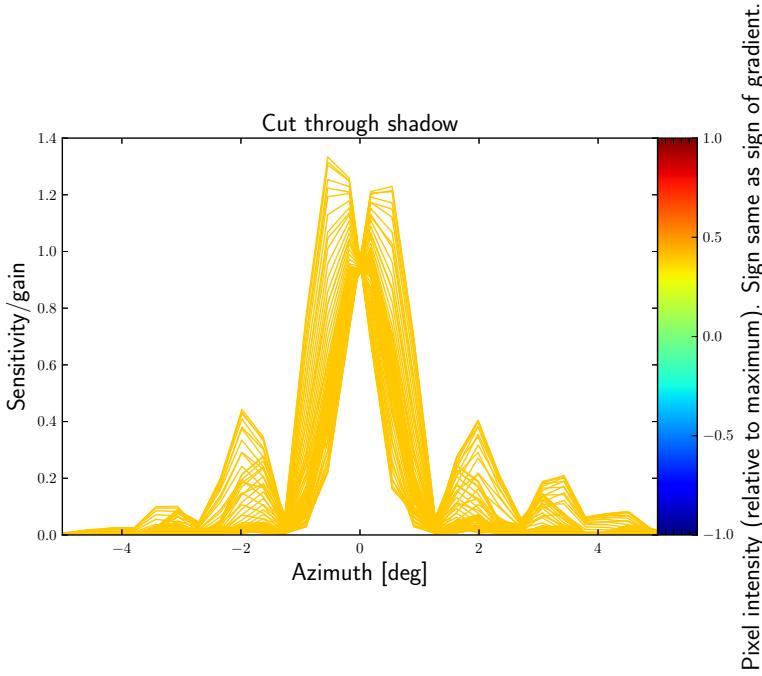
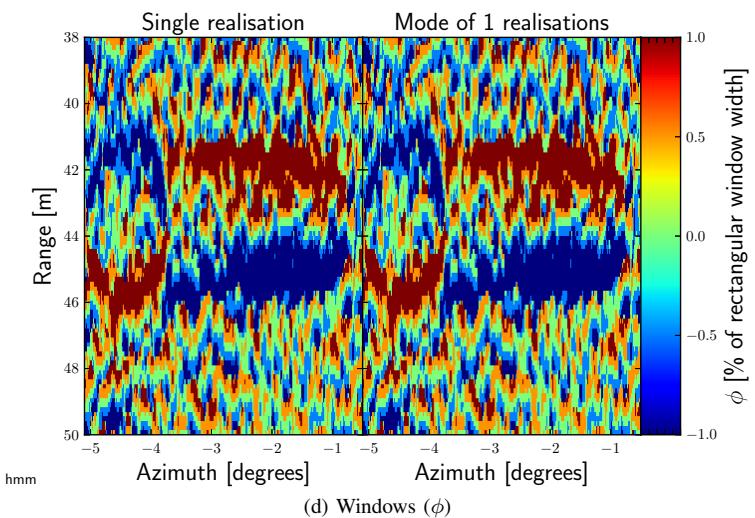
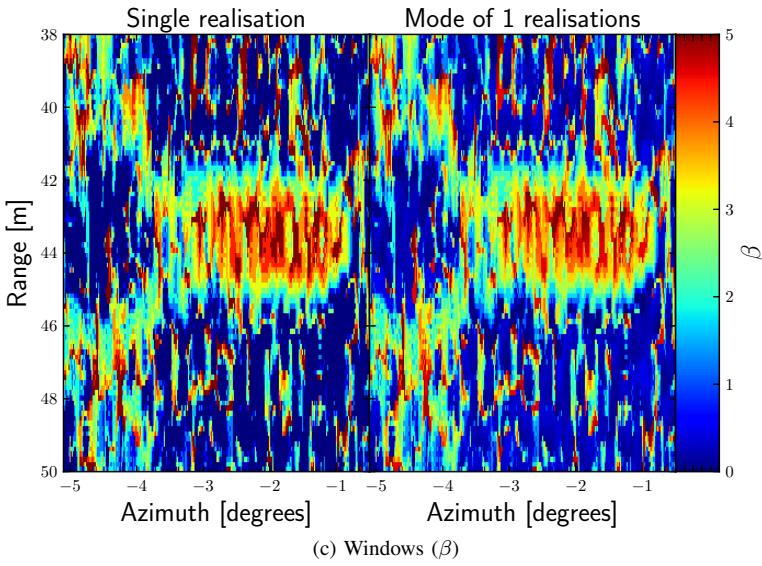
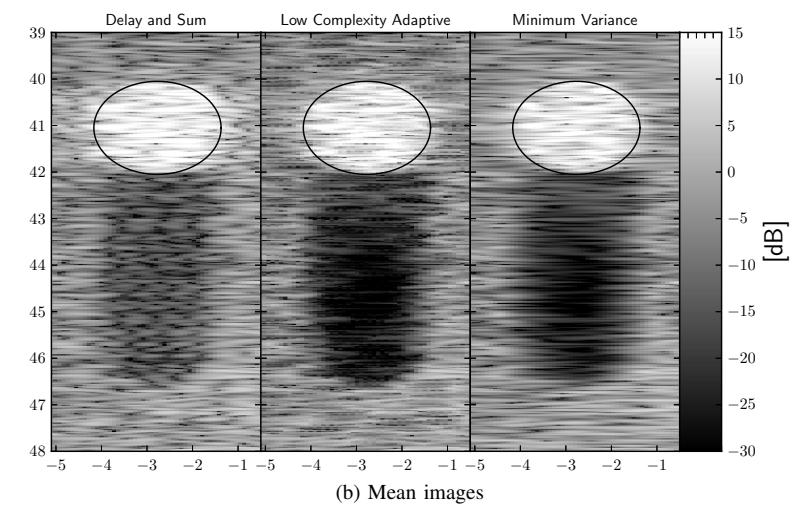
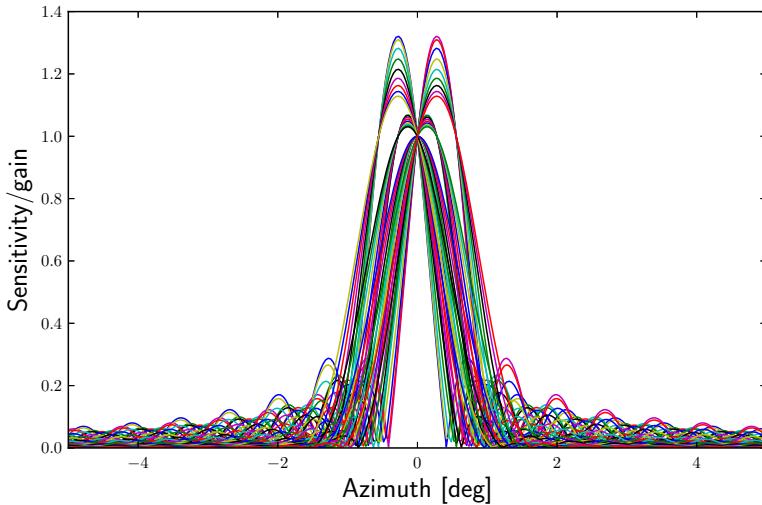
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General $M = 32$
LCA $\beta \in [0, 5]$ (9 values)
Capon $\Delta = 0.01$

LCA: Even less.
 $\Delta r = \frac{c}{2B} = 2.5 \text{ cm}$
 $\phi \in [-0.72, 0.72] \text{ deg}$ (5 values)
 $L = 16$

$\frac{640 \text{ pixels}}{\Delta r} = \frac{4}{3}$
 $\text{Navg} = 7$
 $\text{Navg} = 7$

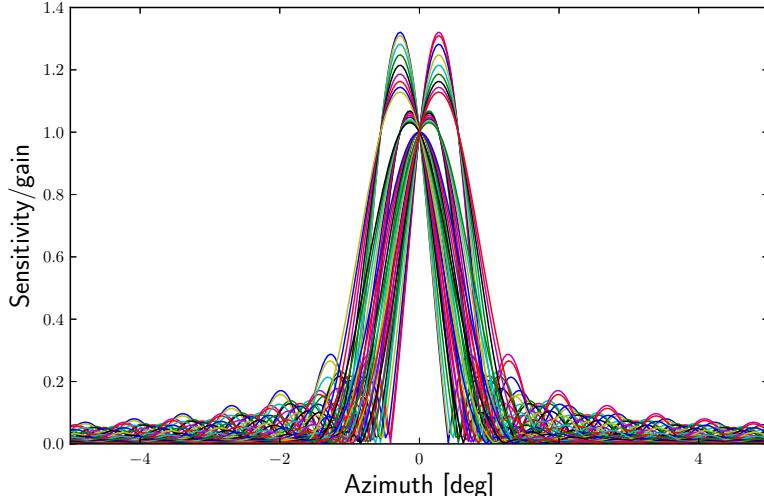


General $M = 32$
LCA $\beta \in [0, 5]$ (9 values)
Capon $\Delta = 0.01$

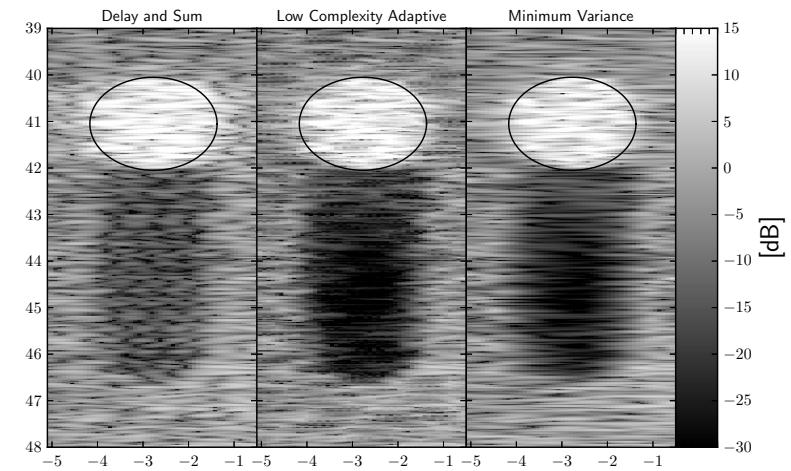
LCA: Hardly any.

$\Delta r = \frac{c}{2B} = 2.5$ cm
 $\phi \in [-0.72, 0.72]$ deg (5 values)
 $L = 16$

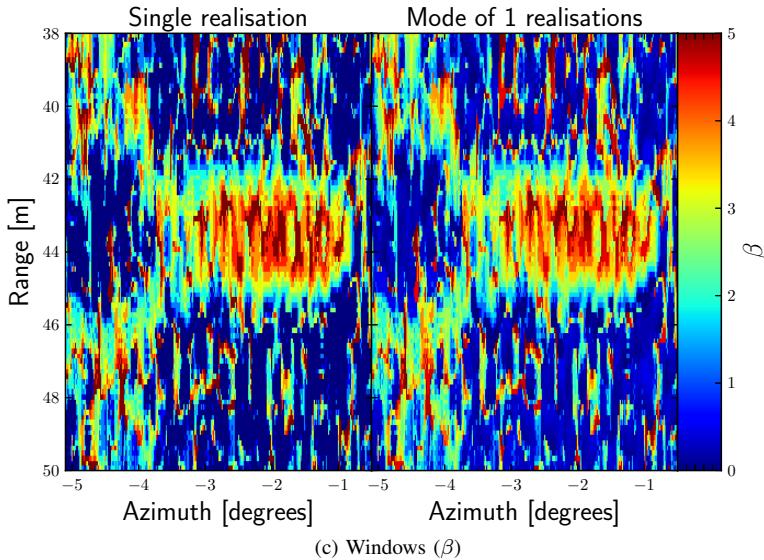
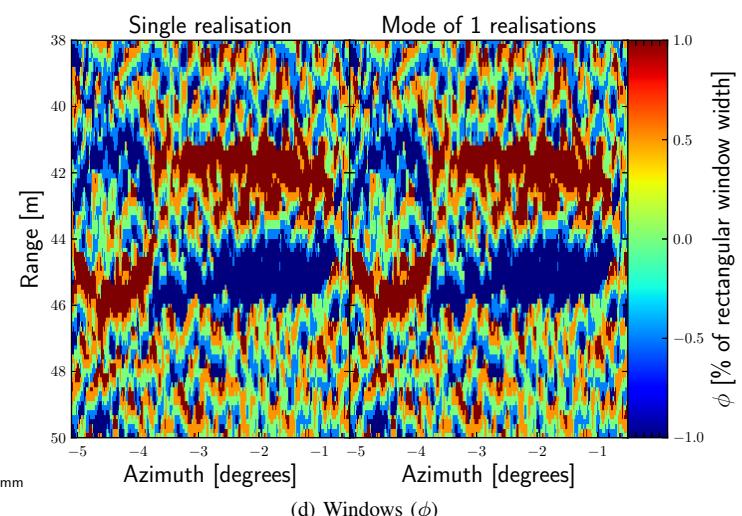
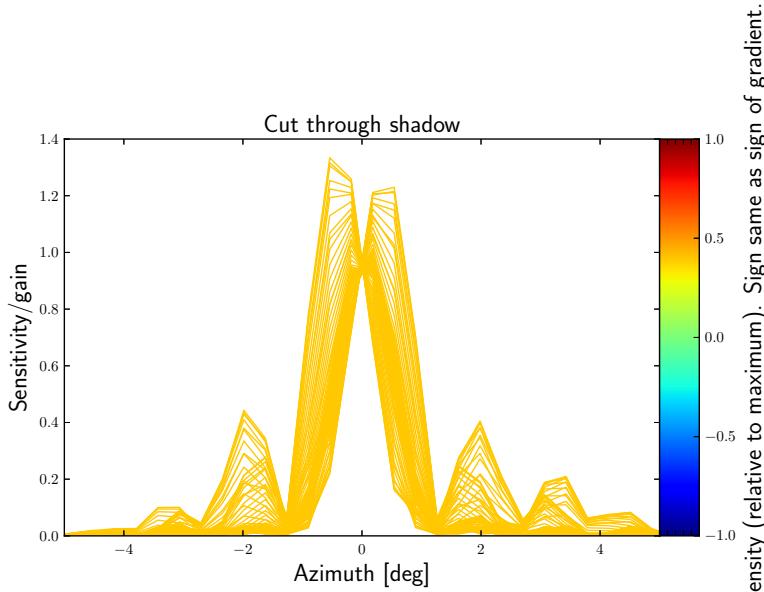
$\frac{640 \text{ pixels}}{\Delta r} / 12 \text{ m} = \frac{4}{3}$
 $\text{Navg} = 7$
 $\text{Navg} = 7$



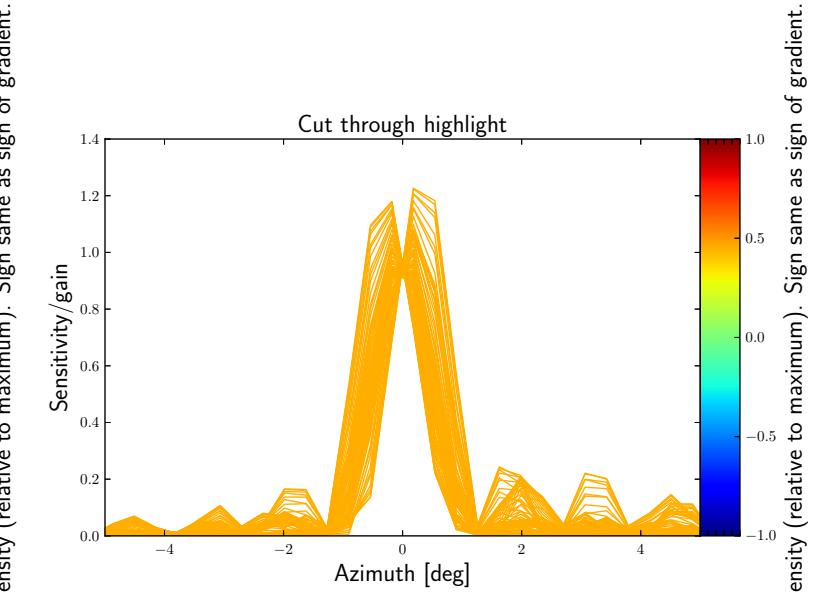
(a) LCA Window Response



(b) Mean images

(c) Windows (β)(d) Windows (ϕ)

(e) Capon win. resp. through shadow



(f) Capon win. resp. through highlight