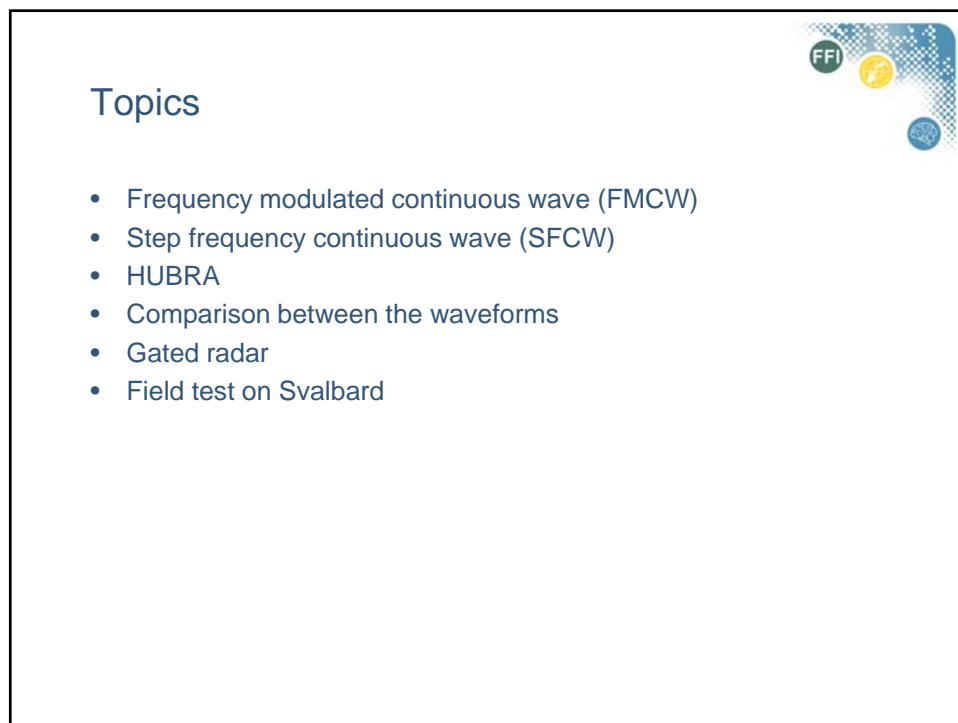


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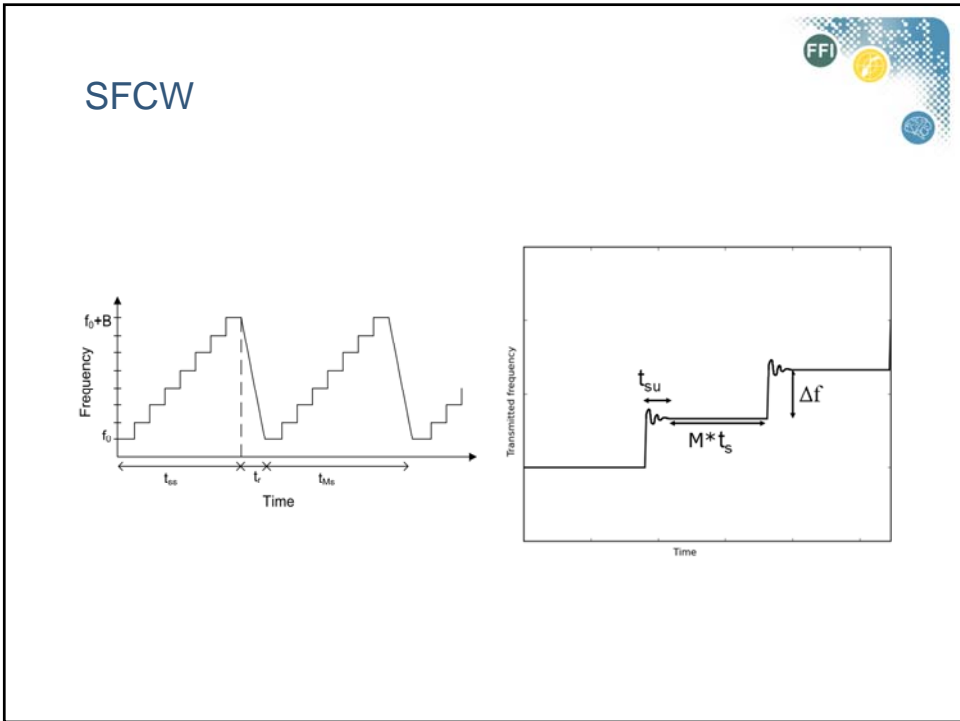
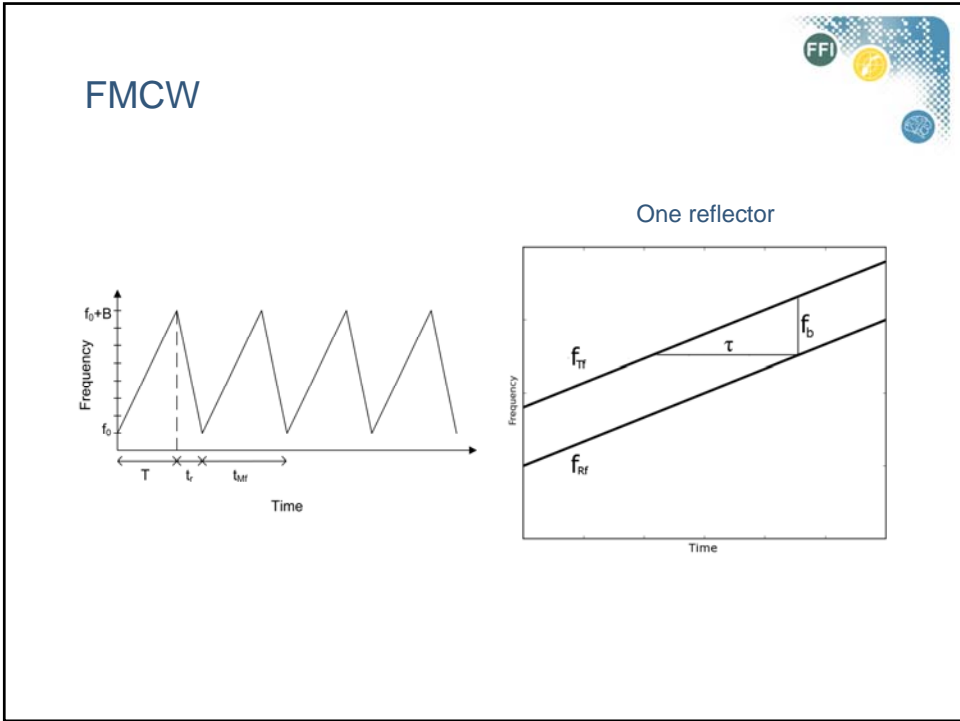
Characterisation of Ultra Wideband Frequency Modulated and Step Frequency Radar with Range Gating

ARP 2009
Mats Jørgen Øyan

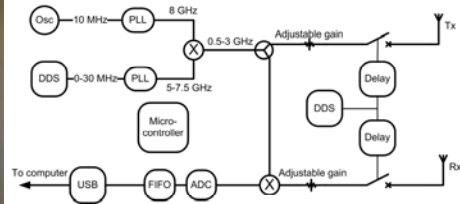
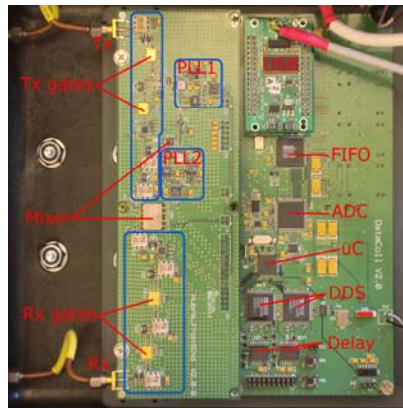


Topics

- Frequency modulated continuous wave (FMCW)
- Step frequency continuous wave (SFCW)
- HUBRA
- Comparison between the waveforms
- Gated radar
- Field test on Svalbard



HUBRA



Phase after mixing

$$\Phi_f(t) = 2\pi(\alpha \cdot t \cdot \tau + f_0 \cdot \tau - \frac{1}{2} \alpha \cdot \tau^2)$$

$$\Phi_s(n) = 2\pi(\Delta f \cdot n \cdot \tau + f_0 \cdot \tau)$$

Residual Video Phase

$$\Phi_s - \Phi_f = 2\pi(\frac{1}{2} \Delta f \cdot \tau^2)$$

Efficiency

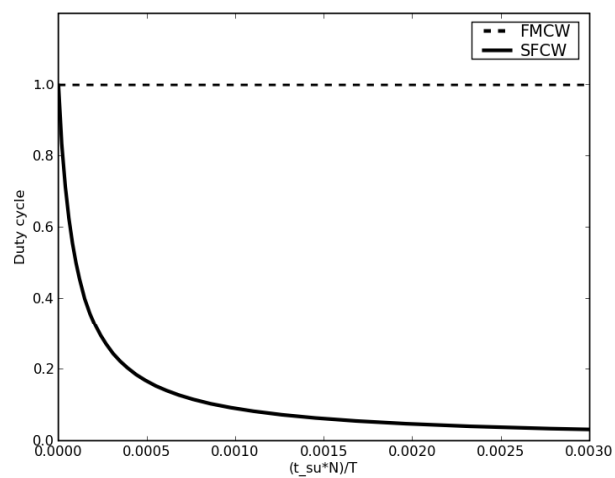
$$t_{Mf} = T + t_r$$

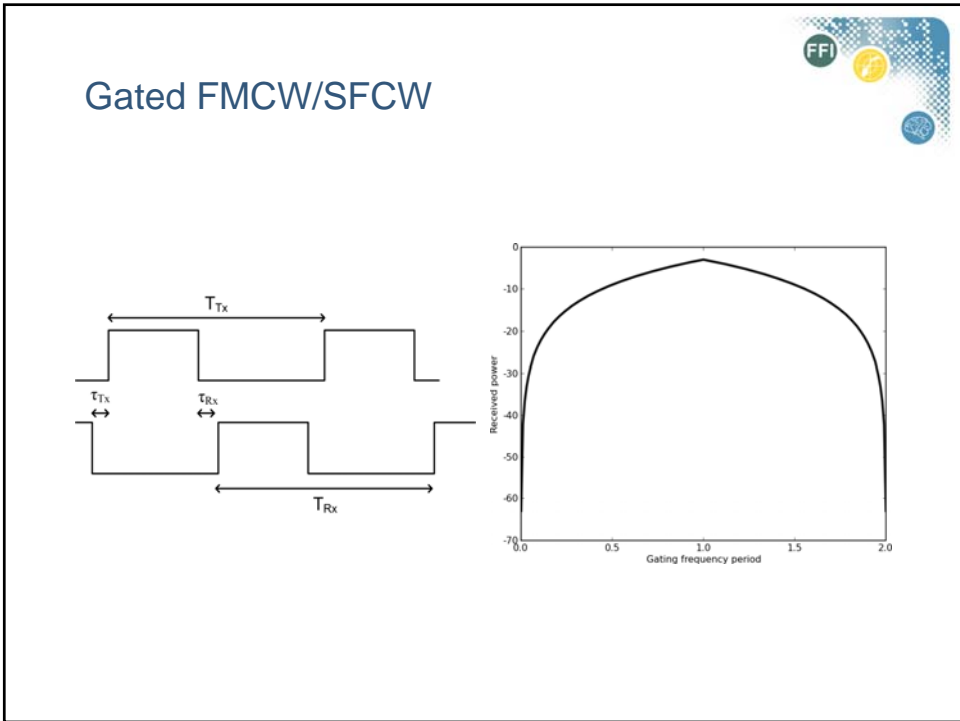
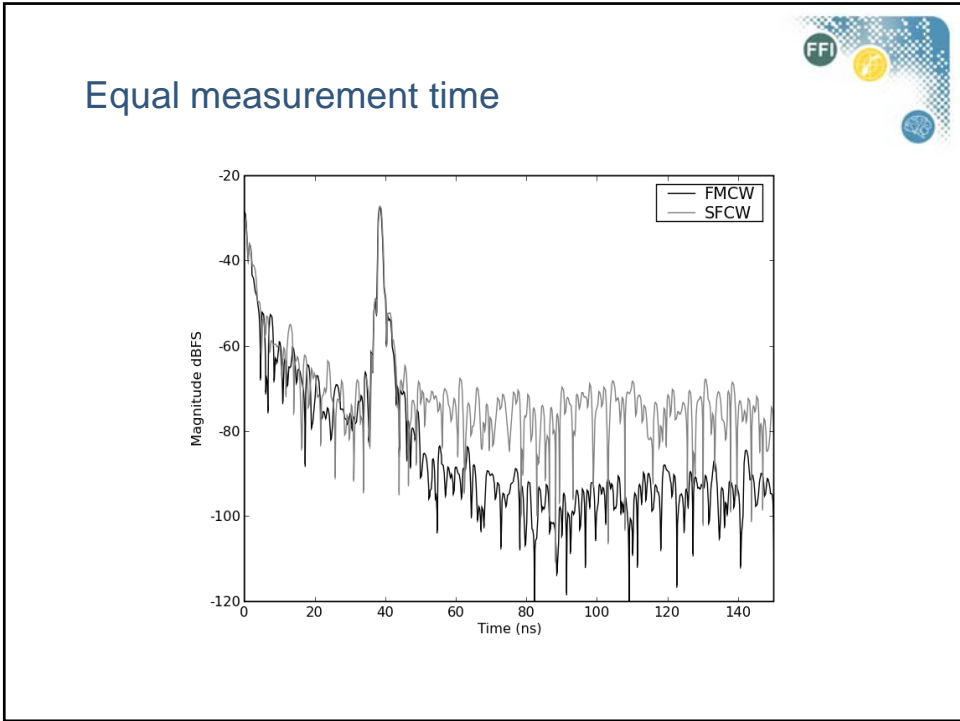
$$t_{Ms} = t_r + N \cdot M \cdot \frac{1}{f_s} + t_{su} \cdot N$$

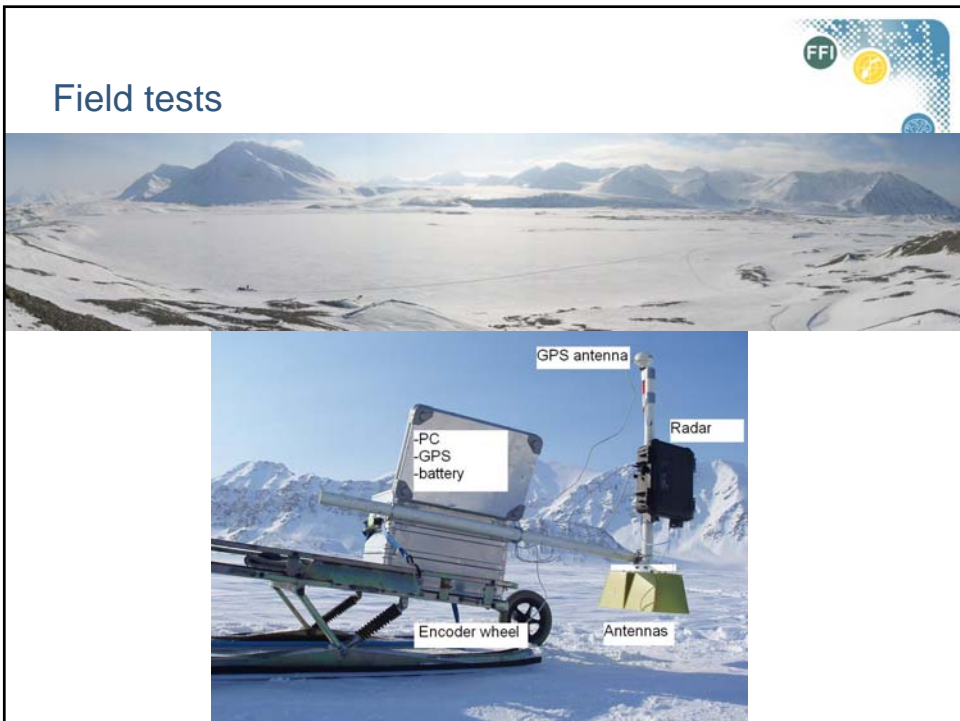
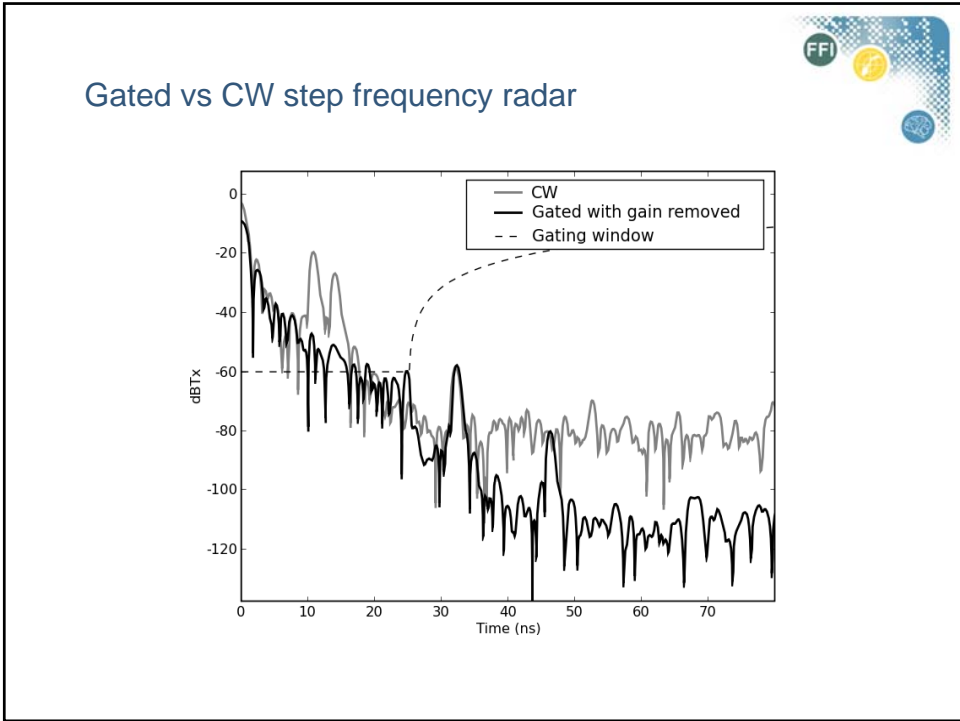
$$D = \frac{T}{t_{Mf/s}}$$

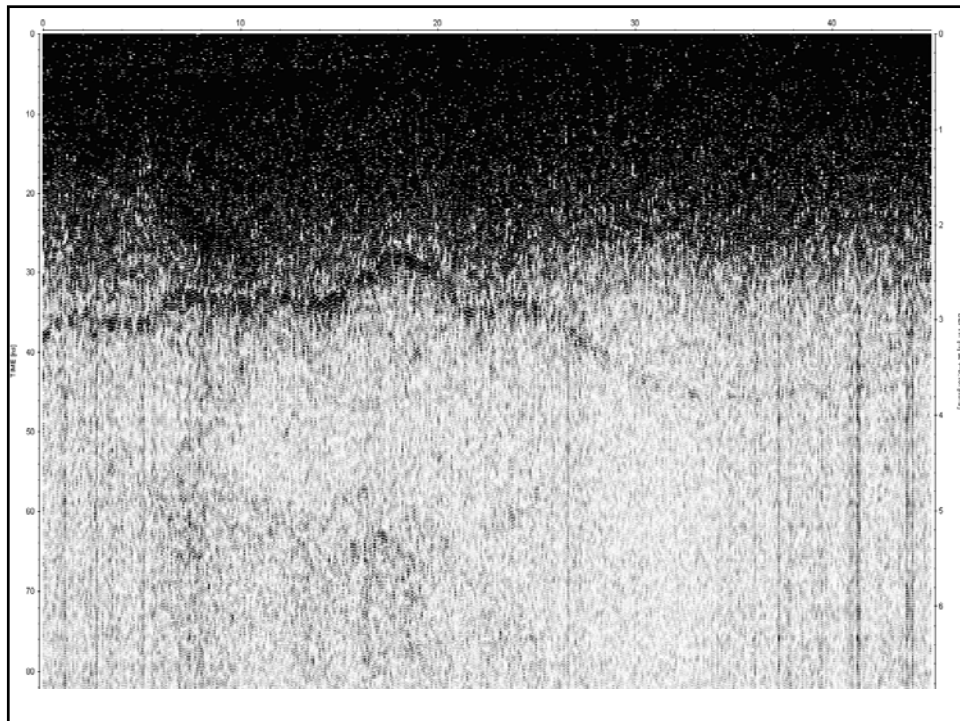
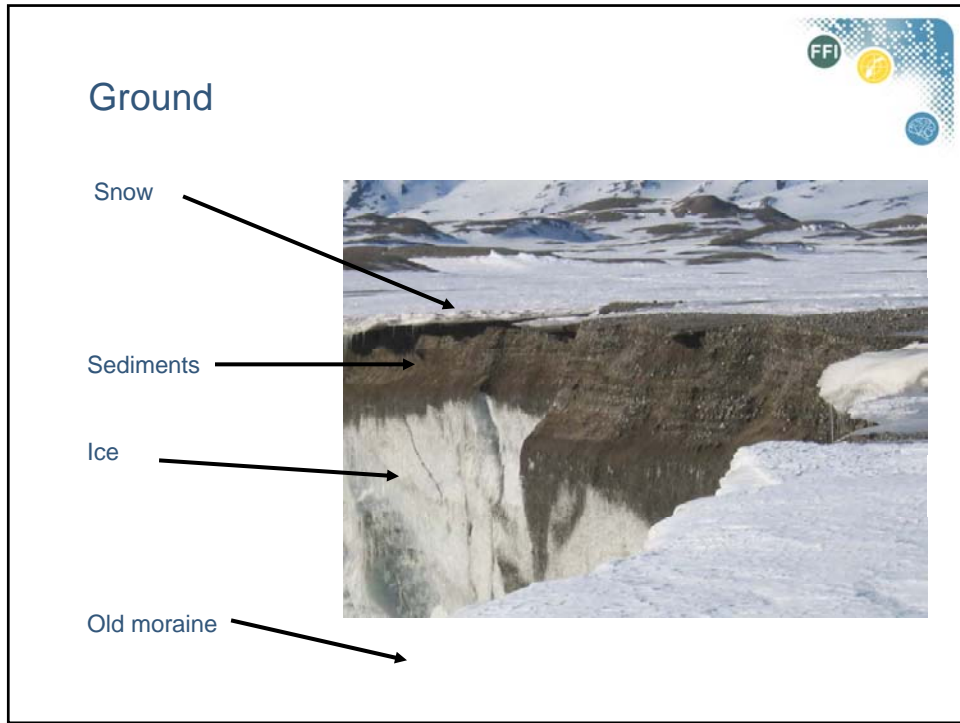


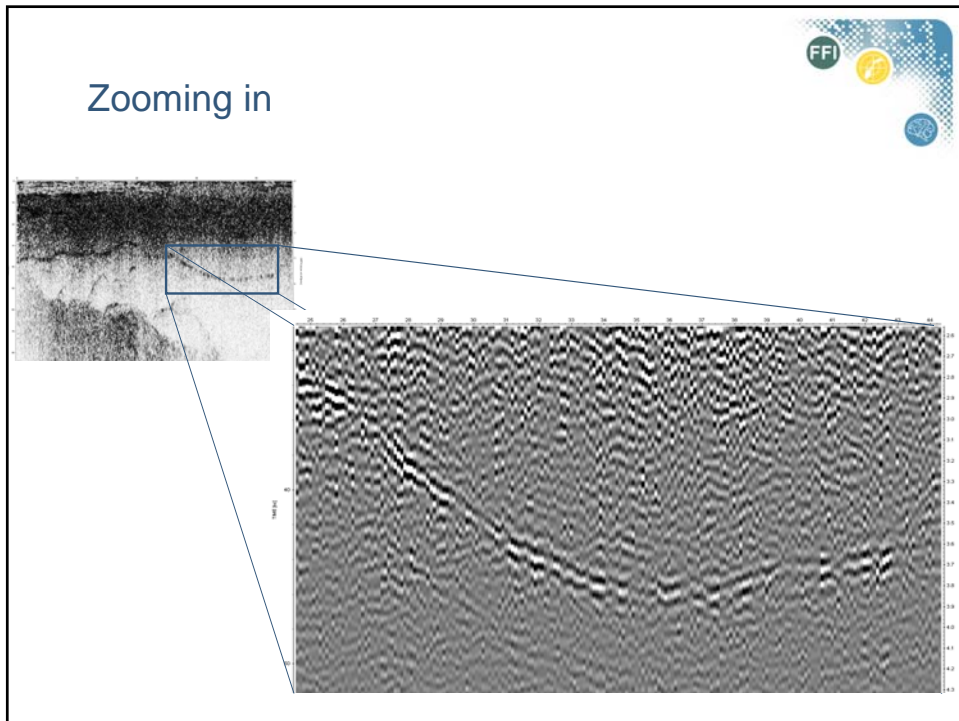
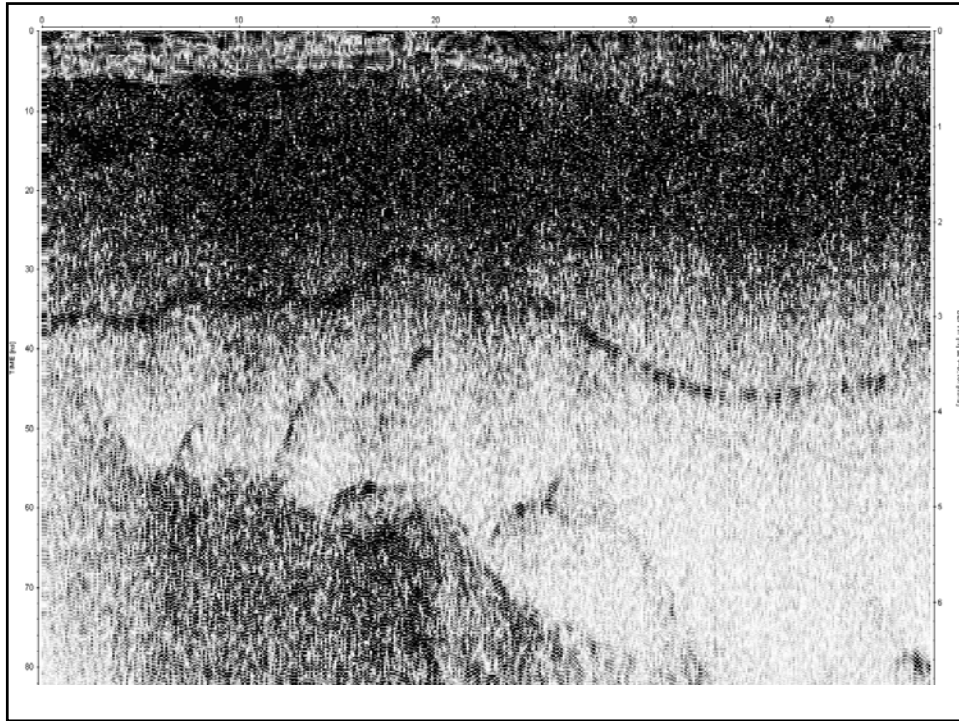
Duty cycle

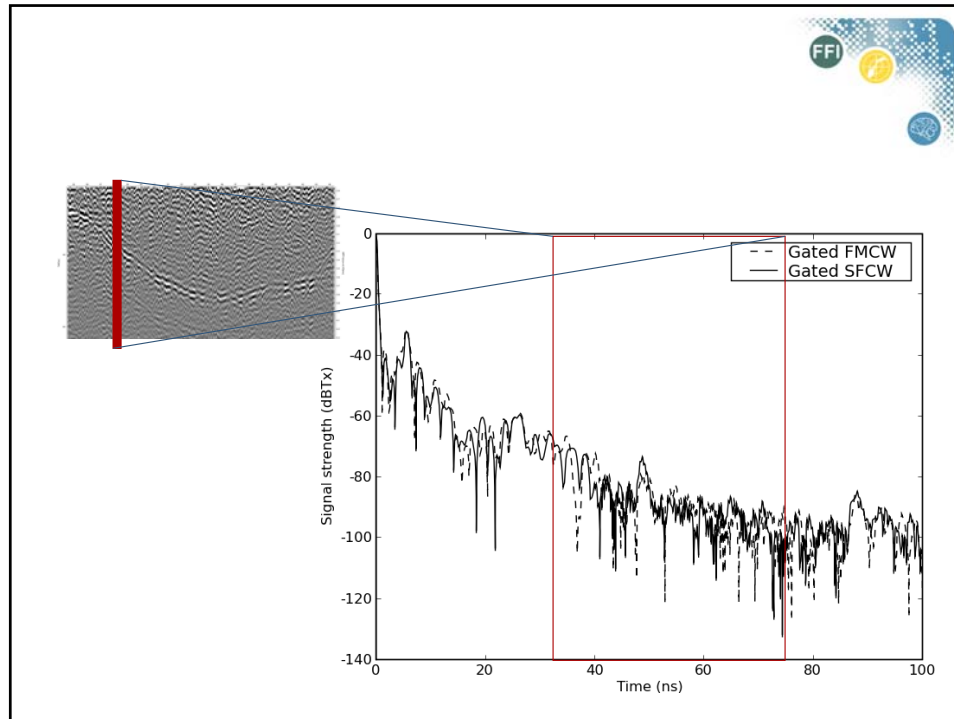












Conclusions

- Signal difference of FMCW and SFCW is the RVP-error
- Advantages of FMCW:
 - Better duty cycle
 - Can remove ambiguities by filtering IF
- Advantages of SFCW
 - Simpler hardware (no linear sweep required)
- HUBRA UWB FMCW/SFCW radar shows:
 - Comparable processing and results for both modes
 - Gated radar can greatly improve receiver dynamic range

