

Surface Flow Velocity Measurement

May 2023



60GHz PCR for Surface Velocity Measurements

Acconeer Innovation Lab Example

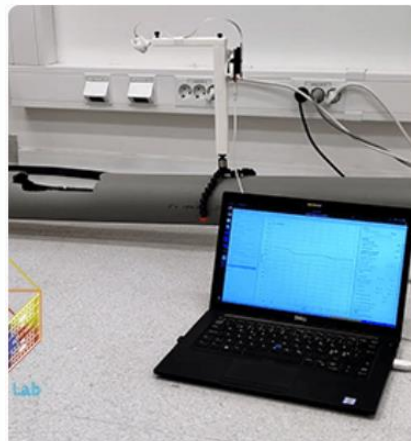
[surface-velocity-measurement](#)

Contactless accurate reading

Small form factor

Low power – enables battery driven devices

Robust detection in harsh environments



SURFACE VELOCITY MEASUREMENT

The A121 Pulsed Coherent Radar sensor is used to monitor and measure water surface speed...

Applications

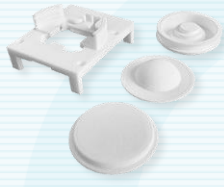
Measuring surface velocity within a wide range of applications

- Running water in rivers and canals
- Surface flow in open pipes and ditches
- Speed of spray and cascades
- Most types of liquids including water, oil, chemicals, fuel



A121 evaluation kit

Surface velocity measurement example



LH132
(Lens kit)



XE125 EVK
(A121 Radar Sensor)

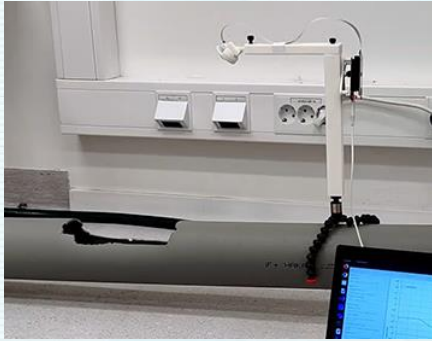


EXPLORATION TOOL
(Windows & Linux)

- Evaluation kit XE125 with A121
- LH132 lens kit with spherical or FZP lens
- Surface Velocity example app included in Python Exploration tool
 - Open-source python code

Proof-of-concept

Lab set-up



- Evaluation kit (XE121 / XS121 / LH112)
- The measurements were done in the Acconeer lab with a pipe and a water hose
- The reference velocity was measured by having a reference object floating within a known distance and time

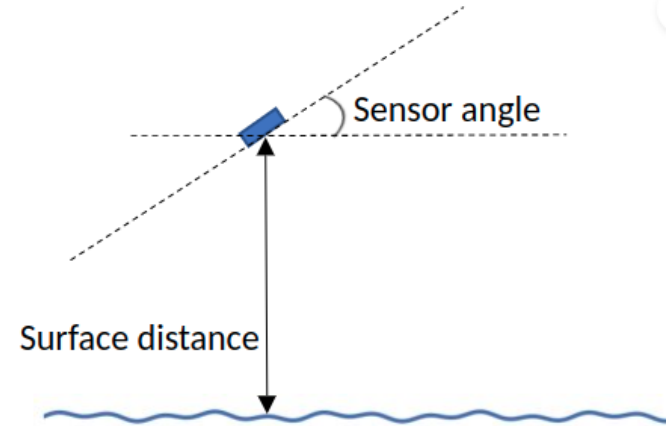
Outdoor



- Evaluation kit (XE121 / XS121 / LH112)
- The measurements were made from a bridge over streaming water
- The reference velocity was measured by having a reference object floating within a known distance and time

PoC - Conditions

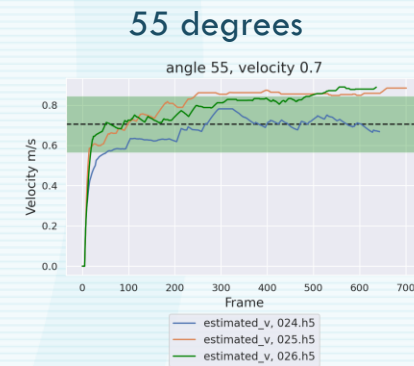
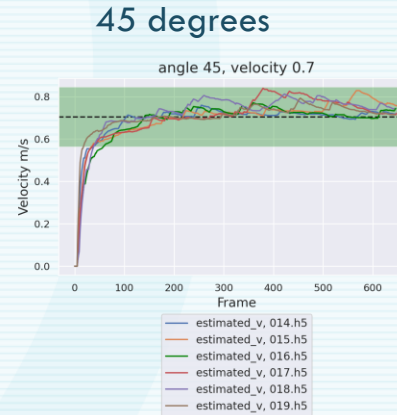
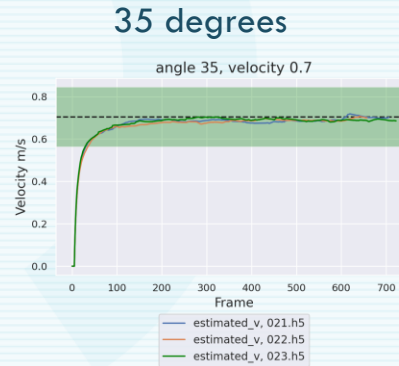
- Sensor to be positioned at an angle of 35 – 45 degrees to surface
- Larger angle gives better velocity estimates, but too large angle leads to signal loss
- Flow is detected through ripples that travel on the surface
- Direction of flow is seen as positive or negative velocity
- Maximum velocity is determined by sweep rate
- Threshold method used is CFAR



PoC Measurements

Lab set up with velocity ~ 0.70 m/s

- Plots show different angles
- The green area shows $\pm 20\%$ of reference value
- For the angle of 45 degrees, two different ranges were tested, and three measurements were done for each
- Three measurements were done for 35 and 55 degrees

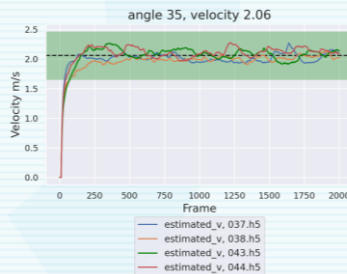


PoC Measurements

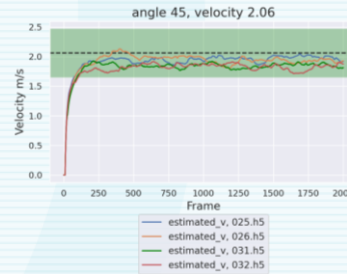
Outdoor with Velocity ~ 2.1 m/s

- Plots show measurements at different angles
- The green area shows $\pm 20\%$ of reference value

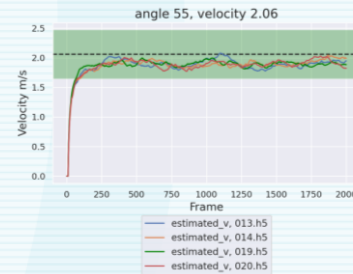
35 degrees



45 degrees



55 degrees



PoC- Summary

Parameter		Comment
Radar	A121	
Detection angle	35° to 45°	With di-electric lens LH112, for ~10° HPBW
Detection distance	Up to ~4m	Depending on surface characteristics
Speed range	0.1m/s to 25m/s	
Power consumption	~30 μ W	Est. with measurement every 10min
Temperature range	- 40°C to + 105°C	

Acconeer - Customer Reference



PROPRIETARY AND CONFIDENTIAL

Customer case – Telchina
Sewer level meter



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