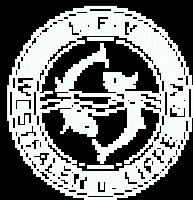


Hydroakustische Methoden zur Fischerfassung unter besonderer Berücksichtigung einer akustischen Kamera (DIDSON) –

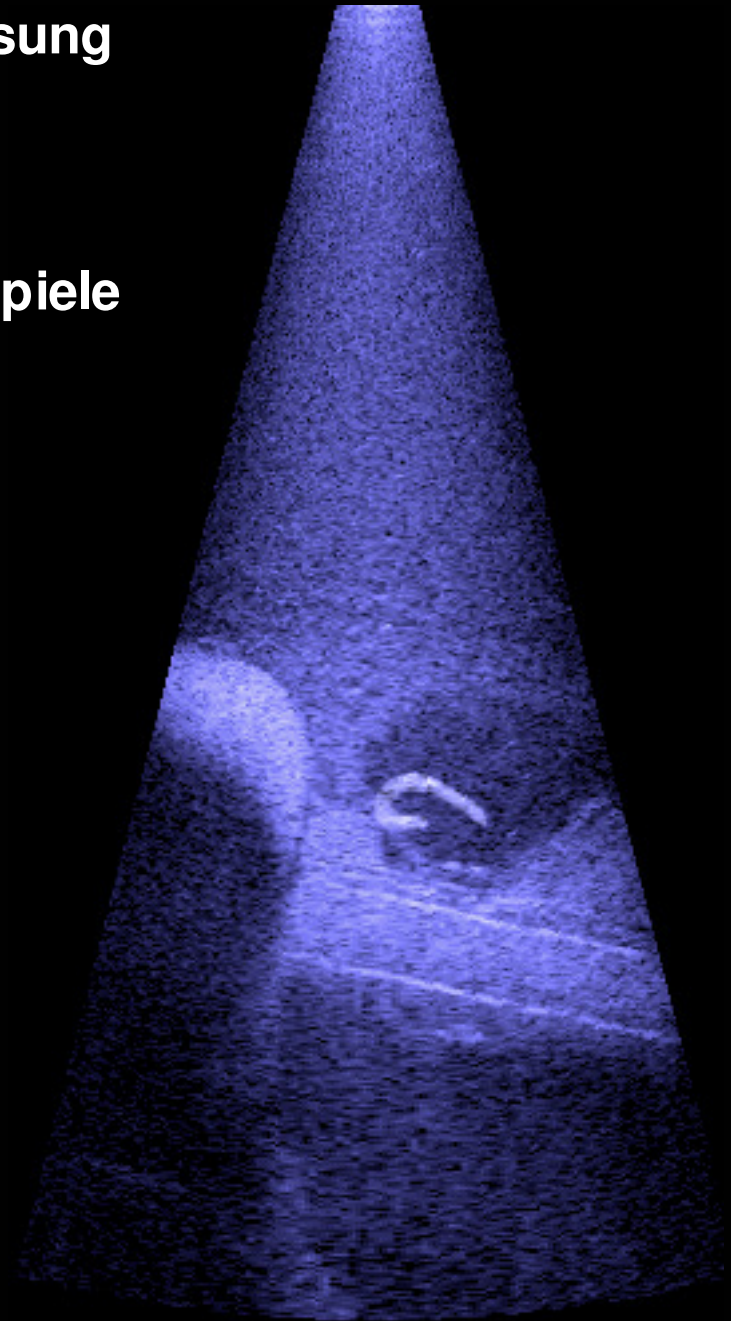
Anwendungsmöglichkeiten und Praxisbeispiele

AFGN-Tagung 18.09.2010



Dr. Marc Schmidt

Landesfischereiverband
Westfalen und Lippe e. V.





1. Grundsätzliches

2. Warum?

3. „Theorie“

4. Praxisbeispiele

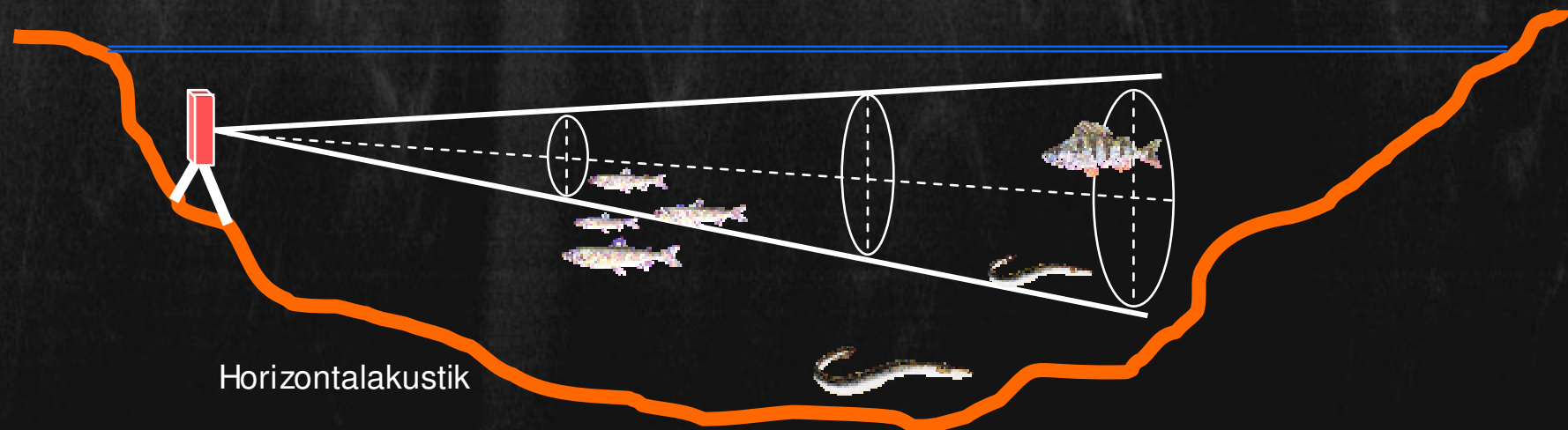
5. Post-Processing

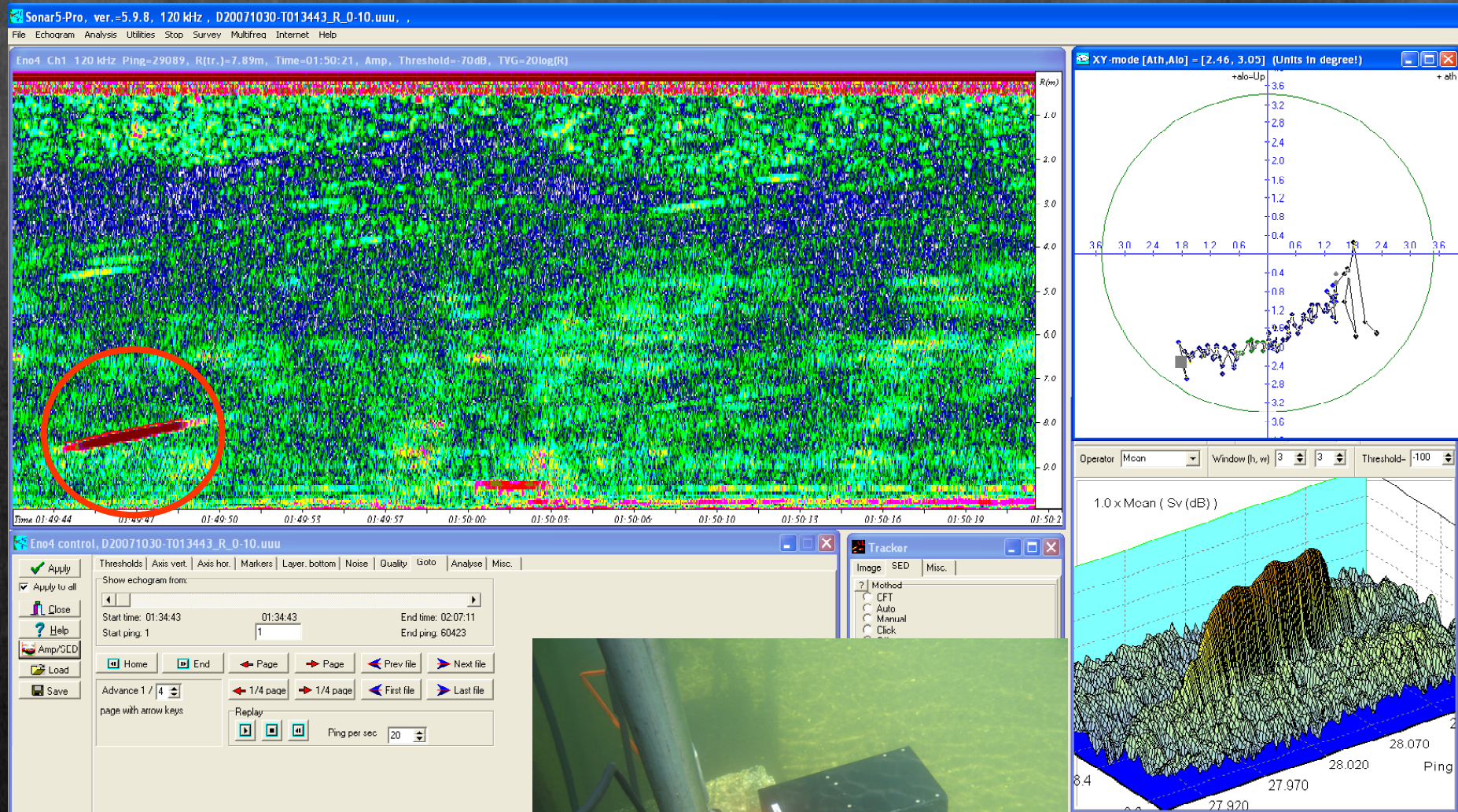
6. Perspektiven

7. Kosten und Praxistauglichkeit



Tana (NO), Dr. Helge Balk, Uni Oslo

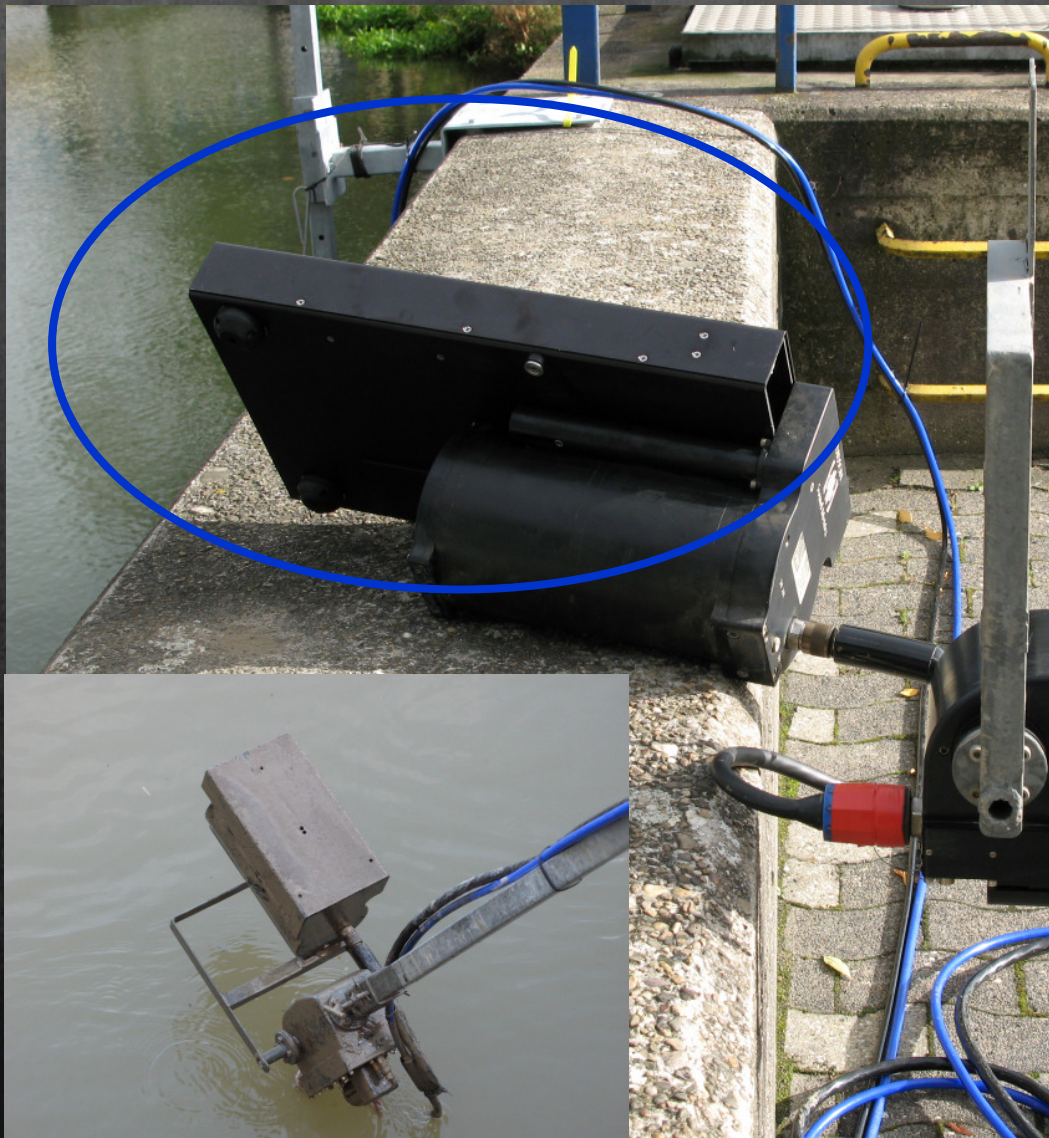




→ SPLIT-BEAM vs. DIDSON

Warum?





DIDSON
Dual Frequency Multi-Beam Acoustic Lens-Based Sonar • Some call it an Acoustic Camera

Evolution of Estimating Fish Passage with Acoustics in Riverine Environments

Bendix (old - 1960s+) • Split Beam (newer 1990s+) • DIDSON (newest 2000+)

- EASY TO USE** – Not much more complex than the average video camera (perhaps far less).
- GOOD DETECTION** – Detection capabilities are far superior to single/split-beam sonar technologies – more forgiving of suboptimal bottom topographies.
- CLEAR DIRECTION OF TRAVEL** – No ambiguity regarding milling fish & downstream debris.
- SHORTER PROJECT DEVELOPMENT TIME** – Site selection, training & system operation are easier than split-beam (and thus economical).
- HIGH LEVEL OF DEFENSIBILITY / CREDIBILITY** – DIDSON output is more intuitive and understandable by biologists, managers and the public.

1.8 MHz freq: 96 – 0.3° x 12° Beams
1.1 MHz freq: 48 – 0.6° x 12° Beams
Field of view: 29°
Frame rate: 5-20 frames/s
Weight in air: 15.4 lbs

Can DIDSON be a solution for you?
For additional images, presentations, movies & papers, see our web page:
www.soundmetrics.com

Standard DIDSON

Sound Metrics Corp.
Using sound to make sound measurements

DIDSON is a unique high-definition sonar that uses acoustic lenses to make almost-photographic quality images in dark, turbid water where optical systems are ineffective.

Visit our website: www.soundmetrics.com. Download papers, specifications, a PowerPoint presentation, additional images and 'movies' covering a wide range of applications.

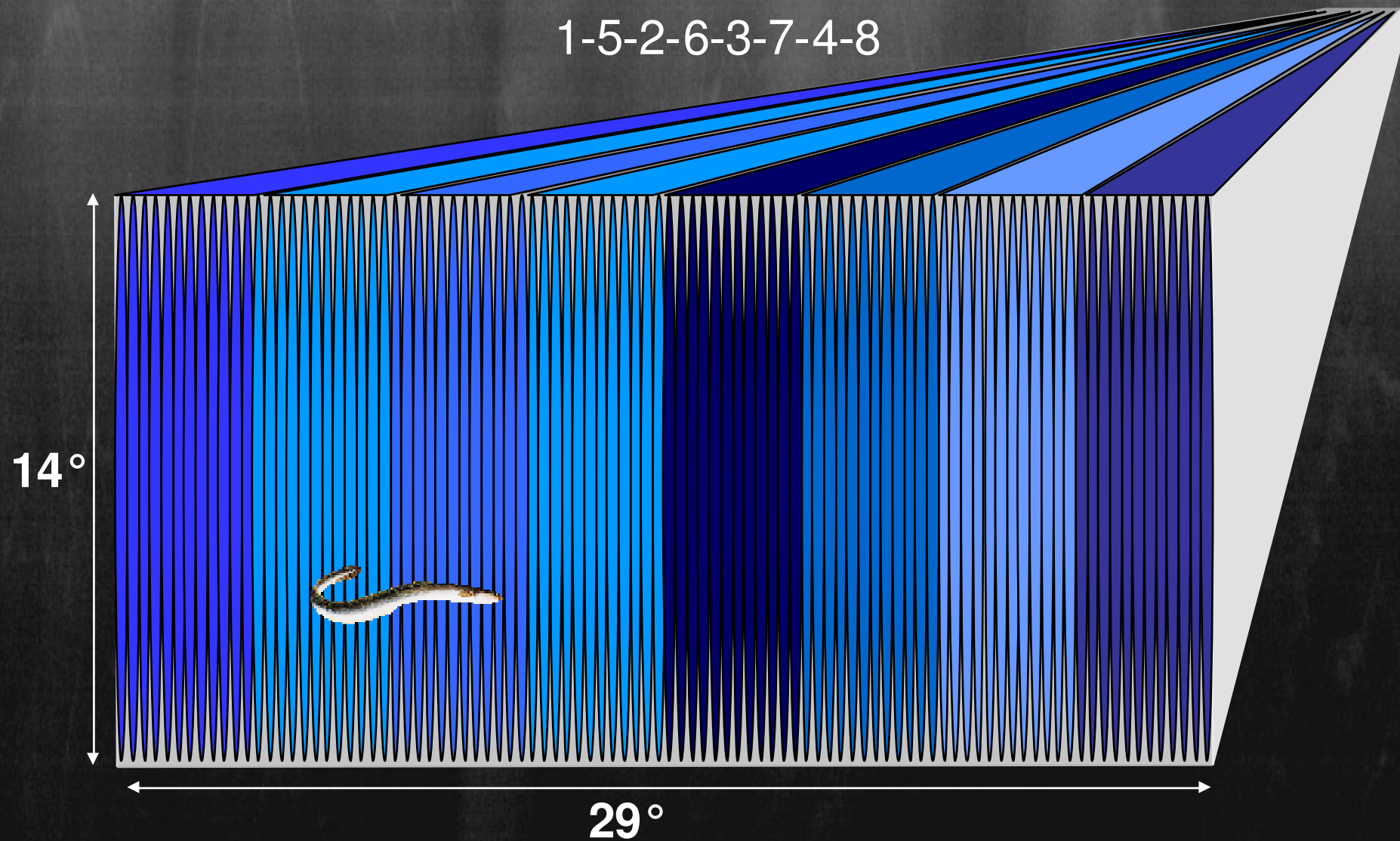
APPLICATIONS:

- Military / Homeland Security
- Hull / Berth Sweeps
- Underwater Surveillance
- Obstacle Avoidance
- Fisheries Management
- Underwater Structure Inspection
- Search and Rescue
- Monitor Particle Dynamics
- Bottom Typing / Environmental Analysis
- Crime Evidence Recovery

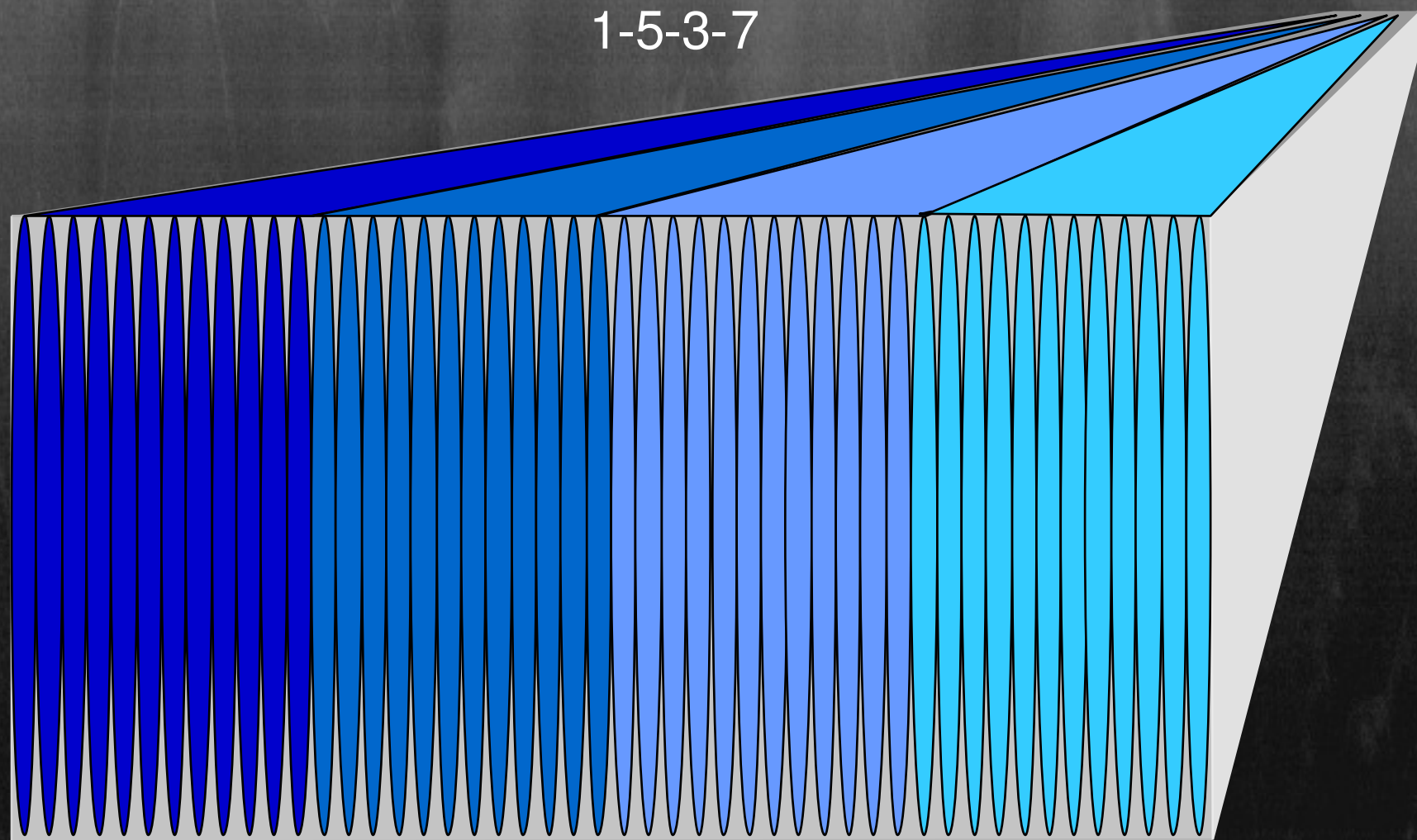
DIDSON applications are limited only by your imagination.

Unabhängig von Lichtverhältnissen und Wassertrübung

„Theorie“



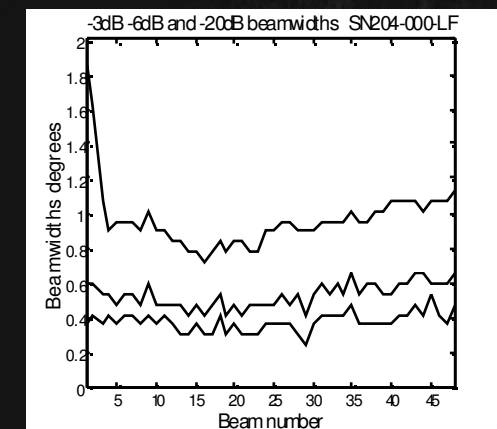
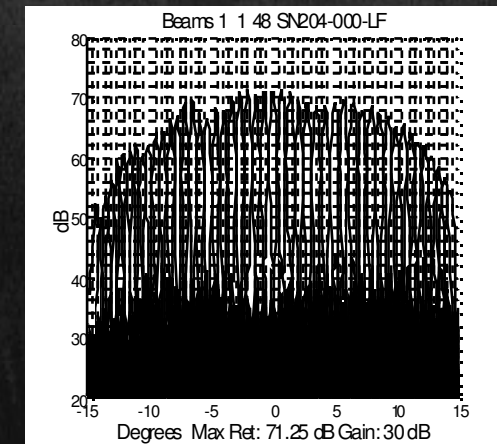
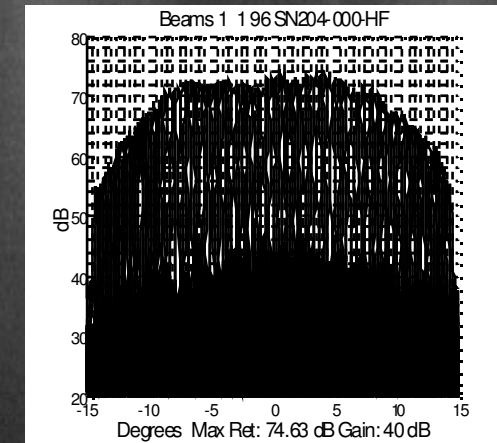
High Frequency (HF): 96 Beams (0.3°)
Keine 3. Dimension!



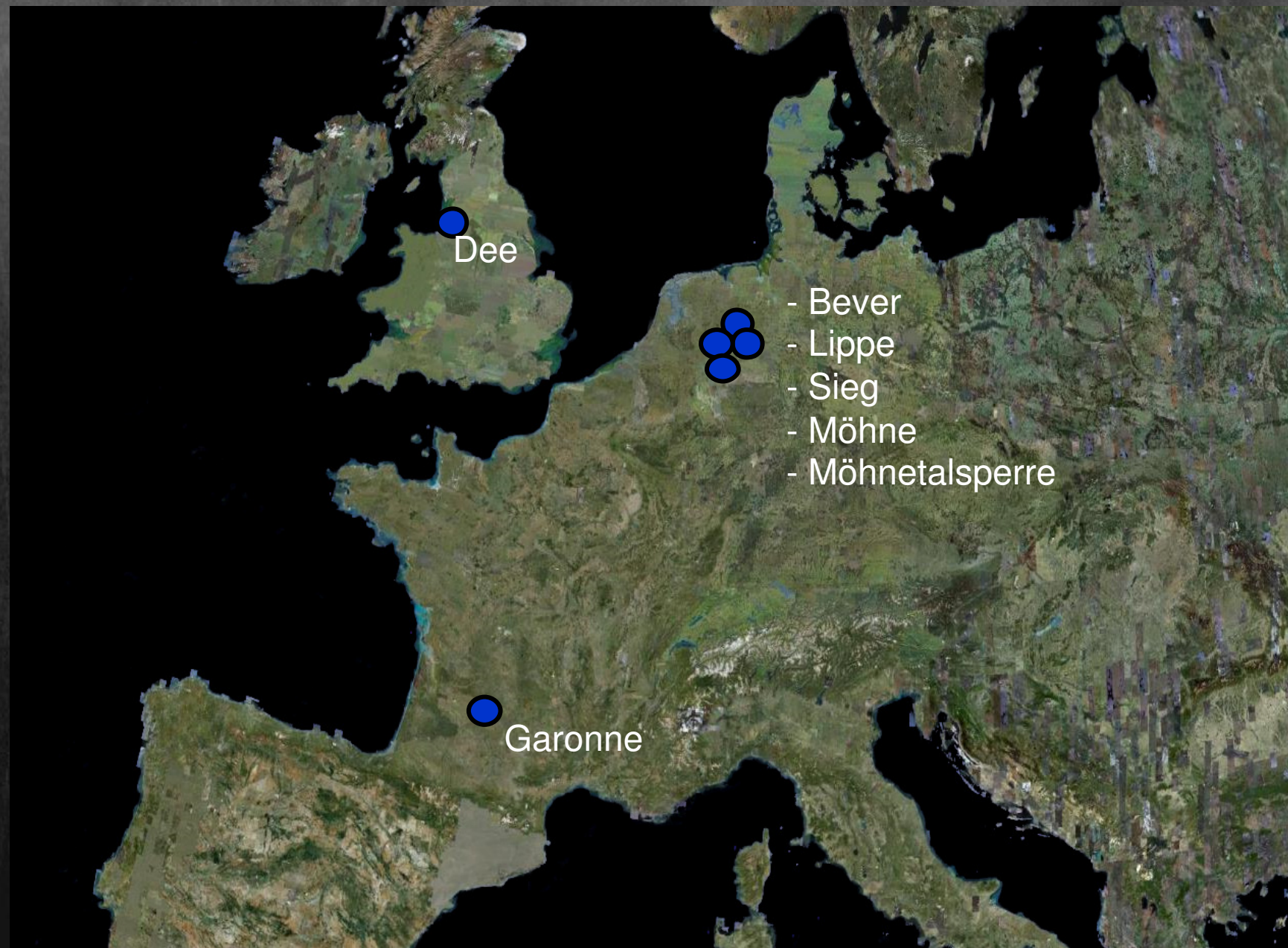
Low Frequency (LF): 48 Beams (0.6°)



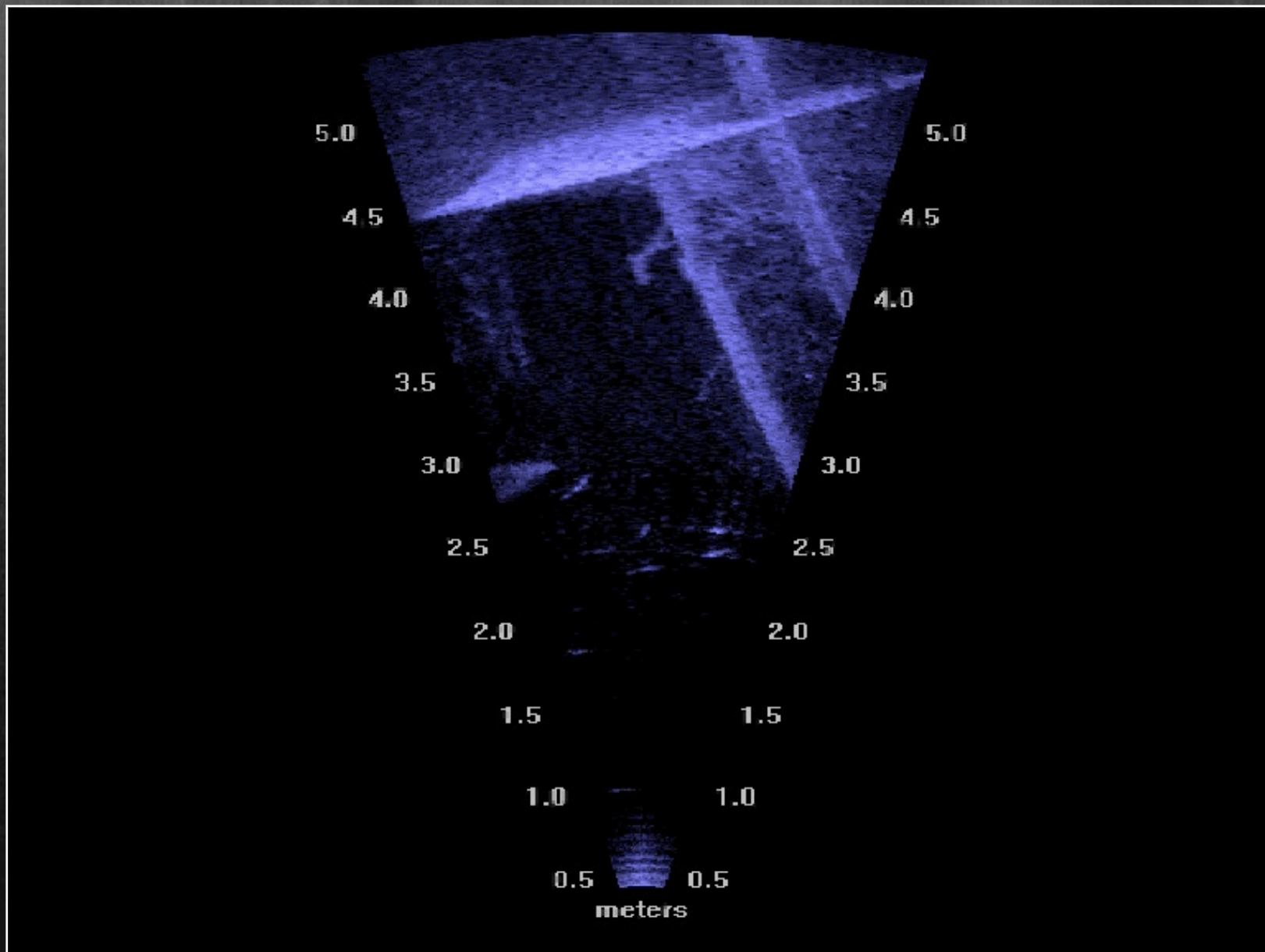
→ „Reichweiten“



Praxisbeispiele

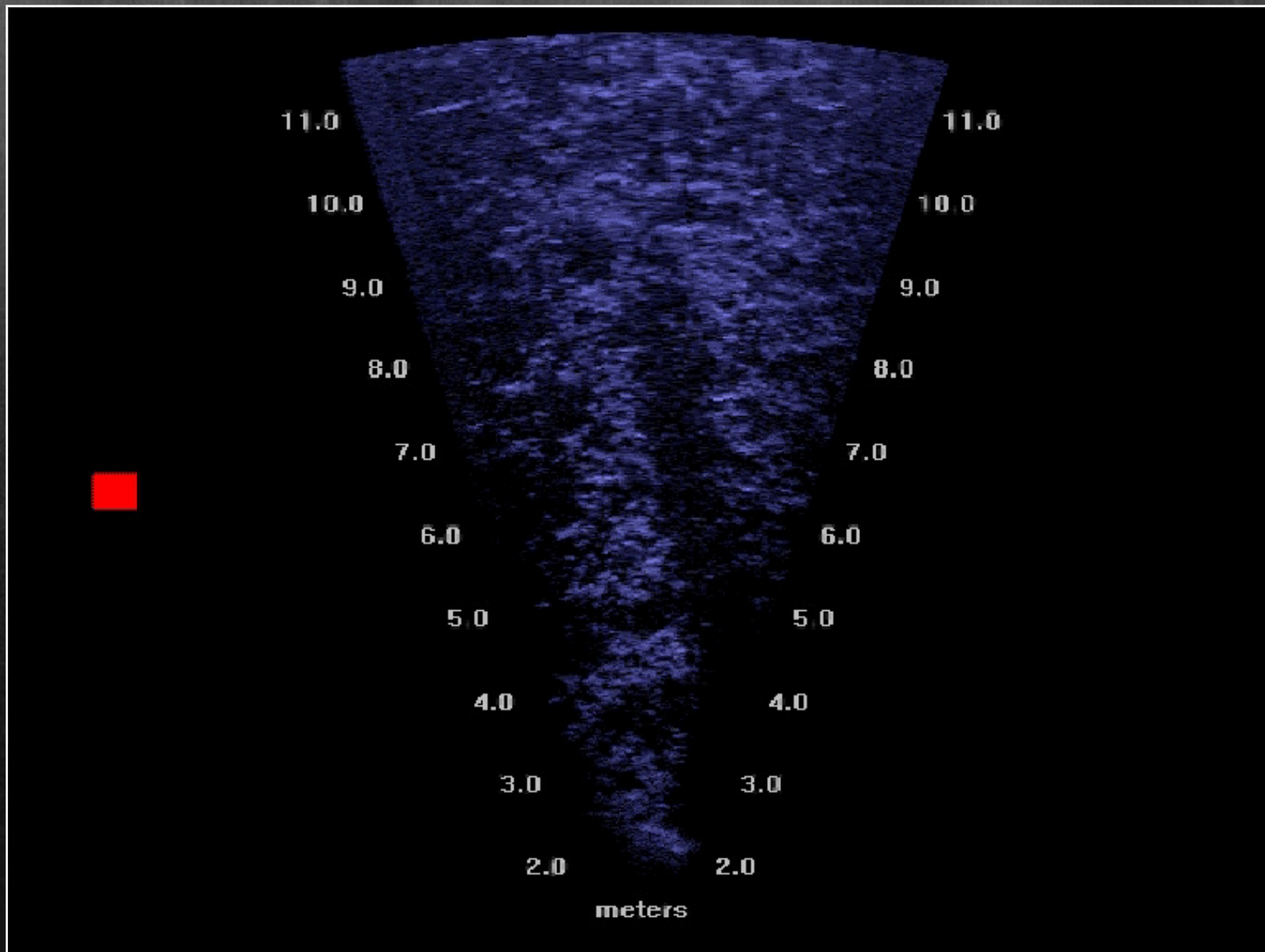






Wasserentnahmebauwerk (River Dee, GB)

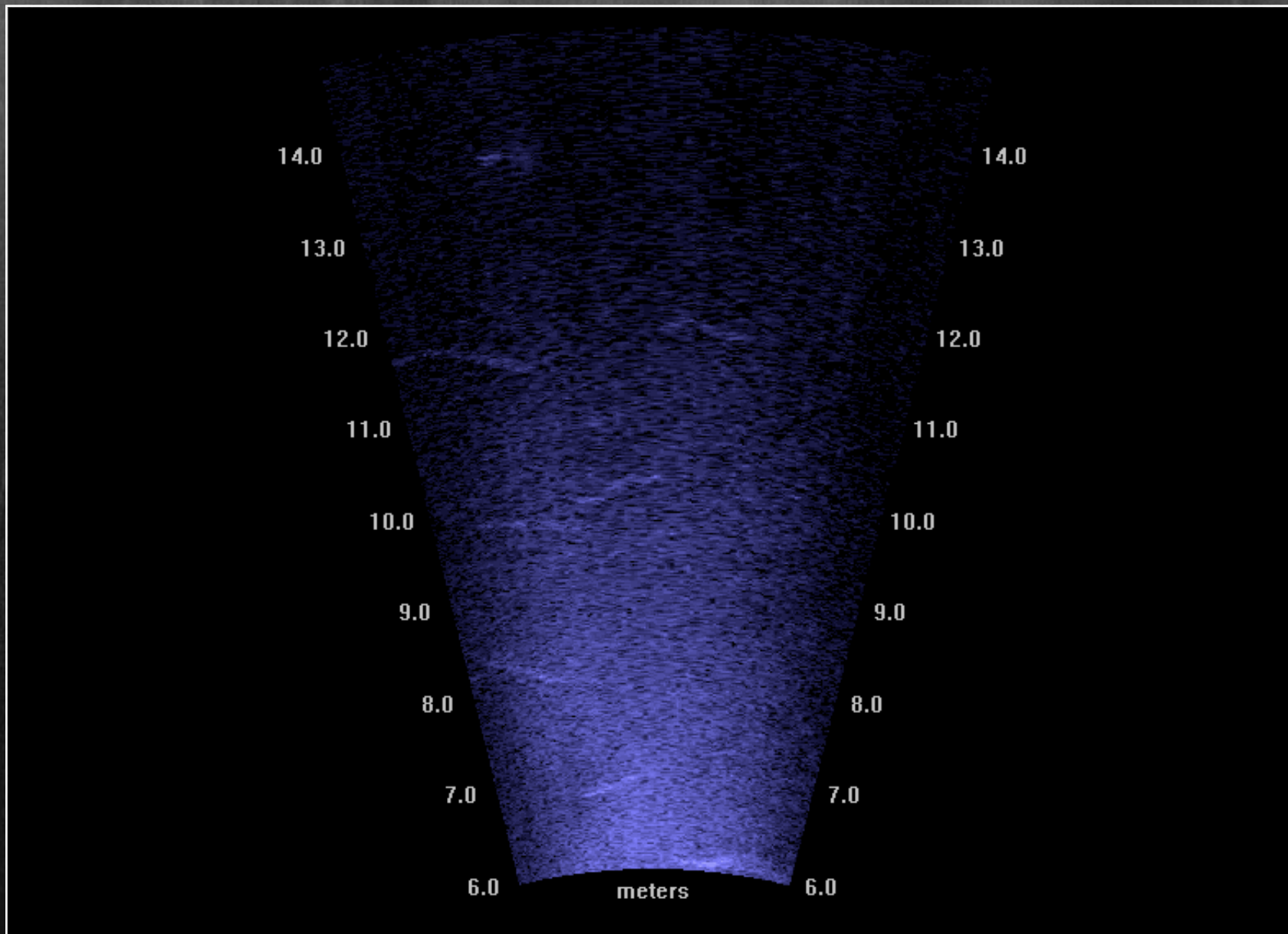
Jon Hateley, Environment Agency, UK



Meerforellen (Tees barrage, GB)

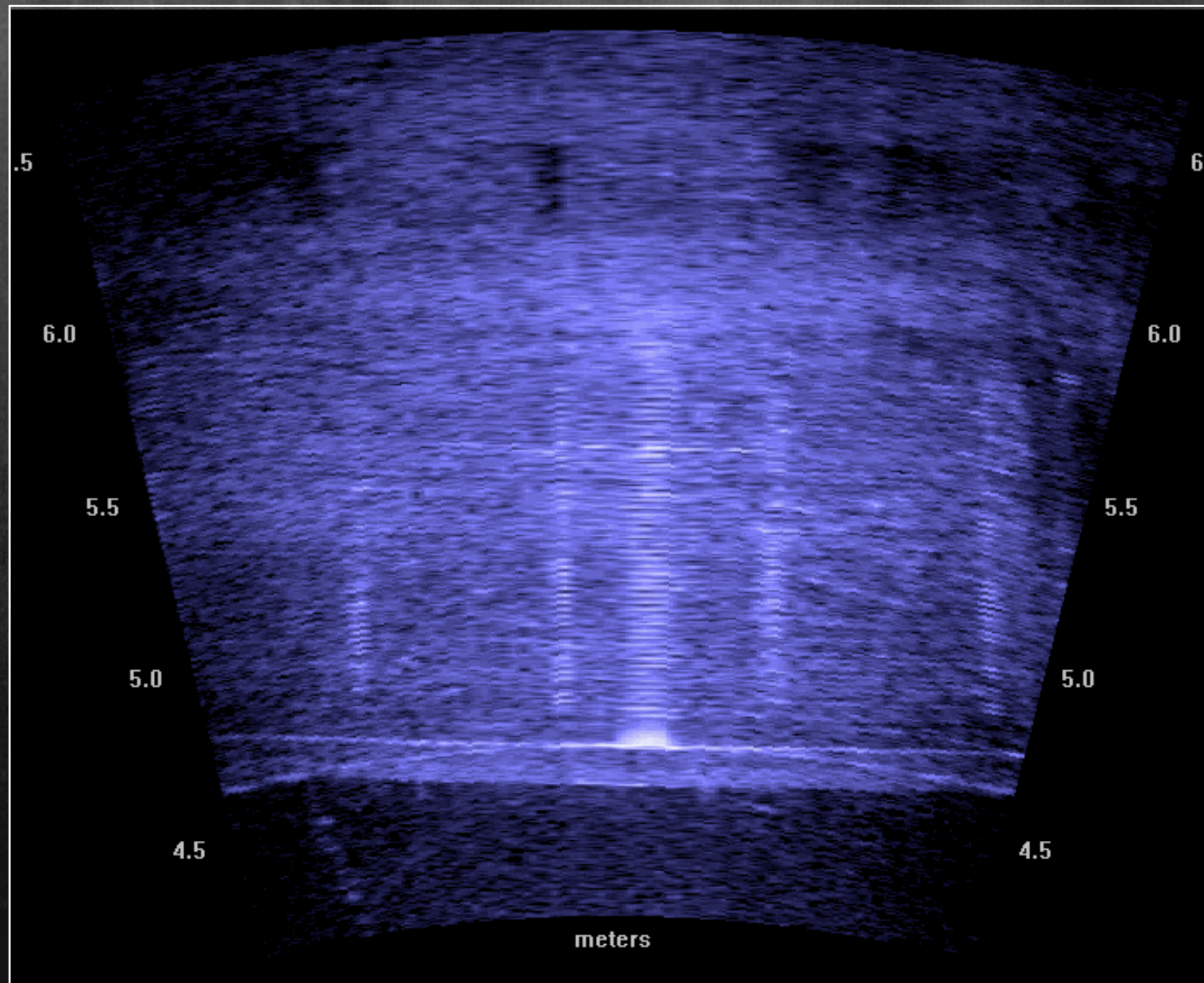
Jon Hateley, Environment Agency, UK



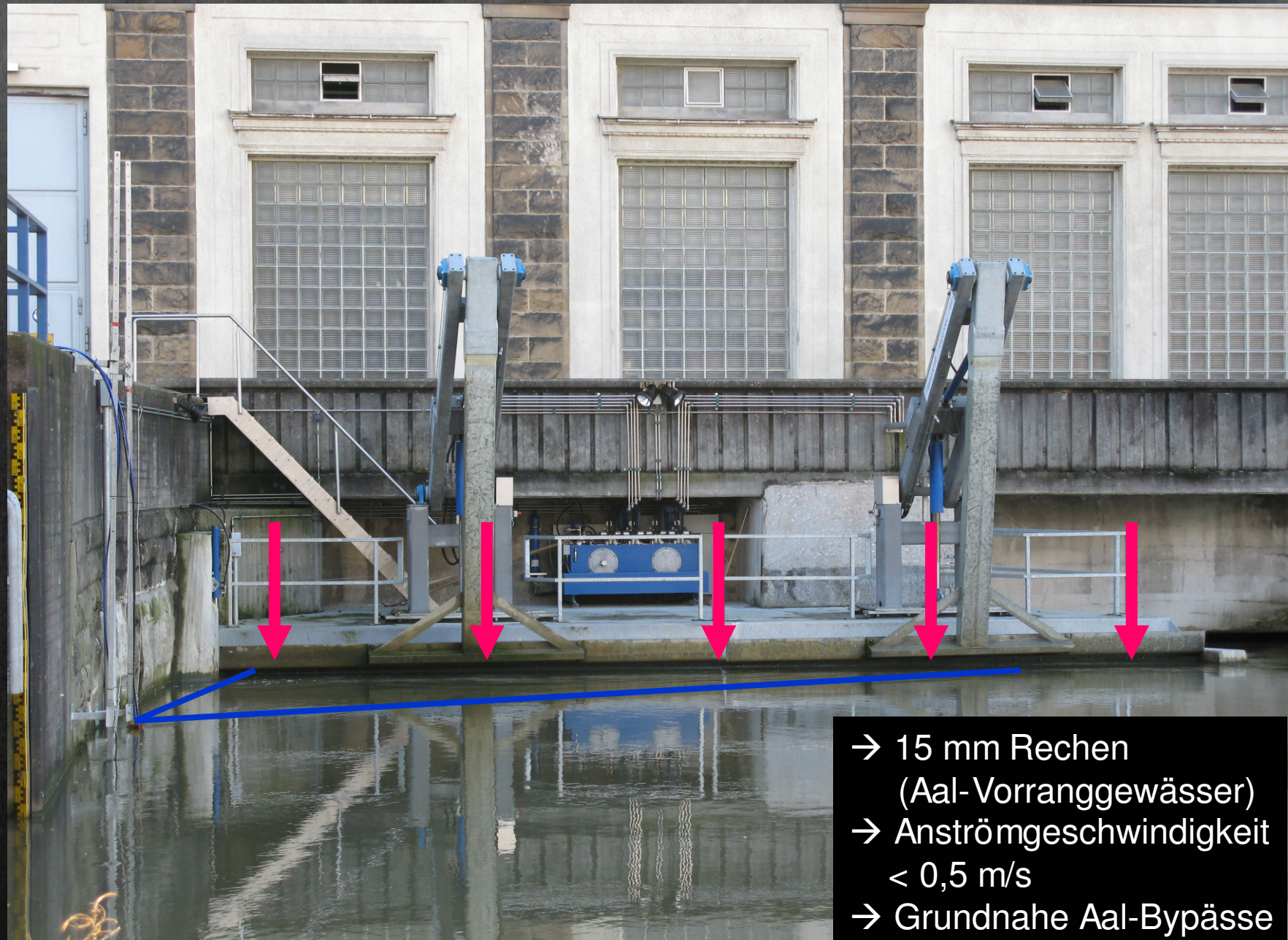


Welse (Fischlift Golfech, Garonne, F)

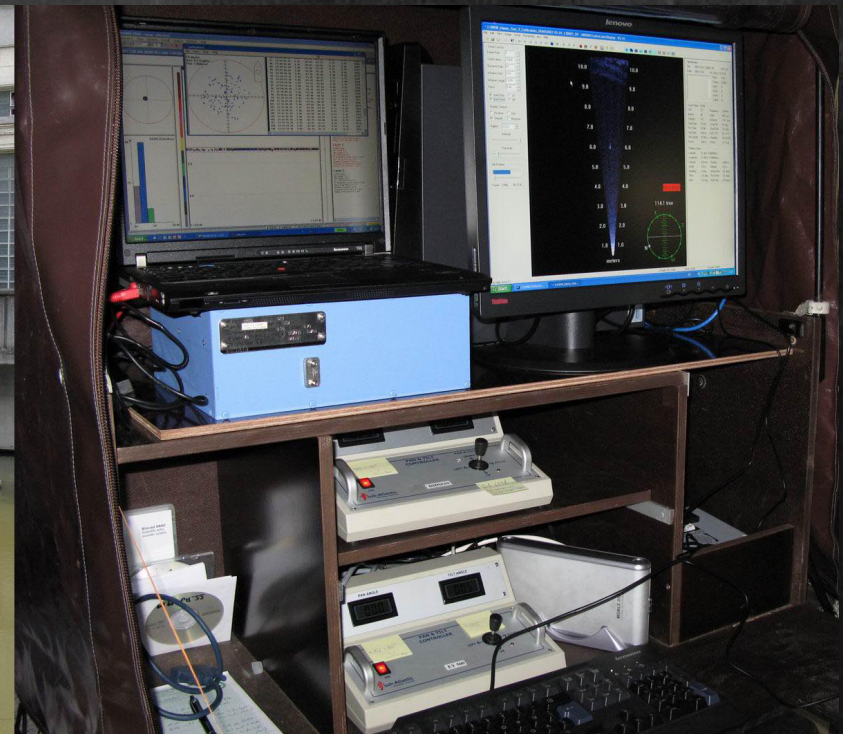
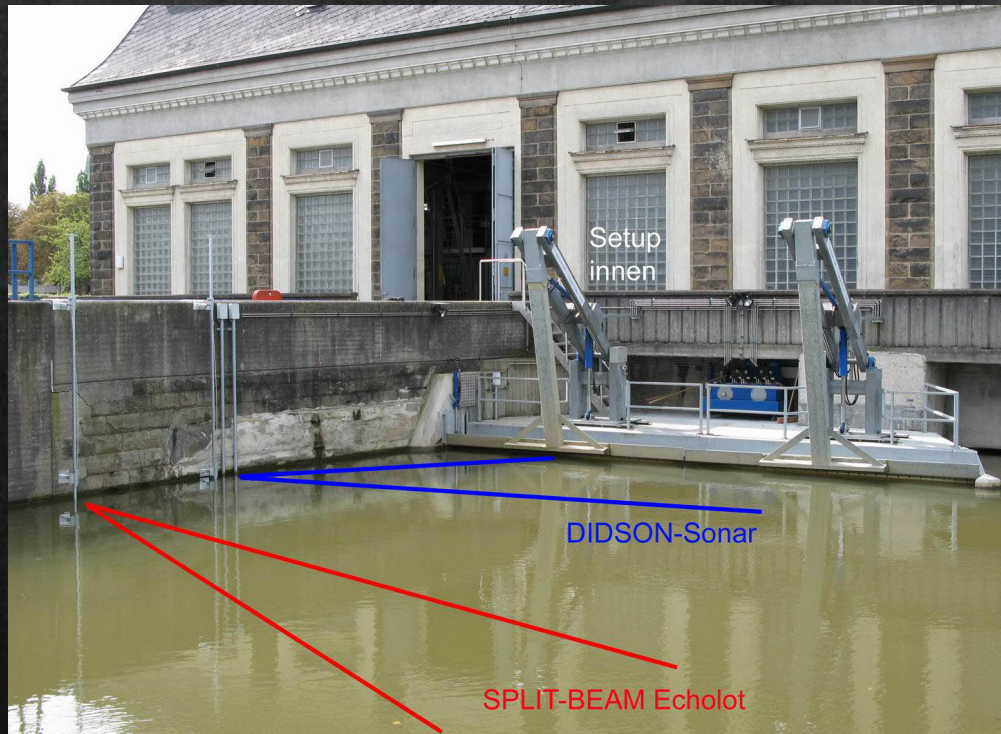




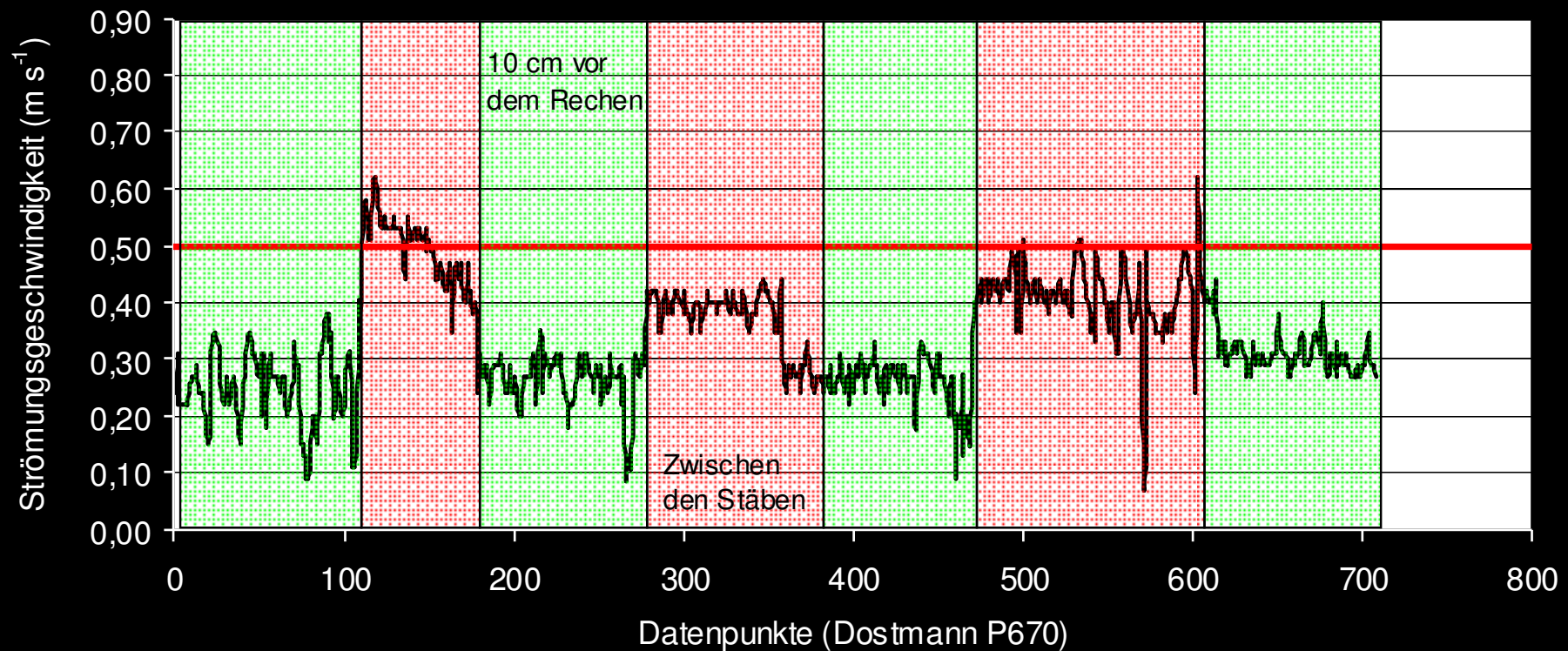
Blankaal am Rechen einer kleinen WKA (Bever, Münster)



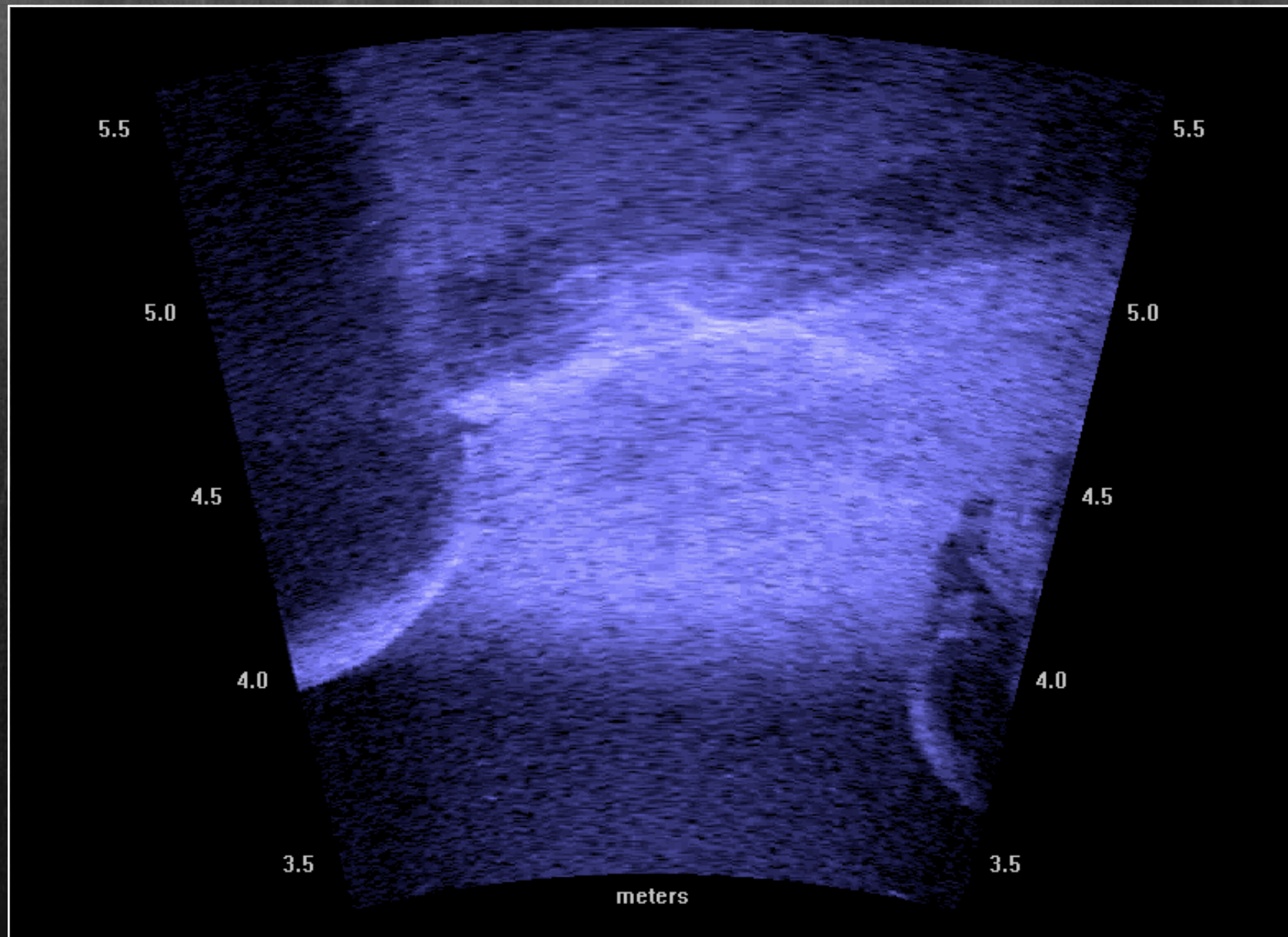
- 15 mm Rechen
(Aal-Vorrangewässer)
- Anströmgeschwindigkeit
 $< 0,5 \text{ m/s}$
- Grundnahe Aal-Bypässe



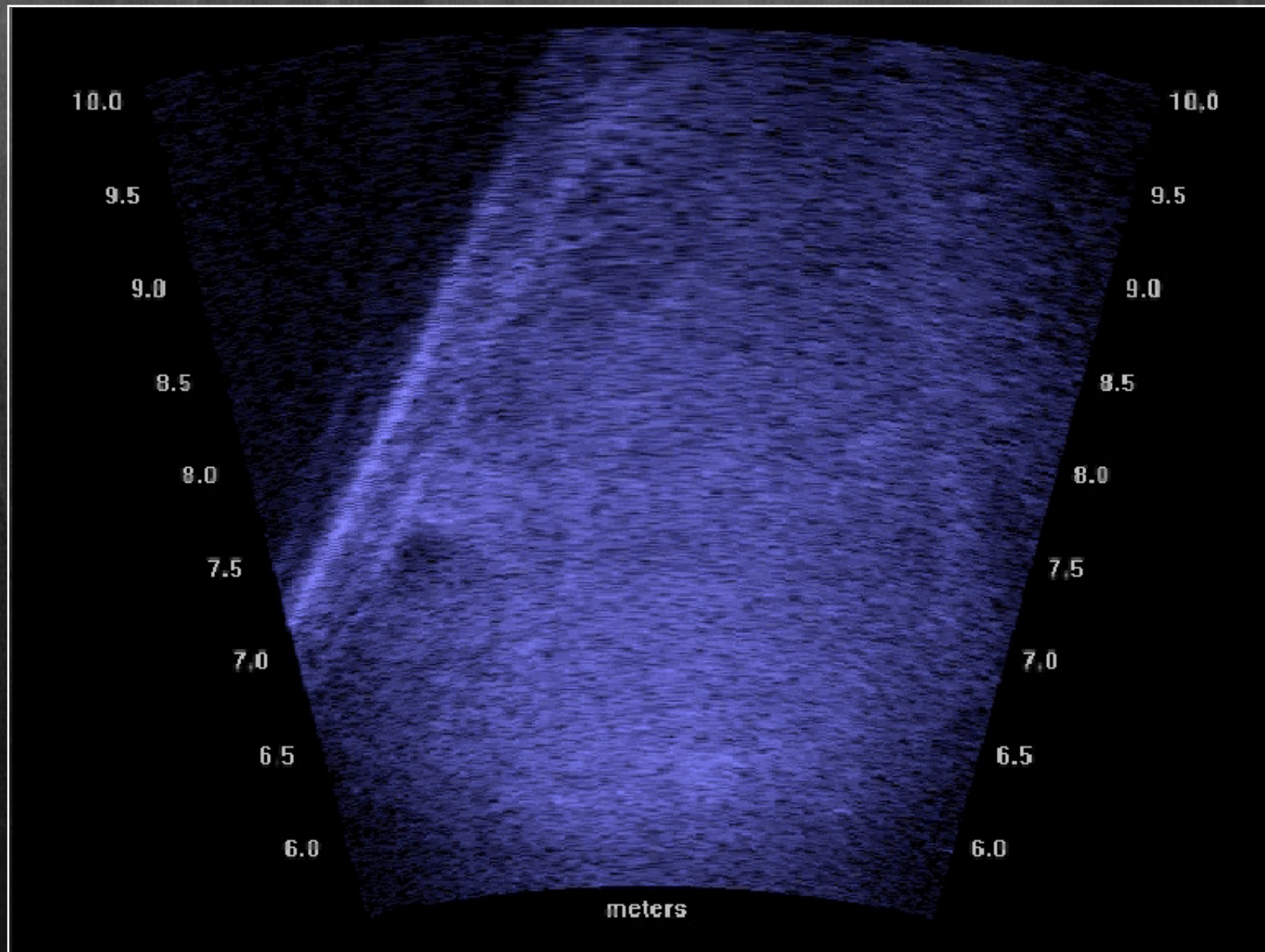
WKW Hamm: Bypässe und hydroakustisches Setup

Anströmung WKW Hamm 26.11.2009 (14 m³ Last): Messpunkt b

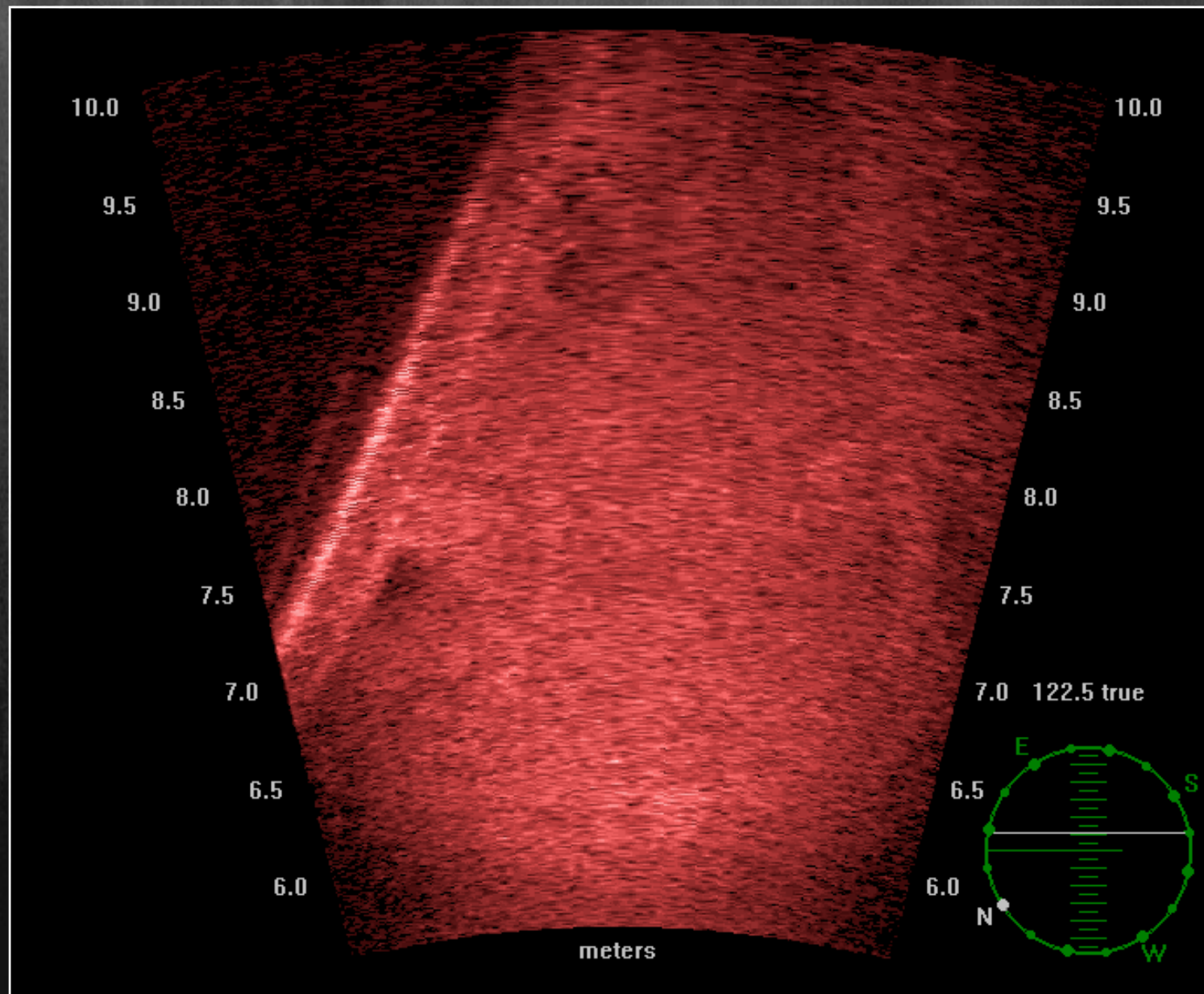
Anströmgeschwindigkeiten WKW Hamm



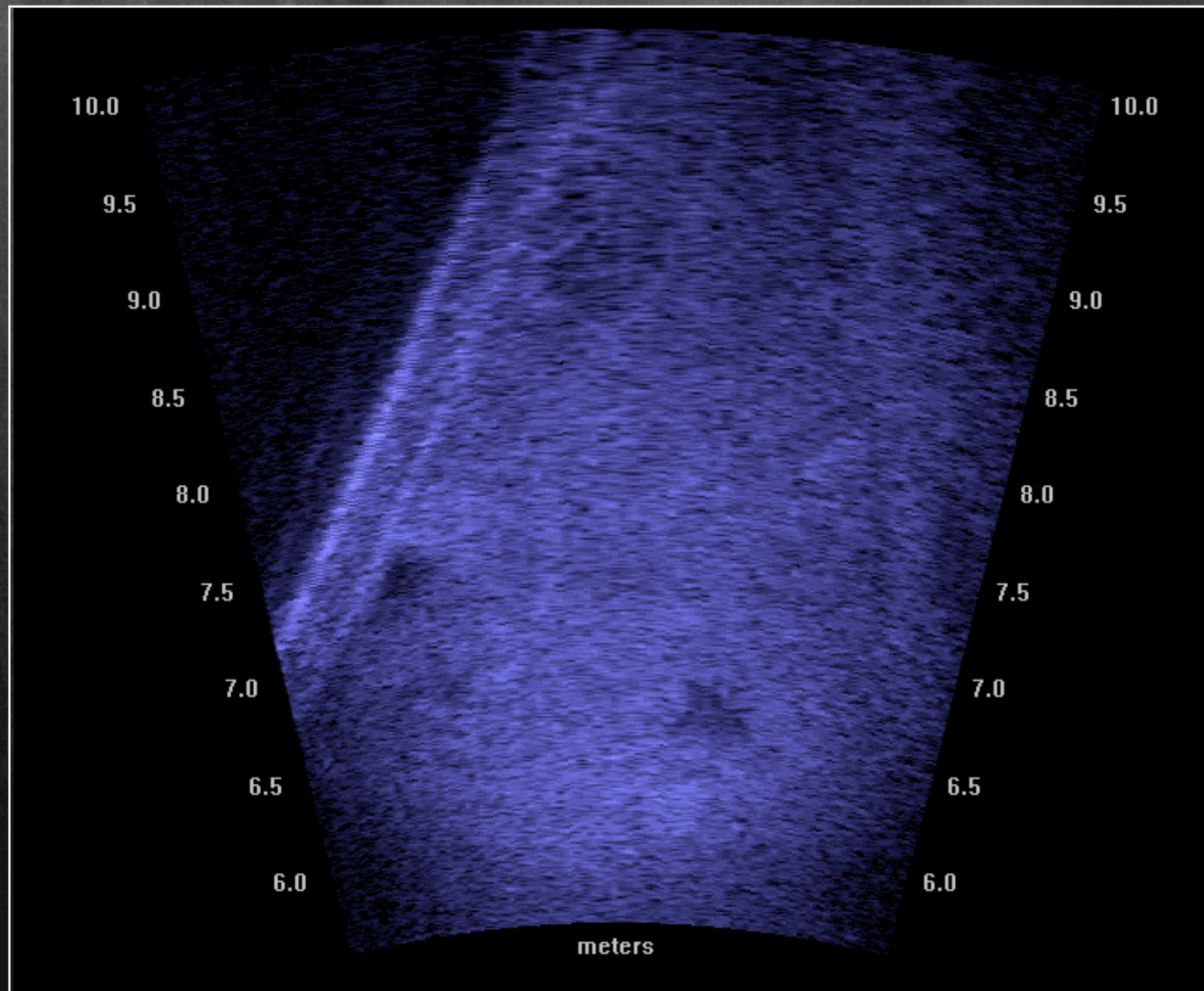
Zwei Karpfen an der Rechenbasis (WKW Hamm, Lippe)



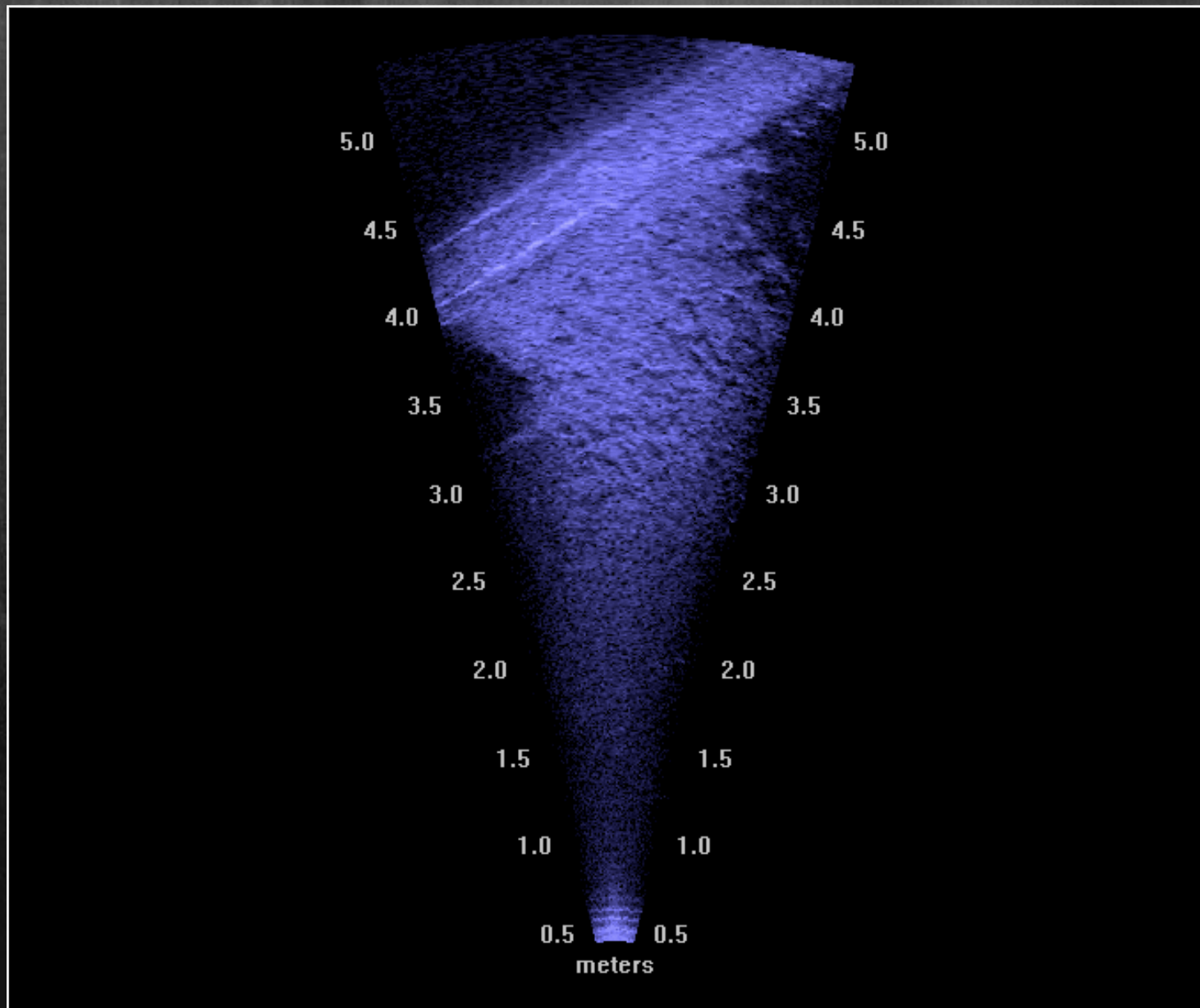
Wels (> 180 cm) am Rechen (WKW Hamm, Lippe)



Reaktion: Auftreffen und Rückschwimmen (WKW Hamm, Lippe)

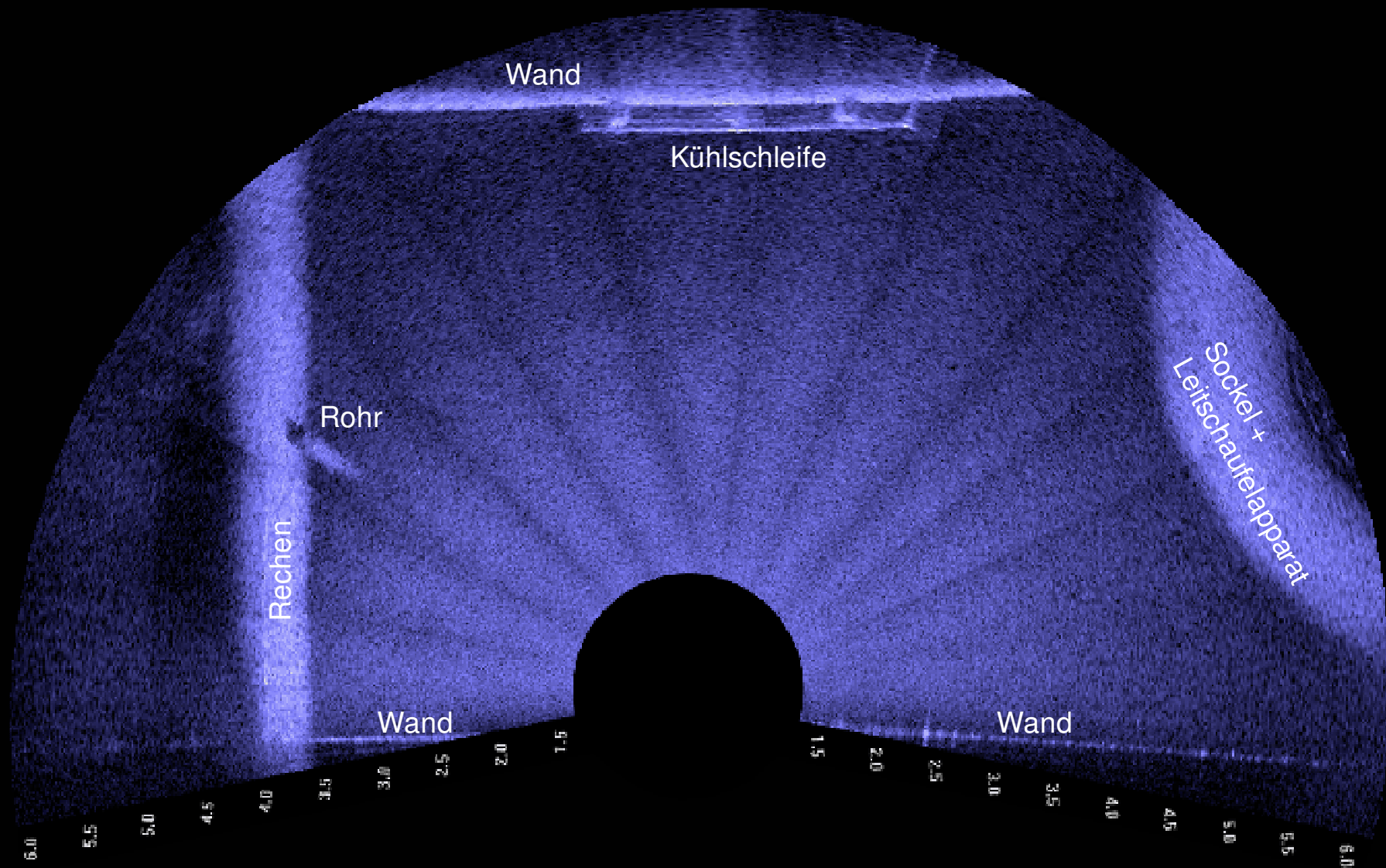


Aal und Rechenreiniger (WKW Hamm, Lippe)

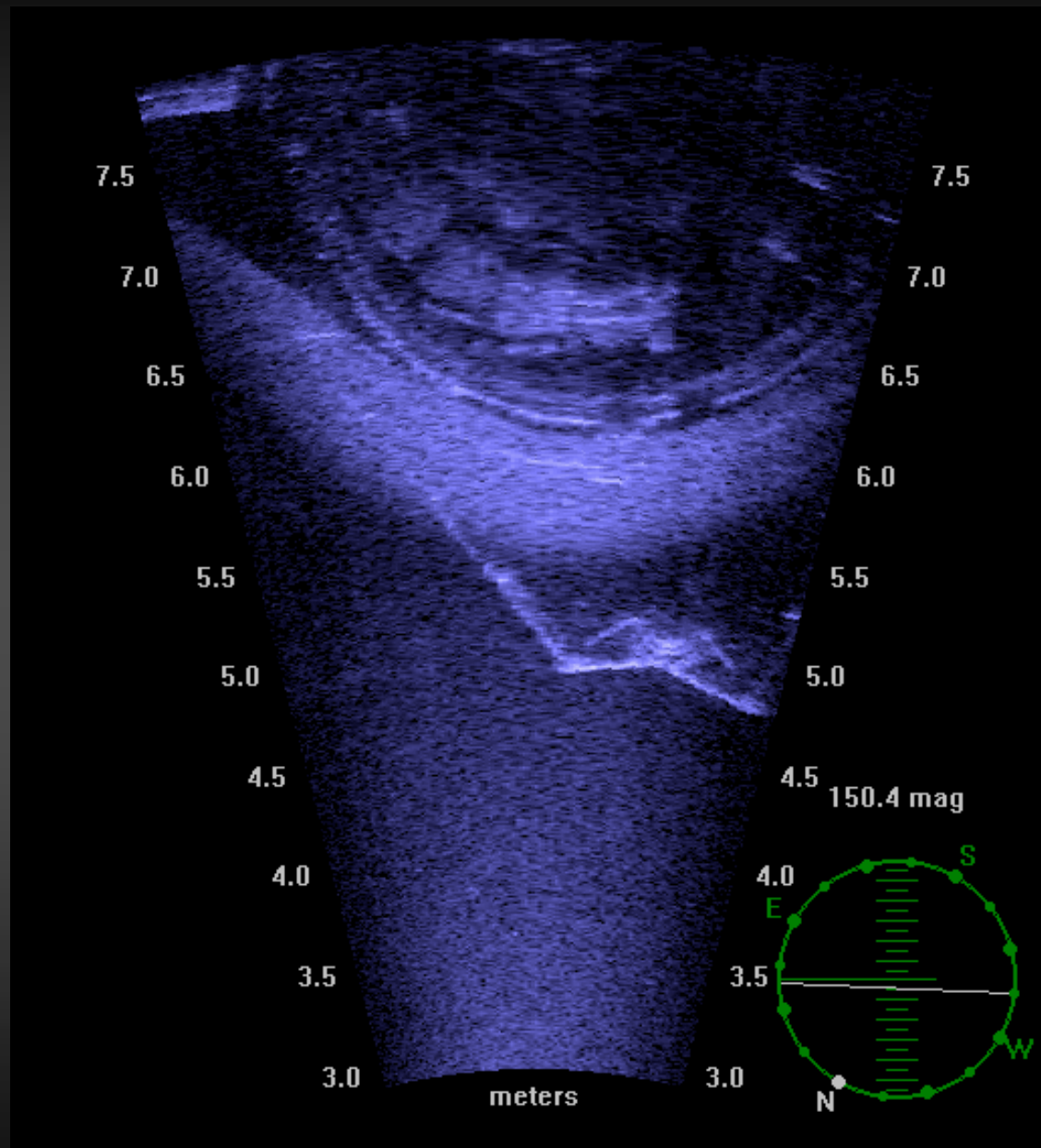


„Passives Einsaugen“ (WKW Hamm, Lippe)

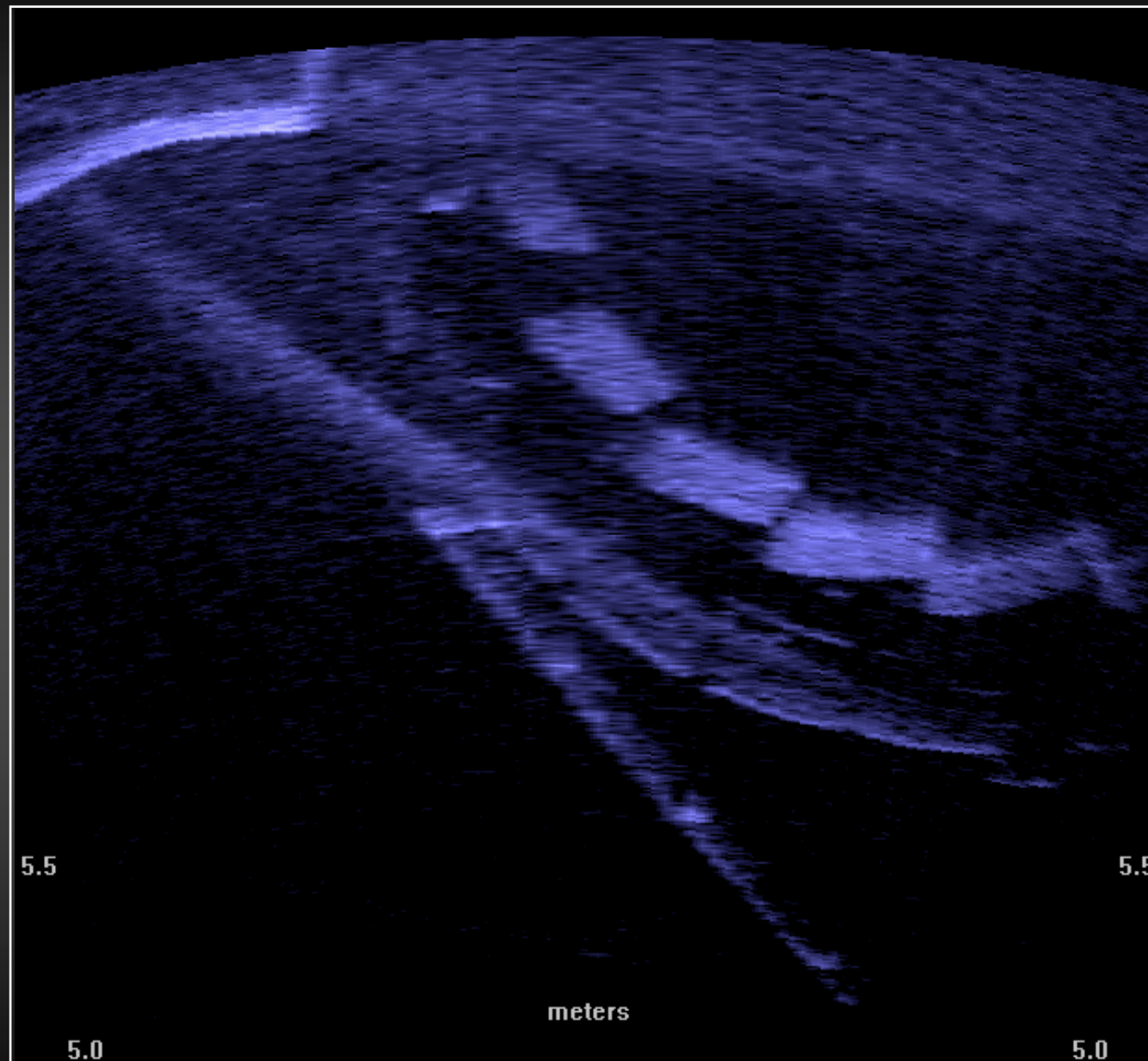




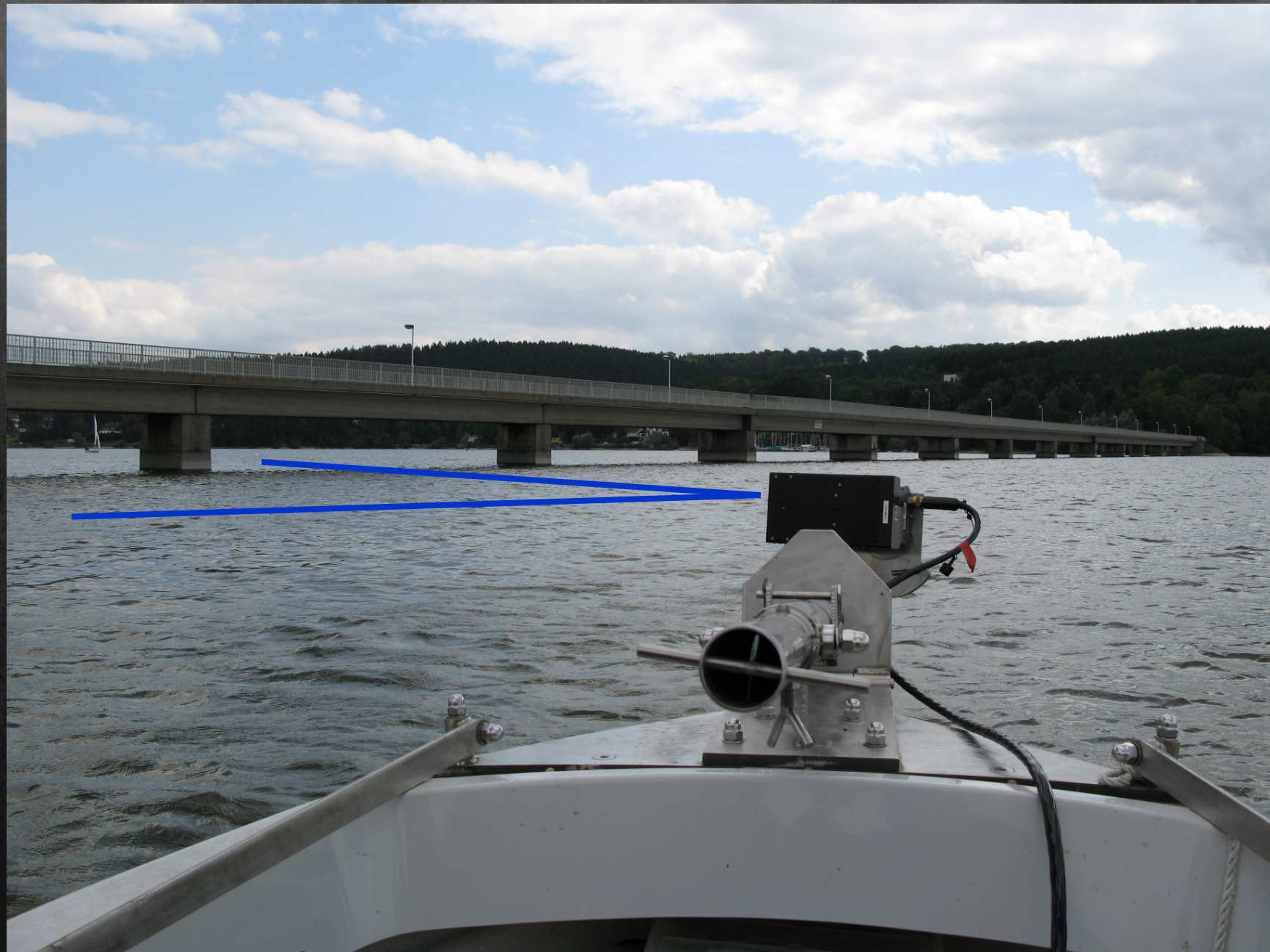
Turbinenzuleitungskanal 180°

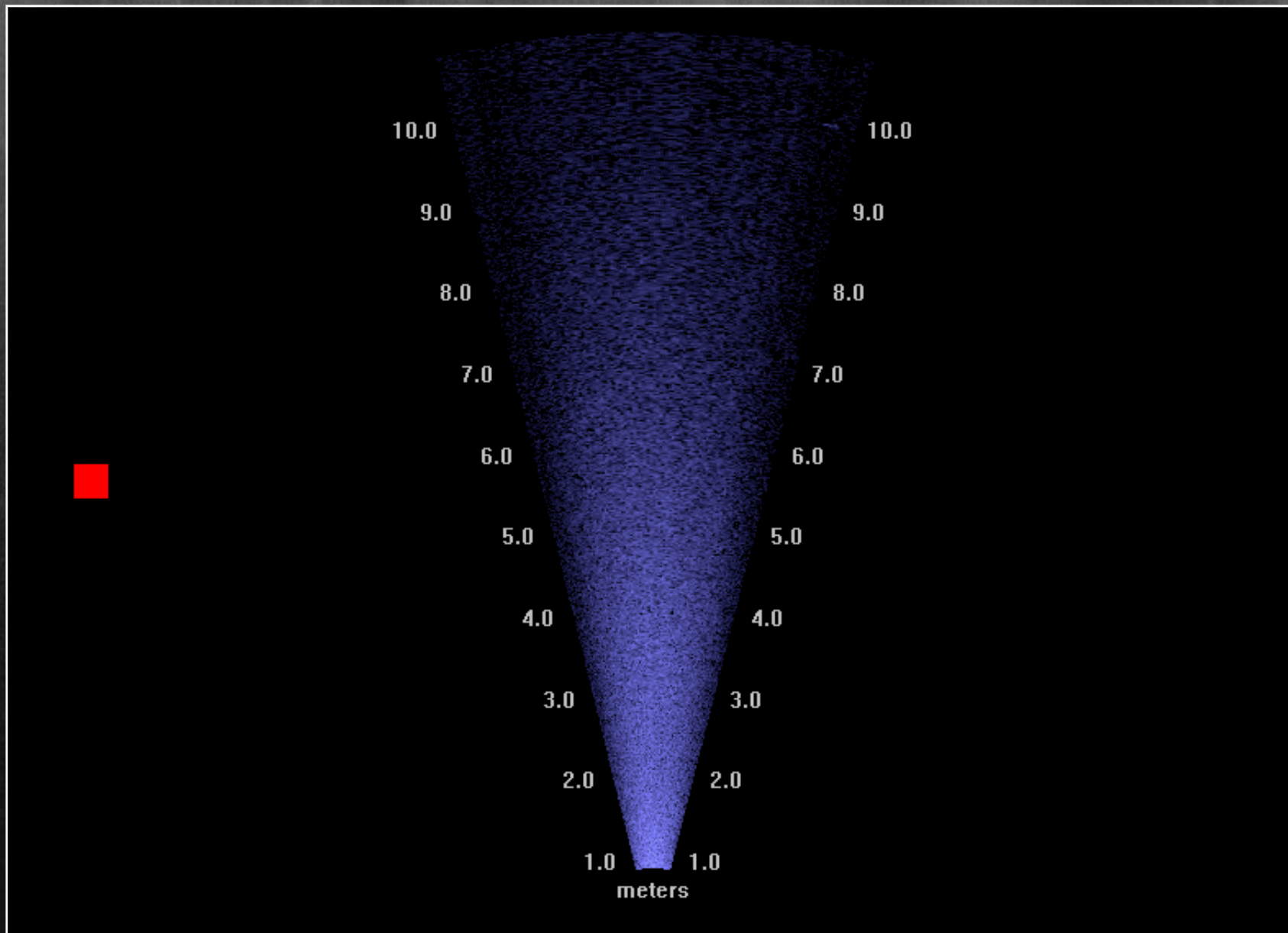


Leitschauflapparat



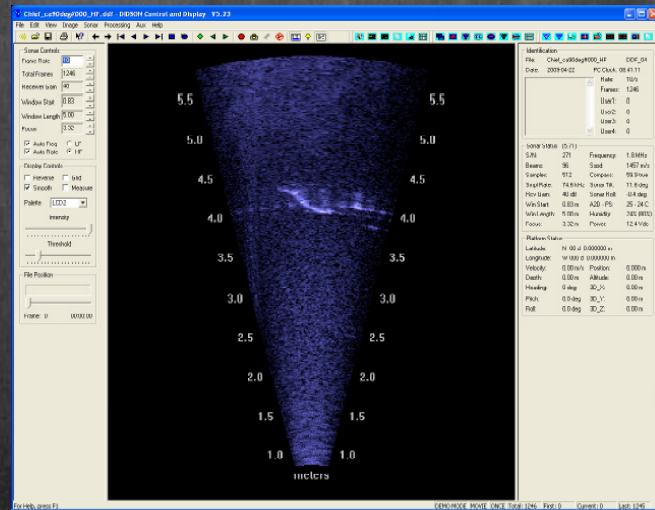
Bachforelle am Leitschaukelapparat einer WKA





Fischansammlungen an Brückenfeilern (Möhnetalsperre)

Datenauswertung/ Post-processing



DIDSON Software (Soundmetrics, USA: Datenerfassung/Auswertung begrenzt möglich, Lieferumfang)



POWERFUL & FLEXIBLE SOFTWARE FOR ECHOSOUNDER & SONAR DATA PROCESSING

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LATEST NEWS

- Welcome to our new website
- New hydroacoustics forum - and competition!
- Echoview Version 4.80 Beta Release
- Training Opportunity in Taiwan!
- Discover Econfusion

NEWSLETTER

Read the latest **quarterly round up** of Echoview and related business.

FORUM

Connect with your colleagues through the global **hydroacoustics forum**.

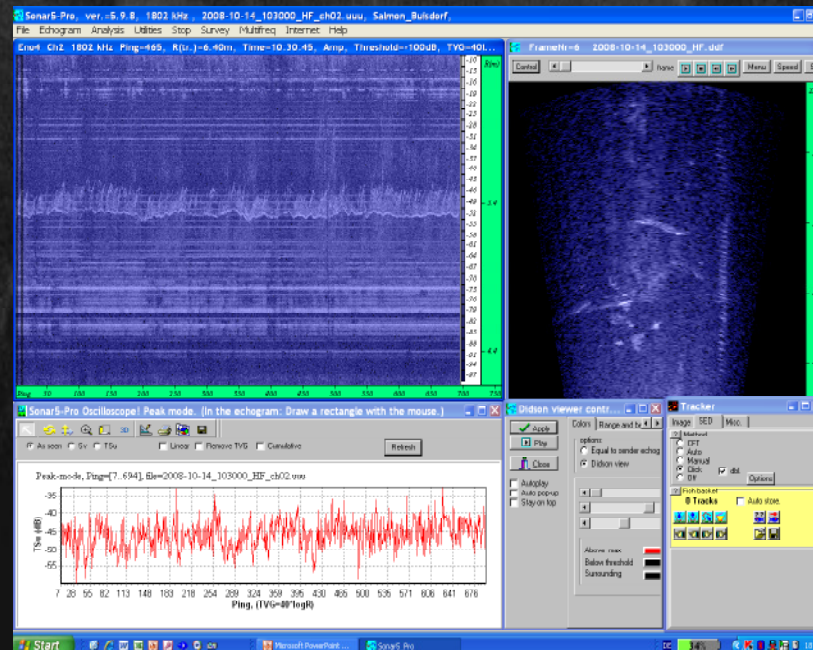
DOWNLOAD

"Thank you... for providing an excellent product that has significantly advanced fisheries science during recent years"

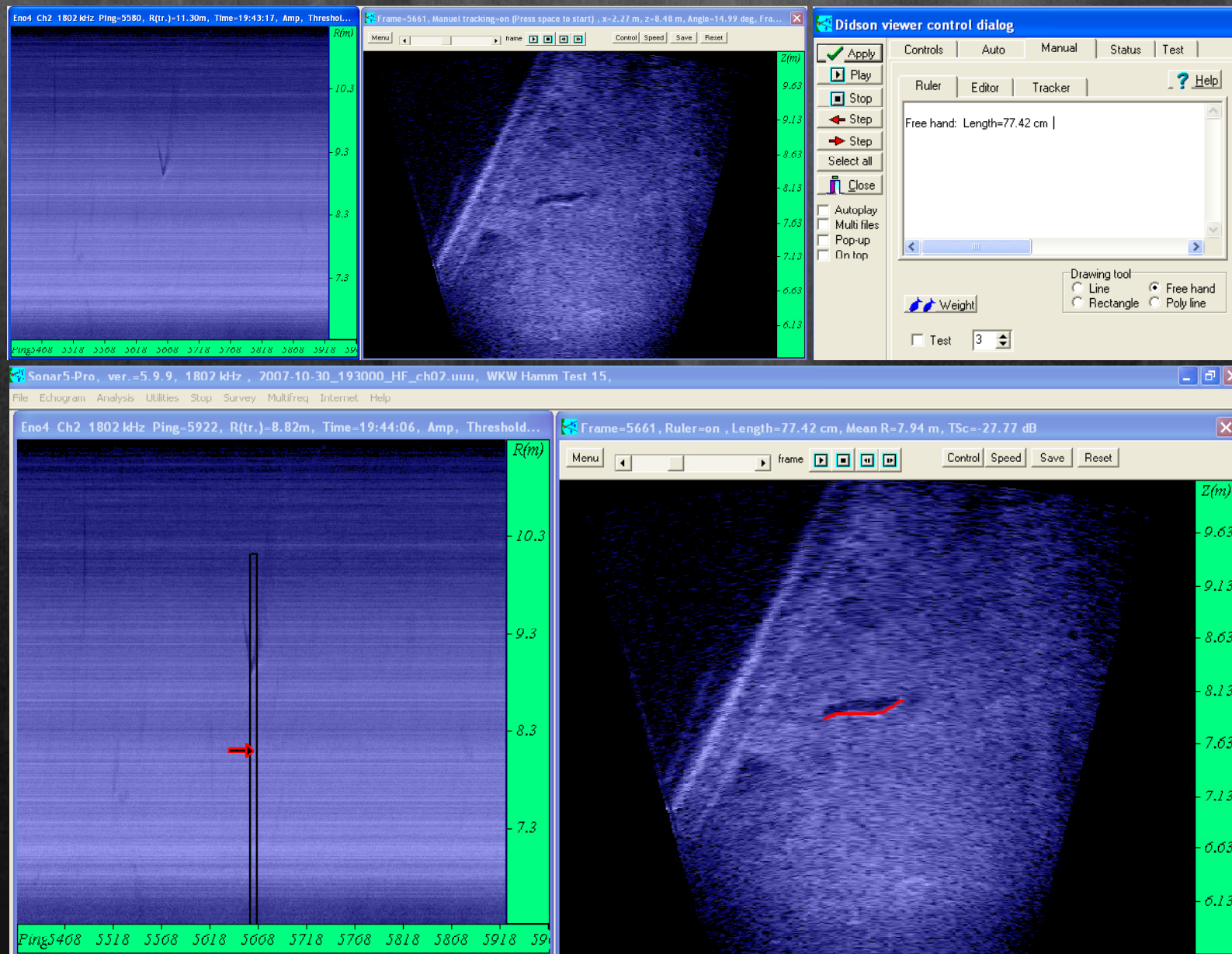
- Echoview user

[News Archive »](#)

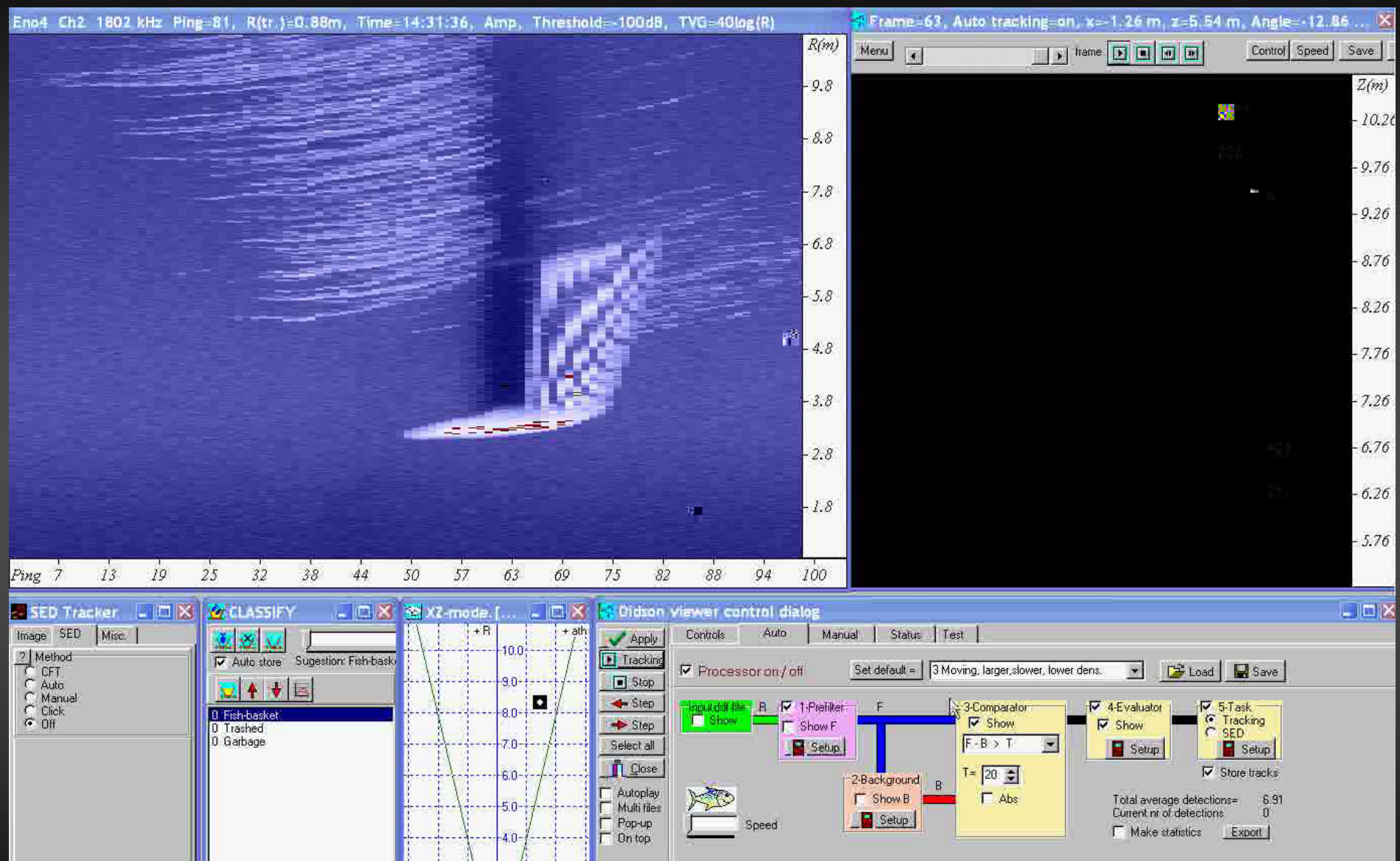
Echoview (Myriax, AUS, vormal's SonarData)



Sonar5 Pro (Lindem Data Aquisition, NO)

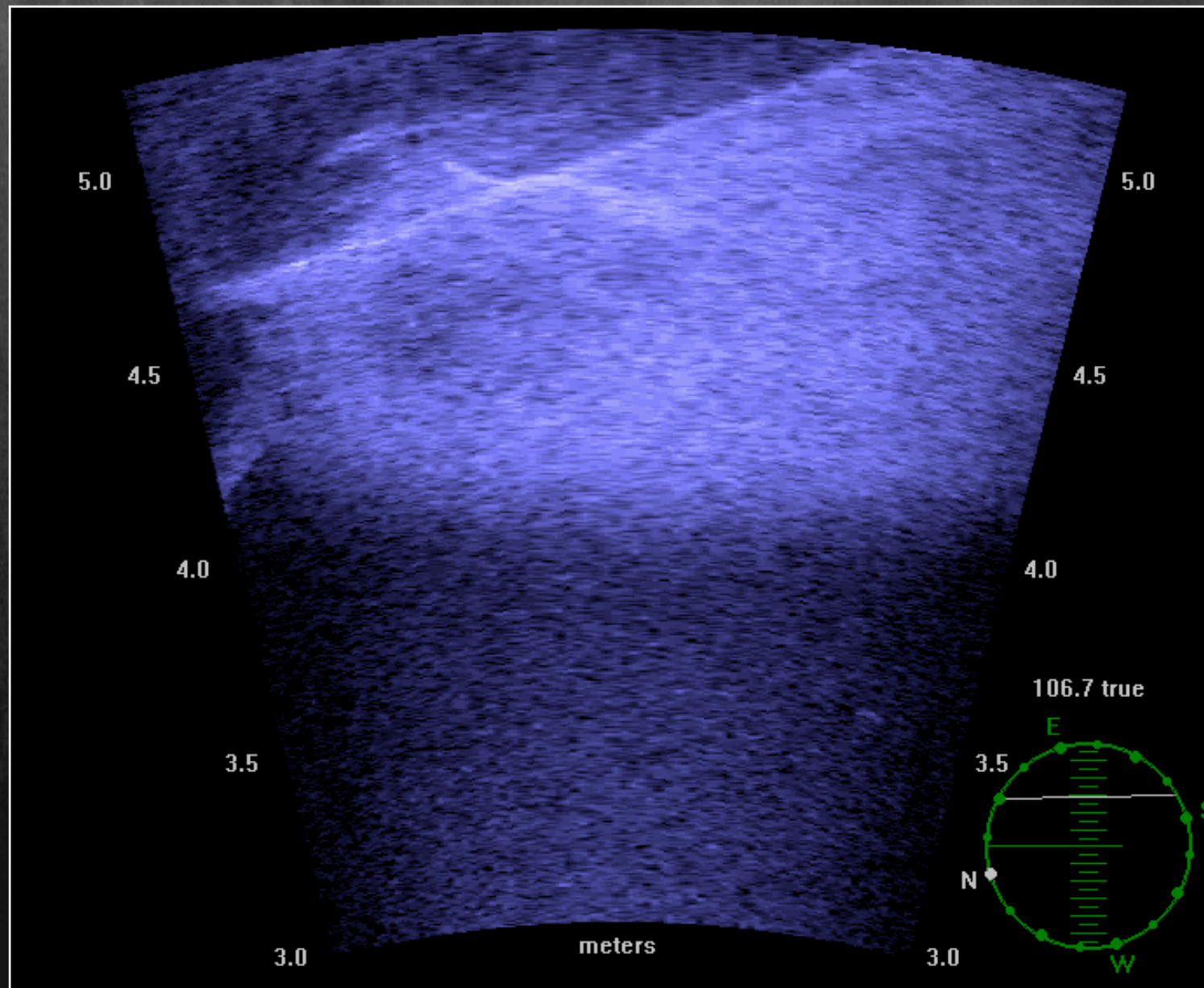


Zählen, Messen, **Verhaltensbeobachtung** *in situ*

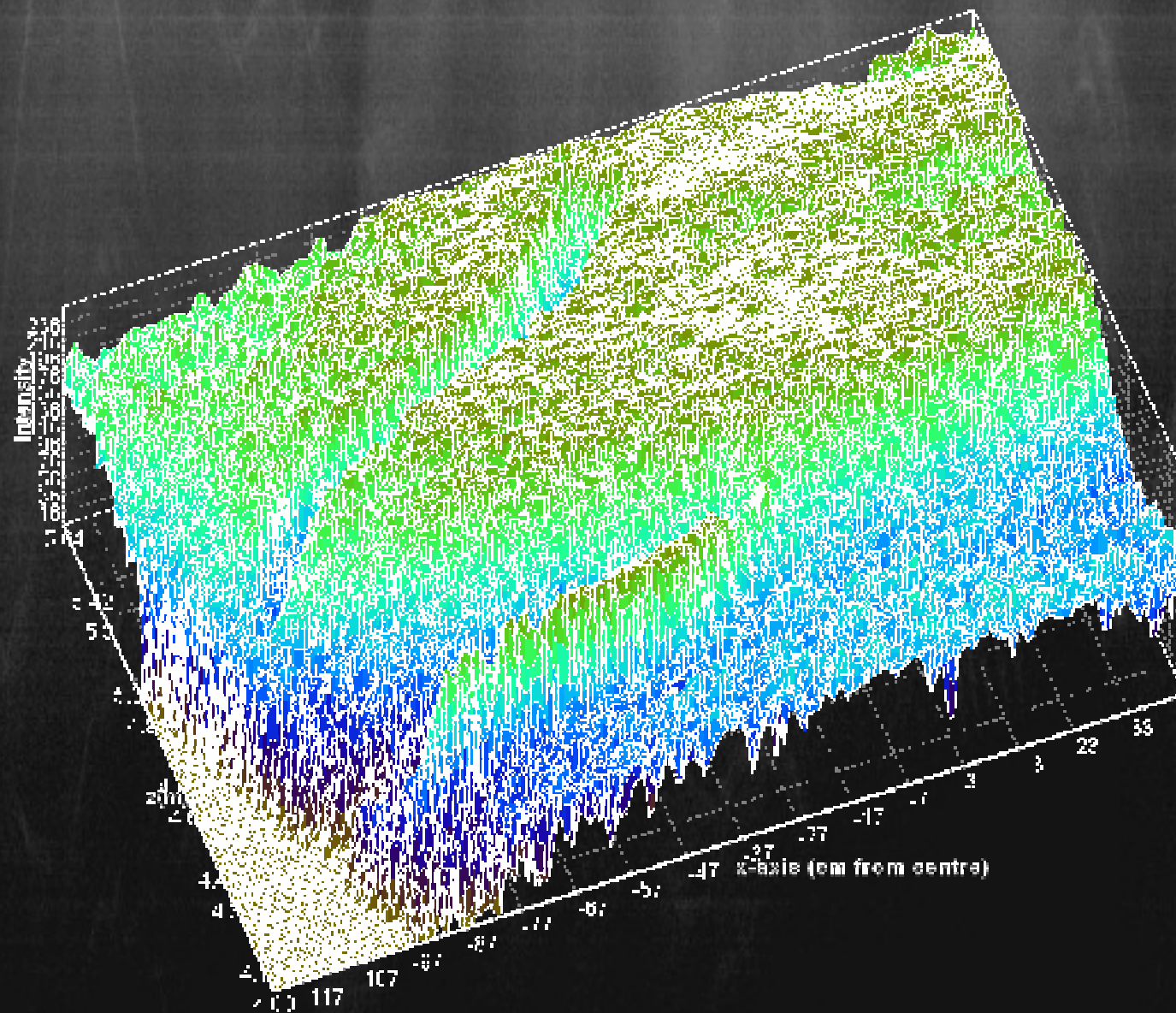


Automatisierte Erfassungssysteme

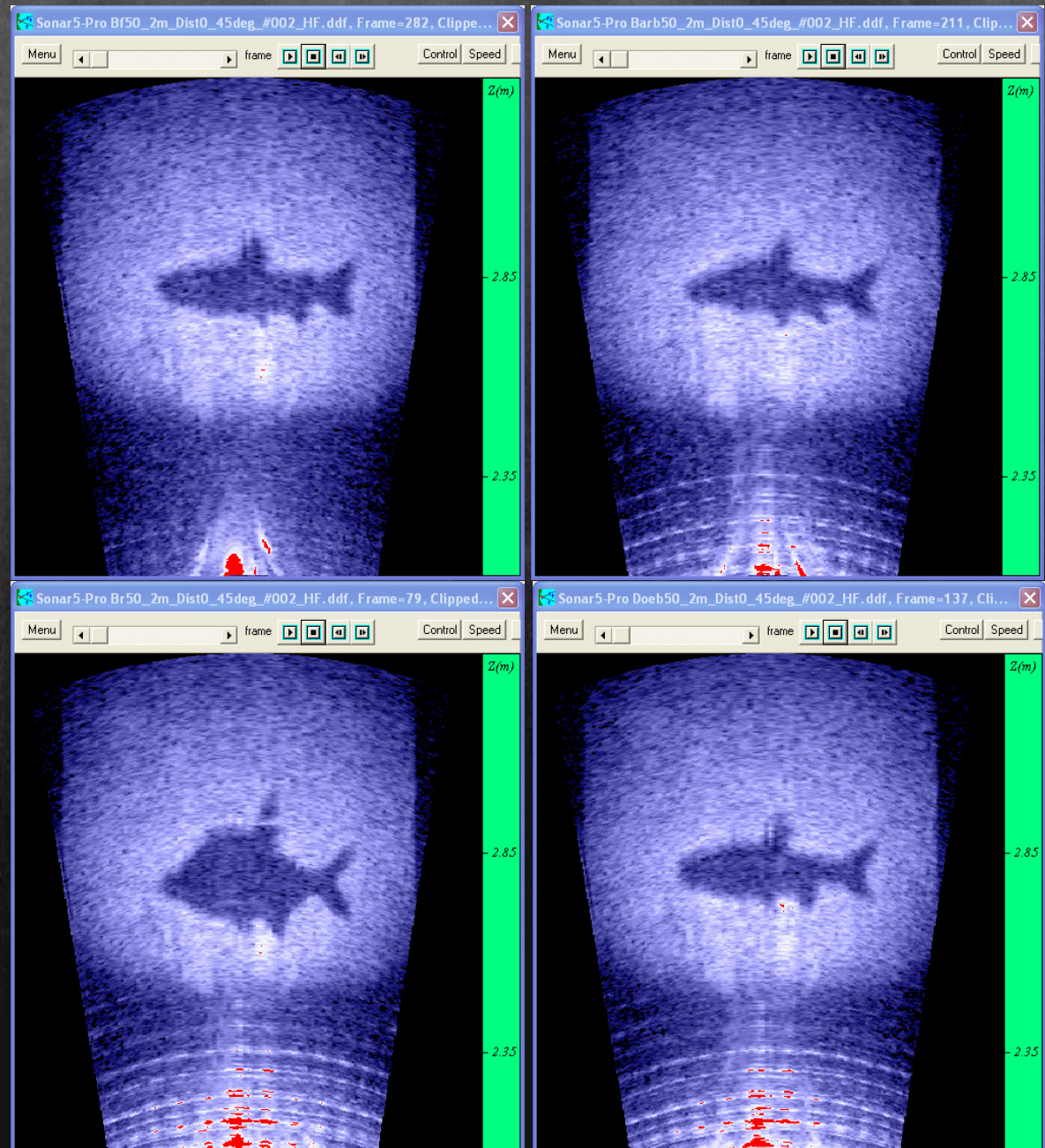
Perspektiven

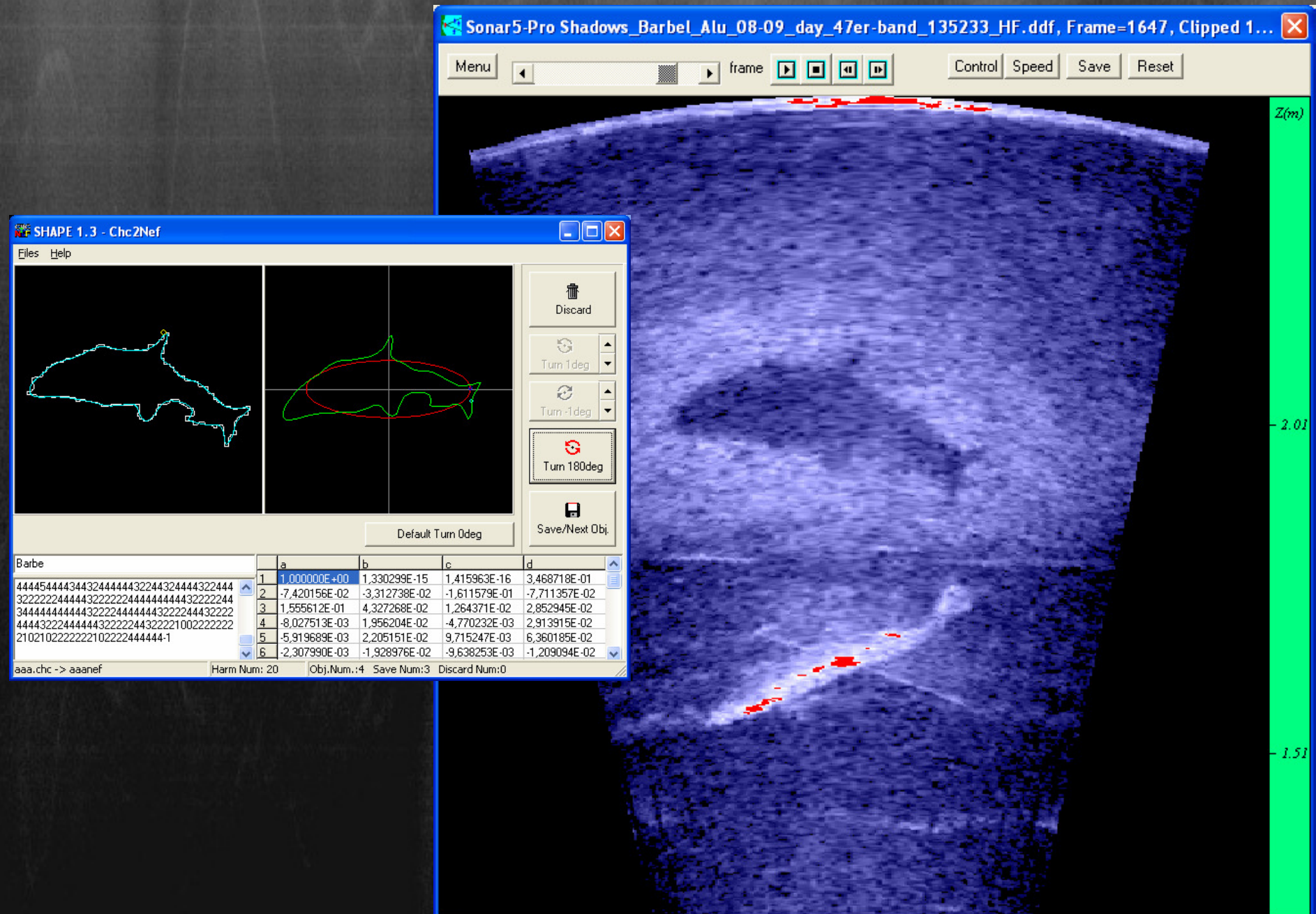


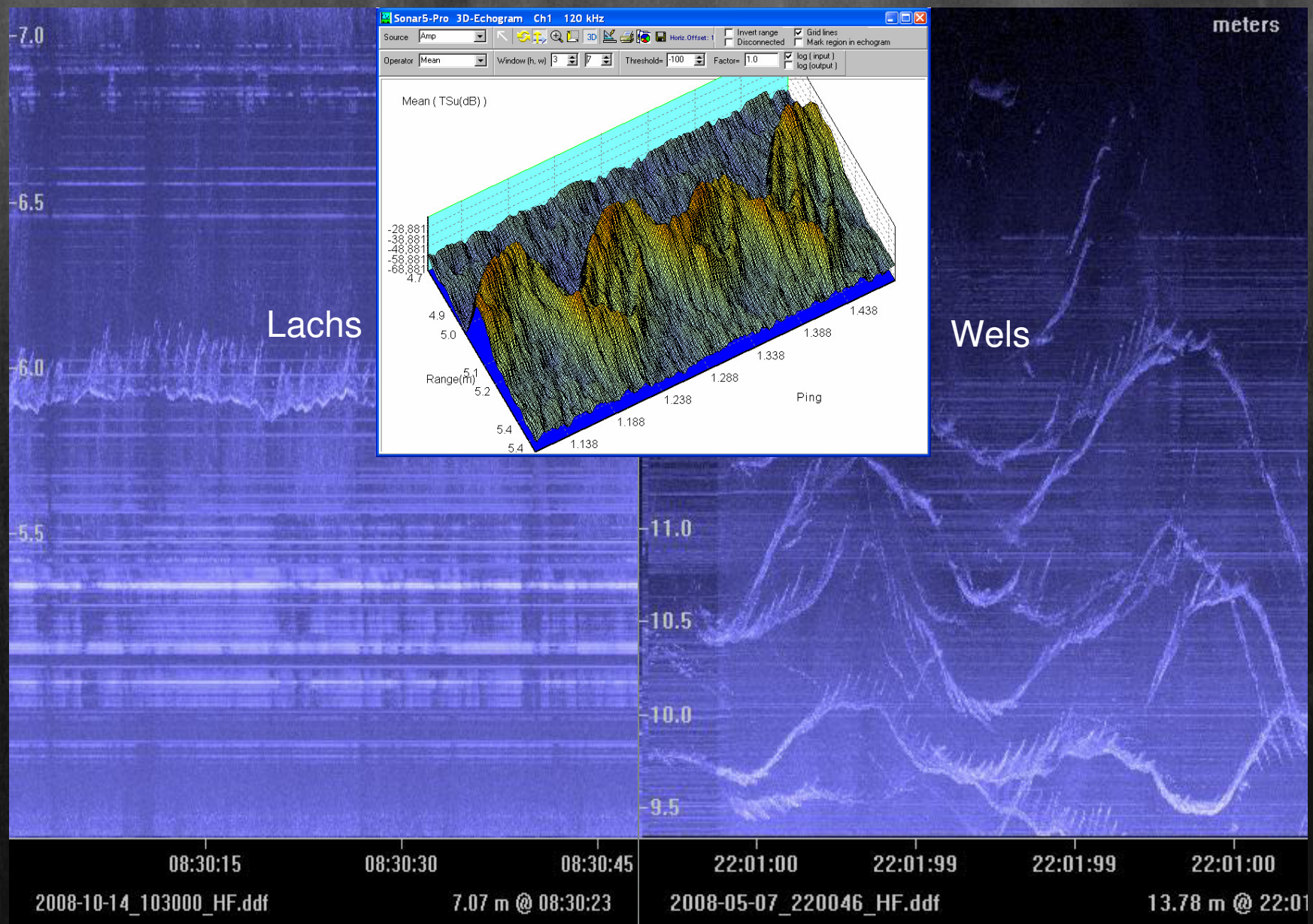
Aal und Echoschatten



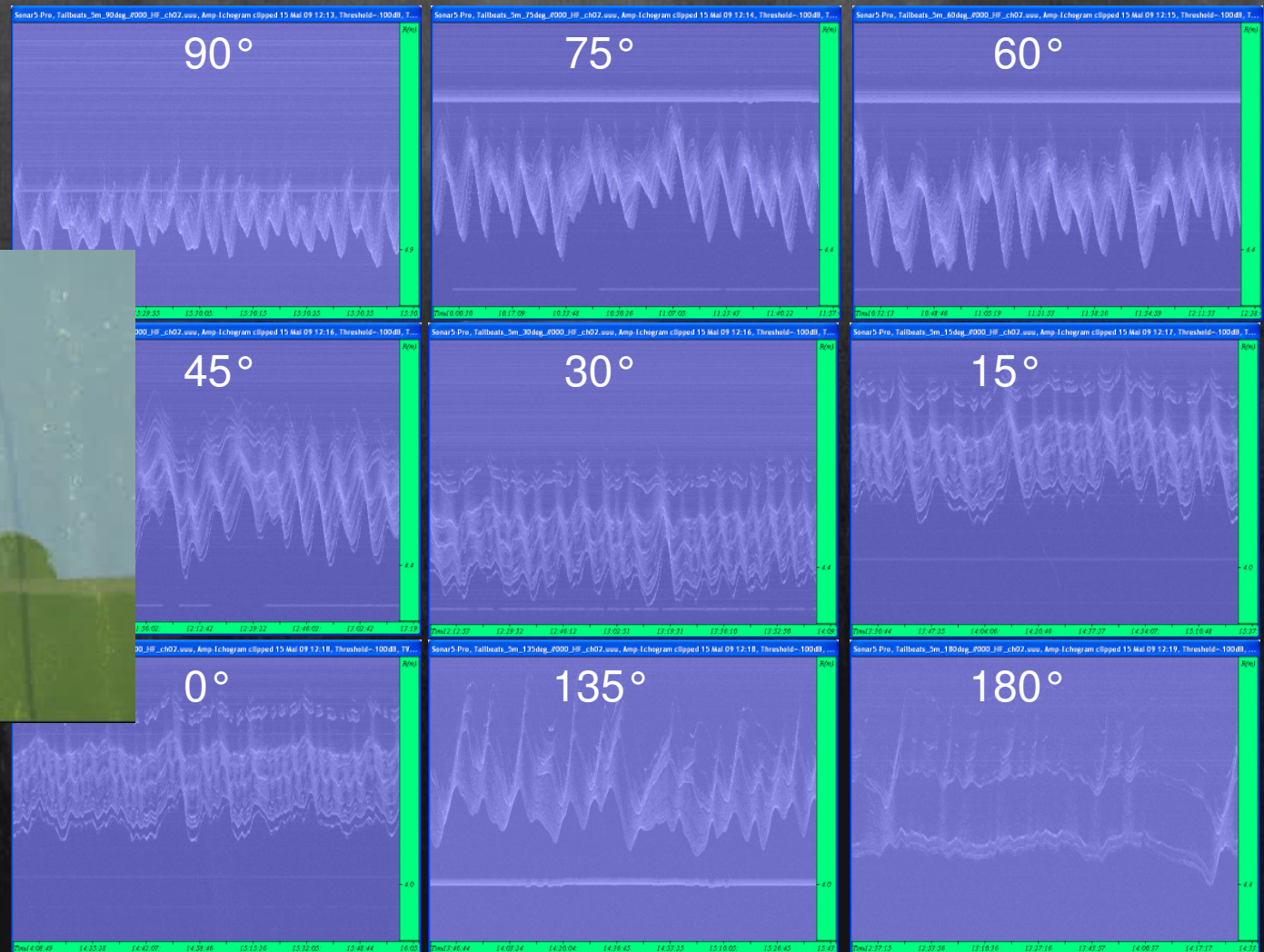
„Akustische Schatten“







Schlagfrequenzen/ Schwimmmuster/ Amplituden



Schlagfrequenzen („Tailbeats“) und Winkelaspekt



Depth Rating
300m

Inspection Mode
3.0 MHz

Detection Mode
1.8 MHz

ARIS SENTINEL 3000

The next generation in image clarity.

The ARIS Sentinel 3000 boasts 128 beams operating at 3 MHz, enabling it to collect more data than any imaging sonar in its class. The result? Unmatched image clarity, even in the most turbid water. Powerful and compact, the Sentinel 3000 is ideal for ROV/AUV integration. And it's designed for low maintenance, making it reliable in waters from the arctic to the equator. For longer-range applications, 1.8 - 1.1 MHz and 1.2 - 0.7 MHz models are available. Regardless of your needs, you'll find the new ARIS line is built to deliver in the real world.



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Innovative Entwicklungen

Kosten & Praxistauglichkeit



DIDSON-Sonar ~ 100.000 €

Pan & Tilt ~ 10 -20.000 €

Zusätzliche Hardware
(Big Lens etc.) ~ 15.000 €

Software ~ 10-20.000 €

Portable Montageeinheit ~ 5.000 €

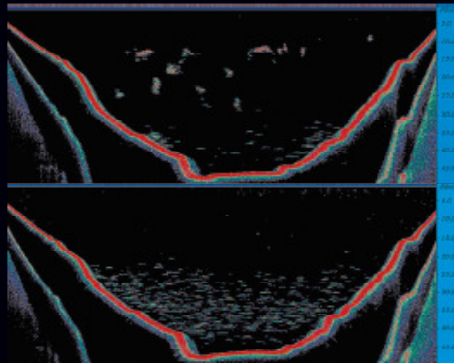
~ 140-160.000 €

Know-how/ Personal...

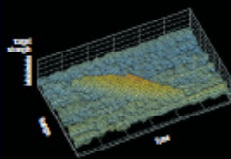




Zweifrequenz Identifikationssonar (DIDSON, links) und Split-Beam-Echolot (FMS, rechts) in der Flussanwendung. Dual-frequency Identification Sonar (DIDSON, left) and Split-beam echosounder (FMS, right) in river application.



Split-beam Echogram Tag (oben) und Nachtaufzeichnung (unten) pelagischer Fische in einer Talpore. Split-beam echogram, Day (above) and nighttime (below) distribution of pelagic fishes in a reservoir.



3-dimensionales Echogramm eines Fisches (Aal), der den Schallkegel eines Split-beam-Echolots passiert. 3-dimensional echogram of a fish (eel) passing the beam of a split-beam echosounder.

Der innovative und professionelle Einsatz von Echotiden und Sonaren (Hydroakustik) zur Untersuchung angewandter und wissenschaftlicher Fragestellungen gewinnt in der Umweltforschung immer mehr an Bedeutung. Für einige Bereiche stellen hydroakustische Methoden häufig die einzige Möglichkeit zur zielgerichteten Beantwortung offener Fragen dar. Der Landesfischereiverband Westfalen und Lippe e.V. hat sich seit dem Jahr 2001 intensiv mit dem Einsatz nichtinvasiver hydroakustischer Methoden beschäftigt und setzt dieses Know-How seit vielen Jahren in der fachlichen Praxis ein. Grundvoraussetzung für die erfolgreiche Arbeit auf diesem Gebiet sind hochmoderne Geräte, das fachliche Wissen zum praktischen Einsatz, zur Datenerfassung und Analyse.

In Abhängigkeit von der Fragestellung kommen verschiedene technische Gerätschaften zum Einsatz. Split-Beam-Echolote im mobilen Einsatz vom Boot aus ermöglichen u. a. die Erfassung von räumlichen und zeitlichen Fischverteilungen und in Kombination mit herkömmlichen Fischereimethoden die Quantifizierung von Fischbeständen hinsichtlich Abundanz und Biomasse. Darüber hinaus sind auch die Untersuchung von Gewässerstrukturen (Tiefenprofile, Tiefenkarten, Erfassung von Unterwasservegetation) und die stationäre Anwendung (z. B. Fischzählungen) ein wichtiger Einsatzgebiete.

Ein hervorragendes Instrument zur Untersuchung von Fischen und ihren Verhaltensweisen ist das Zweifrequenz-Identifikationssonar (DIDSON). Dieses „Akustische Kamera“ stellt den Stand der Technik der sog. „Musikalisierungssensoren“ dar und erzeugt videofischartige Bildsequenzen auch bei extremer Wassertrübung oder absoluter Dunkelheit. Damit ist diese Technik mobil und stationär überall dort einsetzbar, wo optische Sensoren und Kameras aufgrund schwieriger Bedingungen versagen. Die Einsatzmöglichkeiten des DIDSON-Sonars sind sehr vielfältig und ermöglichen u. a. die Erfassung und Untersuchung von Fischwanderungen, Fischverhalten im Wasserkraftanlagen- und Bypasssystemen, Wehren und Wanderbarrieren, Fischlauf- und -abteufanlagen sowie passiven und aktiven Fanggeräten.

Die erfolgreiche Durchführung hydroakustischer Untersuchungen setzt die detaillierte Information des Auftraggebers und eine sorgfältige Planung voraus. Als kompetenter Ansprechpartner für den Einsatz hydroakustischer Methoden steht Ihnen der Landesfischereiverband Westfalen und Lippe e.V. mit seinem Mitarbeiterstab jederzeit zur Verfügung.

Dr. Marc Schmidt
schmidt@lfv-westfalen.de

Dipl.-Biol. Manuel Langkau
langkau@lfv-westfalen.de

Landesfischereiverband Westfalen und Lippe e.V.
Hydroakustik –
www.lfv-westfalen.de/content/hydroakustik/hydroakustik.php

Schmidt M.A., Grosse H., Köttemann M., Mäkelä H. & Meyer G.J. (2005): Hydroakustische neue Fischbestand der Barentsregion (Golfstrom). (Fische & Fischerei) 1, 487-495.
Schmidt M.A., Grosse H. & Meyer G.J. (2005): Distribution and total biomass of a wintering, transient, and migratory fish population in the Baltic Sea. (Fische & Fischerei) 1, 487-495.
Schmidt M.A., Grosse H. & Meyer G.J. (2005): Influence of water level on the abundance of a wintering, transient, and migratory fish population monitored by hydroacoustics. (Fische & Fischerei) 1, 487-495.
Schmidt M.A. (2005): Monthly fish behaviour in the Baltic Sea: seasonal and behavioural studies of common, Baltic herring (Clupea harengus) and Atlantic herring (Clupea harengus). (Fische & Fischerei) 1, 487-495.

Schmidt M.A., Grosse H., Köttemann M. & Meyer G.J. (2005): Short-term effects of fishing on the abundance and distribution of a wintering, transient, and migratory fish population in the Baltic Sea. (Fische & Fischerei) 1, 487-495.
Schmidt M.A. (2005): Seasonal and spatial distribution of wintering, transient, and migratory fish populations in the Baltic Sea. (Fische & Fischerei) 1, 487-495.
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Schmidt M.A., Grosse H., Köttemann M. & Meyer G.J. (2005): Seasonal and spatial distribution of wintering, transient, and migratory fish populations in the Baltic Sea. (Fische & Fischerei) 1, 487-495.

The professional use of cutting-edge technology such as scientific echosounders and split-beam sonars to answer new questions in applied freshwater fisheries science has steadily increased in recent years. For some areas of interest only hydroacoustic methods deliver an appropriate ability for precise and non-invasive responses to a range of issues. The Fisheries Association Westphalia and Lippe e.V. has been working in this field since 2001. The use of non-invasive hydroacoustic technologies and related know-how is a matter of course in our scientific and practical work. Prerequisites for successful investigations are state-of-the-art hardware, practical skills and expertise in data assessment and analysis.

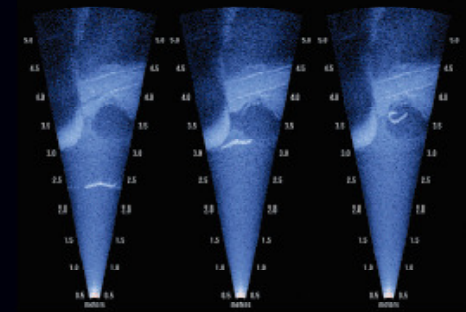
Depending on the question and issue, different technologies can be applied. With mobile scientific split-beam echosounders it is e.g. possible to assess the spatial and temporal distribution of fish. In combination with common methods it is also possible to estimate abundance and biomass of fish stocks. Additionally, investigations on water bodies and their structures (depth profiles, maps, submerged vegetation) as well as stationary applications (e.g. fish counting and tracking) are important fields of work.

The Dual-Frequency Identification Sonar (DIDSON) is an outstanding tool for in situ observations of fishes and their behaviour. This „Acoustic camera“ represents cutting-edge technology within the area of multi-beam imaging sonars and generates video-like images independent of light level and water turbidity. Therefore it can be used in both mobile and stationary mode, especially at locations where optical sensors (like common video cameras) fail. The DIDSON offers capabilities to observe and investigate fish migration, fish behaviour e.g. at hydropower stations and related bypass systems, weirs and comparable barriers and bottlenecks, technical up- and downstream migration facilities (fish ladders), and active/passive fishing gears.

Detailed information from the client and accurate planning is essential for a successful performance of hydroacoustic investigations. The Fisheries Association Westphalia and Lippe e.V. is your competent partner and we offer a variety of applications and services. Please do not hesitate to contact us for further information:



Versuchsaufbau zur hydroakustischen Erfassung von Aalen an einer Wasserkraftanlage (DIDSON und SPLIT-BEAM). Setup for hydroacoustic acquisition of fish at a hydropower station (combined DIDSON and SPLIT-BEAM).



Abfolge von drei DIDSON Standbildern, die das Verhalten eines Silberfisches am Grundboden Bypasssystems (dunkler Kreis) einer Wasserkraftanlage zeigen. Sequence of three DIDSON images showing the behaviour of a silver-phase fish near the entrance (dark rounded shape) of a near-ground bypass system of a hydropower station.



Wenn DIDSON ausgedehnte akustische Schallfelder bilden, ermöglichen sie die Unterscheidung verschiedener Fischgruppen und -arten. DIDSON acoustic soundfields serve the ability to distinguish between different groups of fishes and can be used for species identification.

Landesfischereiverband Westfalen und Lippe e.V.

– Hydroakustik –

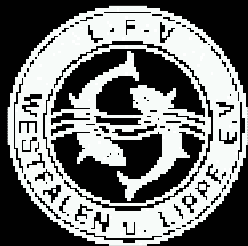
schmidt@lfv-westfalen.de

langkau@lfv-westfalen.de

www.lfv-hydroakustik.de

Vielen Dank

für Ihre Aufmerksamkeit



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