



**37TH INTERNATIONAL
NO - DIG
FLORENCE 2019**

TECHNOLOGY TRANSFER: HOW DREDGING AND SHIPBUILDING INNOVATIONS ARE IMPROVING (MICRO)TUNNELLING OPERATIONS

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ABOUT IHC > THIS IS IHC



DREDGING



OFFSHORE

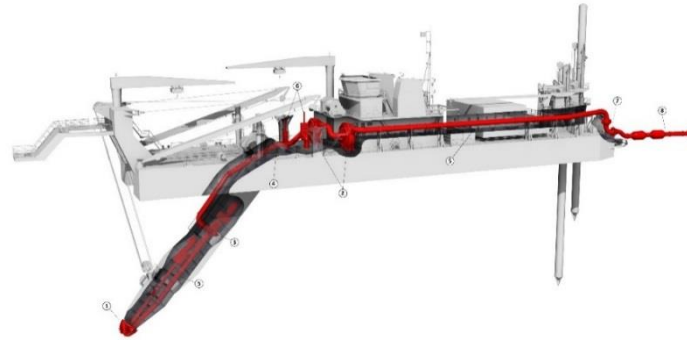


MINING & TUNNELLING

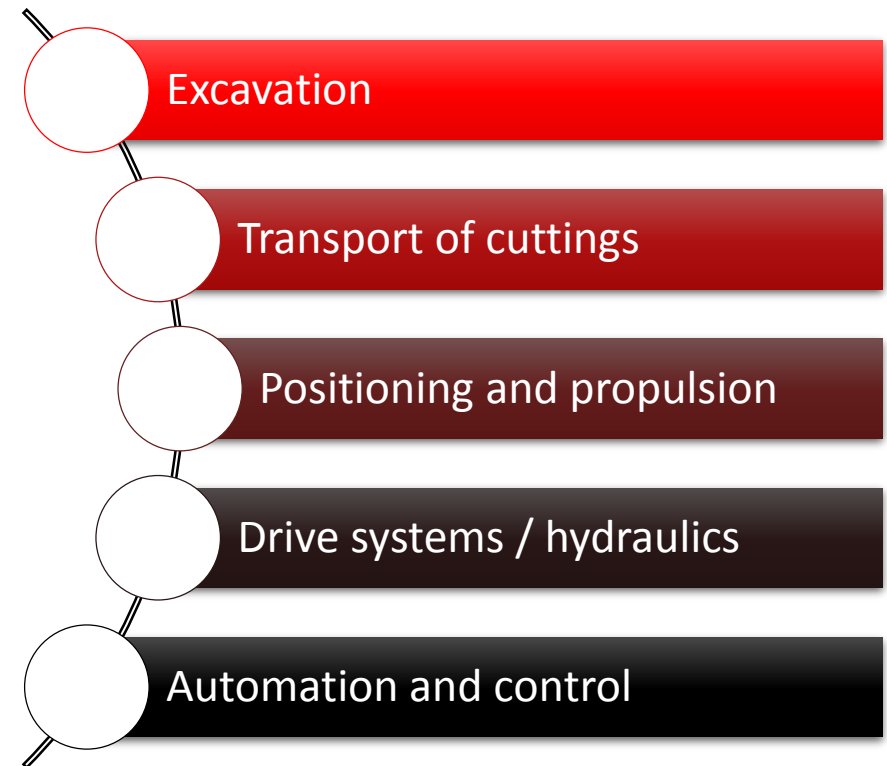
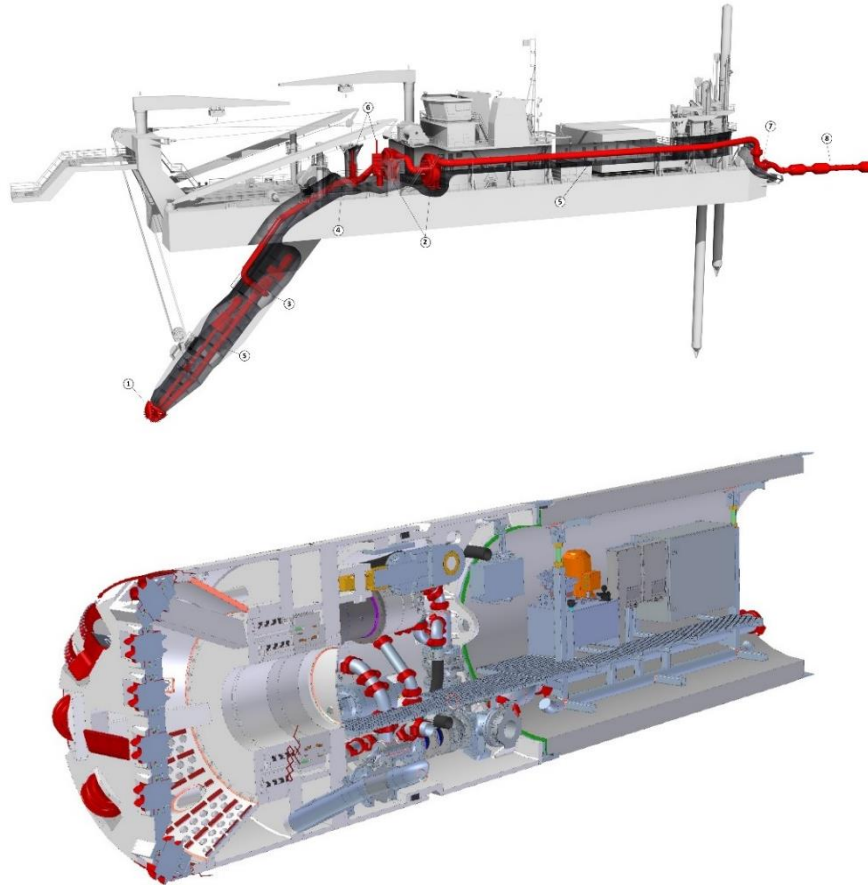
ABOUT IHC > DREDGING

PORTFOLIO

- Standard and Custom-built Hopper Dredgers
- Custom-build Cutter Suction Dredgers
- IHC Beaver™ Cutter Suction Dredgers
- Mechanical Dredging Equipment
- Dredge Line Components
- Dredging Systems & Automation



IHC COMPETENCES > TUNNELLING



MICROTUNNELLING > 1990s/2000s



IHC TUNNELLING > FIELDS OF APPLICATION

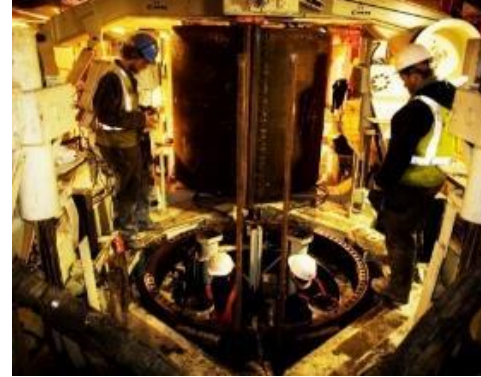
A (MICRO) TUNNELLING



B PIPE RENOVATION



C SHAFTBORING



D TUNNEL INNOVATION



E TUNNELLING EQUIPMENT



TUNNELLING

- Tunnelling equipment for the construction of road tunnels, railway tunnels, metro tunnels and hydropower tunnels
- Built on customer's specification
- Flexible in diameter
- Tunnel built in the machine with concrete segments or shotcrete
- New and refurbished equipment
- Slurry transport system for excavated muck



Innovative



First-rate quality



Custom-built solutions



MICROTUNNELLING

- Microtunnelling equipment for the construction of pipes for
 - water
 - gas
 - sewerage
 - etc.
- New and refurbished equipment
- Slurry transport system for excavated muck
- Scope includes the TBM, jacking station, power packs and control container

✓ Innovative ✓ First-rate quality ✓ Custom-built solutions



INNOVATION

ELECTRIC DRIVE

CONCEPT

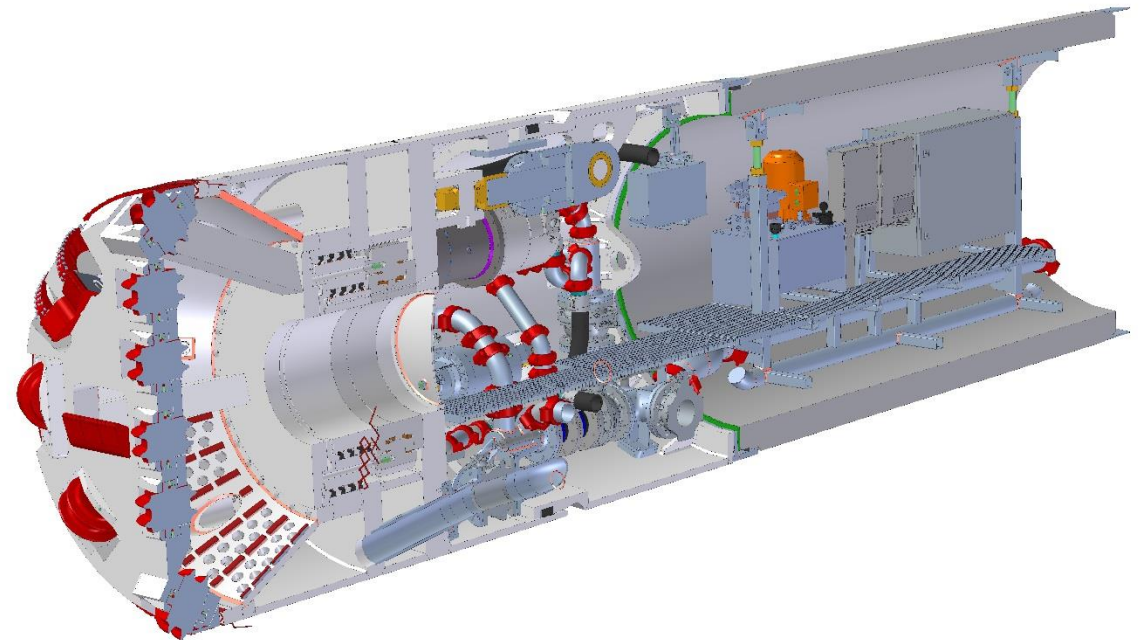


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MICROTUNNELLING > IHC STANDARD RANGE

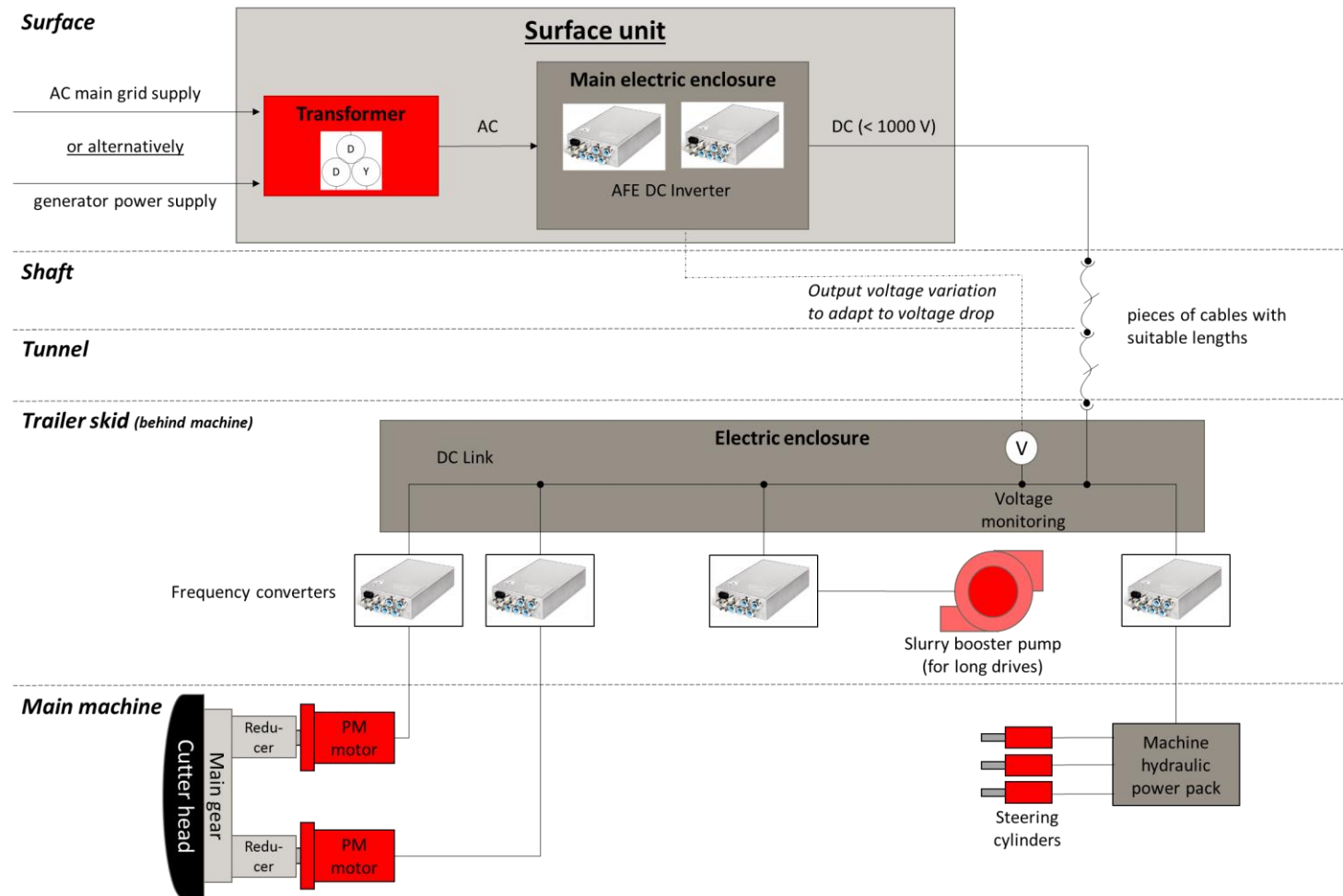
- MTBMs will be delivered with control cabinet and power distribution
- MTBMs can optionally be delivered with
 - Shaft jacking station
 - Intermediate jacking station
 - Hydraulic power pack for jacking station
 - Hyperbaric equipment
 - Guiding system
 - Bentonite lubrication system
 - Slurry pumps
 - Slurry flow/density meter
 - Separation plant



MICROTUNNELLING ➤ ELECTRIC DRIVE CONCEPT

- Surface
 - Step-up transformer supplies the active front end inverters on surface
 - The inverters supply a DC voltage to the tunnel power cable
- Tunnel
 - Tunnel cable is supplied by DC
 - Two wires transmit the current instead of three in the „classic“ AC configuration
 - The current load is doubled, but cable size is only slightly bigger
- MTBM
 - The DC line is split up to all power consumers underground incl. cutterhead motors and booster slurry pump
 - All equipment is located on a „trailer skid“ in the first pipe which results in a shorter overall MTBM (IP65)

MICROTUNNELLING > ELECTRIC DRIVE CONCEPT



MICROTUNNELLING > ELECTRIC DRIVE CONCEPT

- IHC MTBMs are equipped with a frequency controlled synchronous motor drive train
- Flexible motor torque and voltage control by ruggedized frequency converters
- Intelligent power management optimizes use of cable capabilities
- Easy spare parts management due to modular design of drive system

ADVANTAGES

- + High efficiency compared to state-of-the-art cutter head drive trains
- + Decrease of machine weight and overall length
- + Minimizing the use of hydraulic fluids
- + No separate cabling for additional slurry booster pump needed
- + Overall positive benefit on environmental footprint due to saving energy

INNOVATION

RF METER

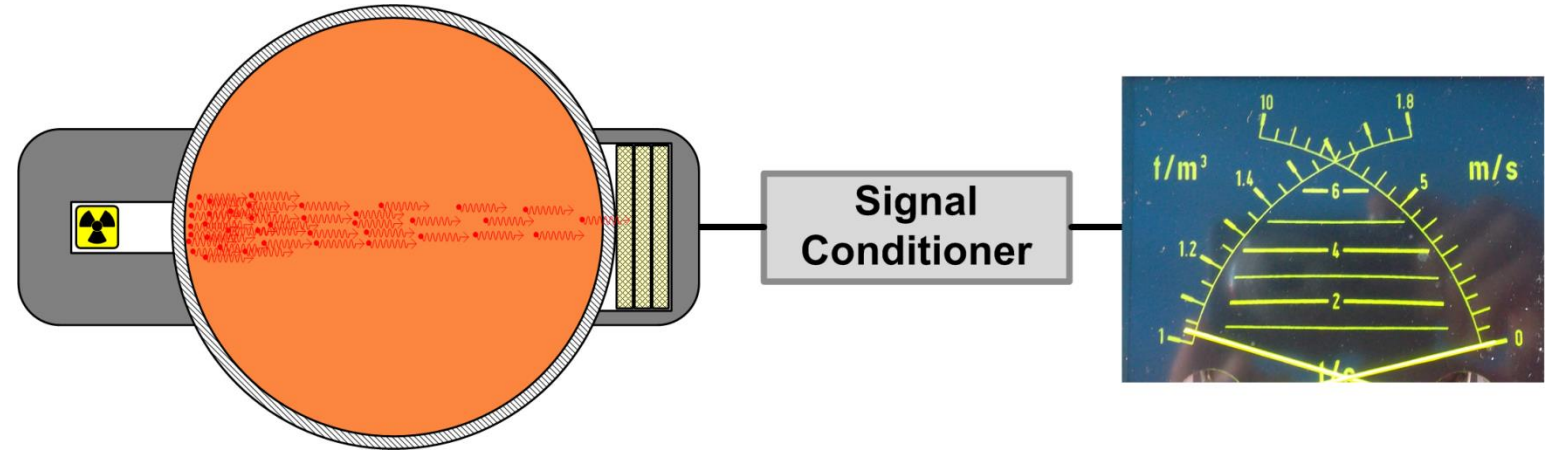


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MOTIVATION ➤ RADIOACTIVE GAUGE (RA)

- Uses ionizing radiation
- Robustness
- Industry standard

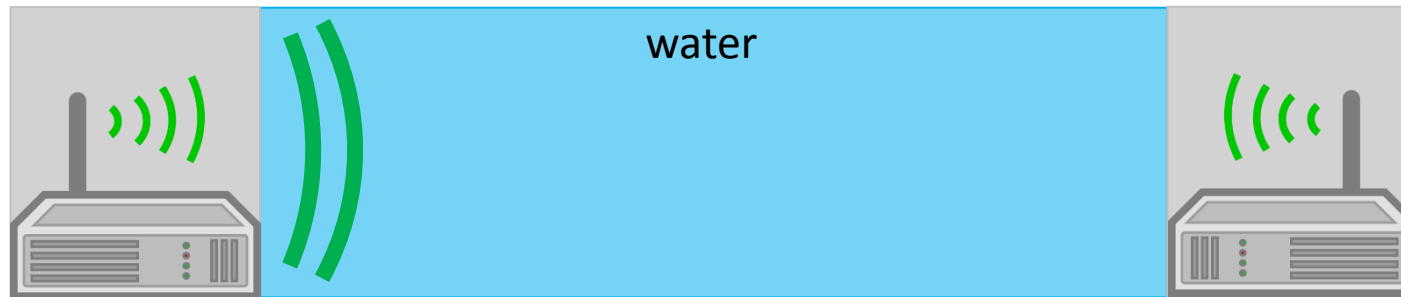


DISADVANTAGES OF RADIOACTIVE MATERIAL

- RSO certified crew
- Maintenance costs

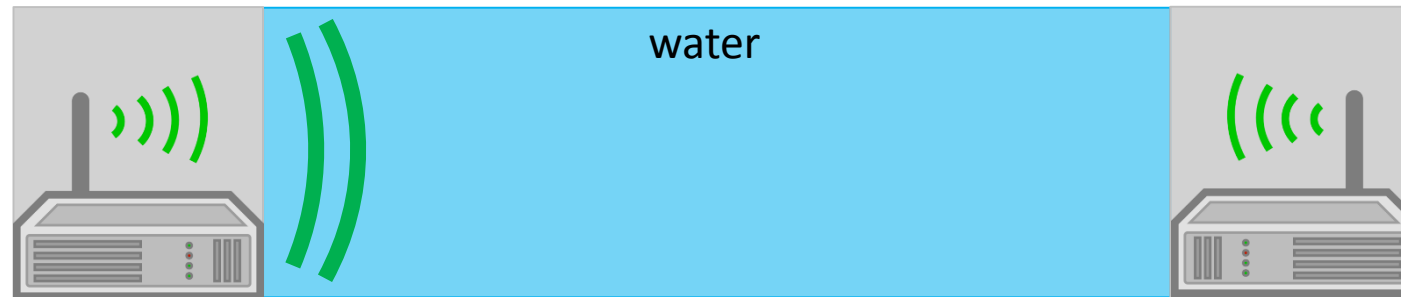


PRINCIPLE ➤ RF WAVES EXPLAINED

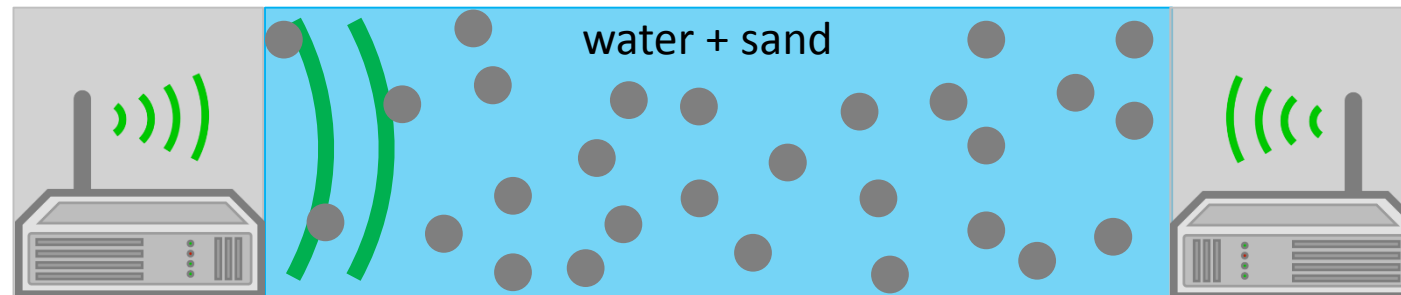


SLOW

PRINCIPLE > RF WAVES EXPLAINED



SLOW

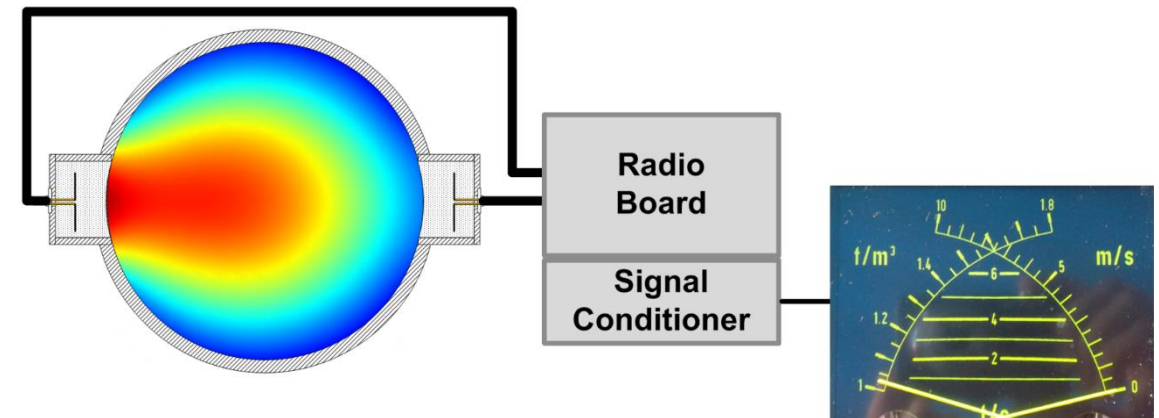


SLOW < v < FAST

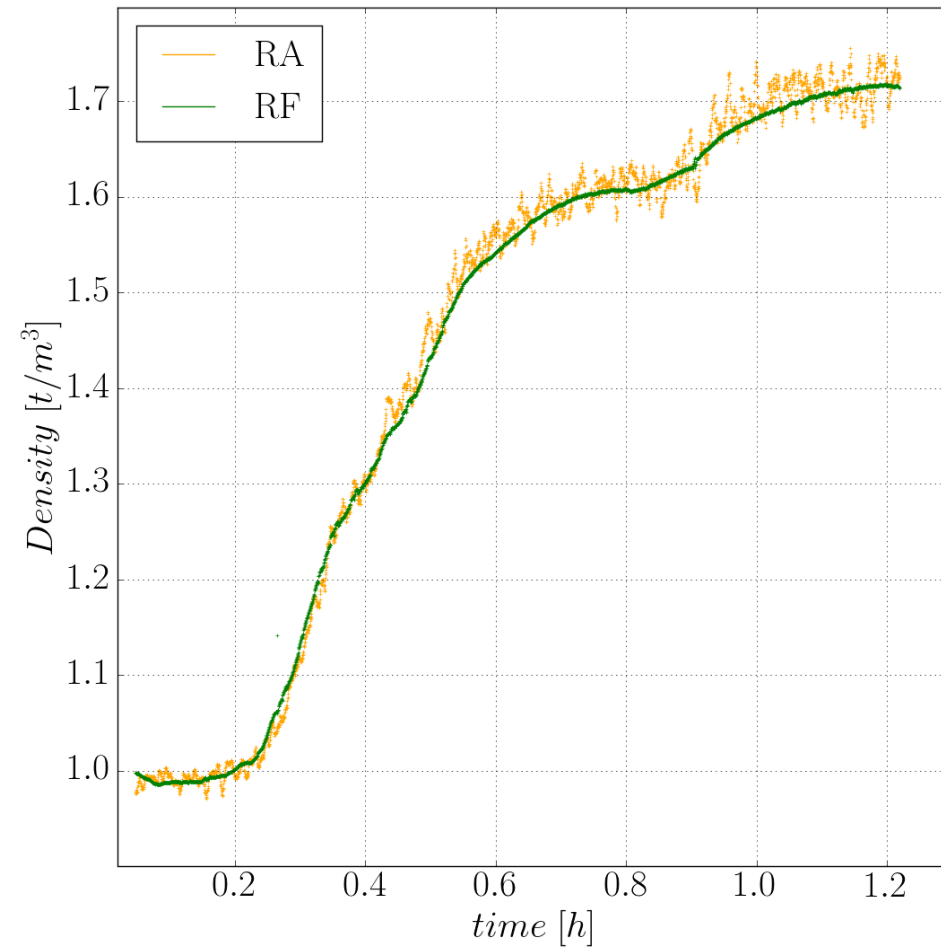
Time of flight is inversely proportional to the amount of total dry solids in water

NON-RADIOACTIVE SLURRY DENSITY METER

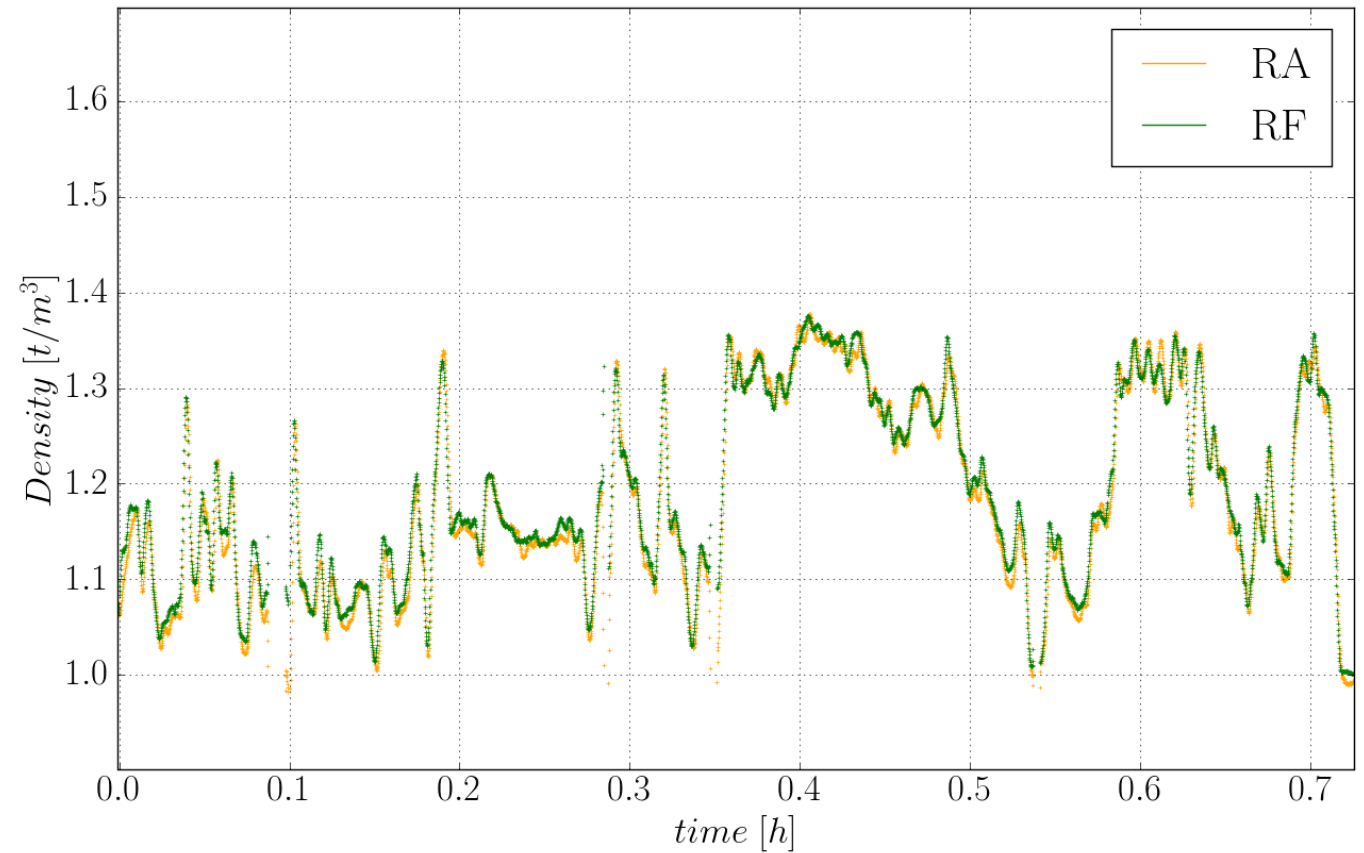
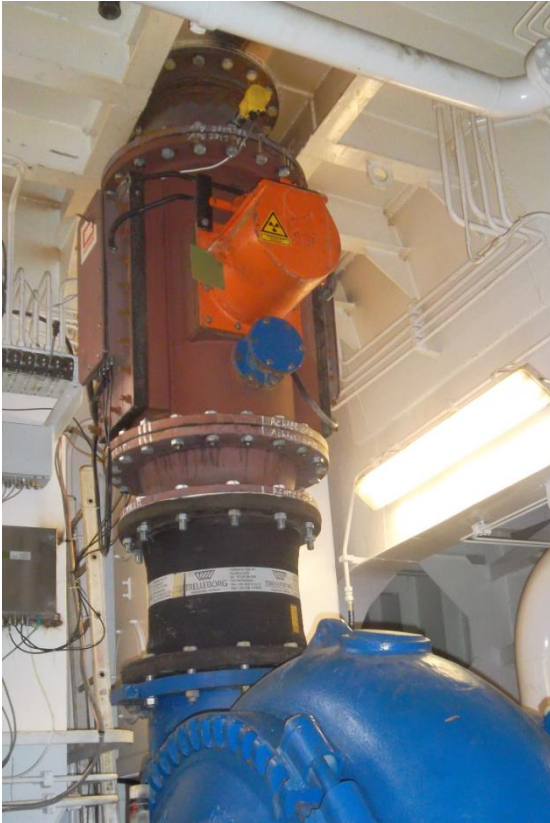
- Uses harmless RF waves
- Measurement pipe fitted with a pair of antennas
- Antennas protected by a wear-resistant Irathane®
- No additional burden for safety regulations
- System components:
 - Measurement pipe
 - Radio electronics
 - Signal conditioner



PROOF OF CONCEPT > LAB ENVIRONMENT



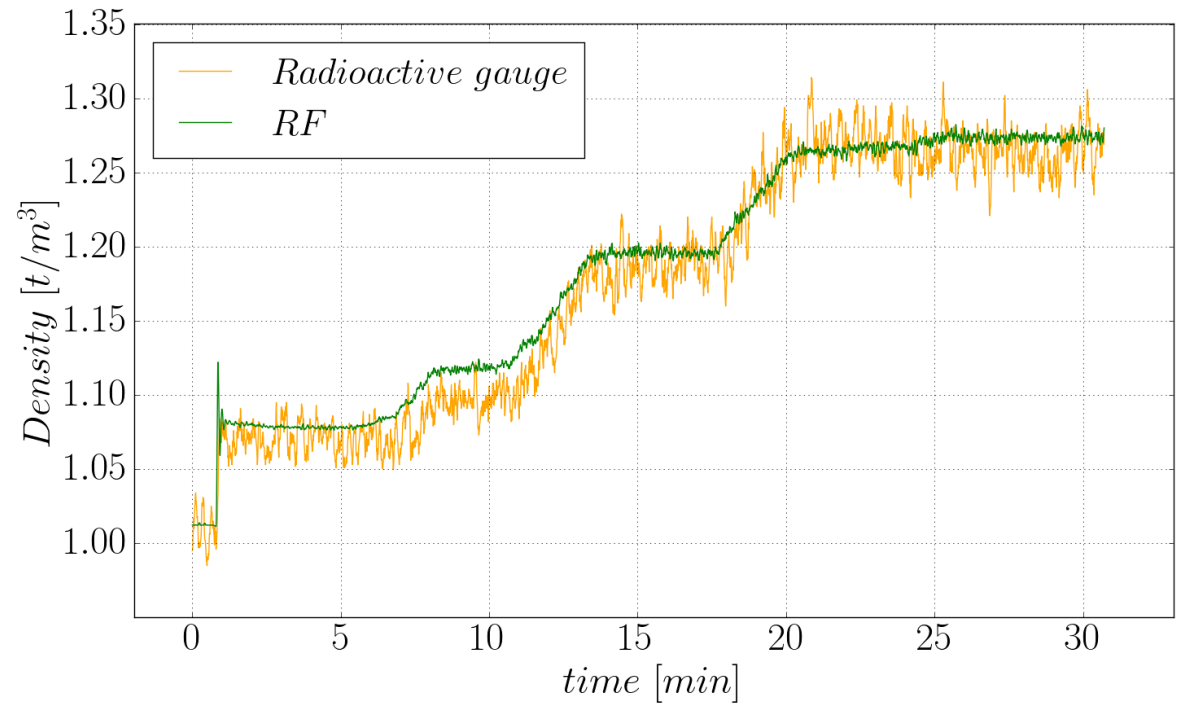
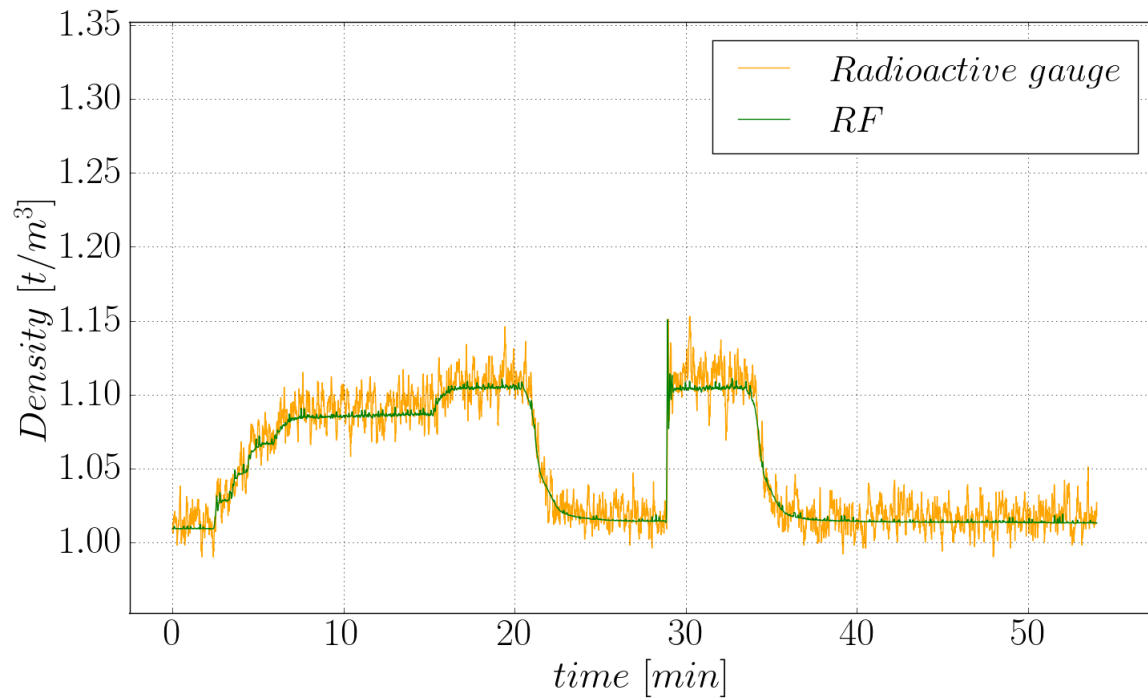
PROOF OF CONCEPT > DREDGING TESTS



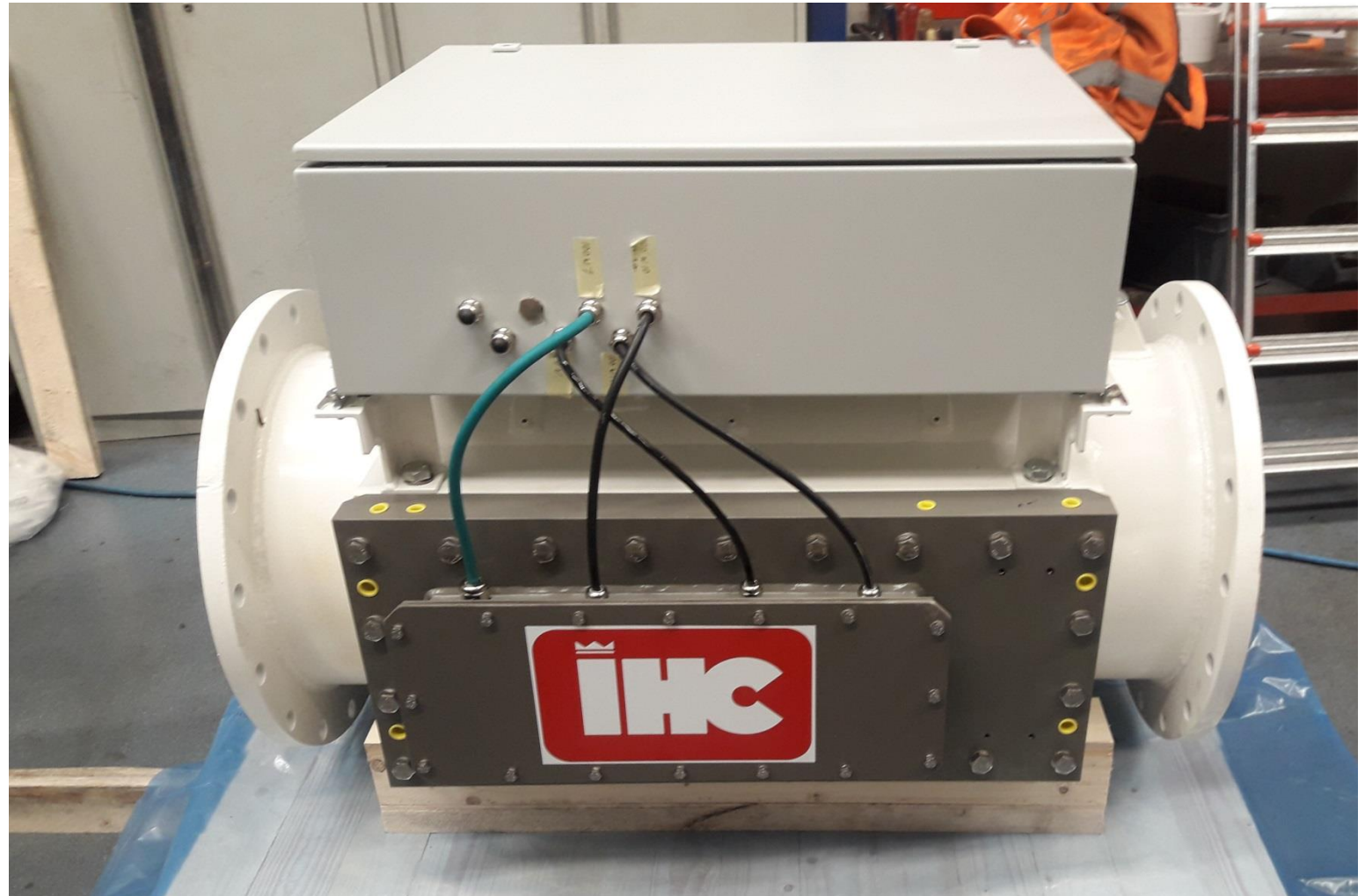
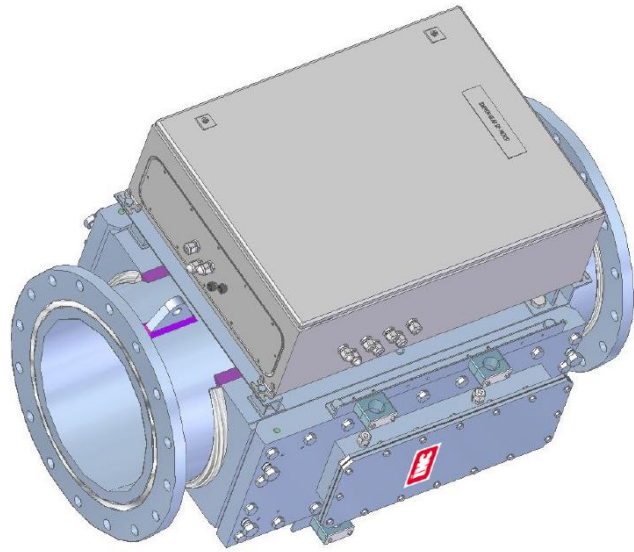
FIRST PRODUCT ➤ DREDGING



TUNNELLING > BENTONITE LAB TEST



TUNNELLING ► FIRST SYSTEM INSTALLED



TUNNELLING ► FIRST SYSTEM INSTALLED



CONCLUSIONS

- Overlapping challenges in tunnelling and dredging allow for synergies in developments
- Technology transfer is part of IHC's strategy for the development of the tunnelling division

RESULTS OF BOTH DEVELOPMENTS

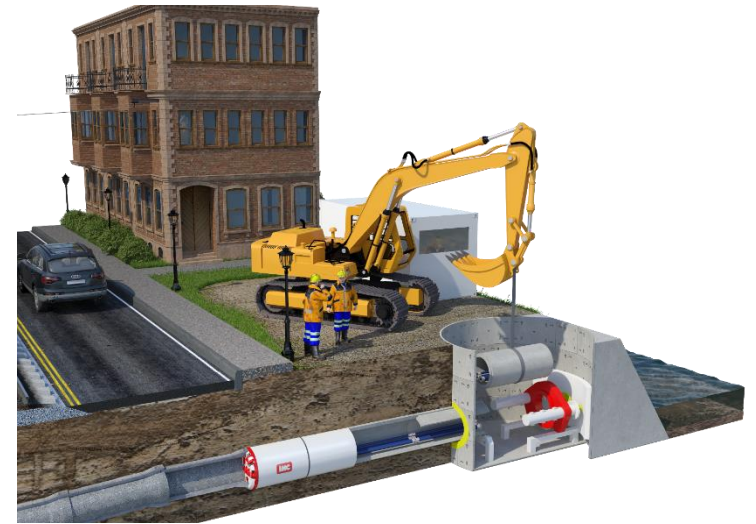
- Higher efficiency of IHC's MTBM systems due decreased energy consumption
- Shorter machine design and therefore time needed for excavation
- Gain experience of the RF meter in tunnelling environment in a field test on a TBM
- Further development of the RF meter as a compact system for a MTBM

AND BESIDES THAT...

R&D > PIPE RENOVATOR

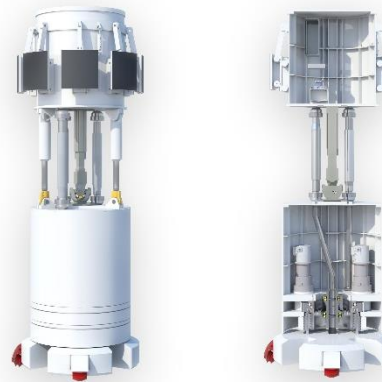
3D PIPE RENOVATION CONCEPT

- Safer and less environmental impact during planned maintenance/replacement of pipes
- Low impact, especially in urban areas
- Lower risk for damages to existing infrastructure



R&D > VERTICAL BORING MACHINE

- Suitable for soft ground and rock
- Applications in mining, utility works and foundation installation
- Lining installation during boring works ensuring stable shaft throughout
- Partial lining of shaft possible without changes to the VBM
- Proven gripper concept enabling accurate thrust control
- Compact topside equipment spread and vibration free shaft construction for application in congested areas



R&D ► HARDT HYPERLOOP



- Hyperloop is a new mode of transportation with the potential to provide long-distance sustainable travel
- Pressurized vehicles travel in a tubular network on low air pressure, providing the ideal conditions for energy efficient travel by dramatically reducing air resistance
- The vehicles are electromagnetically suspended, therefore have no contact with the track eliminating rolling stock maintenance

THANK YOU FOR YOUR ATTENTION!



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