



SMART RADAR INSTANTLY UNLOCKS MINE AND PLANT PERFORMANCE

1D | 2D | 3D RADAR

RTLS | GNSS

AUTOMATION

INVENTORY CONTROL

ANTI-COLLISION

DEBOTTLENECKING

REMOTE CONTROL

PIT TO PORT



Picture Credits:
SONAE ARAUCO



EASY COMMISSIONING KITS:

Products that are self-installable off-the-shelf, with local domestic support available



FULL SCOPE PORTFOLIO:

Tailored high value solutions for mining, processing & ports containing complex kinematic machine models



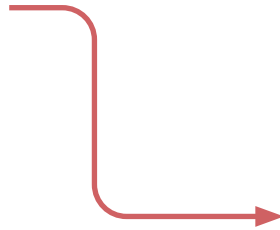
OEM SENSOR HARDWARE:

Proprietary radar sensors, radio transponders & supporting hardware

OVERVIEW:

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iBelt, iChute2D, iApron2D, iScreen, iCrusherSECONDARY, iLevel1D, iSilo1D, iSilo3D, iDome, iStockpileSHED, iPosition1D, iProximityRADAR, iProximityRTLS, iDrillrig



34-55 SOLUTIONS SEGMENT

iCrusherPRIMARY, iStockpileCOS, iStockpileTRAVELLING, iStacker, iReclaimer, iStockyard, iLoadout, iCardumper, iShiploader, iShipunloader, iBerth, iPosition3D



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INDURAD AT A GLANCE - INDUSTRIAL MACHINE VISION BEYOND OPTICAL LIMITS

WHO WE ARE

indurad is a world leader in advanced RADAR and Real-Time Location Systems (RTLS) technologies. With over 15 years of innovation, we provide easy-to-use products and solutions that revolutionize 3D inventory control, bulk flow monitoring, and collision avoidance in mining and heavy industries.

HIGH-VALUE BENEFITS WITH FAST ROI

By increasing productivity and reducing downtime, indurad delivers significant, measurable value to our clients, offering a fast return on investment.

ENHANCING ESG OUTCOMES

We are committed to sustainable practices. Our solutions contribute to reduced energy consumption, waste, CO₂ and dust emissions, while improving safety aligning with your Environmental, Social, and Governance (ESG) goals.

GLOBAL PRESENCE AND DIVERSE CLIENT BASE

With a global footprint that includes seven regional offices, channel partners, representatives, and distributors, we serve clients across five continents. We have established long-term relationships with major mining houses and leading OEMs.

LEADING TECHNOLOGY AND HIGH-CALIBER TEAM

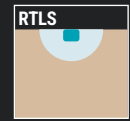
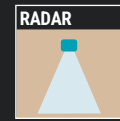
Our team brings deep expertise in mining, engineering, hardware, and software development. Committed to innovation, we invest more than 20% of our revenue in research and development to stay at the forefront of technological advancements.

OUR TECHNOLOGY

Our state-of-the-art sensors are designed to perform reliably in the harshest conditions. They capture, analyze, and act on valuable data including volume, speed, distance, and angle to enhance process control and provide actionable business intelligence.



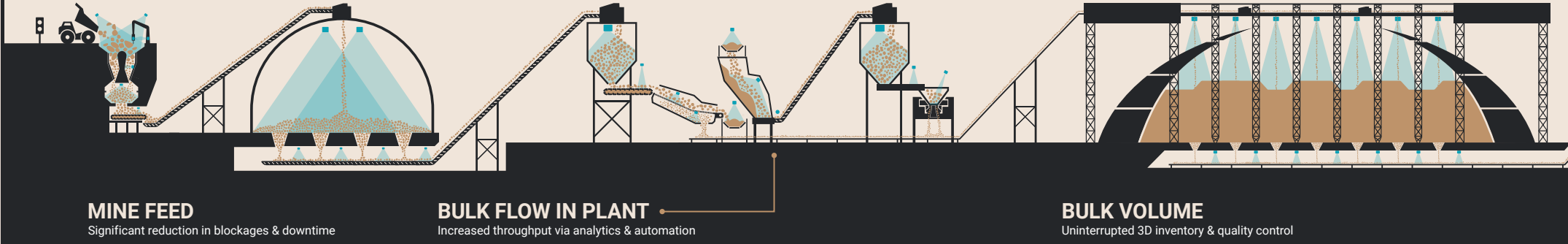
OUR MISSION



indurad is dedicated to transforming asset efficiency and safety through our pioneering radar and RTLS technology and software solutions. Our mission is to enhance safety, reduce

downtime and establish connectivity across the mining and plant sectors, ensuring optimized performance and sustainable operational excellence.

MINE PROCESSING



MINE FEED
Significant reduction in blockages & downtime

BULK FLOW IN PLANT
Increased throughput via analytics & automation

BULK VOLUME
Uninterrupted 3D inventory & quality control

BULK LOGISTICS

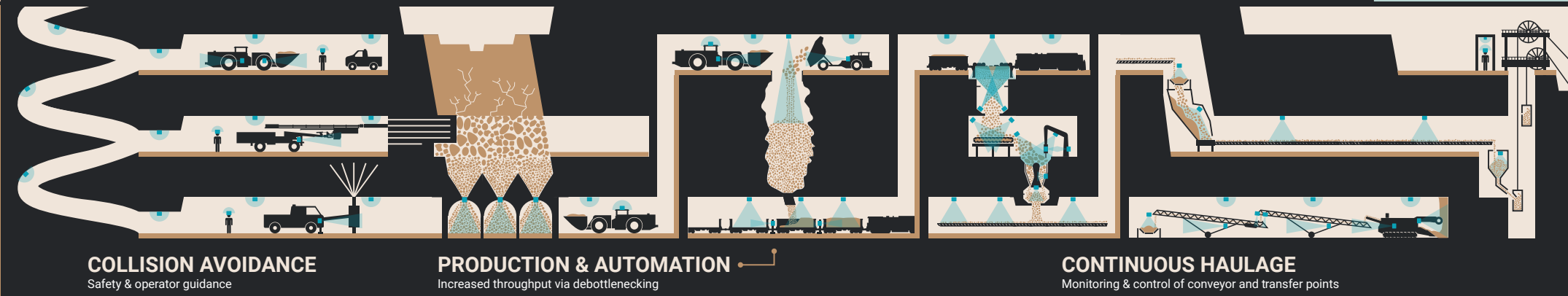


TRAIN LOGISTICS
Increased payloads & reduced waste

STOCKYARD MANAGEMENT
Enhanced efficiency via remote control & automation

SHIPLOADING
Make export safe, fast and plannable

UNDERGROUND MINING



COLLISION AVOIDANCE
Safety & operator guidance

PRODUCTION & AUTOMATION
Increased throughput via debottlenecking

CONTINUOUS HAULAGE
Monitoring & control of conveyor and transfer points

OUTPUT PRODUCTION VOLUME		QUALITY PRICE	COST EFFICIENCY	ESG LICENSE TO OPERATE	\$
MACHINE AVAILABILITY Less downtime by reduced collisions / peak load / over-torque / chute block / unscheduled maintenance	MACHINE PRODUCTIVITY More performance by reduced cycle times / Process control, transparency, efficiency	PRODUCT QUALITY Blending & End2End reconciliation / Homogenization and less variation	CAPEX DOWN Capital costs by debottlenecking / working capital reduction OPEX DOWN automation & machine protection / wear reduction / LCC / spillage reduction	IMPROVE SAFETY & ENVIRONMENT collision avoidance & automation / Reducing emissions with water spray	LEVER

FROM OPERATIONS TO ESG: MAXIMIZING MINING PROFITS BY EMPOWERING EVERY STAKEHOLDER

SAFETY / CAS / PDS

iProximity providing CAS / PDS for personnel and assets like balanced machines and vehicles

SUPPORT OF ELECTRIFIED MINES

iPosition allows automation of complex electrified crushing & conveying equipment replacing diesel

REDUCED ENERGY CONSUMPTION

iBelt empowers intelligent load-based belt speed control

REDUCING CO2 IN TRANSPORT

iLoadout allows reducing the number of trains required through optimising loaded ore per car

REDUCING DUST EMISSIONS

iStacker reduces the free dumping height at ROM and product piles

REDUCING SPILLAGE & EMISSIONS

iShiploader provides hatch selection and path planning in ship loading and unloading

REDUCING WEAR & WASTE

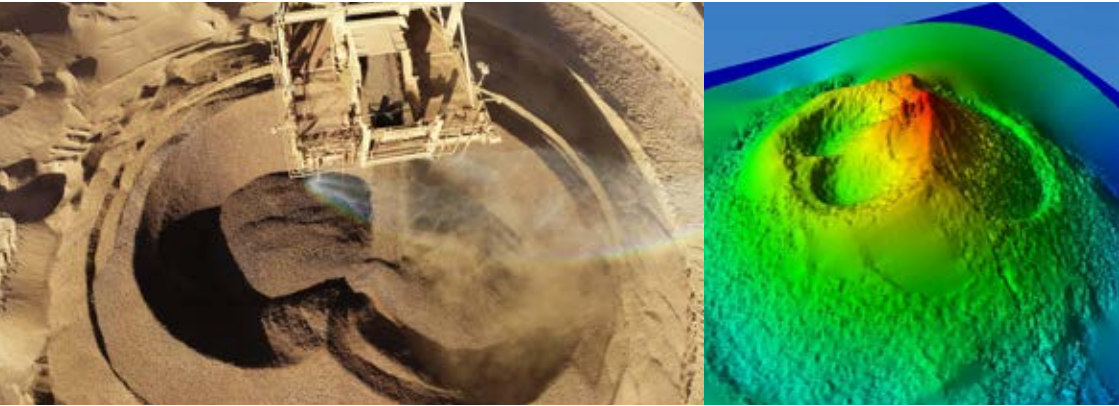
iApron is extending the useful life of equipment through operation monitoring and adjustments

DRIVING OPERATIONAL EXCELLENCE ACROSS THE MINING VALUE CHAIN

We drive the mining industry's EBIT with significant leverage, serving various stakeholders including Operations, Production, Maintenance, Process Control, Big Data & IoT, Metallurgy, Sales, Finance, ESG, and Safety.

At indurad, we empower mining operations with cutting-edge RADAR & RTLS solutions designed to optimize production, enhance safety, and reduce environmental impact. Our technologies enable real-time data capture and analysis, helping businesses drive efficiency in output, cost control, and sustainability - from reducing dust and CO₂ emissions to supporting electric mines and increasing equipment lifespan.

indurad's solutions address the diverse needs of operations, from reducing energy consumption to improving safety protocols. With a focus on delivering fast ROI and aligning with ESG priorities, our systems deliver measurable results, ensuring your mining operations are optimized for today and the future.



INDURAD SMART RADAR: EXCEPTIONAL PRECISION AND ENDURANCE UNDER EXTREME CONDITIONS

PROVEN EIGHT YEARS MEAN TIME BETWEEN FAILURES (MTBF)

Unlike LiDAR or laser systems, radar technology maintains its precision and accuracy even in the most demanding environmental conditions. Its ability to penetrate dust, dense fog, extreme cold, and intense heat makes it an unmatched solution in mining, bulk logistics, and underground operations, where extreme dust, moisture, and temperature fluctuations are common. indurad's radar solutions ensure consistent performance and reliability where other systems struggle.

With over 15 years of experience in radar sensor manufacturing, we have established a proven MTBF of 8 years, forming the foundation of our Lifetime Warranty (see service section).



RADAR SENSORS

1D Level | 2D Profile | 3D Volume
iLDR LinearDynamicRadar

Radio Detection & Ranging

iSDR ScanningDynamicRadar



iLDR-C-1D



iLDR-M-1D



iSDR-M-2D



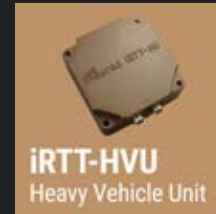
iSDR-P-3D

RTLS SENSORS

Proximity Detection | Collision Avoidance
iRTT RadioTransponderTag

Real-Time Location System

iRTT-CP Personnel Tag



iRTT-HVU
Heavy Vehicle Unit



iRTT-LVU
Light Vehicle Unit



Helmet Tag



Cap Lamp Tag

GNSS & INERTIAL SENSORS

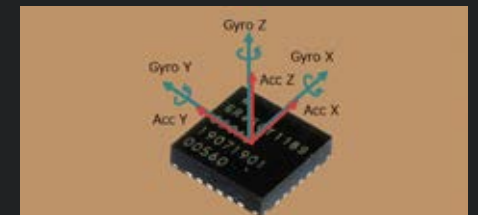
Machine Positioning | Collision Avoidance
iSMU StateMeasurementUnit

Global Navigation Satellite System
GPS, Galileo, Beidou, Glonass

3x Accelerometer & 3x Inclinometer
MEMS chipset in all indurad sensors



iSMU-D





EFFORTLESS DEPLOYMENT WITH INDURAD'S EASY COMMISSIONING KITS

OFFERING

indurad's Easy Commissioning Kits provide solutions that are „productized“ into off-the-shelf hardware, enabling a DIY installation approach. These kits come with local support, ensuring a seamless setup process for users.

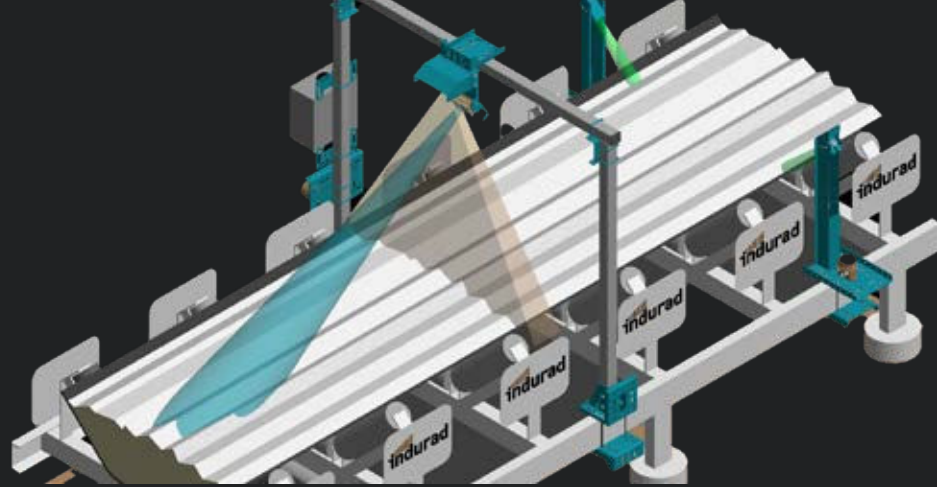
SCOPE

The kits include hardware paired with standard software for easy integration. If needed local commissioning support ensures that users can quickly deploy and configure the system to meet their specific operational needs.

MARKET

Designed for standardized applications, indurad's solutions cater to industries such as mining, bulk materials, cement production, quarries, and agriculture, ensuring broad usability across key sectors.





BULK MATERIAL FLOW & BELT MONITORING

- › For volume reconciliation & production control
- › Allows feed optimization & belt monitoring
- › Contact-free sensing with no maintenance required
- › Reliable radar for operation under all environmental conditions
- › Can be commissioned by the customer

SOLUTION MODULES

VOLUME MEASUREMENT (m³, yd³, ft³)

MATERIAL SPEED MEASUREMENT

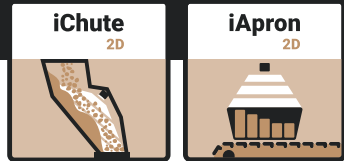
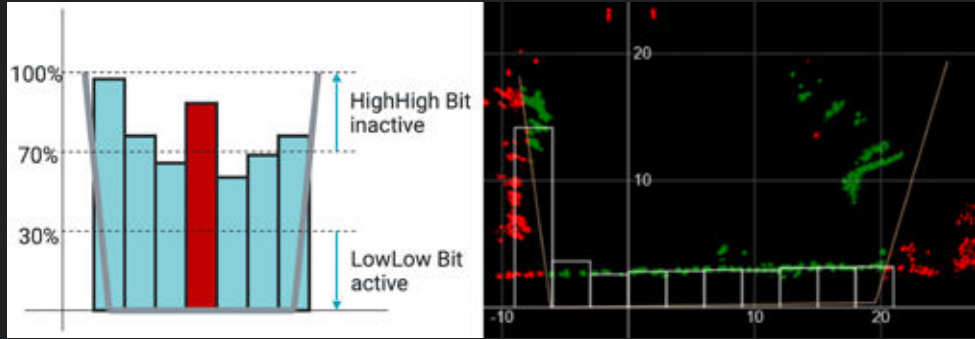
BELT MISALIGNMENT TRACKING

BELT FREEBOARD MEASUREMENT

DENSITY CALCULATION

4G / 5G / STARLINK CONNECTIVITY





2D LEVEL FOR FEEDER CONTROL, CHUTE BLOCK & SCREEN BED

- › 2D contour measurement horizontal over apron feeder | vertical along the chute
- › Reduced downtime and micro-stoppages
- › Software-defined tripping point
- › Increased throughput and dynamic setpoint control
ideal in conjunction with iBeltVOLUME & iBeltALIGN

SOLUTION MODULES

UP TO 10 LEVELS "VIRTUAL BINS"

BUILD UP DETECTION

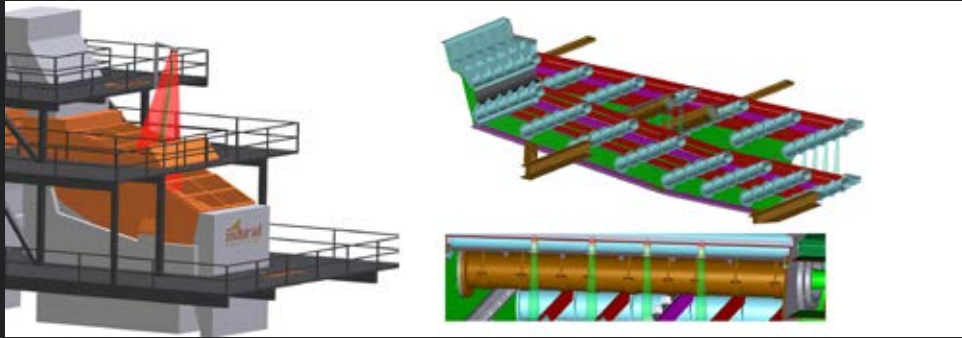
MATERIAL DISTRIBUTION

APRON FEEDER FLOW CONTROL

REMOTE VISUALIZATION

SOFTWARE THRESHOLDS





iScreen



DISCOVER UNKNOWN PARAMETERS OF MULTI VARIABLE PROCESS

- › Online Control Loop use of Output Data: Control distribution valves
Adjust material flow | Adjust exciter frequency | Adjust water use
- › Quality Control: Avoid screen overflow and contamination of oversize
- › Maintenance Team use of Output Data:
Detect partial blockages across the feed
- › Design Team use of Output Data:
Analyse Effective screen Area | Optimize Deck Inclination

SOLUTION MODULES

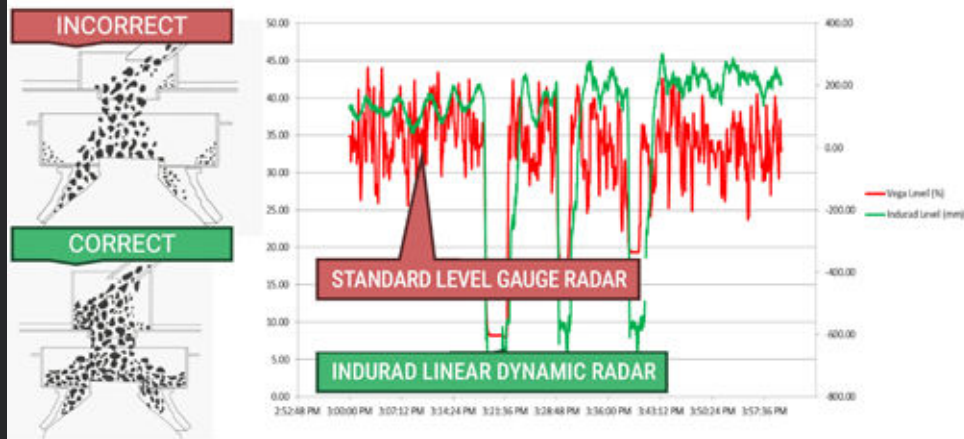
LIVE VOLUME FLOW [m³]

LIVE FLOW / SPEED [m/s]

3-AXIS ACCELEROMETER
SENSING ORIENTATION

3-AXIS GYROSCOPE
SENSING ANULAR VELOCITY





MAINTAINING CHOKE FEED SWEET SPOT TO RAISE THROUGHPUT

- › Sensing under high ore dynamics
- › Sensing in narrow metallic environment
- › High measurement rate of >1000Hz for real-time averaging
- › Stable signals for optimal feeder control
- › Outperforming ultrasonic and level gauge radar

SOLUTION MODULES

LEVEL MEASUREMENT

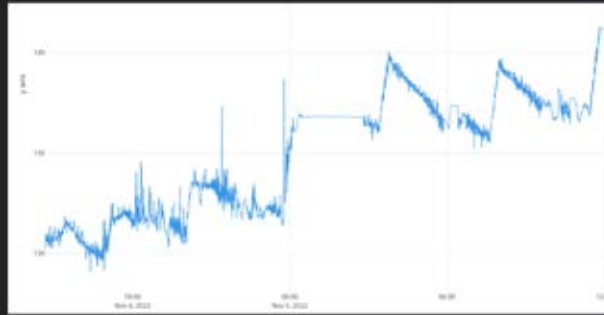
MULTI TARGET TRACKING

CUSTOM NOISE FILTERING

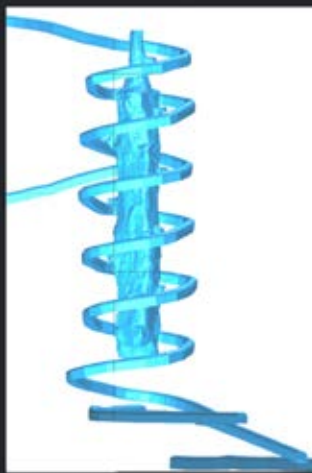


EXAMPLE: 200m DEEP ORE PASS NORWAY

Fill Level (m)



24 hours



iLevel
1D



HIGH FOCUS, HIGH RANGE SENSING WITH CUSTOMIZED NOISE FILTERING

- › Unique till 200m underground and >1000m on surface
- › Allow filtering of falling ore
- › Unique beam focus of $\pm 1^\circ$
- › Full web-based spectrum viewer
- › Multi-target / echo processing (wall to ore level separation)

SOLUTION MODULES

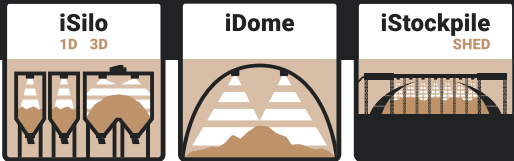
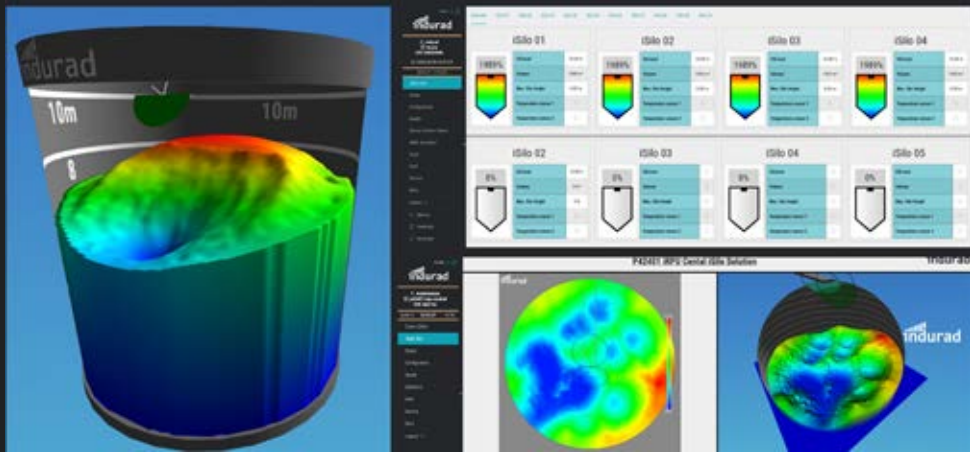
1D LEVEL MEASUREMENT

MULTI TARGET TRACKING

ORE SURFACE TRACKING

BUILDUP MONITORING





INVENTORY CONTROL 3D VOLUME & 1D LEVEL

- › 1D: Level measurement
- › 3D: Full volume measurement for advanced inventory control
- › ATEX and high-temperature sensor enclosure available
- › Replaces expensive and time-consuming manual surveying
- › Valuable data for segregation control

SOLUTION MODULES

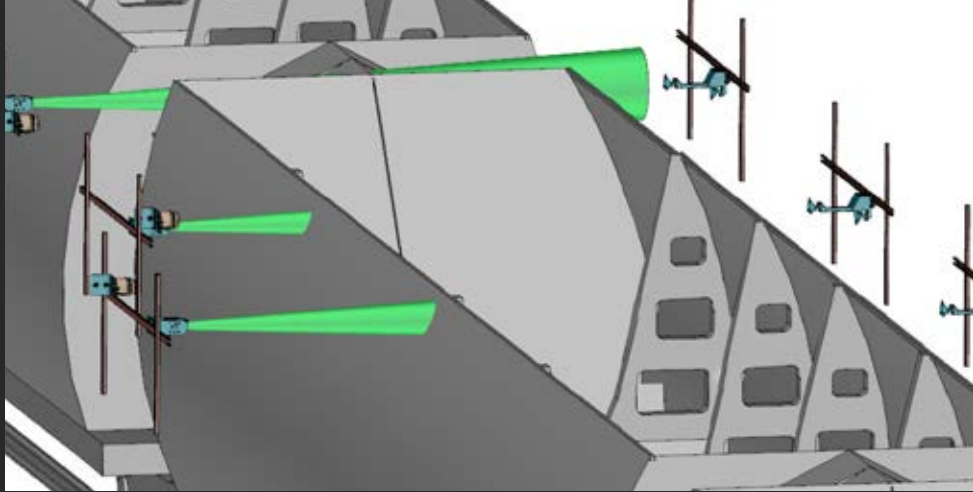
VOLUME CONTROL

DEAD MATERIAL IDENTIFICATION

FEEDING HEIGHT IDENTIFICATION

MATERIAL DISTRIBUTION





PE-CELL REPLACEMENT

- › High Speed PoE iLDR-C Radar
- › Low latency 15ms measurement interval
- › Ideal replacement for photoelectric bells / light barriers
- › Ideal replacement for hydraulic cylinder linear transducers
- › Not impacted by dirt, dust, sunlight, birds
- › Provides travel direction by double target reflector

SOLUTION MODULES

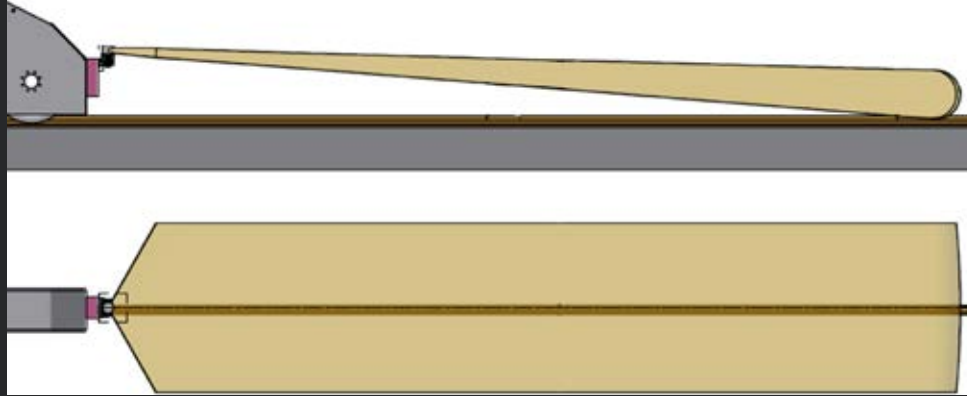
DISTANCE MEASUREMENT

TRAVEL DIRECTION

GAP DETECTION

TARGET DETECTION





1D & 2D RADAR CAS FOR MACHINES & VEHICLES

- › Passive Collision Avoidance Sensors
- › Based on 1D RADAR or 2D RADAR
- › For CAS on balance machines and bogie CAS for rail-bound machines
- › Reverse CAS for heavy vehicles like trucks or wheel loaders
- › Not impacted by rain, dust, dirt or light conditions

SOLUTION MODULES

MULTI ZONES

POLYGON CAS ZONING

RAIN / WATER SPRAY FILTERS

HMI VISUALIZATION





SURFACE & UNDERGROUND LEVEL 9 CAS/PDS

- › Proximity Detection / Collision Avoidance / Vehicle Interaction
- › Dual frequency Sub1GHz & UWB: 150m range straight / 50m around corners
- › Access control, tracking & doppler speed sensing
- › Optional V2I passive radar extension by iProximityRADAR
- › Cap lamps 14h life, up to 230 lumen, cordless inductive charging
- › Optional dozer/truck localization on stockpile / in warehouse

SOLUTION MODULES

„V2“ & V2P: VEHICLE & PERSON	V2I VEHICLE 2 INFRASTRUCTURE
ISO 21815 LEVEL 9 COMPLIANT	INTERACTION REPLAY SERVER
TRACKING & ACCESS CONTROL	VEHICLE DATA LOGGING J1939





ACTIVE & PASSIVE MULTI LAYER DRILL SAFETY

- › Choice of passive iSDR-2D RADAR and / or active 2D iRTT RTLS
- › Intrinsically Safe iLDR-1D RADAR for Drillrig CAS
- › Various interlocking options for drill rig
- › No sensitivity to dust and fog
- › Automatic wall / rib filtering

SOLUTION MODULES

DRILL ROD SAFETY BY iLDR-1D

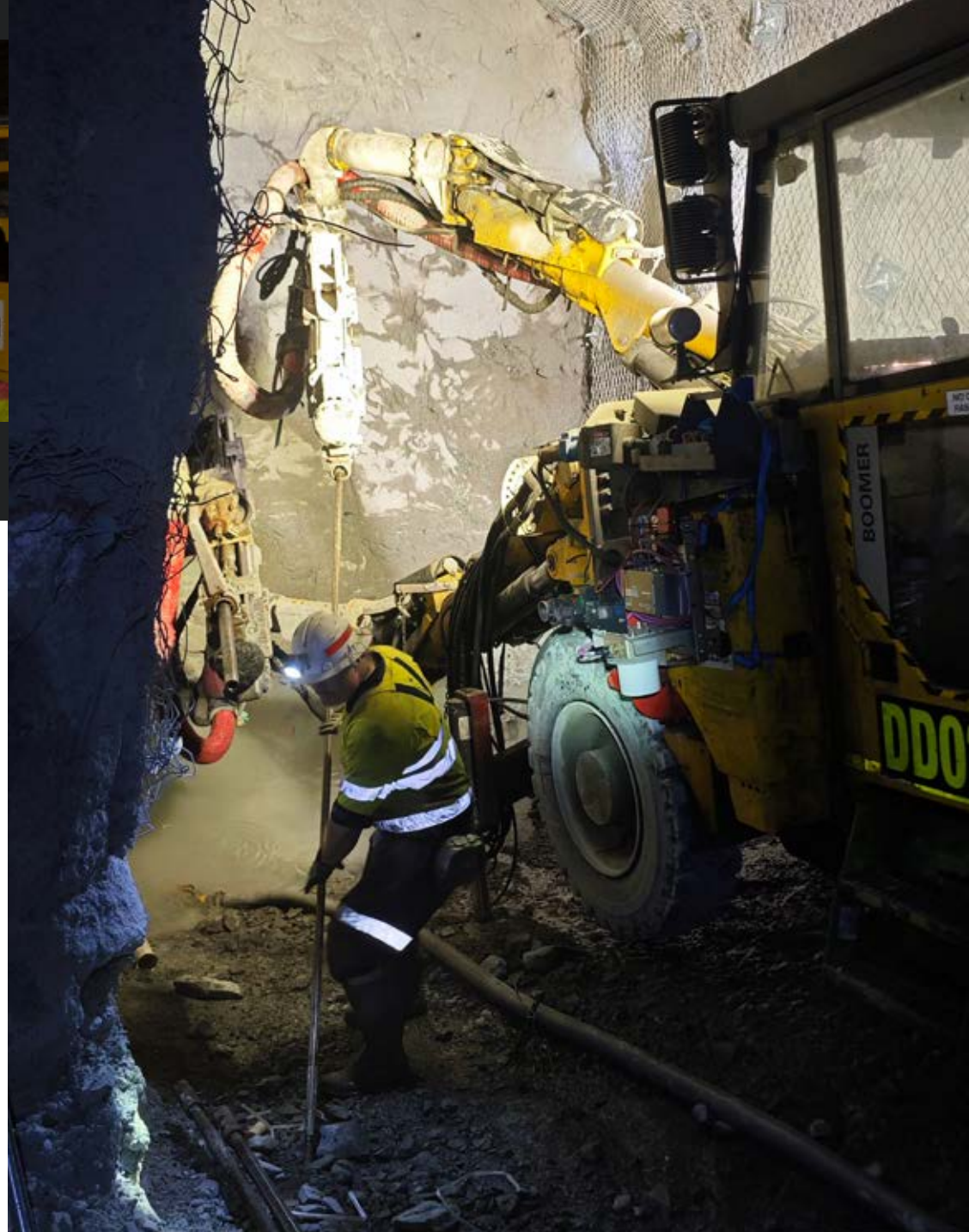
3D VISITOR SAFETY BY RTLS

DRILL JUMBO SAFETY BY iSDR-2D

INTERLOCKING

iPROXIMITY RTLS COMPATIBLE

CAMERA LOGGING OPTION





TAILORED, FULL SCOPE SOLUTIONS FOR MINES, PROCESSING PLANTS AND PORTS

OFFERING

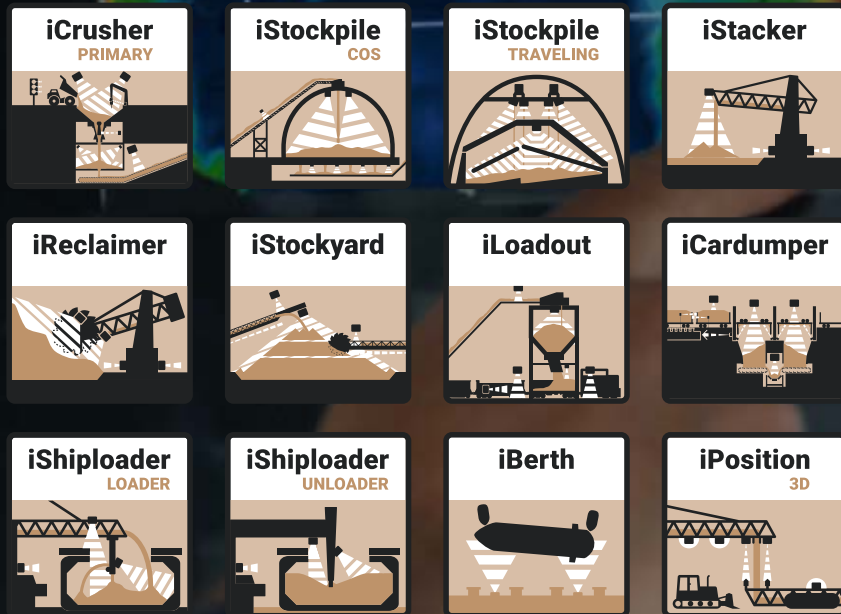
indurad delivers a full-scope portfolio of high-value, tailored solutions for mining, processing, and port operations, incorporating complex kinematic machine models for precision and efficiency.

SCOPE

Our solutions include hardware integrated with customized software, engineering services, remote commissioning, and ongoing maintenance through Service Level Agreements (SLAs), ensuring continuous optimization.

MARKET

indurad's primary focus is on serving mining clients across a wide range of commodities, providing adaptable and scalable solutions for diverse industry needs.





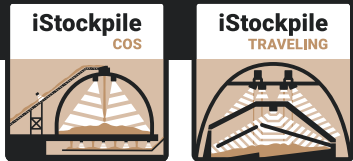
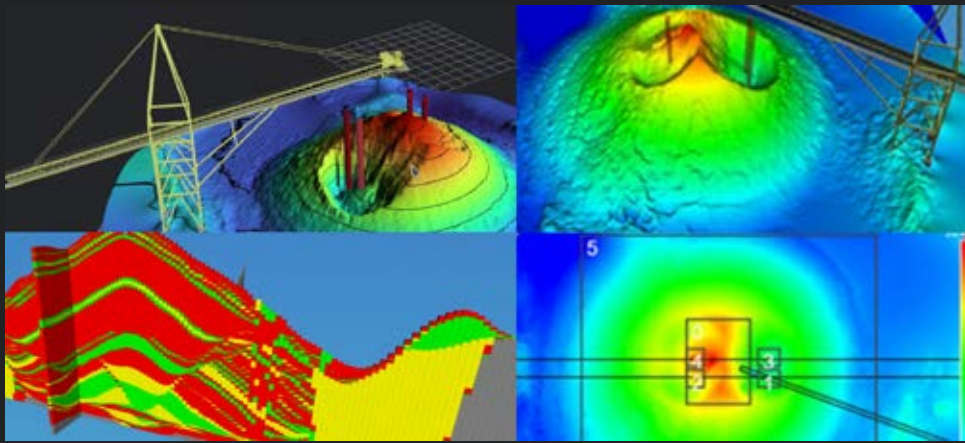
PRIMARY CRUSHER BOOST BY DIGITAL REALITY SCAN

- › Robust & accurate sensing under water spray and dust
- › Traffic light automation & fleet management FMS interface
- › Dump pocket monitoring
- › Truck presence and state monitoring
- › Boost Plant & OEE: Vault scan - 3D bunker, 2D apron or 1D bin
- › Boost availability up to +29%: blockages resolved quickly.
- › Boost productivity up to +21%: control the truck feed rate

SOLUTION MODULES

TRUCK DUMPING STATUS	BLOCKAGE DETECTION
DUMP POCKET SCAN	CRUSHER BIN 1D LEVEL
MATERIAL FLOW IN M³/S	APRON FEEDER 2D PROFILE





HIGH RANGE STOCKPILE 3D | 4D | 5D FOR FIXED & TRIPPER CAR FEED

- › Stockpile volume history, extended reporting, & stockpile visualization
- › Belt Inflow / Outflow volume reconciliation & reclaim feeder control
- › Multi sensor partial overlapping setup with high range iSDR-H-3D
- › Scan from tripper, portal, crane or fixed installation
- › Indoor dozer positioning and draw point safety / interlock

iSTOCKPILE SOLUTION MODULES

3D STOCKPILE VOLUME INFORMATION

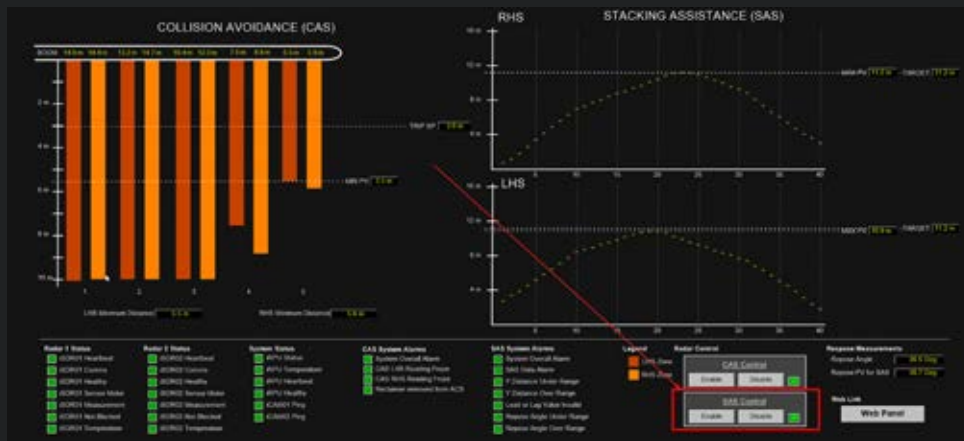
4D MATERIAL AGE INFORMATION

ANGLE OF REPOSE INFORMATION

4D MATERIAL QUALITY INFORMATION

DOZER LOCALIZATION

5D MATERIAL FLOW INFORMATION



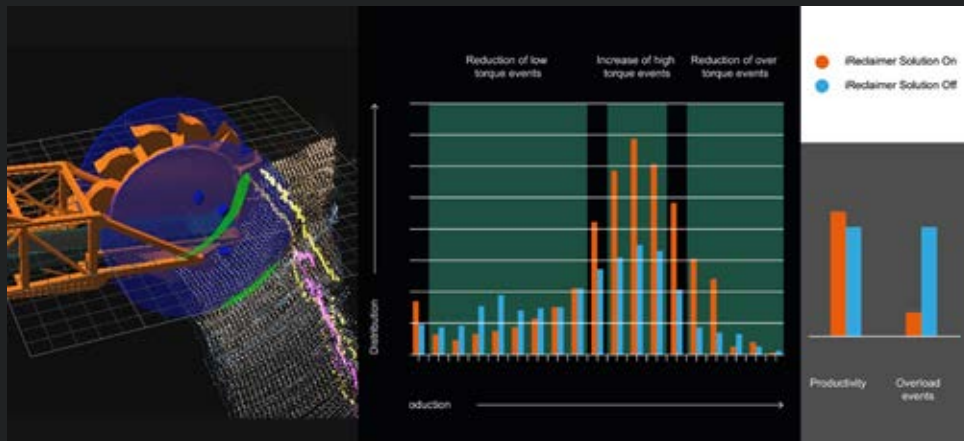
STACKING CONTROL & ANTI COLLISION

- › Increases stockyard volumetric capacity utilization
- › Reduces collisions Boom2Pile and above Rail
- › Optimizes stacking pattern for more efficient reclaiming
- › Dust mitigation by adaptive luff angle and stacking height
- › Basis for quality management and reconciliation with iStockyard4D
- › Dust mitigation by adaptive luff angle and stacking height

SOLUTION MODULES

STACKING ASSISTANCE	2D BOOM TO PILE DISTANCE
DUMP HEIGHT CONTROL	COLLISION AVOIDANCE
FACE-UP WITH I STOCKYARD 3D	MACHINE POSITIONING





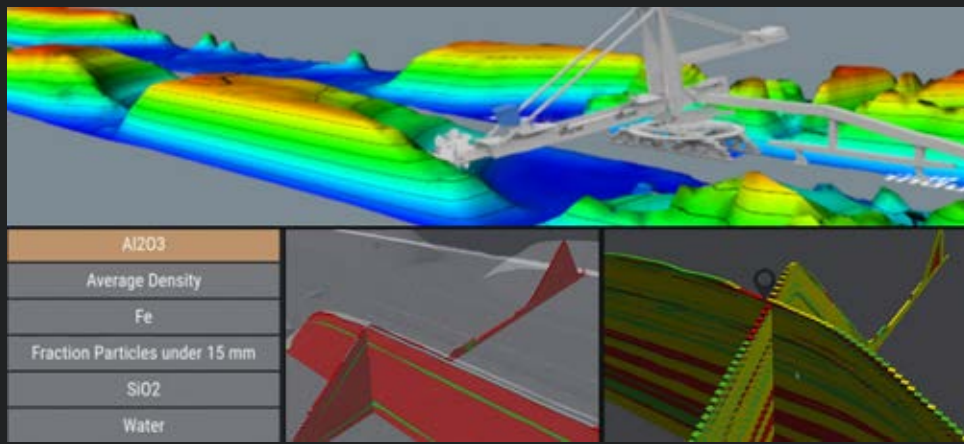
RECLAIMING CONTROL & PRODUCTIVITY BOOST

- › Predictive volume & cutting automation
- › Scalable from operator assistance to autonomous operation
- › Machine throughput ~+10% & higher setpoint conformity (net rate tph)
- › Increasing uptime & machine life by ~50% reduced over-torque
- › Reliable machine positioning by GNSS and RADAR SLAM
- › Extra benefits with iStockyard 3D, 4D quality tracking and iBelt

SOLUTION MODULES

CUTTING DEPTH ESTIMATION	COLLISION AVOIDANCE
BENCH HEIGHT ESTIMATION	FACE-UP WITH ISTOCKYARD 3D
ADAPTIVE SLEW CONTROL	MACHINE POSITIONING





Perspective view, Top view

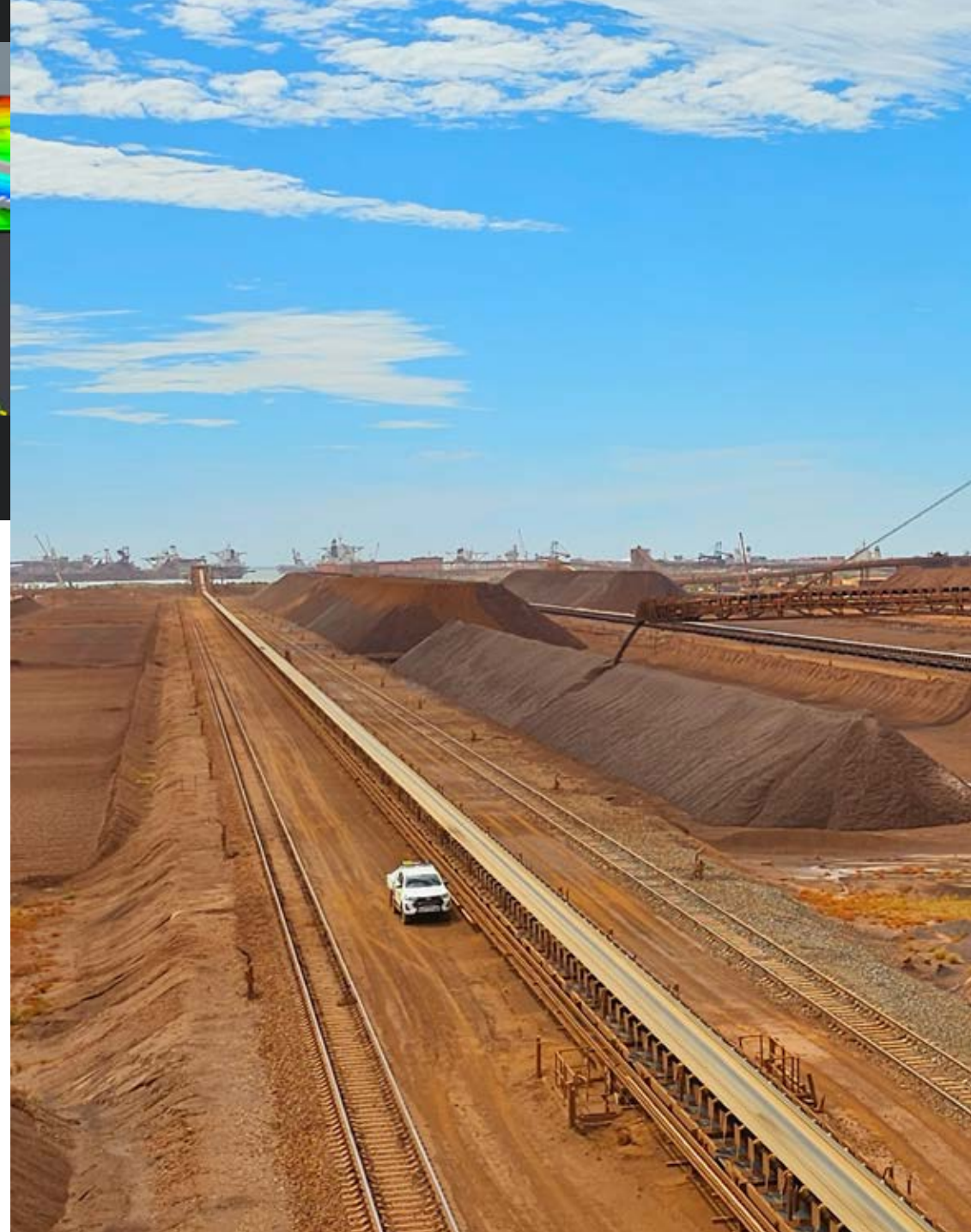


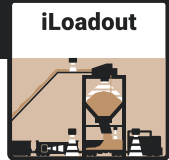
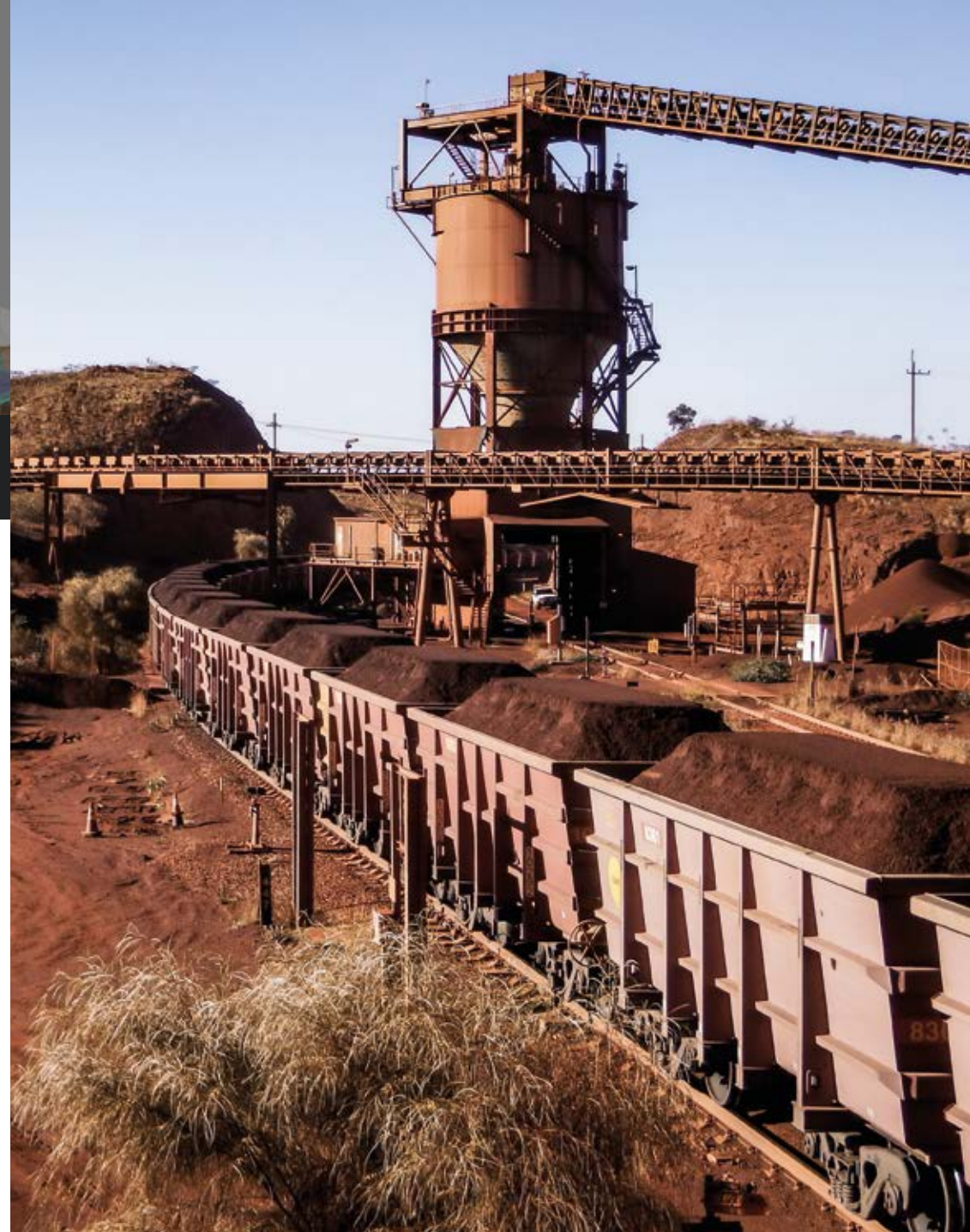
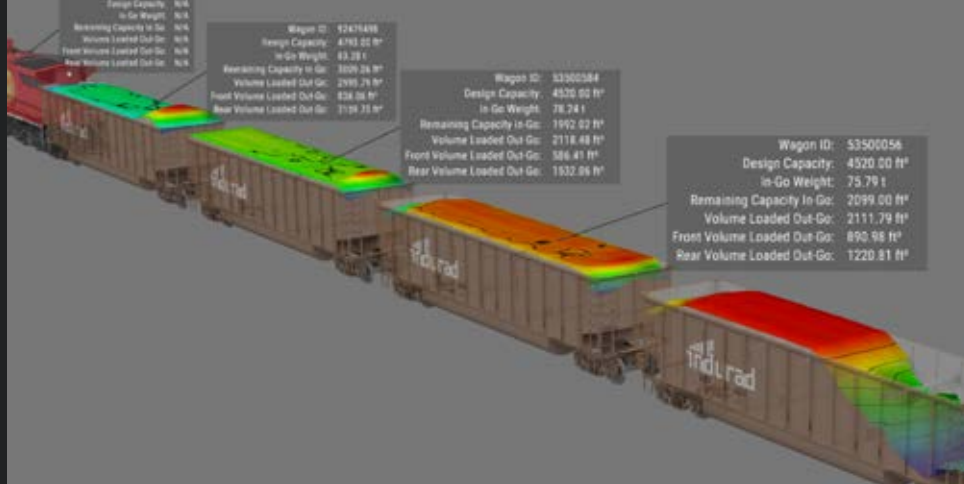
FULL VISIBILITY OF YOUR STOCKYARD

- › 3D Online real-time surveying by iStacker or iReclaimer
- › Increases stockpile volume accuracy and ore grade distribution along stockpile
- › 4D Stockpile quality control with cross belt analyser or LIMS data
- › Sell ore at higher price by quality control, blending, homogenization
- › Reconciliation for supply chain and metallurgy
- › Various extra process control benefits with iStacker or iReclaimer

SOLUTION MODULES

CUTTING DEPTH ESTIMATION	COLLISION AVOIDANCE
BENCH HEIGHT ESTIMATION	FACE-UP WITH ISTACKYARD 3D
ADAPTIVE SLEW CONTROL	MACHINE POSITIONING





ADVANCED SENSING & PROCESS CONTROL MORE ORE | MORE TRAINS | MORE SAFETY

- › Radar-based control solution for train & truck loadout systems (TLO)
- › Enables process optimization, automation, & inventory control
- › Reduces over / underloading (improving compliance)
- › Increases train speed by 10-30% & load by 1-3 tons per car
- › Ensures uniform axle loads

SOLUTION MODULES

TRAIN SPEED MEASUREMENT	WAGGON IDENTIFICATION
VOLUMETRIC WAGGON CONTROL	RESIDUAL MATERIAL CHECK
WAGGON LOAD DISTRIBUTION	+ 11 MORE ON INDURAD.COM



BIN603

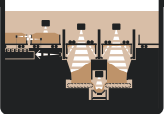
BIN603 Percentage Full 52.1 %
 BIN603 Height 4.7 m
 BIN603 Volume 92.4 m³

BIN604

BIN604 Percentage Full 65.9 %
 BIN604 Height 4.7 m
 BIN604 Volume 108.8 m³

Easy retrofit and integration into existing PLC/SCADA system

iCardumper



IMPROVE RELIABILITY & AVAILABILITY IN INLOAD

- › Process optimization in rail car dumper/waggon tippler
- › Indexer positioning, waggon identification, apron level control
- › Significantly reduce wear & damage to cardumper & apron feeder
- › Reliable measurement in harsh installation environments

SOLUTION MODULES

INDEXER POSITIONING

INDEXER GAP POSITIONING

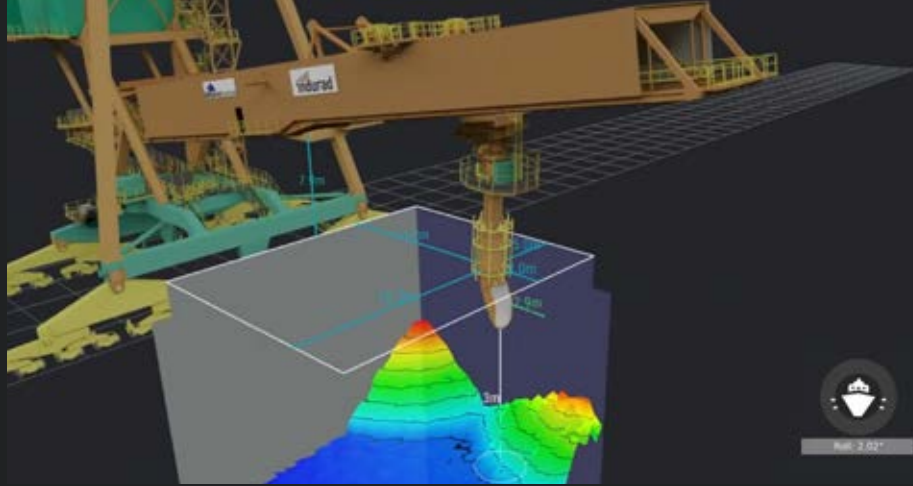
WAGON CLASSIFICATION

APRON FEEDER CONTROL

RESIDUAL MATERIAL CHECK

OUTGOING BELT VOLUME





COLLISION AVOIDANCE, REMOTE CONTROL & AUTOMATION

- › Fully autonomous loading & unloading
- › Ship-hold mapping, hatch size & limit detection
- › Central control & visualization of the entire berth operation
- › Reduces crew exposure to hazardous operations

SOLUTION MODULES

COLLISION AVOIDANCE

REMOTE CONTROL

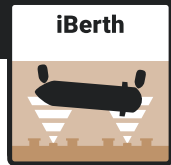
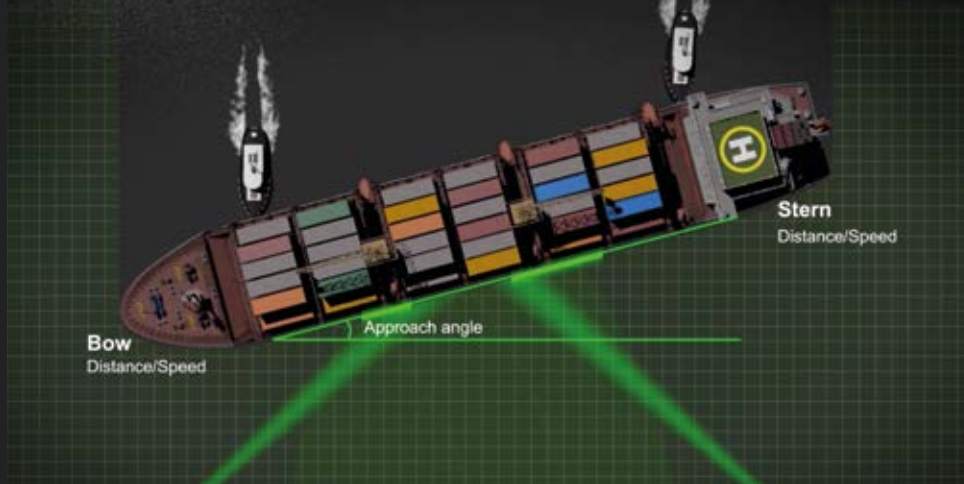
LOADING ASSISTANCE

FULL AUTONOMOUS AUTOMATION

SHIP ROLL, PITCH, YAW

+ 5 MORE ON INDURAD.COM





VESSEL BERTHING & DOCKING CONTROL

- › Static 1D monitoring against uncontrolled vessel movements
- › Dynamic 2D docking monitoring allowing safe mooring (angle, distance, speed)
- › Cost saving in mooring & avoiding fender damage
- › Measures water level (e.g. tide) & wave height
- › Every vessel uses radar - not lidar - works in rain, fog, dust
- › Dynamic 3D ship roll / list with iShiploader

SOLUTION MODULES

DISTANCE STERN / BOW

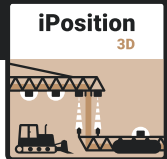
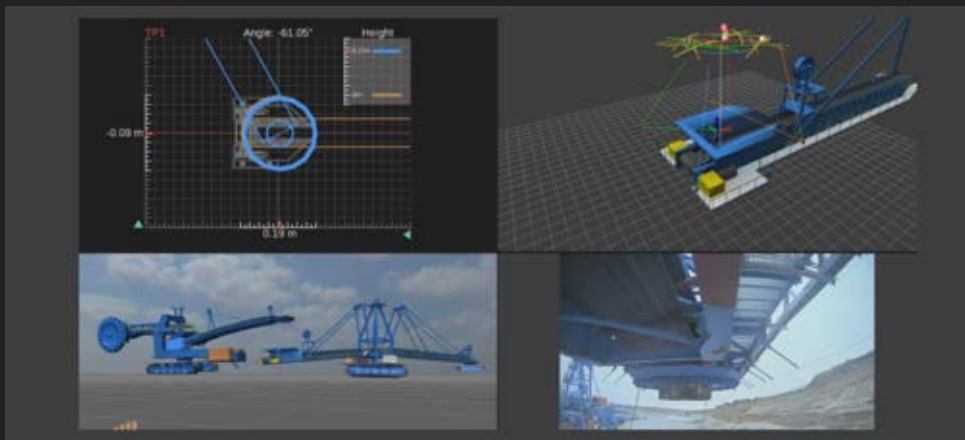
APPROACH ANGLE

APPROACH SPEED

TIDAL & WAVE HEIGHT

SHIP ROLL / LIST





REAL TIME 3D POSITIONING & CAS OPEN PIT & UNDERGROUND

- › Versatile positioning solution for mobile mining machinery
- › Reliable with 2-out-of-3 (2oo3) fail operational design by sensor fusion of RADAR, GNSS and RTLS
- › For bucket wheel excavators, shovels, belt waggons, spreaders, & mobile crushers
- › Automation, (remote) control, & collision avoidance

SOLUTION MODULES

TRANSFER POINT POSITIONING

OPERATOR ASSISTANCE

COLLISION AVOIDANCE

MACHINE POSITIONING

TERRAIN SCANNING

FULL AUTOMATION





ADVANCED OEM SENSOR HARDWARE FOR INDUSTRIAL PRECISION AND INNOVATION

OFFERING

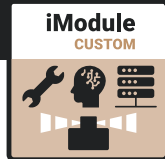
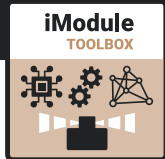
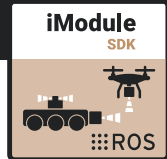
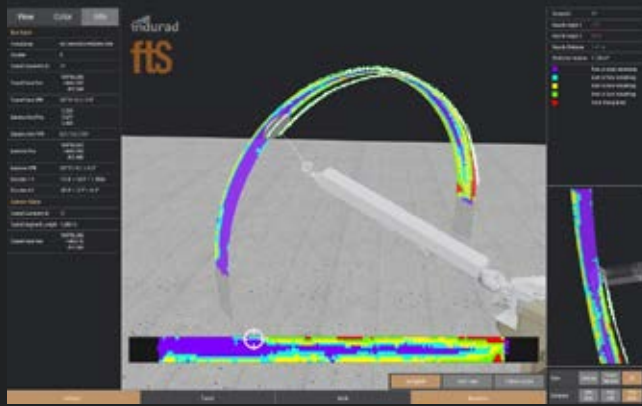
indurad provides OEM sensor hardware, including proprietary radar sensors, radio transponders, and supporting hardware to enhance industrial operations.

SCOPE

Our solutions feature hardware with a standard Software Development Kit (SDK), access to the premium TOOLBOX suite, or fully customized application engineering tailored to specific needs.

MARKET

indurad sensors are designed for a wide range of applications, including autonomous vehicles, mining, tunneling, metallurgy, and indoor localization, supporting both current and future industrial advancements.



SENSORS WITH GIGABITS OF RAW DATA CUSTOM SOFTWARE ON DEMAND

- › The world's best radar sensors for industry and outdoor robotics
- › SDK Software Development Kit with ROS2 Interface
- › Optional signal processing toolbox (SLAM, FFT, CFAR, ..)
- › Custom software engineering on demand
- › Lean on-sensor processing | High-performance with external processing unit

SOLUTION MODULES

ROS2	FFT
KALMAN TRACKER	SLAM
PARTICLE FILTER	CFAR



SENSOR HARDWARE PORTFOLIO

RADAR SENSORS

Compact $\pm 3^\circ$ | 10m

C

Midrange $\pm 2^\circ$ | 50m

M

Highrange $\pm 1^\circ$ | >100m

H

LinearDynamicRadar
iLDR-1D



iLDR-C-1D



iLDR-M-1D



iLDR-H-1D

ScanningDynamicRadar
iSDR-2D



iSDR-C-2D



iSDR-M-2D



iSDR-H-2D

DopplerVelocityRadar
iDVR



iDVR

ScanningDynamicRadar
iSDR-3D



iSDR-P-3D



iSDR-H-3D

RTLS SENSORS

Antenna Unit
iRTT-AU




- > Daisy Chain PoE supply by iRTT-SB
- > UWB Tracking
- > Sub1GHz presence detection & commanding

Light Vehicle Unit
iRTT-LVU



- > Integrated iDVR doppler radar
- > UWB Tracking
- > Sub1GHz presence detection & commanding

Switch Box
iRTT-SB



- > Network switch between iRTT-AUs
- > PoE to iRTT-AUs
- > iRTT clock synchronization in sub 1ns space

Client Personnel
iRTT-CP



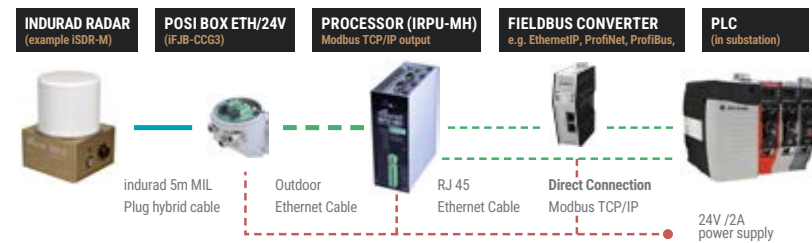
- > Basis is KSElights IXR lamp
- > 14hr life and up to 230 lumen
- > UWB Tracking & Sub1GHz Location

SEAMLESS INTEGRATION WITH INDURAD'S MODULAR SENSOR TECHNOLOGY

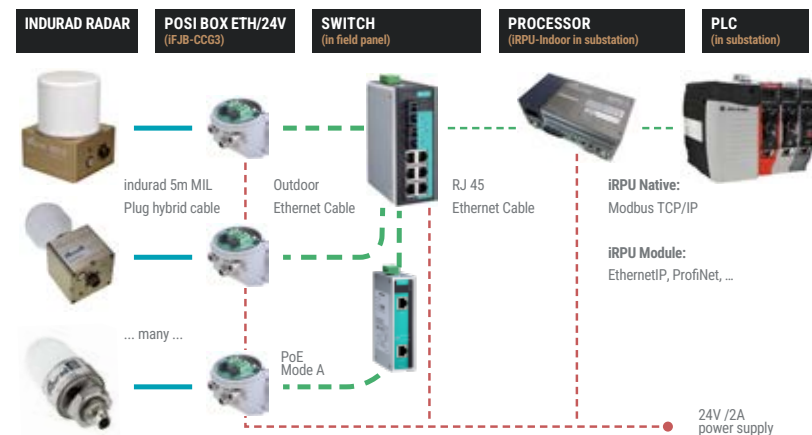
MODULAR, EASY-TO-INTEGRATE SENSORS WITH SIMPLIFIED MAINTENANCE

indurad's sensor integration is modular, with all sensors functioning as Ethernet devices. They come with a connection cable and an indurad-designed ETH/24V field junction box. This setup simplifies cabling and maintenance by using standard 24V power and outdoor Ethernet cables, easily installed in cable trays to the nearest field panel or substation. For plant solutions, fiber optic connections between the field panel and substation are recommended for optimal performance.

SINGLE-LAYOUT EXAMPLE WITH IRPU-MINI IN FIELD PANEL



PLANT-LAYOUT EXAMPLE WITH IRPU-INDOOR IN SUBSTATION



FULL EMPOWERMENT BY HTML5 WEB INTERFACE ON IRPU

WEB INTERFACE FOR OPTIMIZED OPERATIONS AND TROUBLESHOOTING

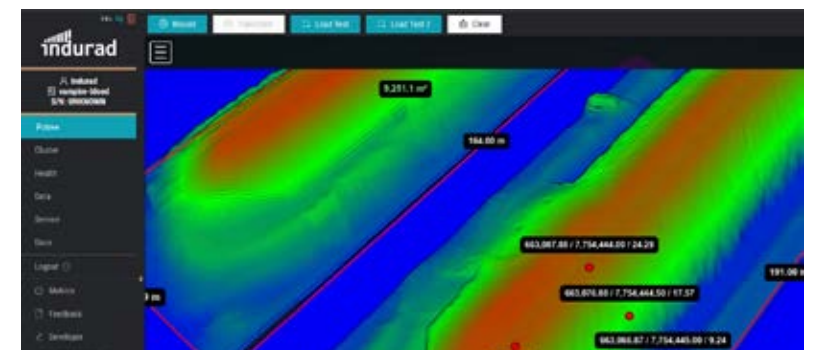
All our sensors, products, and solutions feature a modern web interface, installed on both the sensor and the Radar Processing Unit (iRPU). This interface offers tailored and user-configurable access management for different roles:

- Operations / Supply Chain / Production: Live graphical dashboards and solution cockpits with data export functions for real-time insights.
- Maintenance / Process Control / IT: Comprehensive status information, including error trees for efficient troubleshooting and system optimization.

IWEB SPECTRUM VIEW & ERROR TREE



IPCT POINTCLOUDTOOLBOX



SERVICE LEVEL AGREEMENT

SLA & LIFE TIME WARRANTY

CERTIFIED RELIABLE SENSORS

SLA & LIFETIME WARRANTY

indurad offers three tailored Service Level Agreements (SLA) to meet diverse needs:

- **BASIC - Keep it alive**
- **STANDARD - Sustain it**
- **PREMIUM - Improve it, continuously**

All packages include 24 / 7 support and clearly defined services. While SLAs are recommended, they are not mandatory.

With any SLA, we provide a lifetime warranty backed by an impressive 8-year Mean Time Between Failures (MTBF). Our first sensors, deployed over 15 years ago, continue to operate 24 / 7. Certified by a third-party body following MIL-HDBK-217 VITA 51.1 standards, the MTBF calculation confirms over 10 years of reliability for fixed assets, supported by our in-house statistics.

Additionally, with an SLA, we offer sensor replacements with a 12.5% credit for each remaining year of life, or an optional 100% waiver available for just 3% of the sensor price per year when purchased.

WORLD-CLASS QUALITY & CERTIFICATION

Since 2008, indurad has maintained ISO 9001 certification from TÜV Rheinland. We also hold Hazloc / ATEX certifications (IEC 60079), IECEx certification, and other product-specific approvals from certified bodies, ensuring the highest industry standards.



PACKAGES INCLUDE:

PACKAGE A GETTING THE BASICS IN PLACE	› TRAINING › AUDIT › REMOTE ACCESS
PACKAGE B ON-CALL AVAILABILITY & SUPPORT	› 8/5 HELPLINE › 24/7 HELPLINE
PACKAGE C SOFTWARE PEACE OF MIND	› DIAL-IN STATUS CHECKS › SOFTWARE MAINTENANCE › SOFTWARE UPGRADES › SOFTWARE DEVELOPMENT › PLC TREND ANALYTICS
PACKAGE D HARDWARE WARRANTY	› LIFETIME WARRANTY › SCHEDULED REPLACEMENT › HARDWARE DISCOUNT





- 
Dust
- 
Snow
- 
Rain/Water
- 
Ice/Cold
- 
Heat
- 
Contamination
- 
Sand
- 
Low Visibility

VISION BEYOND OPTICAL LIMITS

INDURAD – INDUSTRIAL RADAR

Radar operates similarly to a laser within the electromagnetic spectrum, but with a longer wavelength, making it far less sensitive to environmental conditions like dust, fog, rain, and dirt. Our radar systems have even been successfully installed in blast furnaces at temperature of 600°c, maintaining reliable performance for over 8 years.

Radar is recognized as a critical technology for outdoor autonomy, offering an uncompromised and dependable method for environmental perception in challenging conditions.

RADAR: $\lambda = 4 \text{ mm}$; $D = 3 \text{ mm}$

The illustration highlights our radar's ability to penetrate obstacles like dust, fog, snow, and steam, showcasing a radar wave navigating around a 3 mm dust particle.



RADAR WITH UNMATCHED RANGE AND PRECISION

While LiDAR sensors excel in controlled environments, they may not be the best fit for harsh industrial applications. Why choose LiDAR when radar can outperform in challenging conditions? Radar sensors are designed to withstand:

- Environmental challenges:** Resistant to fog, dust, snow, and rain.
- Sensor durability:** Unlike LiDAR, radar sensors are less vulnerable to dirt and scratches on the sensor window from cleaning.

indurad's industrial radar sensors surpass traditional radar systems, including level gauges, automotive, and airport/traffic radars, in key areas:

- Precision:** Accuracy down to 50 micrometers in hot-rolled steel.
- Extended range:** Over 1000m on the surface and 200m in ore passes.
- High measurement rate:** Up to 20,000 measurements per second.
- Superior dynamic range:** Featuring a 16-bit ADC, comparable to modern cameras.
- Seamless data integration:** Real-time raw data streaming via Gigabit Ethernet with ROS2 support.

In multiple client audits—ranging from iStockpile, iBelt, iLoadout, and iSilo applications—our radar consistently achieved an accuracy rate of 98-99%, even when benchmark comparisons were difficult to define. Accuracy has never been a limiting factor in any application to date.



indurad Headquarters: Aachen, Germany

CORPORATE OBJECTIVES

- 1 **ZERO HARM**
to people and environment
- 2 **ON-TIME DELIVERY**
with highest quality
- 3 **EMPOWER CUSTOMERS**
to make informed decisions
- 4 **ENHANCE USER EXPERIENCE**
by productization of solutions
- 5 **TAKE OWNERSHIP & SHARE**
and do what you say

OUR COMPANY

INDURAD (TECH) INDUSTRIAL RADAR

INDURARE (LAT.) MAKE HARD, HARDEN, IMPROVE

The brand name indurad is derived from “industrial radar” and from the Latin meaning „to improve” and „to ruggedize.”

The indurad headquarters are located in an old water tower, built on an old flintstone mine which has been closed 4000 BC.

A BRIEF HISTORY

Since inventing the world’s first industrial 2D radar for industrial use, 2iDRR (indurad DualRangeRadar), in 2008, our technology and product range have significantly advanced.

indurad’s mission is to make mining and bulk material handling safer and more efficient. We do this by using our own radar sensors and solution framework.

Today, we offer a comprehensive range of radar sensors that boost the productivity and sustainability for our customers in all environmental conditions. indurad counts more than 150 staff all over the world with a diverse LGBTQ+ background and more than 30 nationalities.

Founded in 2008, we are headquartered in **Aachen, Germany**, with service and sales **offices in Australia, Canada, Chile, Brazil, South Africa and Kazakhstan**. In addition, we have an extensive network of OEM and integration partners to serve our customers around the clock, wherever they are.





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