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# iBelt by indurad: radar-based bulk volume scan for process, machine, and inventory control

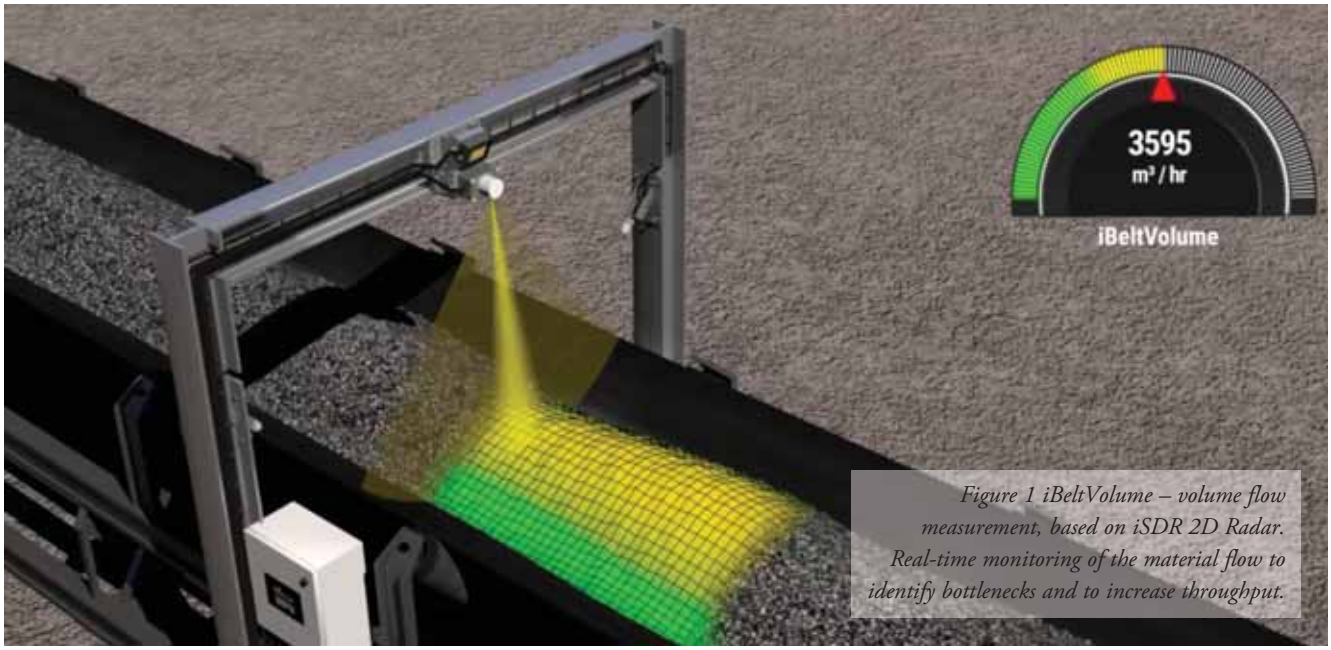


*Figure 1 iBeltVolume – volume flow measurement, based on iSDR 2D Radar. Real-time monitoring of the material flow to identify bottlenecks and to increase throughput.*

indurad's iBelt solution for conveyor belt scanning uses radar technology to measure the volume flow of bulk material on conveyor belts. It reliably measures the conveyor belt's performance and other key performance indicators in real-time. These include material speed for volume flow calculation, belt alignment for better maintenance planning, and conveyor belt freeboard for better utilization of conveyor belt capacity. indurad's iBelt solution is used in bulk handling processes such as loading and unloading of goods in ports and in a variety of other processes that take place in harsh environments.

Conveyor belt material flow scanners typically rely on load cell-based belt scales, laser scanners or radiometric mass flow measurements. However, these solutions have inherent disadvantages:

- Belt scales have a fundamental error in mass calculation due to the fluctuating moisture content of the ore and therefore need to be recalibrated frequently. Process and storage restrictions in handling bulk materials are generally due to the volume and not the mass. Therefore, operational volume flow information is much more valuable than just knowing the mass flow. Load cells or strain gauges must be mechanically integrated in a time-consuming process and need to be recalibrated regularly. Even sophisticated and well-maintained systems deliver measurement errors of 5–10%.
- Lasers require optimal visibility conditions as they are reflected by particles such as dust, rain, fog, snow and steam due to their short wavelength (approximately 1µm). This leads to inconsistent and unreliable measurements. In addition, laser scanners require regular cleaning and maintenance and are therefore cost intensive.
- Radioactive measurements are expensive due to costly transportation, radiation protection and complex hardware and maintenance.

The decisive advantage of radar technology in harsh environments is its long wavelength (approximately 4mm), which is able to penetrate small particles instead of being reflected by them. The influence on the quality of the radar measurements is therefore always minimal. Thus, radar can reliably detect objects behind dust, fog, rain, etc.

In many mining and heavy industry companies where conveyor belts are used, several million Euros are spent annually on their maintenance. indurad customers have reported that conveyor belts are a major cost driver. Traditional trip switches for belt misalignment detection are contact-based and only give feedback when a significant belt misalignment is detected. Therefore, in most cases material has already been spilled. indurad's iBelt solution continuously monitors belt alignment and gives feedback on belt misalignment long before material is spilled to allow for early countermeasures. This also leads to an extension of the service life and a direct and noticeable cost reduction.

The iBelt is unique and impresses with its non-contact measurements, low maintenance requirements, and easy installation — even on inclines/declines and on stacker, reclaimer, and shiploader booms.

For 2D surface profile measurement of the load on the belt, a robust and precise iSDR (indurad ScanningDynamicRadar) sensor is installed above the conveyor belt. To go from a 2D load profile measurement to load volume measurement, the profile information must be combined with a measured or fixed conveyor belt speed value. The volume flow is directly available in cubic metres or cubic yards per second via HMI or PLC/SCADA integration.

To measure the material speed, an iDVR sensor (indurad DopplerVelocityRadar) is installed above the belt with a clear view of the material flow. The iDVR detects both low and high speeds. Measuring the direct material speed instead of the belt speed is especially important for precise results on steep conveyors where material or belt slip occurs more frequently.

iBelt helps prevent conveyor belts from running empty, as it reliably detects both the belt load and belt movement. Conveyor belts running empty can easily be identified and turned off, saving significant amounts of power. iBelt delivers volumetric data rather than mass data, which allows for better operational planning. Using volumetric data also minimizes the rate of over- or underfilling the conveyor.

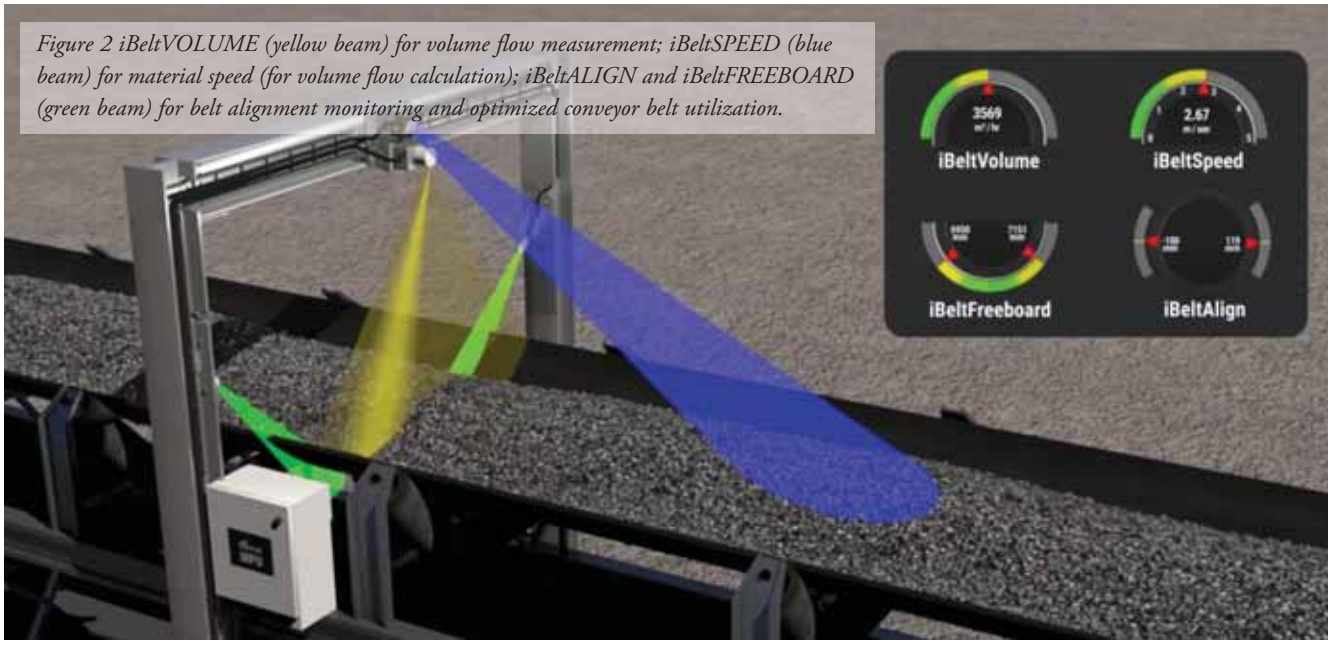


*Figure 2 iBeltVOLUME (yellow beam) for volume flow measurement; iBeltSPEED (blue beam) for material speed (for volume flow calculation); iBeltALIGN and iBeltFREEBOARD (green beam) for belt alignment monitoring and optimized conveyor belt utilization.*

For belt misalignment, one iLDR (indurad LinearDynamicRadar) sensor is installed on each side of the conveyor belt, aimed at the belt edges. The iLDR sensors measure the distance to each belt edge with millimetre precision. The real time offset between the two values allows customers to detect misalignment in a fraction of a second.

This sensor design is also used for continuous and reliable measurement of the freeboard of the conveyor belt, i.e. the distance between the belt edge and the belt load.

All the process data is available to the customer via the indurad iWEB HMI (Human Machine Interface) and via PLC integration in the main control cabin. iWEB also allows the customer to monitor the retrospective development of the volume flow to analyse the process over time.

The webserver runs on a radar processing unit, combining setup and maintenance modules with operator interfaces on one platform. Access is as easy as opening a webpage. Usually, cost-intensive SCADA integration can be avoided, no additional software installation or maintenance is required. The iWEB interface allows the operator to visualize all important process data like current volume flow or a scalable timeline of volume flow.

indurad's dedicated processing unit can be configured to communicate with all common fieldbus interfaces. By default, it comes with the web server and Modbus TCP/IP connectivity.

The iBelt solution is easy to install. Only a very short downtime of the conveyor is required. Together with the hardware, indurad delivers a commissioning manual and provides support for remote commissioning. indurad offers an optional direct access via wireless broadband, which allows for a cost-effective and rapid installation, with quality control.

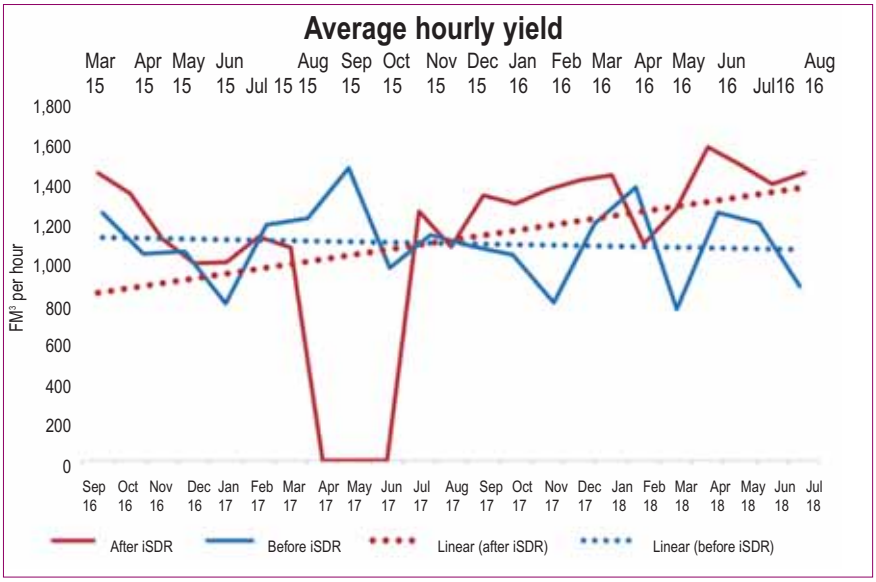


*Figure 3 Effect of the iBeltVOLUME installation on the average hourly yield at PPC Lignite, Greece (red: after iBelt installation; blue: before iBelt installation).*

iBelt has been successfully installed in a variety of applications: coal, hard coal and lignite, iron ore, copper, cement, potash and fertilizer, alumina and bauxite, pulp and paper, food and feed chemicals. indurad's belt solutions are used in mines and ports on all continents except Antarctica.

After installation of indurad's iBelt on a bucketwheel excavator at PPC, Greece, PPC engineers now have the ability to control the productivity of their excavator from a remote engineering station, which has resulted in a 20% increase in the average hourly production of the excavator. iBelt is therefore a reliable and highly robust step towards the digitalization of mines and advanced process control.

## ABOUT INDURAD

indurad is a Germany-based global supplier of radar-based automation technology. indurad's solutions are used to de-bottleneck bulk materials handling systems in mining and port operations. indurad has successfully implemented advanced automation solutions in Africa, Australia, Brazil, Canada, and Europe. indurad's proprietary sensors are part of a multi-purpose solution family that covers real-time inventory control, 2D and 3D stockpile visualizations, machine positioning with high accuracy, speed and volume flow control for conveyor belts, shiploaders, and more.

indurad has partners and clients in the mining, marine, and bulk materials handling industries on all continents and has local offices in Australia, Brazil, Canada, Chile, Russia, and South Africa.