

# SOLUTIONS FOR THE PULP & PAPER INDUSTRY

Mass Flow, Density, Level &  
Moisture Measurement



 **BERTHOLD**

# PULP AND PAPER INDUSTRY

## THE APPLICATIONS

Berthold Technologies' measurement systems are used worldwide in pulp and paper mills monitoring critical processes online and improving production efficiency.

As the technology leader in radiometric and microwave technology we bring extensive benefits to the pulp and paper industry by providing highly accurate and highly repeatable online measurements – leading to major cost savings, stable plant operation and reliable process control.

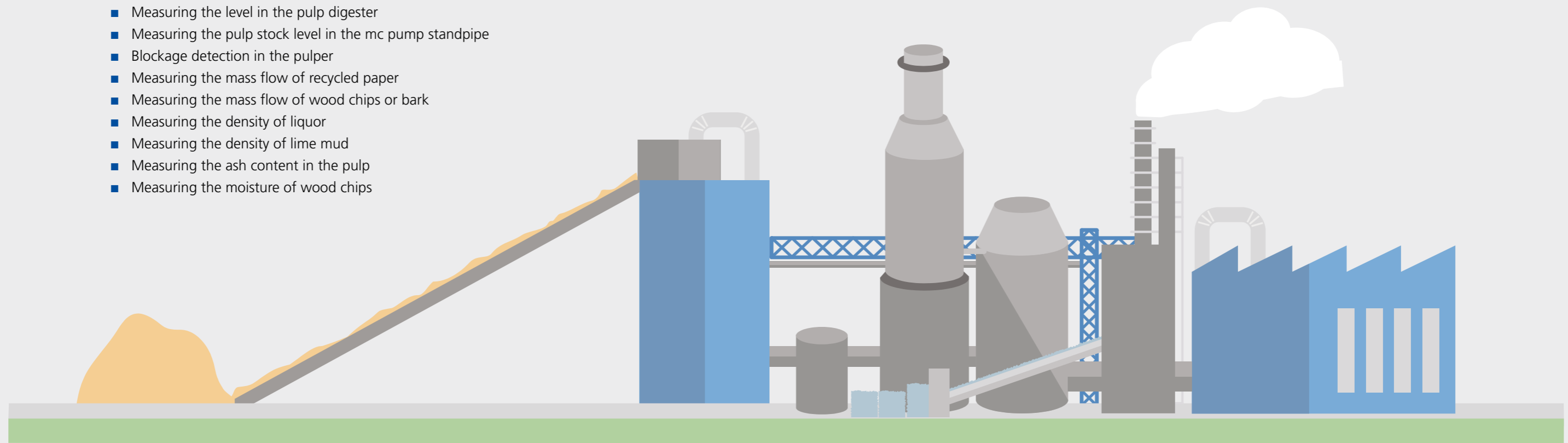
Berthold Technologies is renowned for the ability to provide a wide range of standard products, as well as tailor-made and customized measurement solutions thus perfectly satisfying customers' needs in terms of geometry, measurement performance and economic requirements. The sheer number of measuring systems in operation worldwide is the best proof for the high quality of Berthold products and services.

### Contactless – the ideal solution!

All measurement solutions are contactless and non-intrusive. The advantages:

- No exposure to process media and therefore unaffected by acidic, caustic, abrasive or sticky conditions
- Maintenance-free and wear-resistant
- Easy to install on existing pipes and vessels by clamp-on devices

- Measuring the level in the pulp digester
- Measuring the pulp stock level in the mc pump standpipe
- Blockage detection in the pulper
- Measuring the mass flow of recycled paper
- Measuring the mass flow of wood chips or bark
- Measuring the density of liquor
- Measuring the density of lime mud
- Measuring the ash content in the pulp
- Measuring the moisture of wood chips







# MEASURING THE LEVEL IN THE PULP DIGESTER

The wood chips and chemicals are cooked in the digester in order to extract cellulose. High temperatures and caustic conditions dominate in the digester. To control the filling level in the digester a radiometric level measurement is used. The contactless measurement installed on the outside of the digester is not affected or influenced by the severe conditions prevailing inside. This allows reliable control of the digester filling and optimized loading of the digester. A high level switch providing additional process safety.

## Application Profile

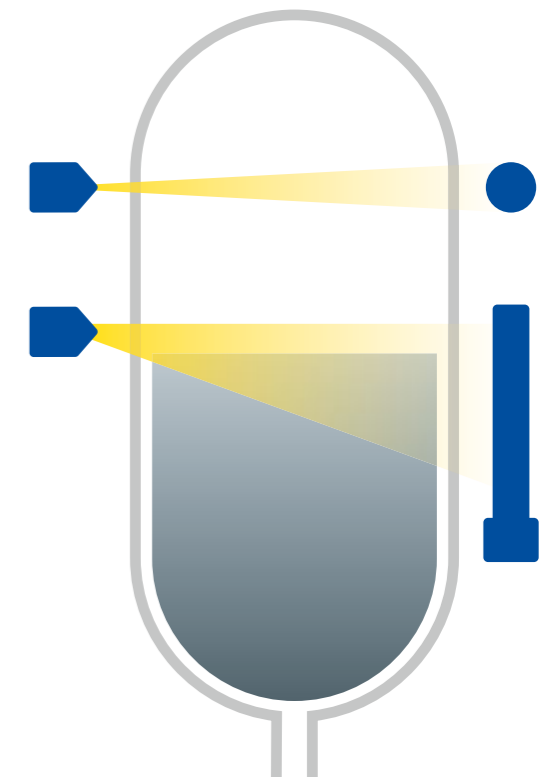
- **Measurement task**  
Level measurement of digester feedstock  
Level and high-level switch on pulp digester
- **Location**  
Pulp digester, cooking process
- **Berthold solution**  
Radiometric level measurement and level switch

## Customer Benefits

- Optimised utilisation of digester capacity
- Increased process efficiency
- Highly reliable control of the cooking process
- Not affected by high temperatures and caustic conditions inside the digester
- Maintenance-free

## Features

- Non-contacting level measurement using radiometric technology
- Detectors and sources are mounted on the outside of the tank
- Accurate and repeatable measurement
- SIL2 / SIL3 certification for continuous level measurement and level switch available



*Typical arrangement of a radiometric system for non-contacting, non-intrusive level measurements.*





## MEASURING THE PULP STOCK LEVEL IN THE MC PUMP STANDPIPE

Maintaining the level of pulp stock in the MC pump standpipe is very critical. If the pulp level in the standpipe falls below a certain value it can cause cavitation in the pump. Standpipe overflow and no-flows should be avoided. Traditional instrumentation, using DP cells, and capacitance probes have proven to be ineffective for this application, leading to false readings and causing high maintenance costs. Consequently a radiometric level measurement is used to control the pulp level in the standpipe – contactless and non-intrusive. The measurement is highly accurate and even quick level changes can be monitored reliably. As a result, the operation and efficiency of the pump can be improved as measurement performance is well beyond that of other technologies.

### Application Profile

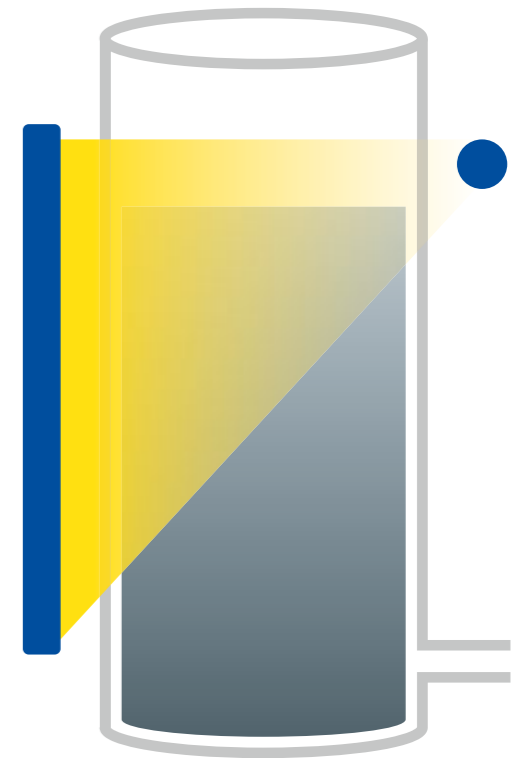
- **Measurement task**  
Level measurement of pulp stock in the MC pump standpipe
- **Location**  
MC pump
- **Berthold solution**  
Radiometric level measurement

### Customer Benefits

- Prevents cavitation of the pump
- Prevents underfilling
- Increased process safety
- Improved MC pump performance
- Rapid measurement response

### Features

- Contactless, non-intrusive level measurement
- Maintenance-free
- Detectors and sources are mounted on the outside of the standpipe
- Highly repeatable measurement
- Unaffected by coating as is non-intrusive
- SIL2 / SIL3 certification for continuous level measurement and level switch



*Radiometric system installed on a MC pump standpipe is a long-term solution to reliably measure the pulp level.*



# BLOCKAGE DETECTION IN THE PULPER

Undesirable blockages in the pulper are one of the primary reasons for process failures and need to be avoided. In order to detect a possible blockage, a non-contact continuous density measurement is used, which signals an alarm to the operators in case of developing built-ups. Automatic process flow may be abrupt or ceased if blockage forms within the process. To ensure a trouble-free operation, the applied measuring system must establish an optimal ratio of wastepaper/pulp to process water. The efficiency of the running process is crucial for the operator. The non-contacting measurement is installed outside of the vessel and is therefore not affected by the conditions prevailing. Thus, as much raw material as possible can be loaded.

## Application Profile

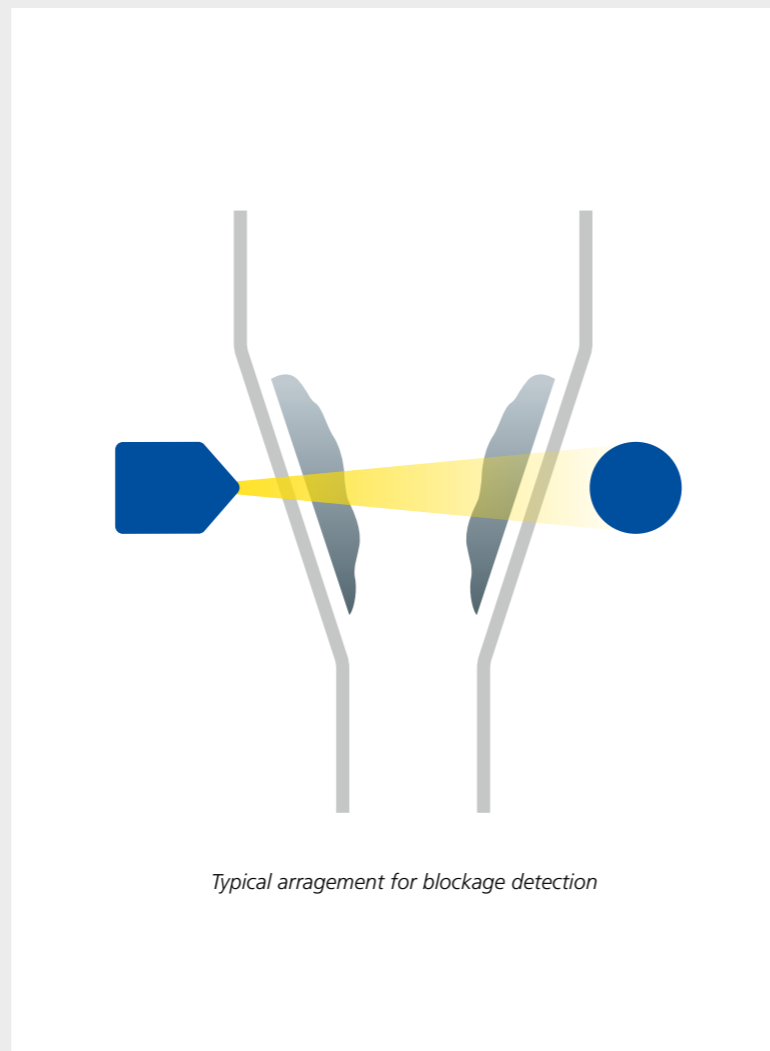
- **Measurement task**  
Blockage protection
- **Location**  
Pulper, woodchip bin, blow tank
- **Berthold solution**  
Density switch LB 414

## Customer Benefits

- Prevents blocking, therefore ensures smooth process
- Enables continuous establishment of wastepaper/pulp to process water ratio
- Continuous build-up signal (density)

## Features

- Non-contact, non-intrusive therefore maintenance-free
- Mounted outside of the vessel
- Compact density device – transmitter and detector in one unit
- Smart and cost-efficient



# MEASURING THE MASS FLOW OF RECYCLED PAPER

The processing of recycled paper involves cooking the paper to recover lignin. In order to control the amount of paper that enters the cooking process, a radiometric belt weigher is used. This system has no moving parts and measures the bulk flow contact-free and non-intrusive. Installations are possible on all conveyor types, e.g. belt conveyors, drag chain conveyors, bucket conveyors or screw conveyors. The measurement is highly accurate and repeatable, so that there is no need for recalibrations.

## Application Profile

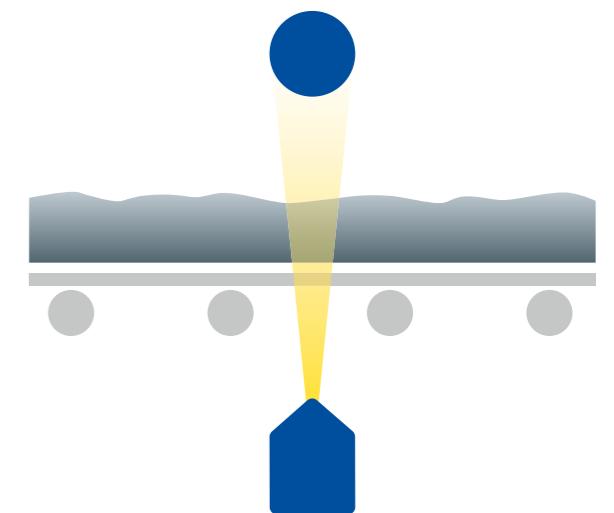
- **Measurement task**  
Mass flow of recycled paper and paper bales
- **Location**  
Boiler feeding line, large chain conveyors
- **Berthold solution**  
Radiometric belt weigher LB 472

## Customer Benefits

- Online, real-time process information
- Optimised boiler operation
- Ideal balancing of boiler feedstock

## Features

- Non-contacting measurement, irradiating the wood chips by means of gamma radiation
- High repeatability, no need for frequent recalibrations
- Maintenance-free
- Virtually no operating costs







# MEASURING THE MASS FLOW OF WOOD CHIPS OR BARK

In order to optimise boiler operation, the amount of fibres that are fed into the tank needs to be controlled. By using a radiometric belt weigher, the mass flow of wood chips or bark can be measured by means of contactless technology. The main advantage compared to conventional weighing systems is that the radiometric belt weigher does not need to be recalibrated and provides reliable results during many years of operation. The system can be installed on all conveyor types, e.g. belt conveyors, drag chain conveyors and screw conveyors. Installations on existing boiler feeding lines are easily feasible.

## Application Profile

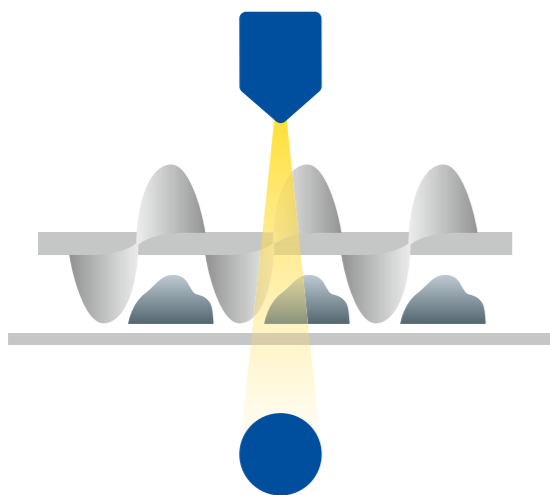
- **Measurement task**  
Mass flow of wood chips or bark
- **Location**  
Boiler feeding line, raw material unload
- **Berthold solution**  
Radiometric belt weigher LB 472

## Customer Benefits

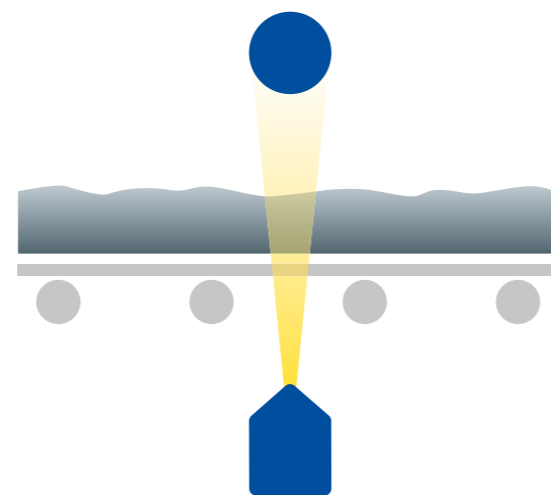
- Online, real-time process information
- Optimised boiler operation
- Ideal balancing of boiler feedstock
- reliable from start to finish

## Features

- Contactless measurement of wood chips or bark by gamma ray attenuation
- High repeatability, no need for frequent recalibrations
- Maintenance-free
- Virtually no operational expenses
- Excellent measurement stability
- Not affected by varying belt tension, vibrations or bumps



Typical measurement arrangement on a screw conveyor.



Radiometric belt weigher measures the mass flow without contact. The results are stable over many years and frequent recalibrations are not necessary.





# MEASURING THE DENSITY OF LIQUOR

In any pulp mill, recovering and regenerating the pulping chemicals and burning off organic material dissolved from wood is a critical step in the process. An accurate, repeatable online density measurement is necessary to operate this phase of the process. Black liquor and green liquor densities are measured reliably by radiometric systems, which are clamped on to the pipe and provide highly repeatable readings. The measurement is carried out without contact and is therefore unaffected by the high temperature and the chemical properties of the liquor. Installation on existing lines is easily feasible without process downtime.

## Application Profile

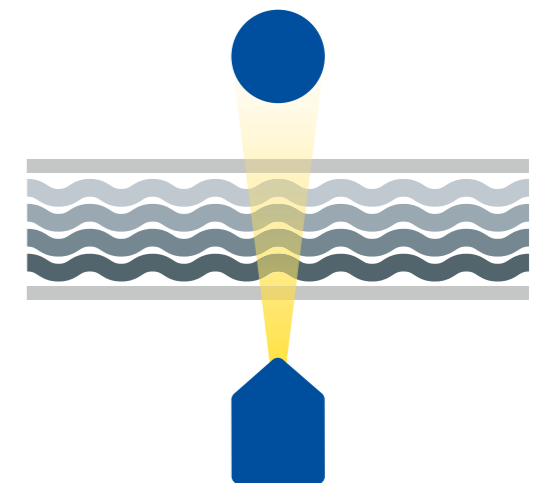
- **Measurement task**  
Green or black liquor density measurement
- **Location**  
Recausticisation process
- **Berthold solution**  
Radiometric density and concentration measurement

## Customer Benefits

- Online information on liquor properties
- Optimised liquor regeneration process
- Reduces the amount of wash water needed in pulp washing systems
- Virtually no operating and maintenance costs
- Unaffected by build-ups and crusting
- Saves energy consumption
- Experts in proven retrofits

## Features

- Non-contacting radiometric density measurement
- No flow disturbance, no wear and tear
- Easy to install or retrofit clamp-on system
- Highly repeatable measurement
- No recalibration necessary
- Not affected by the hostile chemical properties or temperature of the liquor



*Clamp-on density measurement at inlet or outlet pipes*



# MEASURING THE DENSITY OF LIME MUD

In the regeneration of pulping chemicals, lime mud is formed as a by-product. Several process steps follow to convert the suspension back into calcium oxide (“lime”). During these processes it is important to have real-time information on the solids content and the density of the lime mud. A radiometric system is ideal for this type of application, because it doesn’t contact the suspension and is highly wear-resistant. As a simple clamp-on solution it is easy to install without any process downtime. The high accuracy and repeatability of the measurement helps to optimise the recovery process, while the effort to maintain the system is insignificant

## Application Profile

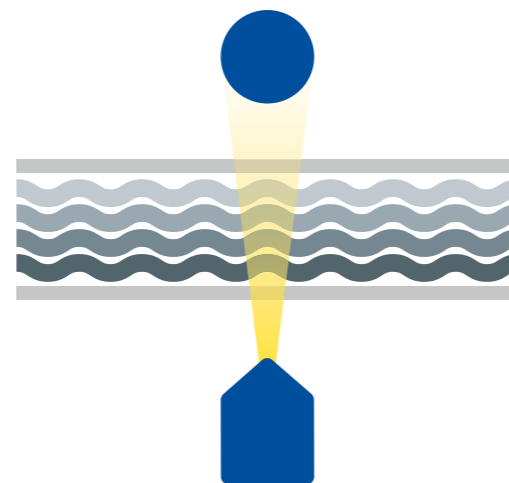
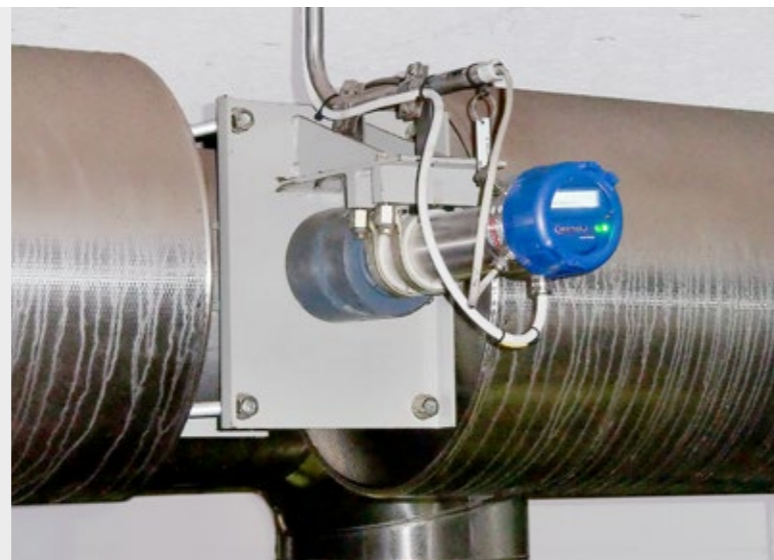
- **Measurement task**  
Lime mud – density and solids content measurement
- **Location**  
Recausticisation process
- **Berthold solution**  
Radiometric density and concentration measurement

## Customer Benefits

- Real-time information on density and solids content
- Improved control over lime mud processing
- Optimised use of recovery chemicals such as flocculants lead to cost savings
- Lowest operation costs

## Features

- Non-contacting radiometric density measurement
- Easy to install, clamp-on system
- Unaffected by product properties
- Highly repeatable measurement
- No need for recalibrations
- Maintenance-free operation



Typical arrangement of a radiometric system for contactless, non-intrusive density measurements.

# MEASURING THE ASH CONTENT IN THE PULP

In the paper industry the deinking process upgrades recycled wastepaper to fresh paper pulp feed for paper machines. Ink and coatings are separated from paper fibres and filler (ash). The aim of this process is to reach a desired stock brightness by removing ink. For this goal, usually two flotation and thickening steps are required. During flotation, ash is lost to certain degree. However, to produce a consistent paper quality, the ash content needs to be constant. Uncontrolled flotation would result in a higher consumption of ash to compensate the loss, higher costs for the disposal of the ash removed by flotation and more wastepaper to receive the same amount of final product. Using Berthold’s density measurement solution to determine the ash content in the pulp, the deinking performance will be optimized by keeping the ash content constant.

## Application Profile

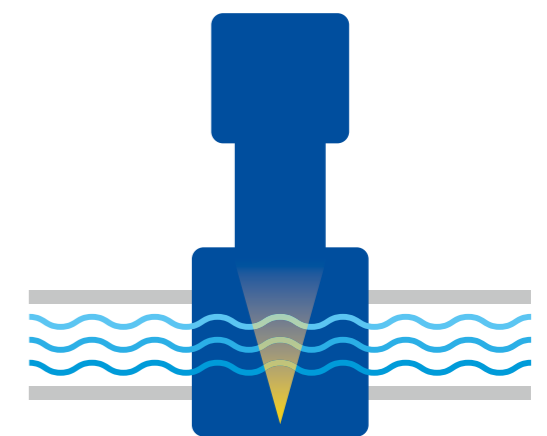
- **Measurement task**  
Ash content measurement
- **Location**  
Standpipe, pre-flotation and in the post-flotation
- **Berthold solution**  
LB 379

## Customer Benefits

- Saves filler material
- Keeps the ash content constant
- Saves energy
- Maximum use of recycled wastepaper fibres

## Features

- Inline density measurement
- Concentration of ash content
- Unaffected by the hostile ambient conditions
- High measurement stability and endurance



Inline density meter flanged to the existing pipeline





## MEASURING THE MOISTURE OF WOOD CHIPS

The determination of moisture in dry fibrous material is important to keep the boiler efficiency constant. Especially in summer, when the wood chip stockpiles are moistened, the water concentration can vary drastically. The Micro-Polar system using microwave transmission technology measures the moisture content online. With an antenna below and above the belt, the microwave measures the whole material cross-section leading to highly representative, real-time information. An additional radiometric system can be used to compensate for variations in bulk density and load.

### Application Profile

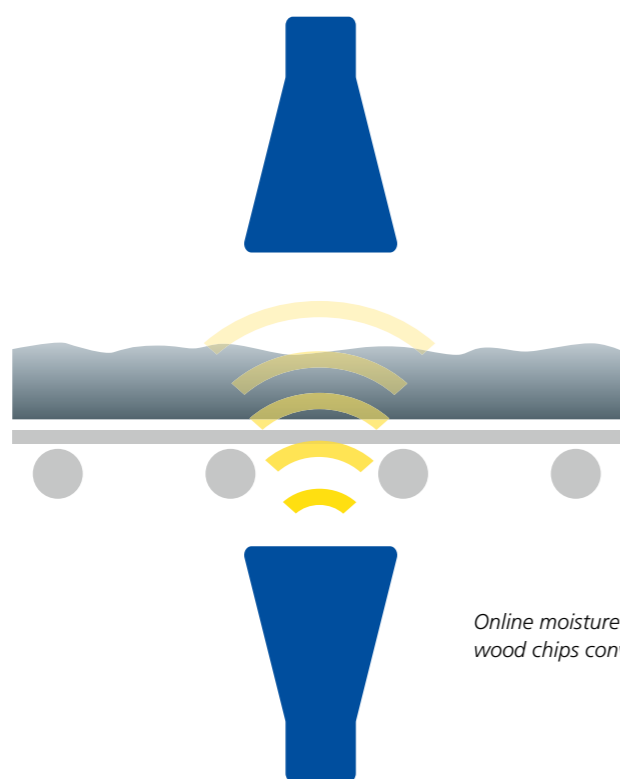
- **Measurement task**  
Moisture content in wood chips
- **Location**  
Boiler feeding line, raw material transportation
- **Berthold solution**  
Microwave transmission system, Micro-Polar LB 567 or LB 568

### Customer Benefits

- Accurate moisture leads to accurate „bone dry“ solids addition leads to accurate digester chemical charge
- Measurement independent of wood species
- Operates reliably at moisture levels up to and above 50%
- Transmission measurement provides representative sample as opposed to traditional „surface only“ measurements

### Features

- Installs around existing conveyor belts
- Non-contacting measurement
- FCC compliant
- High measurement repeatability
- State-of-the-art microwave transmission technology measuring the material cross-section



Online moisture system installed on the wood chips conveyor.





# COMMITTED TO TECHNOLOGICAL LEADERSHIP

## Outstanding long-term stability

The long-term stability of a detector is extremely important for a consistently high quality measurement performance and accuracy during the entire operation. Long-term drifts of detectors sensitivity can be caused by temperature changes and aging. If they go unnoticed and uncompensated, they can cause considerable loss in production yields and product quality.

The accurate and reliable operation of our measurements is guaranteed for the whole time of operation. Our integral automatic sensitivity monitoring and adjustment functionality keeps the sensitivity constant and corrects for any external influences – irrespective of temperature changes and aging effects.

Due to our innovative and patented technology of using cosmic rays as a very stable radiation reference, we are able to achieve this outstanding stability for all of our detectors.

## Retrofits

With hundreds of systems installed in pulp & paper mills worldwide, we have the experience and the technical know-how to solve your measurement tasks no matter if a new system or a retrofit solution is required. In fact, Berthold detectors can be retrofitted on existing measurements where the source has become too weak to work with the current detector. Nuclear sources naturally decay over time, losing their strength, until eventually there is not enough activity left to reliably measure your process. Sources replacements are costly, time consuming, and does not work towards a reduction in overall site source activity. Fortunately, we have another solution. Berthold has the most sensitive and stable detectors on the market, a simple replacement allows users to extend the life of their existing sources by years, while improving measurement reliability for all density and level applications. Key features of our products are

- Berthold detectors are at least 2x more sensitive than the competition, providing 2x source life and 2x better resolution.
- Berthold detectors provide best in class reliability & stability, reducing maintenance costs.
- Easy installation on any brand of source holder and we even could use existing 2-wire cable installation
- One-time calibration required with industry leading long-term detector stability

## Minimal source activity

We are committed to the ALARA principle. ALARA stands for: As Low As Reasonably Achievable and aims to keep the source size to a minimum. According to this, our sources are specifically designed for your individual application. As a result, our sources are equipped with remarkably low activities, which is due to our great advances in the high-sensitive detector technology. Benefit from our pronounced safety awareness, individual project engineering and the reduced costs for shields and transportation.

## SIL2 / SIL 3 certified

The SENSseries LB 480 detectors are certified for use in SIL2 applications. Even SIL3 is achieved with homogenous redundancy. The certificate covers all measurement applications, from high level or low level alarms to continuous level and density measurement. Thus safe operation of critical processes is guaranteed.

[ SIL2 ] [ SIL3 ] [ EX ]





## THE EXPERTS IN MEASUREMENT TECHNOLOGY

Berthold Technologies stands for excellent know-how, high quality and reliability. The customer is always the focus of our solution. We know our business!

Using our varied product portfolio, our enormous specialized knowledge and extensive experience, we develop suitable solutions together with our customers for new, individual measurement tasks in a wide variety of industries and applications. Berthold Technologies is specialised in radiometric process measurements for 70 years. This is our core competence with state-of-the-art and cutting edge products and solutions covering a vast range of industries and applications.

### **We are here for you – worldwide!**

The engineers and service technicians from Berthold Technologies are wherever you need them. Our global network assures you fast and above all competent and skilled assistance in case of need. No matter where you are, our highly qualified experts and specialists are ready and waiting and will be with you in no time at all with the ideal solution for even the most difficult measurement task.

**Berthold Technologies GmbH & Co. KG**

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