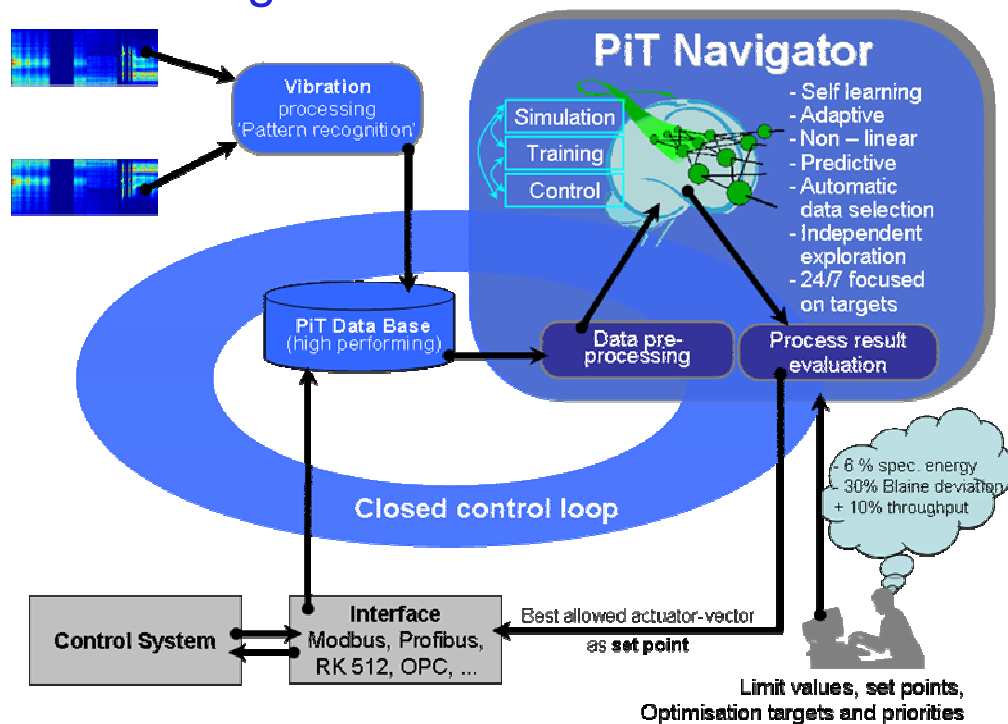


# Plug and play increased mill efficiency, maximised throughput and reduced quality deviation

## PiT Navigator for vertical cement mills



## Your Benefits

- Less specific energy consumption
- Quality based throughput maximisation
- Elimination of lab delay by Blaine prediction
- Fast and stable control
- Recipe independent closed-loop control
- Fast adoption to change in clinker types and clinker granularity
- No mill stop, fast commissioning

### Concept:

- ◆ Integration of additional sensors (vibration sensors mill, pipes and separator)
- ◆ Automatic feature selection and extraction (significance ranking) of existing process data
- ◆ Automatic model generation (regression, neuronal networks, probabilistic nets, Gray-Box-Models)
- ◆ Set point integration into the DCS/PCS

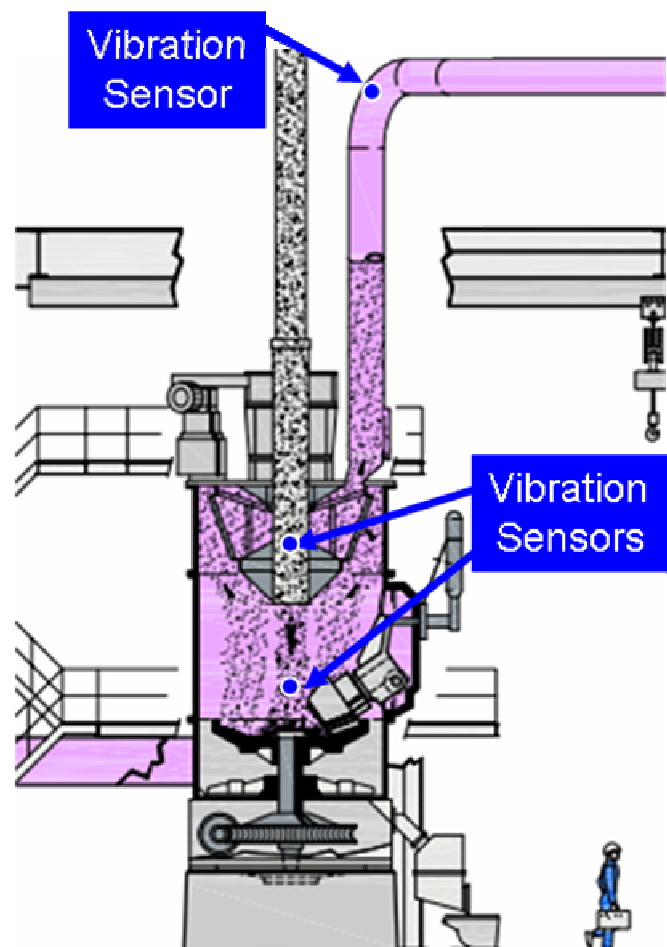
Using optimisation potentials ...

...while quality is kept under control...

...results in reduced grinding costs.

## Technical Advantages:

- ◆ No mill stop necessary at installation and for maintenance – fast commissioning
- ◆ **Online monitoring** with vibration sensors to allow for Blaine prediction (Soft Sensor) by adaptive and non-linear Neural Networks and quality based throughput maximisation
- ◆ **Recipe independent closed-loop control** by using vibration features, Blaine prediction and Advanced Process Control
- ◆ 2 vibration sensors per mill enable proportional measurement, 1 vibration sensor per pipe; wired connection delivers high signal density
- ◆ Piezo-ceramic sensors for industrial use following military specification
- ◆ Positioning decided according to trials, fixed by magnets at locations <160°C
- ◆ Sampling with 10kHz, 16bit
- ◆ Data pre-processing off **all relevant process data** by analysis of correlations
- ◆ Advanced signal processing on acoustic measurements
- ◆ Visualisation highly flexible (integration of PCS data); Graphical User Interface with trending and alarming
- ◆ Modular system: **Upgradeable** to Kiln-Optimiser, easy and inexpensive to scale to multiple mills



## Results:

- ◆ **Reduced quality deviation (Blaine) by up to 30%**
- ◆ **Between 2% and 6% less specific energy consumption**
- ◆ **Up to 10% more throughput**
- ◆ Full automatic closed-loop control
- ◆ Recipe independent throughput maximisation
- ◆ Self learning of controller parameters for different recipes
- ◆ No re-parameterisation at new recipes
- ◆ Elimination of lab delay
- ◆ Fast adoption to change in clinker types

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