VDEh-Betriebsforschungsinstitut GmbH

Introduction BFI HR-Server

Visualisation of high-resolution data across the complete production chain

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"Big Data refers to the analysis of large amounts of data from diverse sources at high speed with the aim of generating economic benefit " (BITKOM)

Task of HR-Server:

Visualisations of one- and two-dimensional <u>high-resolution</u> data across the <u>complete production chain</u>

Big Data im Praxiseinsatz: Szenarien, Beispiele, Effekte. BITKOM-Leitfaden, Bundesverband Informationswirtschaft, Telekommunikation und neue Medien, 2012 https://www.bitkom.org/Publikationen/2012/Leitfaden/Leitfaden-Big-Data-im-Praxiseinsatz-Szenarien-Beispiele-Effekte/BITKOM-LF-big-data-2012-online1.pdf

Industrial Big Data

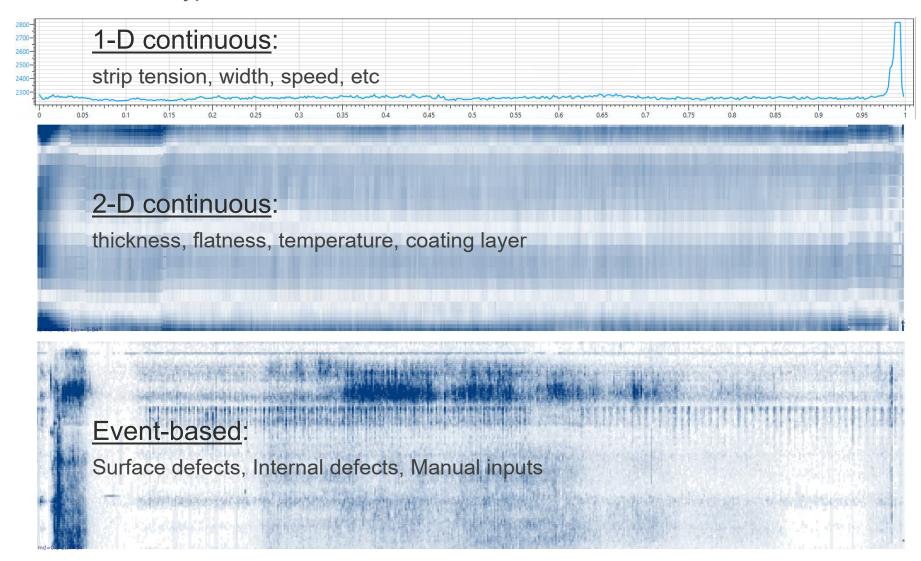




Visualisation of high-resolution Data



Aspect 1 - Different data types

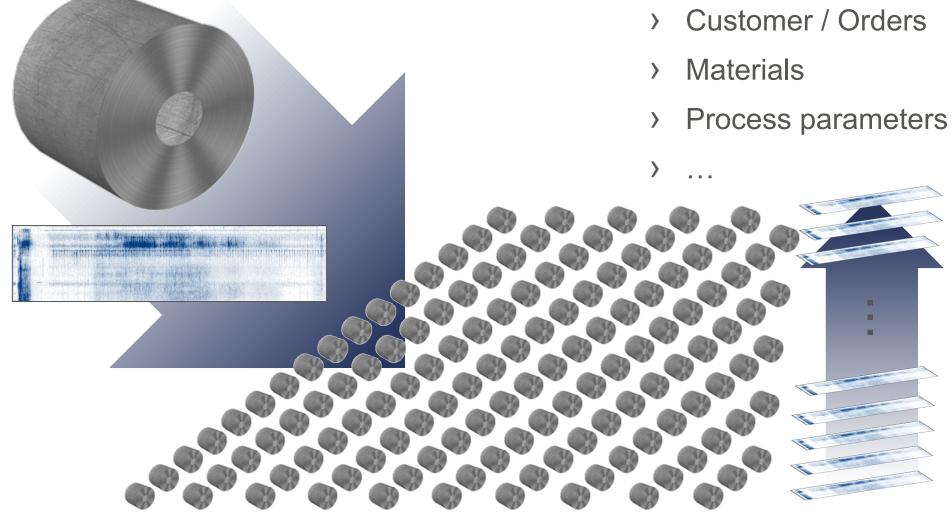


Visualisation of high-resolution Data

Aspect 2 - Not one coil, but many

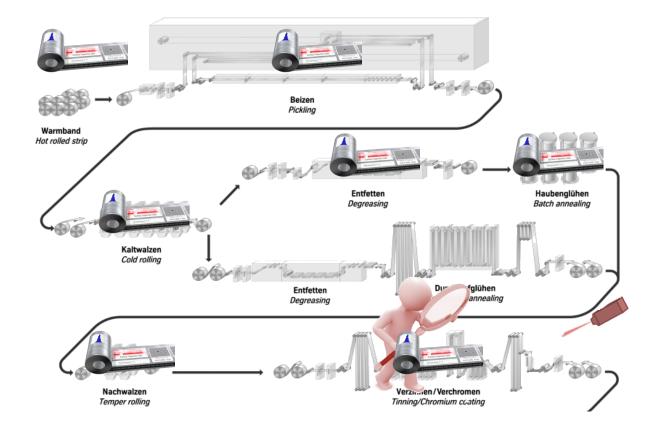


Production periods



Visualisation of high-resolution Data

Aspect 3 – Complex Production flow





Coil changes during processing

Different viewpoints require different data

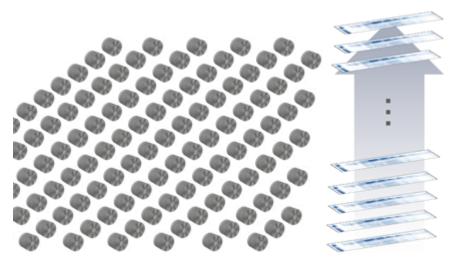
For full production analysis

Material tracking must be considered

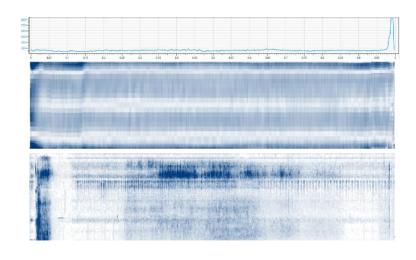
BFI Solution for high-resolution Data Utilisation



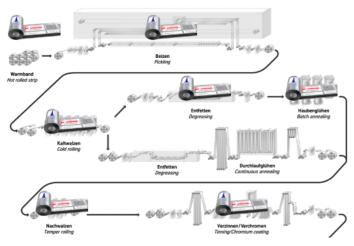
Not one coil, but many



Different data types



Consideration of complex production flow





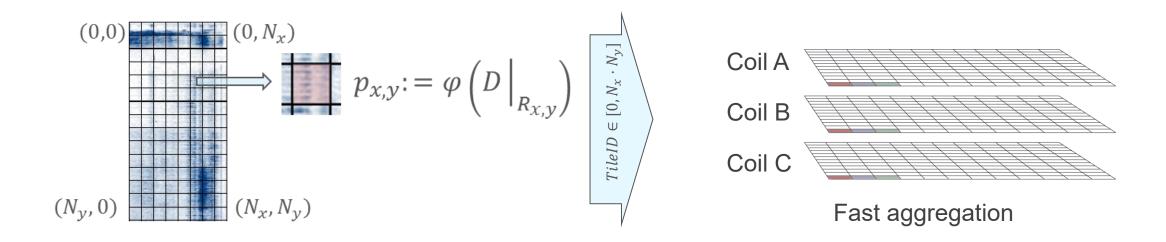
BFI HR-Server Concept



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Visualisation first

- > The amount of data queried is determined by the visualisation
- > For ASIS data visualisation each result is represented as image $I := [0, N_x] \times [0, N_y]$
- > This image is independent of the query result



BFI HR-Server Concept



Coarse to fine multiscale data representation

0	0 1	0 1 2 3 4 5 6 7	•	200		1.		
	2 3	8 9 10 11 12 13 14 15	n = 128	n = 512	n = 2.048	n = 8.192	n = 32.768	n = 131.072
1	4 5	16 17 18 19 20 21 22 23					11 – 32.700	11 - 131.072
Stage 0	6 7 Stage 1	24 25 26 27 28 Staĝe 2 1	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7	Stage 8



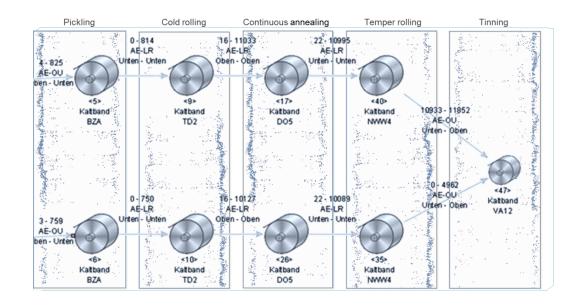
Stage (s)	Tiles CD (s_x)	Tiles MD (s_y)	Δx_S ($c_w := 1.000 \text{ mm}$)	$\Delta y_{_{\mathbf{S}}}$ ($c_{_{oldsymbol{L}}}$:= 10.000 m)
0	1	2	1000 mm	5000 m
1	2	4	500 mm	2500 m
2	4	8	250 mm	1250 m
3	8	16	125 mm	625 m
4	16	32	62,5 mm	312,5 m
5	32	64	31,25 mm	156,25 m
6	64	128	15,63 mm	78,13 m
7	128	256	7,81 mm	39,06 m
8	256	512	3,91 mm	19,53 m

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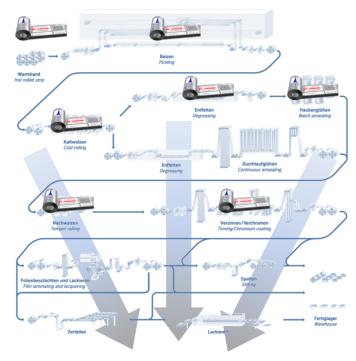
BFI HR-Server Concept



Simultanuous storage across production steps



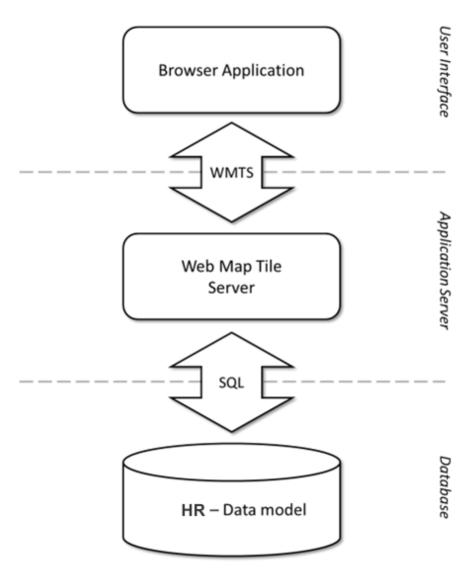
- > Data can be <u>tracked</u> upstream and/or downstream
- > For each measurement further grid data can be created and imported also from the <u>perspective of other production steps</u>





Implementation





- > Realized as <u>three-tier architecture</u> to separate presentation, application processing, and data management functionality
- Based on a <u>WMTS standard</u> provided by the Open-Geospatial Consortium (OGC)
- > Layer concept with 4 different layer types:

Coils - Information on all coils produced, accompanied by all filter relevant properties (e.g. material, thickness, customer, etc.) (**mandatory**)

Event - Event-based data as ASIS defects or manual operator inputs that are characterized by an eventclass (optional)

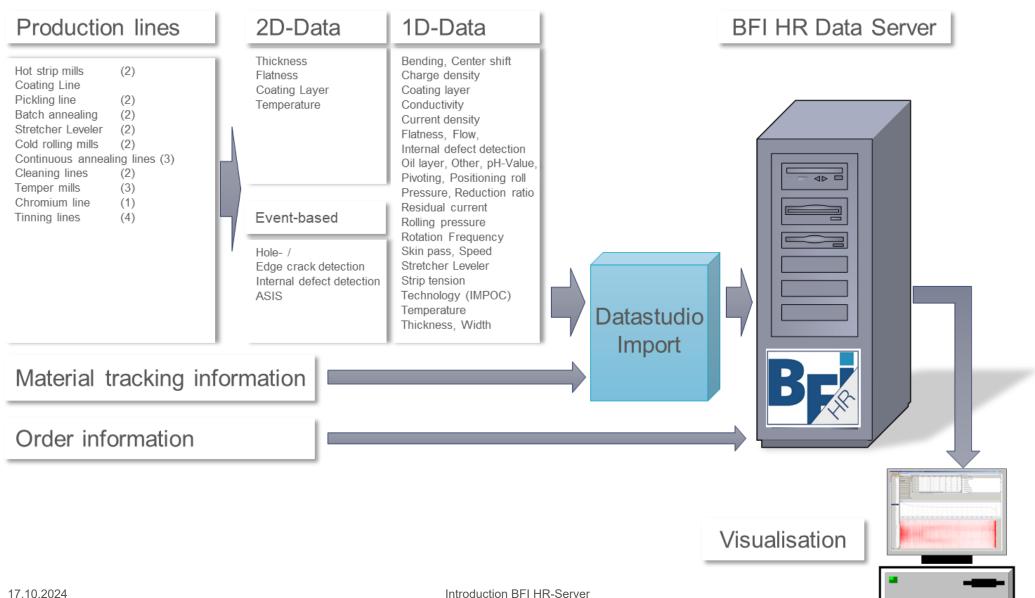
Measure - 1- or 2-dimensional measure that may contain min, max and average values (optional)

History - If material tracking is considered this layer contains the production sequence of each coil (optional)

- > Querying data follows a two-step approach:
 - (1) Query coil-set that meets certain filter conditions
 - (2) Query event and/or measurement data from one or more layers

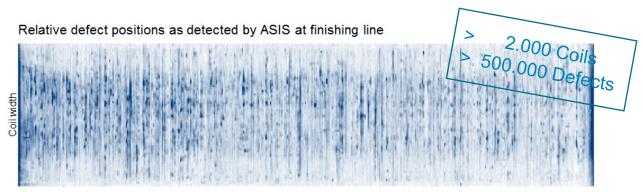
System Architecture



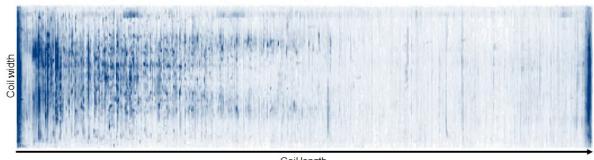


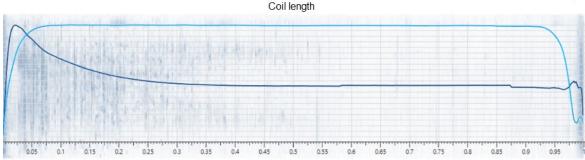
Fast Visualisation with BFI HR-Server





Relative defect positions tracked upstream to degreasing line





- Until now, the detailed analysis of highresolution data could take weeks to generate only rough statements on a few coils.
- With the BFI HR-Server accurate results can be viewed across thousands of coils within seconds.

Application Example:

- Today 90 % less coils have to be reworked due to paw-scratch affection than before the implementation of the HR quality supervisory system
- "Paw-scratch" problem can be regarded as solved