# STEELMASTER 2021

XXIV Edizione (Corso on-line)

**1ª Settimana**
25-29 Ottobre 2021

**2ª Settimana**
22-26 Novembre 2021

# Non-Sticking Furnace Rolls for Continuous Galvanizing & Continuous Anneling Lines

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# Agenda

- Introduction of CGL Sagunto & CAL Dortmund
- Motivation & Preparation of Industrial Trials
- First Operational Results
- Summary

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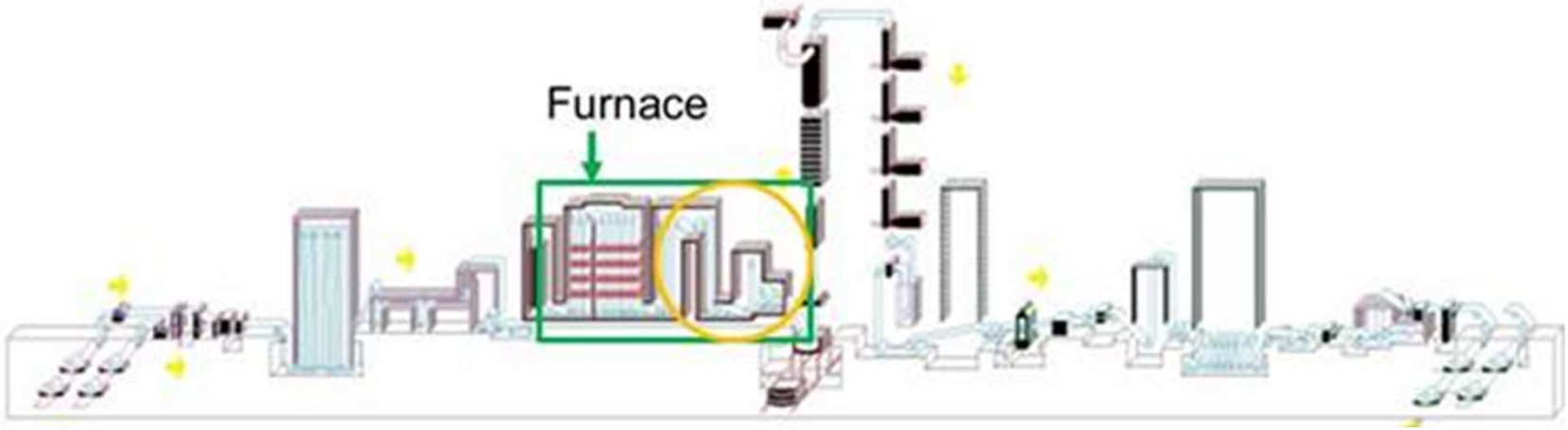
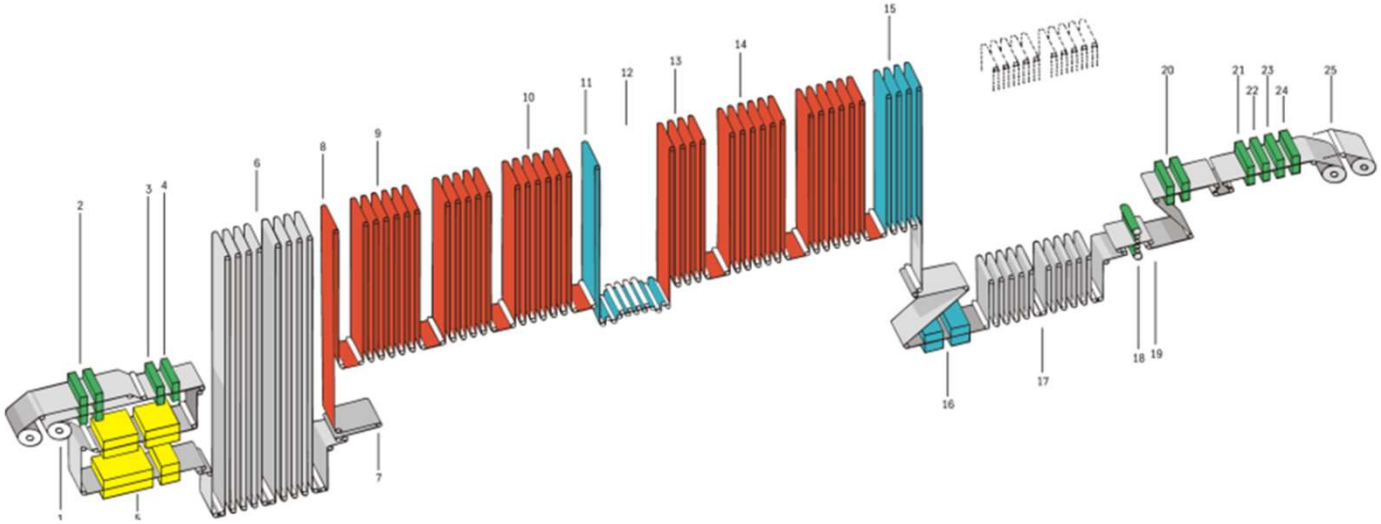
# Line Layout and Specifications – CGL Sagunto




| Continuous Galvanizing Line (AMS) | |
|---|---|
| **erected** | 1998 |
| **furnace type** | vertical furnace, gas radiant tubes for heating section and electrical radiant tubes for soaking section |
| **max. process speed (m/min)** | 180 |
| **strip thickness (mm)** | 0.5-2.2 |
| **strip width (mm)** | 900-1,875 |

CGL Sagunto able to produce both hot-dip galvanized and hot-dip aluminized steel strips.

# Line Layout and Specifications – CAL Dortmund



| Continuous Annealing Line (tkSE) | |
|---|---|
| **erected** | 1985 |
| **furnace type** | vertical all radiant tube furnace, gas radiant tubes in heating and soaking section |
| **max. process speed (m/min)** | 300 |
| **strip thickness (mm)** | 0.4 – 1.9 |
| **strip width (mm)** | 900 – 1,710 |

CAL Dortmund‘s line layout suits well to produce steel strips with high surface quality requirements as well as advanced high strength steels.

# Possible Applications for Continuously Annealed or Galvanized Steel Strips

## Automotive

*Outer panel parts*

*structural parts*

*tailored blanks*

*high strength safety parts*

## Industry

*barrels*

*tubes*

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# Project Motivation

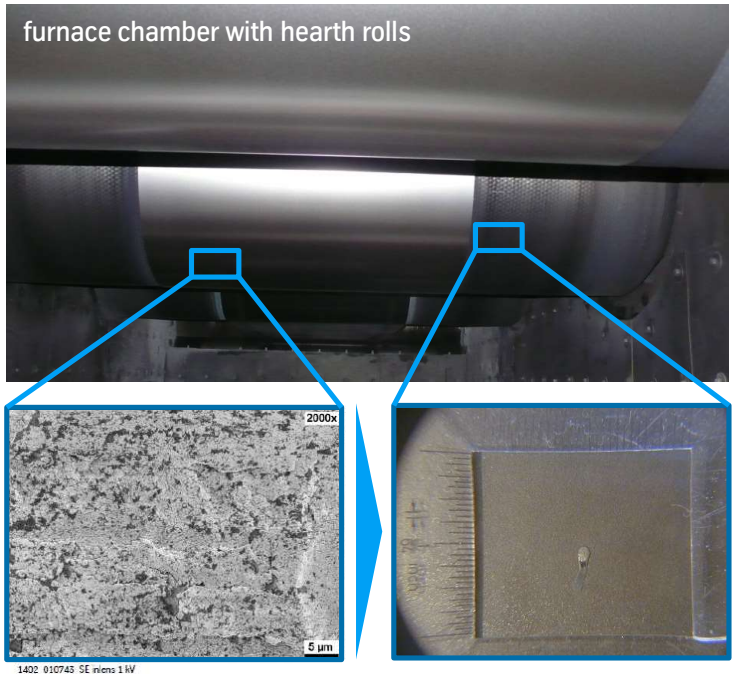
External oxides of less-noble alloying elements appear during annealing causing

- "darker" appearance of steel surface
- pick-up formation on furance rolls (→ dents)

## Contermeasures:

⇒ $H_2$ content and dew point of the $N_2$-$H_2$ furnace atmosphere have to be set in order to hamper external oxidation

⇒ Furance rolls need appropriate coating in dependance of steel alloying concepts to be produced




external oxides | pick-up on roll

**Dents into the steel surface represent a major quality concern causing rejection or re-work**

# Industrial Requirements to New Coatings Aside Good Pick-Up Resistance

The general requirements for new coatings used in CAL and CGL furnaces are to be:

- Thermal and chemical stable during long-term exposure to temperature up to 900°C in combination with an N2-H2-atmosphere.
- Good adhesion to the roll body made of heat-resistant steel.
- Thermal shock resistant, able to resist multiple temperature cycles from up to 900°C without failure.
- Wear-resistant and maintain a certain degree of surface roughness to reduce slip and prevent movements of the strip.
- To withstand contact to air up to a roll temperature of ~500 °C in case of opening the furnace.
- High mechanical stiffness and impact resistance needed in case of a strip breaking.

# Preparation for First Industrial Trials

Selection of
- new coating system to apply and test in CAL &CGL.
- Roll position sensitive towards pick-up formation

Coating of original furance rolls.

For CGL: with stone-polishing

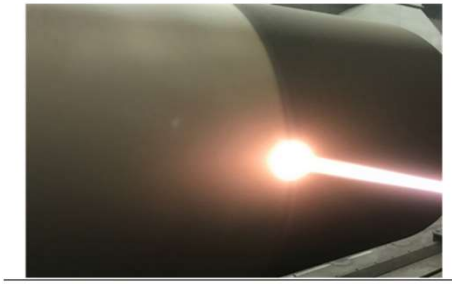
For CAL: without stone-polishing

Installing test rolls during major line stopps in 2019

Operating test rolls
- Annual visibel check during major line stopps
- Monitoring appearance of dents

*Seleted coating:*
*WC-CrC-Ni 73/20/7*

spraying



Polishing with stones

CGL & CAL selected a roll position after the cooling section where pick-ups mainly appear to test the new coating

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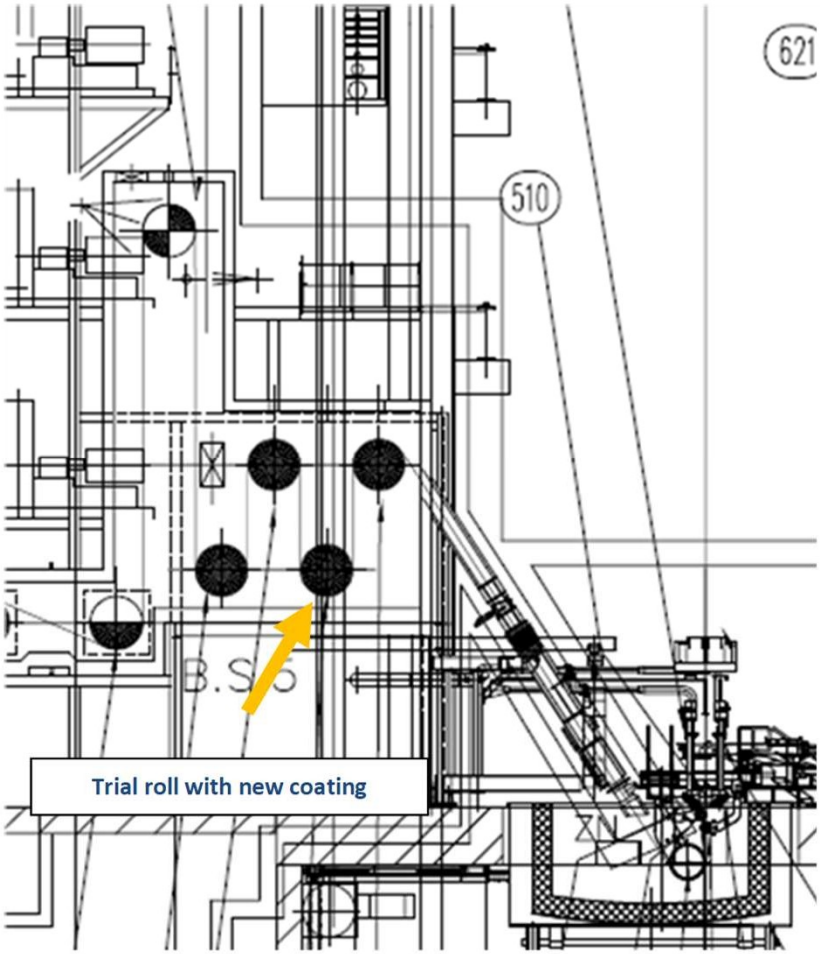
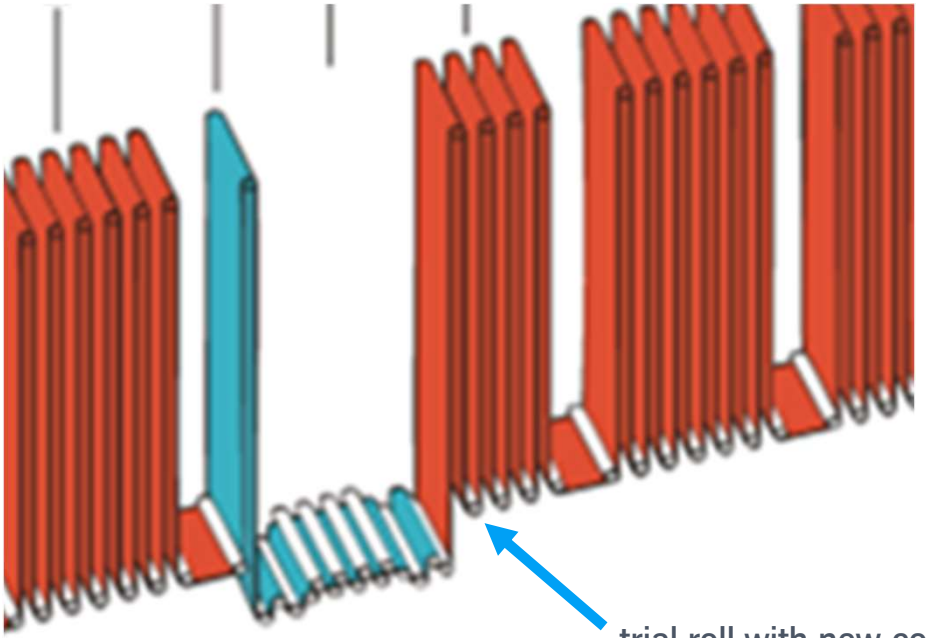
# First Operation Results at CGL Sagunto

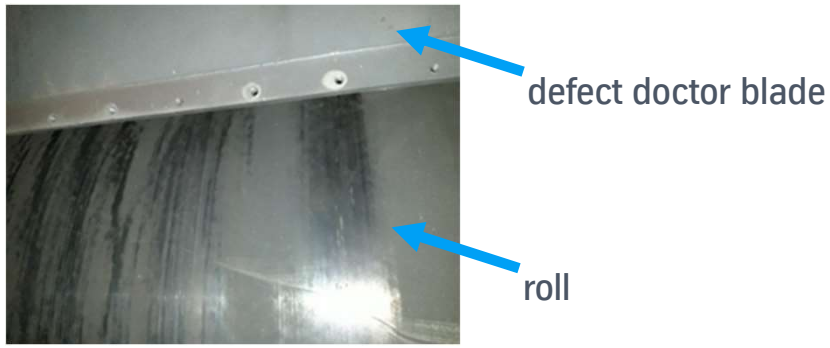



- Test roll installed in the over-aging section ahead of the snout in 08.2019.
- Not exposed side of the strip in contact to roll
- Roll/ zone temperature during operation: ~460 to 640°C, Dew point: ~ -20 to -10°C.
- No dents deteced by in-line visual inspection and off-line check in an inspection line
- First roll inspection in 04.2020 shows any kind of roll nor coating degradation by means of visibel control and profile check.
- Second roll inspection done in 08.2021 confiming results gained by first inspection.

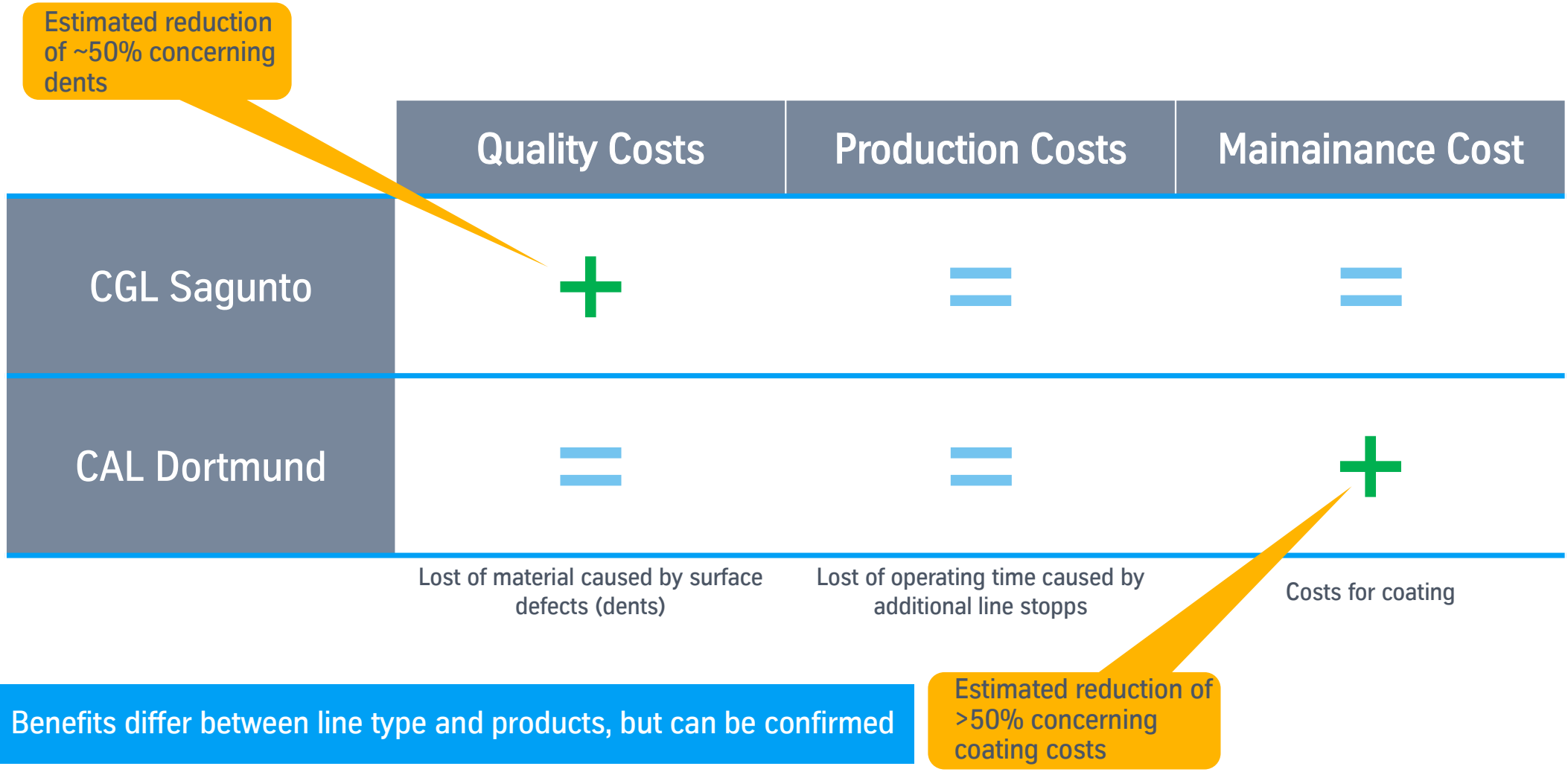
# First Operation Results at CAL Dortmund




- Test roll installed in the over-aging close after cooling section in 09.2019.
- Roll surface roughness ~4,3µm
- Exposed side of the strip in contact to roll
- Roll/ zone temperature during operation: ~460 to 640°C, Dew point: ~ -50 to -30°C
- No dents deteced by in-line visual inspection and off-line check in an inspection line
- First roll inspection in 09.2020 shows mechanical damages caused by a defect doctor blade. As polishing of the damages was successful, it was decided to keep the roll in operation.



# Benefit Analysis by Comparing Performance of Test Roll with Standard Roll




Benefits differ between line type and products, but can be confirmed

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# New Coatings for Non-Sticking Furnace Rolls – Summary & Outlook

## Summary:

- WC-CrC-Ni 73/20/7 as test coating was selected to perform industrial trials.
- Rolls with test coating were installed in both CGL in Sagunto and CAL in Dortmund in 2019.
- Both test rolls are still in operation.
- In CGL Sagunto: Appearance of pick-ups has been significantly reduced.
- In CAL Dortmund: Performace comparabel to standard coating but coating cost are significantly lower.

## Outlook:

- Installation of a second roll with test coating in heating/ soakting section.

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# Thank You very much for Your attention!