

Shape Up! The New Merchant Bar Mill at Nucor Steel Kankakee

IRD Fall meeting 2022

Mario Fabro, SMS group

NUCOR®

SMS group

Project Genesis

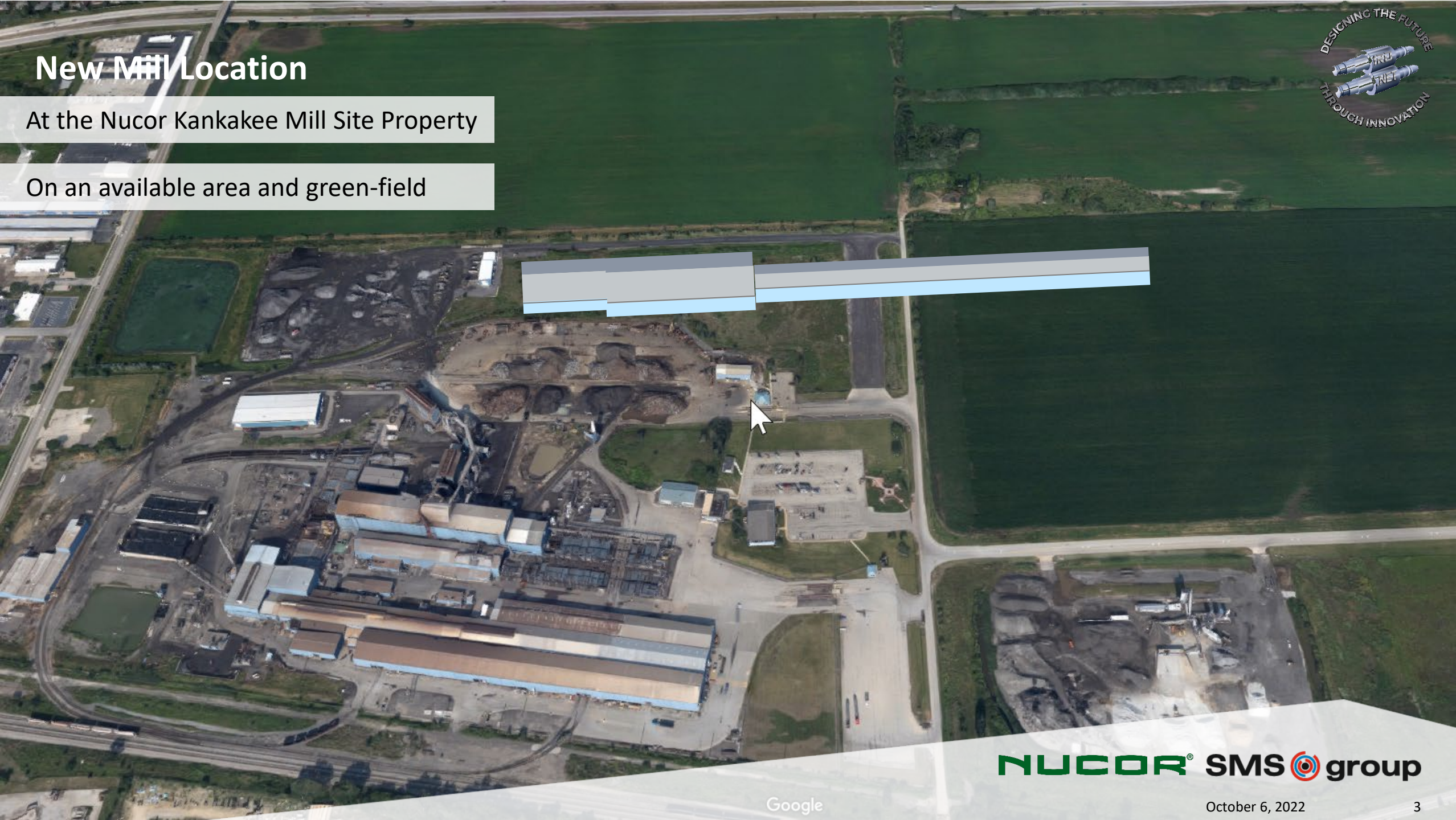


- Nucor was considering an increase in the merchant bar range at their Kankakee, Bourbonnais IL mill
- the existing merchant bar mill had a product range up to 3” angle and 3” channel
- Increasing the range on the existing mill proved to be extremely difficult and requiring a too extensive modification
- The mill had excess melting and casting capacity and thus it was decided that the best option would be the installation of a new rolling for the required range
- The new mill would receive billets from the caster at site (6-¼” square) but also be capable of rolling billets from other Nucor Plants (5”x8-½” and 11-½”x5-½”)
- The mill would be located on a green field next to the existing plant.

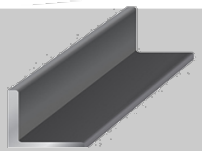
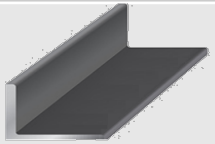
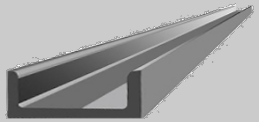
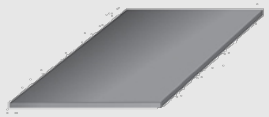
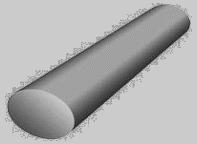
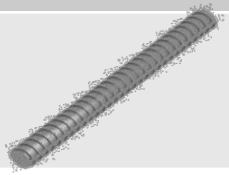
New Mill Location

At the Nucor Kankakee Mill Site Property

On an available area and green-field

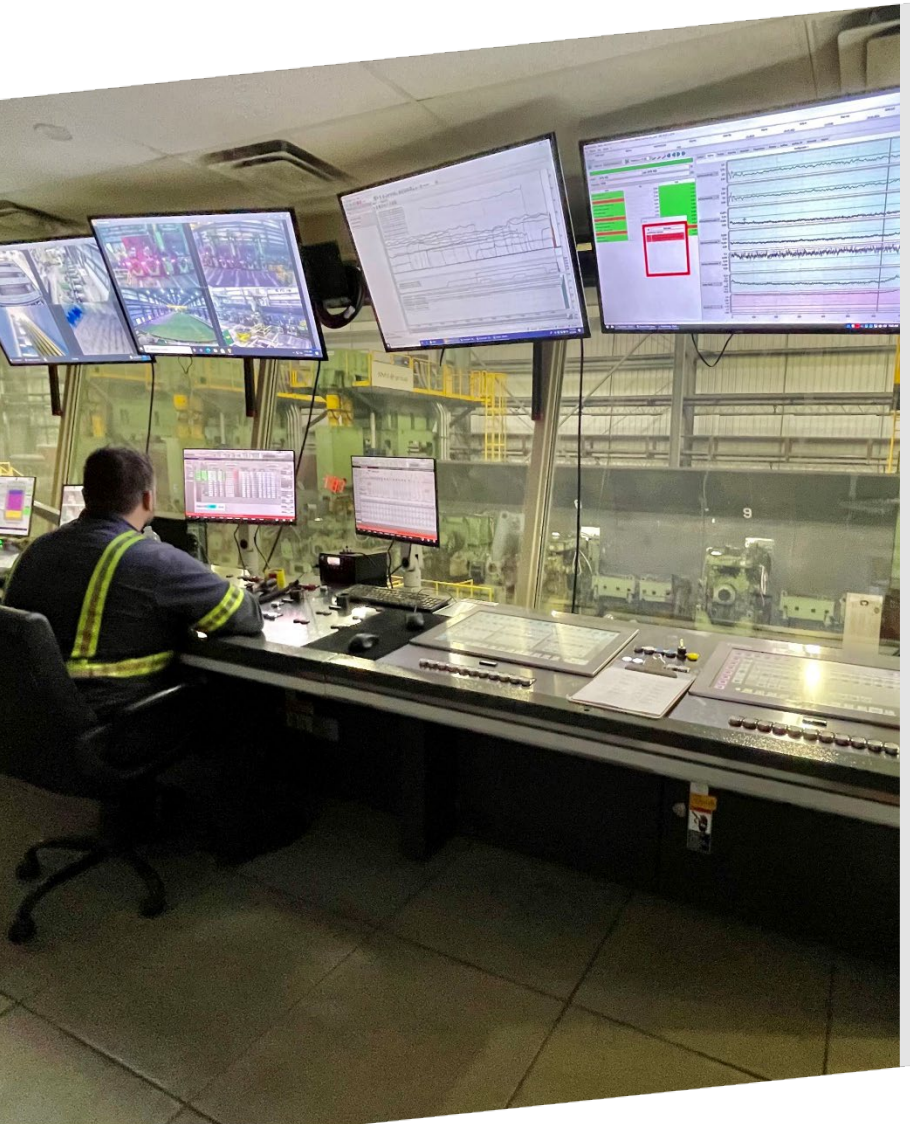


Product Range

	Equal-leg Angles	3” to 6” From 3.7 to 37 lb/ft
	Unequal-leg Angles	3”x2” to 7”x4” From 3 to 26 lb/ft
	Channels	C3x3.5 to C10x20
	Flats	4”x¼” to 12”x1” From 3 to 41 lb/ft
	Rounds	From 1-⅝” to 3-⅝” From 7 to 35 lb/ft
	Rebar	#14 and #18 From 7 to 13 lb/ft

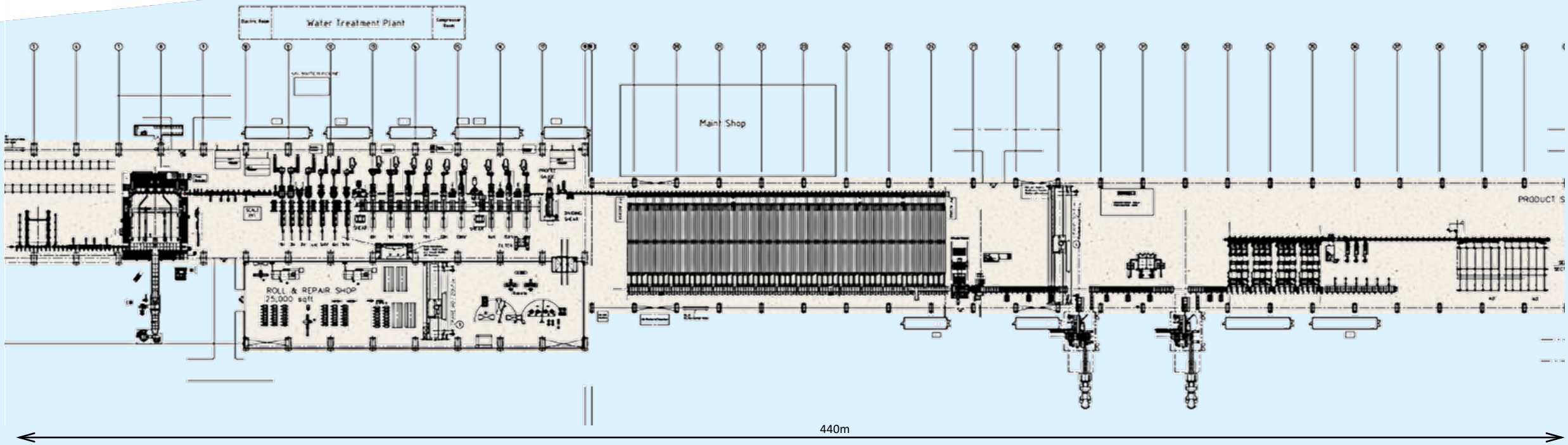


Design Data

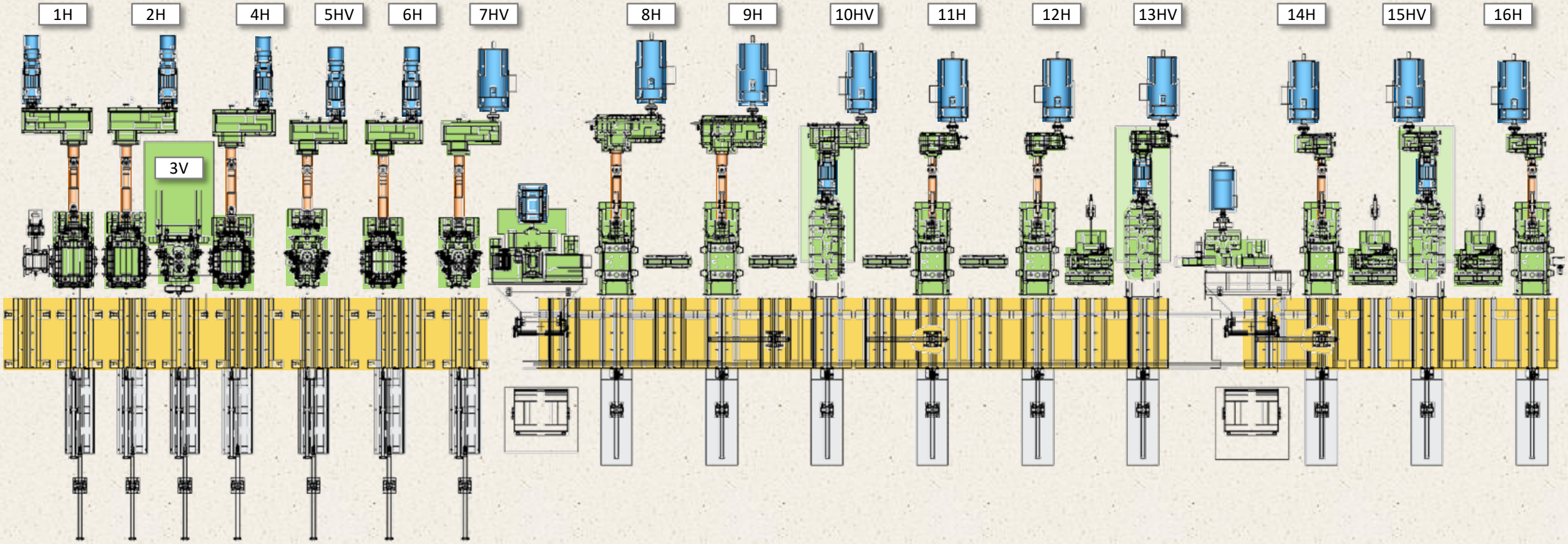


- Design Capacity: 500,000 tpy
- Production Rate: 100 tph
- Starting Billet Sizes:
  - 6.3” x 9” (ideal size)
  - 6-¼” x 6-¼” (existing billet size, limited capabilities)
  - 5” x 8-½” (alternative)
  - 5-½” x 11-½” (alternative)
- Billet length: 28’ to 41’-2”
- Steel grades: Low and Medium C
- Discharge Temp.: 2100°F for sections, 1920°F for rounds and rebar
- Maximum finishing speed: 1180 fpm

Mill Layout


Water Treatment Plant
Main Shop
ROLL & REPAIR SHOP
25,000 sqft
440m

Rolling Mill

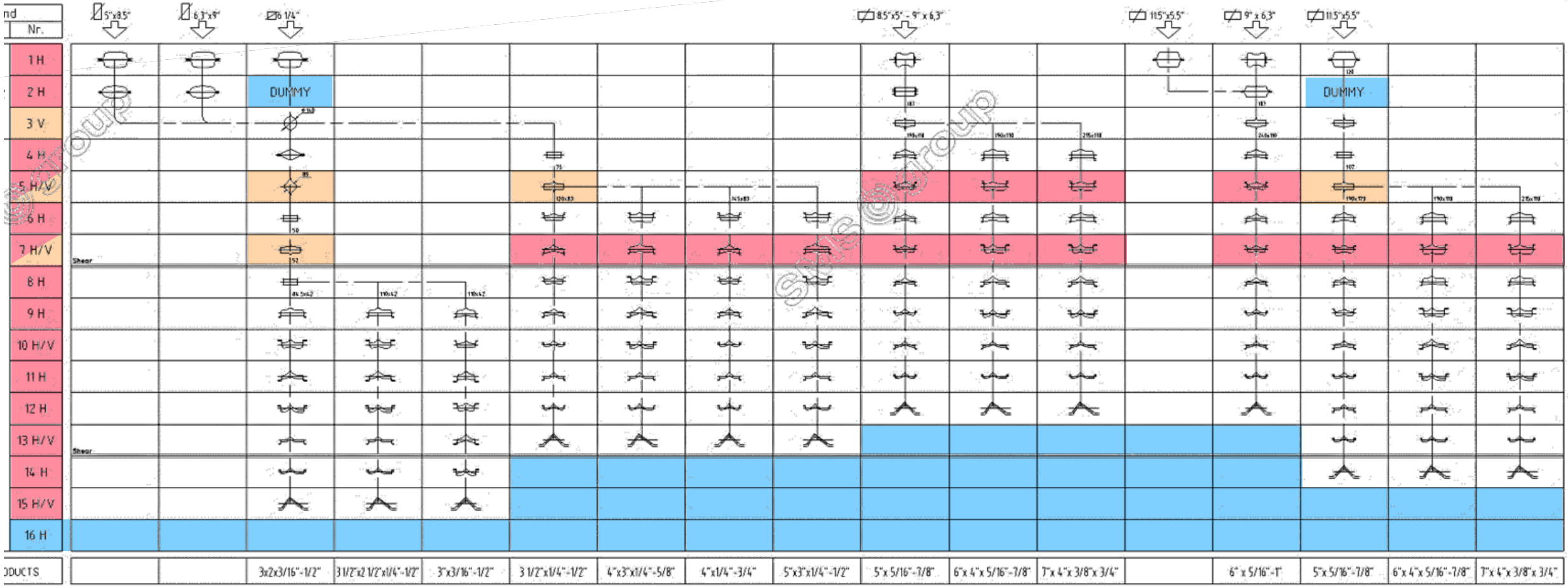


Rolling Mill Main Technical Data

	Stand #	Horizontal	Vertical	Convertible	Rolls Center Distance (max/min)	Rolls Neck	Rolls Barrel Length	Installed Power H motor kW	V motor kW
Rougher	1H	HL 850-32			850/530 mm 33,47/20,87 in	320 mm 12,6 in	1200 mm 47,24 in	500	
	2H	HL 850-32						500	
	3V		HL 850-32						500
	4H	HL 710-28			710/460 mm 28/18,1 in	280 mm 11 in	1000 mm 39,37 in	500	
	5 HV			HL 710-28				500	500
	6H	HL 710-28						500	
	7 HV			HL 710-28				800	500
C&C Shear #1								585	
Intermediate	8H	HL 710-28						800	
	9H	HL 710-28						800	
	10 HV			HL 710-28				800	500
	11H	HL 710-28						800	
	12H	HL 710-28						800	
	13 HV			HL 710-28				800	500
C&C Shear #2								510	
Finish.	14H	HL 710-28						800	
	15 HV			HL 710-28				800	500
	16H	HL 710-28						800	
Divide Shear #3								465	

Roll Pass Design (Example for Angles)

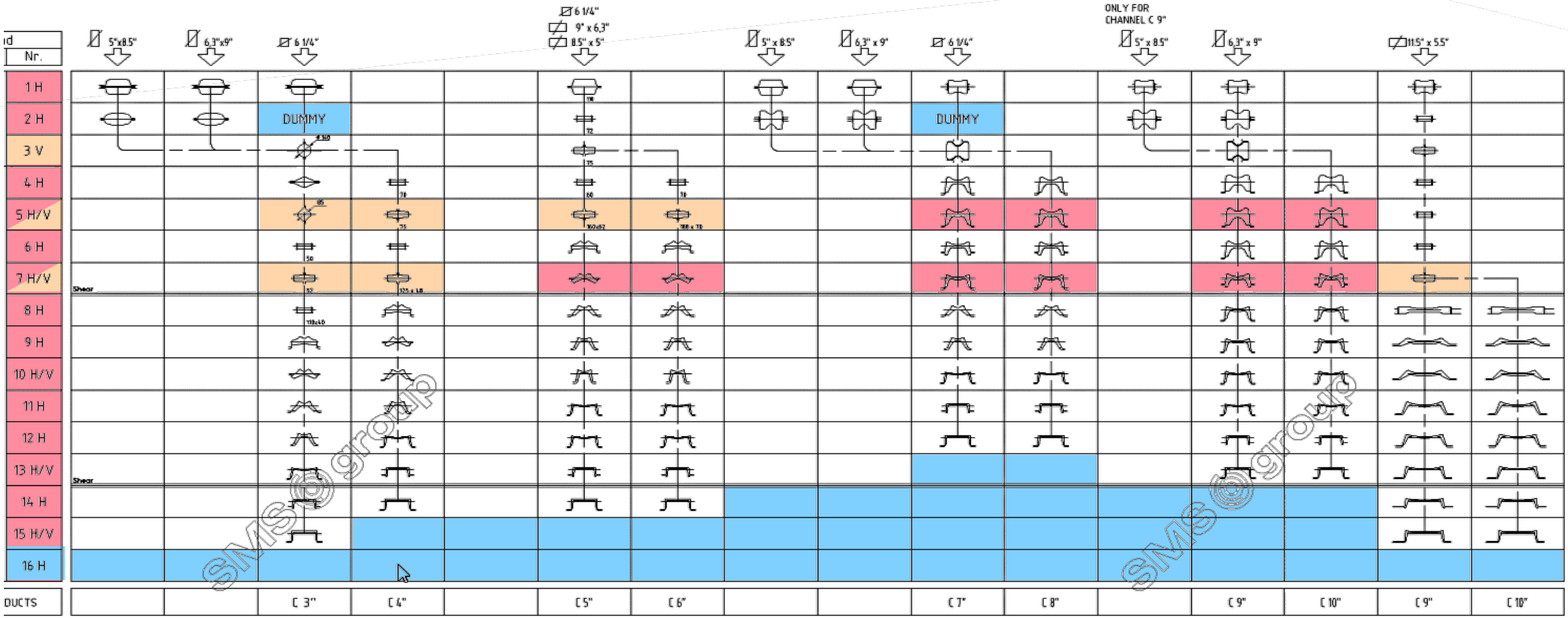
Stand in Horizontal Configuration
Stand in Vertical Configuration
Stand By-passed



- Angles are rolled mostly on horizontal passes, with a couple edging passes
- Larger sizes have the finishing stands by-passed
- This example shows alternative billet starting sizes

Roll Pass Design (Example for Channels)

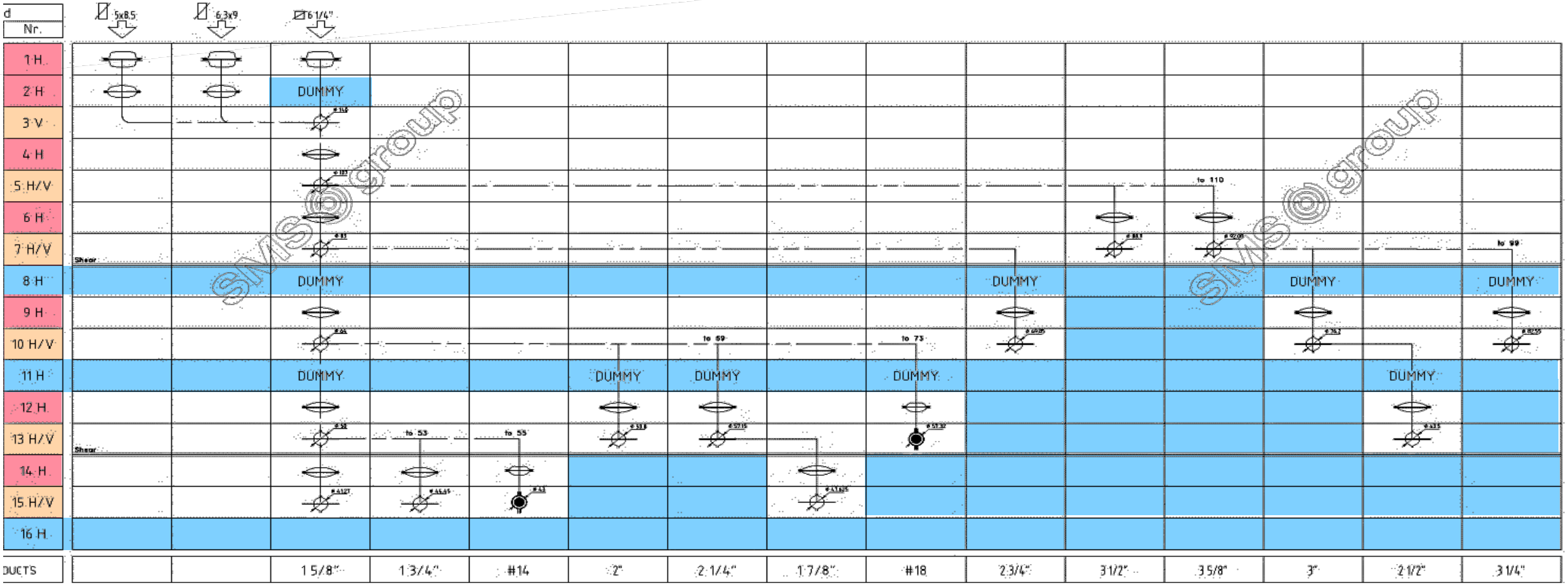
Stand in Horizontal Configuration
Stand in Vertical Configuration
Stand By-passed



- Channels are rolled mostly on horizontal passes, with a couple edging passes
- Larger sizes have the finishing stands by-passed
- This example shows alternative billet starting sizes

Roll Pass Design (Example for Rounds)

Stand in Horizontal Configuration
Stand in Vertical Configuration
Stand By-passed



- Rounds and/or squares can be rolled in a traditional oval/round sequence
- In this case, some horizontal passes need to be by-passed to preserve a true H/V sequence

Project Schedule



Contract Award: December 2017

Equipment Delivery: 2nd half 2019

First Billet: April 2020

End of Commissioning: end of 2020

The project sustained some delays due to longer than expected permitting and the COVID pandemic with resulting supply chain delays

Construction













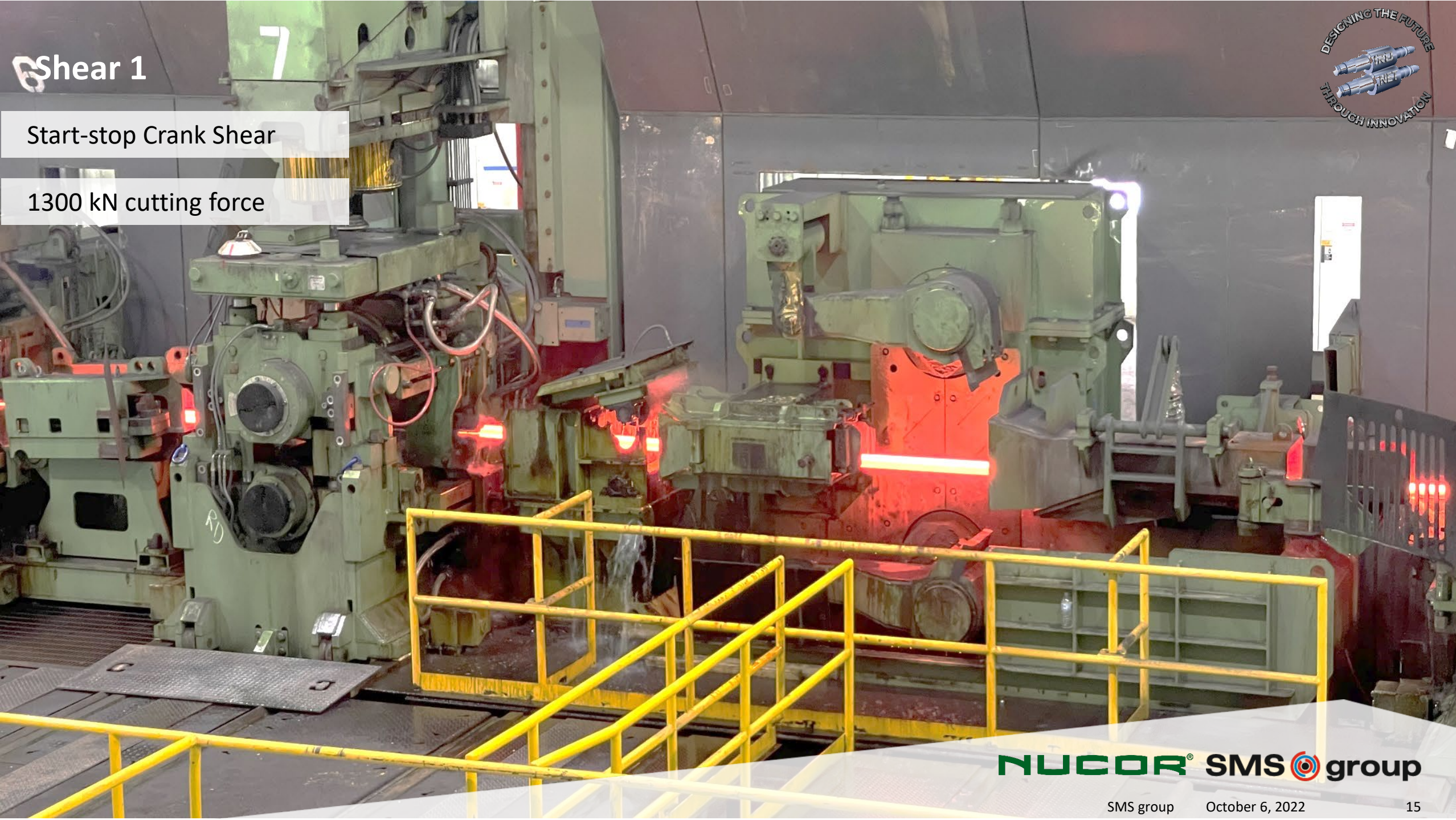
Rougher



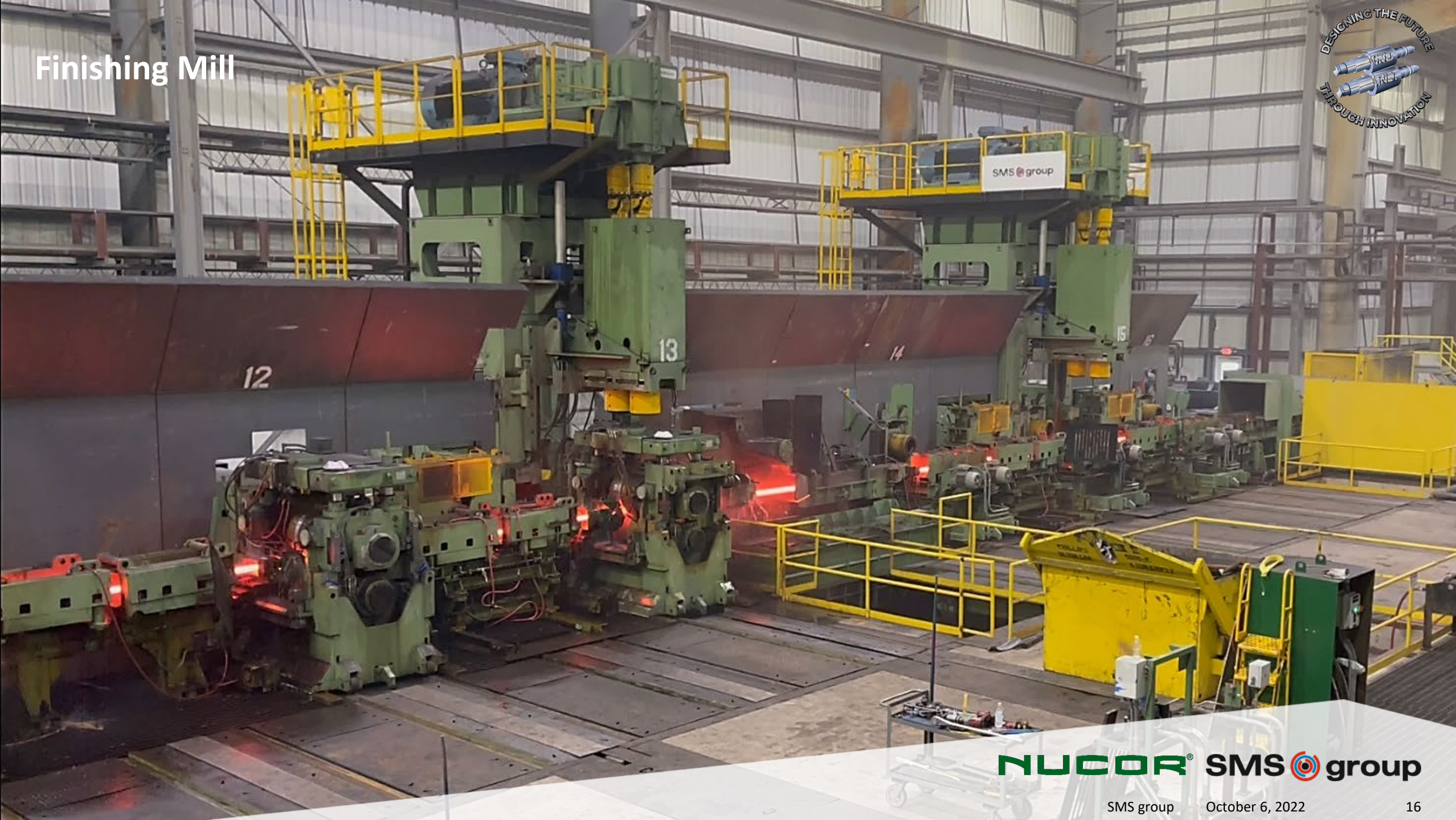
Shear 1

Start-stop Crank Shear

1300 kN cutting force



Finishing Mill



Shear 2

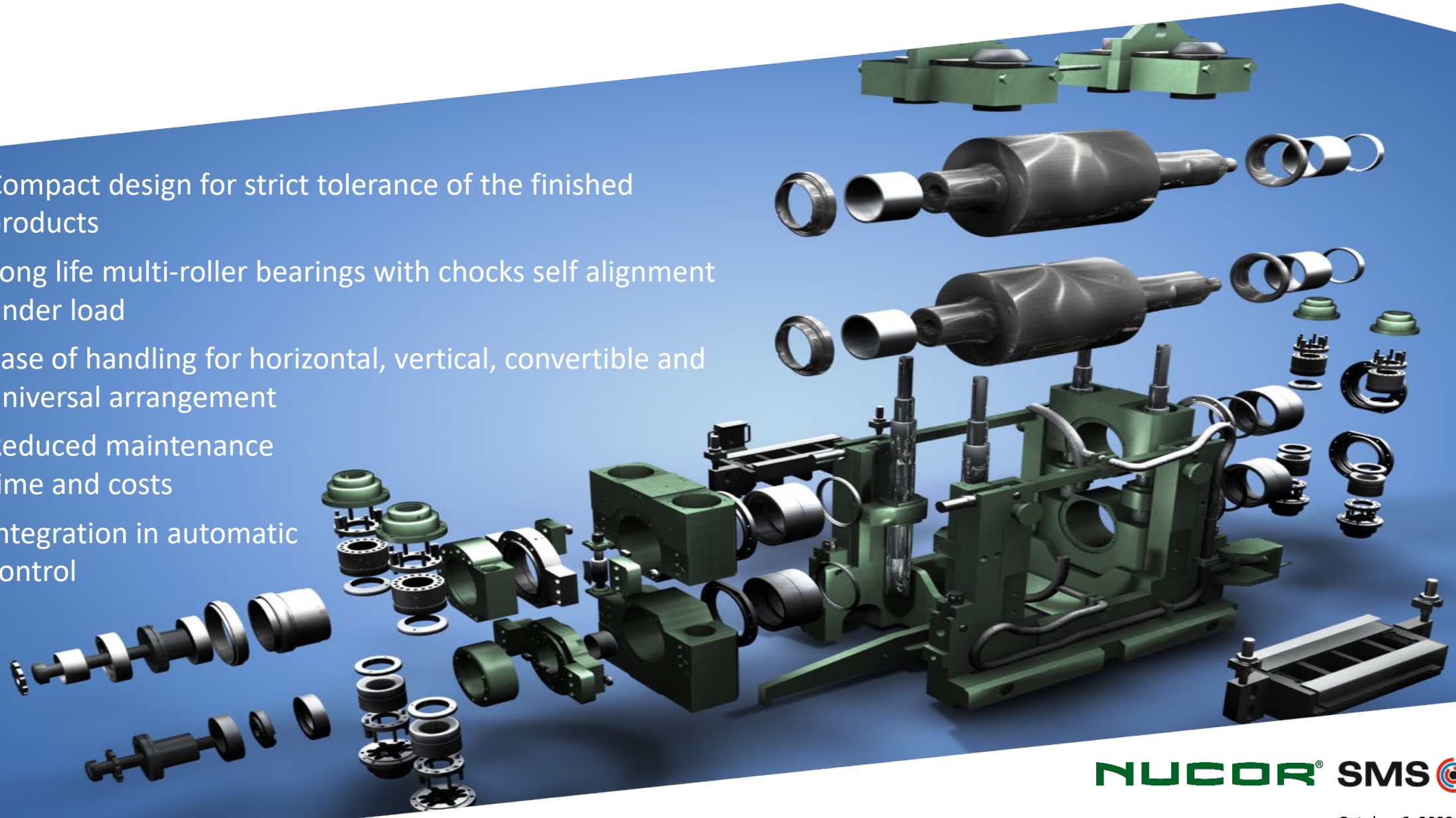
Start-stop Crank Shear

600 kN cutting force

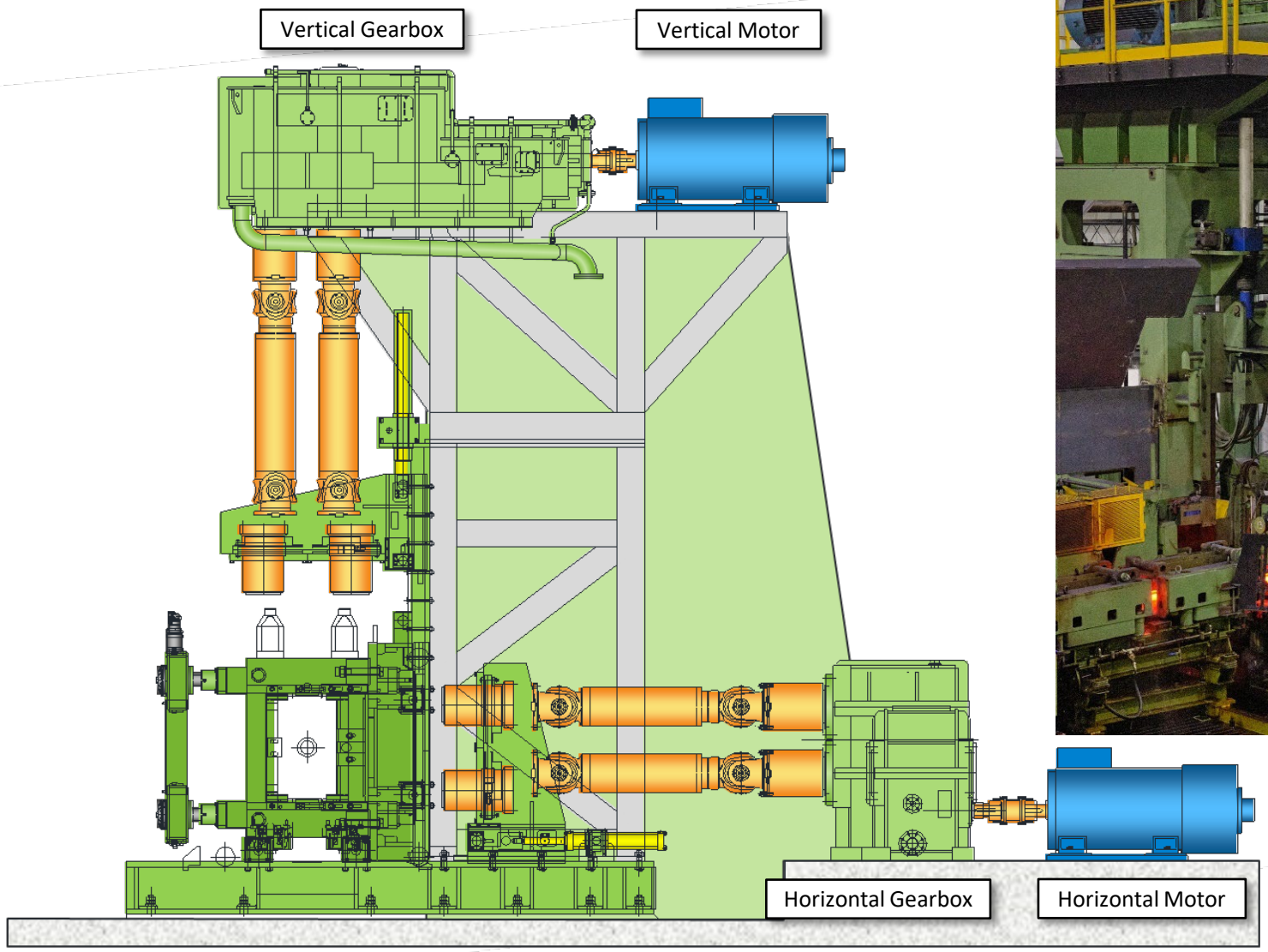


Housingless Stands

- Compact design for strict tolerance of the finished products
- Long life multi-roller bearings with chocks self alignment under load
- Ease of handling for horizontal, vertical, convertible and universal arrangement
- Reduced maintenance time and costs
- Integration in automatic control



Dual Drive Convertible Stand







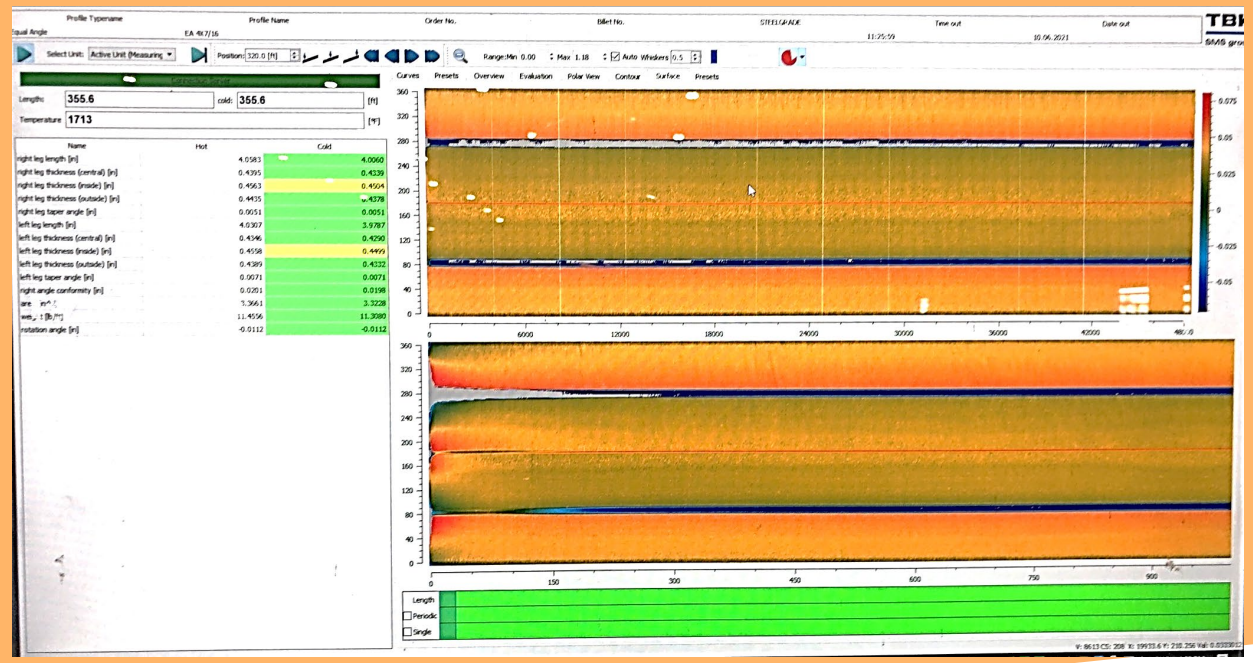
Measuring Gauge

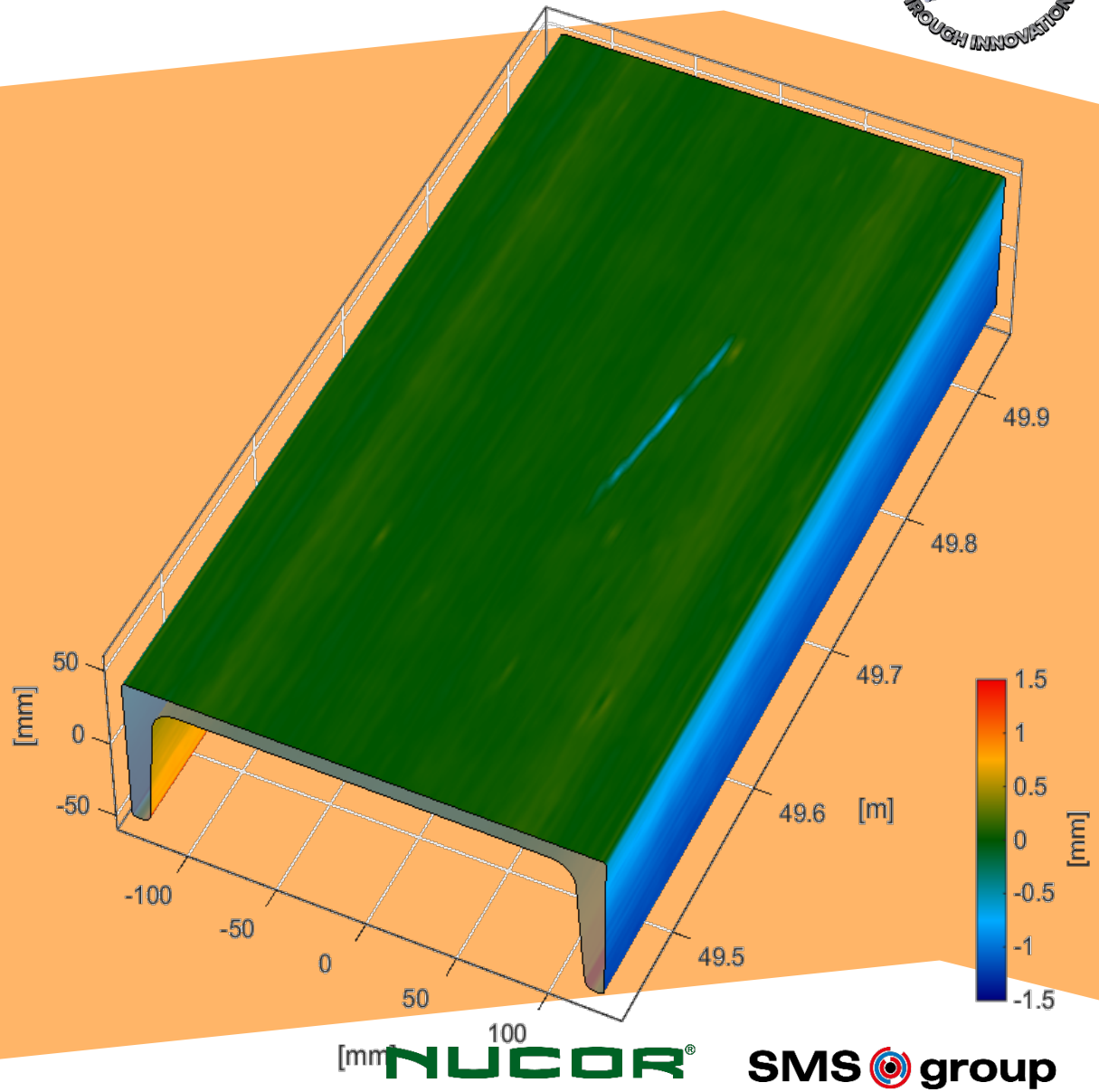


- Four Laser Heads
- Continuous Illumination and Measurement
- 1000 scans per second
- ±0.08mm (3 thou) accuracy

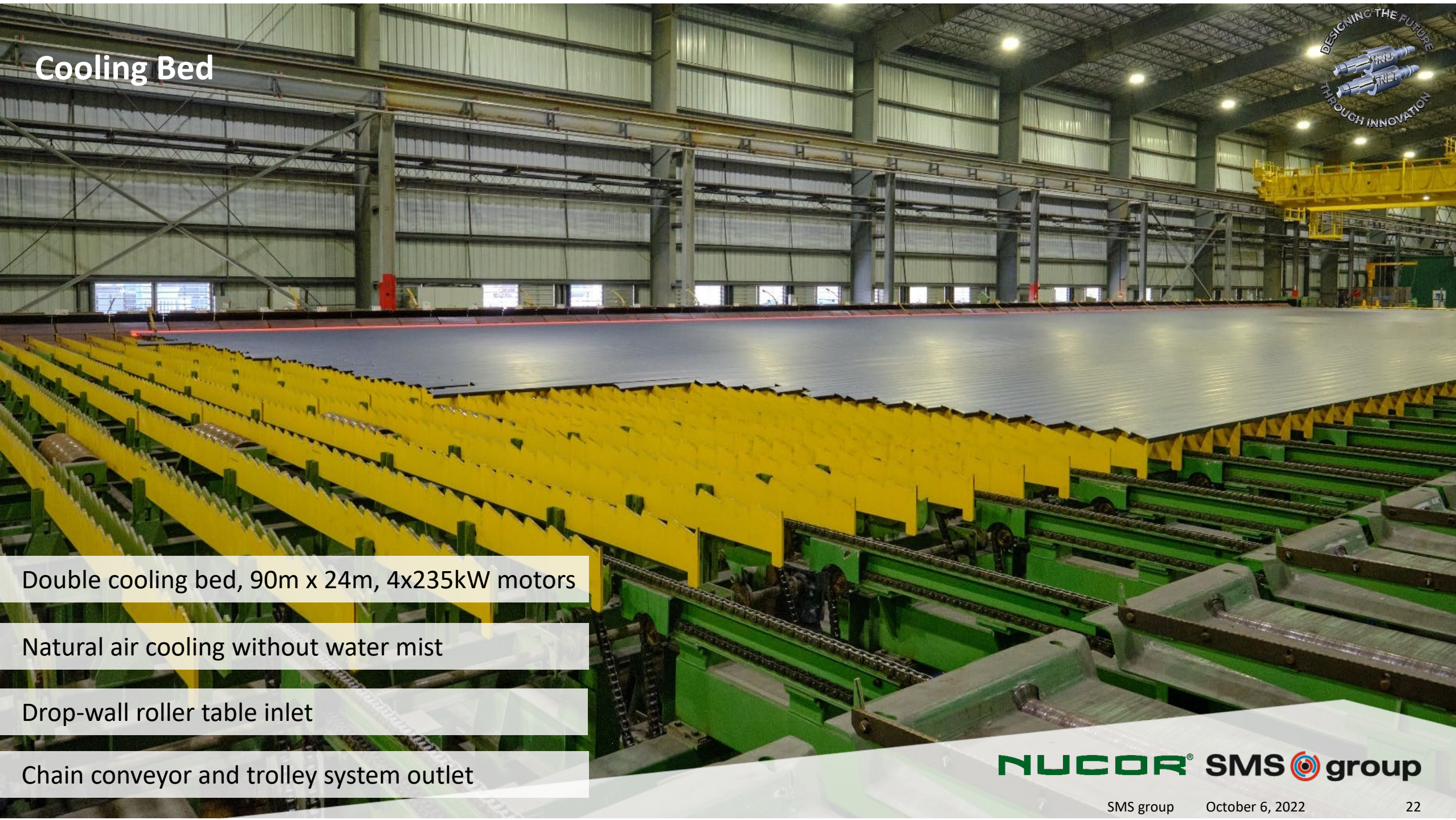
SurfTEC Surface Defect Detection

- Continuous surface inspection capability
- Pre-settable defect detection levels
- Customizable alarms





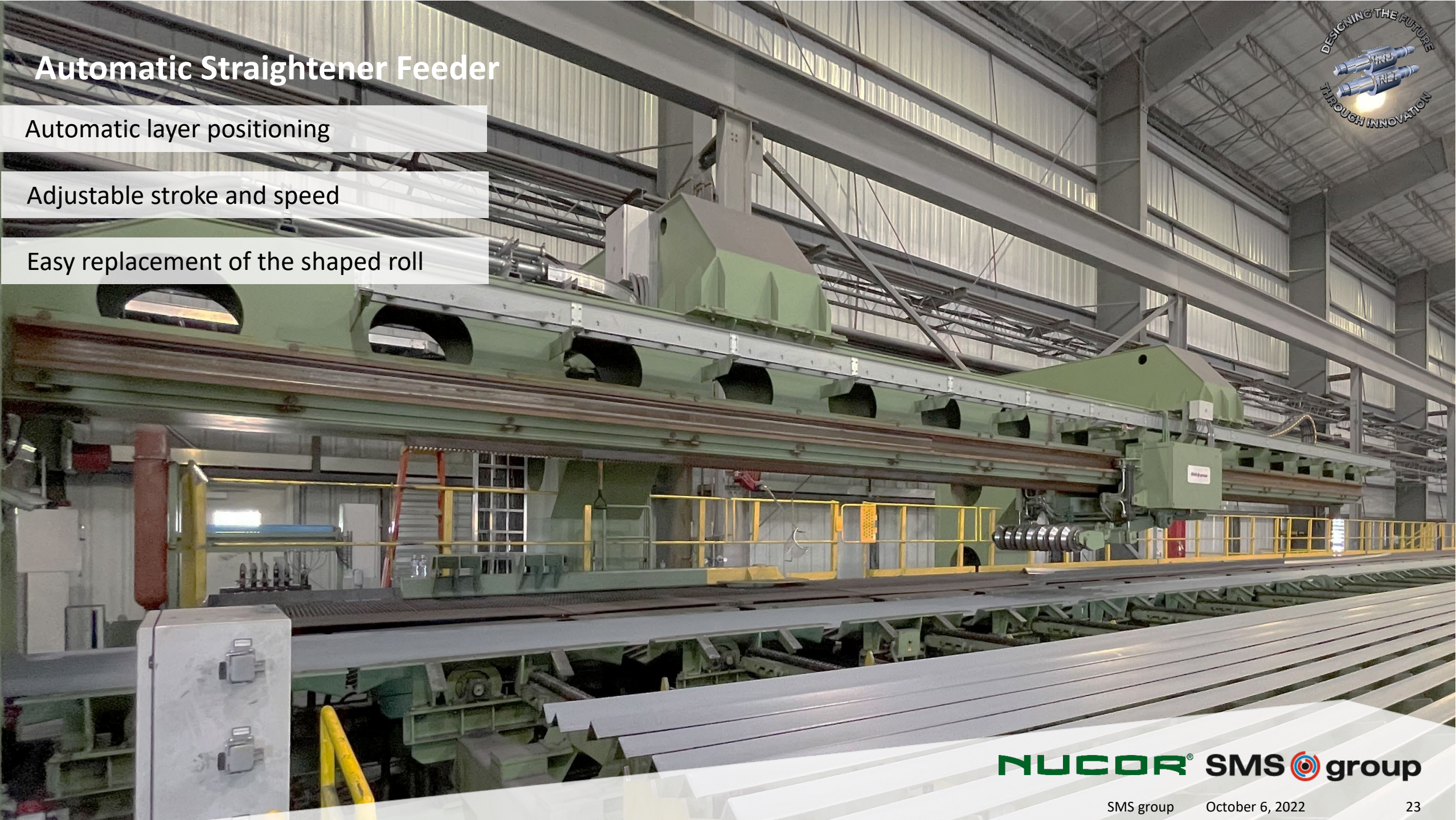
Cooling Bed



- Double cooling bed, 90m x 24m, 4x235kW motors
- Natural air cooling without water mist
- Drop-wall roller table inlet
- Chain conveyor and trolley system outlet

Automatic Straightener Feeder

- Automatic layer positioning
- Adjustable stroke and speed
- Easy replacement of the shaped roll

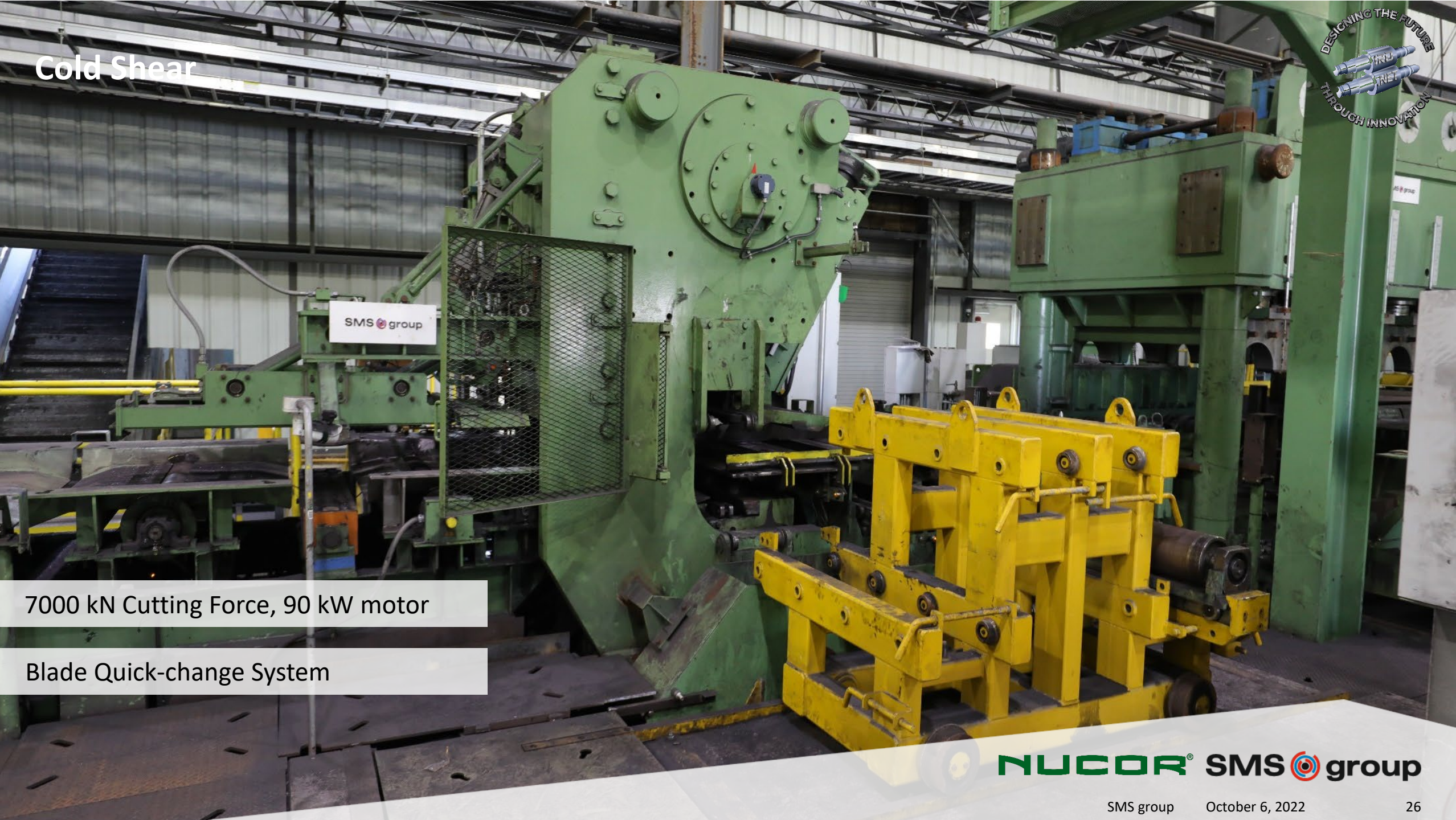


Straightener



- 10-roll multi-strand machine
- 535 kW motor
- Casette mounted rolls
- Dedicated overhead crane

Cold Shear



7000 kN Cutting Force, 90 kW motor

Blade Quick-change System

Cold Saws

Two fixed saws, 390 kW each

Each with measuring gauge

metal/abrasive saw blade capability



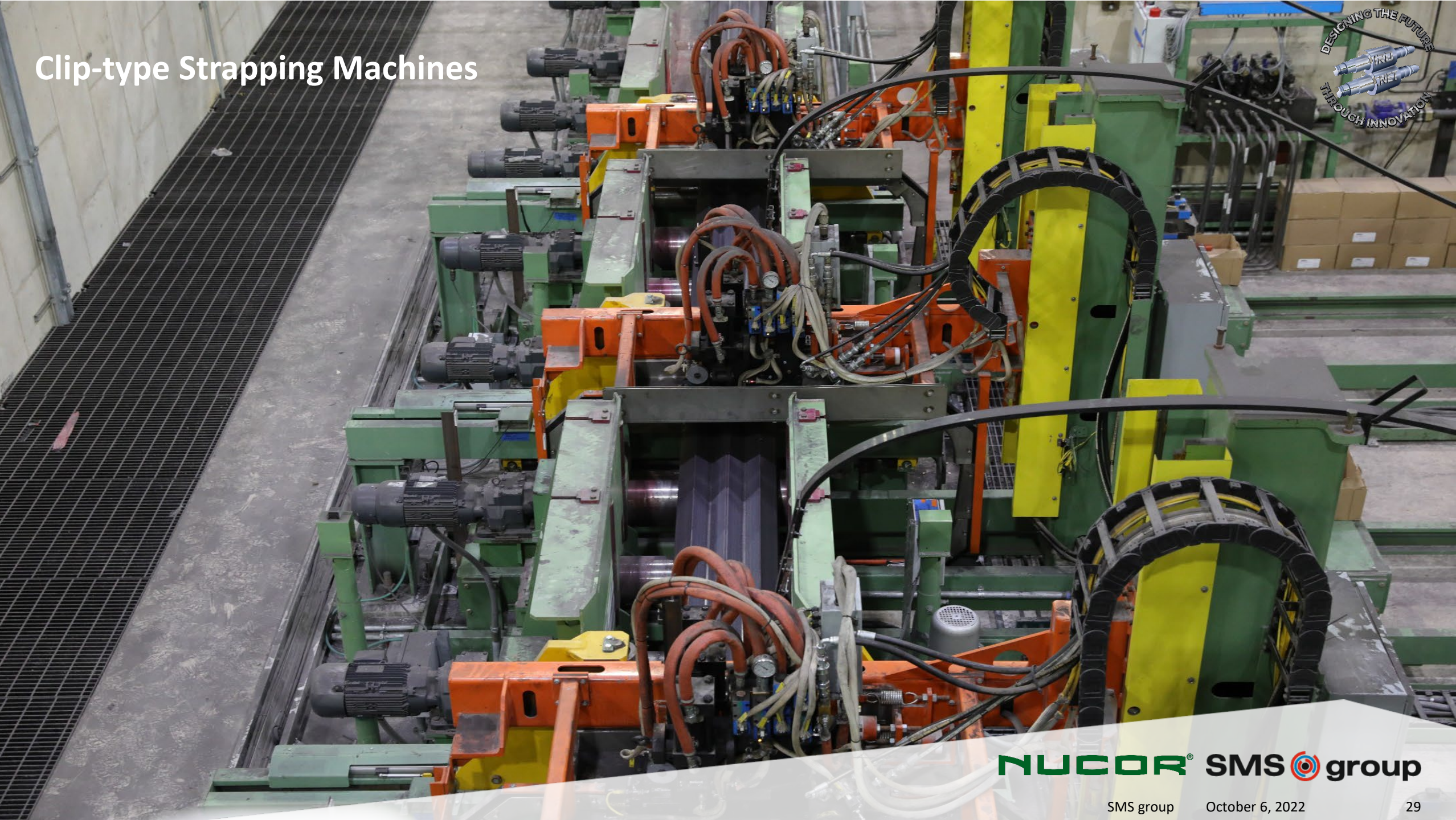
Stacker

4x20’ sections

Independent or combined operation



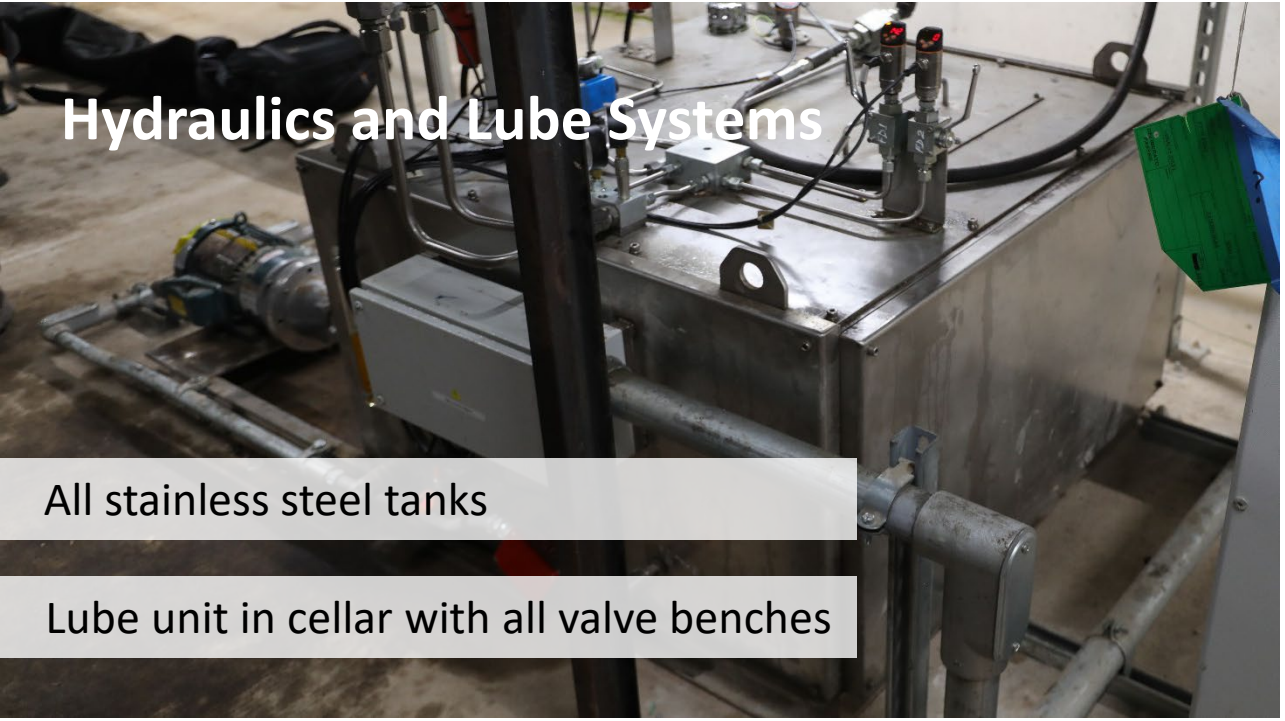
Clip-type Strapping Machines



Welded-pin Robot Tagging

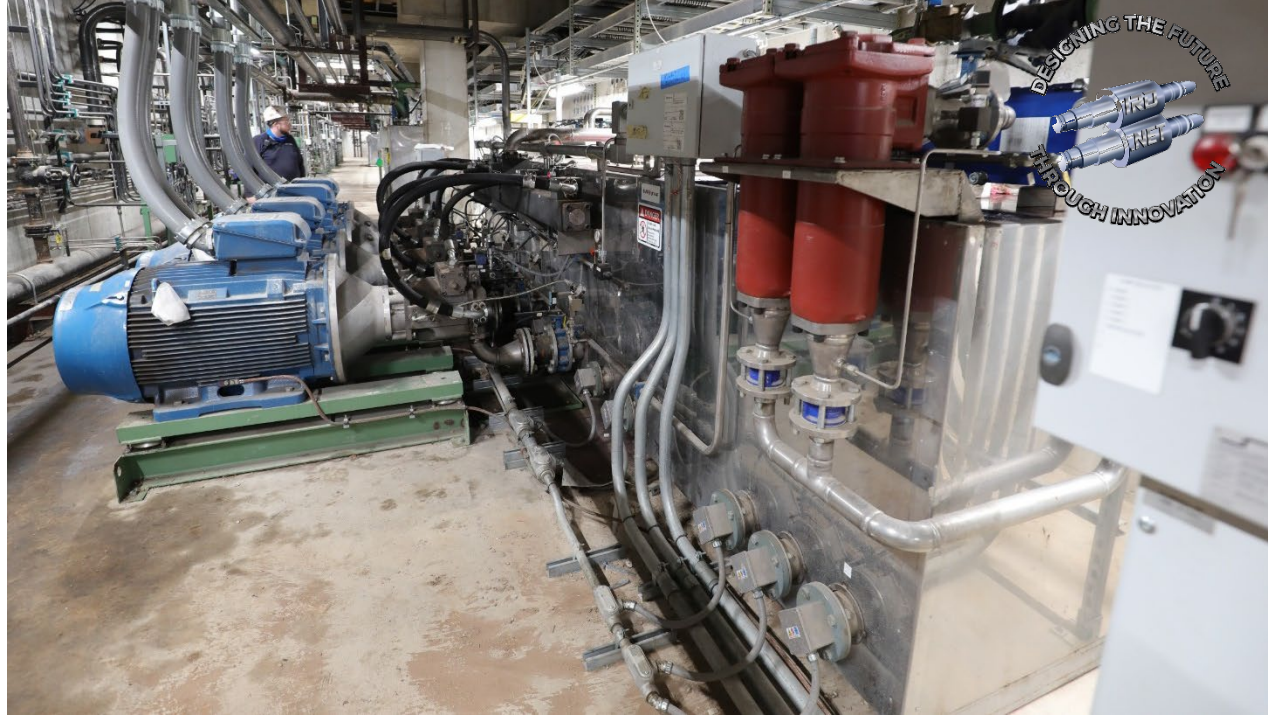


Hydraulics and Lube Systems

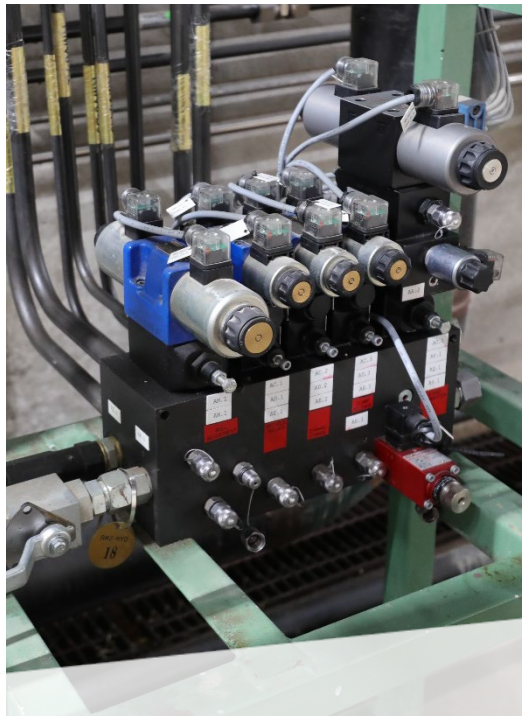


All stainless steel tanks

Lube unit in cellar with all valve benches





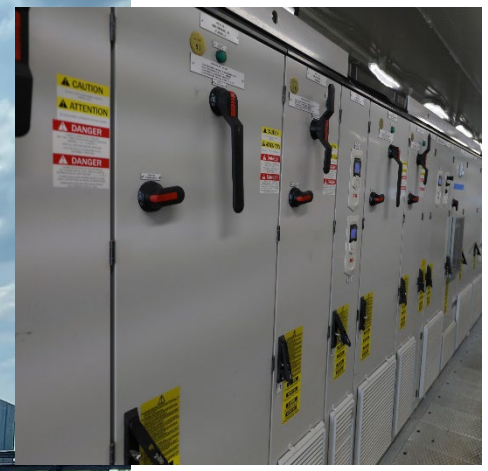




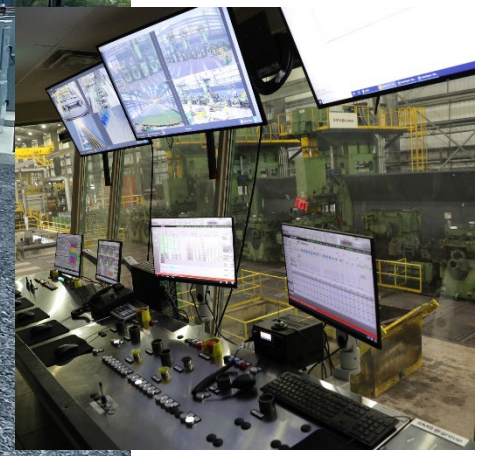
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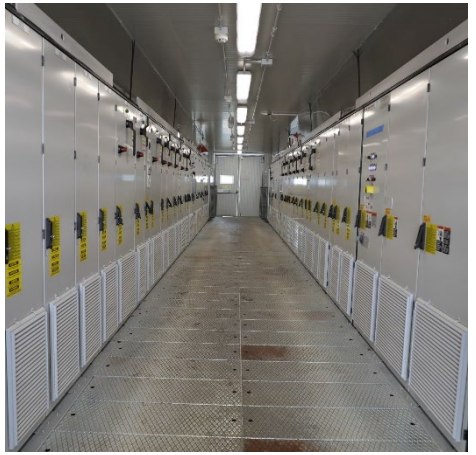
Electric and Automation











- Level 1 and Level 2 automation
- Based on A-B ControlLogix
- 9 PCR Control Rooms

Start-up and Commissioning

- First bar was rolled in April 2020
- The pass design had to be adjusted as the initial objective of minimizing pass shapes and unfirming the different billet sizes in the first few stands proved difficult to reach and maintain
- Overall minor modifications to the equipment were needed
- The mill in on-track to fulfill all market demands





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