Comparing IR camera resolutions—what high resolution buys you

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Why High Resolution?

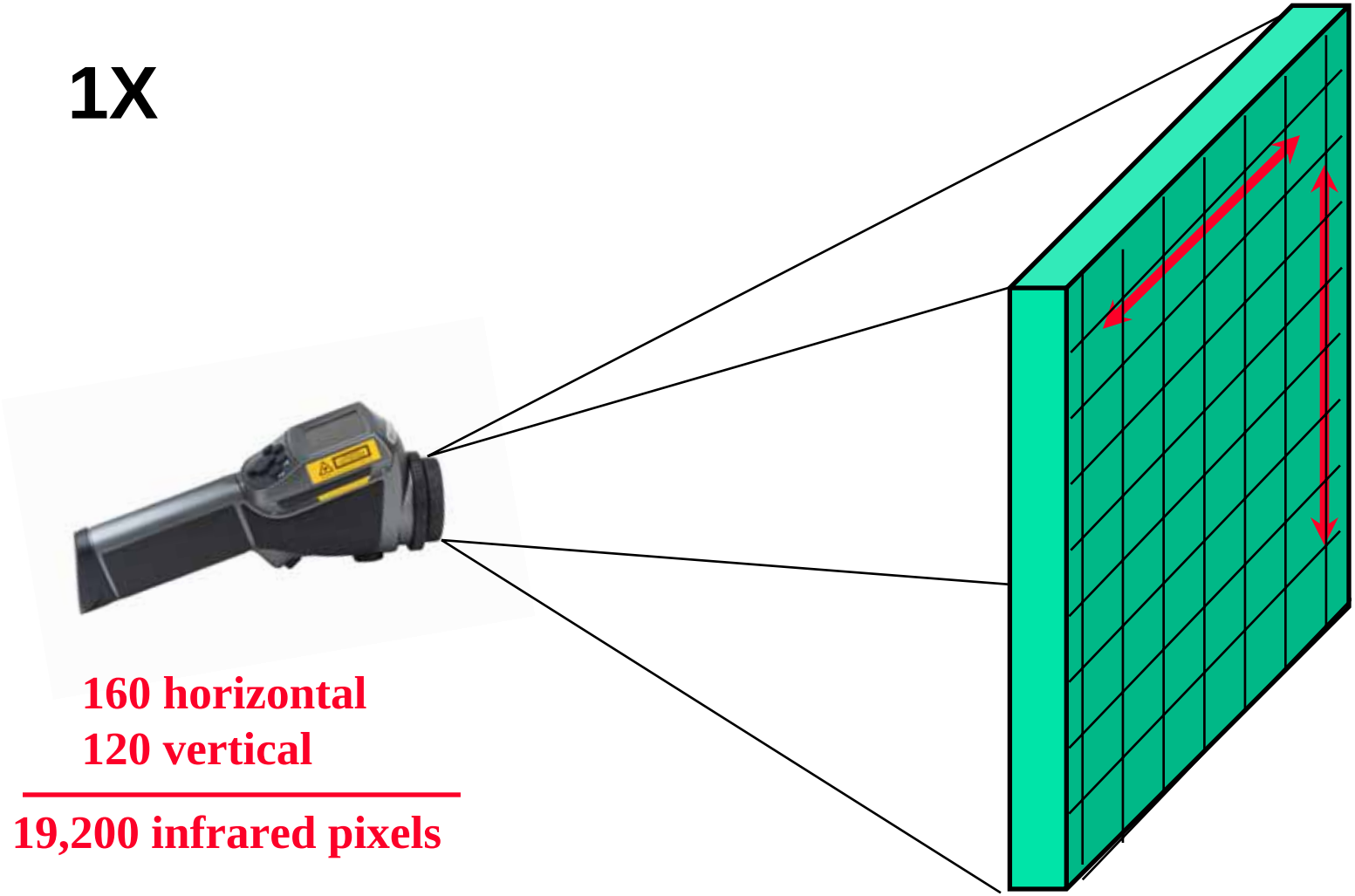
- Higher resolution camera means you will find smaller problems at greater distances
- You can find significant problems that could be missed with lower resolution camera.

Why High Resolution?

- IR survey efficiency is greatly improved
  - You can cover same surface area with ¼ to 1/16 the number of images
  - Means faster surveys and faster report generation

Infrared pixel Count—Lo Res

1X

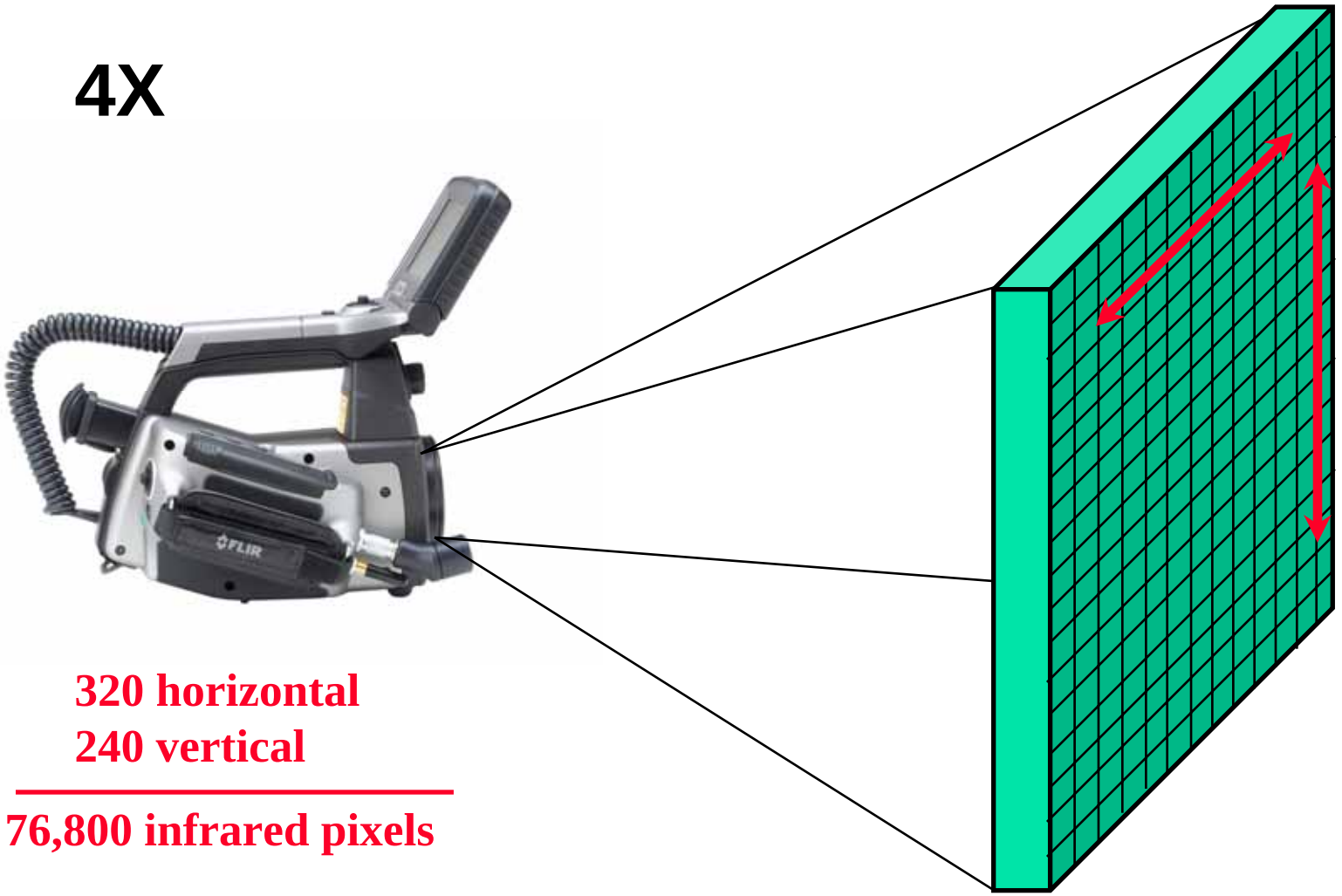


160 horizontal
120 vertical

19,200 infrared pixels

Infrared pixel Count—Med Res

4X

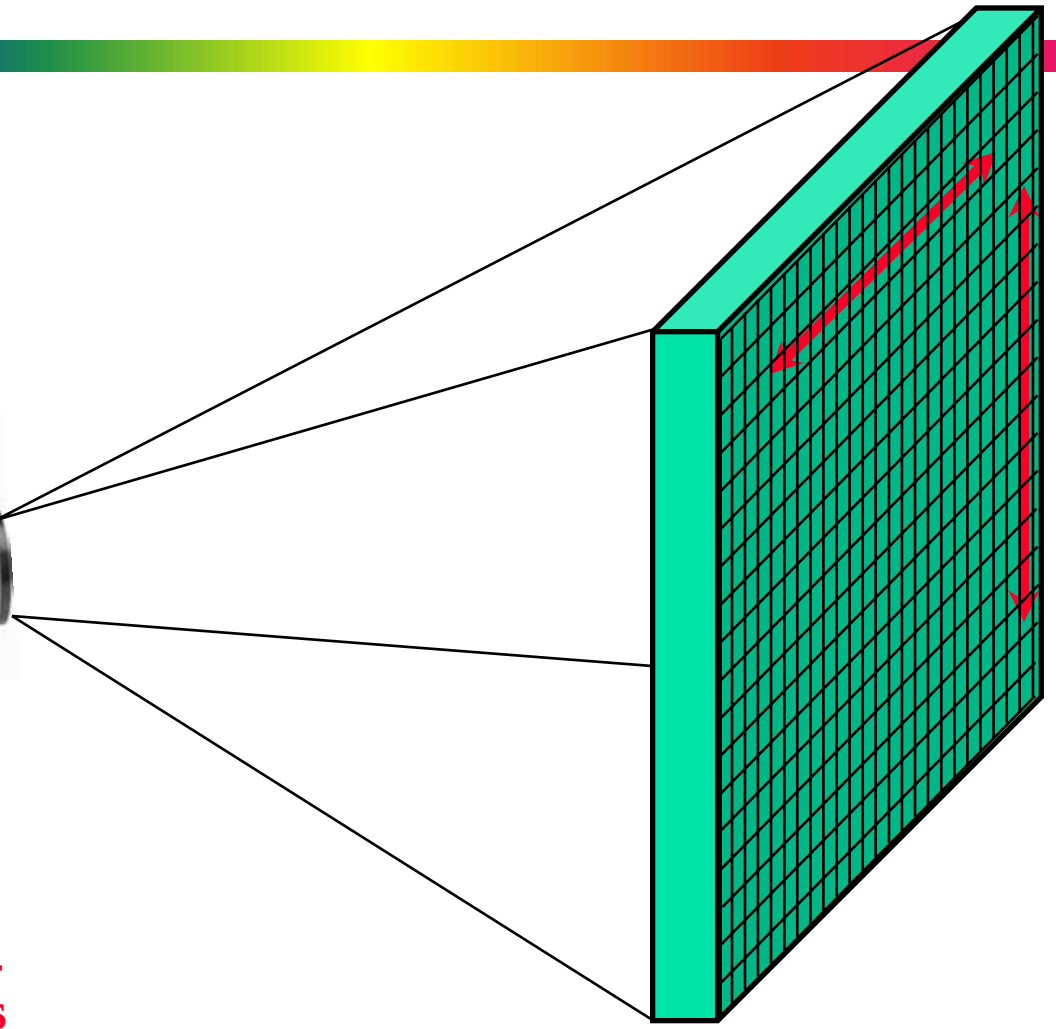


320 horizontal
240 vertical

76,800 infrared pixels

Infrared pixel Count—Hi Res

16X

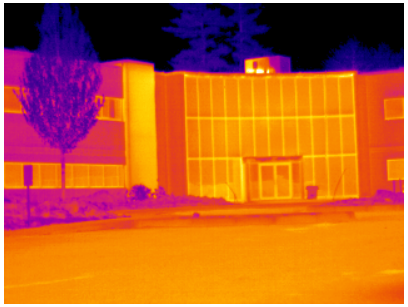


640 horizontal
480 vertical

307,200 infrared pixels

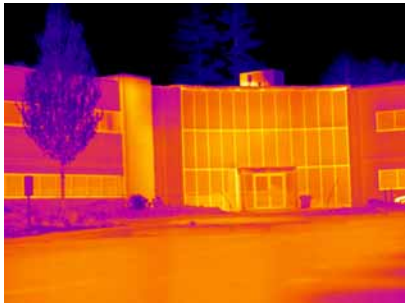
More camera—less work

- 1 IR Image



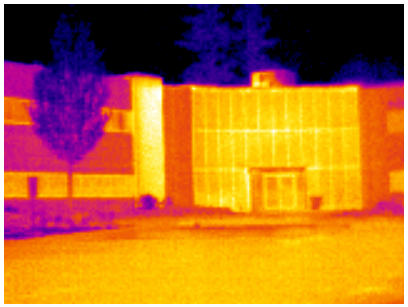
- 4 IR Images

(1/2 the distance to get same resolution)



- 16 IR images

(1/4 the distance to get same resolution)



Explain?

- The Hi Res IR Camera can be 4 times the distance of a Lo Res and 2 times the distance of a Med Res and get the same image detail.
- At 1/2X distance, it takes 4 pictures to cover the same area.
- At 1/4X distance, it takes 16 pictures to cover the same area.
- Think of the savings in capture and reporting time.
- And image interpretation just got easier.

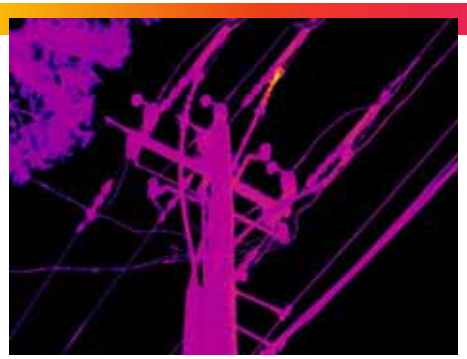
Small, distant targets

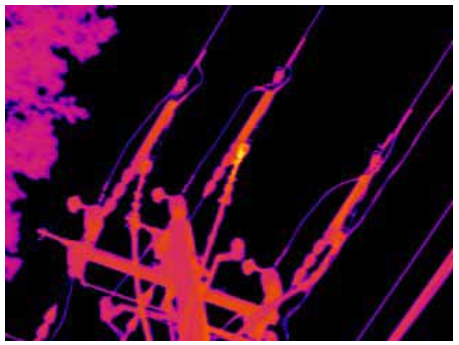
- The Hi Res really comes through for small, distant targets
- Substations, switchyard, transmission and distribution lines are littered with this type of target.

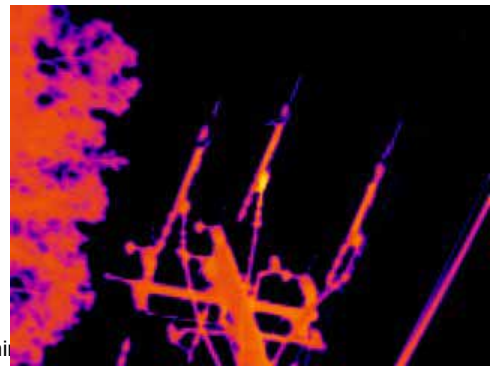
Switch disconnect visual

Switch Disconnect

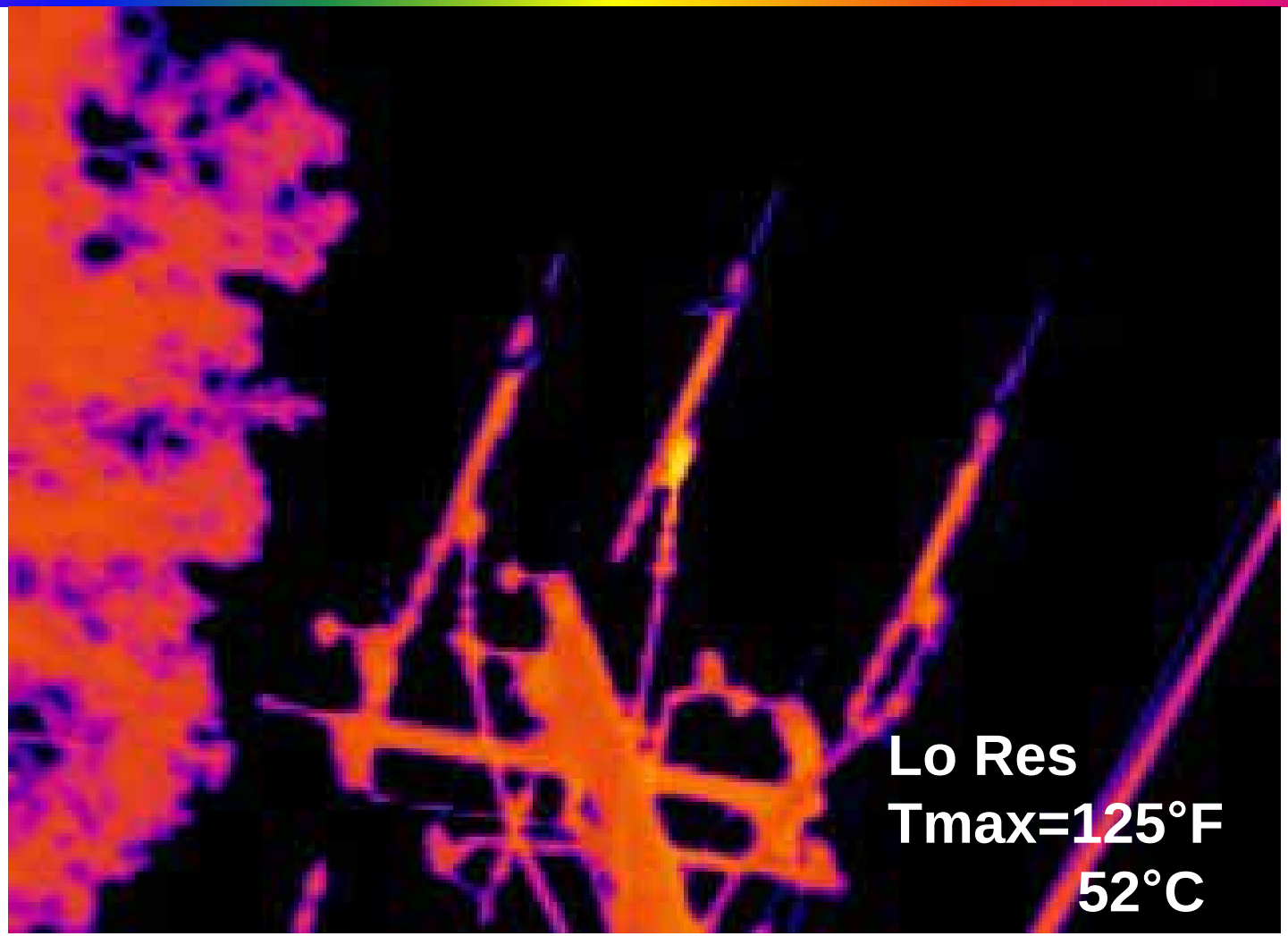
- Pole switch at 12 Yards
- Top, Hi Res--640X480
- Middle, Med Res--320X240
- Bottom, Lo Res--160X120



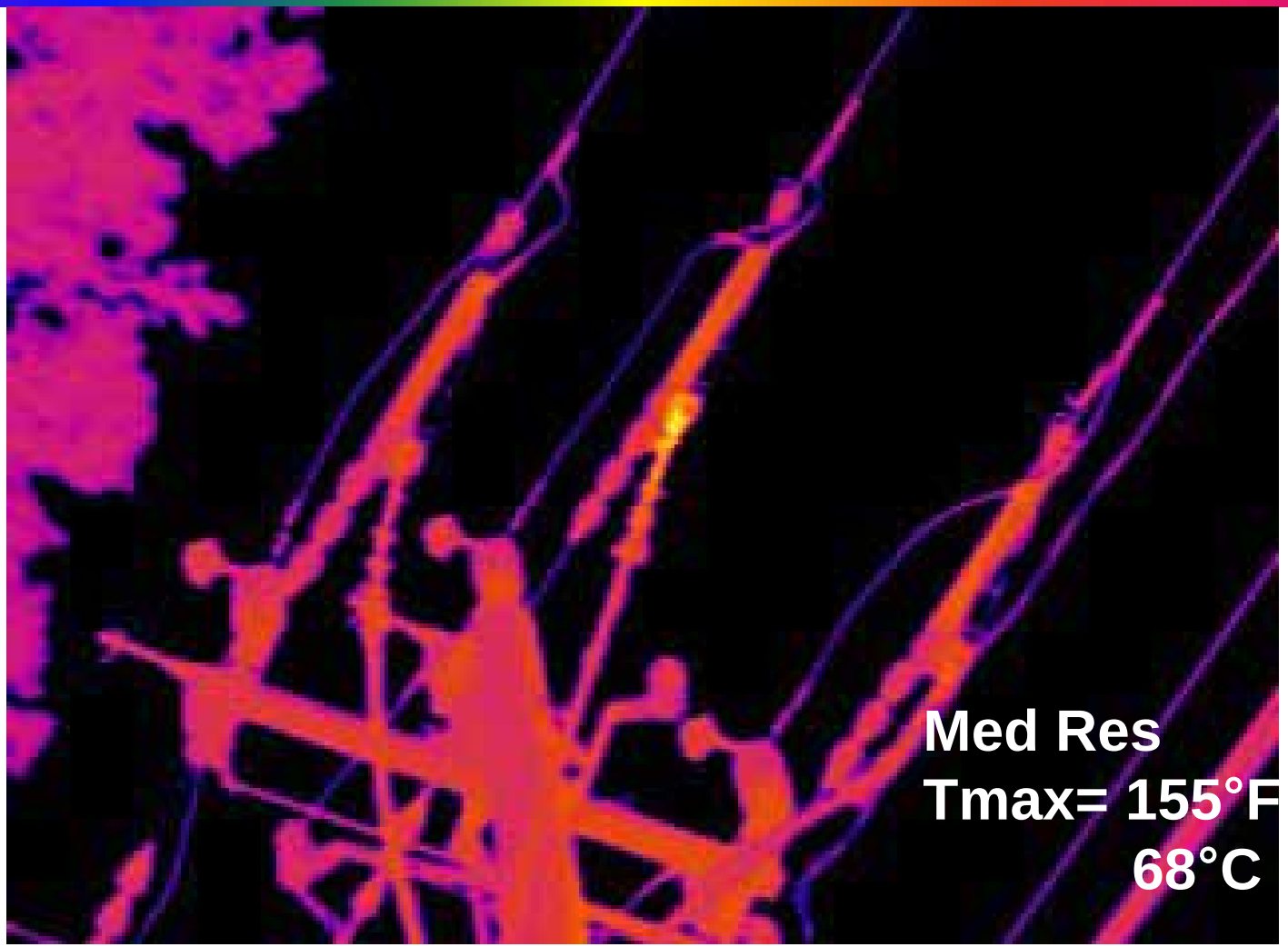




Switch Disconnect—12 Yds

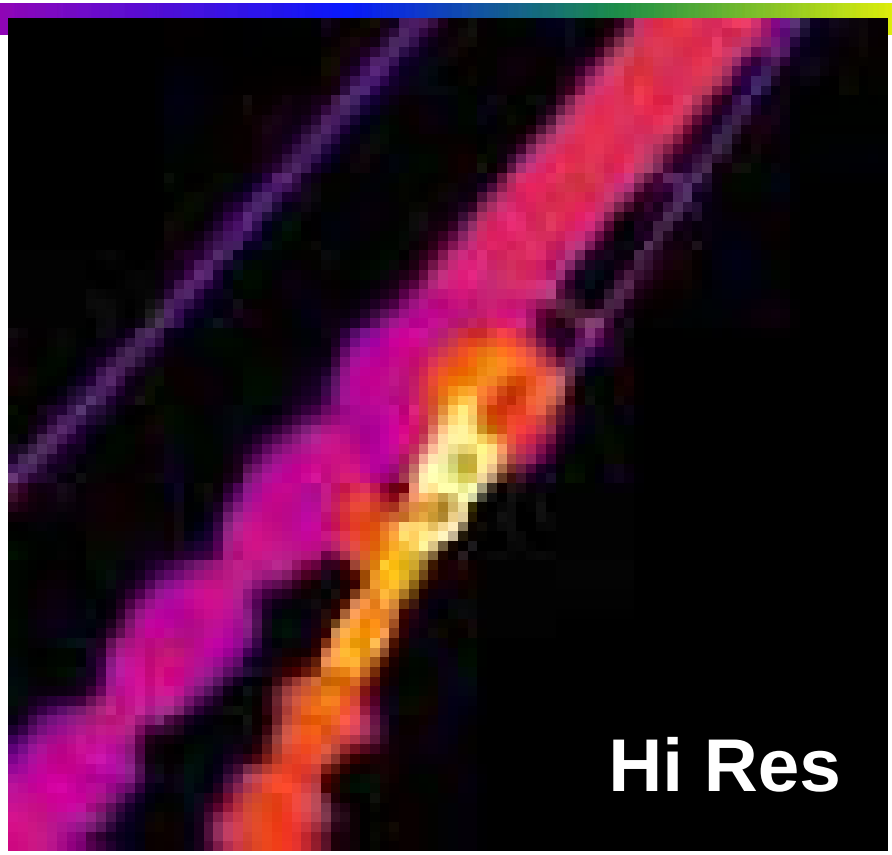


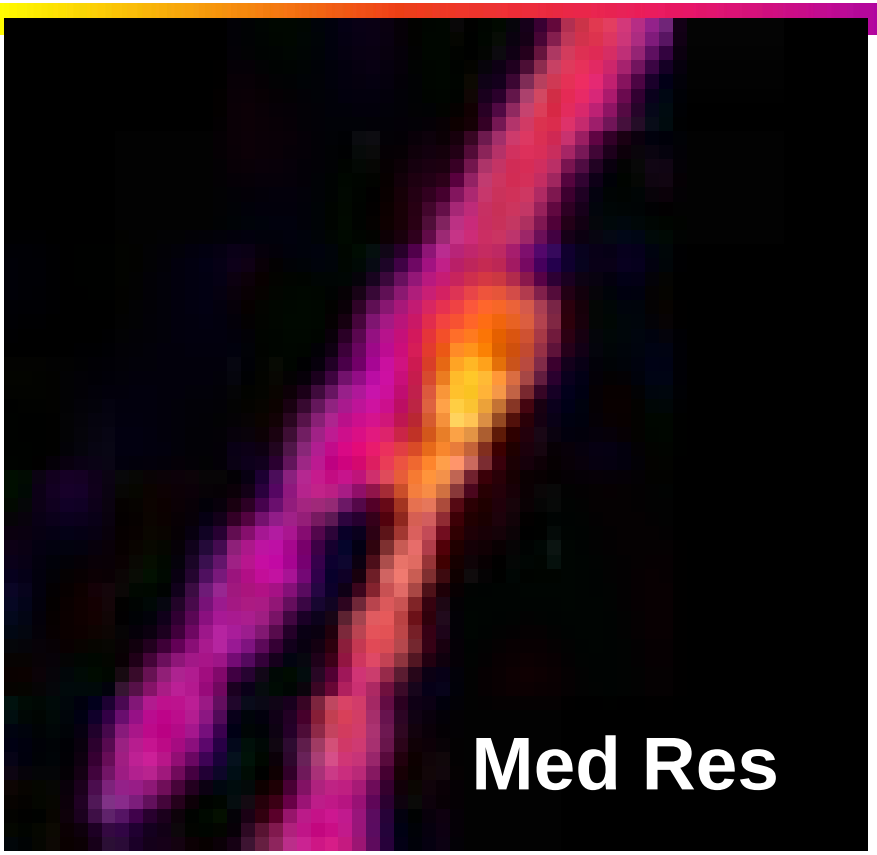
Switch Disconnect—12 Yds



Switch Disconnect—12 Yds

Problem Magnified



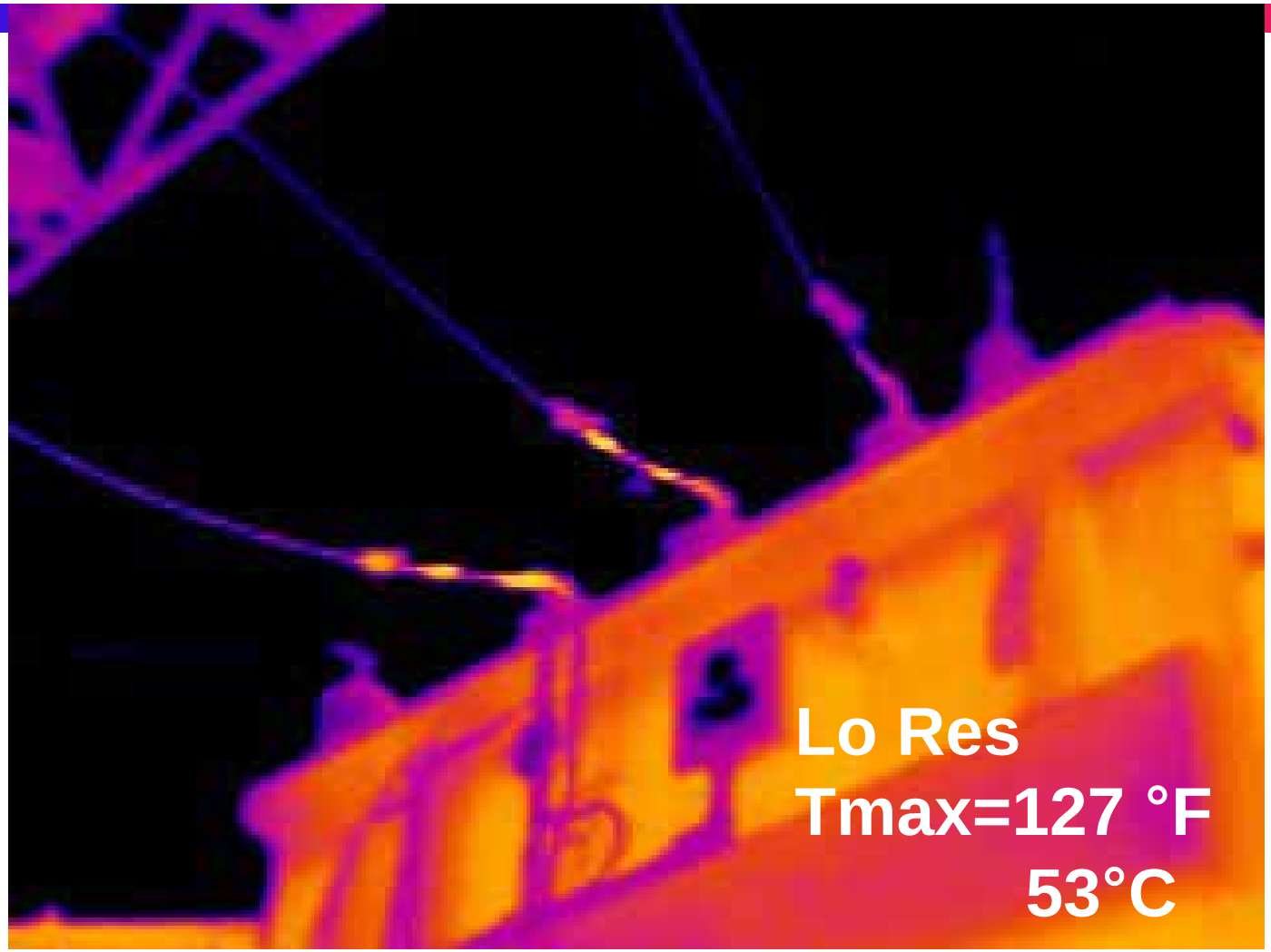


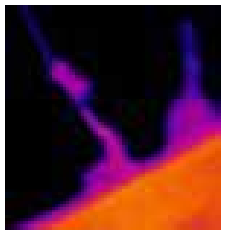
Temperature Data

Switch Disconnect at 12 Yards				
IR Camera	**Temperatures**			**% Load**
	T_{max}	**ΔT**	**$\Delta T_{Load\ Corr}$**	
Hi Res	**173 °F** ***78°C***	**91** ***50***	**271** ***150***	**50**
Med Res	**155 °F** ***68°C***	**72** ***40***	**216** ***120***	**50**
Lo Res	**125 °F** ***52°C***	**45** ***25***	**133** ***75***	**50**

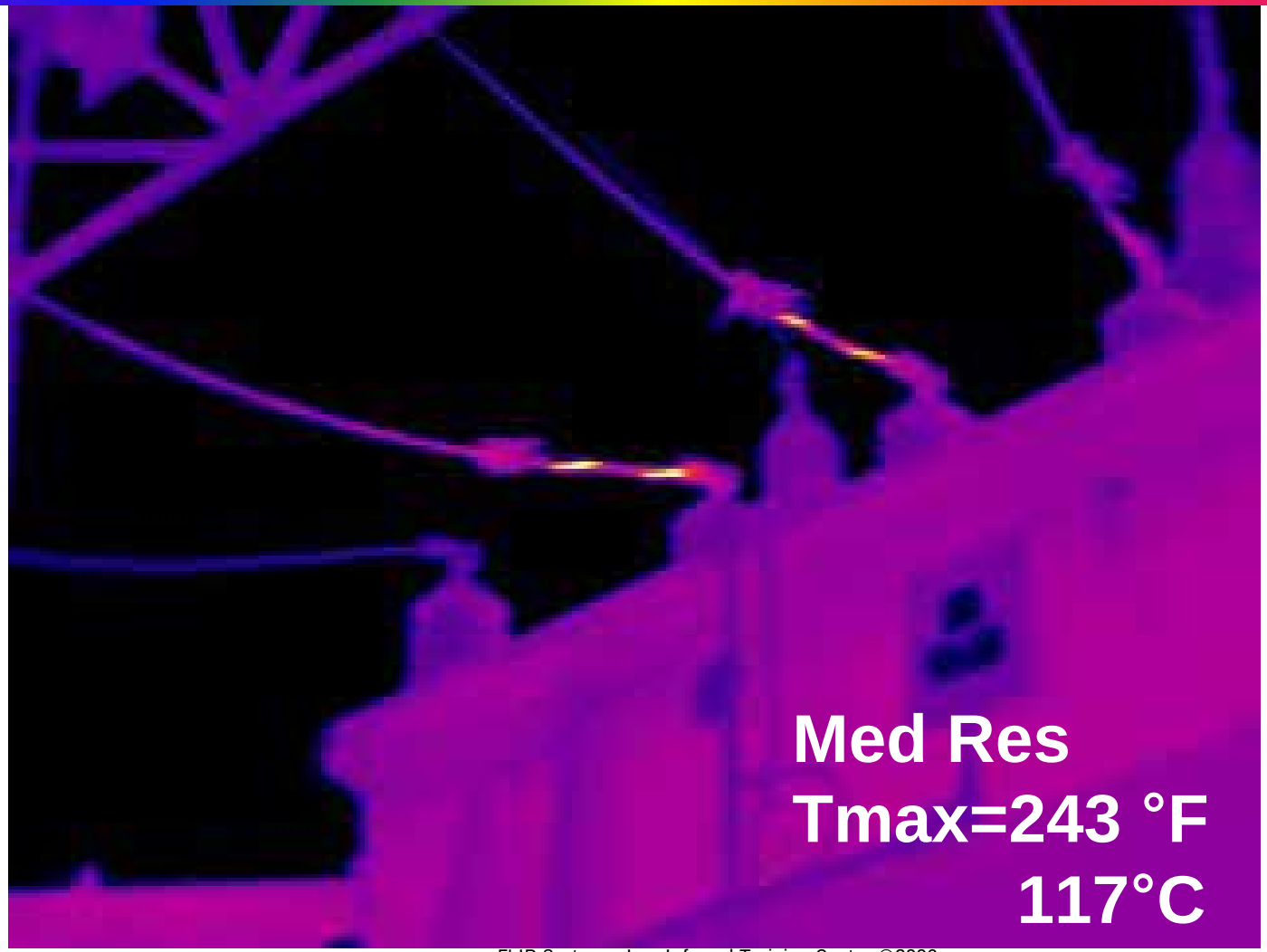
115 KV to 23 KV transformer

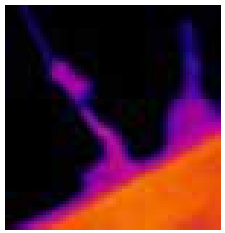
Barber poling 23KV



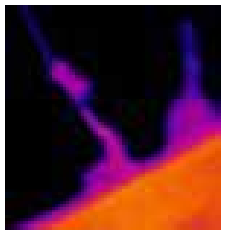


Barber poling 23KV



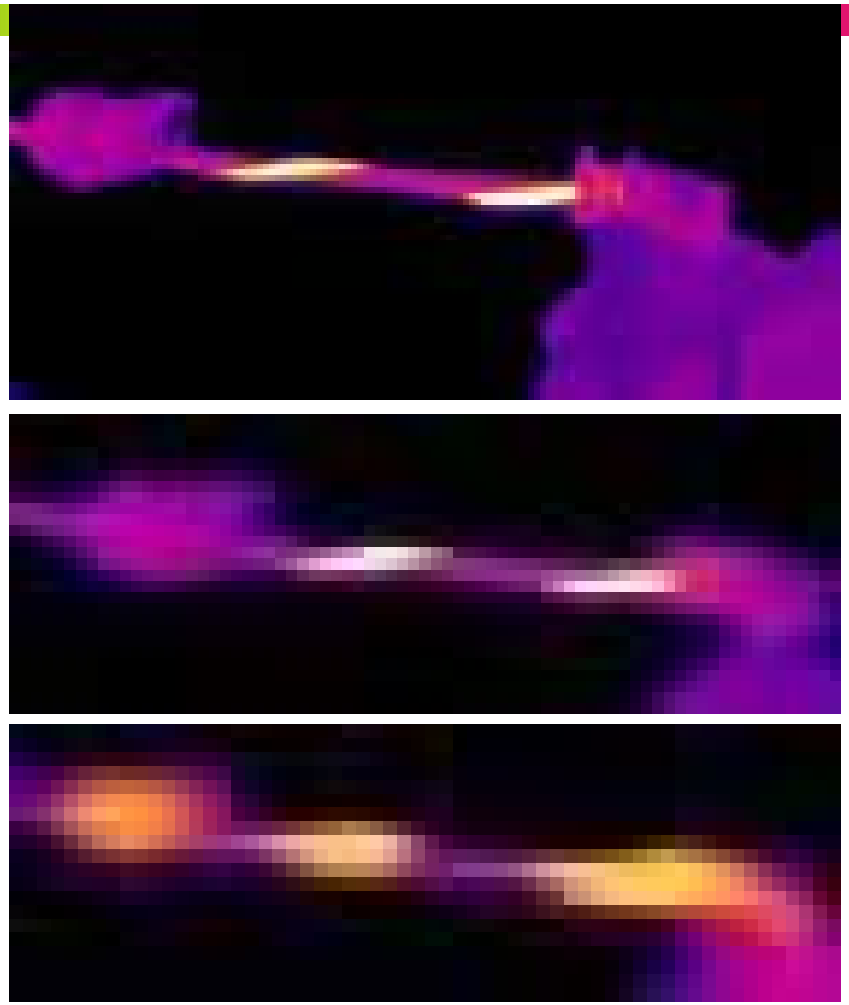


Barber poling 23KV



Barber Poling--magnified

- Hi Res
- Med Res
- Lo Res

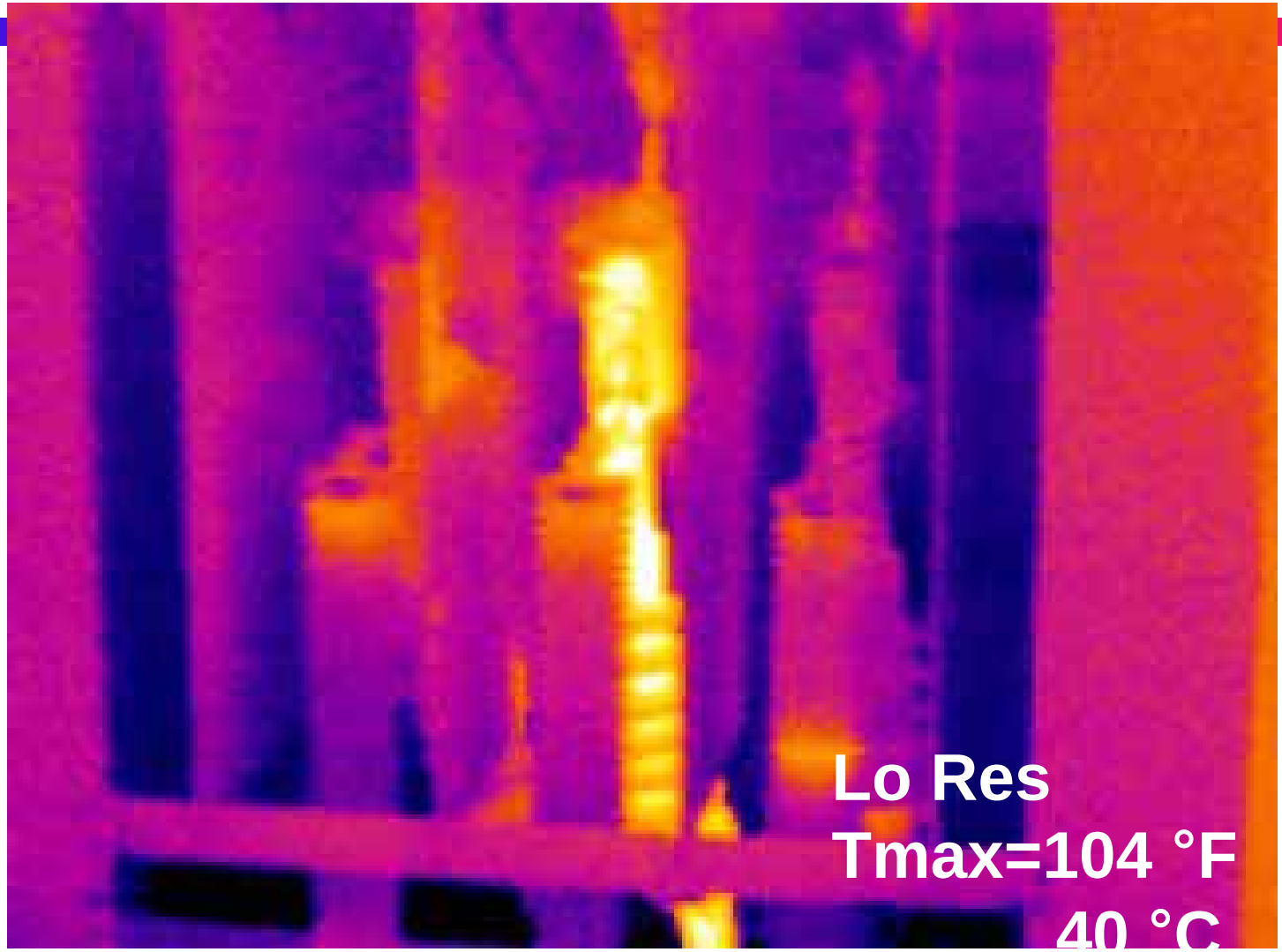


Temperature Data

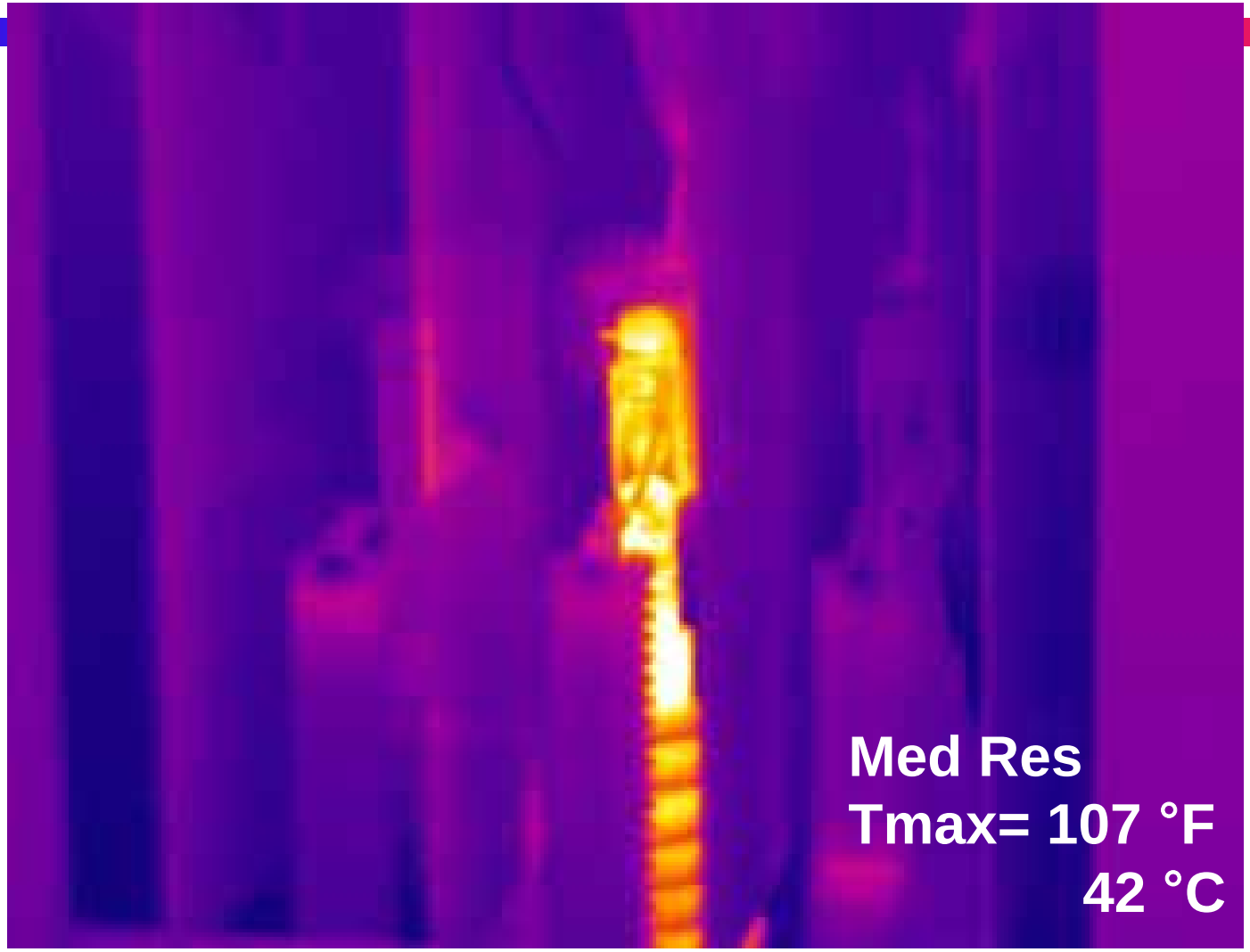
"Stranded" Cable at 11 Yards				
IR Camera	**Temperatures**			**% Load**
	T_{max}	**ΔT**	**$\Delta T_{Load\ Corr}$**	
Hi Res	**280 °F** ***138°C***	**211** ***117***	**889** ***494***	**40**
Med Res	**243 °F** ***117°C***	**172** ***95***	**724** ***402***	**40**
Lo Res	**127 °F** ***53 °C***	**90** ***50***	**380** ***211***	**40**

PMH 23 KV connections

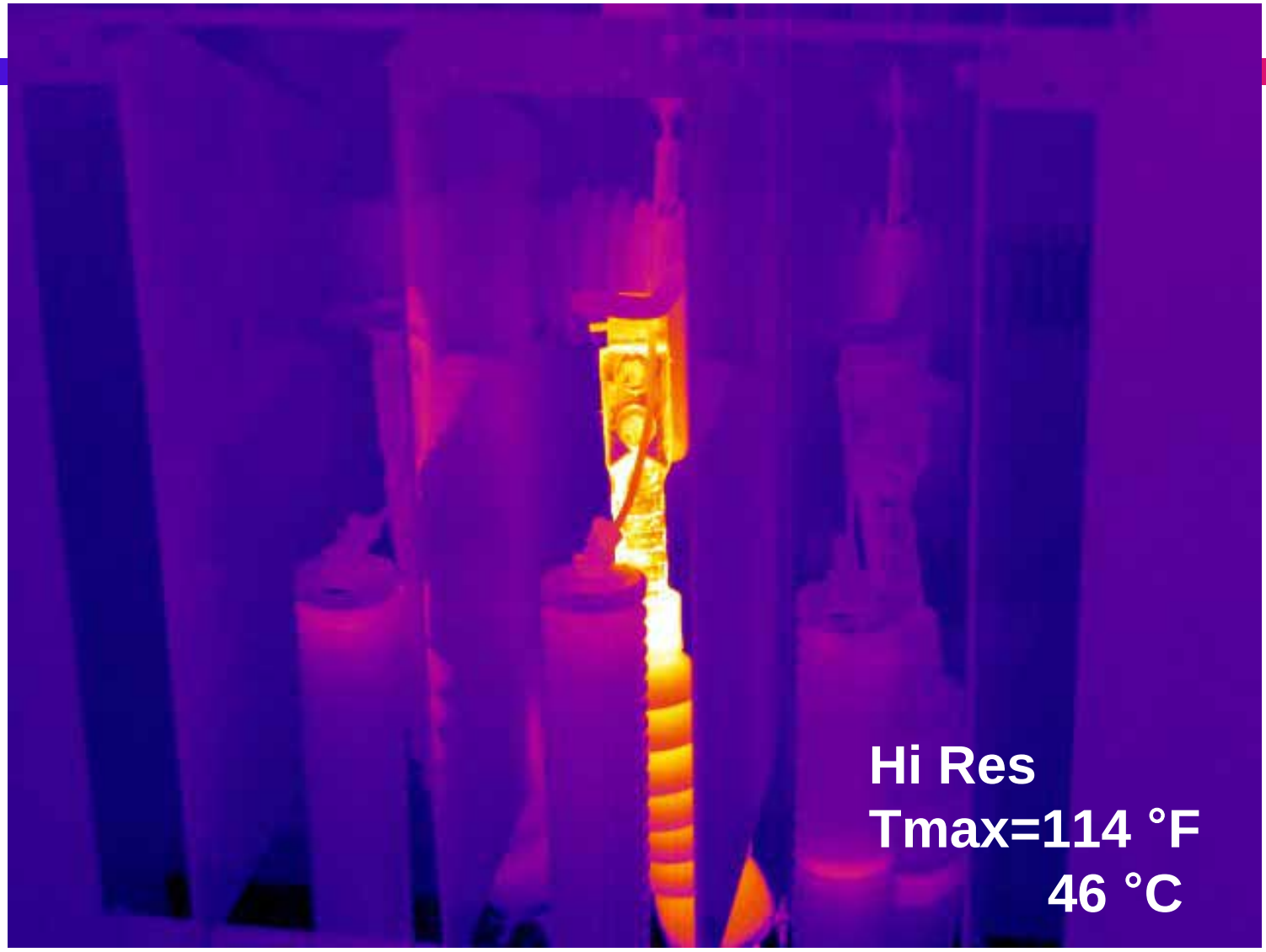
PMH 23 KV temperatures



PMH 23 KV temperatures



PMH 23 KV temperatures



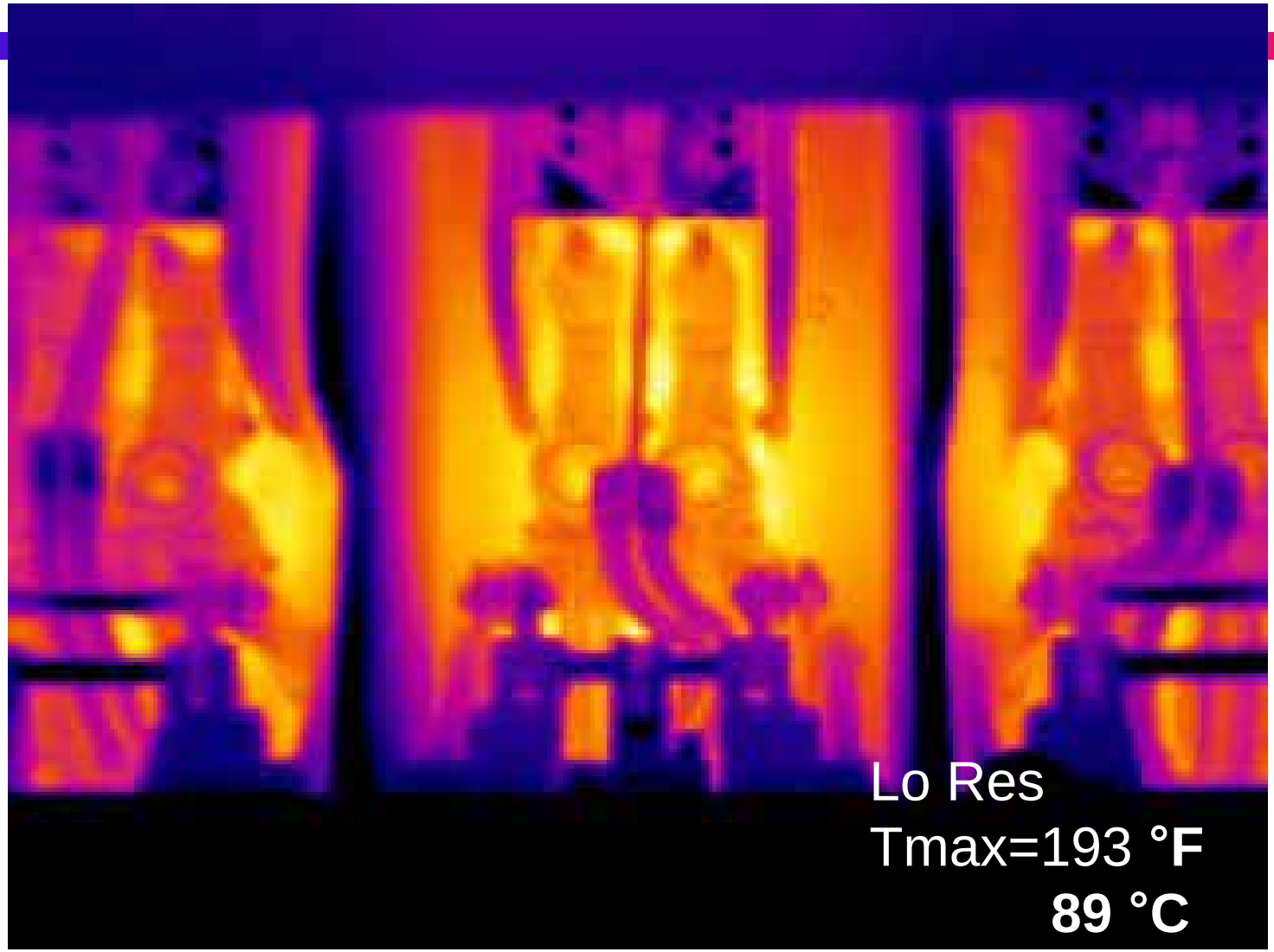
PMH compression connection

PMH 23 KV connection at 10 feet – 3 meters				
IR Camera	**Temperatures**			**% Load**
	T_{max}	**ΔT**	**$\Delta T_{Load\ Corr}$**	
Hi Res	**114 °F** ***46 °C***	**43** ***24***	**128** ***72***	**50**
Med Res	**107 °F** ***42 °C***	**35** ***19***	**104** ***57***	**50**
Lo Res	**104 °F** ***40 °C***	**33** ***18***	**97** ***54***	**50**

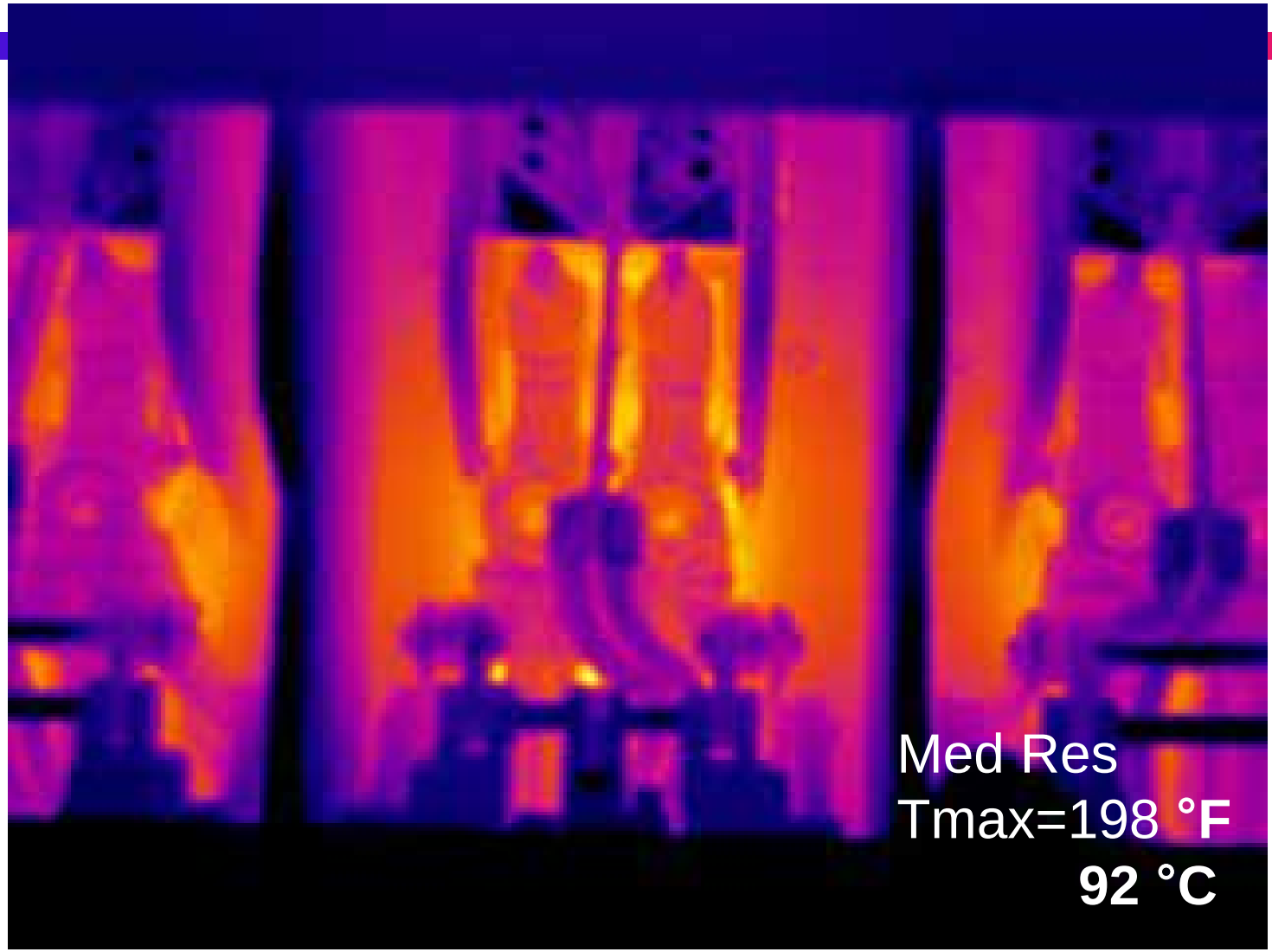
Paper Mill

480V Generator Tie-In Breaker

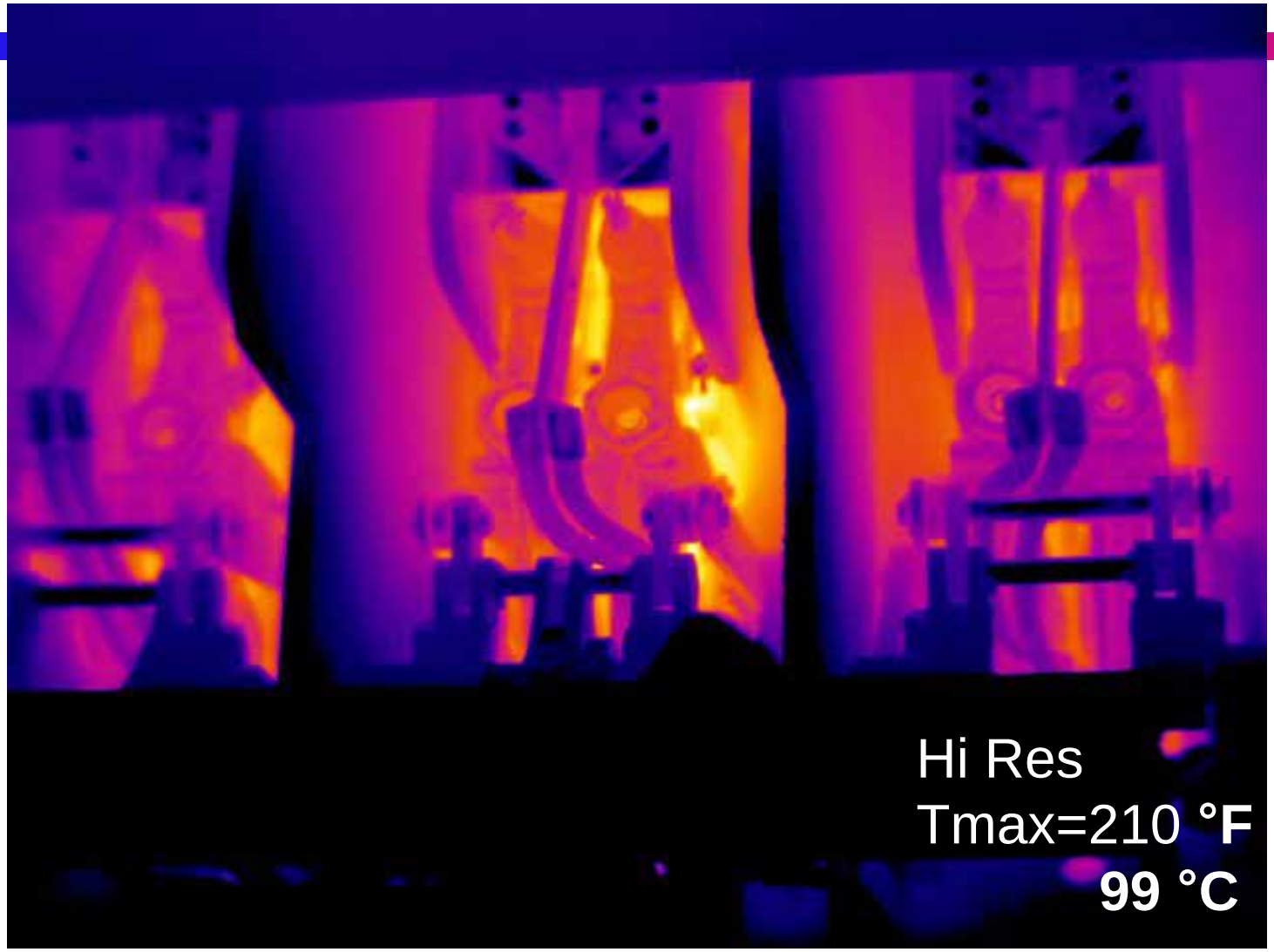
Generator Tie-In Breaker at 4 ft.



Generator Tie-In Breaker at 4 ft.



Generator Tie-In Breaker at 4 ft.



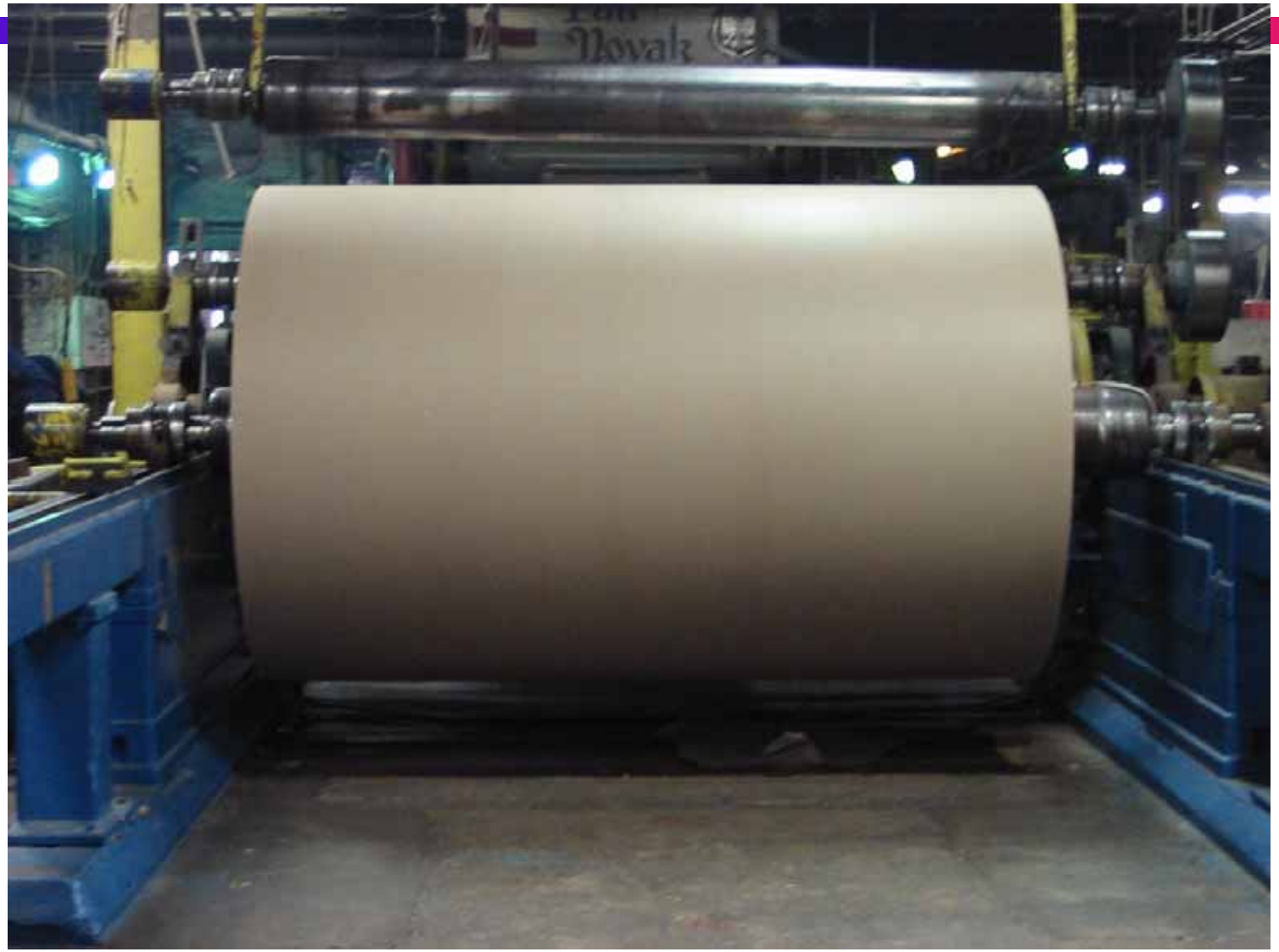
Temperature Data

480V Generator Tie-In Breaker				
IR Camera	**Temperatures**			**% Load**
	T_{max}	**ΔT**	**$\Delta T_{Load\ Corr}$**	
Hi Res	**210 °F** ***99 °C***	**85** ***47***	**134** ***74***	**75**
Med Res	**198 °F** ***92 °C***	**72 F** ***40***	**113** ***63***	**75**
Lo Res	**193 °F** ***89 °C***	**68** ***38***	**108** ***60***	**75**

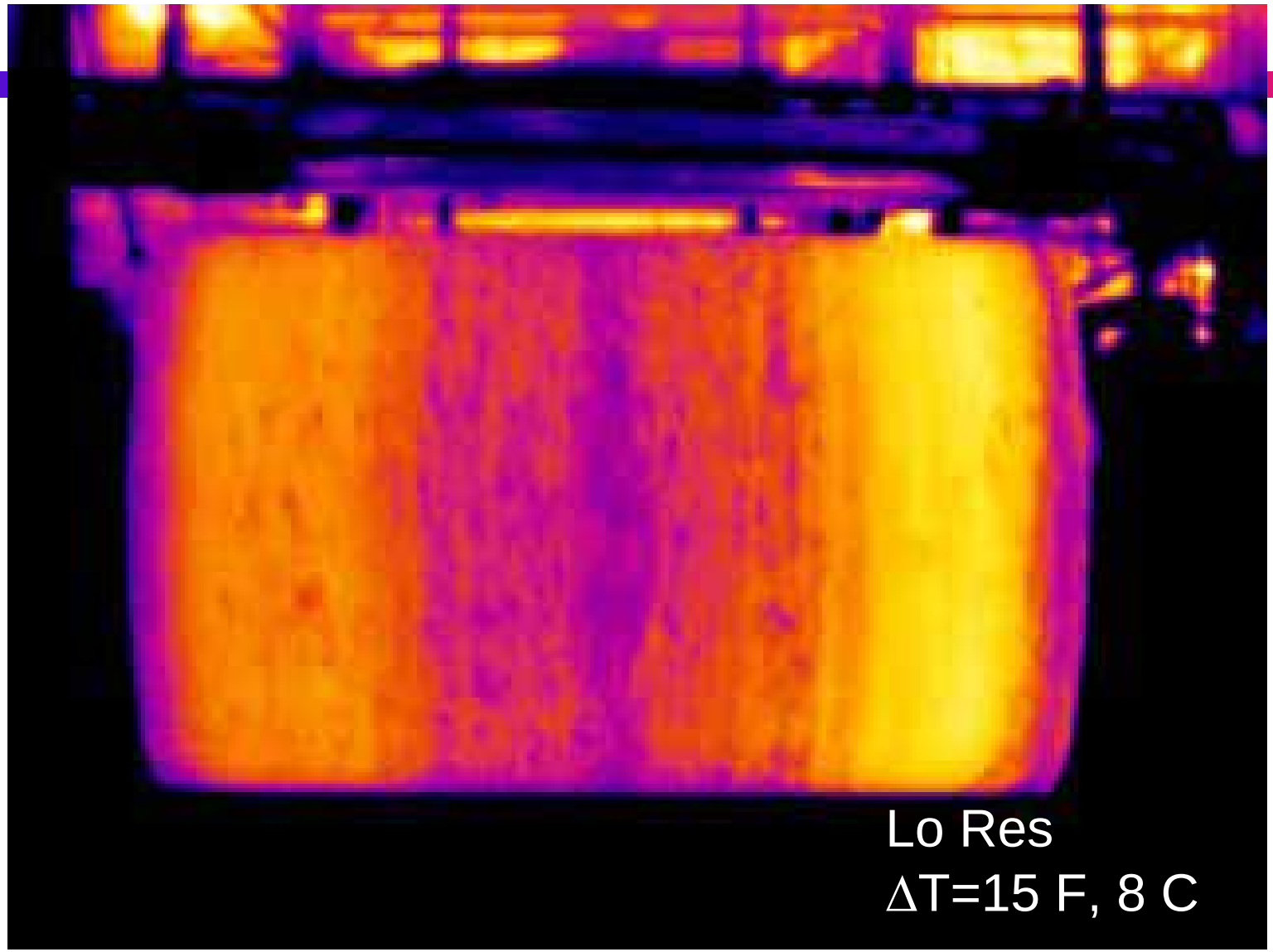
We found the steam traps!

T_{room}= 125 F, 52 C

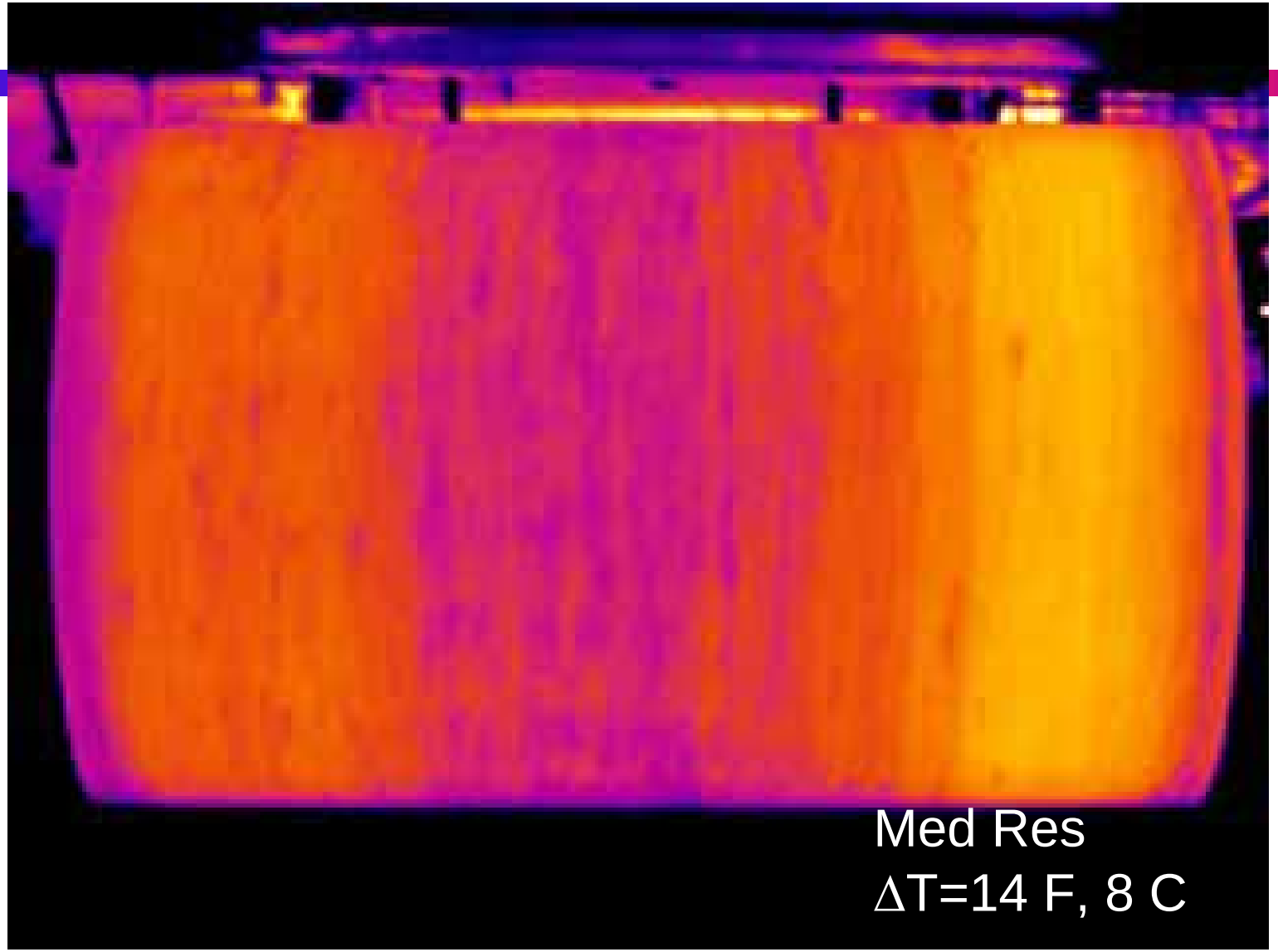
Paper Mill Process



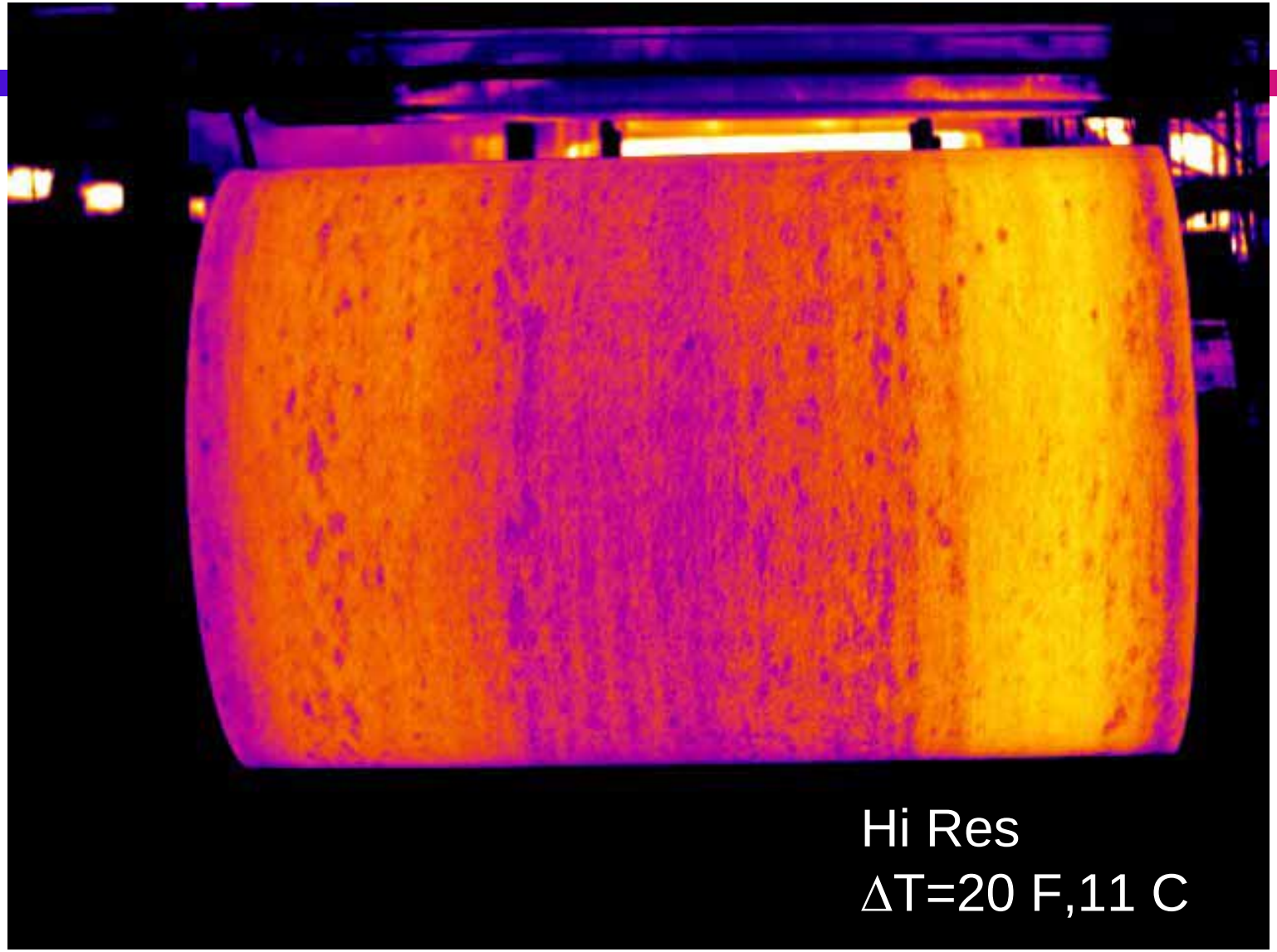
Paperboard Take-up Reel



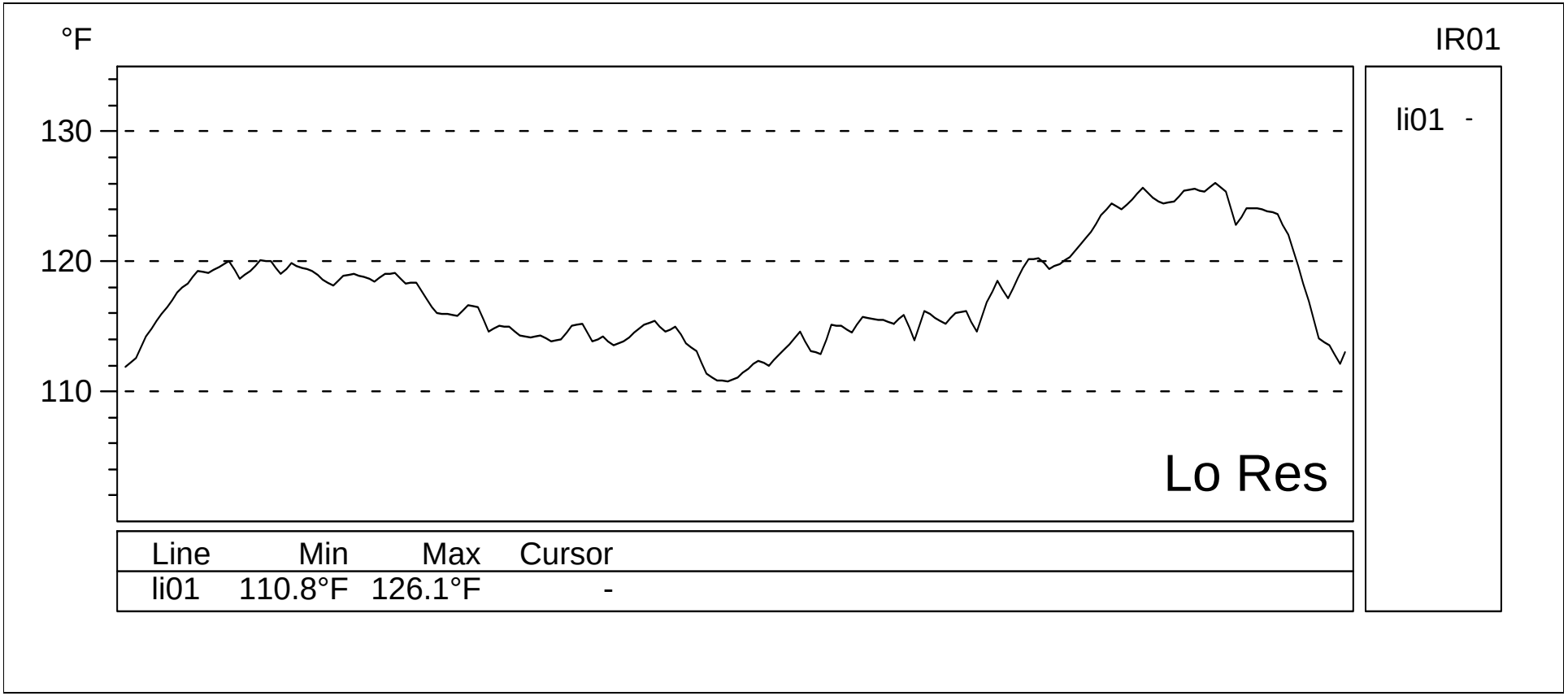
Paperboard Take-up Reel



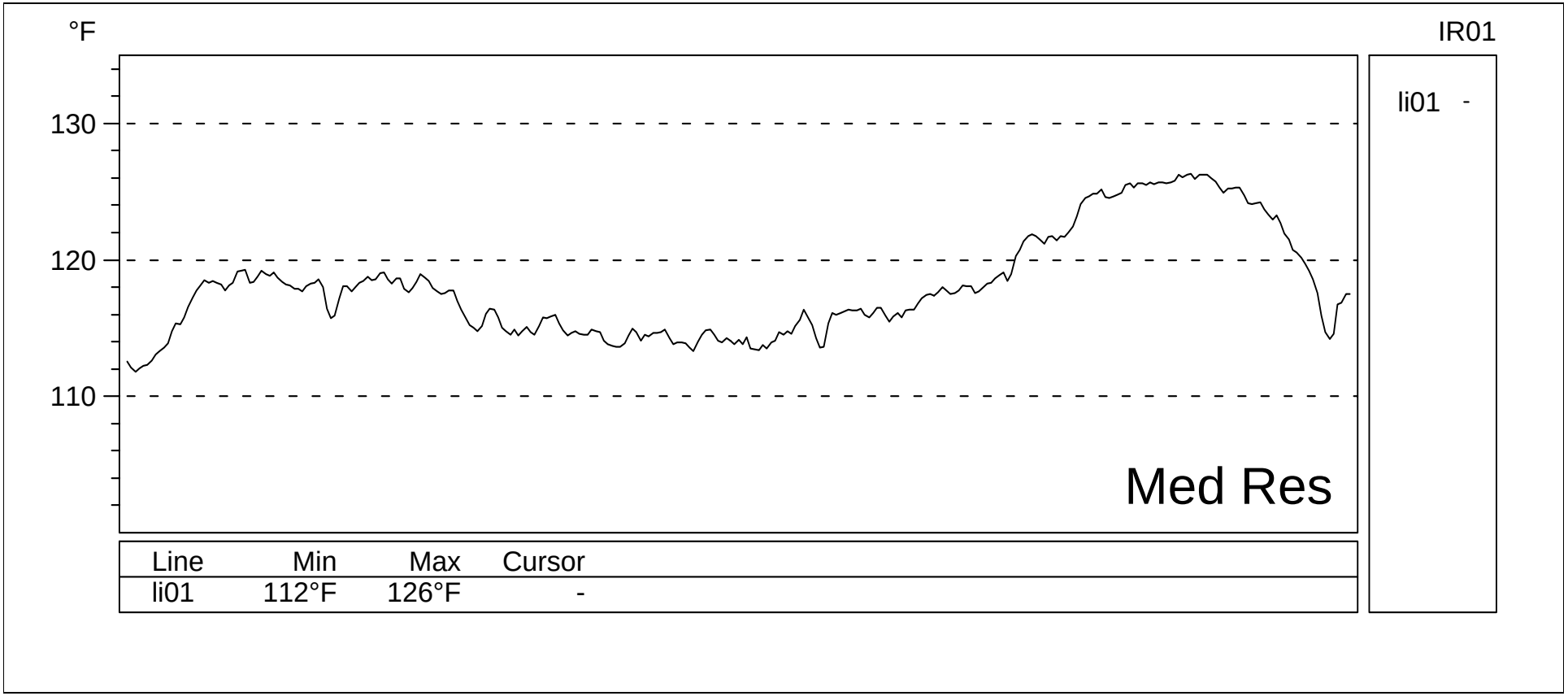
Paperboard Take-up Reel



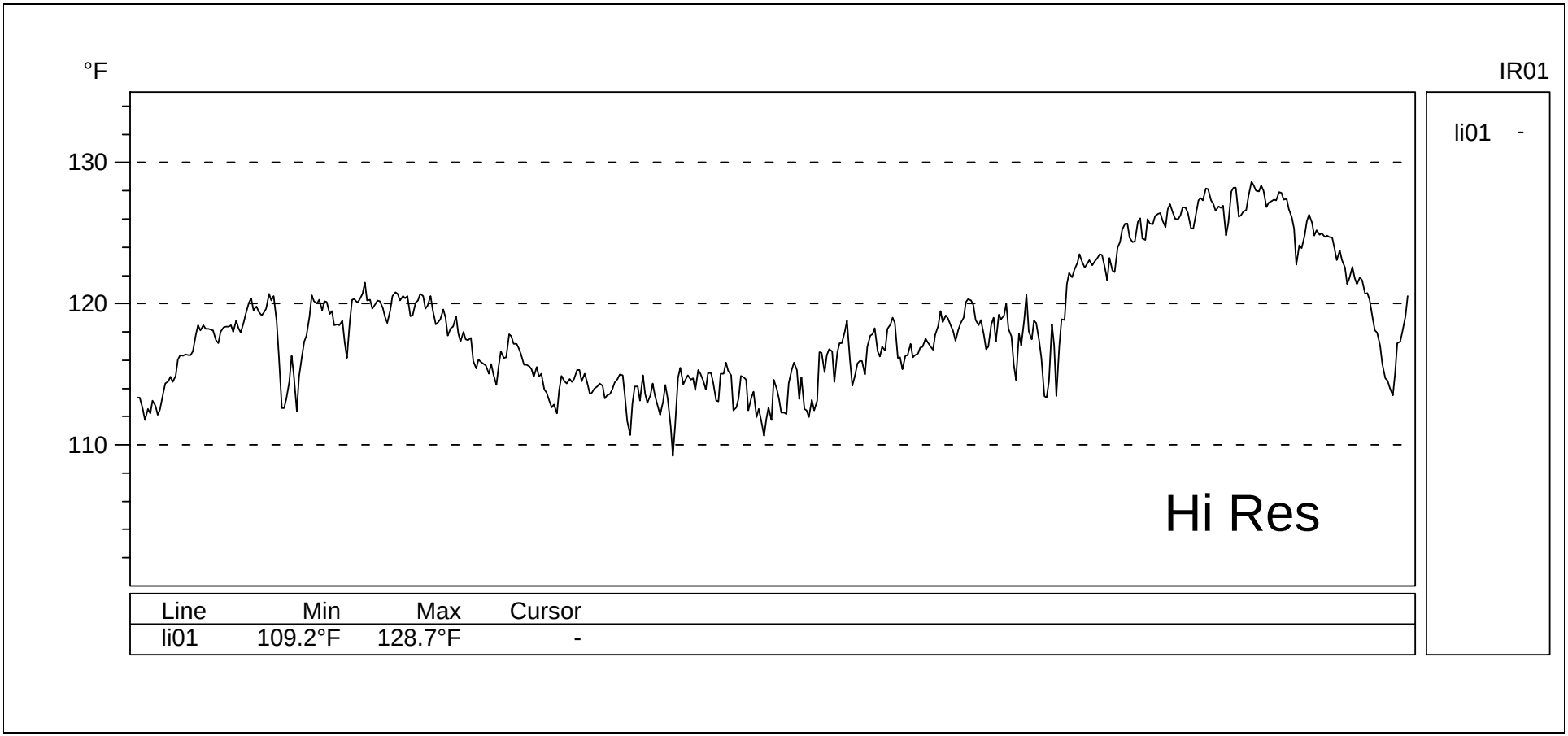
Variation across reel



Variation across reel



Variation across reel



Process diagnostics much improved with small detail now clearly visible.

Examples of various IR camera resolutions from FLIR Systems, Inc.

FLIR IR Camera Model	IR Array Size	Resolution Description
P640	640X480	Hi Res
P65HS	320X240	Med Res
E65	160X120	Lo Res
www.flirthermography.com		

Summary

- Higher resolution means better ability to spot small targets at larger distances
- Higher resolution means better measurement accuracy of small targets
- Higher resolution means larger field of view than ever before for spotting small targets
- Take fewer images. Improve your survey and reporting efficiency with a Hi Res IR Camera

Summary

- Find more problems
- Find smaller problems
- Improve diagnoses with better image detail
- Find problems you would otherwise miss completely
- Measure small targets with better accuracy
- Take fewer images
- Improve your survey and reporting efficiency with a Hi Res IR Camera

THANKS!

THANKS!

- Thanks, Ken Leonard and Donald Smith of Progress Energy for going above and beyond the call of duty to help us get the pole and PMH images. Ken and his co-thermographer, Donald, spent three days prior to our arrival to scope out possible problem targets. Then they spent two more days with us and a video crew shooting images.

THANKS!

- Thanks, Carmine Luongo and Mark Moriarty of National Grid for allowing us to enter a couple of substations on very short notice. We found the barber pole connections on the transformer, a critical problem, and sent a report to Mark right away. Now the lights will stay on in Lowell, MA.

THANKS!

- Thanks to Mike Farrell, Plant Manager, of Haverhill Paperboard for allowing us to survey his facility. They had a problem on Line #2 and he and the engineers loved using the IR cameras to look for it.