Increased Ethylene Furnace Efficiency & Control using Imaging Based Temperature Measurement and Visual Verification

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AGENDA

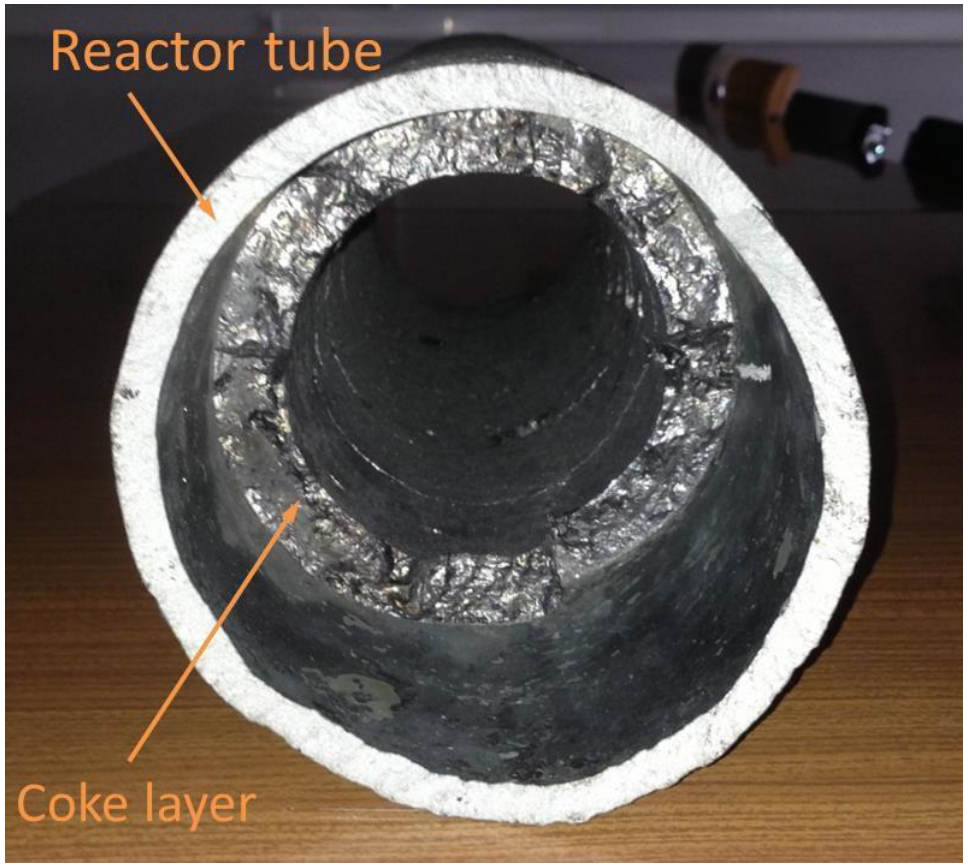
- Operating Issues
- Temperature Measurement
  - Non CANTY Techniques
  - The CANTY Solution
- Advantages
- Conclusions

THEORY vs REALITY

- In theory an ethylene furnace will operate at a consistent operating temperature, which is based the quality of the feed stock, the performance of burners, and the condition of the furnace tubes

- The reality is that the process is not always fed with the same quality feed stock, the burners which are used to heat up the tubes don't always burn at the same temperature, and coking of the tubes can affect their heat transfer properties, and ultimately cause the tubes to plug

THEORY vs REALITY



TUBE METAL TEMPERATURE

- The single greatest cause of component failure and furnace downtown, is overheating tubes. If tubes overheat, it can lead to tube rupture, and possible escape of the feed stock into the firebox area of the furnace, which not only is a process issue, but also a safety issue

- If you know a tube is drastically heating up you can adjust the process - stop feedstock and input steam to prevent tube plugging

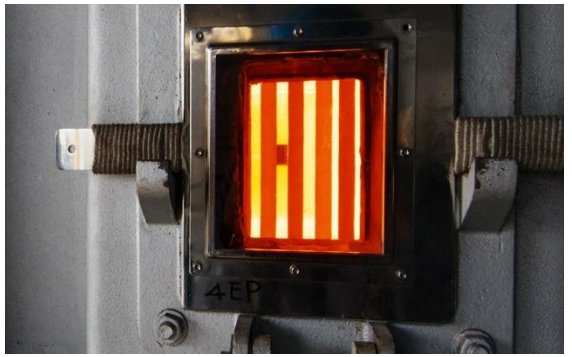
- Tube Metal Temperature measurement is therefore of the utmost criticality

TUBE METAL TEMPERATURE

Common Current Techniques

- Manual measurement by a handheld pyrometer through hatch / door
  - do they leave the door open to long and let the furnace cool down?
  - do they measure the same spot on the tube?
  - if only measured every 8 hours when did the tube fail?

- Thermocouples installed on the tubes
  - contact device – harsh process conditions
  - sensor failure – regular replacement
  - drift in measurement



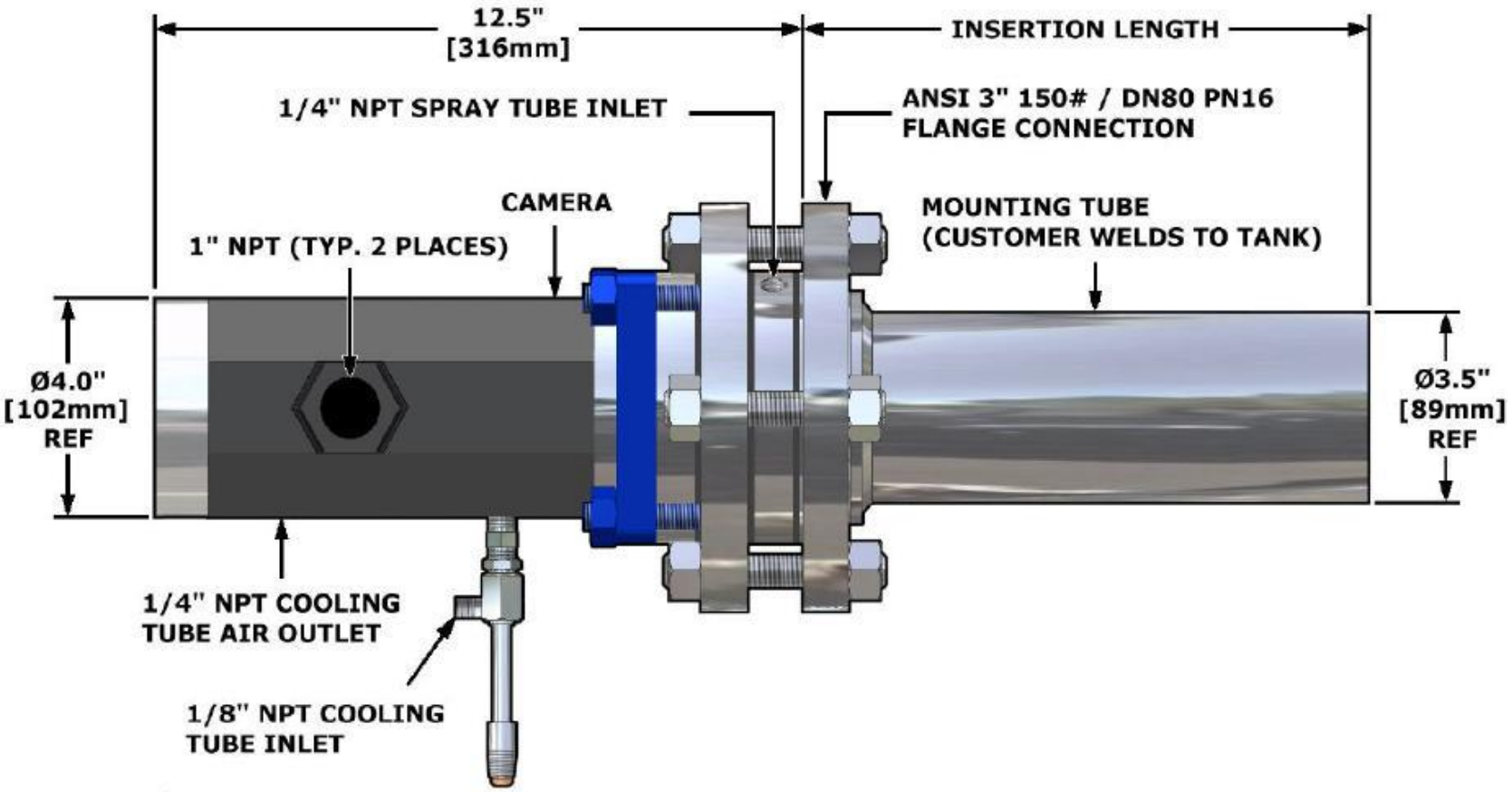
TUBE METAL TEMPERATURE

The CANTY Solution: UltraTemp Cameras with VCM

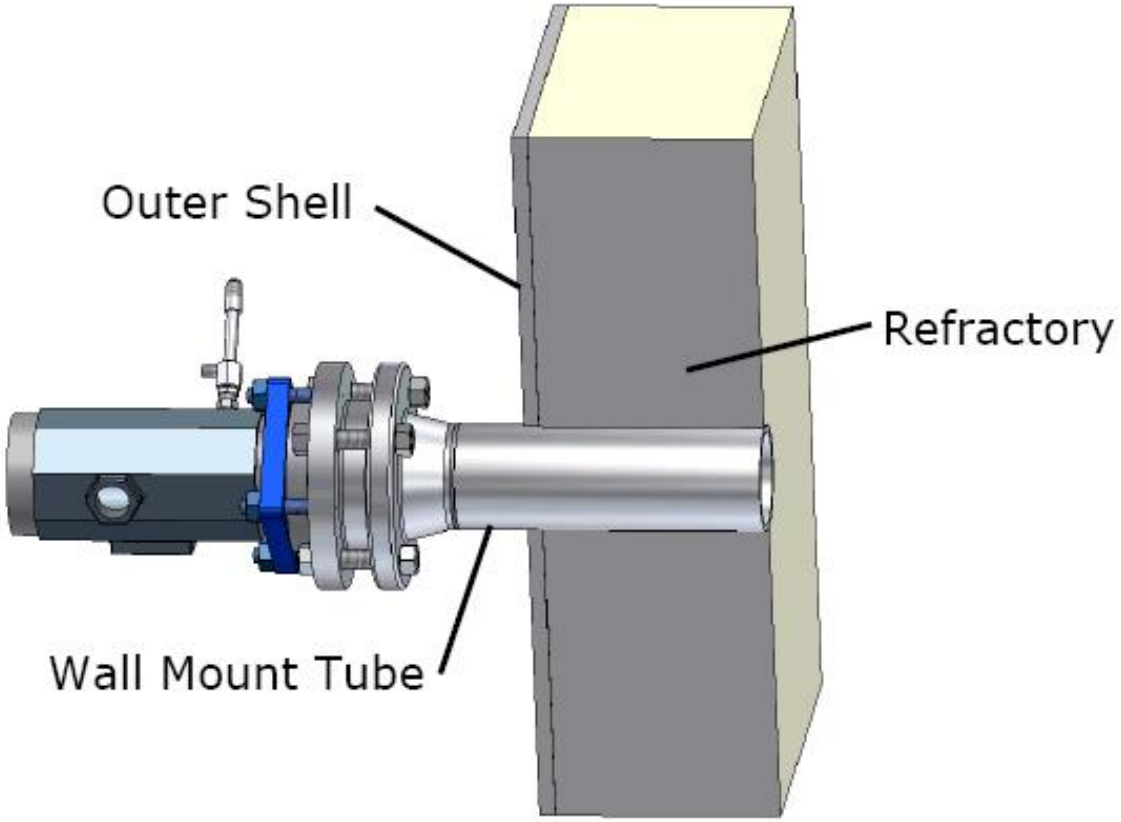
ULTRATEMP CAMERA

- Process Temp: 1370ºC (2500ºF)
- 24” Insertion
- Hazardous Area Rated (EXP / ATEX)
- 65 Degree View Angle

External Features



External Features

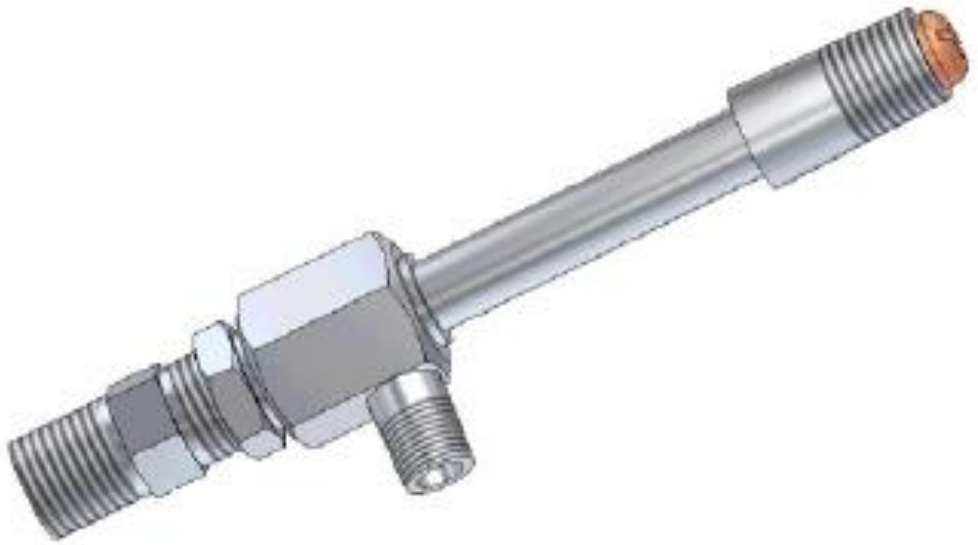


Wall Mount Tube
– User welds in place
– Tip not to protrude into furnace

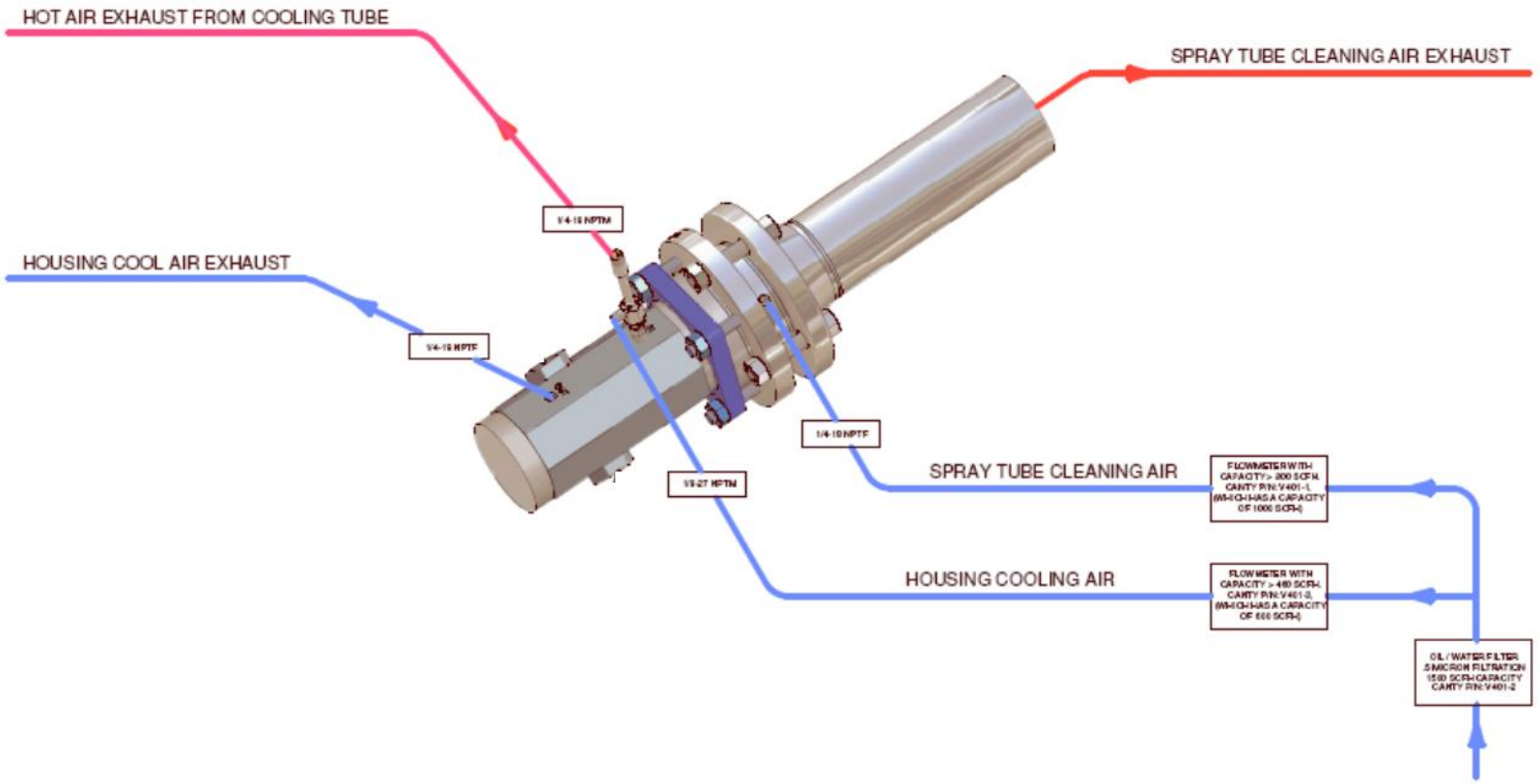
External Features

Vortex Cooling Tube – Used to cool electronic components of camera

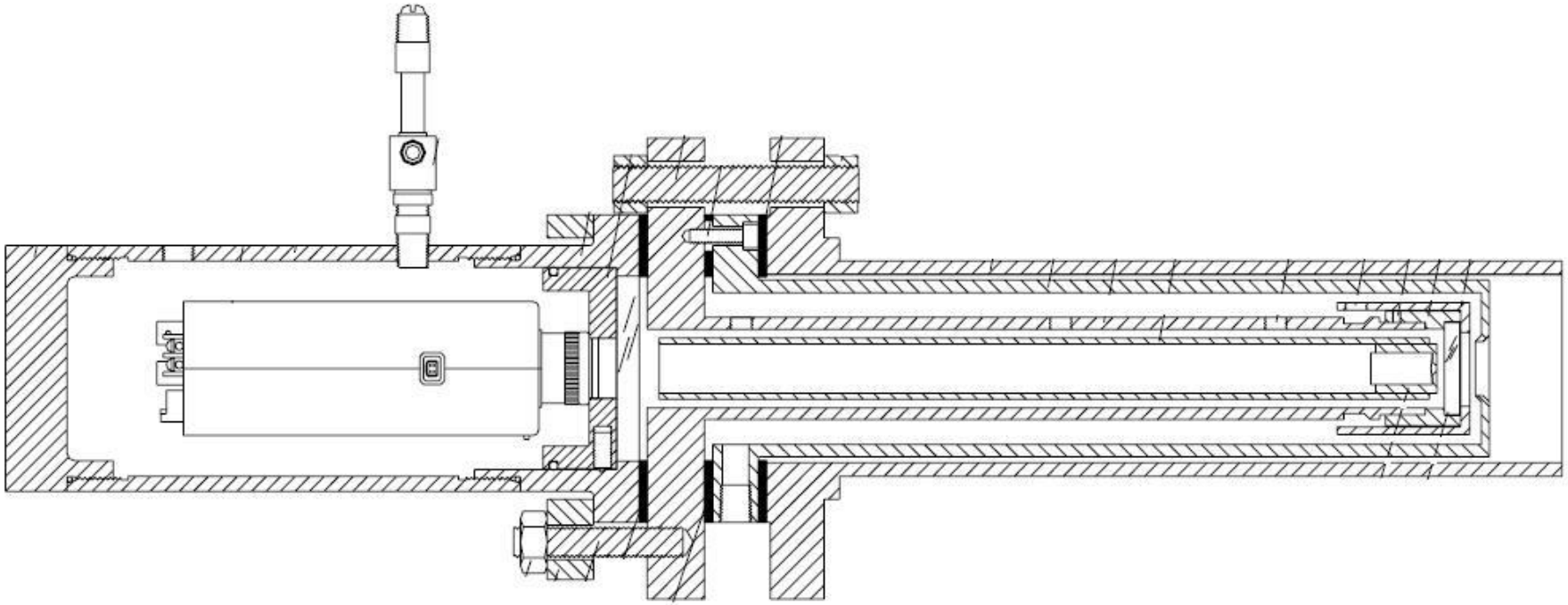
- 8 scfm @ 100 PSI required



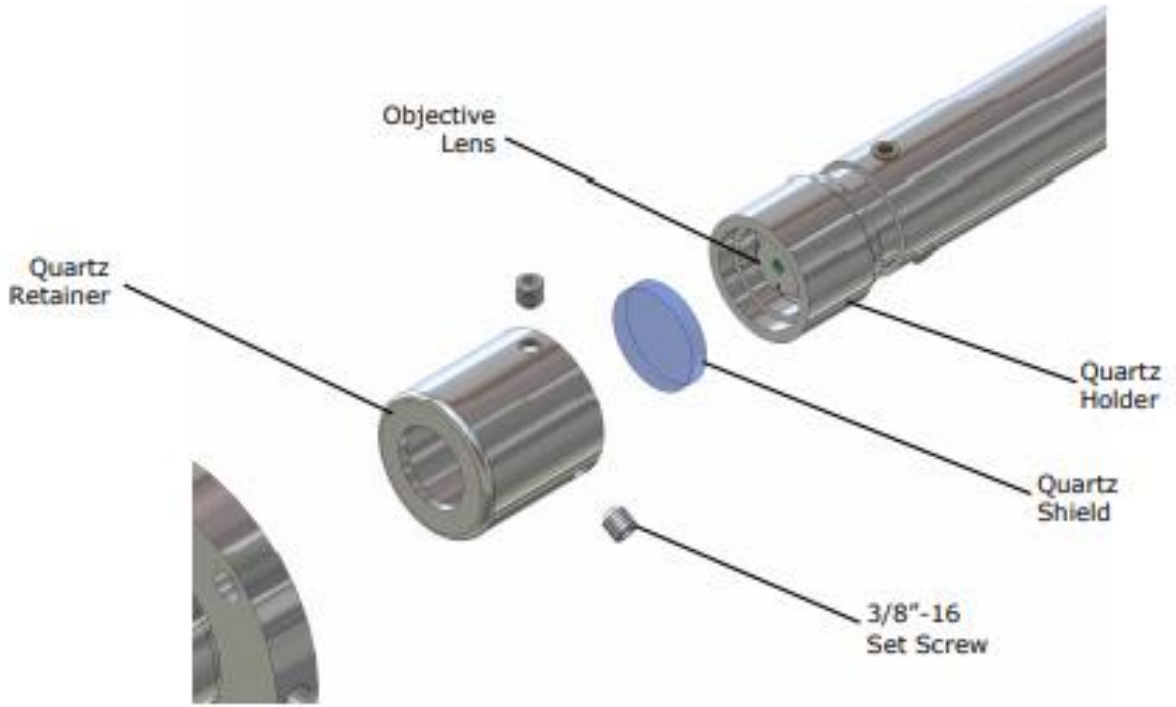
Cleaning / Cooling Air Layout



Internal Features

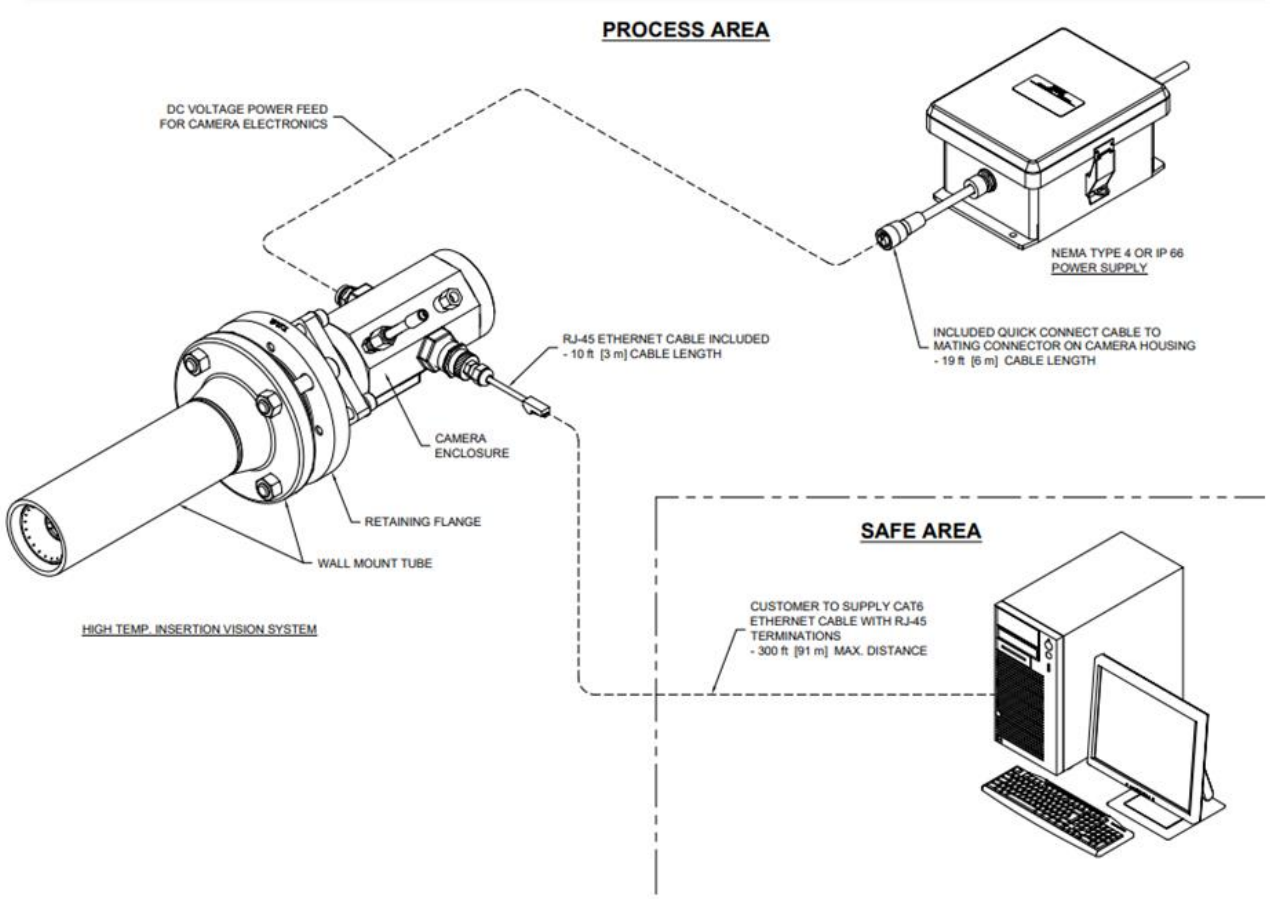


Quartz Shield



Our optics are protected with a Quartz shield, and in the event of a loss of cleaning air, this shield protects the rest of the optics from becoming damaged and is easily and inexpensively replaced

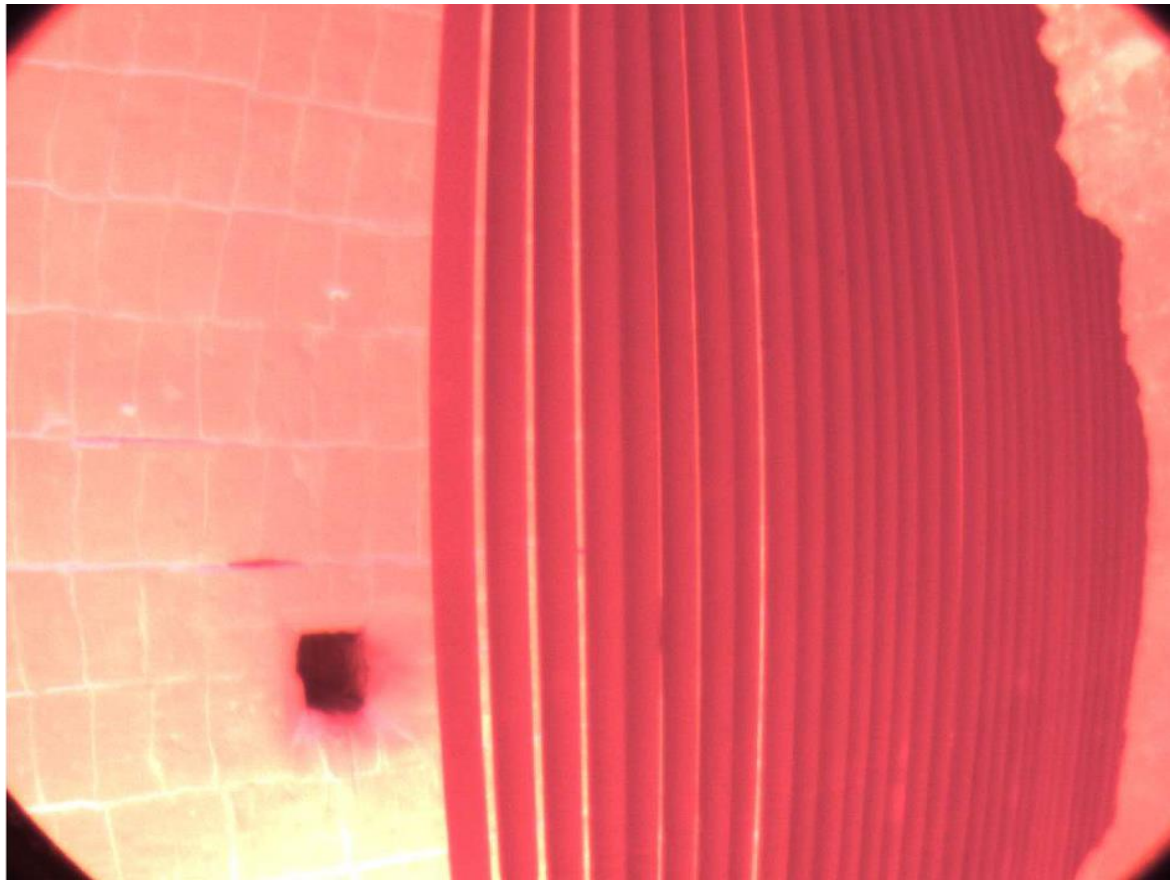
Wiring Layout



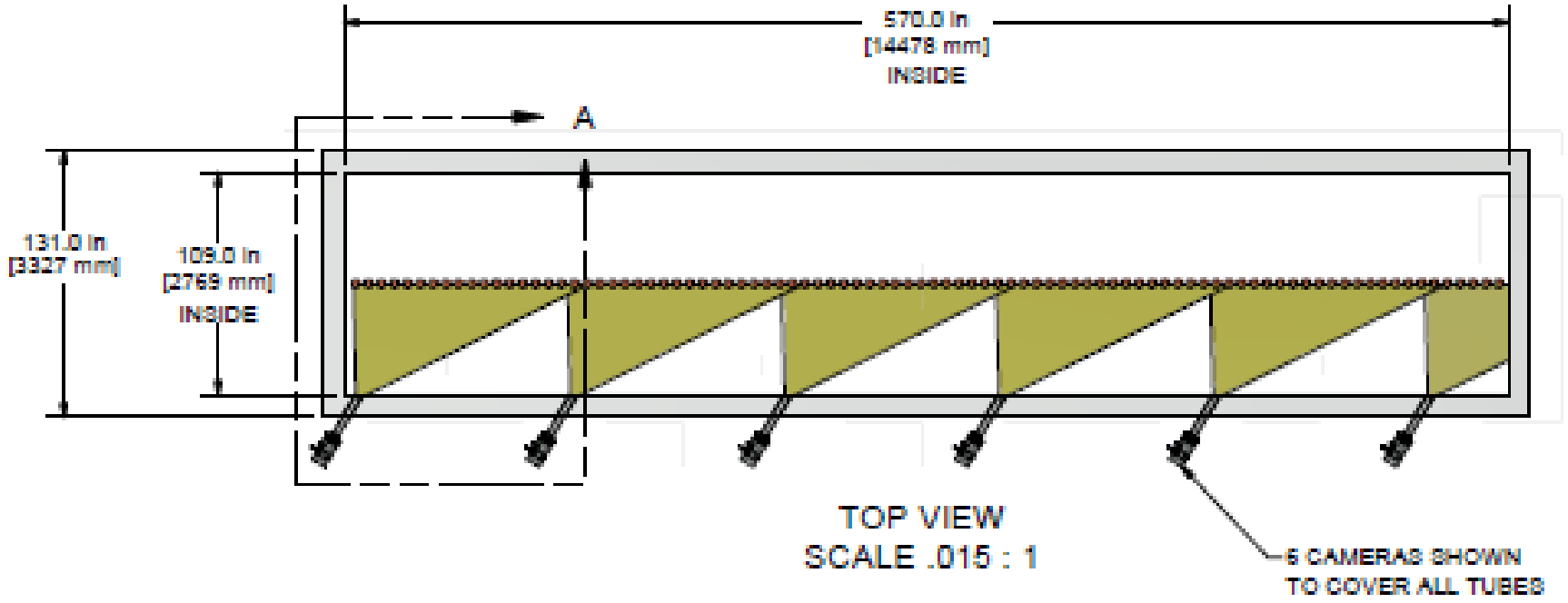
VECTOR CONTROL MODULE

- Allows for input up to 6 cameras
- Temperature measurement by vision
- Multiple outputs
  - OPC
  - Modbus
  - 4-20mA
  - Video Display
- Ease of Remote Support

EXAMPLE VIEW



INSTALLATION LAYOUTS



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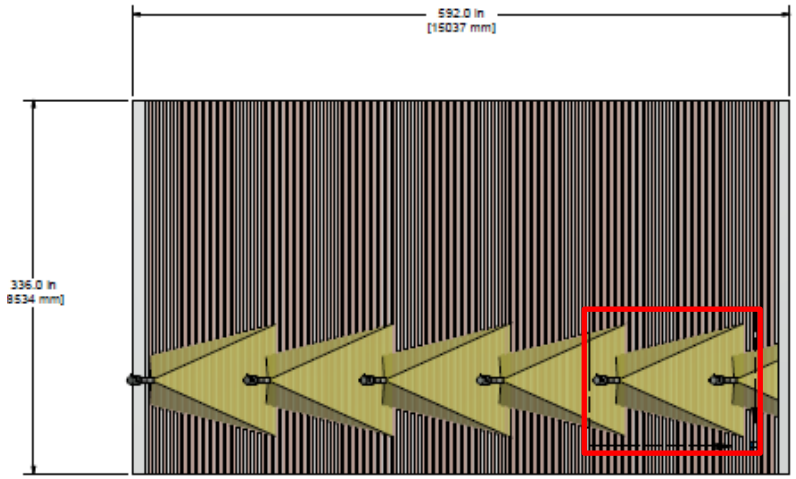
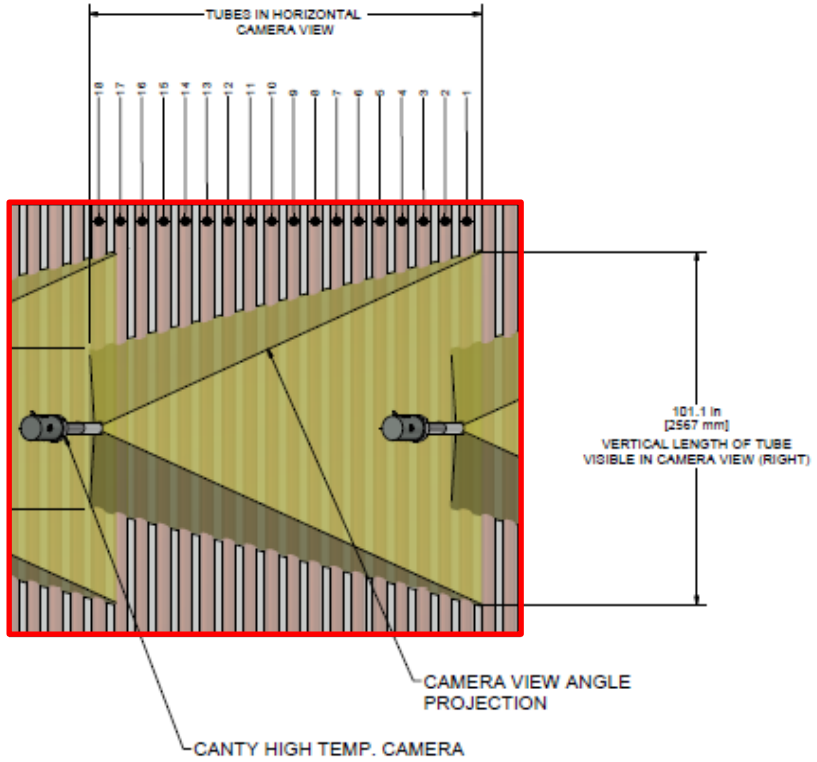
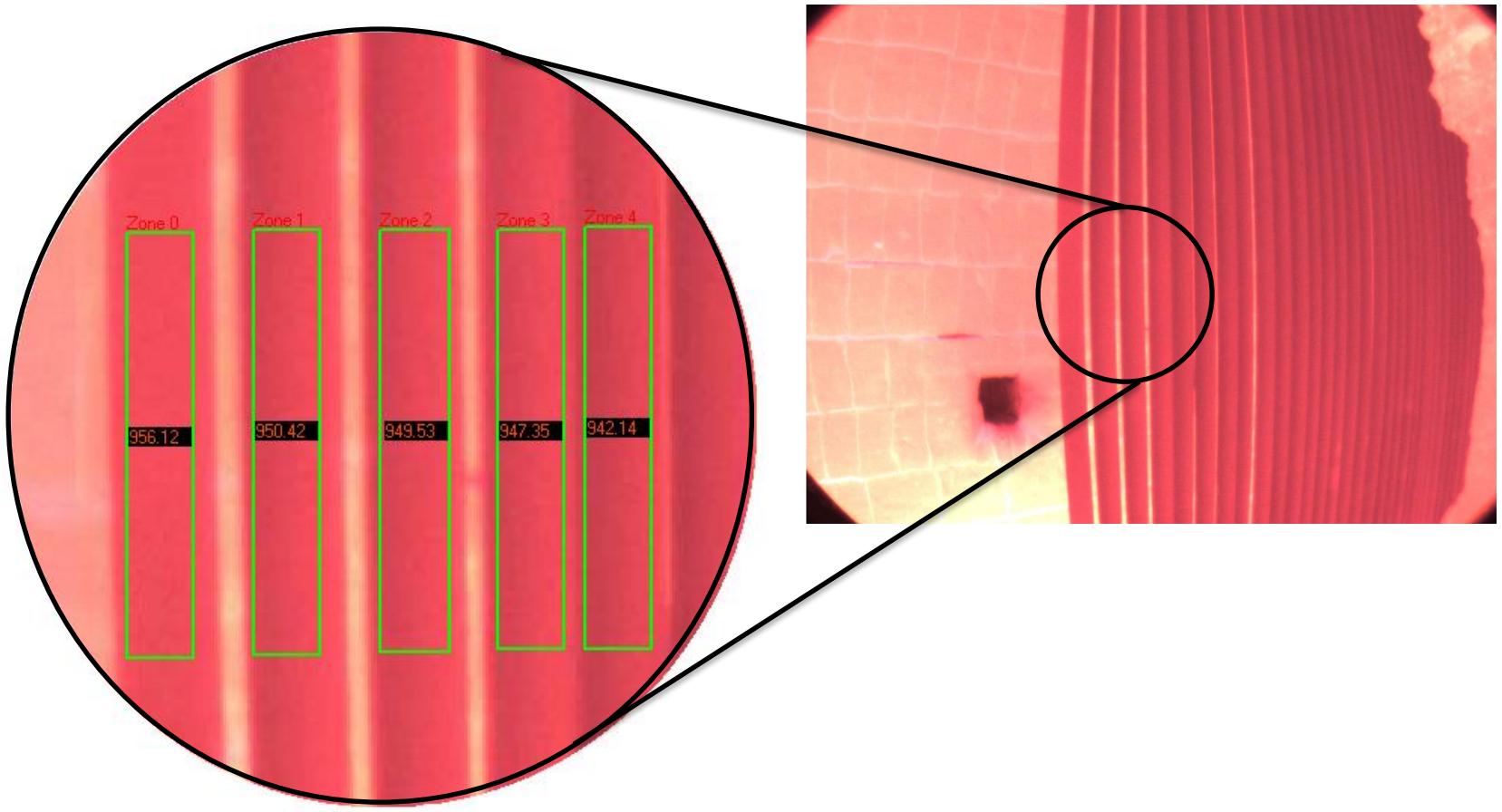
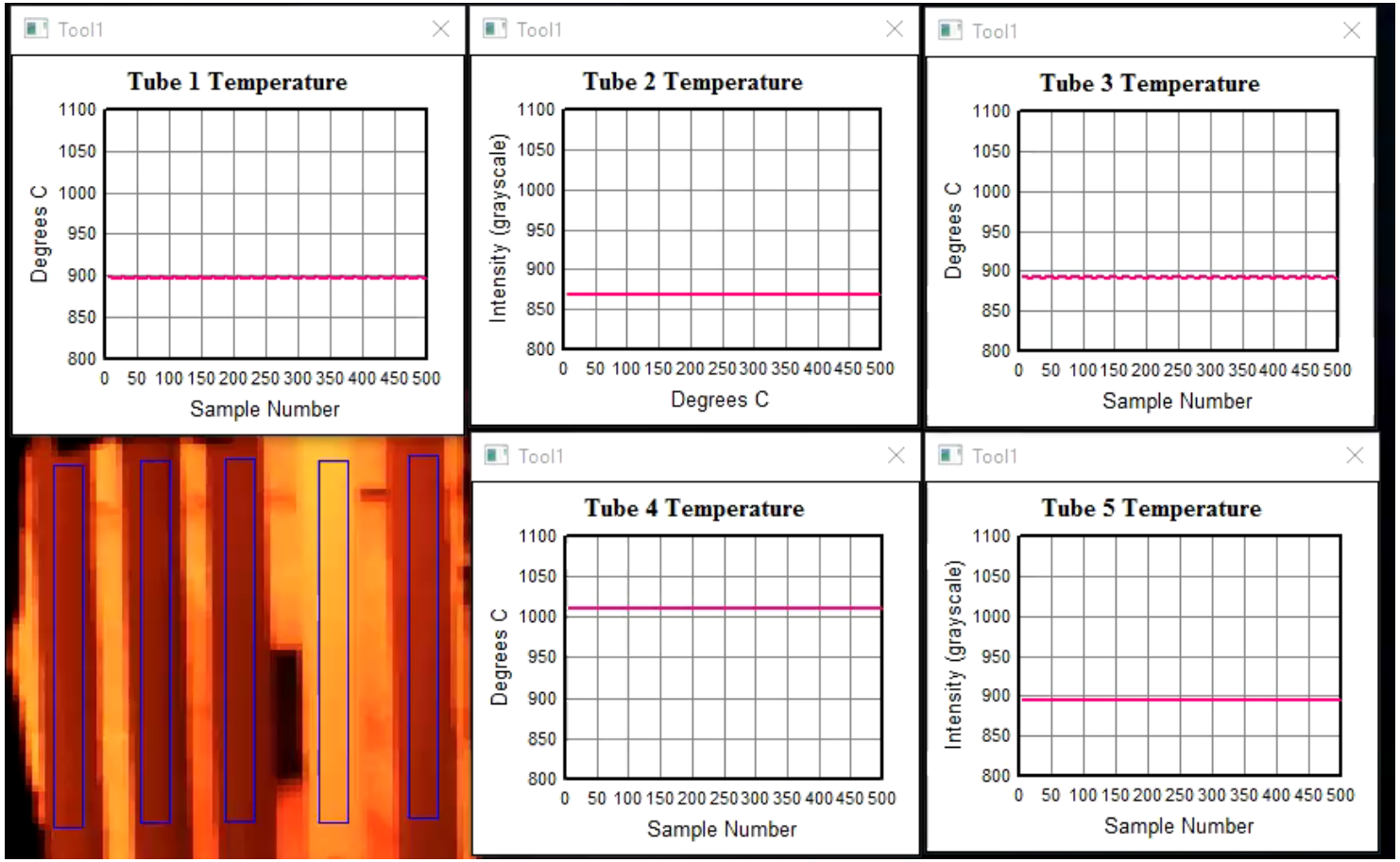




TEMPERATURE BY VISION





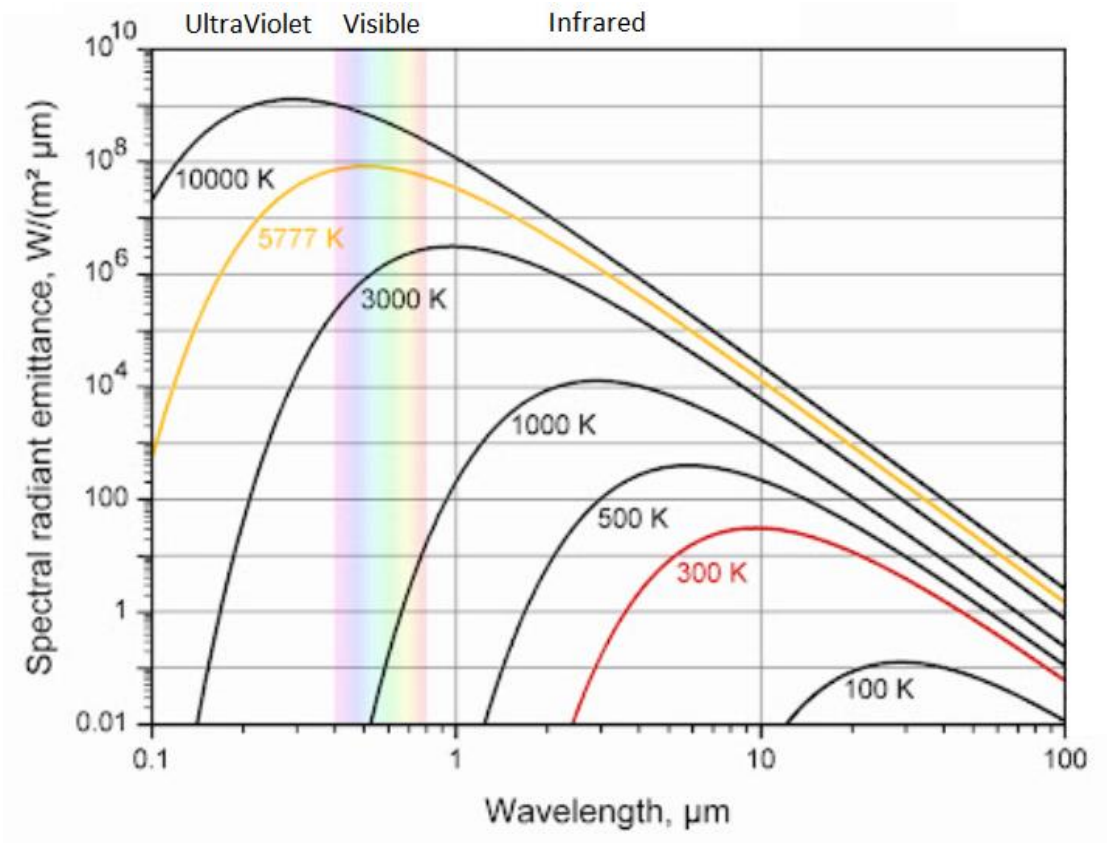
Tube 4 is running too hot

TEMPERATURE BY VISION

Operates in the Visual Spectrum

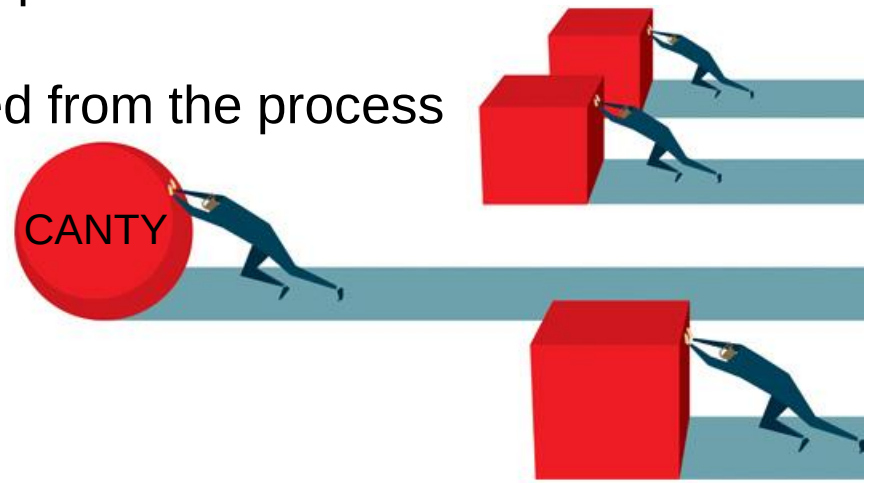
Biggest difference in the spectral radiance (intensity) for any temperature change occurs in that spectrum, meaning higher sensitivity of instruments

Shorter wavelength instruments less affected by changes over time in the emissivity of an object (tube)



CANTY ADVANTAGES

- Non Contact Measurement
- Measurement done in the visual spectrum
  - more sensitive to temperature changes
  - less affected by emissivity
- Visual Verification of process conditions
- Rugged Hardware – fused glass / quartz optics / no retraction system
- Ease of Maintenance – electronics isolated from the process
- Ease of remote support with the VCM



CONCLUSION

- Real time continuous measurement of tube temperature is critical
- Reduces down time, increases efficiency, and therefore yield / profit
- Current commonly used techniques have multiple issues
- Imaging solution can overcome these issues and provide an accurate, reliable, and multi-point measurement

QUESTIONS & ANSWERS