



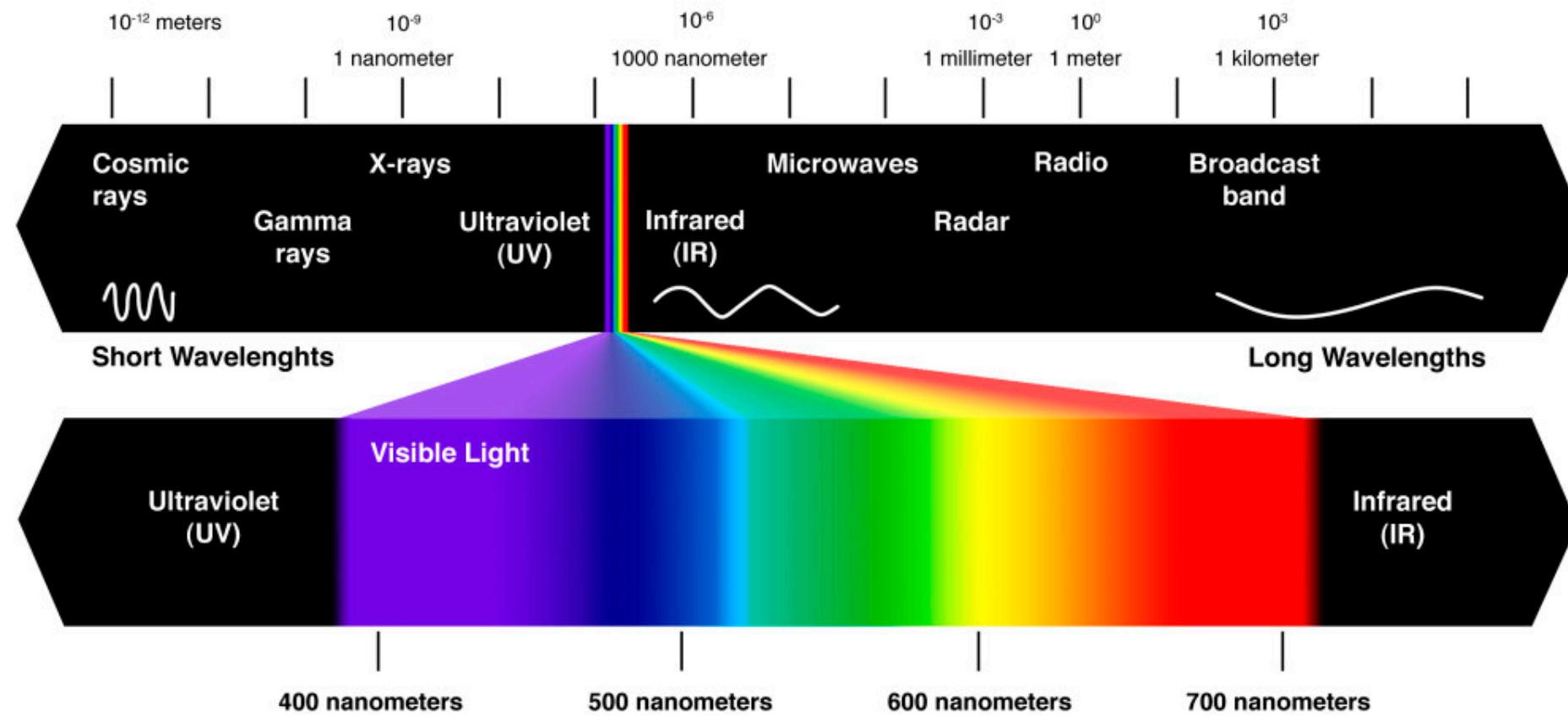
得邁斯科技  
Qtech Technologies Co., Ltd.

## 紅外線與熱像儀應用：提升設備效能

誠信 專注 專業整合 專業服務

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# 何謂紅外線



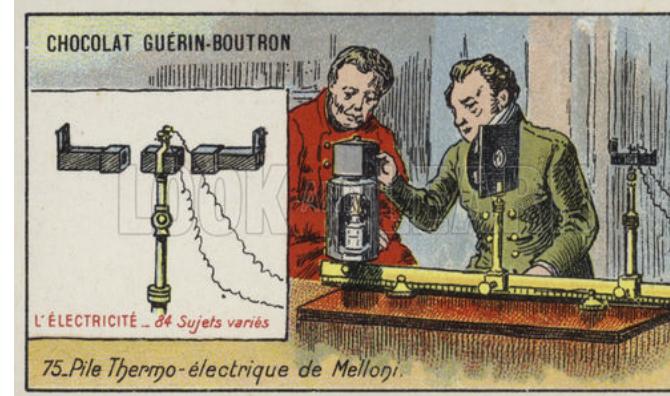
# 歷史

1666 – Newton 發現了光譜

1800 – Herschel 發現了紅外線輻射



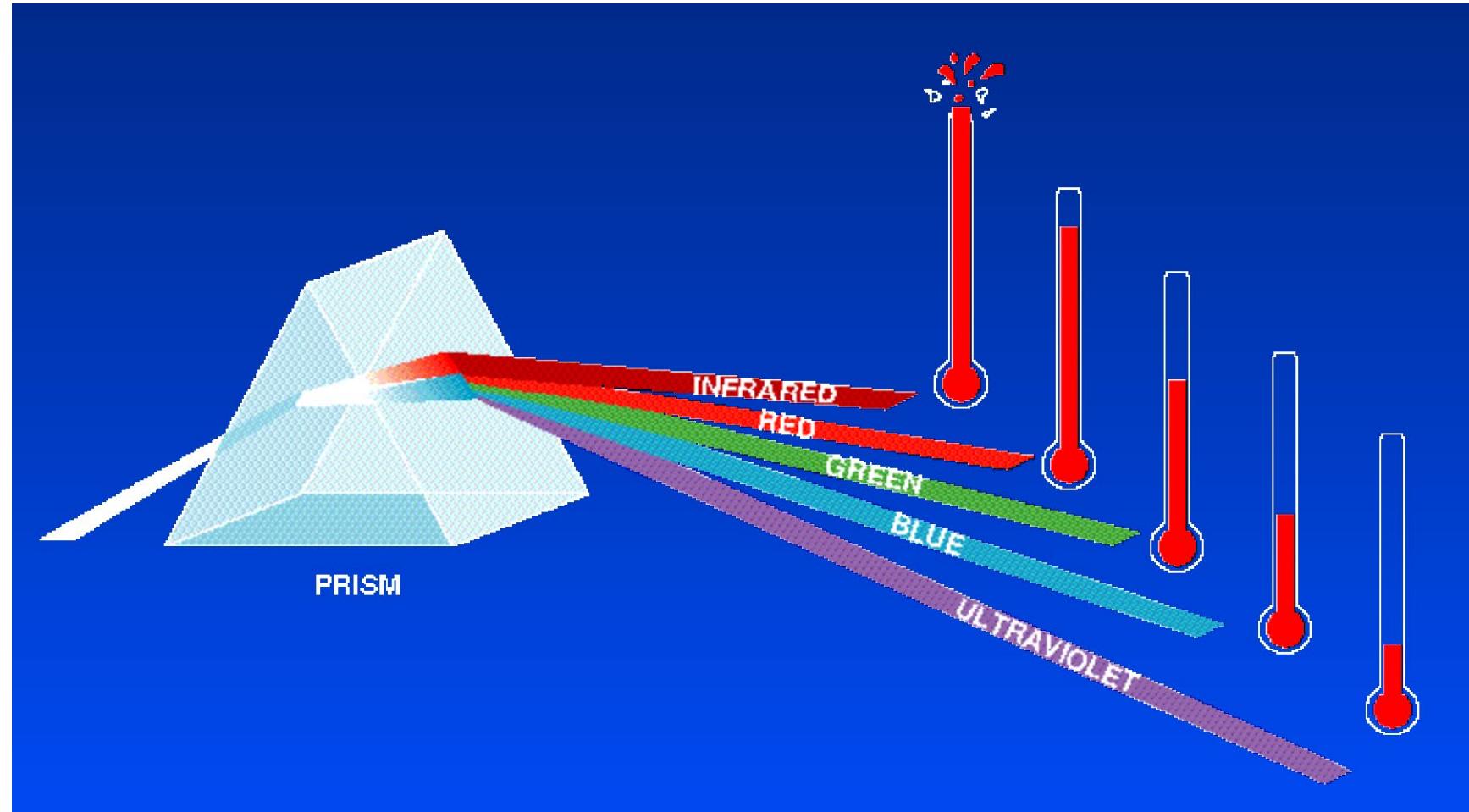
Temperature peaks in  
non-visible range



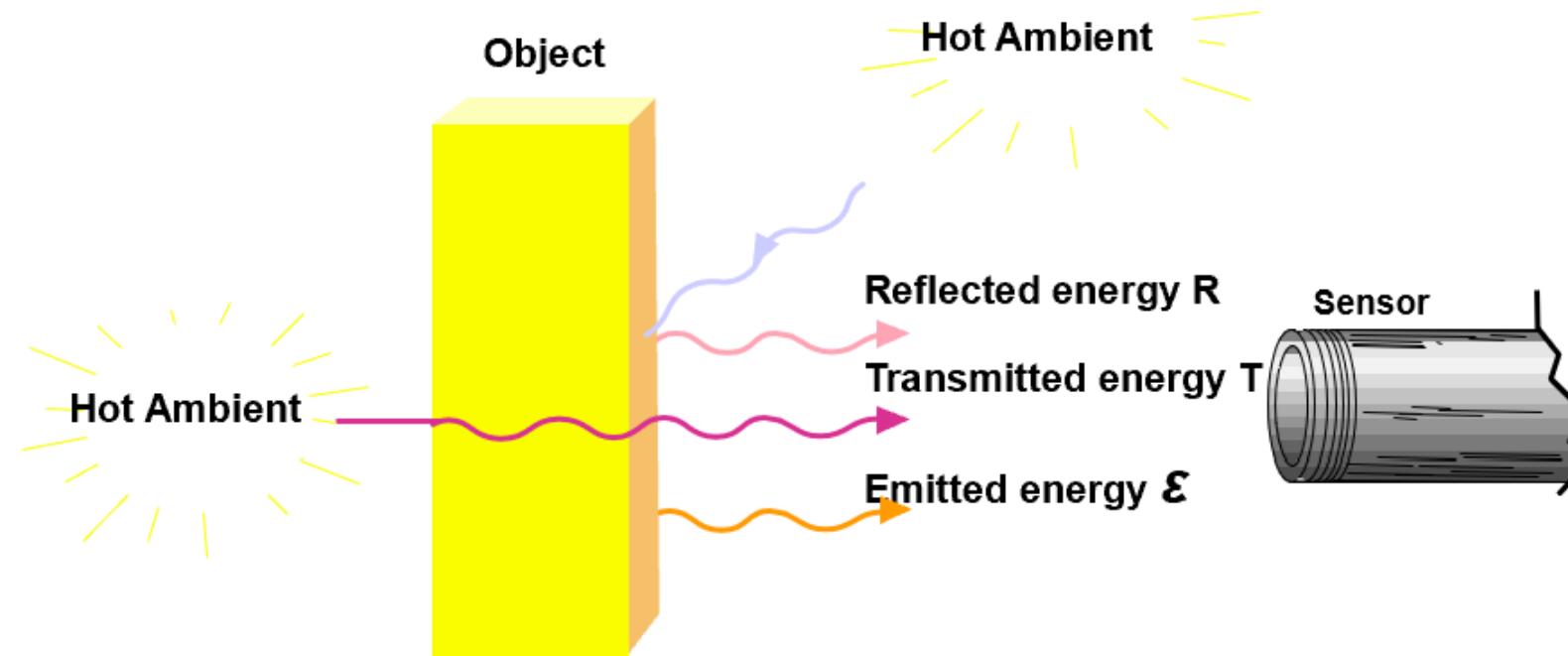
Melloni's thermopile



# 紅外線理論



# 紅外線能量的來源



$$\begin{aligned}\epsilon + R + T &= 1 & // T = 0 \\ \epsilon + R &= 1\end{aligned}$$

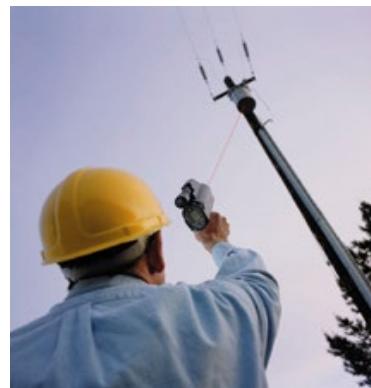
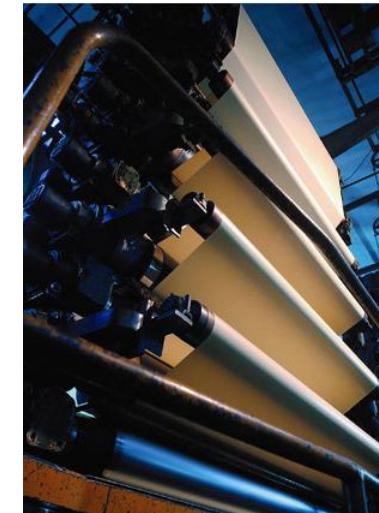
# 紅外線測量的優點

非常快速地測量 (milliseconds)

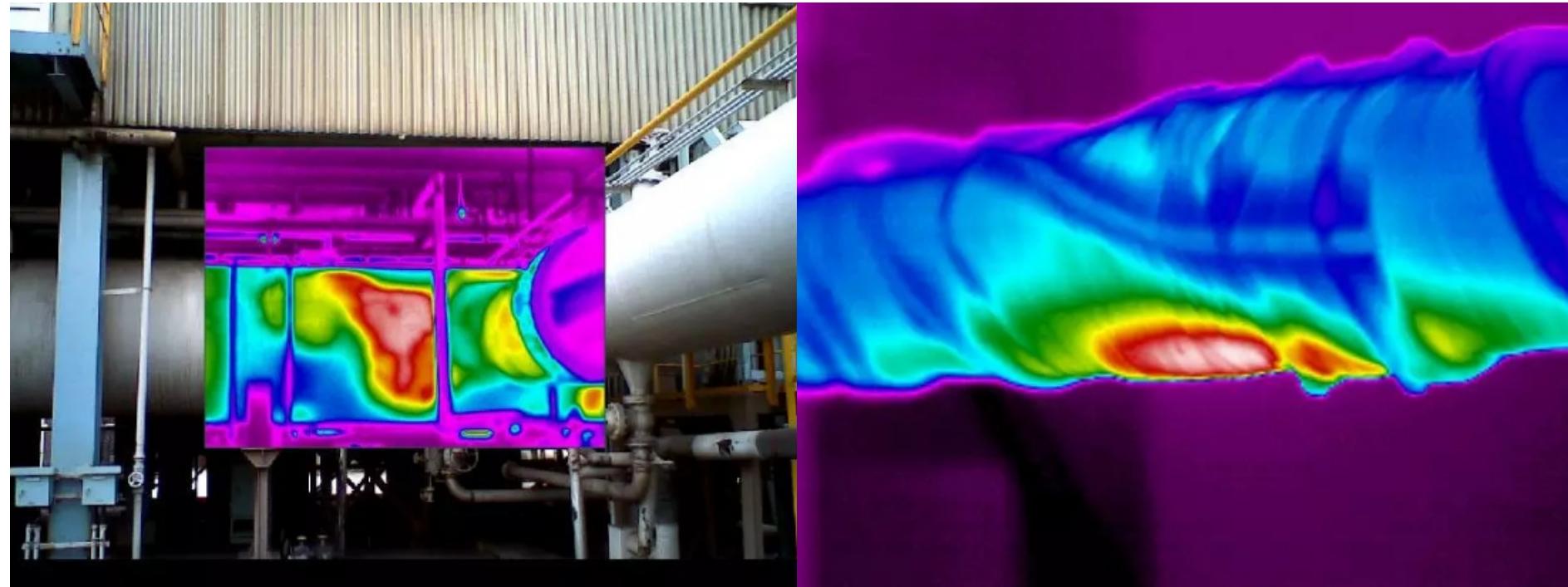
可用於移動的物件

可測量到難以到達的工作

非常高溫的物件 (> 1700°C)



# 紅外線如何幫助我們節能

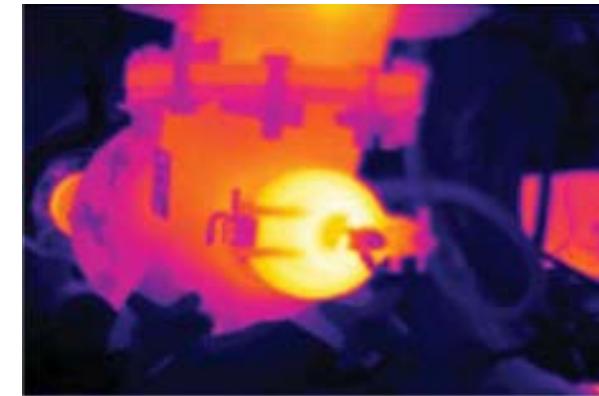


管道保溫

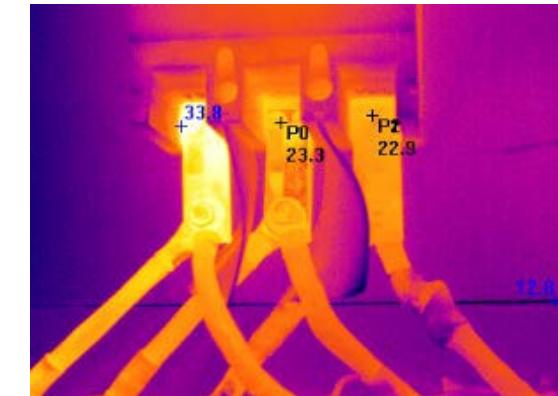
# 紅外線如何幫助我們節能



加熱爐

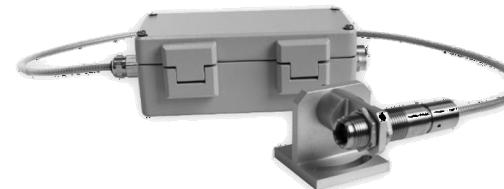


高爐風口

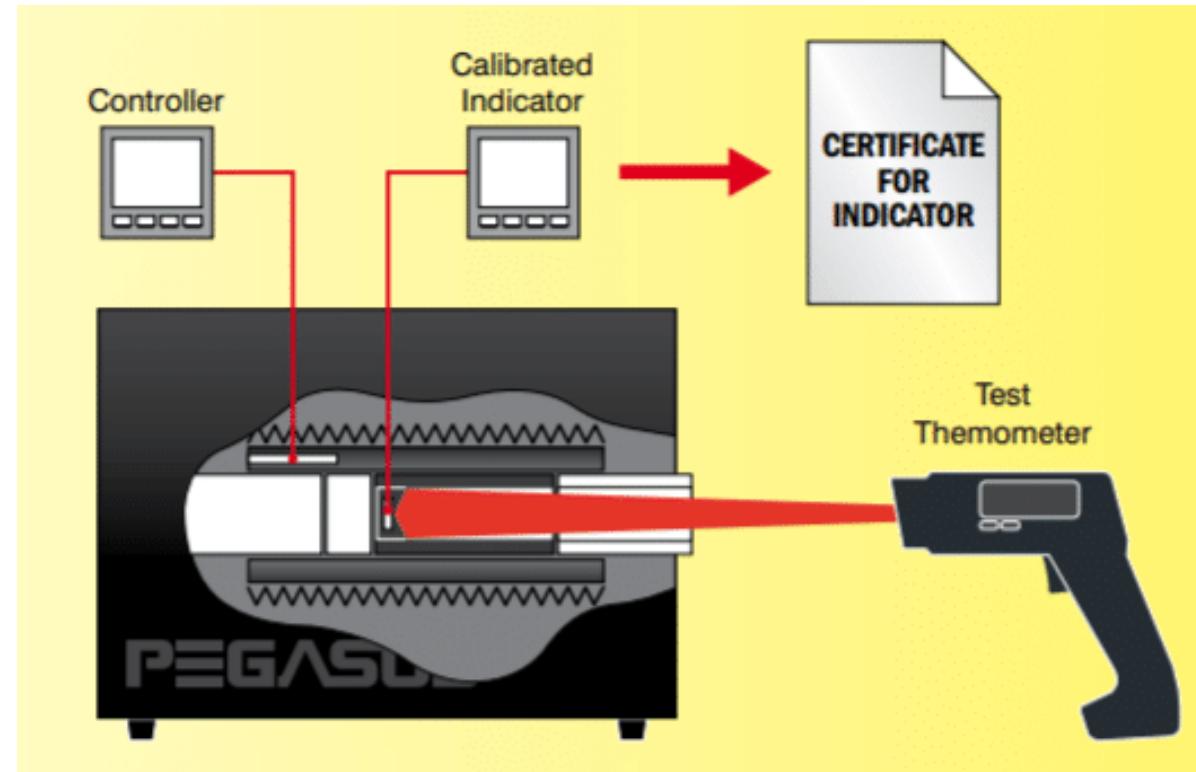


三相電不平衡

# 紅外線如何幫助我們節能

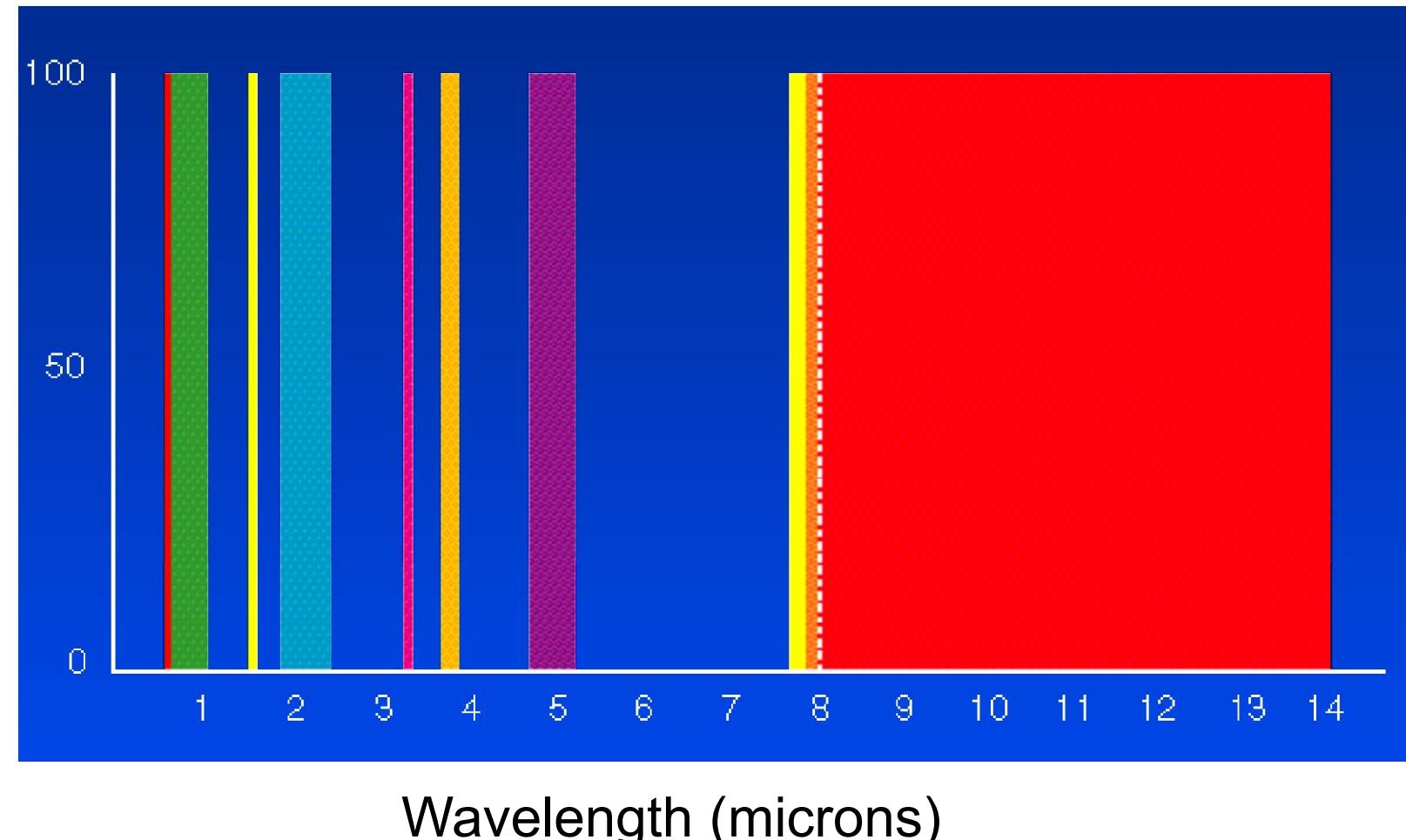


# 紅外線如何幫助我們節能



Fluke 4180/4181  
黑體爐標準源

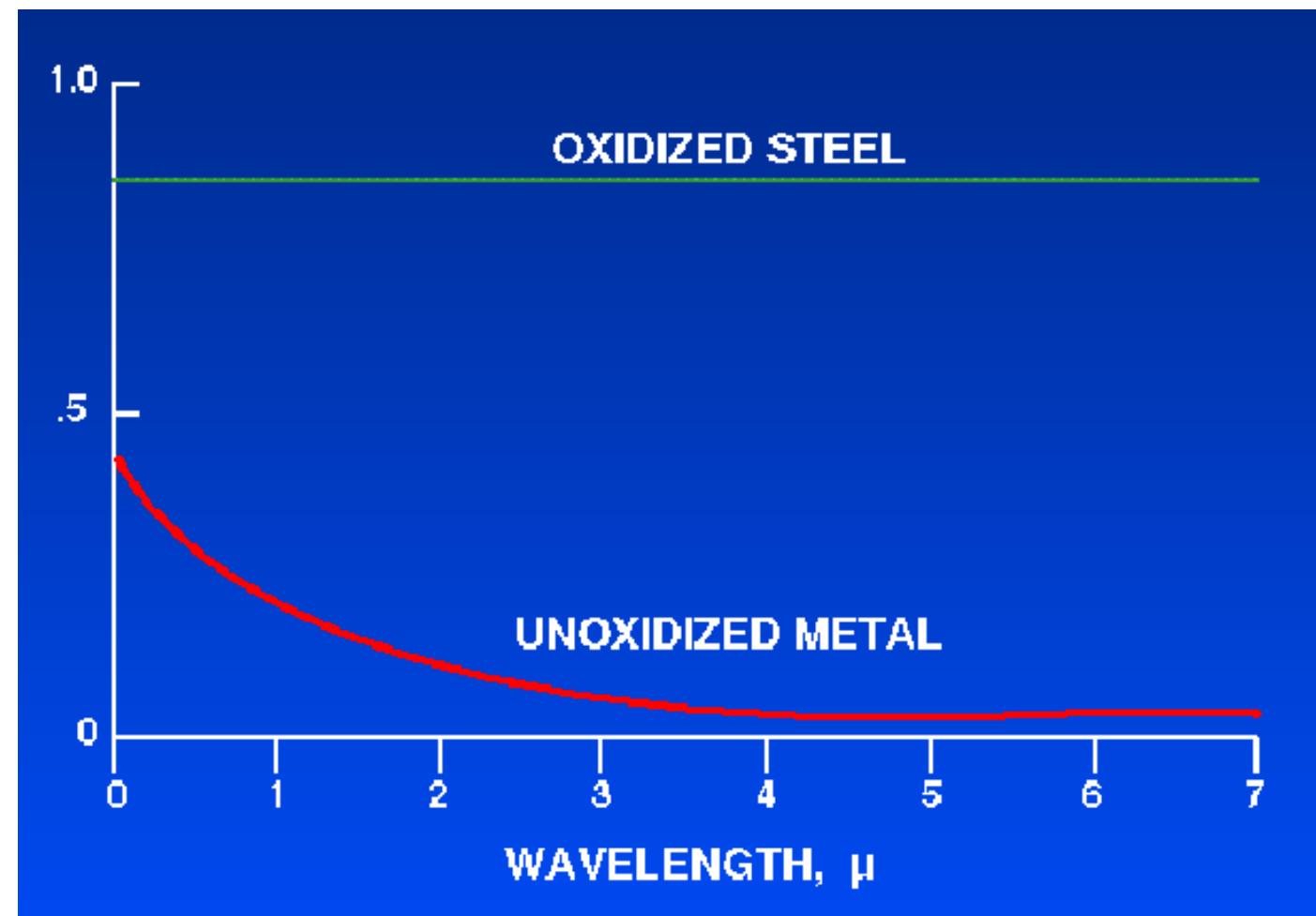
# 如何正確選擇紅外線設備

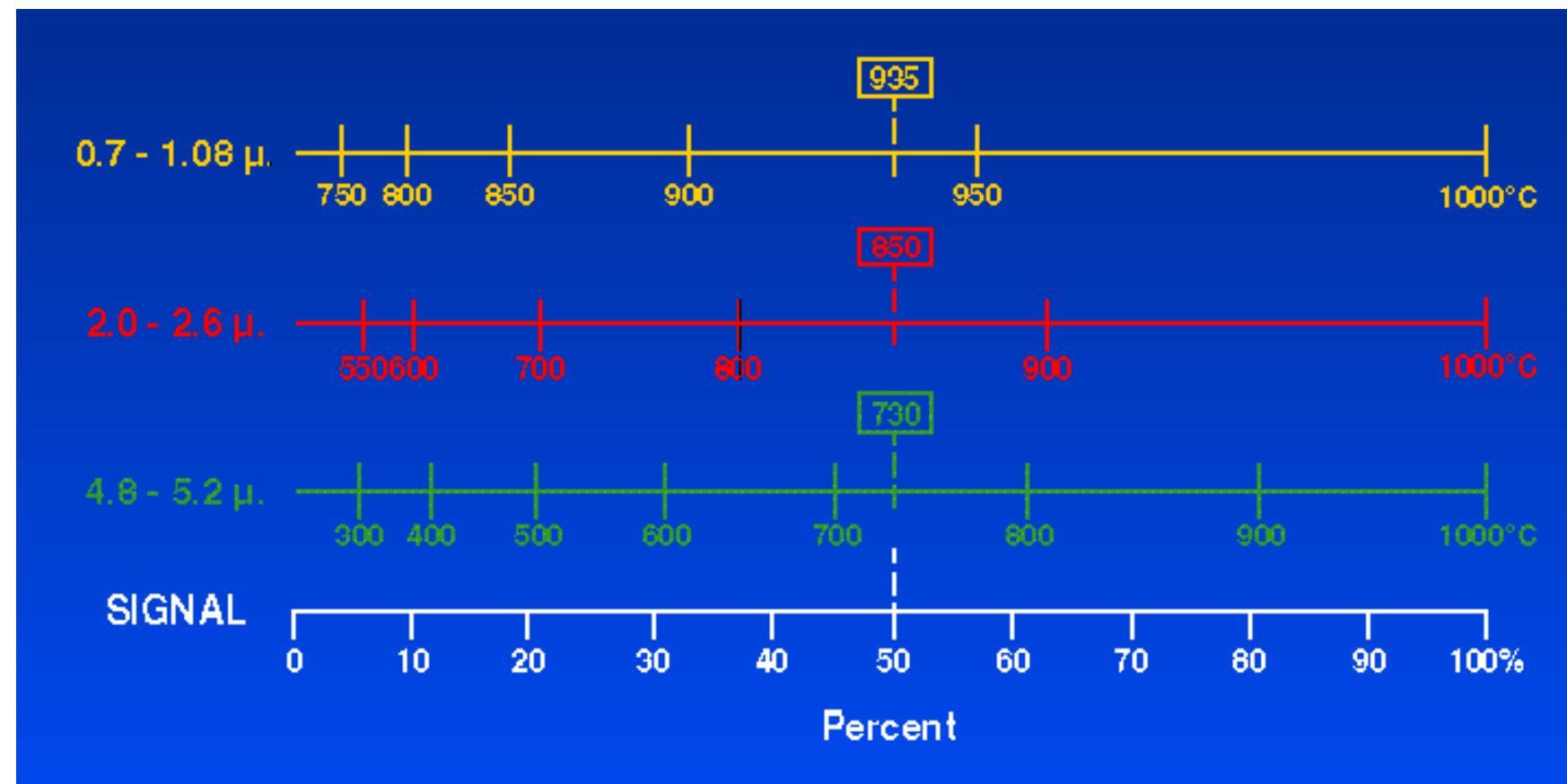


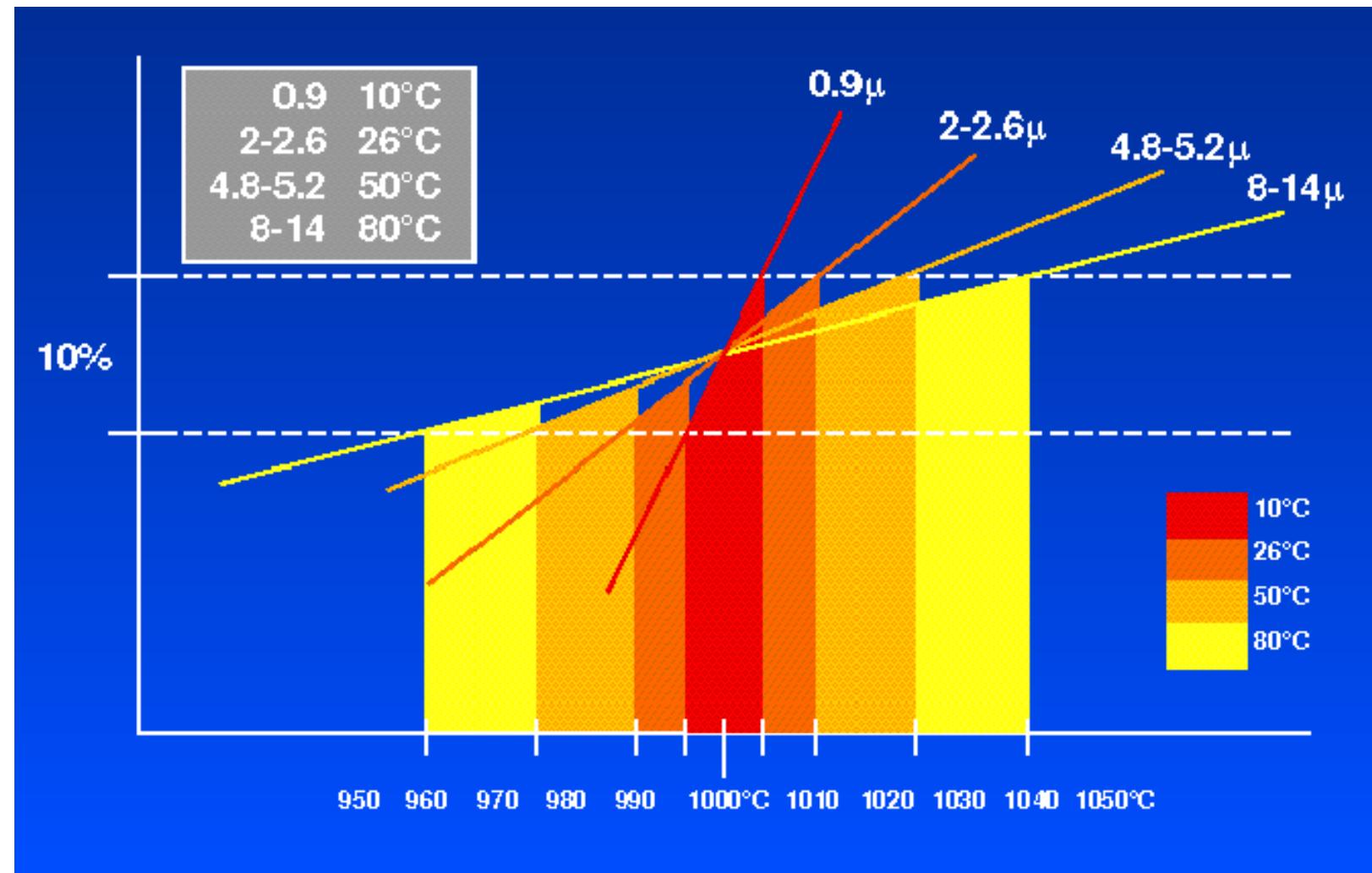
# Rule of Thumb!

Choose the Shortest  
Wavelength that will  
measure your  
temperature









# 顏色與放射率的關係

Sample Number	Color	Emittance at 3.4 Microns
1	White	0.91
2	Dark Brown	0.94
3	Avocado Green	0.92
4	Medium Blue	0.93
5	Yellow	0.92
6	Red Orange	0.92
7	Tan	0.93
8	Black	0.95
9	Dark Green	0.95
10	Bronze	0.93
11	Gold	0.92

# 材質與放射率的關係

## 被測物

## 放射率

## 被測物

## 放射率

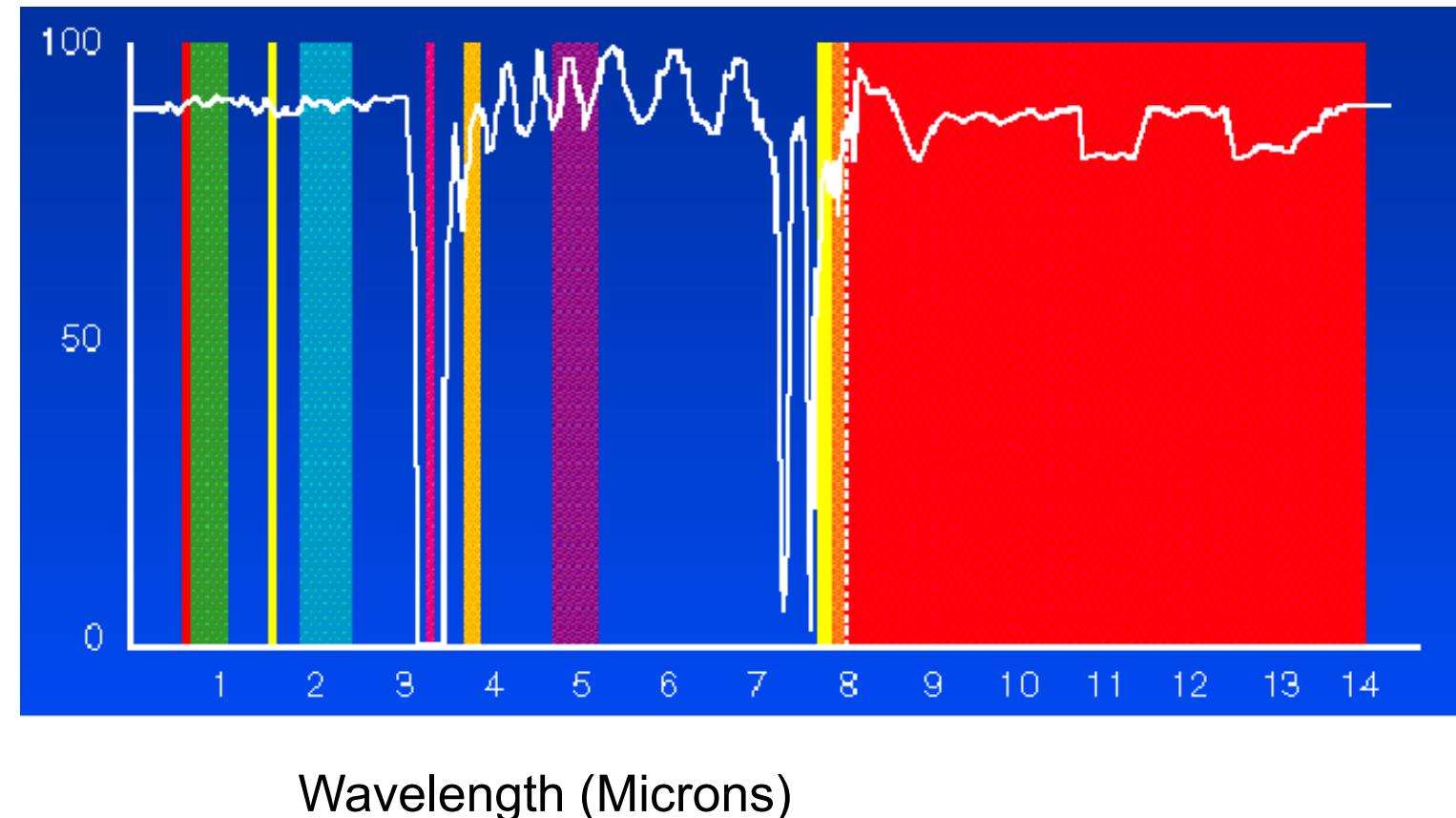
瀝青.柏油	0.90~0.98	橡膠(黑)	0.95
混凝土	0.94	塑膠(不透光)	0.95
水泥	0.95	油漆(亮光漆)	0.80~0.95
沙	0.90	鉛(已氧化)	0.20~0.60
土壤	0.90~0.98	黃銅(磨光)	0.01~0.05
水	0.92~0.96	黃銅(光滑)	0.30
冰	0.96~0.98	黃銅(已氧化)	0.50
雪	0.90	碳	0.80~0.90
玻璃	0.90~0.95	石墨	0.70~0.80
陶瓷	0.90~0.95	木材	0.90~0.95
石膏	0.80~0.95	皮革	0.75~0.80
紅磚	0.93~0.95	黑布	0.98

# What about applications that do not follow the “Rule of Thumb”?

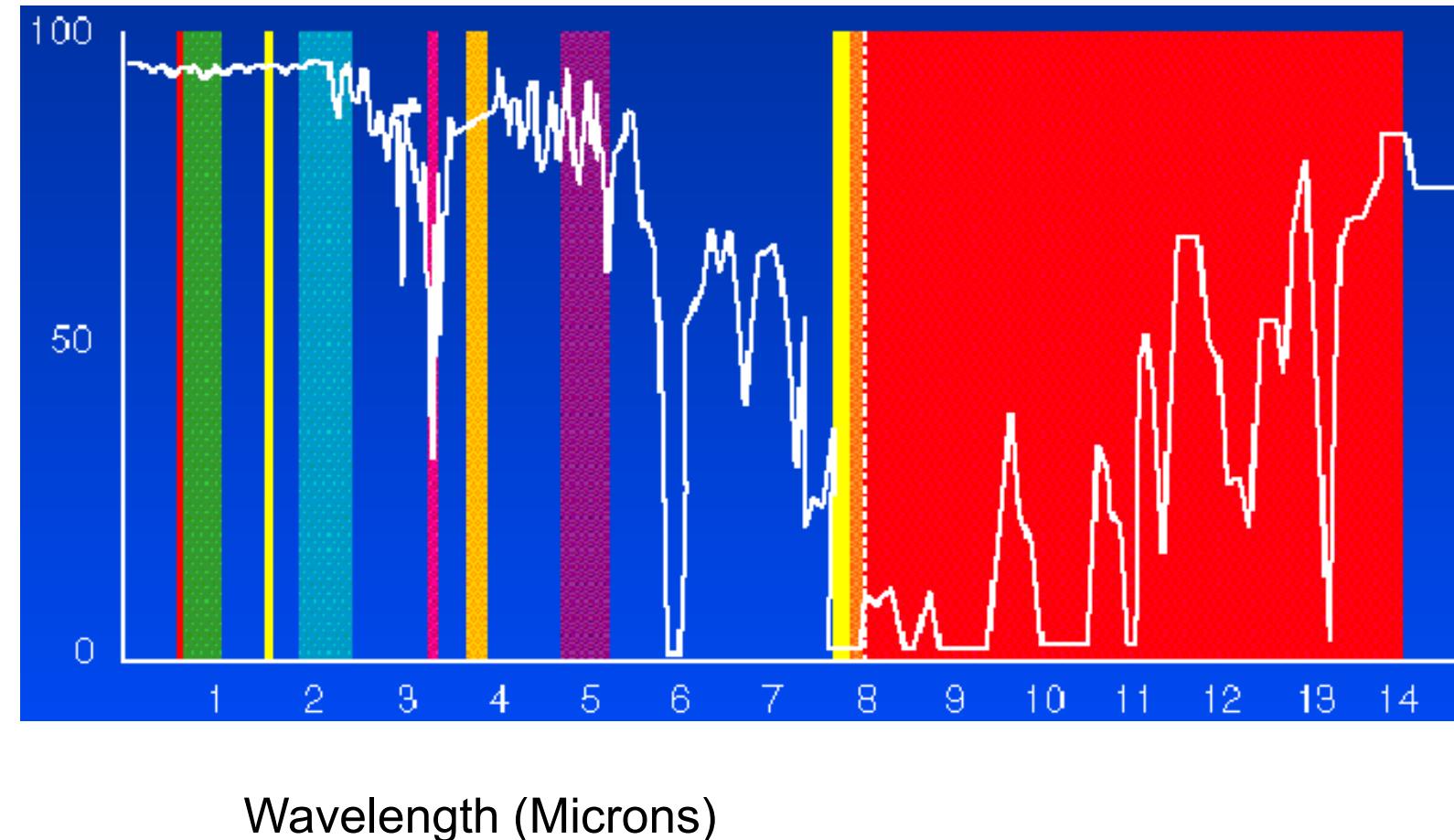


# Polypropylene Film(聚丙烯膜, PP)

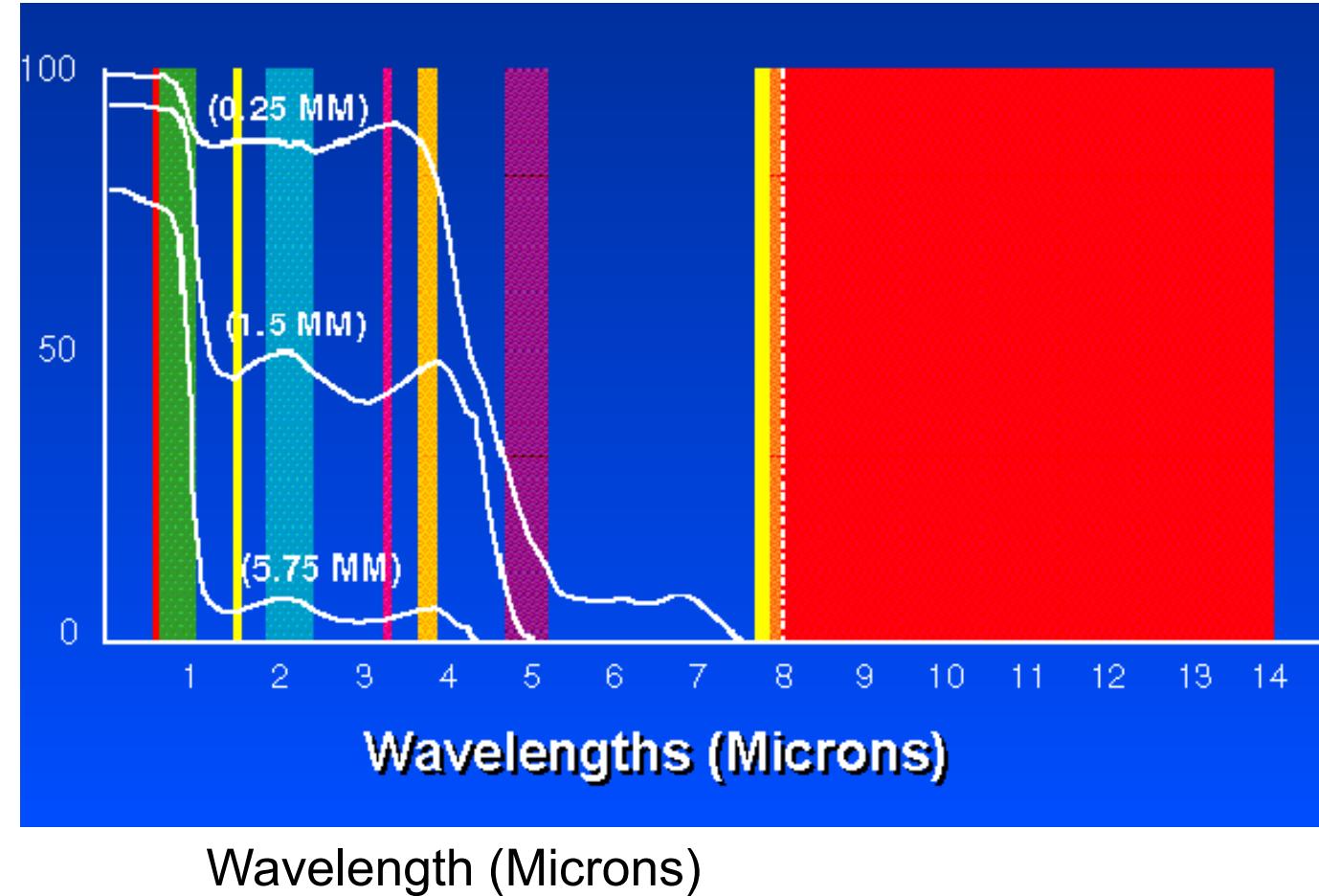
(厚度約從0.012 to 0.12 mm)



# Polyester Film(聚酯膜PET/PF) (厚度約從0.05 to 0.1 mm)



# Transmittance Curves for Soda-Lime-Silica Glass



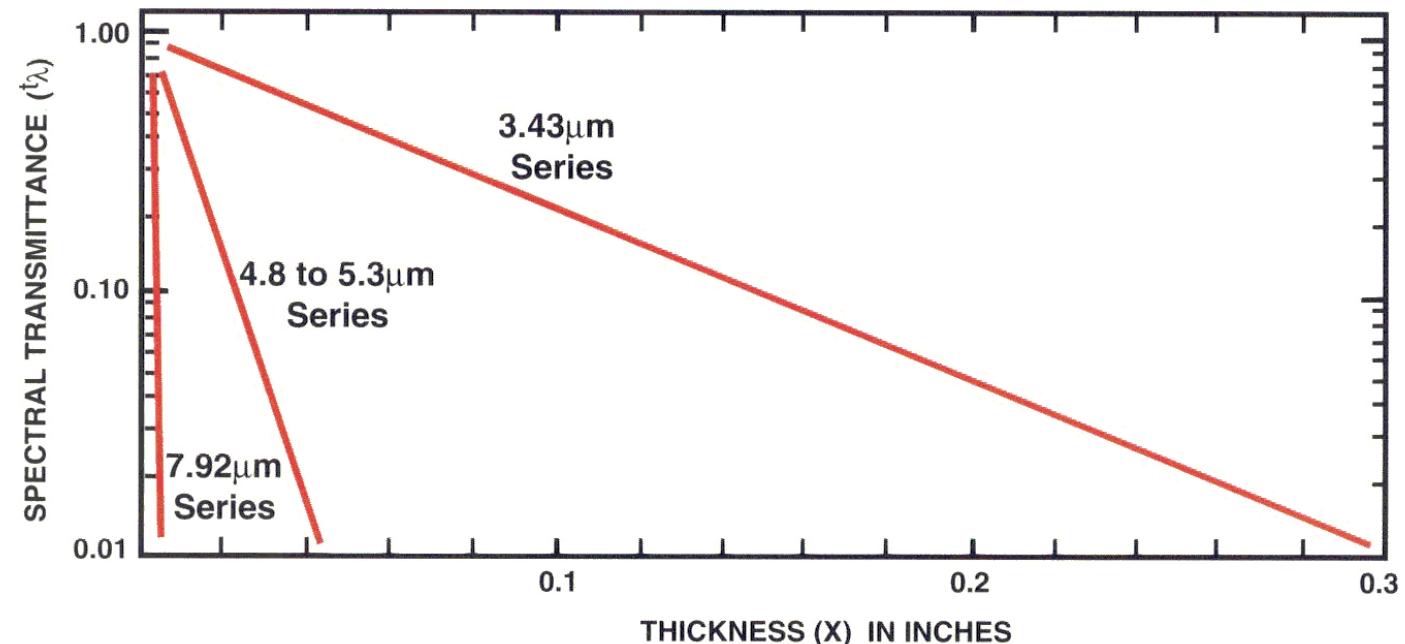


FIG. 2 – TRANSMITTANCE VARIATION WITH THICKNESS FOR SODA - LIME - SILICA GLASS  
FOR VARIOUS MODEL SERIES

# Endurance series



<b>E1R</b>	<b>E2R</b>	<b>E1M</b>	<b>E2M</b>	<b>E3M</b>
<b>E1RL</b> 600 to 1800 °C (1112 to 3272 °F) (2 color mode)	<b>E2RL</b> 250 to 1200 °C (482 to 2192 °F) 75 : 1	<b>E1ML</b> 400 to 1740 °C (752 to 3164 °F) 160 : 1	<b>E2ML</b> 250 to 1100 °C (482 to 2012 °F) 160 : 1	<b>E3ML</b> 50 to 1000 °C (122 to 1832 °F) 100 : 1
550 to 1800 °C (1022 to 3272 °F) (single color mode) 100 : 1				
<b>E1RH</b> 1000 to 3200 °C (1832 to 5792 °F) 150 : 1				
1.0 μm nominal one/two color	1.6 μm nominal two color	<b>E1MH</b> 540 to 3000 °C (1004 to 5432 °F) 300 : 1	<b>E2MH</b> 450 to 2250 °C (842 to 4082 °F) 300 : 1	<b>E3MH</b> 150 to 1800 °C (302 to 3272 °F) 300 : 1
		1.0 μm nominal single color	1.6 μm nominal single color	2.4 μm nominal single color

# TV 40/30 series family



## 產品特色

強大的ThermoView分析軟體，適用於多種工業自動化應用現場，捕捉訊息，分析問題  
可透過軟體直接計算測量有效範圍，讓溫度監控更加準確

通過PoE模組連接網路，可直接透過網路進行連線監測與分析

堅固的鋁合金外殼，IP67(NEMA4)防護等級

加裝高溫保護套，可耐溫至200°C 的環境溫度

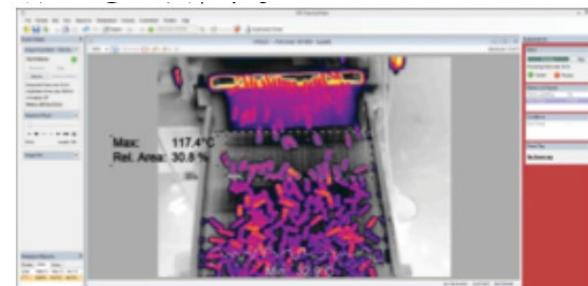
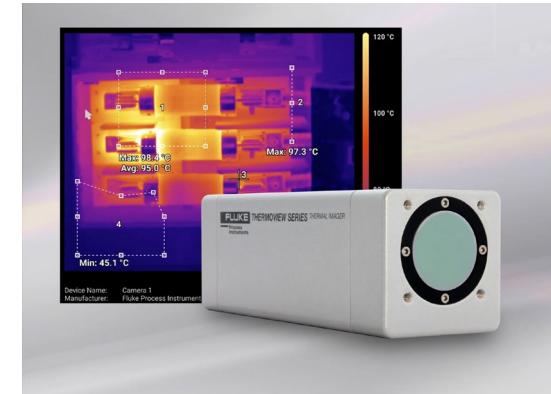
熱圖功能：熱像圖與可見光融合並可遠端對焦

測溫範圍可達1200 °C

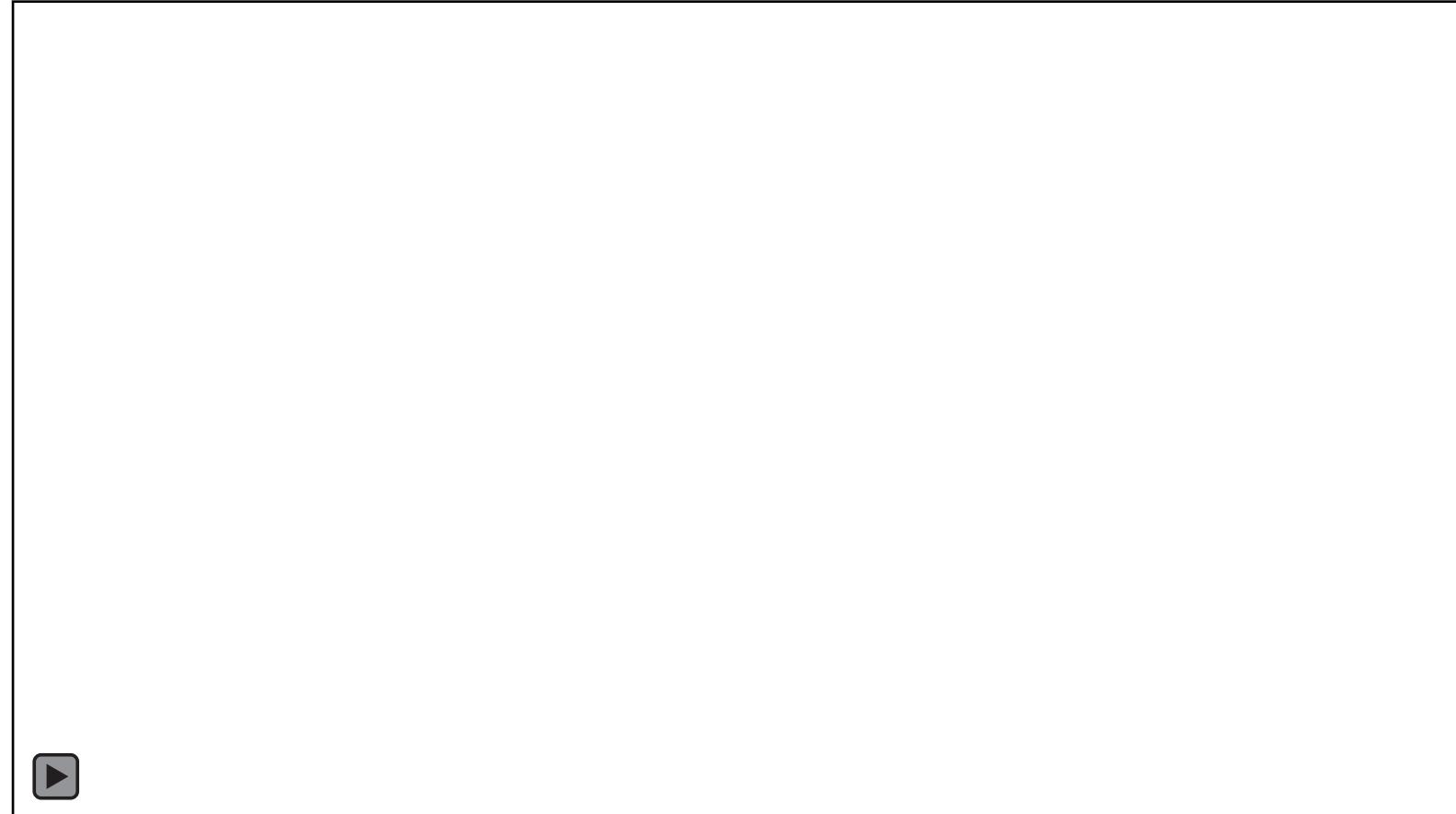
兩種解析度可供選擇：320 x 240畫素及640 x 480畫素

9或60Hz兩種配置可供選擇

可以更換遠距鏡，廣角鏡及微距鏡等不同鏡頭以適用不同應用場合



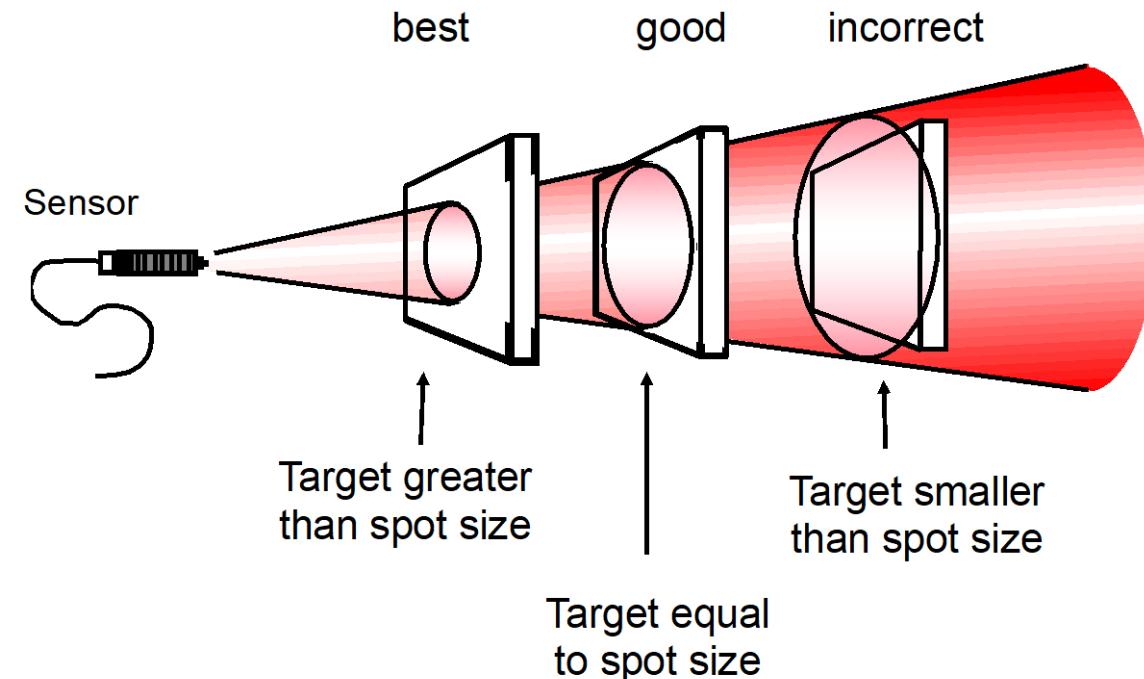
# TV 40/30 series family



# 如何正確使用紅外線測溫槍

1. 工件大小( D:S)
2. 距離 ( D:S)
3. 材質 (波長)
4. 工件溫度 (波長)
5. 速度 (反應速度)
6. 現場環境溫度 (水冷或氣冷)

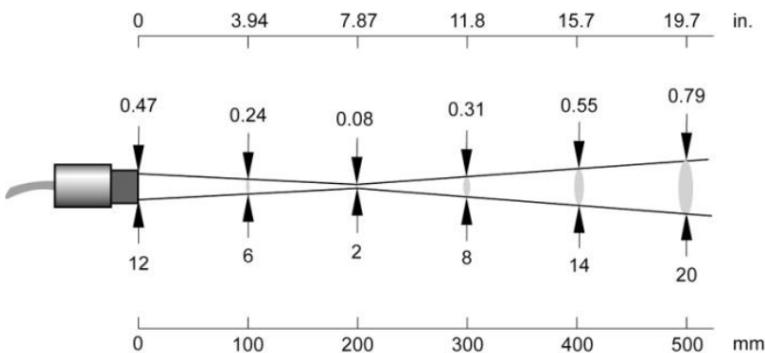
# Optic Issues



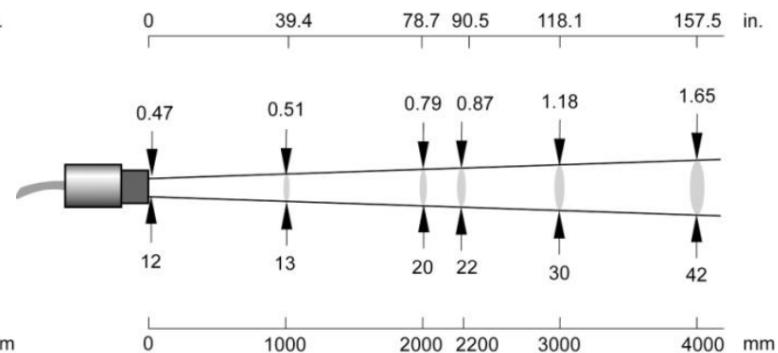
$$\frac{\text{Distance from sensor to object}}{\text{Size of spot}} = D:S$$

# Optic Issues

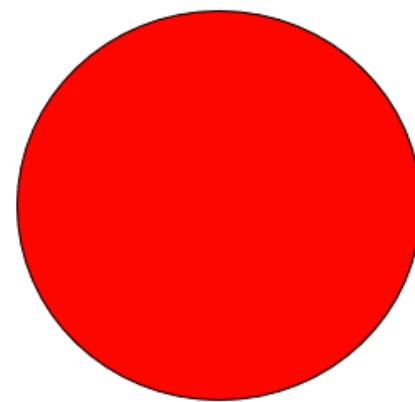
SF1 D:S = 100:1



SF3 D:S = 100:1

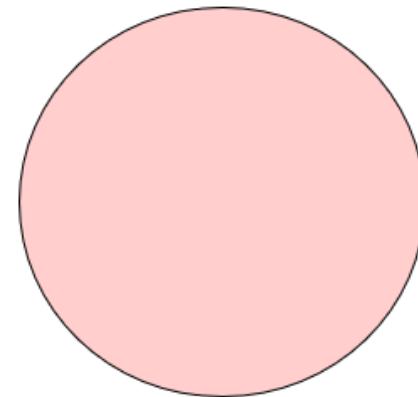


# Hot Target at 1500°F



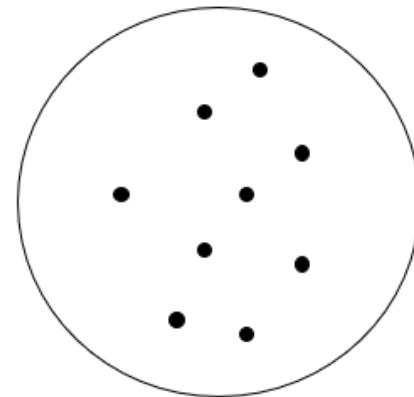
BlackBody

$E = 1.0$



Steel

$E = 0.8$



Aluminum

$E = 0.05$

# 紅外線熱像儀 空間解析度及視角 計算方法

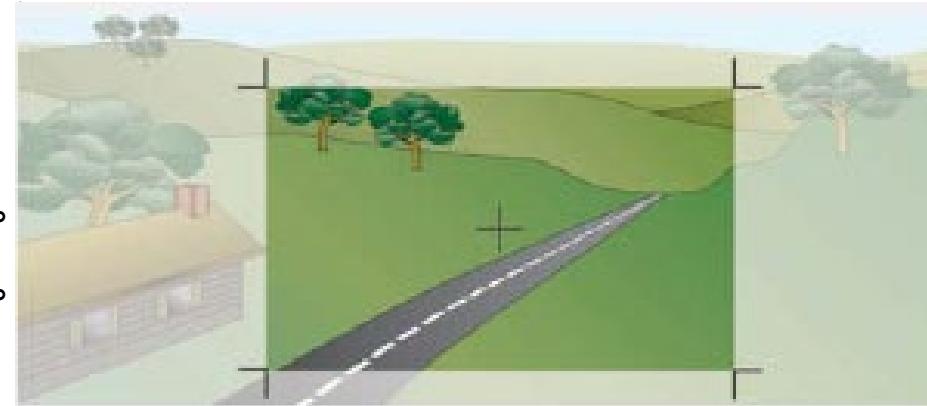
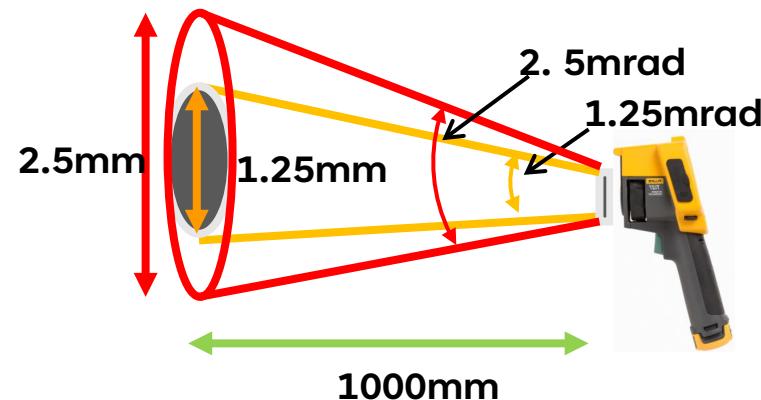
# 什麼是空間解析度 (IFOV) ？

空間解析度(IFOV) 也被稱為暫態視場角，即在多遠的距離可以分辨的目標最小尺寸是多少，IFOV的單位是mrad ( 毫弧度 )

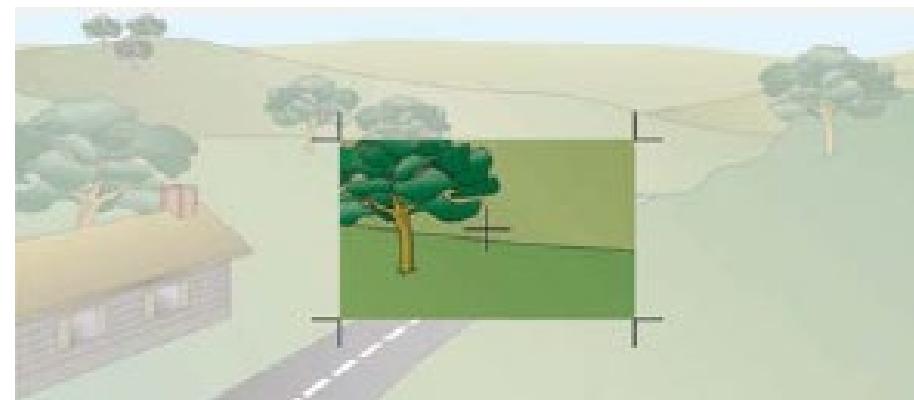
相同檢測距離，同等圖元情況下：

**IFOV越大，成像範圍越廣，圖像越模糊。**

**IFOV越小，成像範圍越小，圖像越清晰。**



IFOV大，目標（樹）包含的圖元少，細節不清晰



IFOV小，目標（樹）包含的圖元多，細節清晰

# 什麼是空間解析度 (IFOV) ?

## 詳細規格

	Ti401 PRO	Ti480 PRO	TiX501	TiX580
主要功能				
紅外線解析度		640 x 480 (307,200 像素)		
SuperResolution 超高解析度	否	有，軟體隨附。拍攝並將 4 倍 數據結合成一張 1280 x 960 的 影像	否	有，軟體隨附。拍攝並將 4 倍 數據結合成一張 1280 x 960 的 影像
IFOV 配備標準鏡頭 ( 空間解析度 )		0.93 mRad , D:S 1065:1		

Lens Type	Distance		HFOV		VFOV		Pixel Size	
	m	ft.	m	ft.	m	ft.	mm	in.
Standard Lens	0.5	1.6	0.3	1.0	0.2	0.8	0.93	0.037
	1.0	3.3	0.6	2.0	0.5	1.5	1.85	0.073
	3.0	9.8	1.8	6.0	1.4	4.5	5.56	0.219
	10.0	32.8	6.1	20.1	4.6	15.1	18.54	0.730
Wide Angle	0.5	1.6	0.4	1.4	0.3	1.0	1.23	0.048
	1.0	3.3	0.8	2.7	0.6	2.0	2.45	0.097
FPI 0.75X WIDE LENS	3.0	9.8	2.5	8.2	1.8	6.0	7.36	0.290
	10.0	32.8	8.3	27.2	6.1	20.1	24.54	0.966



# 感謝您的熱情參與

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