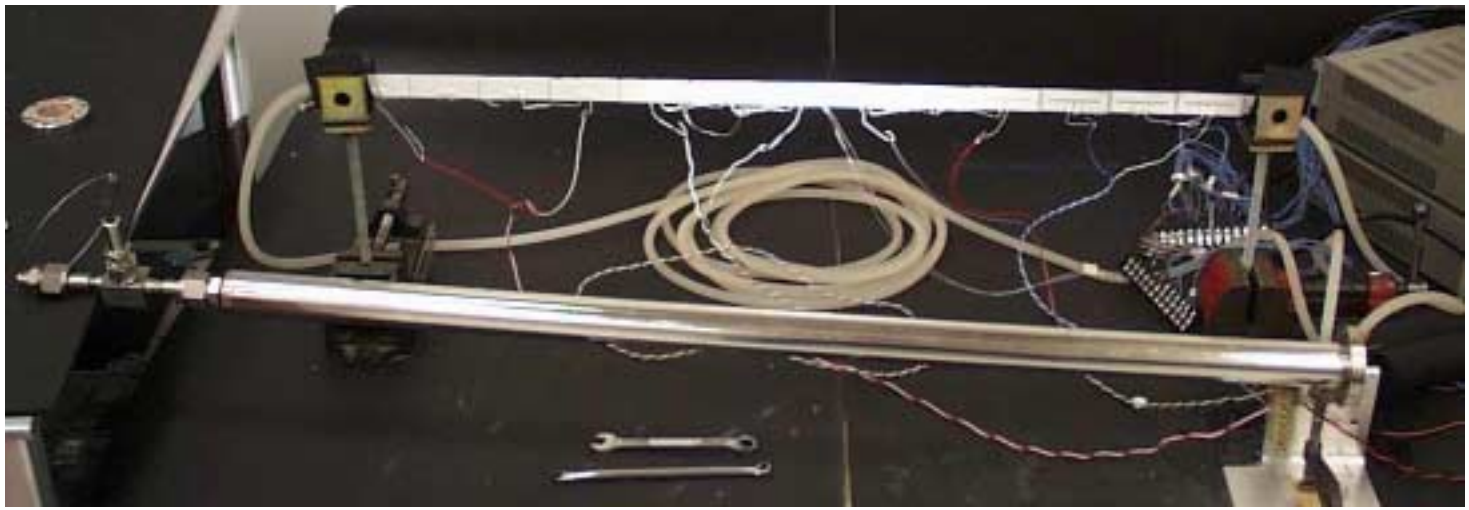
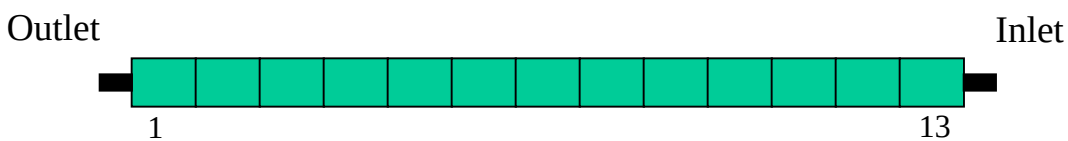
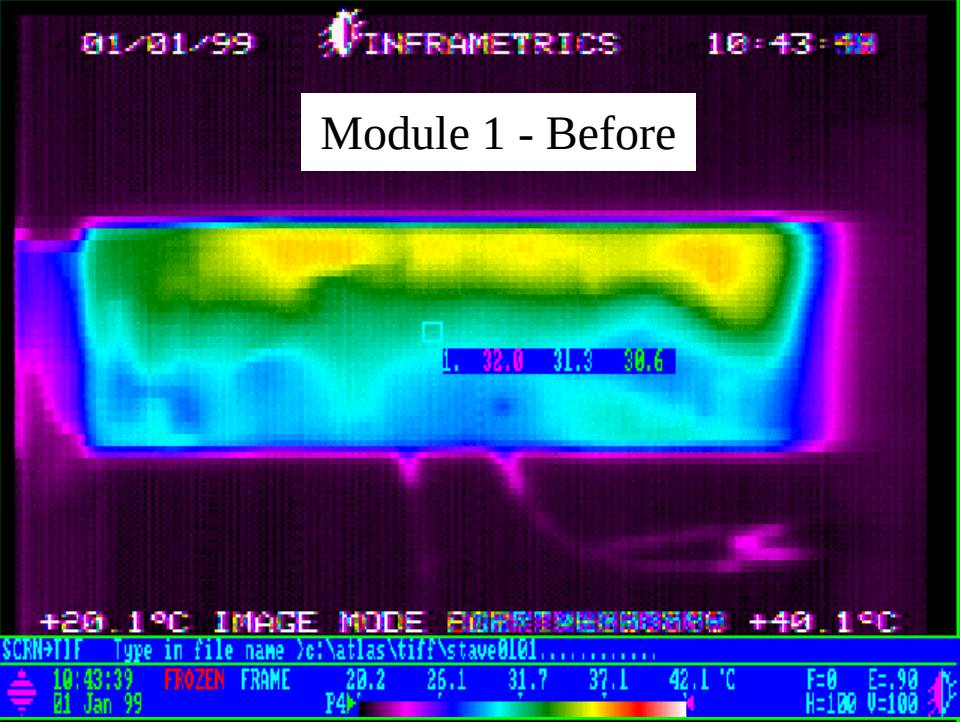
Stave Irradiation

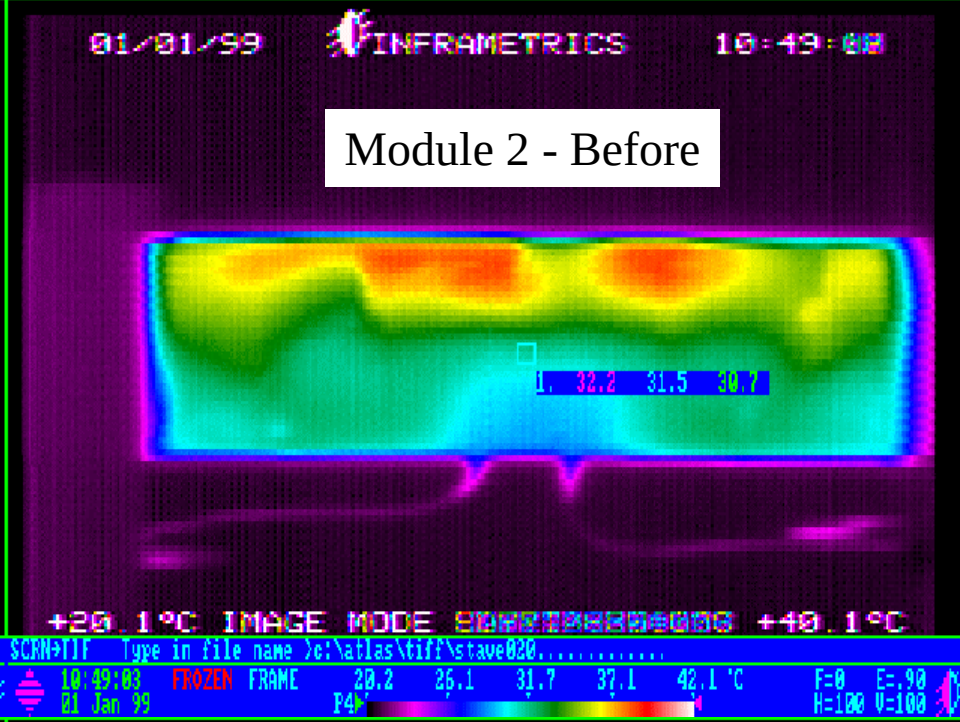
- See setup on next page
- Before irradiation
  - IR imaging done with water coolant at 20.6^{0}C, flow rate of 1 liter/min, 7.1 W/module
- First irradiation
  - Stave in vessel with nitrogen atmosphere.
  - Module #1(M1) end closest to source
  - Stave in vertical position in ring source
  - Maximum dose is 50 Mrad but varies along stave - how much is TBD.
  - IR imaging done with water coolant at 20.8^{0}C, 1 liter/min, 7.1 W/module
  - Before and after images follow
  - Paint quality varies(some bubbles). This affects thermography.
  - Room temperature can vary by up to 2C, which affects measurement
  - Error on comparison measurement around 2C(guess)

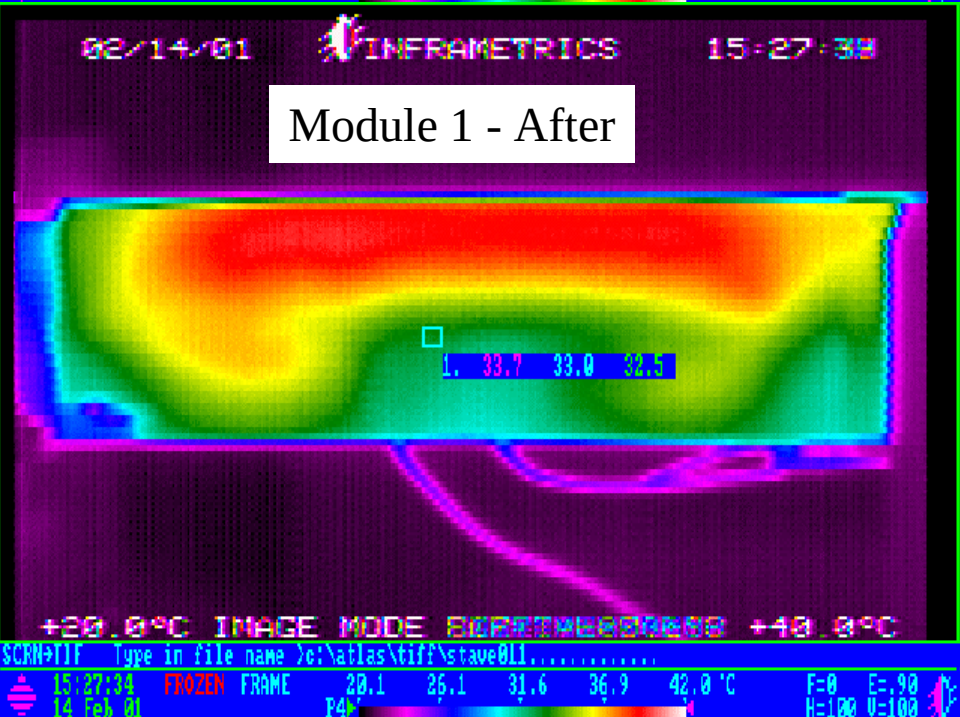
Stave and Holder

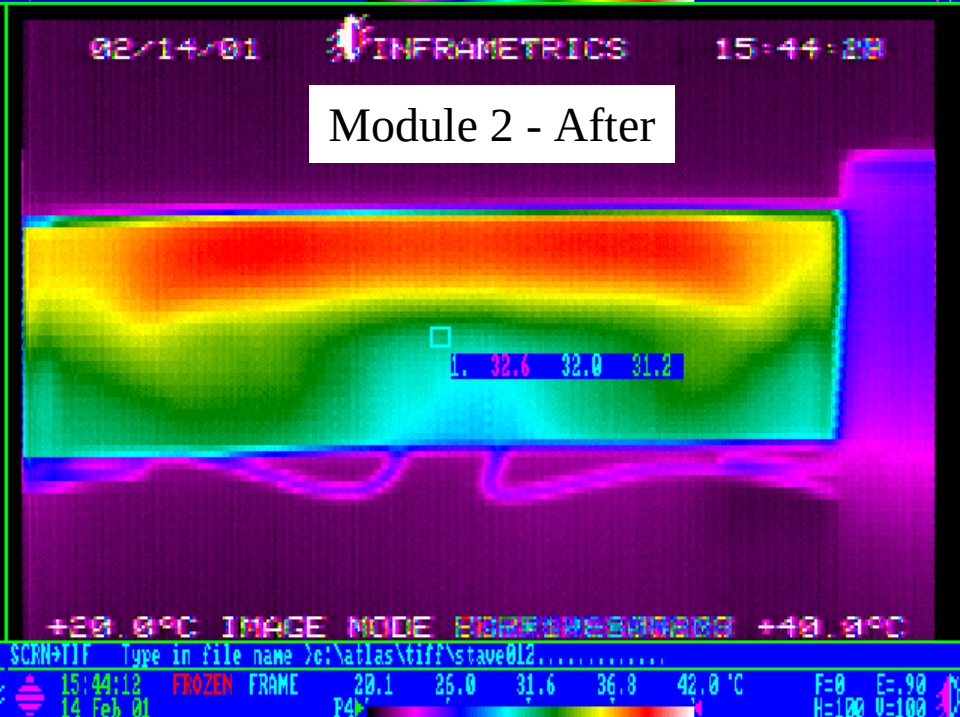


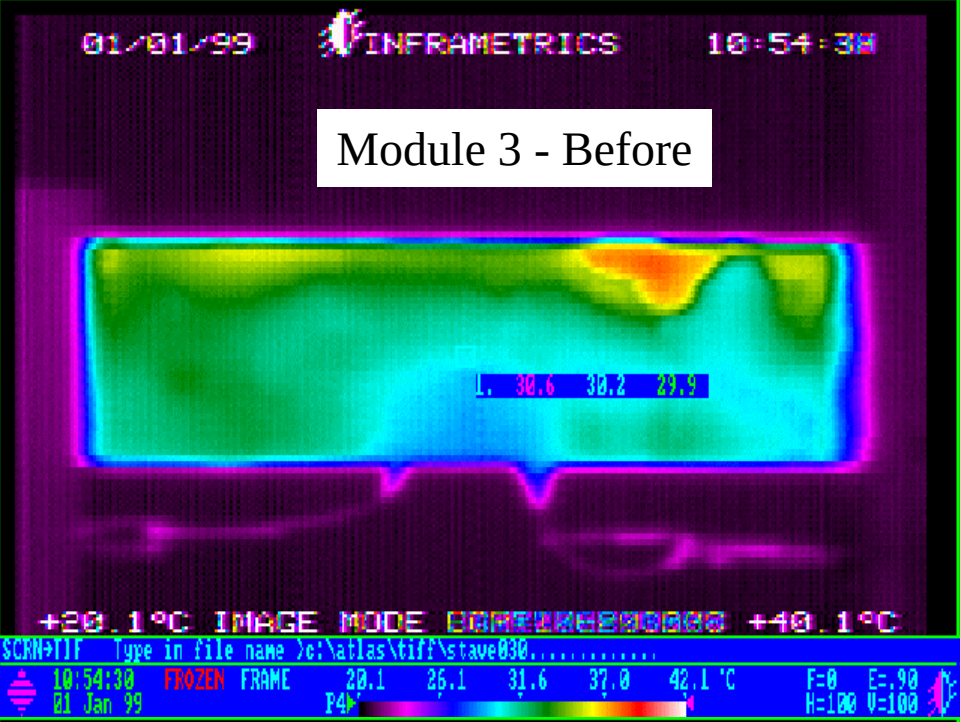


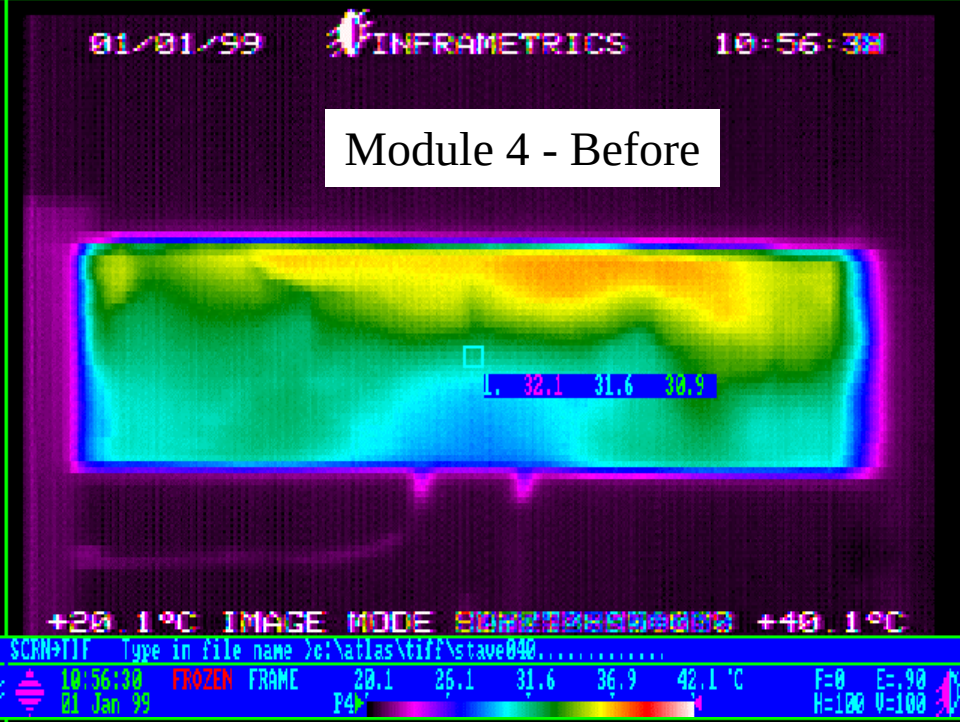

01/01/99
INFRAMETRICS
Module 1 - Before
1. 32.0 31.3 30.6
+20.1°C IMAGE MODE +40.1°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave010.....
10:43:39 FROZEN FRAME 20.2 26.1 31.7 37.1 42.1 °C F=0 E=.90
01 Jan 99 P4 H=100 V=100

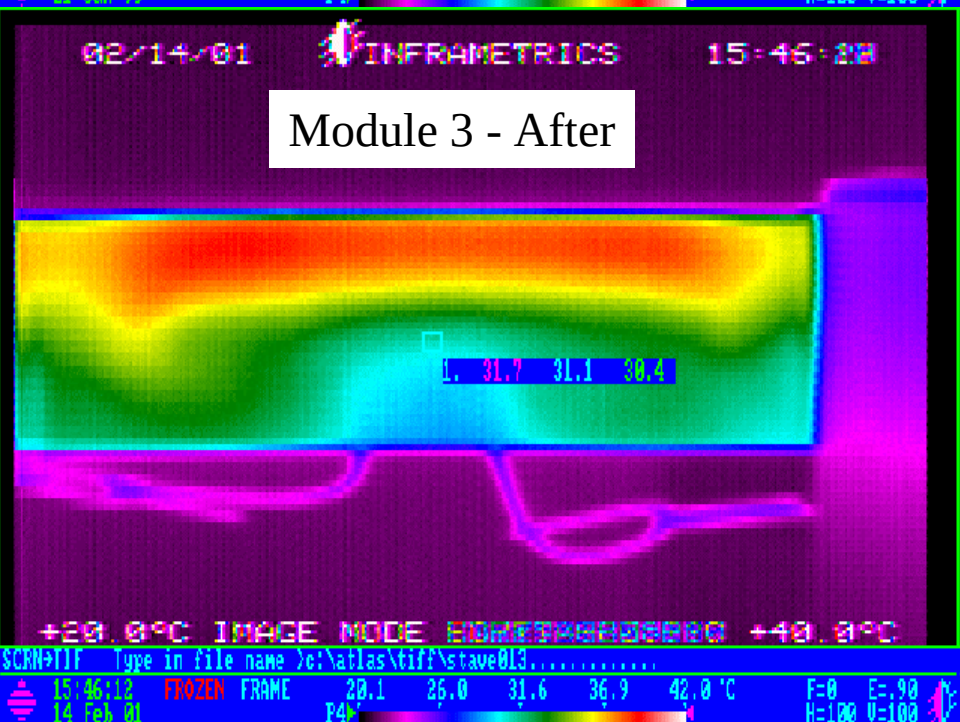

01/01/99
INFRAMETRICS
Module 2 - Before
1. 32.2 31.5 30.7
+20.1°C IMAGE MODE +40.1°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave020.....
10:49:03 FROZEN FRAME 20.2 26.1 31.7 37.1 42.1 °C F=0 E=.90
01 Jan 99 P4 H=100 V=100

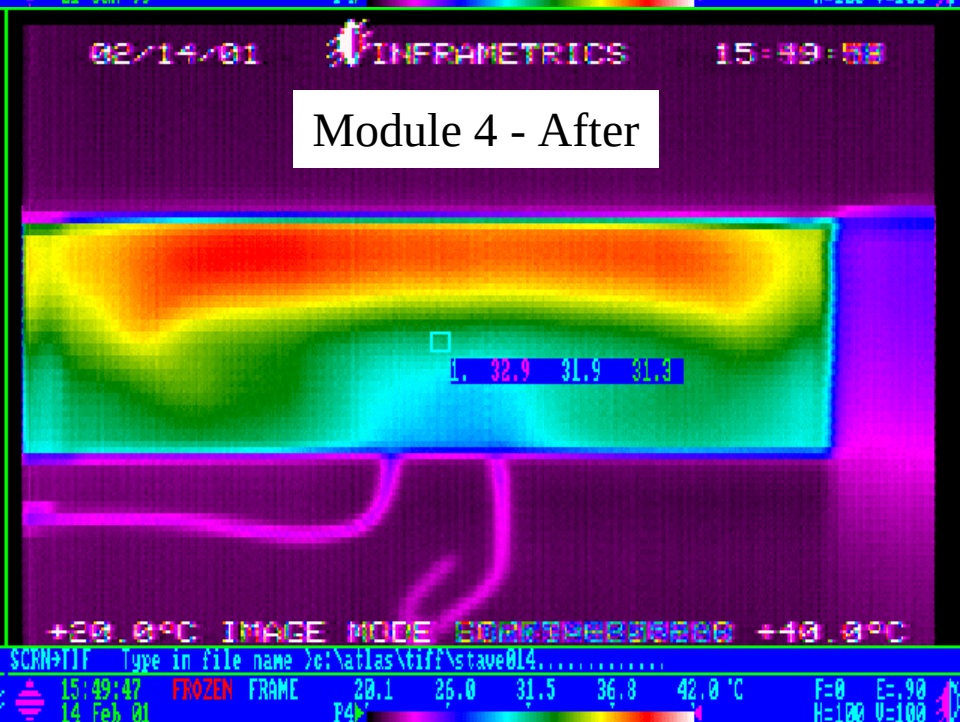

02/14/01
INFRAMETRICS
Module 1 - After
1. 33.7 33.0 32.5
+20.0°C IMAGE MODE +40.0°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave011.....
15:27:34 FROZEN FRAME 20.1 26.1 31.6 36.9 42.0 °C F=0 E=.90
14 Feb 01 P4 H=100 V=100

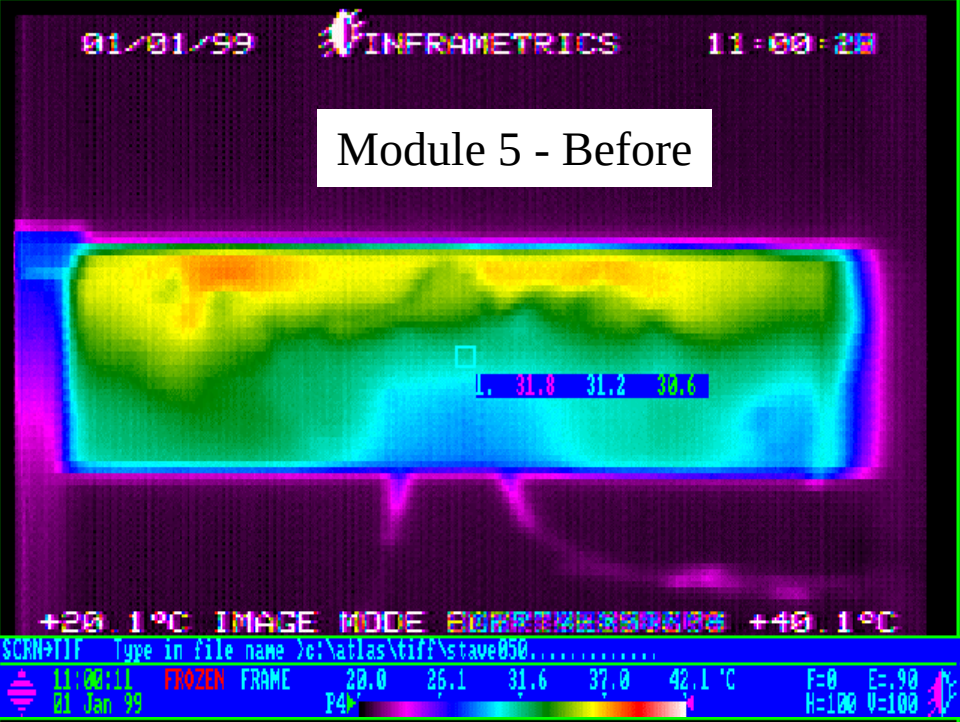

02/14/01
INFRAMETRICS
Module 2 - After
1. 32.6 32.0 31.2
+20.0°C IMAGE MODE +40.0°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave012.....
15:44:12 FROZEN FRAME 20.1 26.0 31.6 36.8 42.0 °C F=0 E=.90
14 Feb 01 P4 H=100 V=100

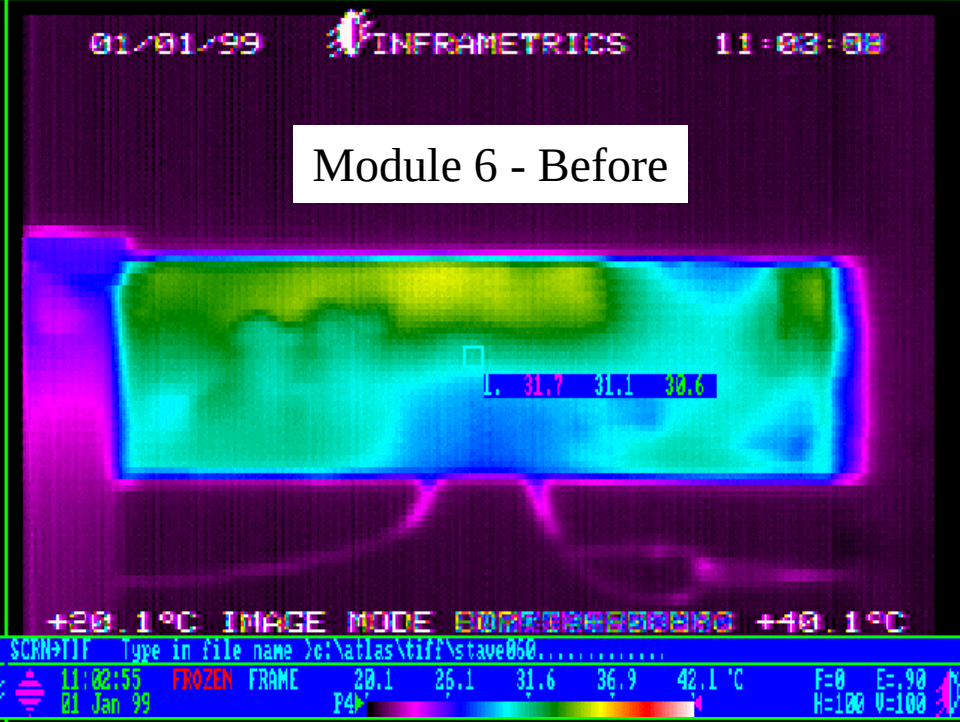

01/01/99
INFRAMETRICS
10:54:38
Module 3 - Before
+20.1°C IMAGE MODE +40.1°C

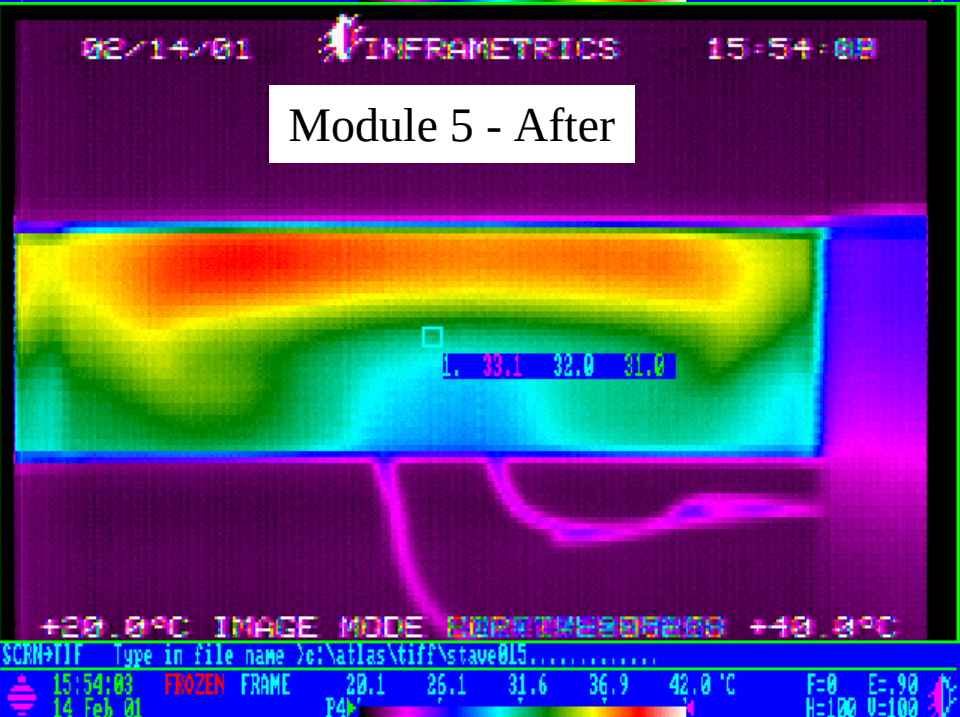

01/01/99
INFRAMETRICS
10:56:38
Module 4 - Before
+20.1°C IMAGE MODE +40.1°C

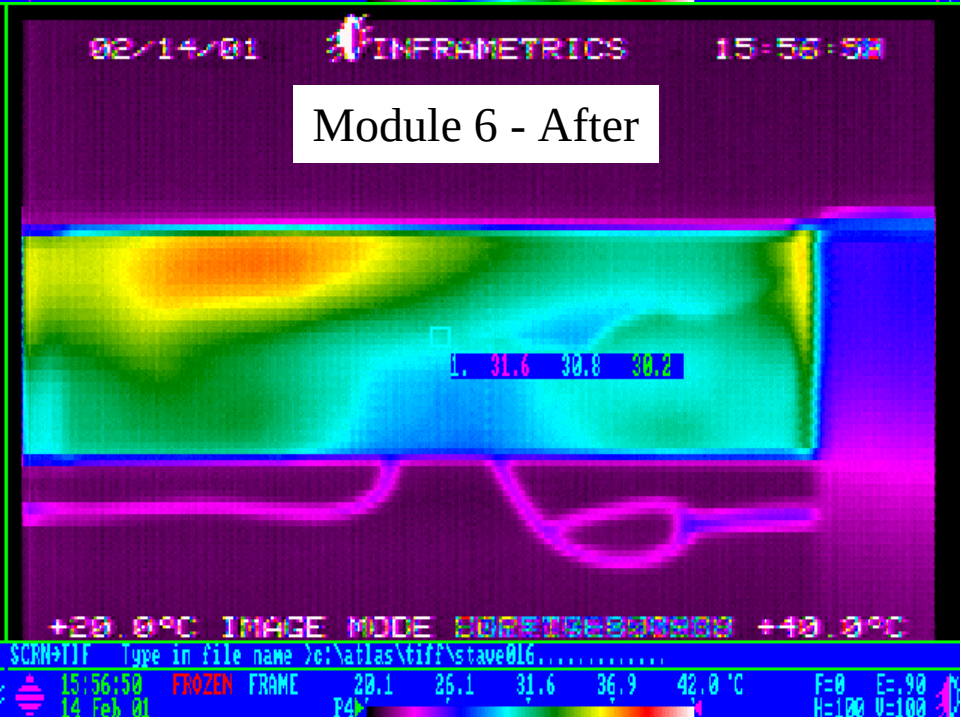

02/14/01
INFRAMETRICS
15:46:28
Module 3 - After
+20.0°C IMAGE MODE +40.0°C

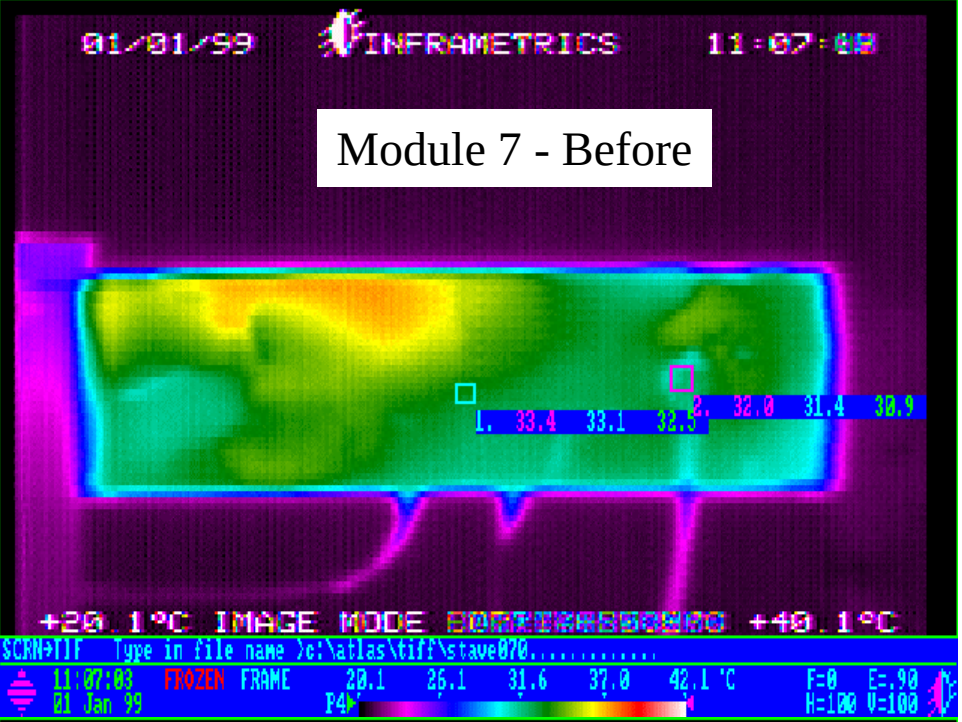

02/14/01
INFRAMETRICS
15:49:58
Module 4 - After
+20.0°C IMAGE MODE +40.0°C

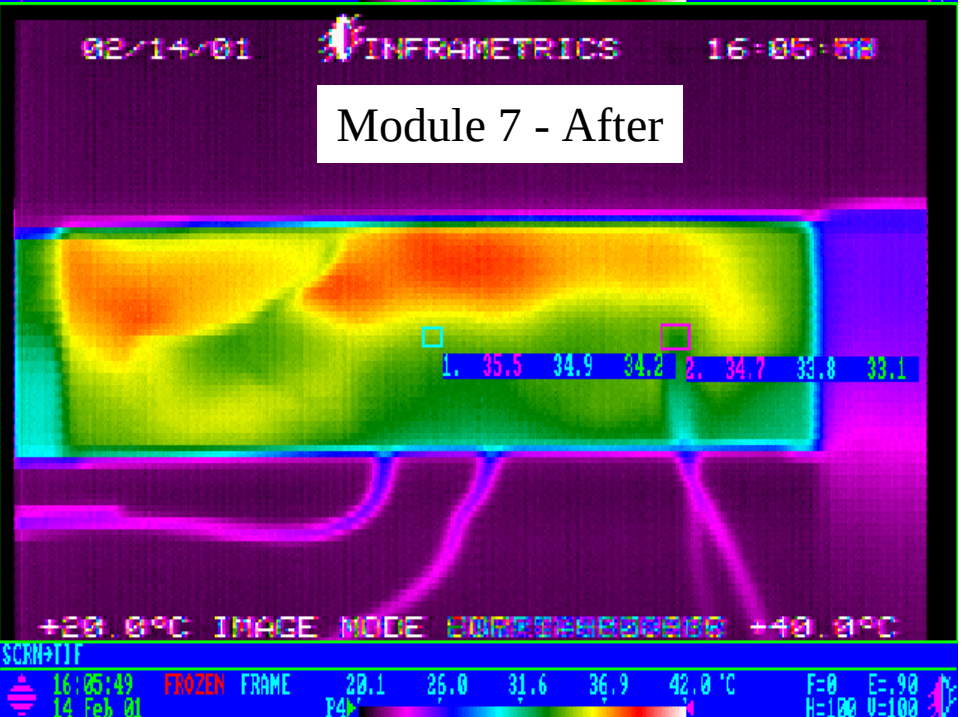

01/01/99
INFRAMETRICS
11:00:20
Module 5 - Before
+20.1°C IMAGE MODE +40.1°C


01/01/99
INFRAMETRICS
11:03:02
Module 6 - Before
+20.1°C IMAGE MODE +40.1°C


02/14/01
INFRAMETRICS
15:54:03
Module 5 - After
+20.0°C IMAGE MODE +40.0°C


02/14/01
INFRAMETRICS
15:56:50
Module 6 - After
+20.0°C IMAGE MODE +40.0°C





- Conclusions after first irradiation
- Max temperature rise is $<4^0$C comparing hottest points
- Size of warmer regions increases after irradiation
- There is already large spread in temperature on module before irradiation..

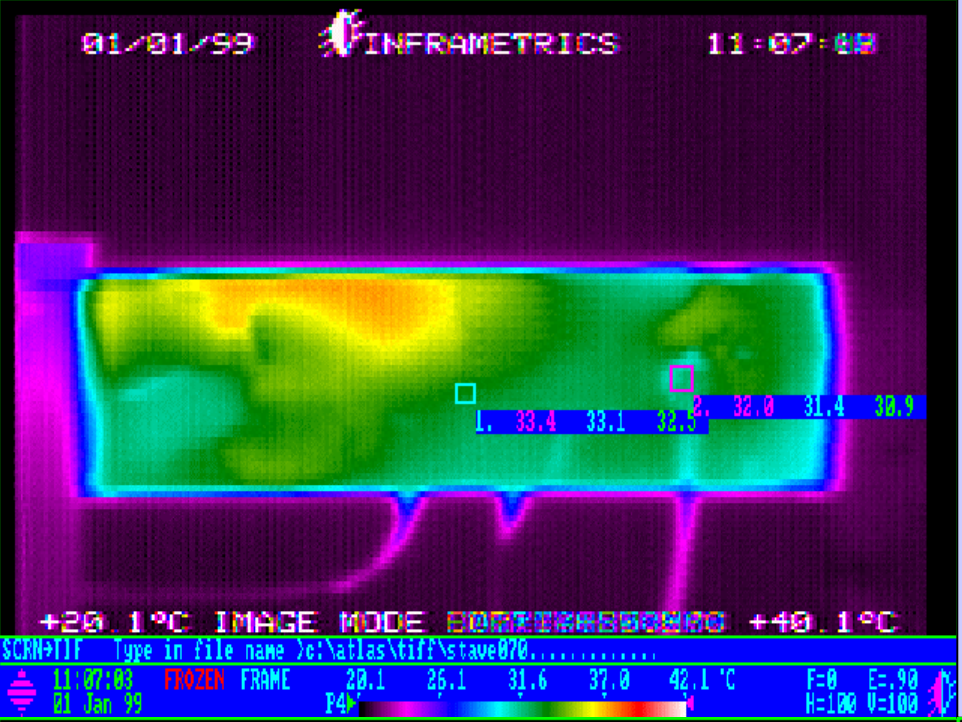
Thermography After 2nd Irradiation

- Modules 7-13 only
- Operating conditions
  - Water temperature 20.7C
  - Water flow 1.02 l/min
  - Power per module about 7.0±0.1W
  - Other modules are masked off except one viewed.
- In the next pages, three thermograms are shown - original(before any irradiation), after 1st irradiation, after 2nd irradiation.
- Order is shown on next page

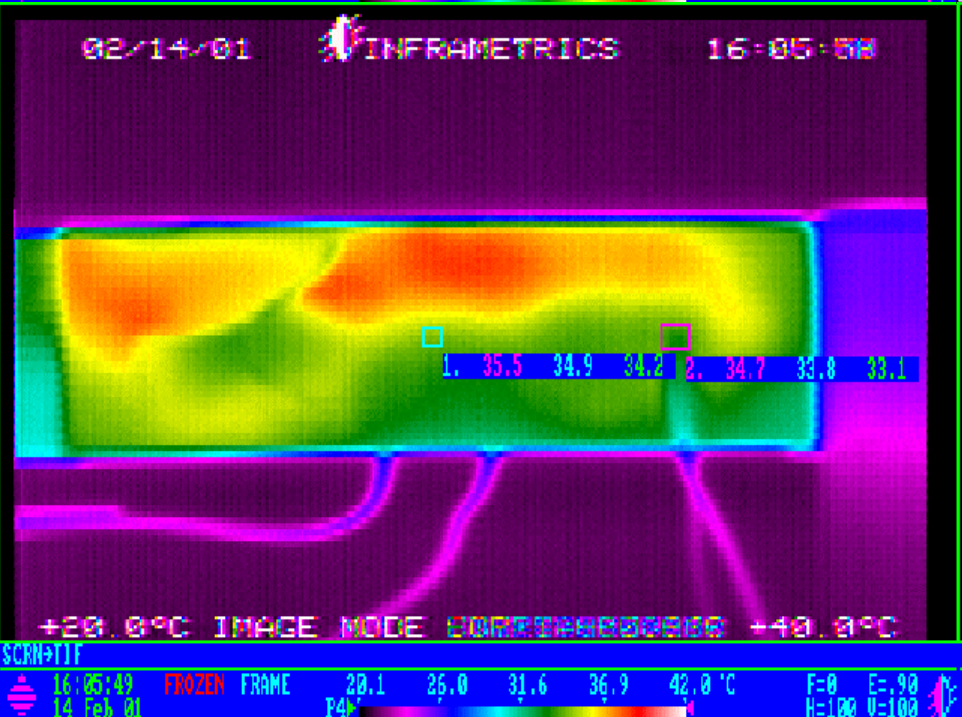
Before Irradiation

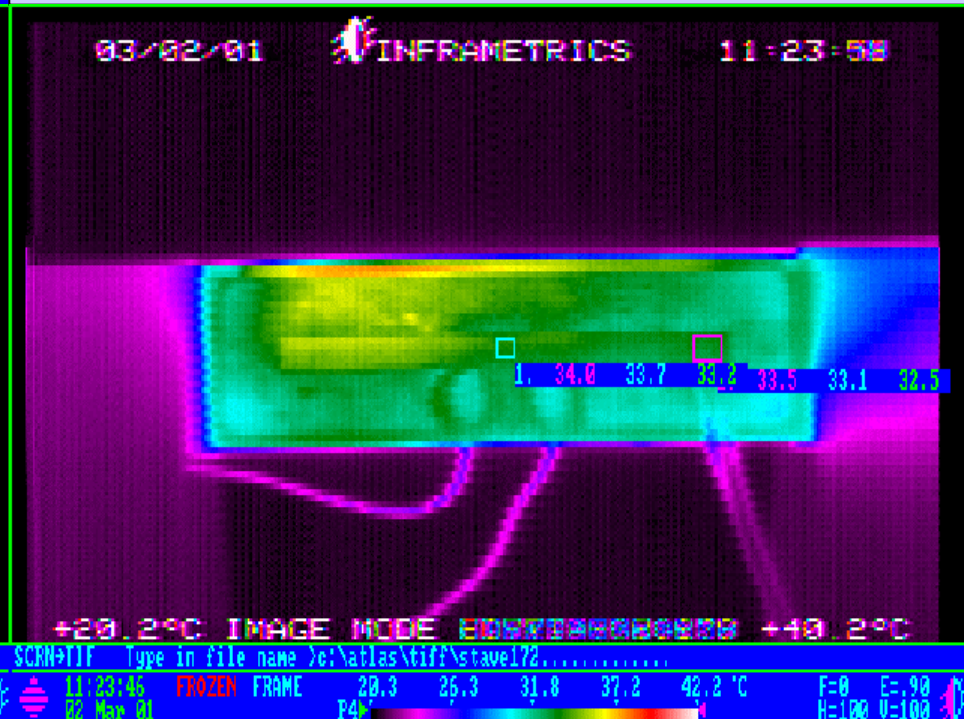
After 1st irradiation

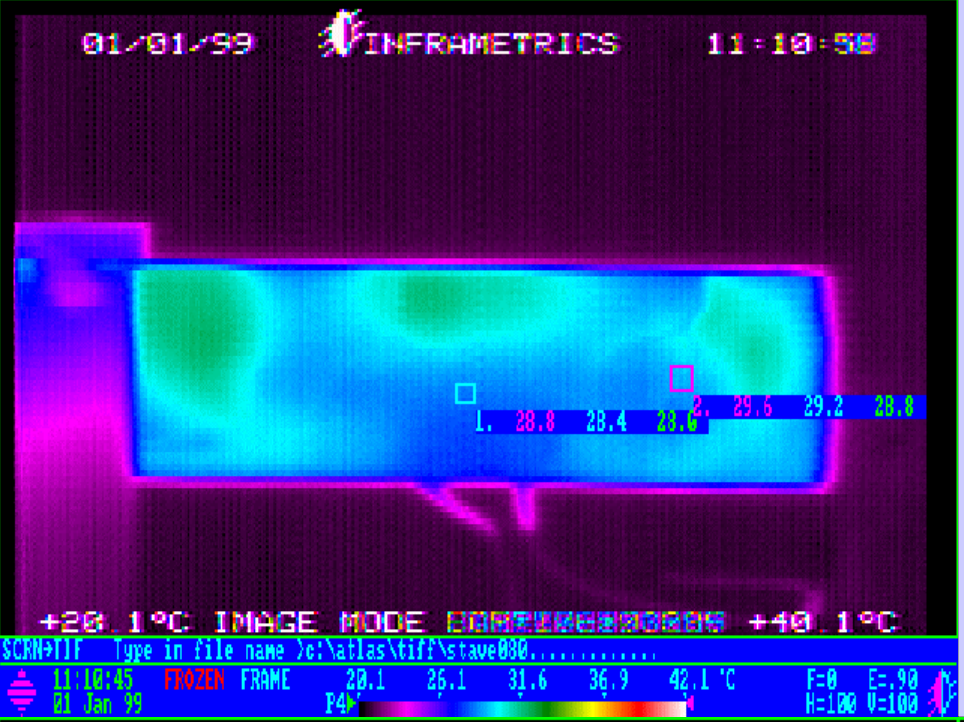
After 2nd irradiation


01/01/99
INFRAMETRICS
11:07:09
1. 33.4 33.1 32.5
2. 32.0 31.4 30.9
+20.1°C IMAGE MODE +40.1°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave070.....
11:07:03 FROZEN FRAME 20.1 26.1 31.6 37.0 42.1 °C F=0 E=.90
01 Jan 99 P4 H=100 V=100

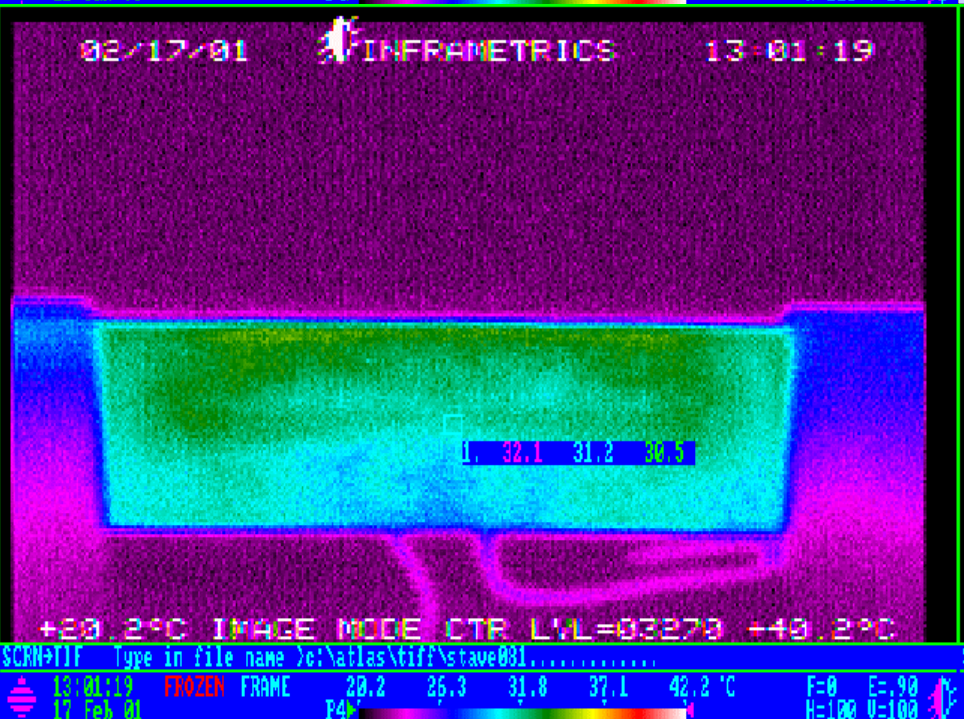
Module 7

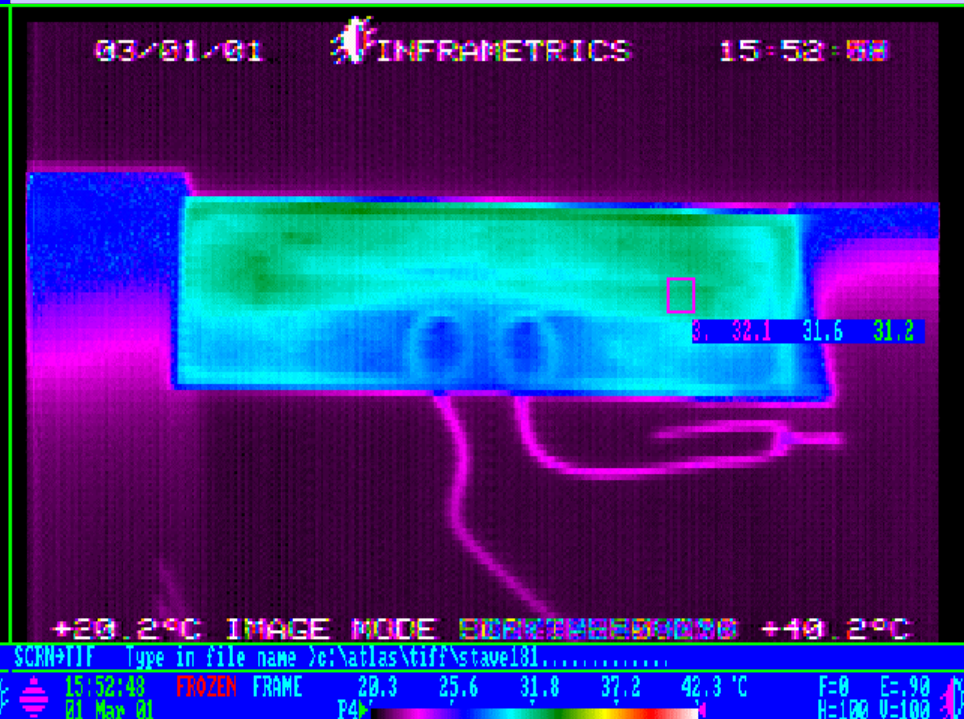

02/14/01
INFRAMETRICS
16:05:58
1. 35.5 34.9 34.2
2. 34.7 33.8 33.1
+20.0°C IMAGE MODE +40.0°C
SCRN→TIF
16:05:49 FROZEN FRAME 20.1 26.0 31.6 36.9 42.0 °C F=0 E=.90
14 Feb 01 P4 H=100 V=100

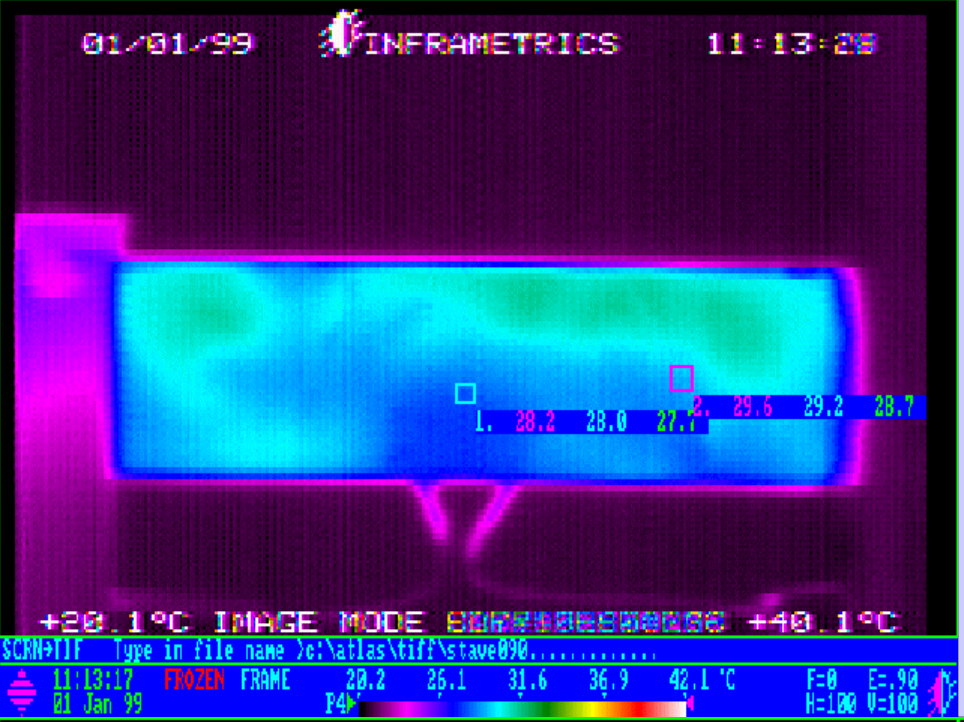

03/02/01
INFRAMETRICS
11:23:58
1. 34.0 33.7 33.2 33.5 33.1 32.5
+20.2°C IMAGE MODE +40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave172.....
11:23:46 FROZEN FRAME 20.3 25.3 31.8 37.2 42.2 °C F=0 E=.90
02 May 01 P4 H=100 V=100


01/01/99
INFRAMETRICS
11:10:58
+20.1°C IMAGE MODE
+40.1°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave080
11:10:45 FROZEN FRAME 20.1 26.1 31.6 36.9 42.1 °C
01 Jan 99
F=0 E=.90
H=100 V=100

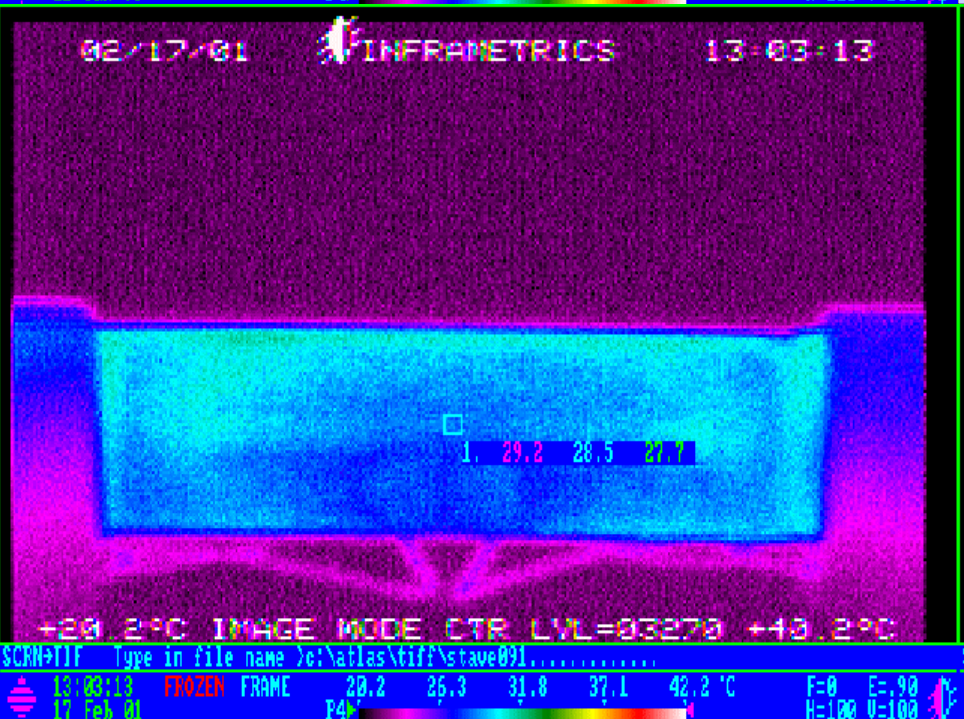
Module 8

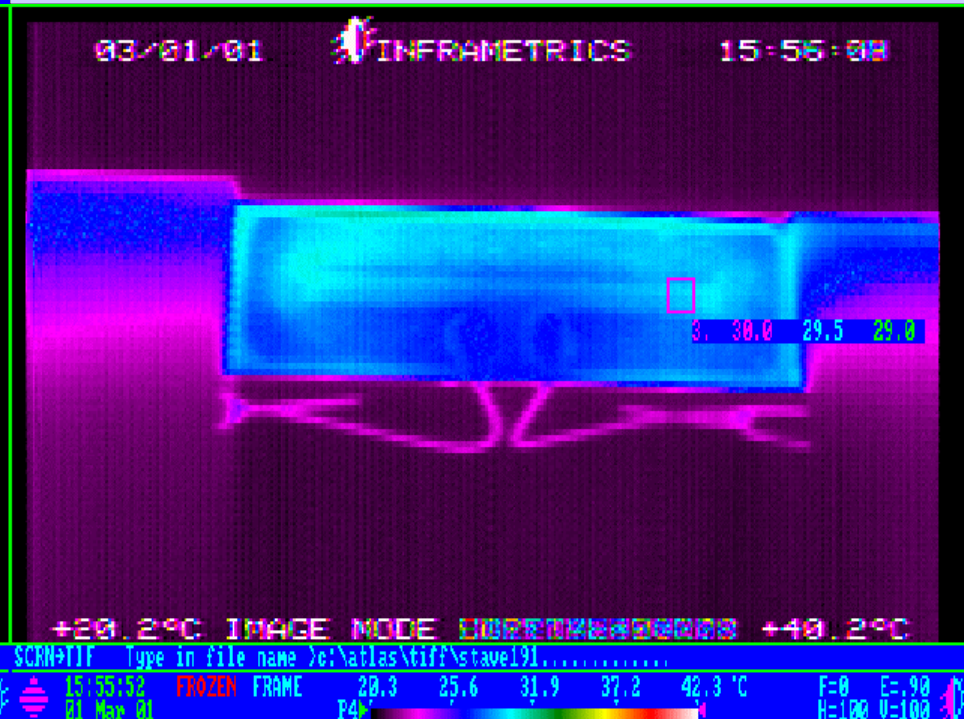

02/17/01
INFRAMETRICS
13:01:19
+20.2°C IMAGE MODE CTR L'VL=03279
+40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave081
13:01:19 FROZEN FRAME 20.2 26.3 31.8 37.1 42.2 °C
17 Feb 01
F=0 E=.90
H=100 V=100

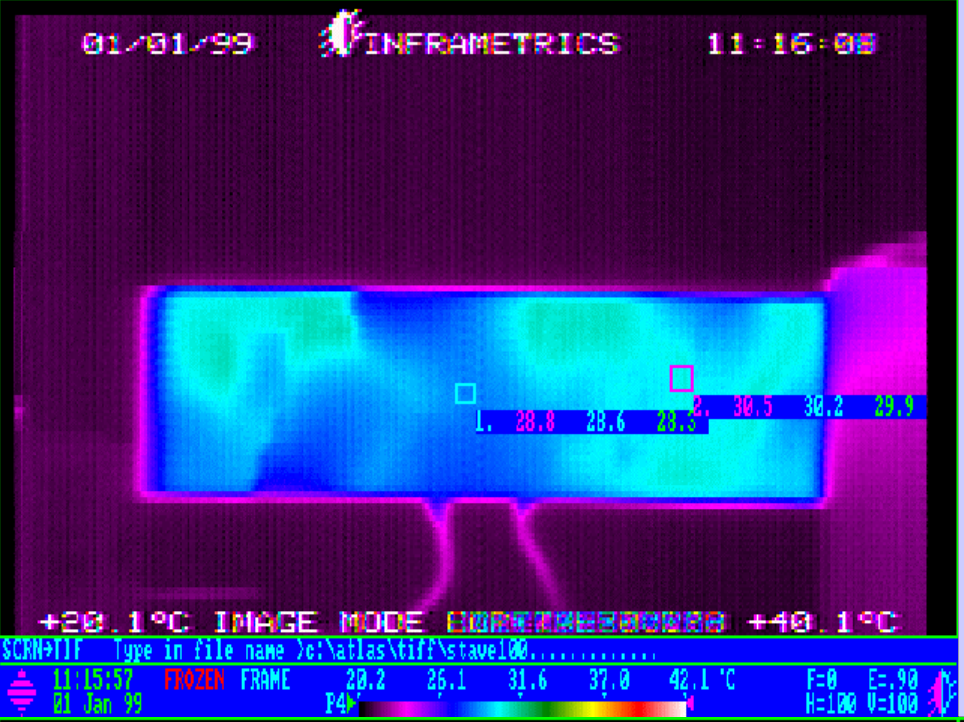

03/01/01
INFRAMETRICS
15:52:58
+20.2°C IMAGE MODE
+40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave181
15:52:48 FROZEN FRAME 20.3 25.6 31.8 37.2 42.3 °C
01 May 01
F=0 E=.90
H=100 V=100


01/01/99
INFRAMETRICS
11:13:28
1. 28.2 28.0 27.7
2. 29.6 29.2 28.7
+20.1°C IMAGE MODE +40.1°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave090.....
11:13:17 FROZEN FRAME 20.2 26.1 31.6 36.9 42.1 °C F=0 E=.90
01 Jan 99 P4 H=100 V=100

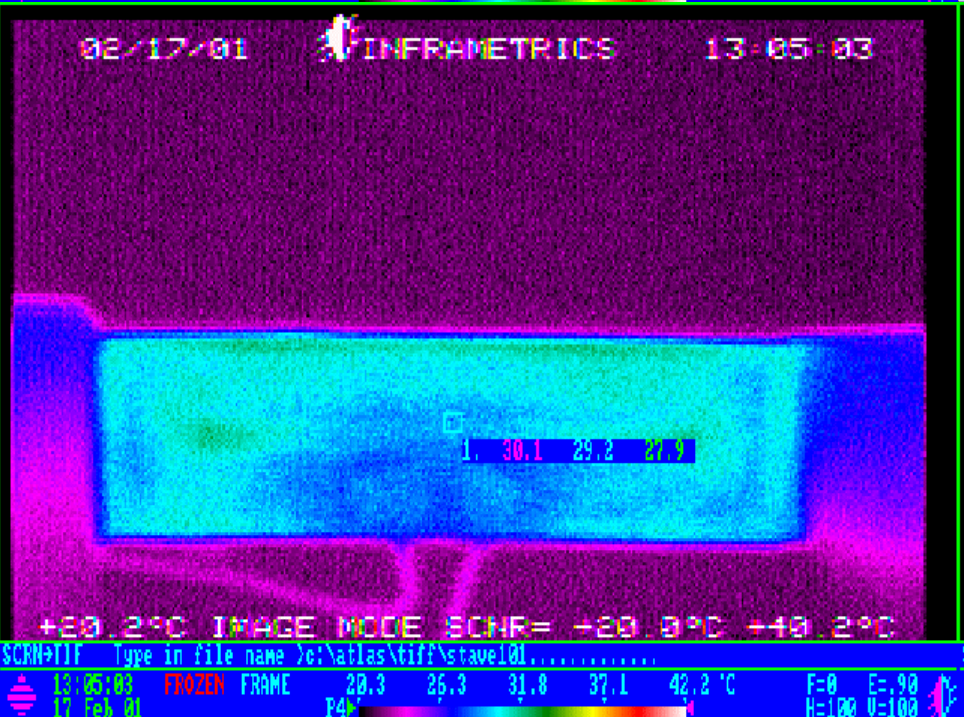
Module 9

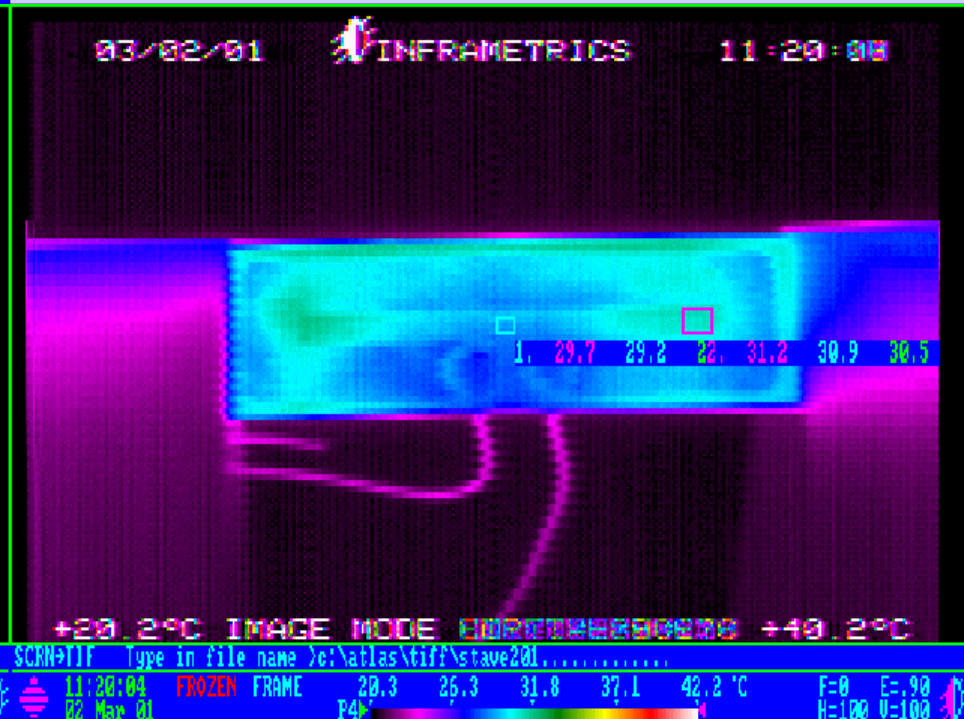

02/17/01
INFRAMETRICS
13:03:13
1. 29.2 28.5 27.7
+20.2°C IMAGE MODE CTR LVL=03270 +40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave091.....
13:03:13 FROZEN FRAME 20.2 26.3 31.8 37.1 42.2 °C F=0 E=.90
17 Feb 01 P4 H=100 V=100

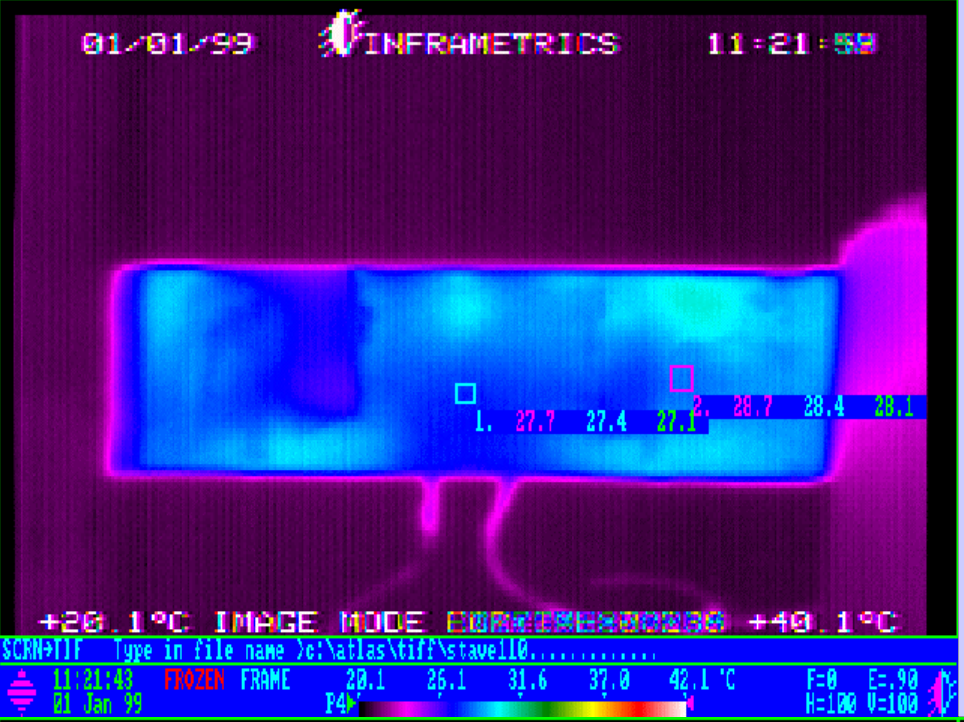

03/01/01
INFRAMETRICS
15:55:00
3. 30.0 29.5 29.0
+20.2°C IMAGE MODE +40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave191.....
15:55:52 FROZEN FRAME 20.3 25.6 31.9 37.2 42.3 °C F=0 E=.90
01 May 01 P4 H=100 V=100


01/01/99
INFRAMETRICS
11:16:08
1. 28.8 28.6 28.5
2. 30.5 30.2 29.9
+20.1°C IMAGE MODE +40.1°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave100
11:15:57 FROZEN FRAME 20.2 26.1 31.6 37.0 42.1 °C F=0 E=.90
01 Jan 99 P4 H=100 V=100

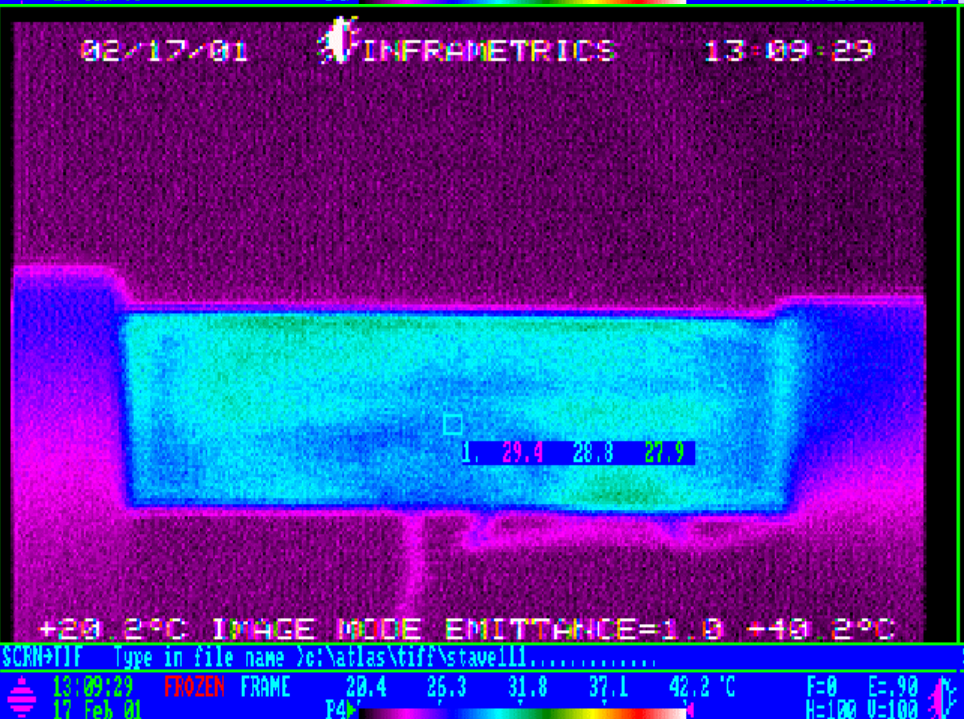
Module 10

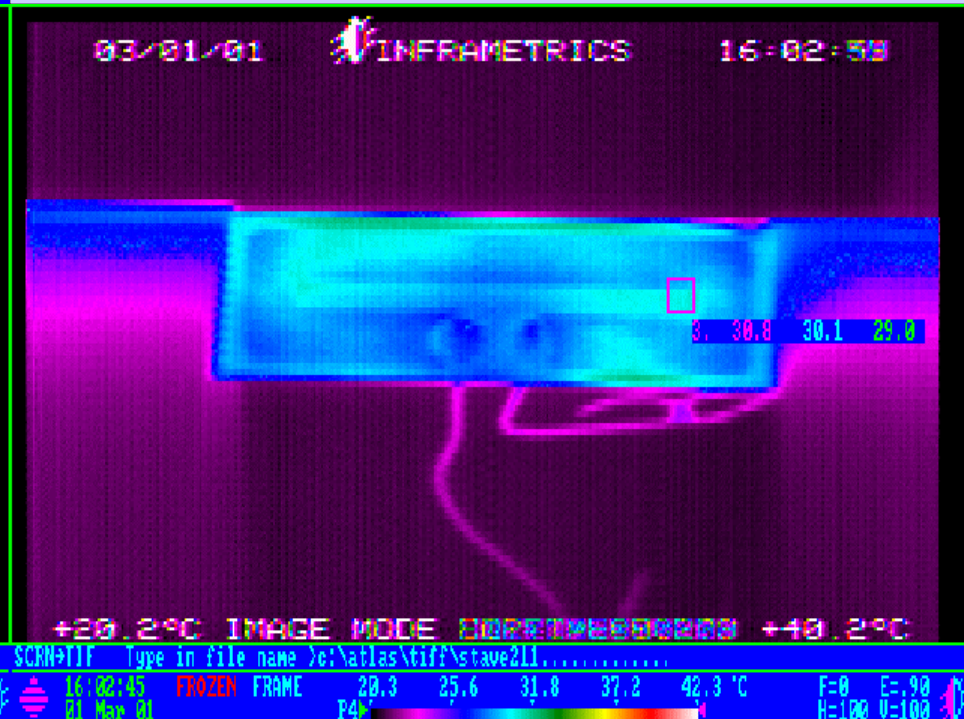

02/17/01
INFRAMETRICS
13:05:03
1. 30.1 29.2 27.9
+20.2°C IMAGE MODE SCNR= +20.0°C +40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave101
13:05:03 FROZEN FRAME 20.3 26.3 31.8 37.1 42.2 °C F=0 E=.90
17 Feb 01 P4 H=100 V=100

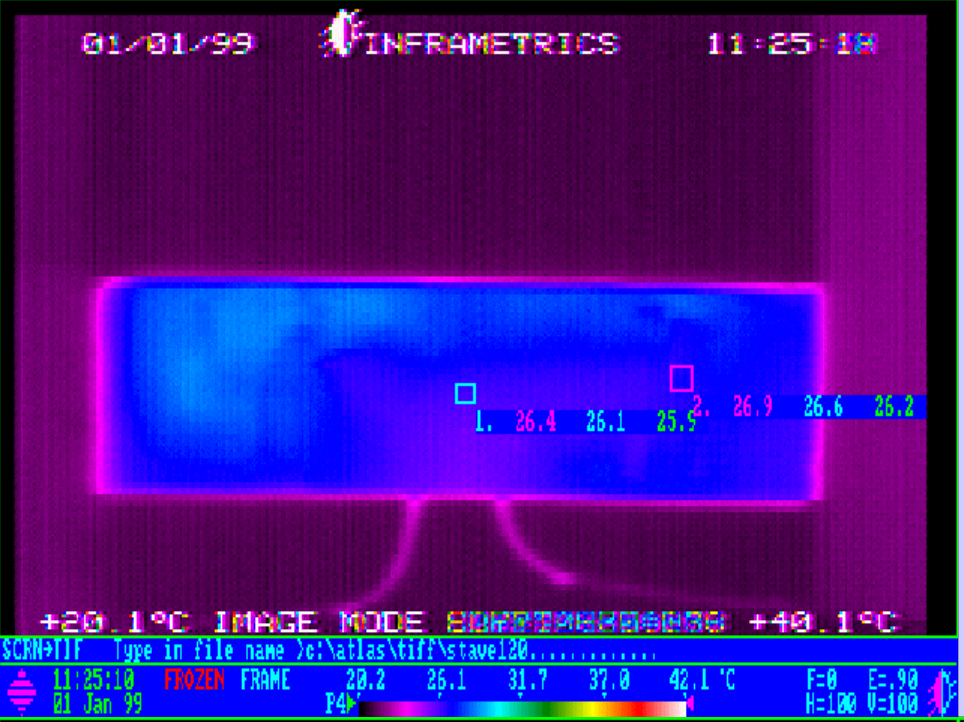

03/02/01
INFRAMETRICS
11:20:04
1. 29.7 29.2 2. 31.2 30.9 30.5
+20.2°C IMAGE MODE +40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave201
11:20:04 FROZEN FRAME 20.3 26.3 31.8 37.1 42.2 °C F=0 E=.90
02 May 01 P4 H=100 V=100


01/01/99
INFRAMETRICS
11:21:59
1. 27.7 27.4 27.1
2. 28.7 28.4 28.1
+20.1°C IMAGE MODE +40.1°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave110
11:21:43 FROZEN FRAME 20.1 26.1 31.6 37.0 42.1 °C
01 Jan 99 P4
F=0 E=.90
H=100 V=100

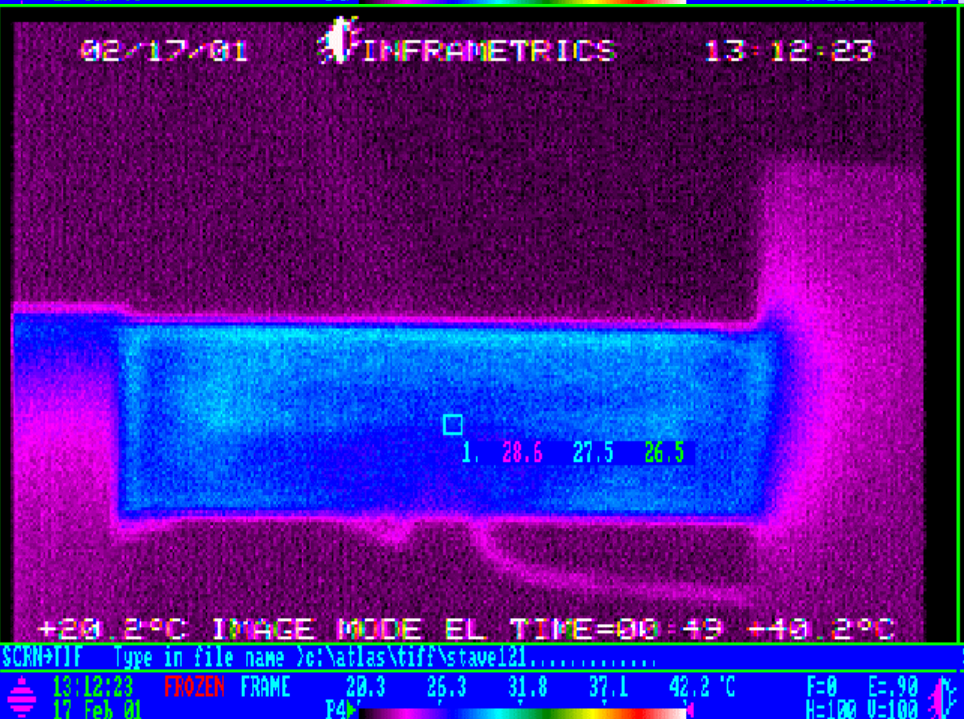
Module 11

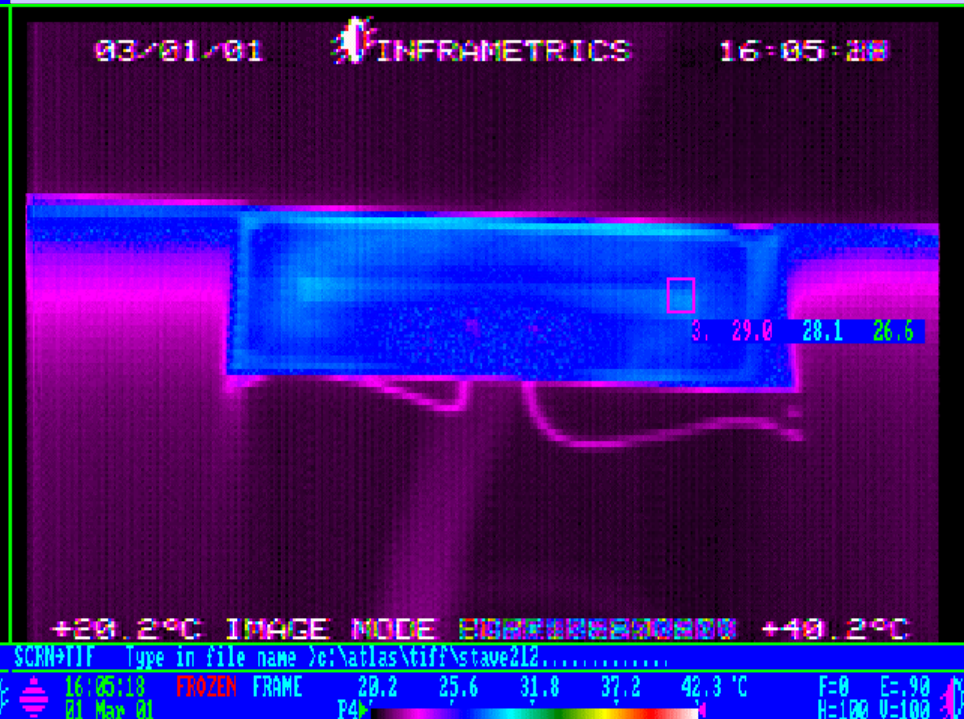

02/17/01
INFRAMETRICS
13:09:23
1. 29.4 28.8 27.9
+20.2°C IMAGE MODE EMITTANCE=1.0 +40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave111
13:09:29 FROZEN FRAME 20.4 26.3 31.8 37.1 42.2 °C
17 Feb 01 P4
F=0 E=.90
H=100 V=100

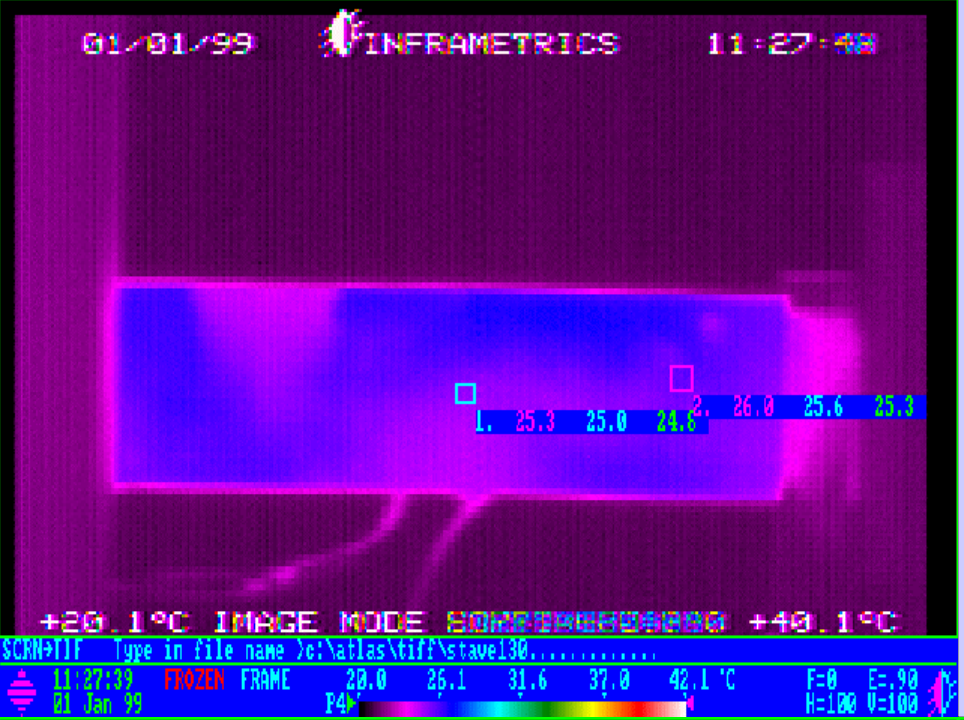

03/01/01
INFRAMETRICS
16:02:59
3. 30.8 30.1 29.6
+20.2°C IMAGE MODE +40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave211
16:02:45 FROZEN FRAME 20.3 25.6 31.8 37.2 42.3 °C
01 May 01 P4
F=0 E=.90
H=100 V=100


01/01/99
INFRAMETRICS
11:25:18
1. 26.4 26.1 25.5
2. 26.9 26.6 26.2
+20.1°C IMAGE MODE
+40.1°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave120
11:25:10 FROZEN FRAME 20.2 26.1 31.7 37.0 42.1 °C F=0 E=.90
01 Jan 99 P4 H=100 V=100

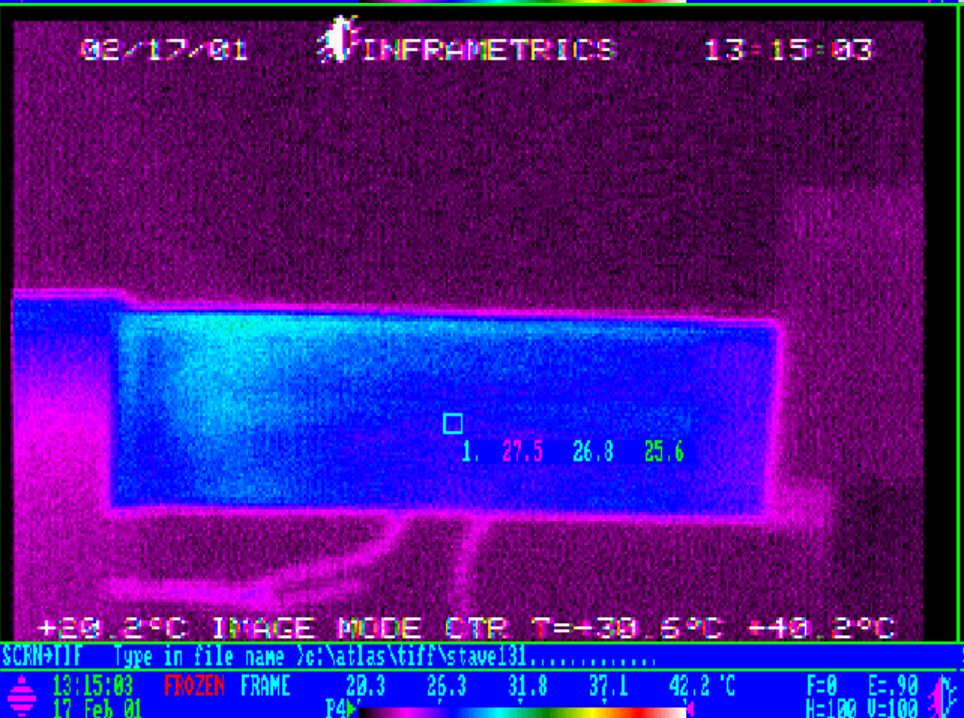
Module 12

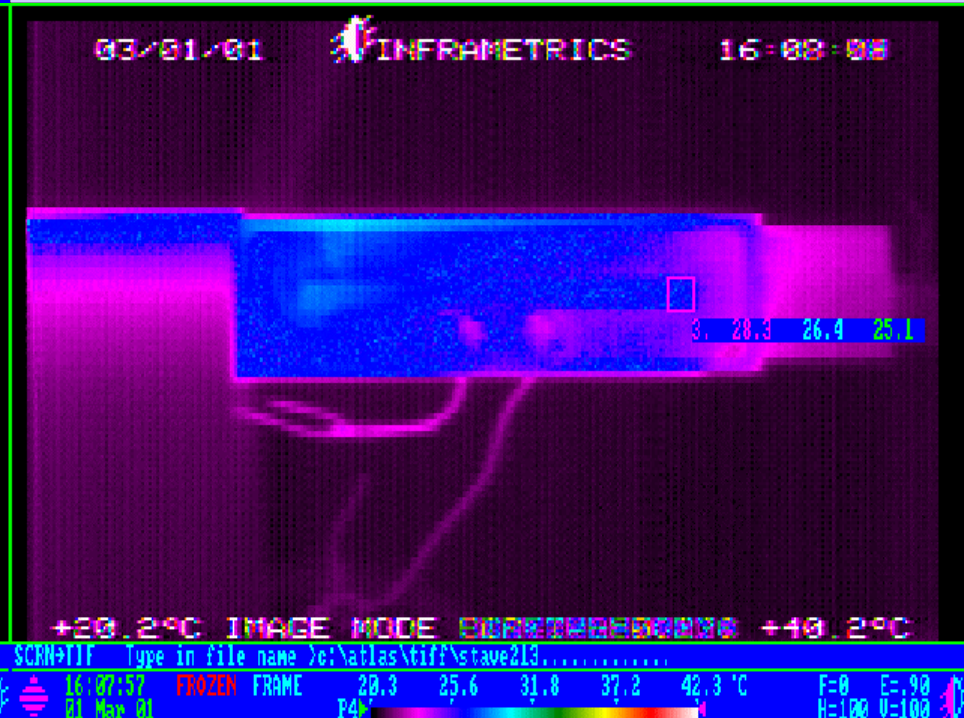

02/17/01
INFRAMETRICS
13:12:23
1. 28.6 27.5 26.5
+20.2°C IMAGE MODE EL TIME=00:49
+40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave121
13:12:23 FROZEN FRAME 20.3 26.3 31.8 37.1 42.2 °C F=0 E=.90
17 Feb 01 P4 H=100 V=100


03/01/01
INFRAMETRICS
3. 29.0 28.1 26.6
+20.2°C IMAGE MODE
+40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave212
16:05:18 FROZEN FRAME 20.2 25.6 31.8 37.2 42.3 °C F=0 E=.90
01 May 01 P4 H=100 V=100


01/01/99
INFRAMETRICS
11:27:40
1. 25.3 25.0 24.8
2. 26.0 25.6 25.3
+20.1°C IMAGE MODE +40.1°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave130
11:27:39 FROZEN FRAME 20.0 26.1 31.6 37.0 42.1 °C F=0 E=.90
01 Jan 99 P4 H=100 V=100

Module 13


02/17/01
INFRAMETRICS
13:15:03
1. 27.5 26.8 25.6
+20.2°C IMAGE MODE CTR T=+30.5°C +40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave131
13:15:03 FROZEN FRAME 20.3 26.3 31.8 37.1 42.2 °C F=0 E=.90
17 Feb 01 P4 H=100 V=100


03/01/01
INFRAMETRICS
16:08:08
3. 28.3 26.4 25.1
+20.2°C IMAGE MODE +40.2°C
SCRN→TIF Type in file name)c:\atlas\tiff\stave213
16:07:57 FROZEN FRAME 20.3 25.6 31.8 37.2 42.3 °C F=0 E=.90
01 May 01 P4 H=100 V=100