

# Vacuum Equipment Prototype Results

December 96

LIGO-Gxxxxxxx

L160-G-960243-00-V

# Prototype tests: Background

- Proposed by PSI - Not originally a LIGO requirement.
- PSI wanted to control their risk.
- PSI wanted to link prototype results to acceptance testing.

# Prototype tests: Scope

- Confirm mechanical constructability of a typical component - BSC.
- Confirm outgassing performance after proposed cleaning, bake, and vent cycles.
- Confirm vibration performance of 80K pump.

# Results: Mechanical

- Joint fab between RANOR and PSI with PSI welding.
- Dimensional inspection revealed minor tolerance problems - but within LIGO specs.
- One leak found at final assembly and leak test - Conflat to nipple weld - now procured as an assembly from Varian.

# Results: Mechanical

- deflection - measured at one point - consistent with PSI finite element analysis.
- Handling problems with doors - four lifting points instead of one.

# Results: Bakeout

- 51 heating zones on BSC.
- Temperature range from 127 to 152 C.
- Poor fit in some places, shedding of fibers -  
As a result PSI rebid the blanket contract.
- Bakeout controller worked well - minor  
complaints about blanket connectors - will  
be changed.

# Results: Vacuum

- Post bake -  $7 \times 10^{-9}$  torr with 500 l/s ion pump.
- Backfilled and soaked with “dry nitrogen” for 24 hours - then begin 100 hour pumpdown.
- 100 hour result -  $5 \times 10^{-8}$  torr - attributable to bad vent gas AND nitrogen adsorption/absorption by viton

# Results: Vacuum - Isolatable Volume (100 hours)

- LIGO Goal -  $1.2 \times 10^{-8}$  torr
- Predicted -  $1.8 \times 10^{-8}$  torr after 24 hour N<sub>2</sub> soak.
- Significant component is N<sub>2</sub> which is 10 times goal. Other partial pressures ok.



# Results: Vacuum - Isolatable Volume (100 hours)

Possible solutions for nitrogen problem:

- for initial IF - do nothing.
- Add distributed pumps along beam tube - getters, ion, cryo.
- Upgrade to metal seals.
- Subcool 80K pumps.

# Prototype tests: 80K pump tests

Vibration tests on cold 80K pump:

- Measurements over a range of boiloff.
- Little correlation between noise and flow.
- Warm measurements same as background.
- Background measurements taken on different day.

**TABLE 3.4-1**  
**ISOLATABLE SECTION ULTIMATE PRESSURES @ 100 HRS, PREDICTED**  
**VERTEX + BEAM MANIFOLD**

|                         | LIGO           | Predicted      | Predicted      |
|-------------------------|----------------|----------------|----------------|
|                         | Pressure       | Pressure       | Pressure       |
|                         | Goals          | 24 hr exposure | 1 hr exposure  |
| Species                 | Torr           | Torr           | Torr           |
| H2                      | 5.0E-09        | 4.0E-09        | 4.0E-09        |
| H2O                     | 5.0E-09        | 2.4E-09        | 2.4E-09        |
| N2                      | 5.0E-10        | 7.2E-09        | 7.0E-10        |
| CO                      | 5.0E-10        | 3.0E-09        | 3.0E-09        |
| CO2                     | 2.0E-10        | 3.0E-10        | 3.0E-10        |
| CH4                     | 2.0E-10        | 9.0E-10        | 9.0E-10        |
| OTHER                   | 5.0E-10        | 6.6E-10        | 6.6E-10        |
| TOTAL EXCLUDING H2O, H2 | 1.9E-09        | 1.2E-08        | 5.5E-09        |
| <b>TOTAL</b>            | <b>1.2E-08</b> | <b>1.8E-08</b> | <b>1.2E-08</b> |

# Vacuum Equipment Prototype Results

NOT PRESENTED DUE TO  
LACK OF TIME

J. Worden

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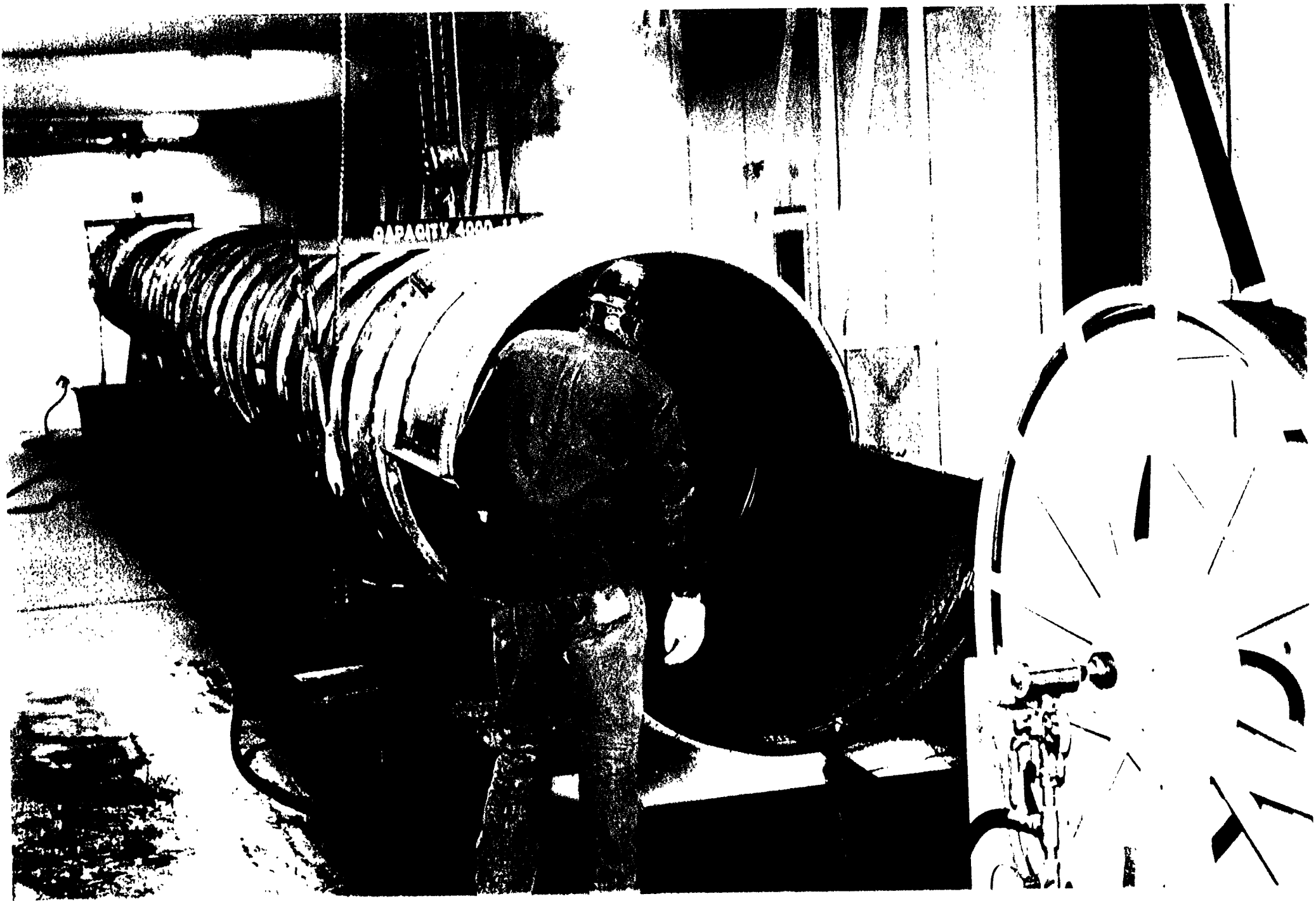
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# Beam Tube Installation

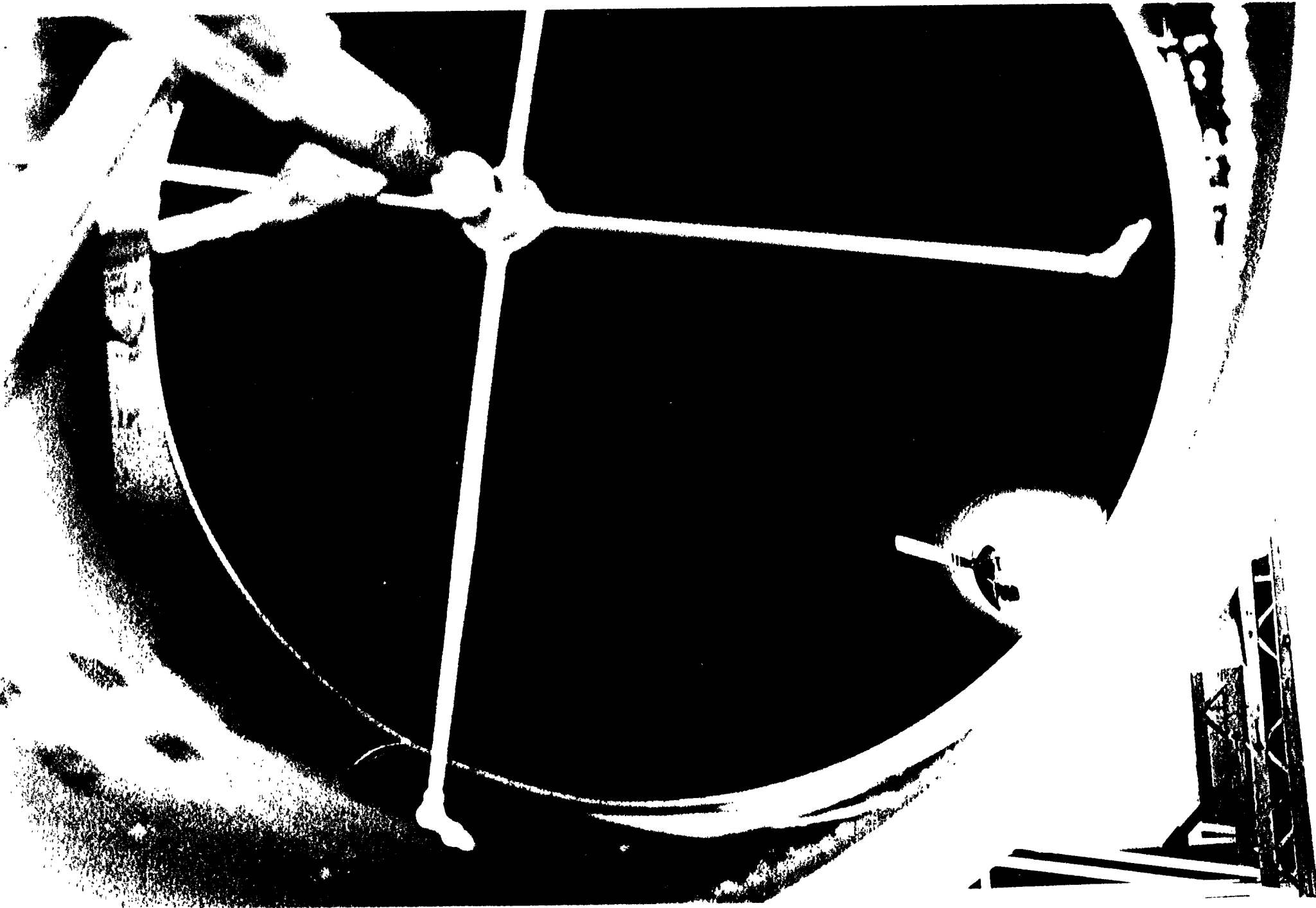
- Cleaning tube sections
- Shipping tube sections
- Fitup & welding girth seams
- Leak checking girth seams
- Baffle installation
- Support installation
- Alignment

*Not presented  
due to lack of  
time*

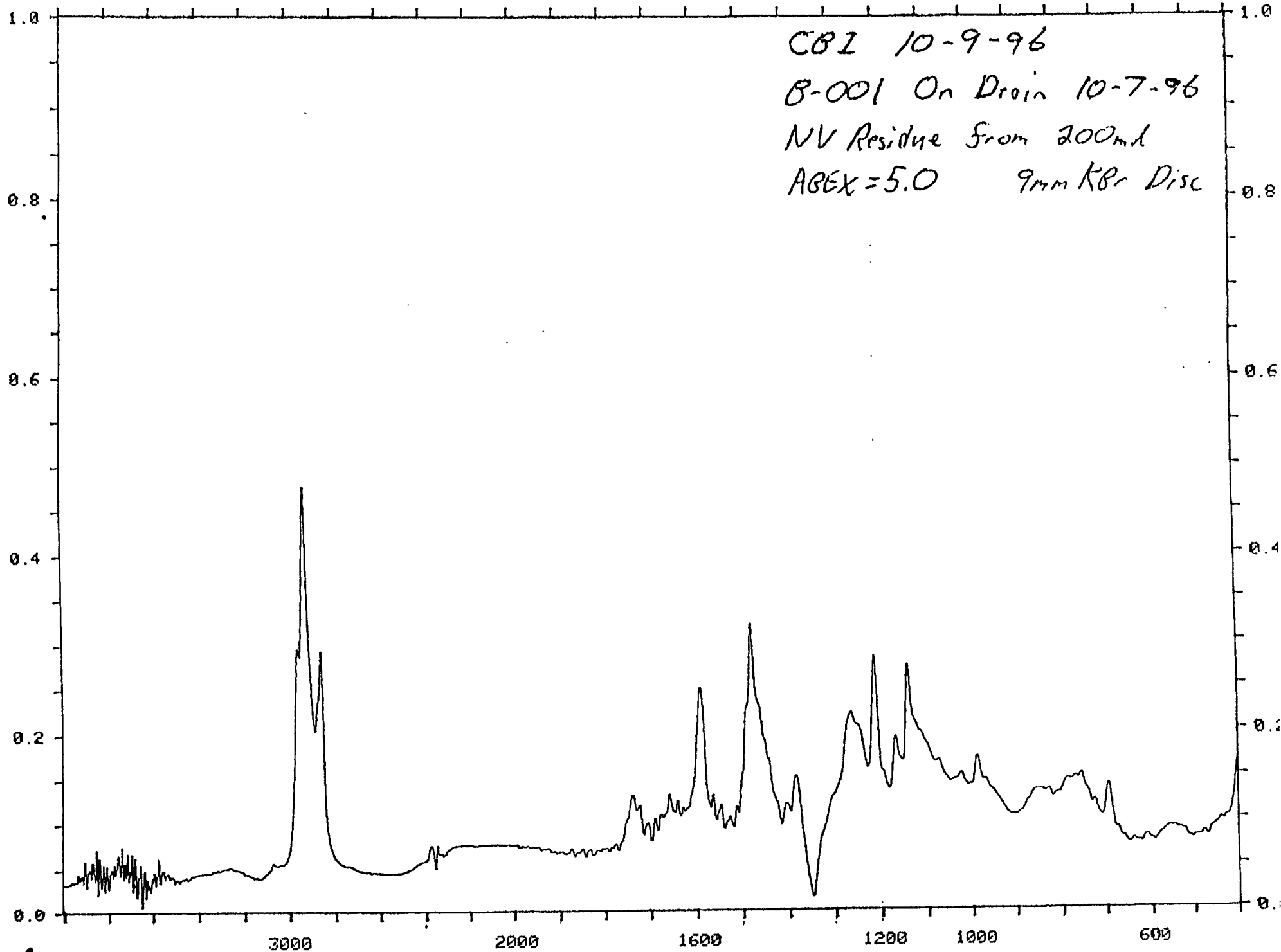




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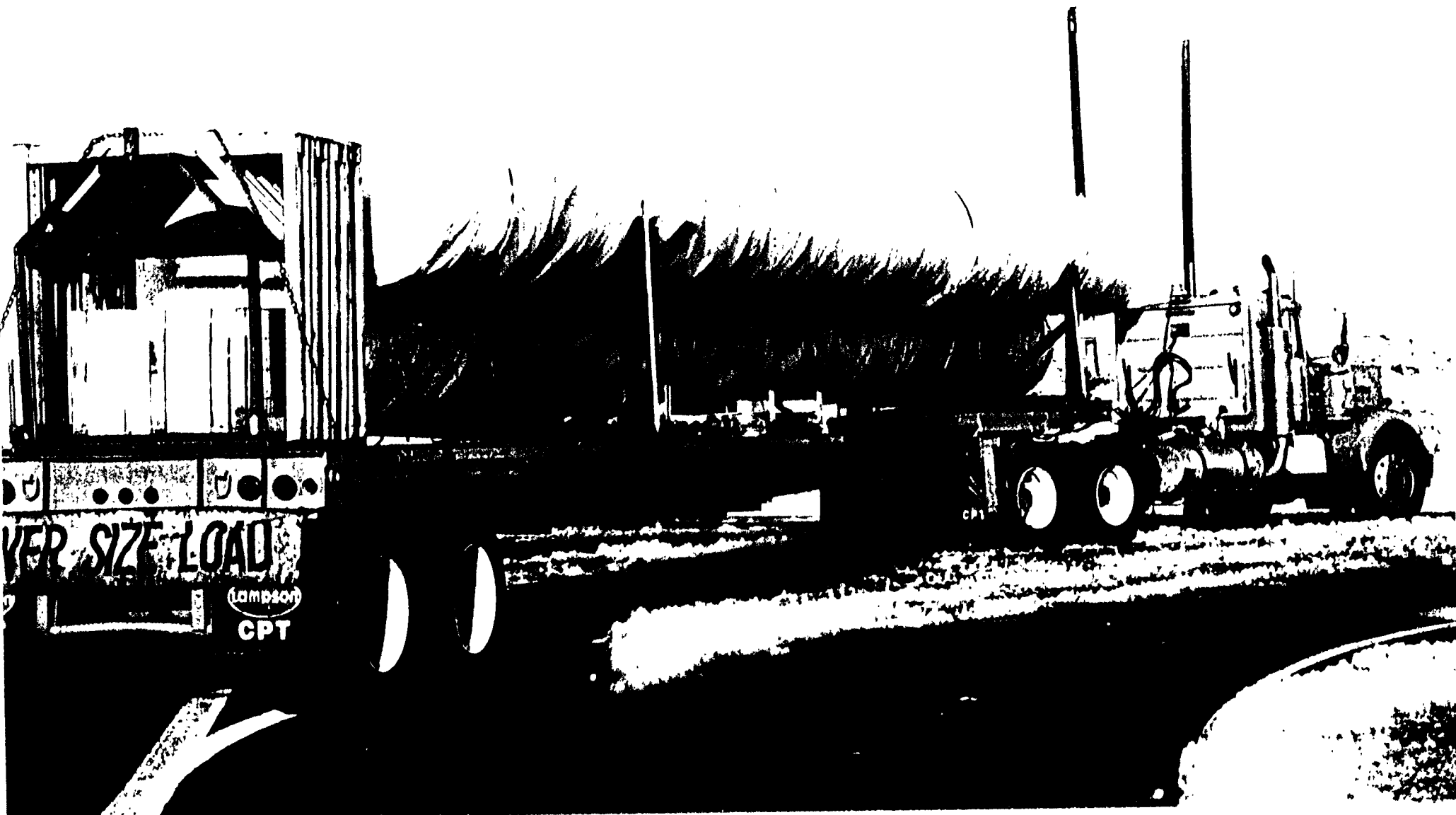
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# FTIR Results

| <b>Tube No.</b> | <b>Z1480</b><br>x1E-4 | <b>Z2950</b><br>x1E-4 | <b>Comments</b>                                      |
|-----------------|-----------------------|-----------------------|--|
| B001            | 0.32                  | 0.47                  | Recleaned, after process/equipment mods.             |
| B002            | 0.00                  | 0.00                  | Recleaned, after process/equipment mods.             |
| B003            | 0.06                  | 0.37                  | Recleaned, after process/equipment mods.             |
| G001            | 0.00                  | 0.21                  |  |
| I001            | 0.03                  | 0.27                  |  |
| G002            | 0.19                  | 0.83                  |  |
| H001            | 0.18                  | 0.58                  |  |
| S001A           | 15.7                  | 4.01                  | After second wash (first wash drying looked suspect) |
| S002B           | 0.21                  | 0.85                  | After second wash (first wash drying looked suspect) |
| S001F           | 1.25                  | 1.00                  | After alcohol wipedown and sixth wash                |
| A003            | 0.15                  | 0.65                  |  |
| S001G           | 1.27                  | 0.56                  | After second alcohol wipedown and seventh wash       |
| A009            | 0.03                  | 0.31                  |  |
| S001J           | 0.62                  | 1.47                  | After tenth wash + two additional steam rinses       |
| B045            | 0.37                  | 1.47                  |  |
| C001            | 0.25                  | 0.65                  |  |
| C002            | 0.34                  | 1.23                  |  |
| A047            | 0.19                  | 0.62                  |  |





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NO SMOKING

MA BELVEDARCE

3571

003

TESTING





