MDCIII Progress and Schedule

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(BES'99 Annual Meeting)
Beijing, Jun 14-16, 1999

1 The necessity of MDCIII construction

The BES Main Drift Chamber (MDCII) was built as part of the upgrade of the BES detector. Because of the problem of injection molding, feedthroughs in MDCII could not work when working high voltage, causing unacceptable noise levels in the data and drawing large amounts of dark current. A program to temporarily repair the MDCII, splitting HV scheme, has been undertaken. At present, BES has obtained the R scan, ψ' scan and J/ψ data.

It is a big worrying that the damaged feedthroughs in MDCII will not work properly for long time. BES Collaboration is in agreement, building a new main drift chamber as quickly as possible to replace MDCII is necessary.

2 Mechanical construction of MDCIII

MDCIII is a replacement of MDCII, the chamber is also cylindrical structure , based on a four sense wire cell, ten concentric cylindrical layers, containing 48 to 128 cells counted from layer 1 to 10 for a total 804 cells, alternate layers have their wires either parallel to the cylinder axis or at a small angle to the axis to provide stereo information. The total number of sense wires is 3216 and total number of wires is 22936. (Fig .1)

Two endplates are made of 40mm aluminum and held apart by a 12.7mm thick cylindrical aluminum outer shell and by a 2mm thick carbon-fiber plastic inner cylinder, the active length is 2.2m. There are 22936 wire holes, optical survey holes, pre-stress rod holes in the endplates, total number of holes is 50960.

The accuracy of holes and the accuracy of the endplates alignment mainly limit the mechanical accuracy of the chamber, directly influence the position resolution of the chamber. An accuracy of σ_x of $200\mu m$ or better for an individual wire will be expected.

It is hardly to find huge size aluminum plate and there is technique difficult for aluminum welding, Hawaii University proposed that the construction of the MDCIII outer cylinder would be changed from whole to six parts. The six parts are pieced together with riveting, the collar and the outer cylinder are connected with 32 pins and screws, not welding as MDCI & MDCII. (Fig.2) This is an important modification. This design was discussed seriously by both IHEP and Hawaii sides, some mechanical analysis and simulated calculation have

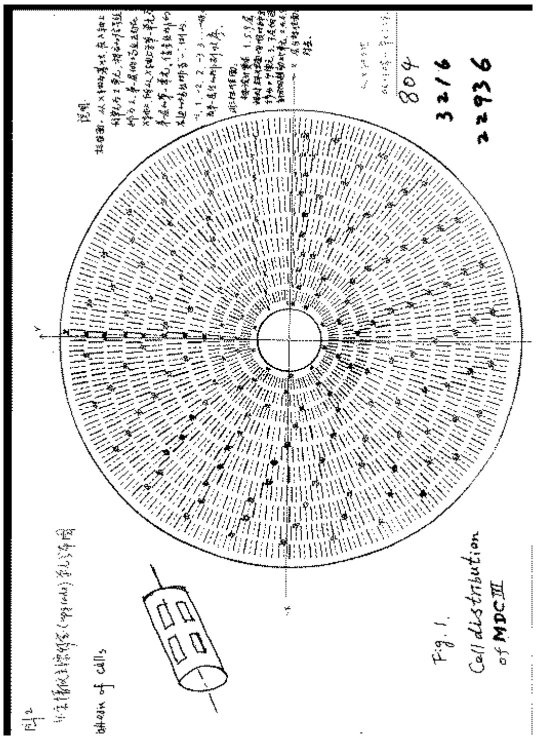

Figure 1: Cell Distribution of MDCIII

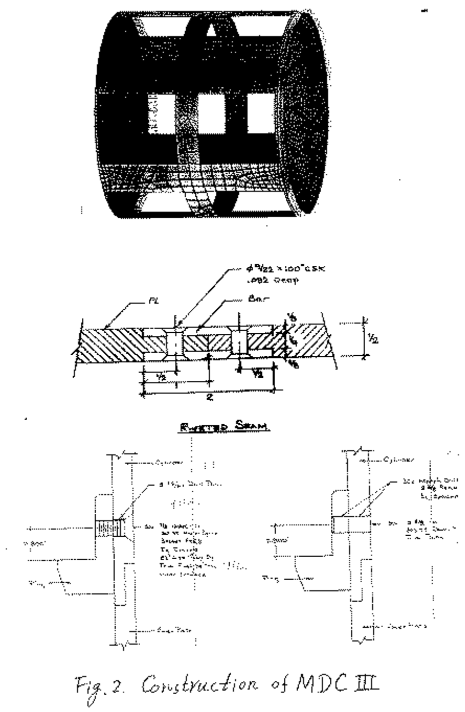

Figure 2: Construction Of MDCIII

been done in both sides. From the results this construction is stable and the endplates' deformation under wires tension (total 10.2T) is acceptable.

3 Responsibility of each part and the progress

3.1 Outer cylinder

Hawaii University

3.2 Endplates

Hawaii University
Hawaii side will give a detail report for these items.

3.3 Feedthrough

Colorado University
Detail from Dr.Rusty
Test in IHEP:

We got some samples of feedthroughs from CSU. High Voltage tests and dimensions measurement made in IHEP. (Fig.3-5)

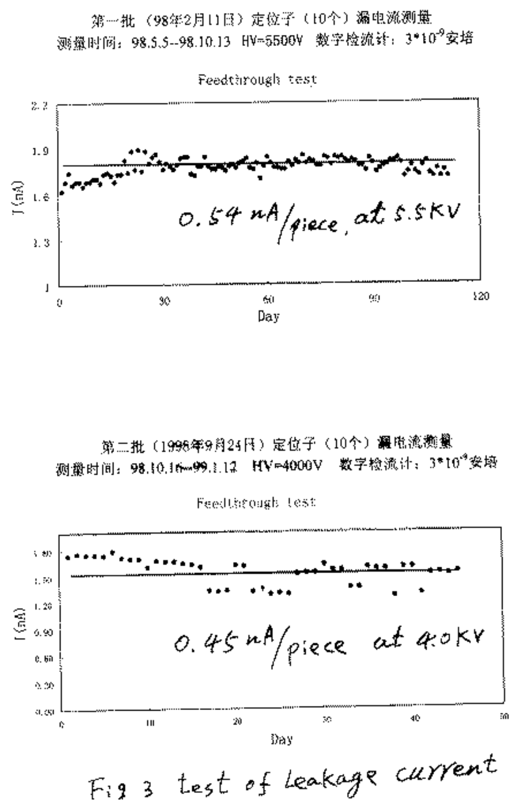

Figure 3: Test Of Leakage Current

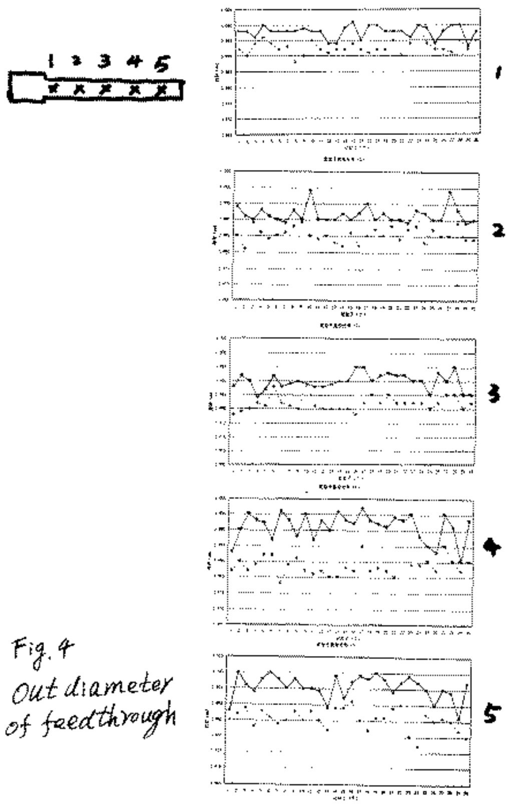

Figure 4: Out Diameter Of Feedthrough

3.4 Inner Cylinder

IHEP

The Inner cylinder is made of carbon fiber as MDCI & MDCII, thickness is 2mm, a weight of 7Kg, and the specific gravity is 1.475g/cm^3. The inner cylinder was made in the factory, which the MDCI inner cylinder made in.

Three points were tested for the inner cylinder:

a) Pressing along the axis, 500Kg per step to 5,000Kg;

Keeping the 5,000Kg press for 16 hours.

b) Leakage test

Filling nitrogen with 0.2Kg/cm^2 for 4 hours before pressing and 0.2Kg/cm^2 for 3 hours after pressing, no any observable change for both cases. (Fig. 6-12)

c) Dark current between copper film and the cylinder was measured. It is 13×10^{-12} A at 3kV voltage for 1 hour.

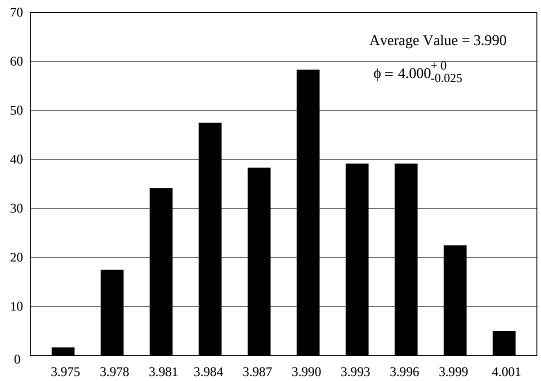

Figure 5: Distribution Of Diameter For Feedthrough

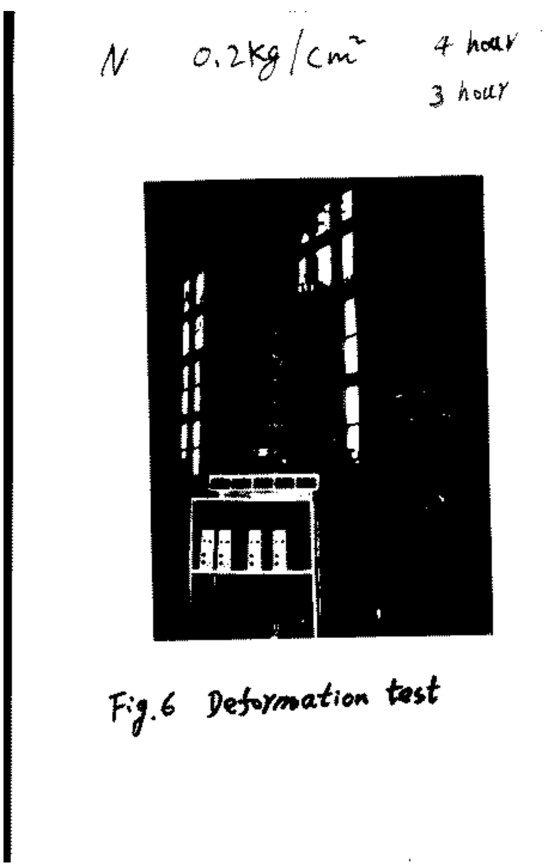

Figure 6: Deformation Test

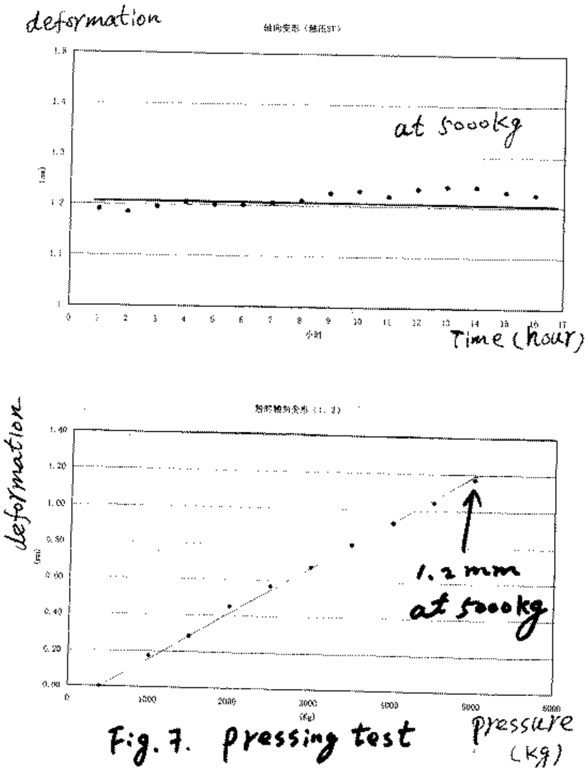

Figure 7: Pressing Test

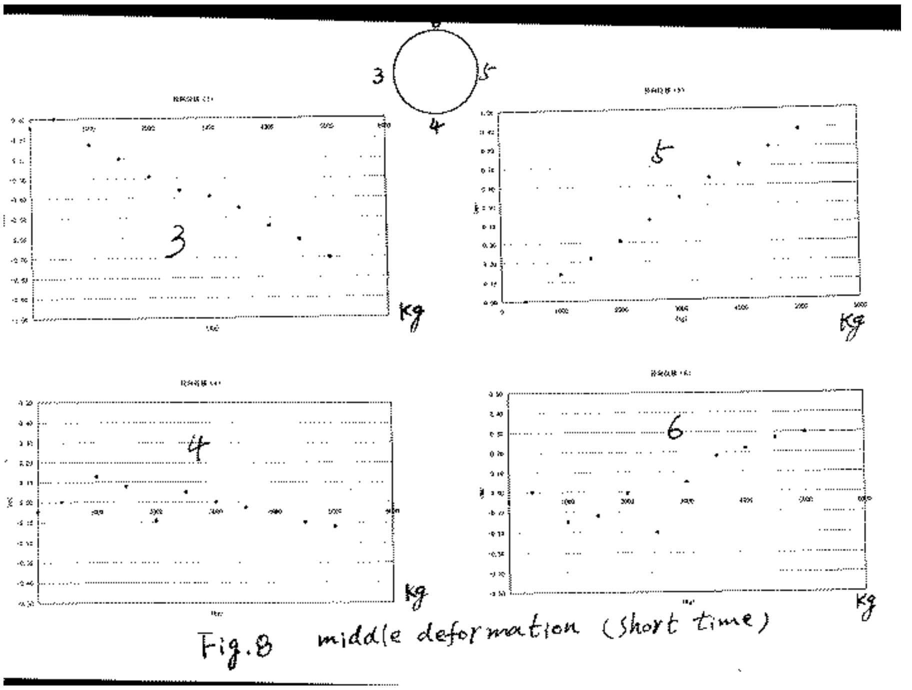

Figure 8: Middle Deformation (short time)

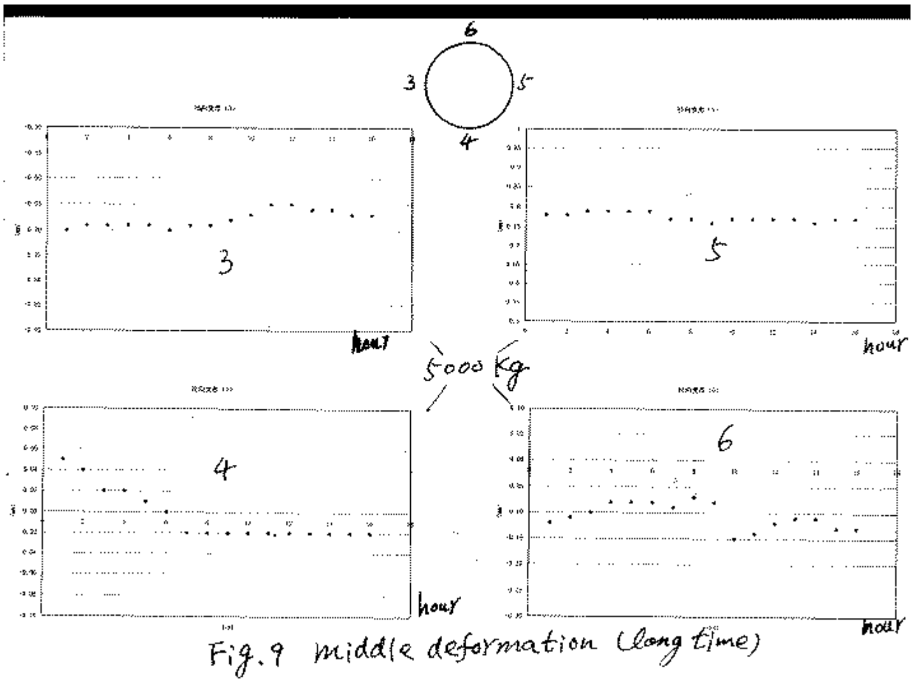

Figure 9: Middle Deformation (long time)

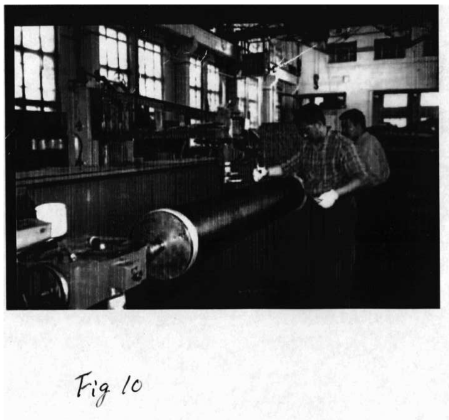

Figure 10: Making mark line

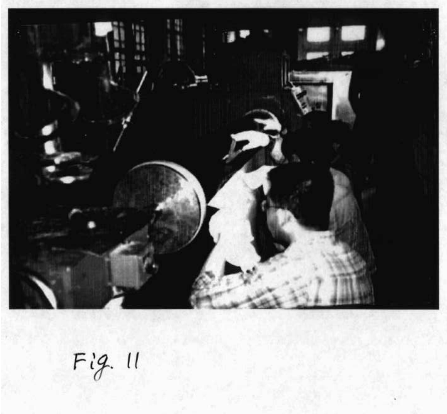

Figure 11: Sticking Mylar Film

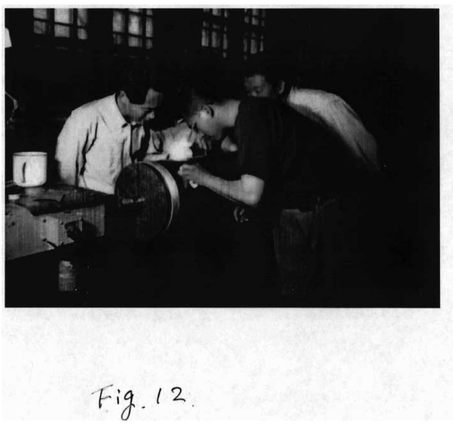

Figure 12:

3.5 Material preparation

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All wires are ready.

Wires: Gold plated tungsten wire, 0.030-mm ± 0.5PCT,

Gold plated inconel wire, 0.004"**,**

Gold plated alloy Be/Cu wire 0.007" **and** 0.009"**.**

Wires will be tested in following items:

Tolerance of diameter, line density, broken point and the length change with the tension and temperature. (Fig. 14-15)

Films:

Kapton: 2 Mil thick, 25" **width**

Copper-clad kapton film: 1.4 Mil copper, 5 Mil kapton. (Not find the type to order until now)

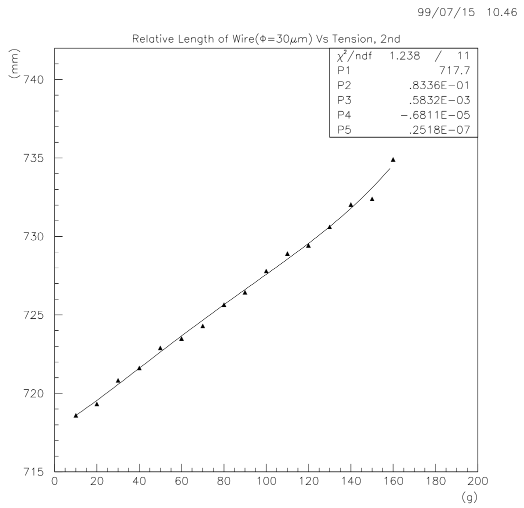

Figure 13: The Relative Length of Wire Vs Tension

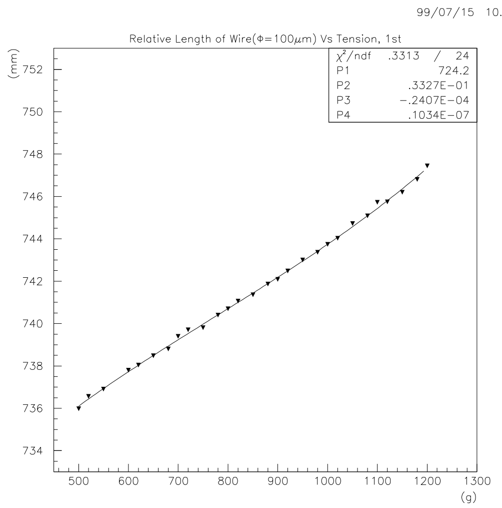

Figure 14: The Relative Length of Wire Vs Tension

3.6 Pre-amplifier boards

Hawaii University, collaborating with IHEP Electronics Division

3.7 Mechanical survey

IHEP

The chamber alignment will be made with about $250\mu m$ accuracy by professional survey people who finished MDCI & MDCII mechanical survey. A contract was made in last month.

3.8 Wiring

IHEP

Every thing is in the preparation. Clean room and the air conditioning system will be ready next month, study of wiring technique, training of wiring people and material preparation are going on. The wiring contract is under discussion.

3.9 Wire tension test

IHEP

Electrostatic resonant method will be used to test the wire tension, the system has been prepared as MDCII used. Some improvements are being studied. (Fig.16)

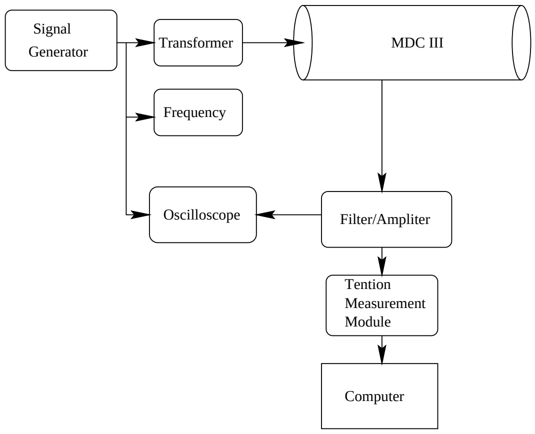

Figure 15: The Tension Measurement

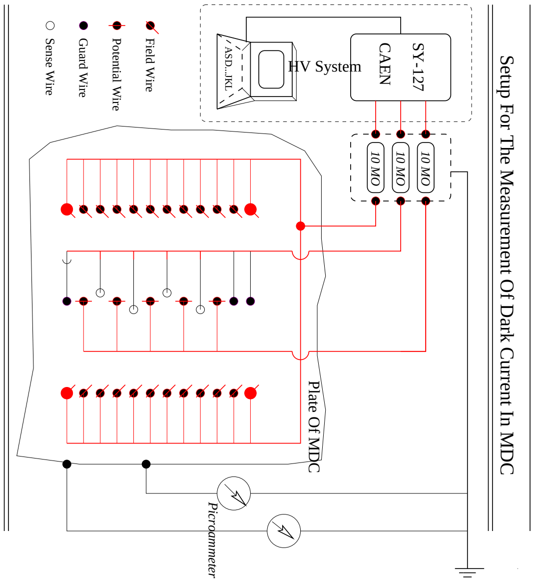

Figure 16: HV Test

3.10 High voltage

IHEP

Leakage current test during MDCIII wiring. (Fig.17)

MDCII works well with splitting-HV more then one year, in view of this, the splitting-HV supply mode will be used for MDCIII.

3.11 Chamber sealing and Leakage test

IHEP

Filling nitrogen with 5cm H_2O, leakage of whole chamber will be less then 0.5% for one hour.

3.12 Cosmic ray test in 1/10 of the chamber

IHEP

Propose:

1) To check the chamber's performance with cosmic ray

2) Long time training for lose efficacy of some wires.

4 Progress table

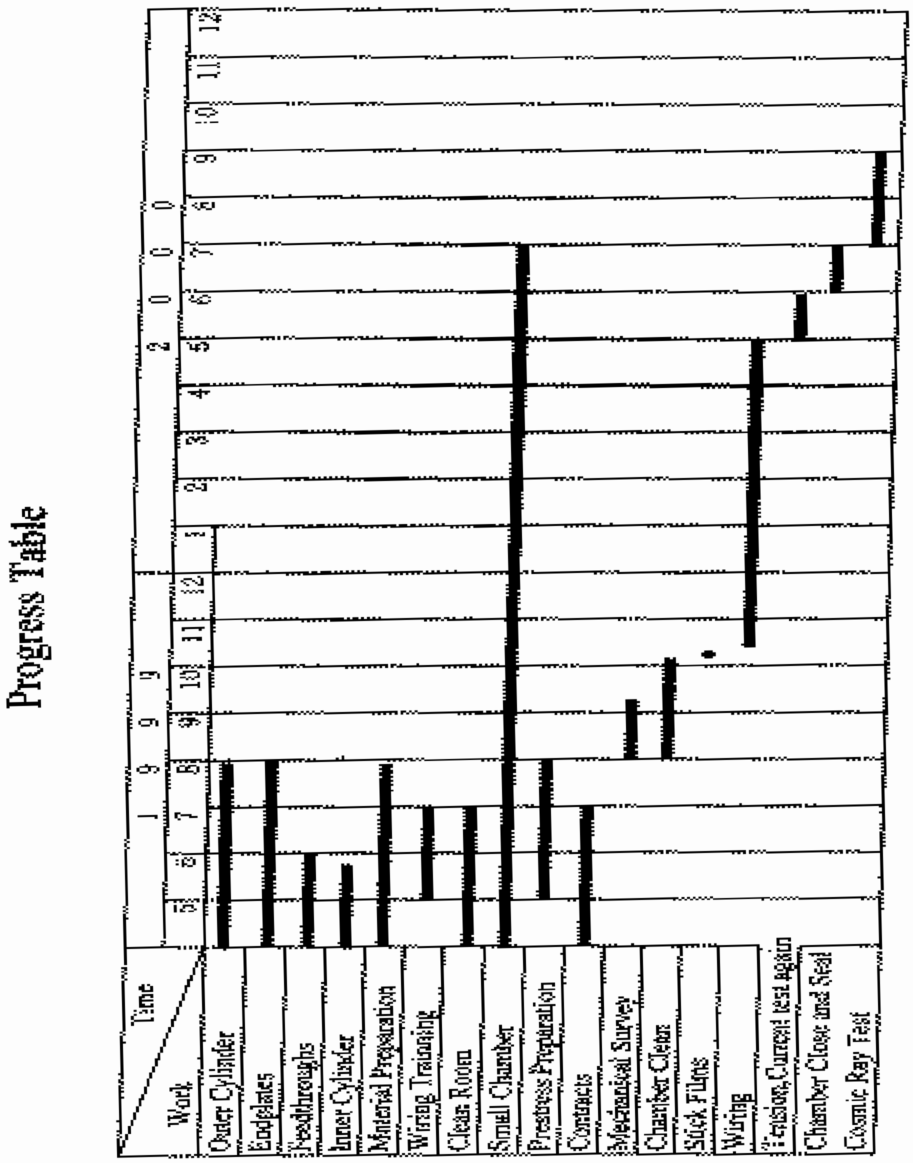

Figure 17: The Map For the Wires of MDCIII