The Progress of MDCIII Construction

Bai Jingzhi
Institute of the High Energy Physics
Academia Sinica
Beijing 100039, P. R. China

June 6th, 2000

Contents:

1. Preparation for Wire Stringing

2. Outer Cylinder and Endplate

3. Plan and Schedule

MDCIII is a cooperated project between China and America. At the last year's BES annual meeting, I reported the mechanical construction of MDCIII, Prof. Fred Harris introduced the outer cylinder and drilling machine, and Dr. Rusty Malchow gave a talk about the feedthrough.

Today, I'm going to give a talk on the progress of MDCIII construction during the past year.

1 Paration for Wire Stringing

1. Place for building MDCIII has been prepared
Super clean room has been recovered.
Criterion: number of dust particles is less than 350 in a liter of air. The diameters of the particles are bigger than half micron.

2. Some wire property has been studied, including: Stretch property, recovering property, temperature property, fatigue property

The relationship between sag and tension was tested.
Study of the tension property related to endplate deformity has been done, etc. (Fig. 1 – 5)

3. Equipment for dark current and tension measurement is available and ready to use.

4. Inner cylinder construction and sealing test have been done.

5. Prototype construction and cosmic ray test of MDCIII are going on.

6. Feedthrough was made in Colorado State University (CSU), concentricity and dimension for every feedthrough has been tested in CSU. There are total 390 boxes of feedthrough (55335 pieces). Some samples have been also tested in IHEP. Most of them had satisfactory diameter.
$D \geq 4.000mm$ 1.3 %
$D \leq 3.975mm$ 0.5 % (Fig.6 – 8)

A high voltage at 4Kv has been applied to 30 pieces of feedthrough to have long-term leaking test. So far the dark current is still less than 13pA (13×10^{-12}) for each feedthrough. (Fig. 9)

7. Al Wire Experiment

After TCF was cut down, some people suggested that we study the possibility to use Al wire and He gas for MDCIII. Prof. Steve Olsen gave us a big support, he bought some Al wires and solder for us to work with. Our first impression i about solder was that KR19 is better than KR18. The KR19 soldering points were smoother and brighter than KR18.
Other studies of Al wire are still going on. (to see Fig. 2)

2 Outer Cylinder and Endplate

1. Outer Cylinder

The outer cylinder is being fabricated at Bear Machinery in Kaneohe, Hawaii. It will be finished soon. The inner diameter is ok, but outer diameter is 2mm large than the designed. (Fig. 10).

2. Drilling Machine

The drilling machine used for MDCIII was made by Engineer Tom Conlin. The performance of machine are:

X direction: $\pm$ 0.0002 inch (5.0 μ m). Y direction: $\pm$ 0.0001 inch (2.5 μ m). (Fig. 11 – 12) Rotation accuracy: $\pm$ 0.0002 degree.

3. Scheme for Drilling

In order to reduce the effect of stress which was produced during drilling process, we arranged to drill holes at different layers and blocks in a staggered manner.(Fig. 13)

However, there is a little difference for endplate 1 and 2. For endplate 1, initially only the field wire, potential wire and guard wire holes were drilled, and the sense wire holes were drilled the last. For endplate 2, in order to reduce the tolerance caused by multi-rotation, all of the holes in each block were drilled at one time. (Fig. 14) In a more detailed level, the drilling process of any specific layer in any specific block was carried out in the following way: starting from the right side to the middle and then shifting to left, then go back to the middle. In this way, the tolerance accumulation has been minimized (see Fig. 14).

4. The Data Quality

* Test Holes

In order to insure data quality, before drilling a new block, several test holes were drilled on the new block. If measuring data were correct, then the drilling process would continue to finish. Otherwise, the drilling machine will be aligned again (see Fig.14).

* Measurement

For every block, six sample holes were chosen and have been measured. Here are some plots. (Fig.15 – 20) The sampling ratio is about 30%. The measurement results show that more than 90% of the holes are within tolerance range.

* Tolerance

Machine accuracy: $\pm$ 0.0006 inch (15.0 μm) – maximum (Fig. 21)
Measurement tolerance: $\pm$ 0.001 inch (25 um)
Tool accuracy: $\pm$0.001 inch (25 μm)
Measuring bar error: $\pm$ 0.0005 inch (13 μm) (Fig. 22)
Temperature effect: $\pm$ 1 degree C ($\pm$ 23 μm) – maximum (Fig. 23)
Effect of endplate deformity : ?? (Fig. 24 – 27)

5. Progress Update

It took us six months to drill endplate 1, and two months for endplate 2. So far, What's finished and what need to be done ?
—To see Project checklist:

Project checklist

Number	Item	Plate1	Plate2	Note
1	Wire hole	22936	22936	drilled
2	Optical and Mechanical hole	72	72	drilled
3	Electronic hole	7000	7000	drilled
4	Enlarge Optical hole	24	24	To be done
5	Inner cylinder hole	16	16	To be done
6	Installing hole	24	24	To be done
7	Holes to be repaired	51 Done	2 TBD	
8	Chamfer	45872	45872	Finished
9	Reamer	22936 Done	22936 Not yet	
10	Taping	7000 Done	3000 TBD	
11	Polishing	Done	TBD	
12	Reamer again	22936 Done	22936 TBD	
13	Cleaning			To be done
14*	Assemble	– with	outer	cylinder

* — I wish that we finish assembly of outer cylinder and endplates before

end of July. And MDCIII body will be shifted to Beijing by first August.

3 Plan and Schedule

This schedule is based on that MDCIII will be a copy of MDCII. Al wire and He gas will not be used for MDCIII.

1. Outer cylinder and endplates Two months Aug. 1, 2000

2. Chamber assembly alignment One month Sep. 1, 2000

3. Cleaning/Kapton film sticking One month Oct. 1, 2000

4. Wire Stringing Six and a half months Apr. 15 2001

5. Sealing and Leakage test One month May 15, 2001

6. Cosmic ray test Three months Aug. 15, 2001

7. Assembling with TOF II One month Sep. 15, 2001
(Would be parallel with disconnecting MDC II from BES II)

8. Installing MDC III and TOF II into BES II One month Oct.15, 2001

9. Mounting boards for HV and Preamp. 1.5 months Dec. 1, 2001

10. Cosmic ray test again ten days Dec. 10, 2001

11. Unexpected events twenty days Dec. 31, 2001