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DEVELOPMENT OF LASER MEASUREMENTS AT THE **ATLAS** TILE CALORIMETER MODULE PRODUCTION

Introduction

The Barrel Module production at JINR goes well in accordance with the plan. By the beginning of October 2001 we have completed the assembly of more than 51 Modules.

Having non-ideal Module parts such as girders and submodules [ref. 1, 2] we are trying to do our best to produce Modules with side surfaces as flat as possible. We are learning to solve this problem with time, getting experience in the assembling process and slightly changing its technology. These changes allow us to accept some parts that were put aside earlier and yet to get correct Module assembly. Though all these take more efforts and time than before, we still keep our previous tempo of production, namely one Module in two weeks.

Module assembly under double top line control

During Module assembly we use the Laser Measuring System (LMS), which is described earlier in the ATLAS TILE-CAL report and Notes [1,2]. Its principle can be understood from Fig.1

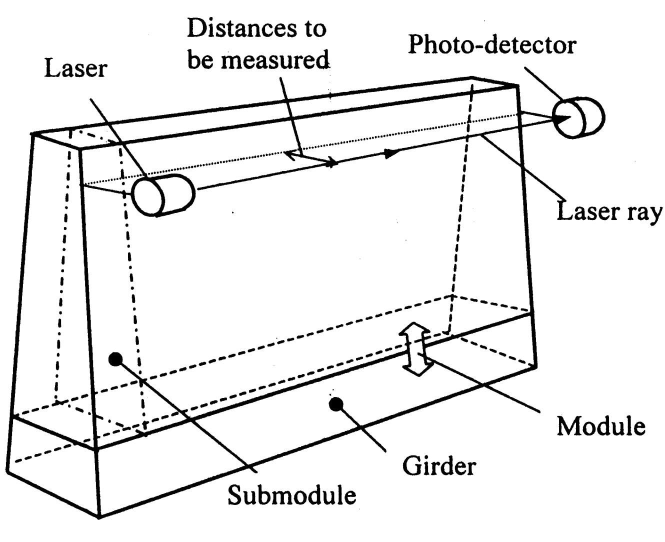

Fig.1 Laser Measuring System (on the module top line)

The idea (Fig.1) is to measure distances from the side module (or submodule) surface to the laser ray with the help of a quadrant photo-detector and a micro screw on its base support. We use the LMS for adjustment of submodules during module assembly as well as for final measurements of the finished modules or other objects.

The new method of the submodule adjustment binds to a necessity to use as much as possible already produced submodules and yet to keep module within the given tolerances.

Starting with module 23 during module assembly we begin submodule position measurements on *both module sides* (A_i-B_i in Fig.2) at the top lines. With these results, we adjust submodules in an optimum position (Fig.3). This mode of measurements allows us to use some moderately distorted (mainly twisted) submodules that were earlier regarded as unfit and still to keep side module surfaces within tolerances. As one would expect, this procedure takes more time then earlier. It should be mentioned that the use of practically all submodules increases the average nonplanarity of the side surfaces of the finished modules (see Fig. 4).

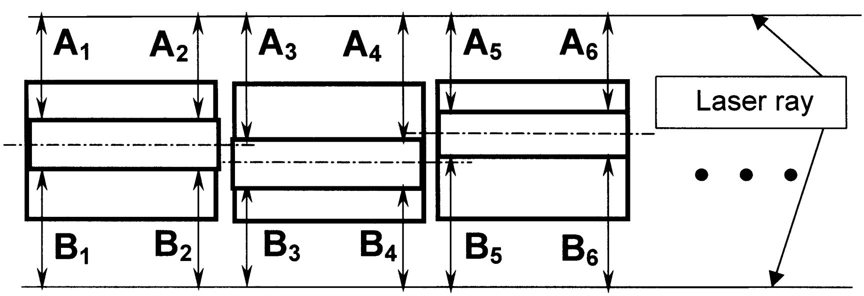

Fig.2 Double top line control (top-view)

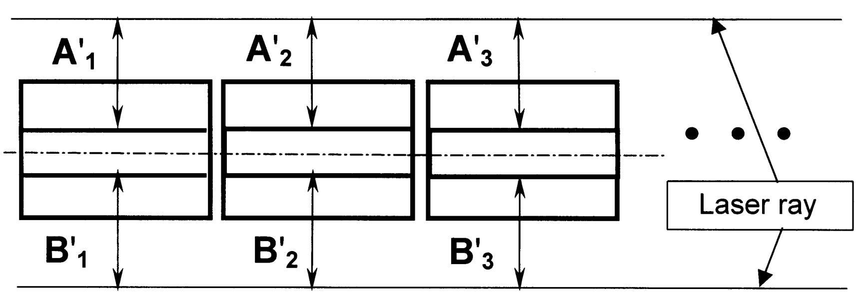

Fig.3 Resulting positions after adjustment (top-view)

Current State of Measurement Results

The main results of the measurements of 51 finished modules are shown in Fig.4, 5. Here one can see that all modules are well within tolerances. All positive ("+") deviations off the nominal plane are *less than the allowed ones (+ 0.60) at least by a factor of 2*. A gap in Fig.4 means zero maximal deviation of module 21. Figure.4 shows that after improvement (in average) of the accuracy of the assembly process, maximal deviations became larger again, starting with module 22. This is because we began to use distorted submodules, that we could not use earlier. Namely from this point on we are using the double top-line control described above.

The negative ("–") deviations are more noticeable (Fig.5). This might be explained by a rather stable tendency of the manufacturers to avoid the "drift" of the submodules beyond the tolerance in a positive deviation region, which would be more dangerous at the Barrel assembly stage.

Both figures show that the LMS technology really guarantees a high quality of module assembly.

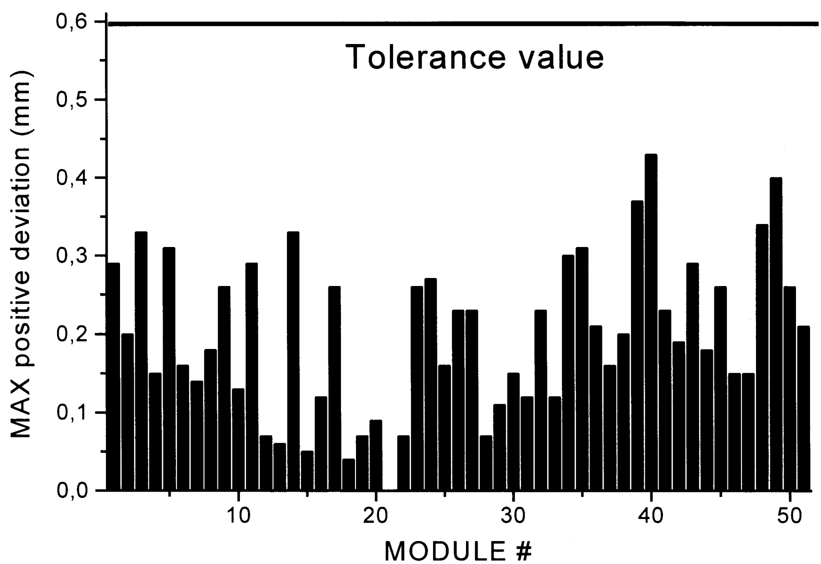

Fig.4 Maximal positive (+) deviations of module side surfaces off the nominal planes.

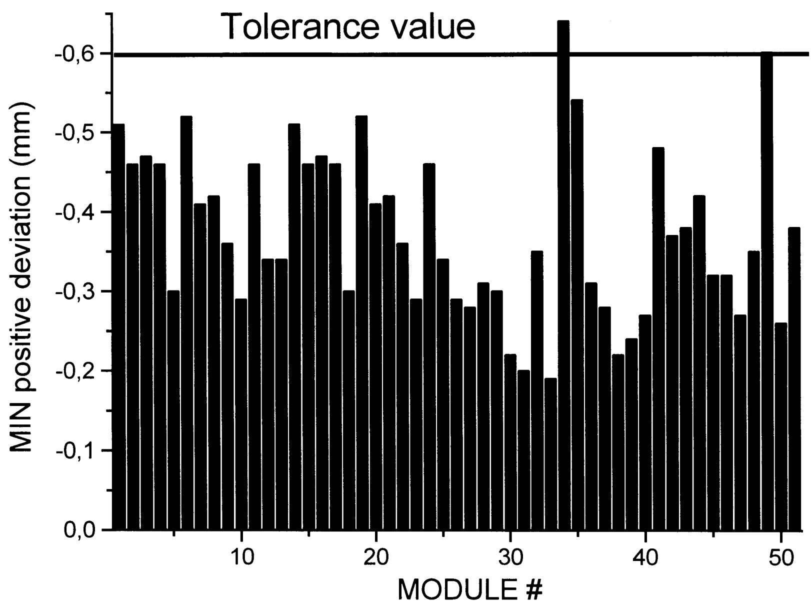

Fig.5 Maximal negative deviations (-) of module side surfaces off the nominal planes

Future laser measuring system upgrading

We propose to carry out further system development through automation of the adjustment procedure, "zero-keeping" and increasing measurement precision. It would be very convenient to make another Laser Measuring System at CERN too.

Conclusions

- The results obtained with the new LMS-based adjustment procedure during module assembly allow us to guarantee the desirable high precision of finished modules, even if we use moderately distorted submodules.
- The laser-based measurement system can be used to check different large-scale units. In the combination with other means of measurement, the method

can be a significant element of more general adjustment procedures during the assembly of the ATLAS subsystems or the ATLAS as a whole.

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" http://atlasinfo.jinr.ru/TILECAL/dm_m/ ".

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Развитие лазерного метода измерений
при производстве модулей тайл-калориметра установки ATLAS

Представлены результаты выполненных с помощью лазера измерений 51 модуля барреля, которые собраны в ОИЯИ к началу октября 2001 г. Для того чтобы использовать практически все поставляемые нам субмодули, мы были вынуждены усложнить измерения при сборке модулей. Тем не менее скорость производства была сохранена прежней — 1 модуль за 2 недели.

Работа выполнена в Лаборатории ядерных проблем им. В. П. Джелепова ОИЯИ.

Сообщение Объединенного института ядерных исследований. Дубна, 2001

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Development of Laser Measurements
at the ATLAS Tile Calorimeter Module Production

We present the results of the laser measurements of 51 Barrel Modules assembled at the JINR by the beginning of October 2001. To use practically all submodules supplied by the manufacturers we were forced to complicate measurements during the assembly process. Nevertheless the rate of production remained the same — 1 Module in 2 weeks.

The investigation has been performed at the Dzhelepov Laboratory of Nuclear Problems, JINR.

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