

# Prototyping of the CBM STS module

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For the prototyping of CBM-STS module, a unit of Demonstrator 2-a and front-end board (FEB) with flexible chip commutation were developed by the participants of the CBM-MPD STS Consortium and manufactured using aluminium-polyimide commutation elements and “Chip-on-Flex” assembly technology in SE SRTIIE, Kharkov, Ukraine.

Each prototype of the Demonstrator 2a detector modules, shown in Fig. 1, comprises one or three thin, double-sided silicon sensors measuring 42 mm by 62 mm (CBM03/ISTC) or 62 mm by 62 mm (CBM03/CiS), multi-layer connecting boards as shown in Fig. 2, pitch adapters, and mechanical holding elements. The demonstrator prototypes are designed for modeling the space position of the module components, for developing fabrication methods of the components, procedures of assembling module units and the module in whole, as well as for measuring parameters of the sensors.

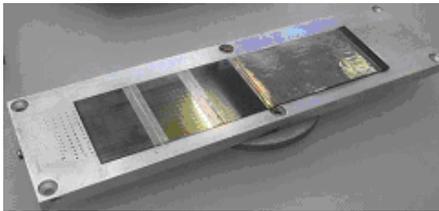


Figure 1: Demonstrator 2a

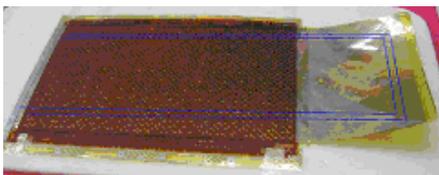


Figure 2: Multilayer readout cable

The design of the multilayer analogue connecting cable was optimized to improve the capacitive parameters. The suggested design of the optimized board is shown in Fig. 3. The total length of lines on the measured samples was approximately 24-26 cm, indicated in blue colour in Fig. 2. The measured inter-trace capacitances are presented in Table 1. An assembly sequence of the demonstrators was developed, using methods like ultrasonic bonding, gluing, and soldering. Since the number of bondings for the 2a Demonstrators is as high as 40,000, the bonding regimes were studied, and it was decided to bond the connecting boards on the automated EM-4370 machine.

Table 1: Measurement of inter-trace capacitances

	M1, pF	M2, pF	Mean, pF	pF/cm
C12	6,80	7,10	6,95	0,29
C13	3,90	4,10	4,00	0,17
C34	8,00	8,30	8,15	0,34
C1G	5,80	5,90	5,85	0,24
C3G	7,00	7,10	7,05	0,29

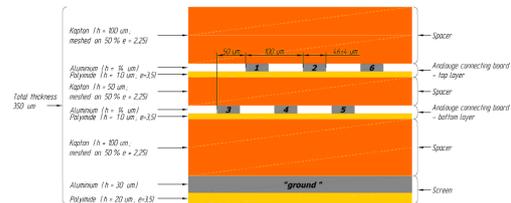


Figure 3: Structure of an analogue multi-layer cable

A further double-layer micro-cable was developed for the connection of the chip to the FEB (Fig. 4). The proposed cable design reduces the number of output contacts on the board to nearly one half. Later on, such cables will make it possible to test the chips after bonding to the cable, prior to mounting them on the board, i.e. to have on the board the indubitably operable chip. Five front-end boards with application of the n-XYTER-v01 chip and chip-cables were assembled.

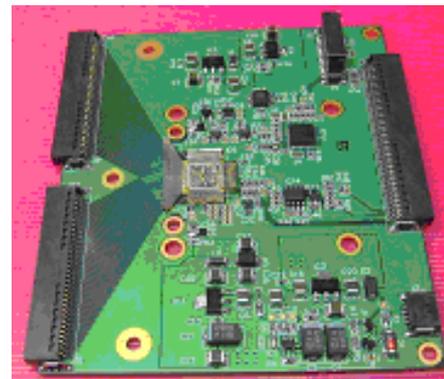


Figure 4: FEB with a cable-connected chip

The development outlined above allow us to gain experience which will be applied in future for the manufacturing of the CBM STS detector modules by the CBM-MPD STS Consortium.