APPENDIX 4 TO SCT-BM-FDR-6

ASSEMBLY JIGS AND PROCEDURES FOR THE SCANDINAVIAN CLUSTER

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Jigs and their use in Oslo.

This document describes all the jigs, used at The University of Oslo for the fabrication of ATLAS Barrel modules.

1 Alignment.

1.1 Detector Alignment.

The Alignment -jig is used for placing the detectors at the correct position to the module.
All angles of the module, are implemented in the line-up process.

The jig is placed on a XY stepper motor system that allows to move the jig under the camera.
There are also 6 stepper motors that place each of the detectors individually.
(XY and rotation) (fig. 1).

On top of the rotation stepper motors, there are vacuum chucks holding the detectors.

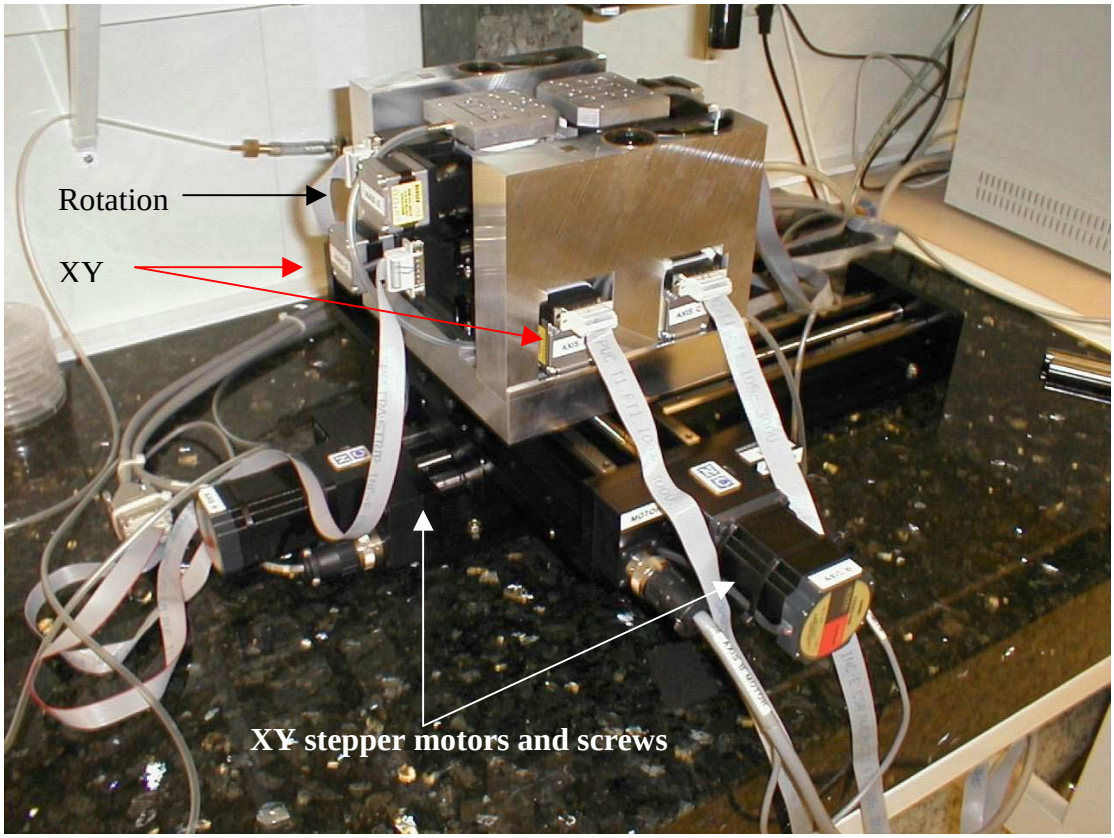


fig.1

1.2 Bearings and Shafts.

To be able to pick up the detectors after alignment, there are two linear ball bearings, one on each “sidewall” of the jig.
Those bearings are tuned to the accuracy needed by a tube of Brass (Fig. 2).
By using precision shafts in the bearings, we are able to slide the Pickup-jigs correctly down onto the Alignment-jig, and pick up the detectors (Fig. 3 and 4).

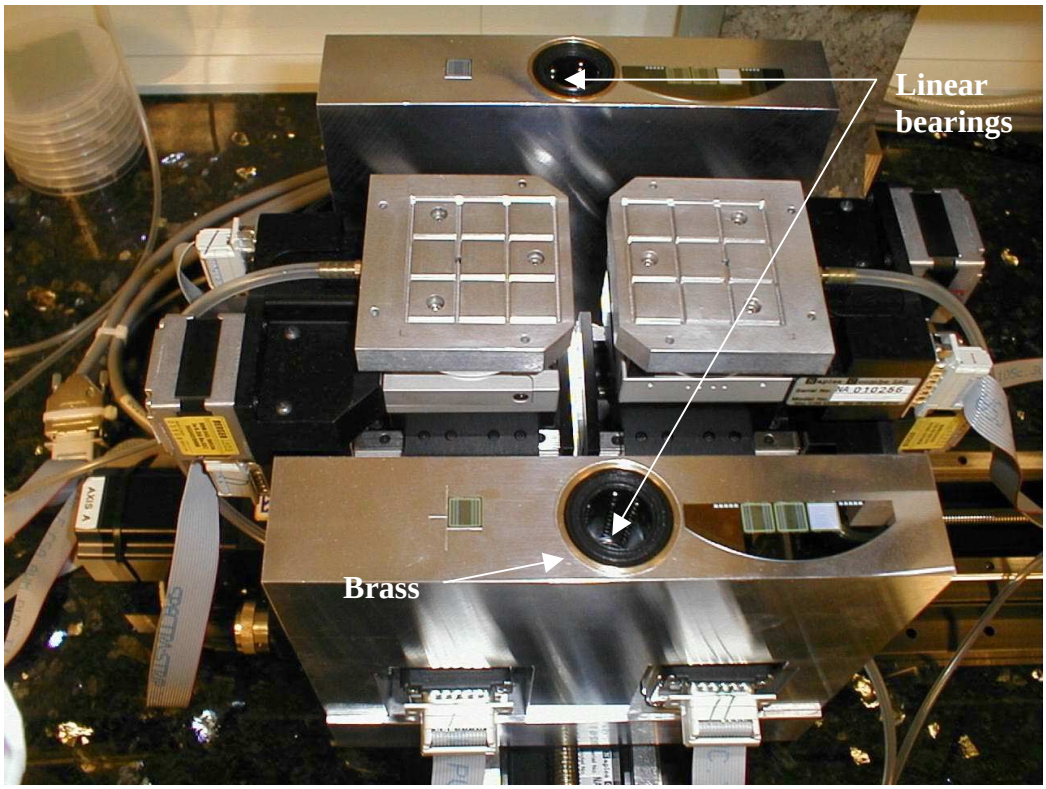


Fig.2

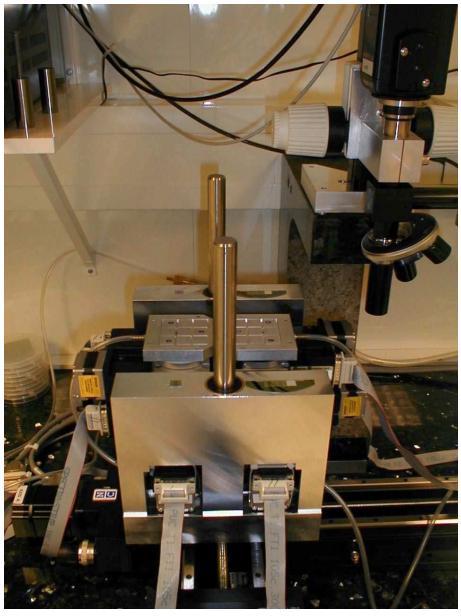


Fig. 3

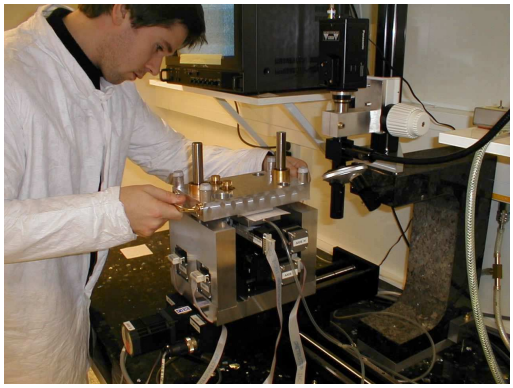


Fig.4

The bearings on the jig are placed with an angle of ~20 mrad compared with the jig itself.

This is done so that the camera follows the edge of the aligned detectors while the jig moves.

1.3 Components and materials.

Components	Type	Supplier
Aluminium	ALPLAN 5083 (AlMg4.5Mn)	Astrup
Linear ball bearings	CBCR 20-2LS	SKF Multitec
Precision Shafts	High-grade steel 20 mm ∅ Tolerance h6	SKF Multitec

2 Vacuum jigs.

2.1 Pickup jigs.

There are two different jigs used to alignment detectors from the Alignment-jig.
The first used in the process, has positioning screws for the baseboard.
This jig always holds the lower side of the module.

The other Pickup-jig is similar to the first one, but without the baseboard positioning screws. (Fig 4.)

2.2 Baseboard-jig.

To be able to glue the module in two steps, we need a similar jig to the Pickup-jigs to hold the baseboard during gluing the first step of the module. (fig. 4)

Fig. 4

2.3 Materials.

Components	Type	Supplier
Aluminium	ALPLAN 5083 (AlMg4.5Mn)	Astrup

3 Glue-jig.

3.1 Baseboard-support.

To be able to handle the baseboard during the dispensing of glue, we have a Support-jig. This jig clamps the baseboard carefully, using brass-clamps with rubber underneath. The clamps are supported by spring-loads.
To position the baseboard, there are pins that fit into the baseboard mounting holes. A mechanical support for the baseboard is mounted on the jig used when dispensing onto a bare baseboard. (Fig. 5)

3.2 Positioning the frame.

The Baseboard-jig has a Position-jig mounted onto the glue dispenser. These part fits together with linear bearings and precision shafts. The Baseboard-jig fits onto the Position-jig with either of its flat sides facing up, but with the Baseboard-jigs fiducial pointing in one direction only.

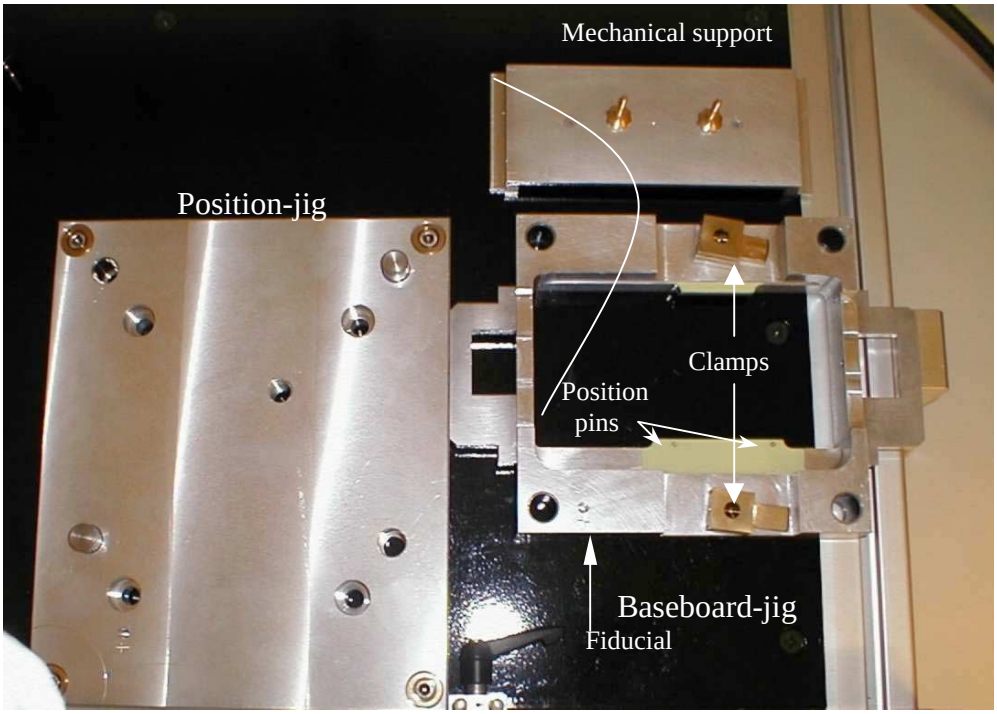


Fig. 5

3.3 Materials

Components	Type	Supplier
Aluminium	Alcoa Alca Plus	The Empire
Linear bearings	PG 12 1420 F	SKF Multitec
Precision Shafts	High-grade steel 12 mm ∅ Tolerance h6	SKF Multitec

Module building in Oslo

1.1 Detectors:

Detectors, either from Hamamatsu or Sintef, will arrive to Oslo after testing in Bergen.

1.2 Baseboards:

The baseboards, will be sent us from CERN.

1.3 Glue:

The thermal conductive glue, is Araldite 2011- AW 106/HV 953U supported by a Norwegian vendor: “Lindberg og Lund”.

The filler, Boron nitride, was delivered from RAL.
The electrically conductive glue is delivered from KEK.

1.4 Storing the parts:

All the parts will be stored in our clean-room under controlled temperature and humidity. They will remain in the original packets until they are to be used.

The glues are stored at room temperature approx. 22° C, and the Boron nitride is stored in the original bag, containing silicon gel as well.

1.5 Other parts in the process:

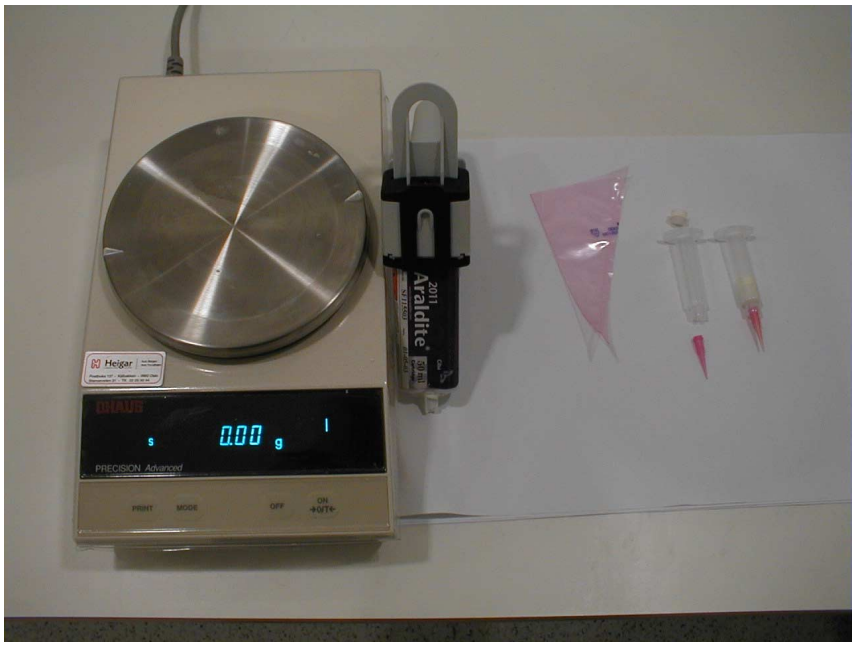
We are using clean-room paper in between the different vacuum chucks, and the detectors.

This has been a problem to get from vendors, but for the moment we use
“Rice paper H44-001B” from Metron TechnologyNordic AB.

2. Dispensing the glue

2.1 Mixing the Glue:

Both the glue-types used for the detectors, are mixed by hand.
To fill the syringe with the thermal conductive glue, we use a special designed plastic pouch, like a cornet. (Picture 1)



Picture 1

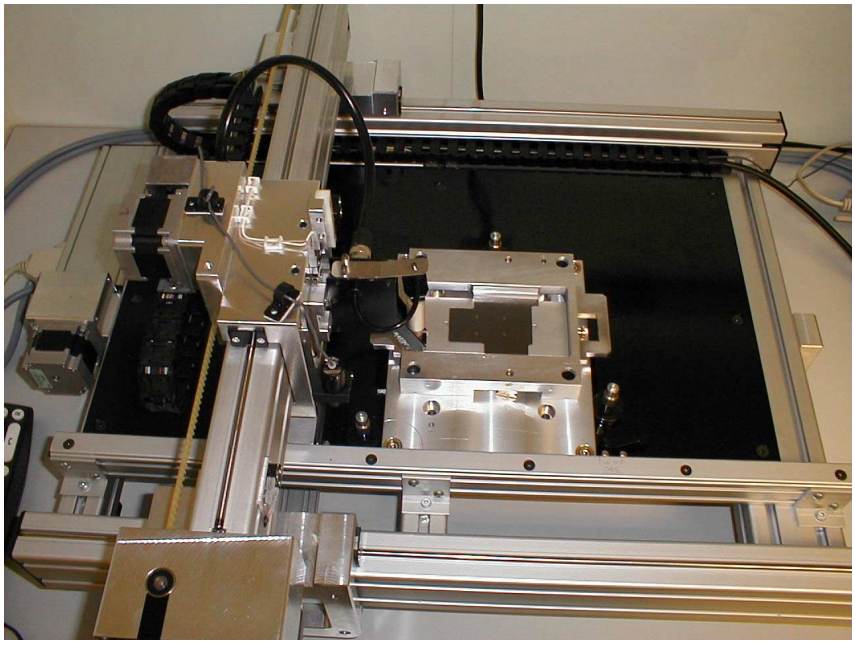
2.2 Glue dispenser:

This unit is capable to read for instance Gerber –files, and convert it to a steering-program for the unit. (Picture 2)

Picture 2

2.3 Baseboard jig:

To be able to treat the baseboard during the dispensing, we are using a jig that holds the baseboard in a careful way, with to pins into the baseboard holes, and two clamps with rubber legs touching the Beryllia facing.
This jig is designed to hold a single baseboard, or a baseboard with to detectors glued on one side (half-module). That allows us to glue the modules in to steps. (4.1)



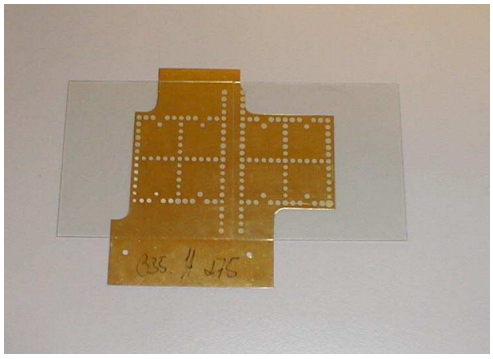
Picture 3

2.4 Moving the Baseboard:

To move the Baseboard from its original box to the glue-jig, and between the dispenser and the module-assembly jigs, we are using either the handling-tool provided by Martin Gibson, or a similar tool built in Oslo.
This tool uses the handling points on the Baseboard.

2.5 Testing the glue dispenser:

To test the glue-dispenser, we have used dummy components in Plexiglas and brass, to learn and understand more of what's going on in-between the detectors and the Baseboard.
(Picture 4)

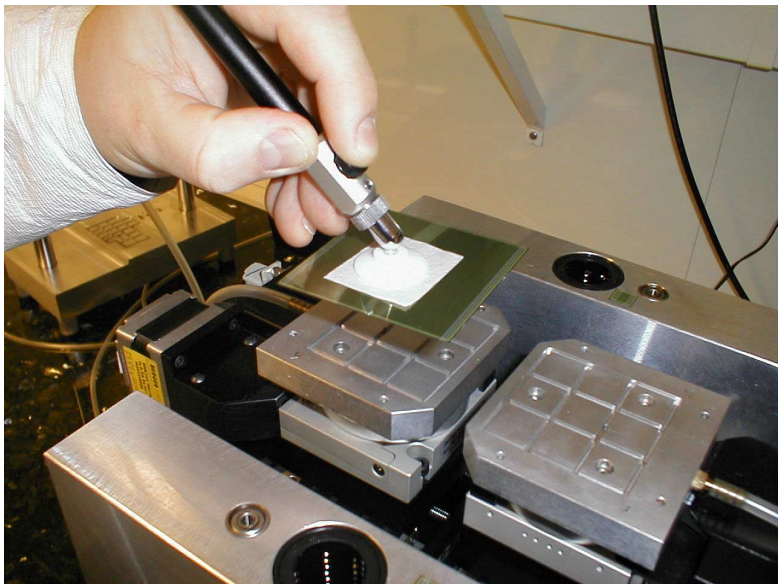


Picture 4

3. Lining up detectors

3.1 Pick up the detectors:

To pick up the detectors from the transportation packets, we are using a handheld vacuum-pen with plastic foot. This tool is placed directly to the top surface.
To prevent damaging the detector, we also have clean-room paper in-between the detector and the pen. (Picture 5)



Picture 5

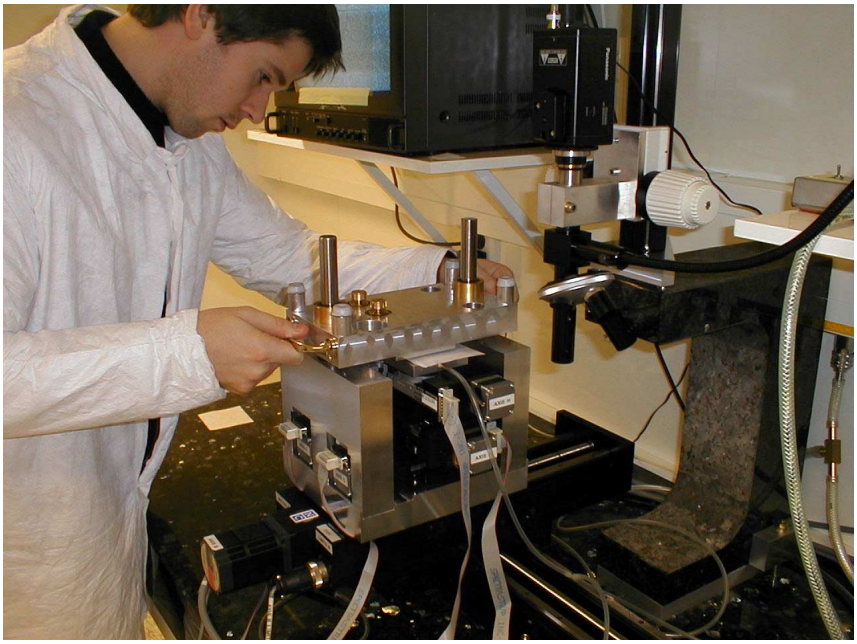
3.2 Alignment:

The alignment of the detectors is done with our step-engines jig, using software from Manchester, and a Labview program developed in Oslo.

3.3 Pickup jigs:

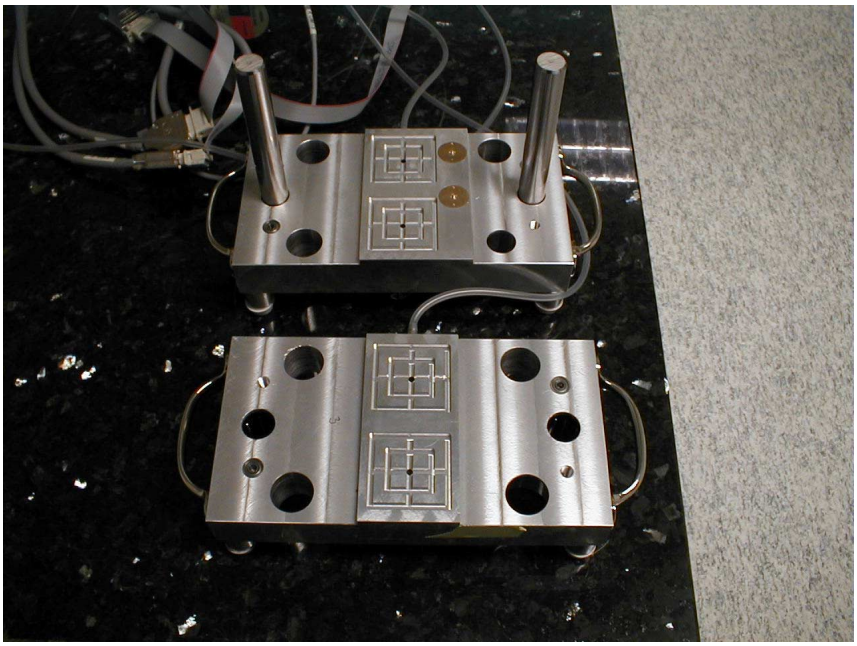
To be able to transfer the aligned detectors from the alignment jig, and to the gluing process, we pick them up with the gluing jigs directly, using vacuum.

The jigs used for this purpose, are lowered onto the detectors, with a sheet of clean-room paper in-between. They slide down on to dowel pins as shown in picture 6.



Picture 6

We have two different jigs for picking up detectors. One of them has also two small pins for positioning the Baseboard trough its holes. (Picture 7)

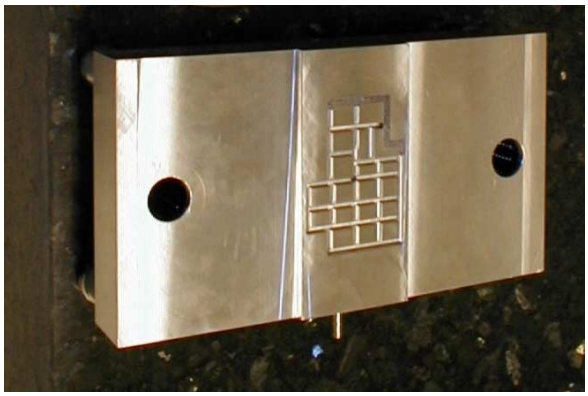


Picture 7

4. Gluing the module:

4.1 Two step gluing:

To be able to do the “Two step” gluing, we have developed a jig to hold the baseboard in the right position while doing the first step. (Picture 8)
This support the Baseboard with vacuum, so that the pins used for positioning no longer are needed, and they will be unscrewed from the jig.



Picture 8

After hardening the first step, the “half”- module is placed back in the gluing-jig (Picture 3), and glue is dispensed on the other side of the Baseboard.
Then the “half”- module goes back to its originally gluing jig, and the second half of the module is glued, using the other pickup-jig.

4.2 Spacers:

To control the glue-thickness of the modules, we will use spacers in-between the jigs.
Those give us the possibility of controlling the thickness of the glue on each side.

5 Transportation:

After the modules are glued in Oslo, they will be transported to Uppsala, for metrology measuring, hybrid mounting and testing.