

Preliminary Report on US Barrel Module Site Qualification Request

The US Cluster submitted their Site Qualification Request on July 19th 2002, and provided data and results on five modules (Q1 to Q5). Information was also provided on two modules made earlier (E3 and E4). The module numbers are:

Q1	20220040200004
Q2	20220040200003
Q3	20220040200006
Q4	20220040200007
Q5	20220040200005
E3	20220040200001
E4	20220040200002

These are the first modules seen from the US Cluster and are a significant achievement towards Site Qualification. This preliminary report is provided now, to help the US Cluster advance with its module assembly programme. The features of each module have been assessed and are commented upon, as are the overall procedures, and a recommendation is provided. Discussion of the exchanged modules is in the attached documents.

1. Module Assessments:

Bonding: for several modules (Q1, Q2, Q4) the leakage currents are significantly more than the sum of those for the individual detectors after strip wire-bonding, and also bond-shorts are reported on some modules.

Damage: two of the qualification modules were damaged during assembly, Q2 by scratching a detector, and Q4 by a bonding machine accident requiring replacement of ASICs

Electrical readout: both E3 and E4 had failed timewalk, and Q5 had 5 chips with rather severe s-curve anomalies. Otherwise the results as satisfactory.

Mechanical: most xy results are within specification; midyf is slightly out of tolerance for Q4. The spread of midyf in the qualification modules is worrying. Although the z-shape is understood with the flatter detectors, the asymmetry of the shape in the upper and the lower side is noticeable and should be corrected (see the "CommonProfile" from the 5 US site qualification modules shown in the KEK cross-check report).

Hybrid mounting: from the visual inspection of module Q1 and from the temperature difference in T0 and T1 in several modules (Q1, Q2, and to some degree in Q3, Q5), it may be concluded that there is insufficient adhesion in the hybrid mounting, or possible asymmetries. The mounting was done with a different fixture from that to be used in the Series Assembly. Similarly, the adhesion of ASIC's appears to be insufficient in some chips (Q1).

Metrology: in Series Assembly the metrology of hybrids and the big capacitors has to be made.

Cleanliness: from the inspection of modules (Q1 and Q3) the cleanliness of the assembly and/or testing environment must be improved.

Consistency/Cross-check: for the exchanged Q1 module, there is good consistency in the results obtained, both mechanically and electrically. Measurements of Q3 are still in progress.

2. Site Qualification Requirements

In the SQ requirements it was agreed 5 successful modules must be achieved for site qualification. Clearly, if for example 6 attempts are made then 1 is allowed to fail. We do not believe that the US Cluster has yet completed the necessary number of successful modules for SQ. However this should not be allowed to inhibit the progress in module building at the Cluster provided the necessary improvements are achieved. The main requirements relate to the following:

- (a) It is clear that achieving leakage currents for completed modules that are close to the sum of the intrinsic currents of the bare detectors has proved difficult but E4 and Q5 show that this may have been achieved. However the detector temperature of the US measurements is unclear. It needs to be assured that little excess current is induced in module assembly.
- (b) 2 modules out of 5 (Q1 to Q5) suffered damage, and it needs to be demonstrated that this is not a recurring problem.
- (c) The results of all mechanical and electrical data from Q1 at KEK and Q3 at RAL need to be fully assessed for checking both performance and consistency of measurements (the Q1 KEK cross-check is appended)
- (d) Given the importance of the hybrid mounting technique it is necessary to assess modules made with the final US tool.
- (e) The difficulty mentioned over detector bonding is worrying, as other sites have used the existing glue pattern for a long period of time for many successful modules. There are definitely implications in now changing this pattern: glue will be placed closer to detector edges and hence be more liable to emerge on detector surfaces. Further discussion would be needed before such a change could be implemented.
- (f) It is necessary for the US site to guarantee insurance for all the module components that are being provided to it, and for the completed modules.
- (g) The US site is requested to provide the specification of cleanliness of the areas used for module assembly and for testing, and to confirm that either face masks are worn during assembly, or else appropriate protection schemes are in place. The cleanliness of the exchanged modules is not satisfactory.
- (h) Demonstration of complete metrology is required before getting into large scale series production.

3. Recommendation

The US Cluster should address each of the points mentioned above, some of which need collaboration with other Clusters. After reviewing the necessary changes that may be required in procedures and training we believe that the Cluster should then start to use the Series Assembly components recently provided to make up to 10 more modules. Data on each module should be fed back to the Module Co-ordinators regularly, and exchange of the first two of these modules urgently with UK-B and Japan is requested. We expect that site qualification will be achieved within the assembly of the coming 10 modules. If problems do arise during this sequence, further US Series Assembly should be halted after 10 modules for SCT re-appraisal.