BIS2: CIBFi FMECA

Thomas Cartier-Michaud
Milosz Blaszkiewicz
TE-MPE-CB

Beam Interlock System II

Provisional Results for the Analysis of the Second Version of the BIS in the LHC

2/4/2022
Outline

1) Status of the study
2) Updated reliability predictions
3) Results of CIBFi FMECA
   1) Types of components vs failure rate
   2) Boards vs failure rate
   3) Boards vs failure rate per end effect
   4) Individual components vs failure rate
4) Next steps
5) Questions
## Status of the study

<table>
<thead>
<tr>
<th></th>
<th>Design (Altium)</th>
<th>Prediction (Isograph)</th>
<th>FMECA</th>
<th>Fault Tree</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIBM</td>
<td>ok</td>
<td>ok</td>
<td>ok</td>
<td>ok</td>
<td>reviewed – updated <a href="https://edms.cern.ch/document/2641123/1">link</a></td>
</tr>
<tr>
<td>CIBU</td>
<td>ok</td>
<td>ok</td>
<td>ok</td>
<td>ok</td>
<td>reviewed – plots updated <a href="https://edms.cern.ch/document/2643512/1">link</a></td>
</tr>
<tr>
<td>CIBFi</td>
<td>ok</td>
<td>ok</td>
<td>ok</td>
<td>-</td>
<td>draft <a href="https://edms.cern.ch/document/2648311/1">link</a></td>
</tr>
<tr>
<td>CIBG 4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CIBDS 4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Table 1. Status of the study

1) Reviewing the CIBFi Prediction (operational voltages are missing) = **ok**
2) Reviewing the CIBFi FMECA = **100% completion (some question marks remain)**
3) Reviewing reports of CIBM and CIBU = **updates of the plots**
4) Writing report for CIBFi = **draft**
Updated reliability predictions

Predictions use failure rates of individual components calculated in Isograph. They also assume 250 days per year.

The design predictions continue to deliver failure rates meeting the target for blind failures. For false dump, the “reliability” (or availability) target is not met.

Update for transils: contacted the producers, waiting for the reply.

Working on translating the reliability into number of failures per year.

<table>
<thead>
<tr>
<th>Scenario B</th>
<th>False Dump</th>
<th>Blind Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIBU (channel)</td>
<td>99.994835</td>
<td>99.967861</td>
</tr>
<tr>
<td>CIBM (channel)</td>
<td>99.948366</td>
<td>99.898368</td>
</tr>
<tr>
<td>CIBFi</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Table 2. Requirement allocation to each subsystem (reliability target)

<table>
<thead>
<tr>
<th></th>
<th>False Dump</th>
<th>Blind Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIBU (channel)</td>
<td>99.9374</td>
<td>99.9997</td>
</tr>
<tr>
<td>CIBM (channel)</td>
<td>99.7156</td>
<td>99.9904</td>
</tr>
<tr>
<td>CIBFi</td>
<td>99.7780</td>
<td>99.9961</td>
</tr>
</tbody>
</table>

Table 3. Failure rate predictions for each subsystem
Types of components vs Failure Rate [FITS]

Normalized by the number of components
Components vs Failure Rate, I

**Blind Failure**

**False Dump**

![Graphs showing the comparison of Blind Failure and False Dump components vs failure rate](image-url)
Components vs Failure Rate, II

No Effect

Maintenance

Maintenance Contributors - Description

Maintenance Contributors - Part Name
Fault tree of the CIBFi
Defining reliability figures in a more readable way
CIBDS link mode
CIBG – when ready
Questions?