ATLAS PROJECT	Performance Requirements of the Signal Feedthrough Vacuum Cables		
ATLAS Project Document No.: **ATL-AE-EN-0002**	Institute Document No.:	Created: 25 Jun 1999	Page: **1 of 5**
		Modified:	Rev. No.:

LAr Signal Feedthroughs

Performance Requirements of the Signal Feedthrough Vacuum Cables

Abstract

This note outlines the electrical performance requirements of the signal feedthrough vacuum cables.

Prepared by:	Checked by:	Approved by:
M. Fincke-Keeler R. Keeler M. Lefebvre	D. Makowiecki D. Rahm S. Rescia H. Takai	J. Colas C. De La Taille V. Radeka P. Pailler D. Fournier

Distribution List

W. Bonivento, J. Colas, C. De La Taille, M. Fincke-Keeler, D. Fournier, T. Hodges, P. Imbert, R. Keeler, J. Kotcher, R. Langstaff, M. Lefebvre, D. Lissauer, D. Makowiecki, H. Oberlack, P. Pailler, M. Price, V. Radeka, D. Rahm, S. Rescia, B. Szeless, H. Takai

History of Changes

Rev. No.	Date	Pages	Description of changes

Performance Requirements of the Signal Feedthrough Vacuum Cables

The vacuum cables of the feedthrough assembly provide the connection between the cold flange and the ambient flange of the feedthrough units. The large number of readout channels per feedthrough unit of the ATLAS liquid argon calorimeters require special cables (microstriplines) that provide little heat leakage to the cryogenic system.

The intention of this note is to outline the electrical performance requirements of the feedthrough vacuum cables and to provide guidelines for measurements that can readily be performed in order to qualify a cable design as well as to provide suggestions for QA/QC measurements of vacuum cables during production.

Each vacuum cable consists out of 2 mirror-symmetric striplines. Each stripline has 32 traces, where each "trace" is comprised of a signal and a ground trace. Unless specified, the term "trace" refers to the matching pair of signal and ground traces.

The basic electrical measurements and requirements of the feedthrough vacuum cables is outlined below.

1 Measurements

1.1 R & D measurements for qualification

Measurements should be done on a set of at least 60 cables (corresponding to two feedthrough units).

- A precision measurement of the DC resistance R should be done on all signal traces.
- The impedances Z_o of all traces should be determined.
- The contact resistance between the ground contacts of the cable connector and the wall of a gold-plated pin carrier should be measured on all vacuum cable connectors. The connectors have to be fully inserted into the pin carrier.
- The cross talk to the (3) nearest neighbours (above or below, left and right) and their next to nearest neighbours should be established for all traces. The full cross talk matrix should be established on at least 20 cables. A suggested setup for cross talk measurement is shown in figure 1.

1.2 Production measurements

- A precision measurement of the DC resistance should be done on all signal traces. The most uniform cables shall be singled out to be used as calibration cables.
- The impedances of 3 arbitrary traces per stripline should be measured. (Based on the experience of the prototype measurements, the variation of the impedance within a stripline is small.)
- The cross talk to the nearest neighbours should be established for all traces. Broken ground traces can be detected by significantly enhanced cross talk in the neighbouring channels.
- The ground contact resistances in the feedthrough assembly should be tested with a multi-pulsing measurement - poor ground connections can result in a reduced transmitted amplitude if all 64 traces are pulsed simultaneously.

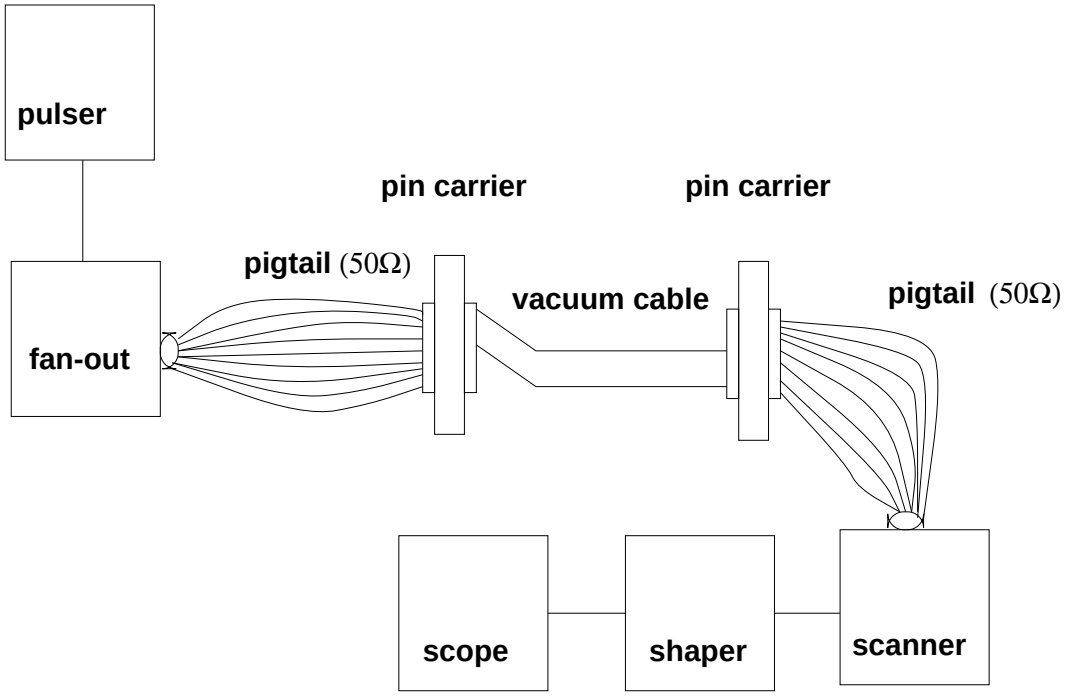

Figure 1: Suggested setup for cross talk measurement. Note that all channels should be terminated in 50 Ω.

2 Requirements

2.1 For all cables:

- There should be no broken signal or ground traces on the two striplines that make up a vacuum cable.
- The maximum peak of the cross talk between traces should to be less than 0.8% to the nearest neighbours and less than 0.2% for distant neighbours.
- The contact resistance between the ground contacts of the cable connector and the wall of a gold plated pin carrier should be less than 1 mΩ when measured with a milli-ohm meter.

2.2 For all signal cables within a given feedthrough:

- A uniformity requirement of 1% of all signal traces within a feedthrough can be translated into an absolute maximum spread of their DC resistances of
  $(R_{\max} - R_{\min}) \leq 500$ mΩ measured under ambient conditions and
  $(R_{\max} - R_{\min}) \leq 600$ mΩ measured under operating conditions.
- The value of the mean impedance $\langle Z_\circ \rangle$ of all cables within a feedthrough can be within a range of (33 ± 3) Ω. The spread in impedance around this mean value should be within $\pm 10\%$.

2.3 For all calibration cables within a given feedthrough:

- The uniformity condition of all 2×64 calibration traces within a feedthrough can be expressed as an absolute maximum spread of their DC resistances of
  $(R_{\max} - R_{\min}) \leq 70$ mΩ measured under ambient conditions, resulting in about
  $(R_{\max} - R_{\min}) \leq 120$ mΩ under operating conditions.