Change Notice

Issue 1.0	24 Feb 2009	Follows Sarah's injunction on the structure of calibration file derivation and now has proper values for all channels This note constitutes Version 0.1 release of the spectrometer JFET calibration files

Reference Documents

RD1 Detectory Summary Spreadsheet SPIRE-RAL-TN-002783 v12.1

Scope

This note describes how the spectrometer JFET relative calibration data were obtained from a set of measurements made on the flight model JFETs and DCU in October 2006. This measurement is described below and cannot be repeated. The values obtained represent our best measurement of the end-to-end gain of the system in a realistic situation. The use of the gain data is subject to discussion, in this note I give the values as obtained. I attempt to follow the format requested by Sarah Leeks in her e-mail of 18 September 2009 – *vis.*

Documentation of Calibration Product Values

For each calibration product there needs to be a procedure that says how to derive the calibration data (including what algorithm should be used and any decisions and judgements to be made to get the data values) and also a note that says how each version of data were actually made (i.e. following the procedure version x using data from OBSID yyyyy, with script version www pipeline version zzz, etc ....).

The procedure only needs to be updated if the procedure changes.
However a new version of the note must accompany each delivery of (updated) data for a calibration file.
The note should reflect the full history of the calibration file (i.e. all releases, versions, editions etc in one document) with the most recent version at the start [note we will see how practical this turns out to be].

Also scripts used to get the values should be made available (possibly placed in CVS or more likely delivered with the data and the notes).

The purpose of the documentation is three fold:

1. *To enable someone else to be able to produce updated values (in case that the original person is not available).*
2. *To enable us to review and confirm that the values are what we want to use before a changed calibration file is released for use.*
3. *Also because we must be able to tell astronomers (and ourselves) how calibration data were made.*

Measurement Set up:

Warm JFETs connected to the FM warm electronics via RAL cryoharness.

No FPU present and bias fed directly to JFET inputs through test connectors and the FM backharness.

Electronics driven through standard instrument GSE and test scripts.

Measurements were taken as "standard loadcurves" (ILT_PERF_DAB_S) with fixed phase

Three bias frequencies were used namely 80, 160 and 241 Hz

At each frequency the phase was optimised:

80.046107 Hz	both phases set to 180.70528
160.09221 Hz	SSW phase 180.70528 SLW Phase 179.29352
241.12654 Hz	both phases set to 180.70528

Datasets used:
The data were exported into FITS format from the database *PFM4_TEST* using the "Export" tool (*which version?*). The detector data were exported in raw format and the Housekeeping were converted using *err which version*[1] of the calibration. Three files are available for each frequency with the suffix SPECF (DCU full spectrometer frame), SPECOFF (spectrometer offset frame) and NHK (nominal housekeeping frame). The following suffixes are used for the three frequency measurements. All data files are available through the Test Team website.

80 Hz	ILT_PERF_DAB_S_SinglePhase_300000FB_
160 Hz	ILT_PERF_DAB_S_SinglePhase_300000FC_
240 Hz	ILT_PERF_DAB_S_SinglePhase_300000FD_

Data Reduction:
Briefly: Bias converted to rms by dividing converted housekeeping values by sqrt(2). Gains applied as per DCU design description. No phase correction applied. Residual gain derived by first order (only) fit to data before saturation and extracting slope. See figure 1 for an example.

The data were reduced using IDL routines. The results are given in the tables in the appendix.

Conclusions
Basically the results are as expected for the JFET gain – nominal ~0.96 – with some small variation from membrane to membrane and channel to channel. There is a slight, no more than 2-3%, overall gain variation with frequency. This is possibly due to one of the following causes: the phase not being set absolutely precisely for each frequency; a variation in the gain of the JFETs with frequency or a variation in the bias output with frequency. It is hard to tell which is the culprit. We can take the measured values per channel as relative channel to channel gain variation. We can either normalise them or use them directly as the JFET gain – especially if the bias frequency is selected to be one of those where the measurement was made.

[1] As the knowledge of what calibration and software version has been lost – I will redo the FITS derivation with the latest versions and report these in an update to this note.

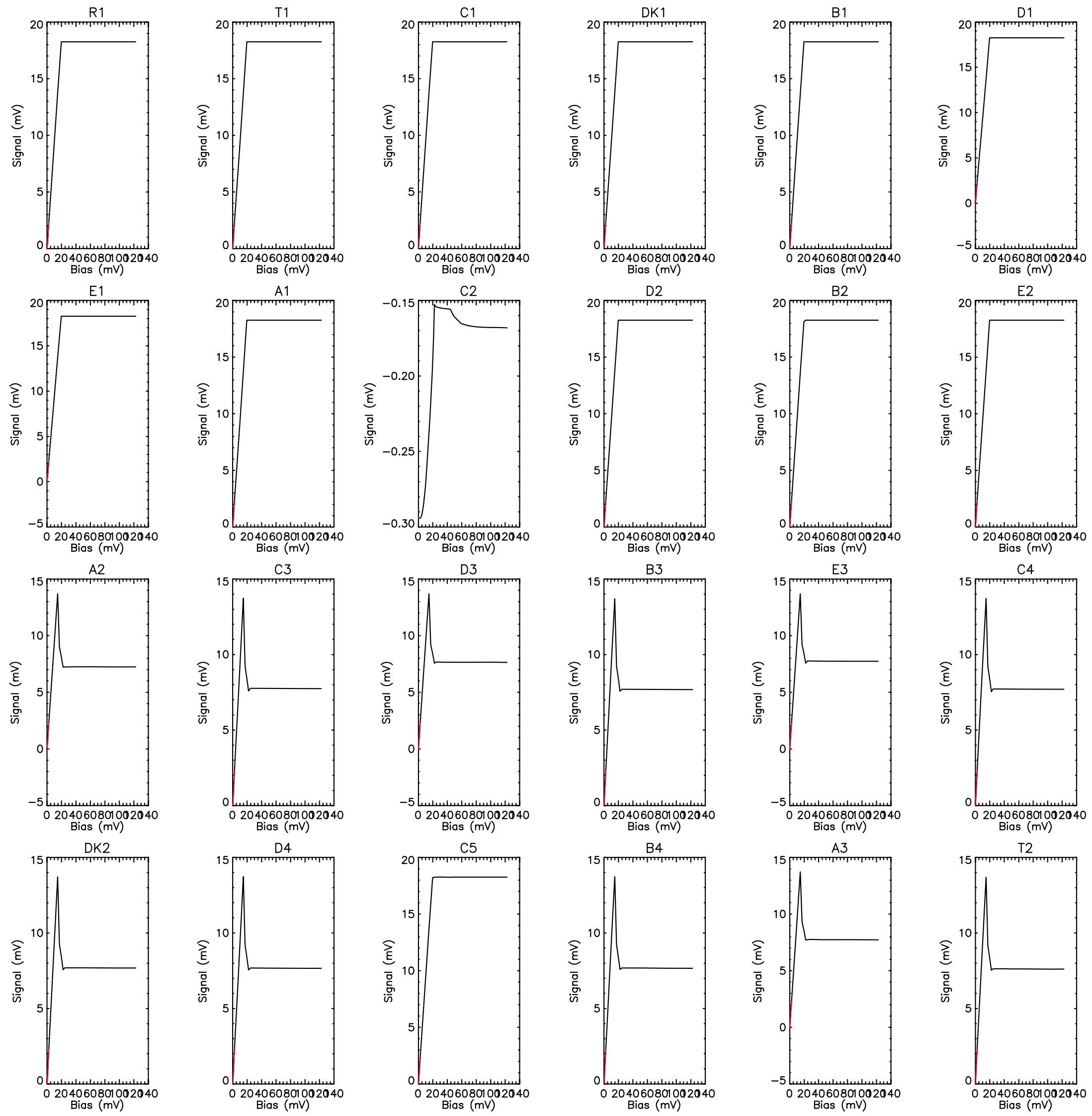

Figure 1: Example of slope fitting for gain determination. This is for SLW. The black line is the measured voltage versus applied bias after gain correction and addition of offsets; the red line is a first order fit to the data. The slope of the fit is taken as the residual gain.

Appendix: Residual Channel Gains after LIA Gains Are Applied

SLW

Channel	80Hz	160Hz	240 Hz	
R1	0.925557	0.969421	0.967215	
T1	0.924769	0.968814	0.966481	
C1	0.924689	0.968967	0.966649	
DK1	0.923284	0.967182	0.964572	
B1	0.924717	0.968715	0.966518	
D1	0.923312	0.967019	0.964220	
E1	0.924481	0.967029	0.964179	
A1	0.924455	0.969438	0.967116	
C2	0.924	0.968	0.965	**Inoperable channel All values interpolated**
D2	0.925915	0.968810	0.966379	
B2	0.923080	0.965399	0.964045	
E2	0.926149	0.969509	0.967116	
A2	0.923707	0.967010	0.964497	

C3	0.925141	0.969452	0.967292
D3	0.922973	0.966752	0.964326
B3	0.923469	0.967136	0.964689
E3	0.924608	0.967049	0.964443
C4	0.923877	0.968994	0.966771
DK2	0.924613	0.969287	0.967133
D4	0.926795	0.969575	0.966841
C5	0.924369	0.966935	0.964286
B4	0.926003	0.969595	0.967271
A3	0.925526	0.969589	0.967395
T2	0.923575	0.967410	0.964958

SSW

Channel	80 Hz	160 Hz	240 Hz	
R1	0.927784	0.966656	0.960939	
A4	0.928365	0.967052	0.961355	
A3	0.920761	0.960958	0.956440	
A2	0.927492	0.966977	0.961399	
A1	0.925148	0.966246	0.961025	
DK1	0.926165	0.966134	0.960635	
B3	0.921702	0.960801	0.955700	
B2	0.926116	0.965727	0.960529	
B1	0.927049	0.966622	0.961036	
C3	0.925868	0.966589	0.961382	
C2	0.926006	0.966611	0.961192	
C1	0.925651	0.966588	0.961435	
D3	0.926367	0.966960	0.961702	
D2	0.926922	0.966187	0.960464	
D1	0.925225	0.964819	0.959760	
E3	0.926572	0.966087	0.960533	
E2	0.926034	0.966252	0.960905	
E1	0.926931	0.966553	0.961043	
F3	0.925959	0.966163	0.960563	
F2	0.917103	0.956321	0.951947	
F1	0.926051	0.966000	0.960627	
G1	0.925888	0.966227	0.960824	
T1	0.906353	0.944595	0.941232	
G2	0.902226	0.939484	0.936542	
E5	0.926504	0.965506	0.960003	
E4	0.921128	0.961355	0.956783	
D7	0.921	0.960	0.956	**Inoperable channel All values interpolated**
D6	0.921003	0.960370	0.955959	
D5	0.924149	0.962957	0.958990	
D4	0.923061	0.961996	0.957268	
C6	0.925587	0.965616	0.960595	
C5	0.925768	0.964981	0.959607	
C4	0.925368	0.965040	0.960082	
B5	0.924298	0.964331	0.959443	
B4	0.926440	0.964868	0.959595	
T2	0.924520	0.965190	0.960072	
G3	0.925965	0.965484	0.960130	
G4	0.900343	0.932831	0.931258	
DK2	0.924061	0.964353	0.959243	
F5	0.925691	0.965167	0.959877	
F4	0.923672	0.962758	0.957230	
E6	0.926397	0.965049	0.959631	