(VIEWGRAPHS) SPIRE/RAL/M/0055.1C

SPIRE Consortium Meeting
Coseners House, Abingdon 1,2 December 1998
Provisional agenda

Item	Time	1st December, Morning: Plenary session Chairman: Griffin	Presenters
1	09.00	Introduction and logistics	King
2	09.15	Agree agenda	
3	09.30	Statements	
4	09.45	Status of FIRST and SPIRE	Griffin
5	10.15	SPIRE scientific requirements	Gear, Baluteau
6	11.00	Status and outline of SPIRE instrument design	Swinyard
7	11.45	Overall schedule and work breakdown structure	King
8	12.15	Management of the project: - Project teams - Interface control - Documentation and reporting - Institute managers and responsibilities	King
	13.00	Lunch	
		1st December, Afternoon: Plenary session Chairman: Swinyard	
9	14.00	Report from Systems Team: - FPU - Electronics - Technical meetings with ESA	 Cunningham Rodriguez Swinyard
10	15.00	Overview of detector array test programme	Hargrave
11	15.30	SPIRE performance modelling	Vigroux
12	16.00-16.30	Schedule and planning of activities for the SPIRE Preliminary and Critical Design Reviews, CQM and AVM manufacture, and AIV.	King
		End of Day 1 ☺..... Except for the SPIRE Steering Group ☹	
	17.00-18.30	SPIRE Steering Group meeting (Chairman: Griffin)	
		2nd December: Morning: Splinter meetings	Chairmen
13	09.00-10.30	Institute Managers' meeting	King
14	09.00-10.30	Scientific priorities and requirements	Gear
15	11.00-12.30	ICC organisation and activities - Set up GS group - Rewriting of SIP – Steering Group mtg. Needed - FINDAS development - Commonality working groups - Simulations: operating modes etc./ SJU to coord. - Support and planning of ICC development	King
16	11.00-12.30	Structure	Swinyard
	12.30	Lunch	
		2nd December: Afternoon: Splinter meetings	Chairmen
17	13.30-15.00	Warm electronics and on-board software requirements + Instrument simulator	Cara
18	13.30-14.30	Detector array programme	Hargrave
19	14.30-16.00	SPIRE performance modelling	Vigroux
20	14.00-16.00	Optics and FTS	Swinyard
		Plenary session: Chairman: Vigroux	Presenters
20	16.00	Reports from splinters	Chairmen
21	17.00	Summary of actions	King
22	17.15	Summary of meeting	Griffin
	17.30	Meeting ends	

- ESA Commonality working groups:
  - SPIRE participating

- FPU hardware commonality:
  - FPU hardware commonality workshop between FIRST/SPIRE/HIFI planned for next Spring

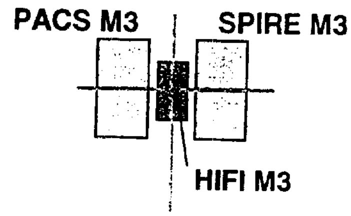
- SPIRE working groups:
  - Systems Team
  - Detector Arrays
  - FTS/Optics
  - Structure and Internal Layout
  - Electronics and On-Board Software
  - Simulations
  - Ground Segment (to be established)

- SPIRE funding and schedule status:
  - CNES profile problem
  - UK overall amount problem
  - Others: OK generally
  - Some uncertain workpackages (EGSE; need for shutter?; baffles)
  - Detailed ICC development plan not yet defined
  - Baseline schedule involves SPIRE PDR in July 1999

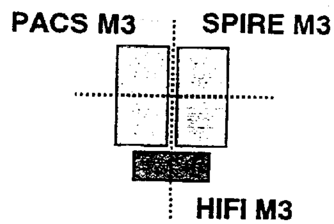
- SPIRE critical technical areas:
  - Detector development and selection
  - Instrument structure design

FIRST focal plane sharing

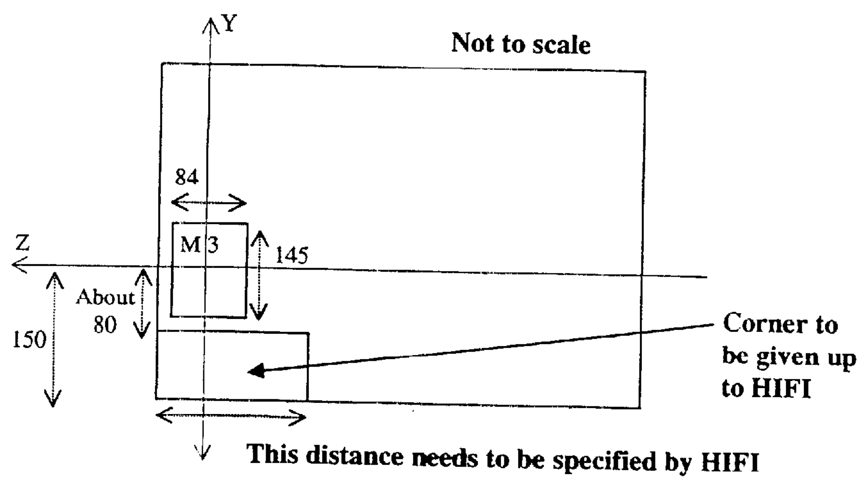
Current arrangement:



Proposed arrangement:



Modifications to SPIRE enclosure:



5. SPIRE SCIENTIFIC REQUIREMENTS

W. GEAR
J.P BALUTEAU

SPIRE SCIENCE REQUIREMENTS

Consortium meeting Dec 1/2 1998

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WHAT ARE SCIENCE REQUIREMENTS ?

Science requirements are NOT the same as Scientific goals

They are requirements on the instrument specification derived FROM the Scientific goals

SPIRE CONSORTIUM MEETING

at COSENER'S HOUSE 1-2 DEC. '98

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4. STATUS OF FIRST AND SPIRE

M. GRIFFIN

Main aims of this meeting

- Bring the consortium up to date on recent activities and current status

- Clarify:
  - Management Plan
  - Work Breakdown Structure
  - Reporting mechanisms
  - Schedule
  - Funding status

- Review scientific priorities and their impact on detailed instrument design

- Define priority work for next year and leading up to PDR, CDR, AVM/CQM manufacture

Status of FIRST

- Carrier is preferred option of the ESA SPC
- Telescope size: 3.5-m = baseline; 3.8-m being studied
- Revision of focal plane sharing – SPIRE may move closer to the centre
- Use of X-band transponders likely ⇒ available data rate should go up by a factor of ~ 4.
- Mission confirmation by SPC planned for Feb. 1999. For the payload, the main criteria are:
    - Technical status of the instruments
    - Consortia management structures
    - Response to FSEC recommendations
    - Funding and schedule status
- Funding problems generally in Europe ⇒ problems with the schedule
- Actions on Instrument teams from Oct. 21 Payload Funding meeting to determine:

    (i) what can be done within available funding limits and profiles

    (ii) what additional resources would be needed to meet the current schedule
- The FIRST Science Team will meet for first time on Dec. 18

Status of SPIRE

- FSEC recommendations:
  - **SPIRE has responded positively**

- Detector array programme:
  - **Experimental evaluation in 1999**
  - **Development/test schedule is very tight**
  - **Selection in Jan 2000 will be based on:**
    - **Experimental results**
    - **Detailed simulations of survey observations**
    - **Detailed system designs**
  - **Informal review in January with external experts**

- FTS study:
  - **Decision planned for January**

- Focal plane sharing:
  - **Alternative layout of focal plane being considered, with PACS and SPIRE closer to the centre**
    - ⇒ **Improved image quality**
    - ⇒ **Simpler optical design ?**
  - **New focal plane sharing scheme being drawn up by HIFI for circulation to PACS and SPIRE and joint proposal to ESA.**

- Photometer optical design:
  - **Needs optimisation for image quality and throughput.**
  - **On hold pending focal plane sharing outcome**

- SPIRE Systems Team:
  - **Active in progressing instrument design, budgets, interface definition and control**

- Meetings with ESA:
  - **Meetings in July and November on technical and management issues**

- Management structure:
  - Management Plan circulated.
  - Will be updated based on internal and ESA comments
  - Meeting on management issues with ESA on Dec. 16

- Simulations if SPIRE observations:
  - **Work started on end-to-end modelling of sky, telescope/ instrument/observing modes, data reduction.**
  - **Initial aims: use to inform detector array choice.**
  - **Ultimate aims: instrument sensitivity prediction and time estimation, optimisation of observing modes and survey strategy.**

- Science Requirements Document:
  - **Draft is now available**

Science Requirements

- Angular resolution IS a science requirement
- Optical design is NOT

- Mapping speed IS a science requirement
- Detector array type is NOT

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Project Scientists

- Jean-Paul Baluteau - LAS, Marseille (Baluteau@astrsp-mrs.fr)
- Walter Gear - MSSL, University College London (wkpg@mssl.ucl.ac.uk)

Project Scientists

- The job of the Project Scientists is to protect the the Science Goals by ensuring the Science Requirements are met.

- It is also to protect technologists and scientists from each other !!

Science Requirements

- We should NEVER be afraid to push the instrument technologists HARD if we believe the scientific gain is worthwhile !!

- They can only say NO !!

SPIRE SCIENCE GOALS

- SURVEYS ARE HIGHEST PRIORITY
- Extragalactic - how and when did galaxies form ?
- Galactic - how do stars form ?

SURVEY FOLLOW-UP

- The spectrophotometric follow-up of sources discovered in the surveys form the next highest priority science goal

- This may be of individual objects of several in a single field.

Observations of known sources

- Studies of previously known sources will also be an important part of the SPIRE science programme

- These observations will be both imaging and spectrophotometry of individual and extended sources.

10/

- Science Requirements Document has been circulated
- There is a 90-minute splinter discussion group scheduled for tomorrow morning

6. STATUS AND OUTLINE OF SPIRE INSTRUMENT DESIGN

B. SWINYARD

SPIRE INSTRUMENT DESIGN

Activities Since AO Response

- Response to the FSEC recommendations:
  - R>100 (but not necessary to very much higher)
  - Look at combining Photometer and Spectrometer
  - Look at recovery of 50% loss in spectrometer
  - Worries about the data rate
- Consolidation of the FTS design
  - consolidation of optical design
  - intensity beam splitter option
- Review of the structural design concept
- Review of the photometer optical design
- Consolidation of the detector array options.

SPIRE INSTRUMENT DESIGN

Response to the FSEC

- R~100 – our reply is “o.k. but we’ed still like to go higher if there is no cost”. Baseline instrument has R=500 at 250 μm with a goal of 1000

- Combine photometer and spectrometer – NO!

- Recovery of 50% loss. We are actively looking at an FTS design that employs broad band intensity beam splitters.

- Data rate. We have carried out a study into the requirements for decimation of the interferograms. This appears to be within the capabilities of the SPU. However, we have not carried the same level of study into how we remove glitches before co-addition.

  ESA have since given a strong hint that FIRST will have x-band transponders. However, ESOC may still not be able to cope with the data rate.

SPIRE INSTRUMENT DESIGN

Design Teams

- We have formalised the *ad hoc* groups that were concerned with the instrument design into the following design teams:

  Systems Team – Chair: Louis Rodriguez
  (Colin Cunningham is FPU systems engineer)
  Remit is to set up and monitor the ICDs; take an overview of the instrument design; define and write the systems requirements etc etc.....

  Detector Arrays – Chair: Matt Griffin
  Remit is to monitor the activities of the detector array groups; advise on the trade-offs between the different array options; set up the detector selection process etc....

SPIRE INSTRUMENT DESIGN

Simulations – Chair: Laurent Vigroux

Set up to look at the intricate problems associated with the use of different array types in the context of confusion limited surveys. The remit has since widened to include the FTS response.

FTS/Optics – Chair: Bruce Swinyard

Remit is to design the FTS and instrument optics – this includes setting up studies into various aspects of performance.

Structure and Internal Layout – Chair: Alan Smith (MSSL)

Remit is to design the opto-mechanical system that will hold the instrument optics; detectors and mechanisms; control the straylight; allow the instrument to be built; tested and operated within the budgets set by the system team.

SPIRE INSTRUMENT DESIGN

Electronics and On-Board Software – Chair: Christophe Cara

Remit is to design the "warm" electronics system and specify the requirements for the on-board software – not really started yet.

Ground Segment (to be established)

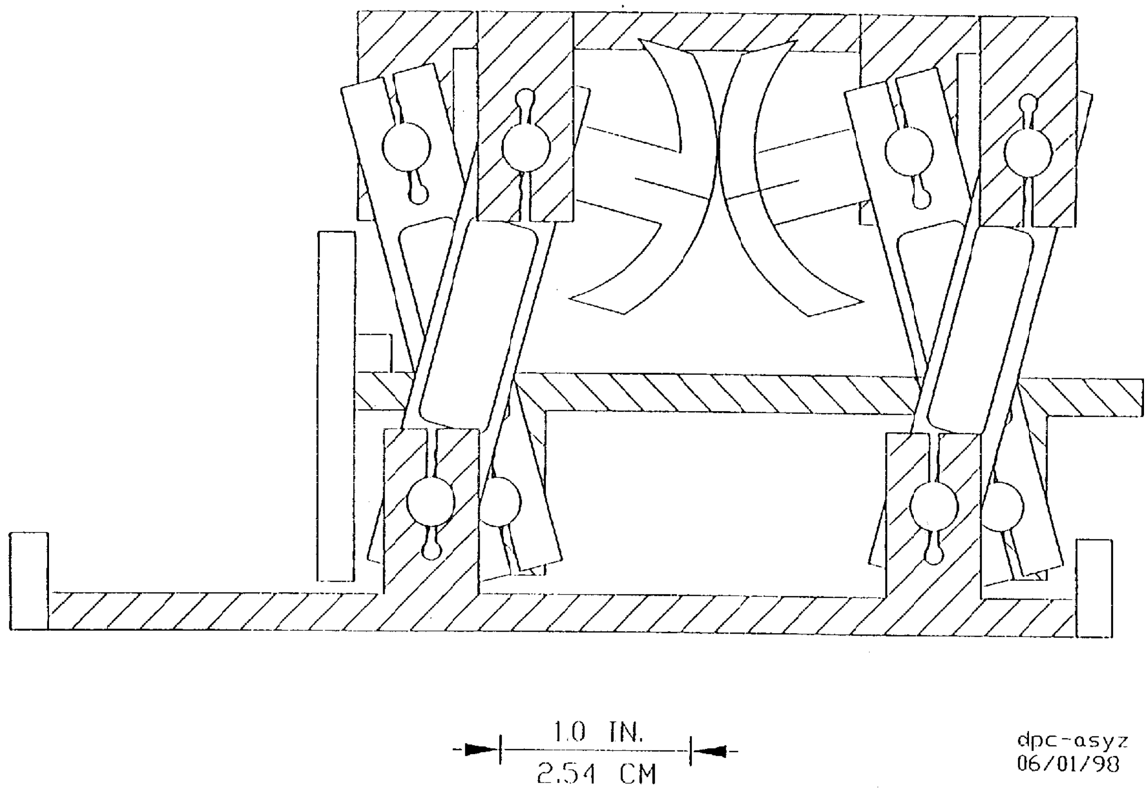
Remit will be to look at the end-to-end design of the ground segment.

- These groups form the basis for the reporting to the systems team on design progress and issues for discussion at a "higher" level.
- Some of them will disappear as the design progresses and we move into Phase C/D.
- New groups will be needed for the later phases – specifically AIV and Calibration and possibly Flight Operations.

SPIRE INSTRUMENT DESIGN

FTS Design

- Swinging arm concept has been dropped so that the GSFC design for the mirror mechanism can be used for either the baseline MP or for the dual-beam intensity splitting FTS.
- Optical feed to from the intermediate focal plane has been designed in geometrical optics.
- Outstanding issues remain for the design associated with the measurement accuracy required for the mirror mechanism; whether the intensity beam splitters will work; the need, or otherwise, for a "Gaussian beam" approach to the feed optics; will two feed horn arrays be sufficient to give efficient wavelength coverage etc etc.....



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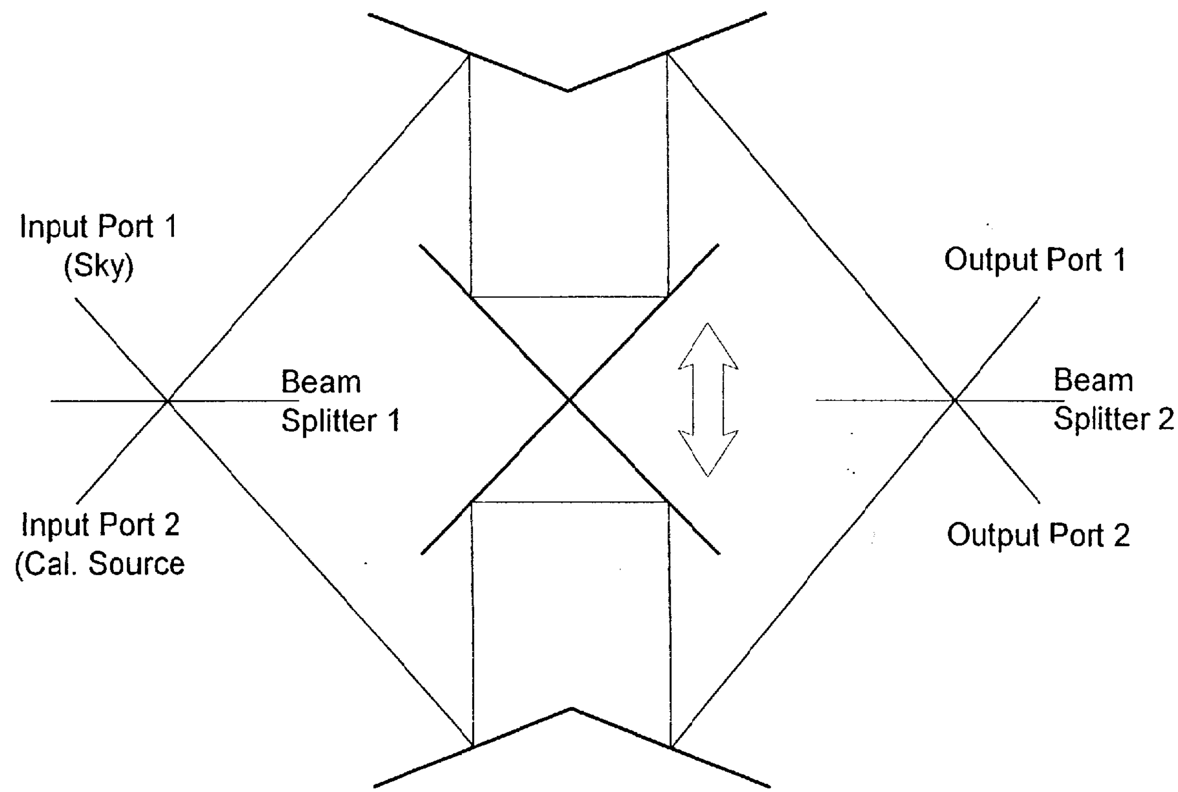
SPIRE INSTRUMENT DESIGN



SPIRE INSTRUMENT DESIGN

Structural Design Concept

- **ESA are clearly concerned to keep the mass of the focal plane instruments within the original limits. The mass of the three focal plane instruments proposed for the AO response was ~100 kg cf. 75 kg in the Phase A study.**

- **The starting point for the first conceptual layout for the instrument was with load bearing walls holding the optics and mechanisms. A layout done on this basis gave a mass of ~40-45 kg for SPIRE.**

- **A round robin series of discussion has lead to an updated concept with plates hold the optics and mechanisms and light-weight covers to control the straylight. A very preliminary look at the mass of such a scheme shows it could be done for ~30 kg.**

- The major outstanding issue for this concept is –
  WILL IT WORK!?

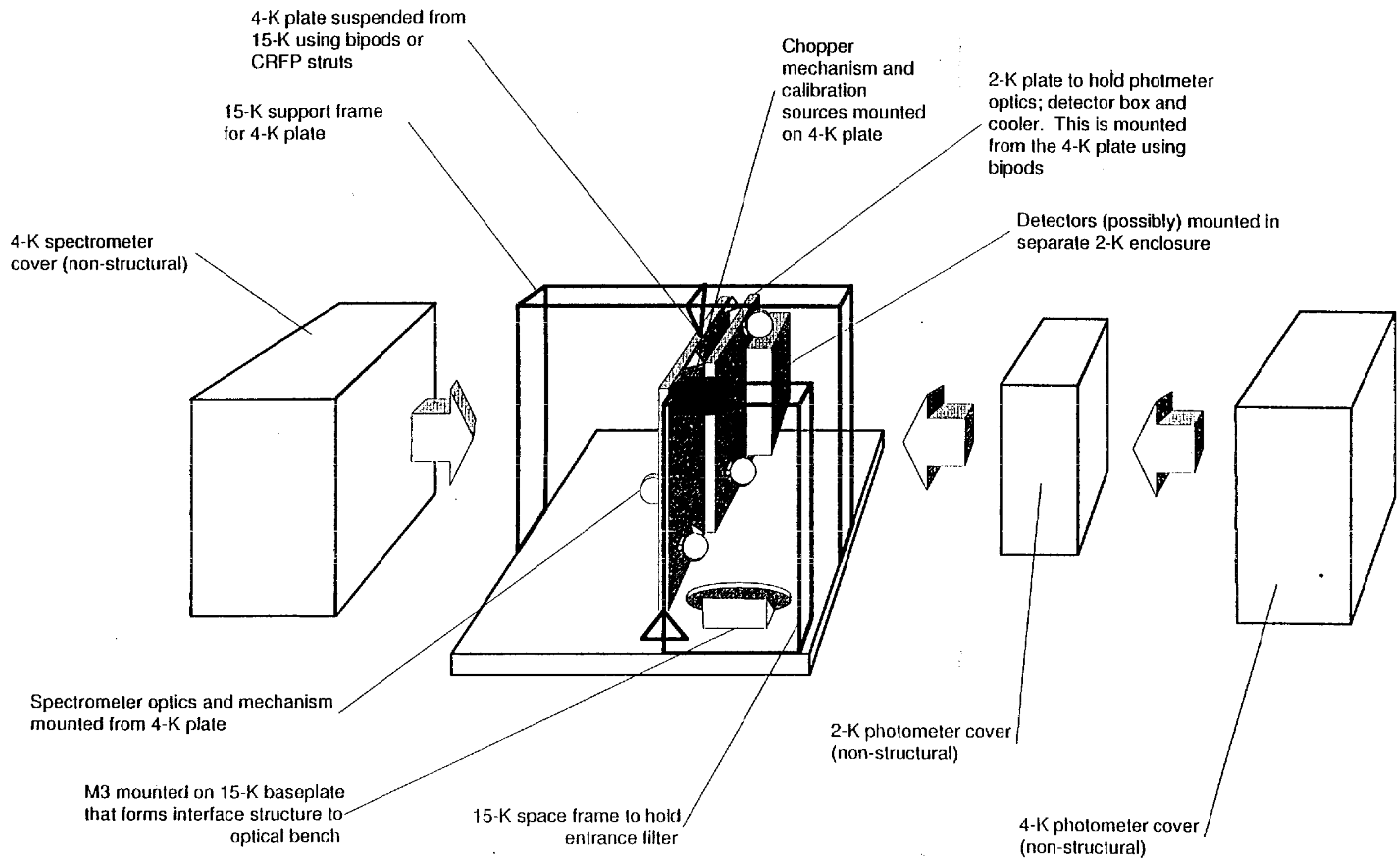


Figure 1: Conceptual layout for the SPIRE structure based on non structural covers (15-K cover not shown)

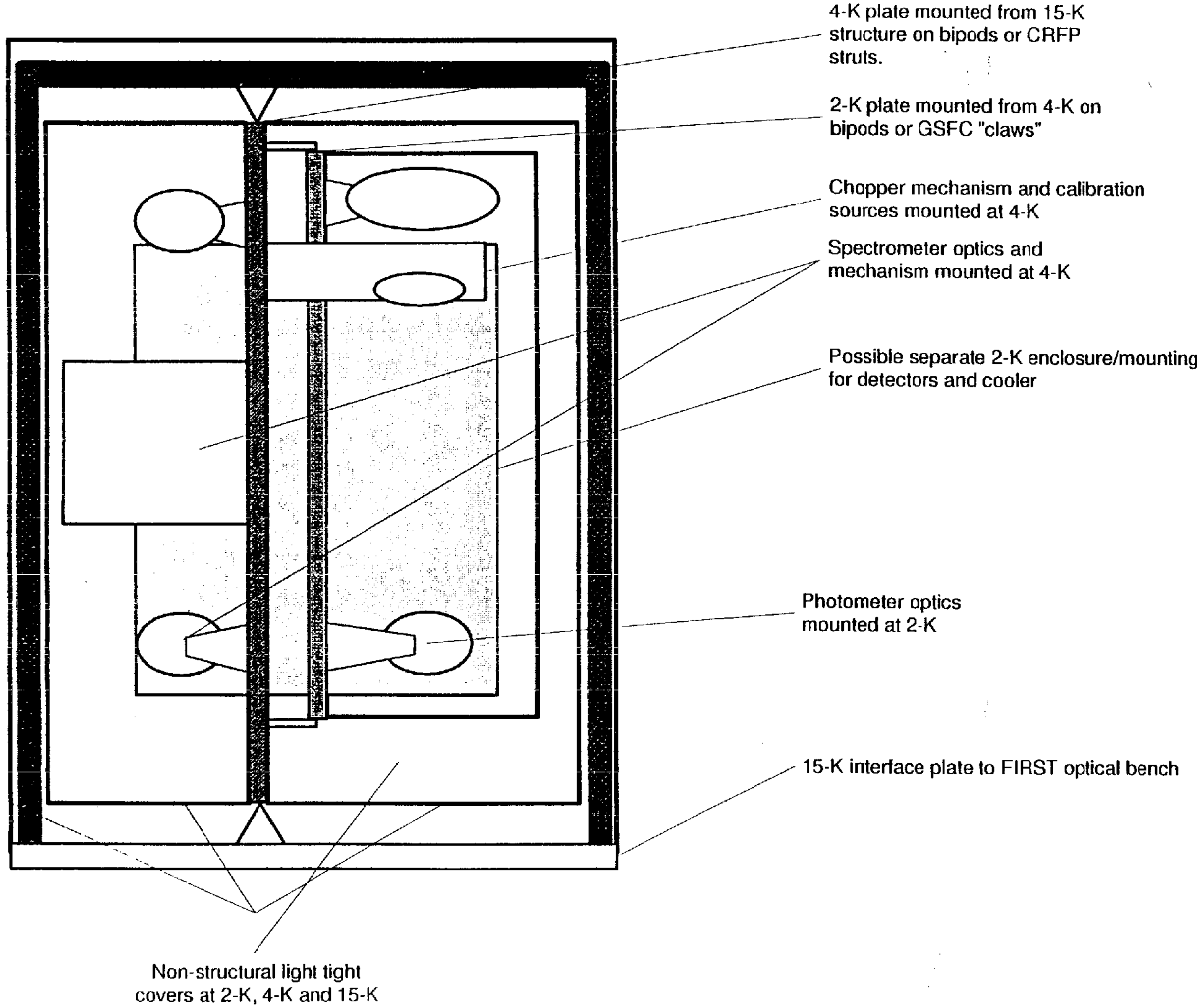


Figure 2: End on view of conceptual layout for SPIRE structure

SPIRE INSTRUMENT DESIGN

Photometer Optical Design

- The AO design had a problem with the control of the pupil aberrations. The cold stop would have to be under sized leading to a significant loss in throughput.

- The pupil aberration can be alleviated to some extent within the existing design by using more complex optical surfaces. However it is also difficult to keep the image quality good over the whole FOV.

- Kjetil has proposed a new design with a separate re-imaging camera for each wavelength band. This gives much better image quality and pupil aberration is negligible. However the final focal ratio changes with position in the FOV.

- The real problem is the highly curved telescope focal plane. IF we could move into the centre then many of the problems would go away.

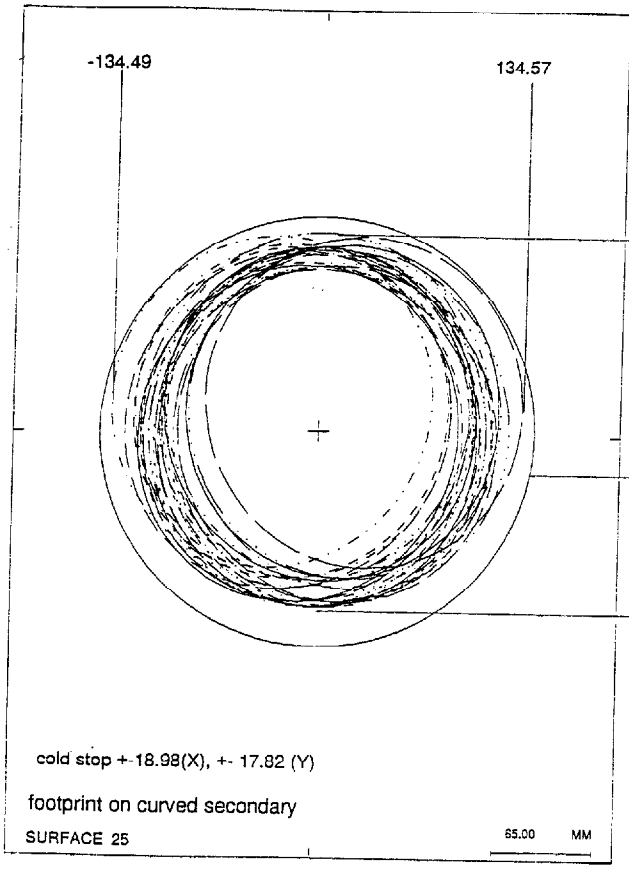


Figure 8 SPIRE FOV footprint on telescope secondary mirror

Figure 8 shows that the present dimension chosen for the cold stop gives no margin at the secondary for SPIRE misalignment tolerances or diffraction effects, so the size given in table 4 and used hereafter is an absolute maximum size permitted.

Table 4 Dimension of an elliptical cold stop used in SPIRE footprint analyses

Dimension	full axis length,mm
X	18.98
Y	17.82

After having set up the cold stop in the CODEV model to have the dimensions shown in table 4, the composite FOV beam was tracked through the optical system and its footprint

SPIRE INSTRUMENT DESIGN

Detector Arrays

- Four and half options now consolidated to just three:
  - Feedhorn Option: Spider-web bolometers with NTD Ge thermistors and JFET amplifiers placed within the FPU and no multiplexers. (JPL/Caltech/GSFC).
  - TES Option: Pop-up silicon absorbers with TES thermistors readout out with highly integrated cold SQUID sensors; amplifiers and multiplexers all placed at 2 K. (GSFC/NIST Boulder/Caltech/JPL)
  - CEA Option: Silicon resonant absorber arrays with high impedance Si thermometer bridge readouts with CMOS amplifiers and multiplexers at 2 K.
- All options use 300-mK ^{3}He fridge.

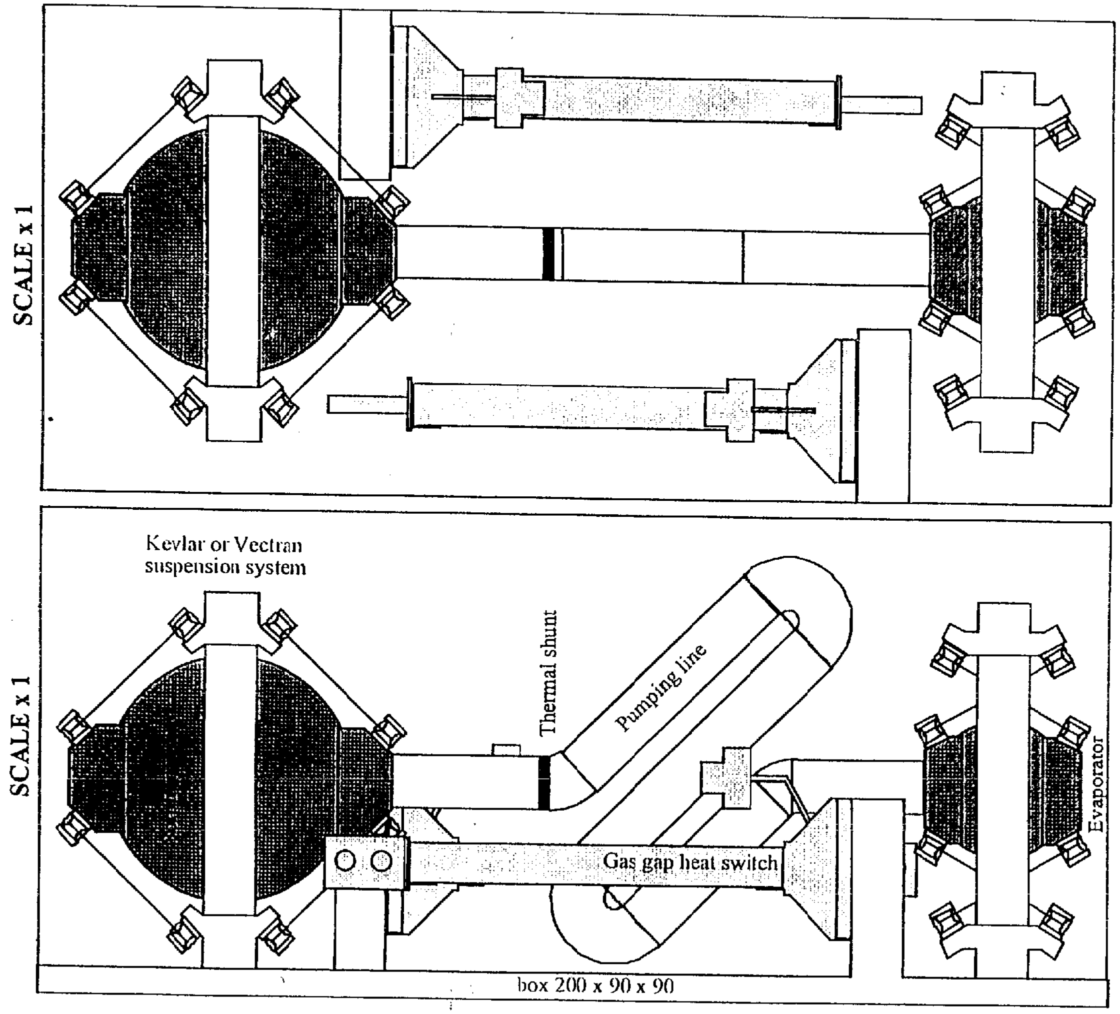
SPIRE INSTRUMENT DESIGN

Detectors ctd....

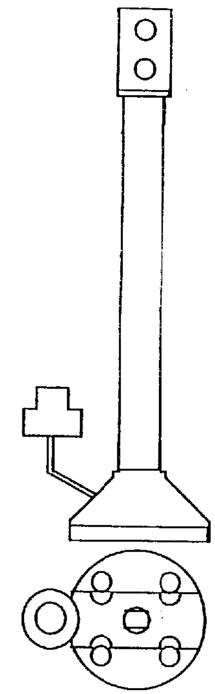
- Progress made on all three options and on test programme:
    - JFET box is pretty well defined – all power to be dumped into 15-K stage; modular construction allows for addition/subtraction of channels.
    - CEA have built test versions of the arrays and defined the final configuration of the array/CMOS layout.
    - SQUID multiplexers have been tested on their own – will be (have been?) linked to TES thermistors soon.
- LOTS of issues remain! Regular meetings of the detector group monitor the goings on – next meeting is January. Decision in December 1999.

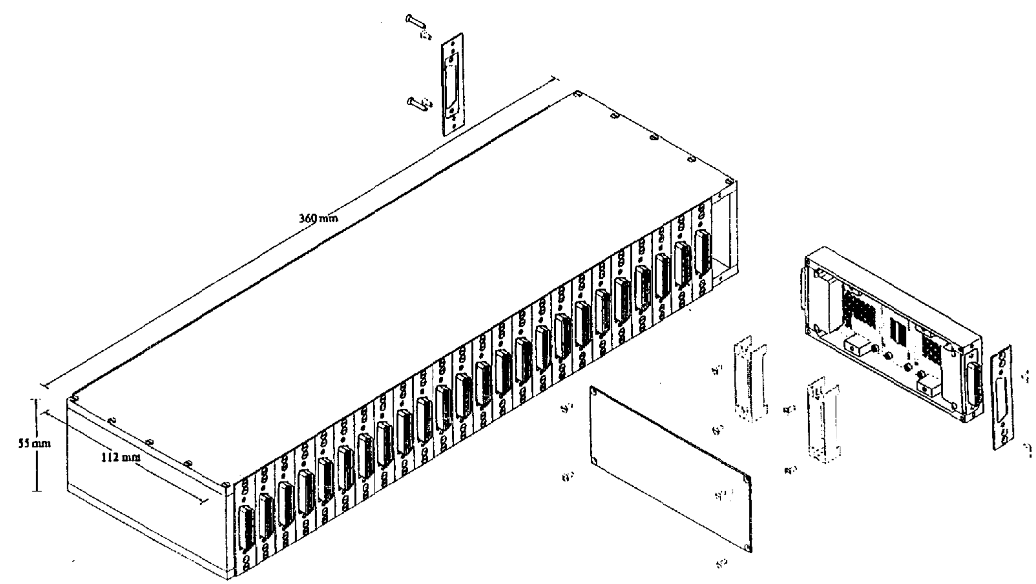
SPIRE 3HE COOLER

WARNING:
- This is an "artist" view of a possible arrangement
- No detail calculations have been performed on the support structure



November 7th, 1997 - Lionel Duband CEA - SBT





Low-Power Si JFETs
Twenty Five, 25 Channel Modules

7. OVERALL SCHEDULE AND WORK BREAKDOWN STRUCTURE

8. MANAGEMENT OF THE PROJECT

K. KING

Planning SPIRE Development

Currently development is based on results of informal discussions and agreements on:

- the major products (instrument models),
- a basic design and method for assembly and testing
- the areas of work assigned to each institute,
- an approximate schedule.

Now is the time to put these agreements on a more formal footing.

a) To make sure that everyone is aware of, and agrees, exactly what is required from them, and when, and how this is to be achieved.

b) To satisfy ESA that we are able to build the instrument to schedule and that we will be ready and able to operate it.

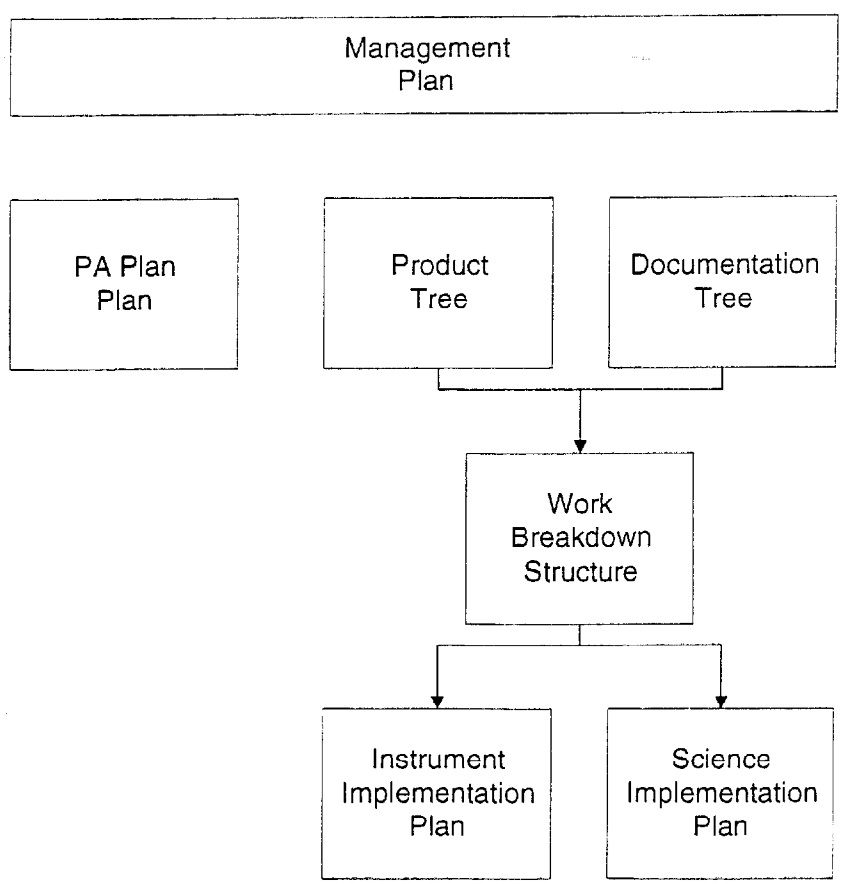
We can do this by:

- completeing and documenting our current plans,
- getting 'formal agreement' to them by each institute and country (do we need MOUs?),
- putting into place controls to ensure that the plans are followed (and as necessary, updated to take account of new circumstances).

We need to do this before the 'Payload Confirmation' meeting of the ESA SPC (February 1999).

What do we need to provide, and what stage are we at?

SPIRE Development Planning



SPIRE Development Plans - Status

Management Plan

- First Draft was issued (to all Co-Is and PMs) at end of October, for comments.
- Several groups have provided useful comments, including the ESA project group. These will be incorporated into the plan for the second draft (the SPIRE Steering Group will be discussing some of these areas at today's meeting)
- Draft 2 will be issued by 11th December.

Product Tree

- First draft is under discussion internally at the moment.
- Draft 2 will be issued by 11th December for detailed review by the consortium.

Documentation Tree

- First Draft is under discussion internally at the moment.
- Draft 2 will be issued by 11th December for detailed review by the consortium.

Work Breakdown Structure

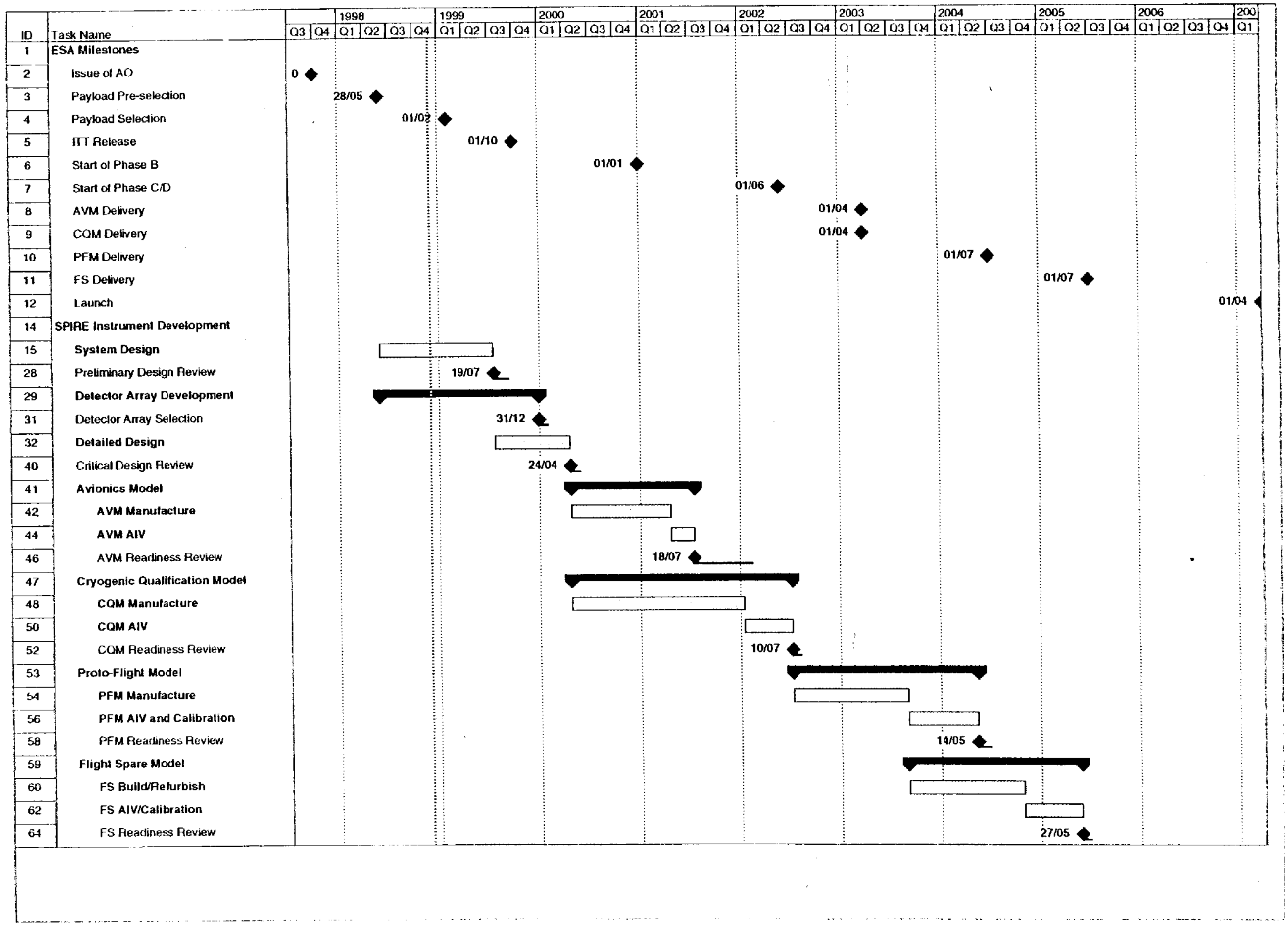
- First Draft was produced in the ESA proposed format at end of October. This was discussed at the last ESA/SPIRE technical meeting.
- Draft 2 will be issued by 11th December for detailed review by the consortium.

Instrument Implementation Plan

- Plan has still to be produced. ESA have provided the Planck LFI Instrument Development Plan as a template for us to use. Most of the information is already available in SPIRE notes.
- A first draft is due by the 15th December.

Science Implementation Plan

- A first draft was provided in the response to the AO. This needs to be revised and updated.
- ESA are planning to start working with the instrument groups on the definition of the Ground Segment early next year.
- We propose to set up a SPIRE Working Group to define the SPIRE ICC and its implementation (see splinter session at this meeting) .



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Task Name
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Q1 Q2 Q3 Q4
1 ESA Milestones
2 Issue of AO
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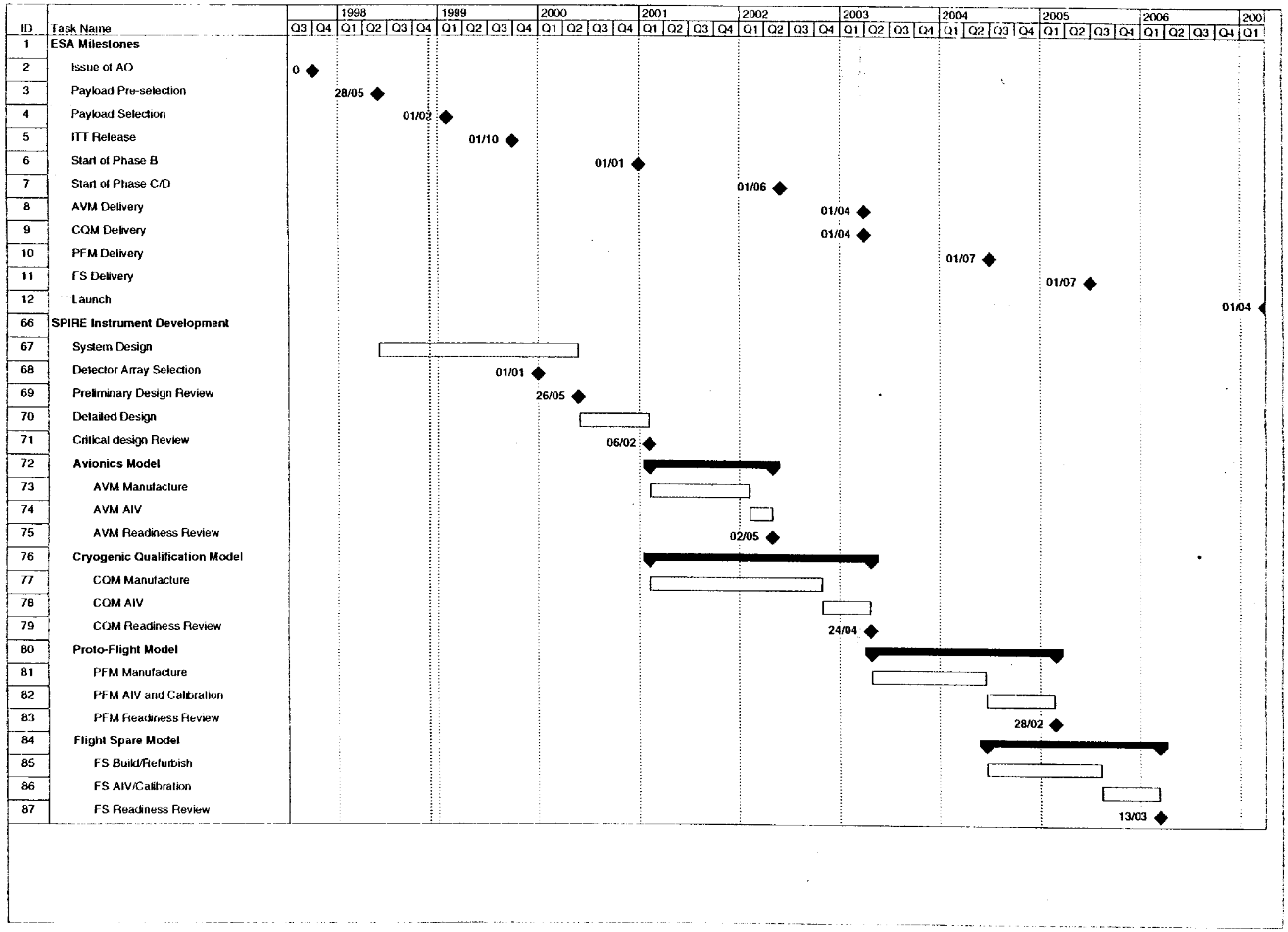
3 Payload Pre-selection
28/05
4 Payload Selection
01/02
5 ITT Release
01/10
6 Start of Phase B
01/01
7 Start of Phase C/D
01/06
8 AVM Delivery
01/04
9 CQM Delivery
01/04
10 PFM Delivery
01/07
11 FS Delivery
01/07
12 Launch
01/04
14 SPIRE Instrument Development
15 System Design
28 Preliminary Design Review
19/07
29 Detector Array Development
31 Detector Array Selection
31/12
32 Detailed Design
40 Critical Design Review
24/04
41 Avionics Model
42 AVM Manufacture
44 AVM AIV
46 AVM Readiness Review
18/07
47 Cryogenic Qualification Model
48 CQM Manufacture
50 CQM AIV
52 CQM Readiness Review
10/07
53 Proto-Flight Model
54 PFM Manufacture
56 PFM AIV and Calibration
58 PFM Readiness Review
14/05
59 Flight Spare Model
60 FS Build/Refurbish
62 FS AIV/Calibration
64 FS Readiness Review
27/05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1998
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79 CQM Readiness Review
80 Proto-Flight Model
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82 PFM AIV and Calibration
83 PFM Readiness Review
84 Flight Spare Model
85 FS Build/Refurbish
86 FS AIV/Calibration
87 FS Readiness Review
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26/05
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13/03

3. Product Tree

3.1 Instrument Items

ID	Product Item	Other Units	AVM	CQM	PFM	FS	Description
Cold FPU (FSFPU)							
FPU_11	Structure			MSSL	MSSL	MSSL	'15K', '4K' and '2K' boxes; Thermal Straps ; Structure Thermistors; MGSE required to mount the structure on the satellite and AIV facilities; Transport Container
FPU_21	Optics			LAS	LAS	LAS	Photometer mirrors and their mounts; Spectrometer mirrors and their mounts; Optical baffling; Baffle mounts; MGSE to install mirrors, baffles onto the structure
FPU_22	Filters			QMW	QMW	QMW	Passband filters; Fore-optics filters; Dichroics; Polarising Grids; Filter, Grids and Dichroics mounts (excluding detector filters); MGSE to install Filters, Grids and Dichroics
FPU_31	Baffles			TBD	TBD	TBD	Photometer Baffles Spectrometer Baffles MGSE to install them
FPU_41	Photometer Arrays			GSFC JPL SAp	GSFC JPL SAp	GSFC JPL SAp	Photometer Bolometer arrays (3); Feed Optics; Cold readout electronics; Focal plane structure (including filter mounts and thermal strap); Cold harness and connector(s); MGSE to install Arrays; EGSE to test Arrays
FPU_42	Spectrometer Arrays			GSFC JPL SAp	GSFC JPL SAp	GSFC JPL SAp	Spectrometer Bolometer arrays (2); Feed Optics; Cold readout electronics; Focal plane structure (including

ID	Product Item	Other Units	AVM	CQM	PFM	FS	Description
							filter mounts and thermal strap); Cold harness and connector(s); MGSE to install Arrays; EGSE to test Arrays
FPU_51	Cooler			Grenoble	Grenoble	Grenoble	^{3}He Cooler Unit; Cooler cold harness and connectors; Mechanical interface structure; Cold finger interface structure; MGSE to install Cooler; EGSE to test Cooler
FPU_61	Chopper			ATC	ATC	ATC	Chopper unit; Mechanical interface structure; Cold harness and connector; MGSE to install Chopper EGSE to test Chopper
FPU_71	Spectrometer			LAS	LAS	LAS	Moving mirror support structure; Spectrometer motor; Mirror movement measurement system; Mechanical interface structure; Cold harness and connector; MGSE to install Spectrometer; EGSE to test Spectrometer
FPU_81	Photometer calibration source			QMW	QMW	QMW	Temperature controlled radiation source; Mechanical interface structure; Cold harness and connector; MGSE to install Calibration Source EGSE to test Calibration Source
FPU_82	Spectrometer calibration source			ATC	ATC	ATC	Temperature controlled radiation source; Mechanical interface structure; Cold harness and connector; MGSE to install Calibration Source; EGSE to test Calibration Source
FPU_91	JFET Module (TBC)			JPL	JPL	JPL	JFETs and associated components; RF Filters and associated components; Box and mechanical interface structure; Cold harness and connectors; MGSE to install JFET Module EGSE to test JFET Module

ID	Product Item	Other Units	AVM	CQM	PFM	FS	Description
FPU_A1	Shutter (TBD)			TBD	TBD	TBD	Shutter unit; Mechanical interface structure; Cold harness and connector; MGSE to install Shutter EGSE to test Shutter
Buffer Amplifier Unit (FSBAU)							
BAU_10	Buffer Amplifier Unit			SAp	SAp	SAp	Buffer Amplifier Unit; Savers; MGSE to install BAU; EGSE to test BAU
Detector Readout and Control Unit (FSDRC)							
DRC_10	Detector Read-out and Control Unit			SAp	SAp	Sap (Parts)	Detector Read-out and Control Unit; Savers;
Digital Processing Unit (FSDPU)							
DPU_10	Digital Processing Unit		IFSI	IFSI	IFSI	IFSI (Parts)	Digital Processing Unit (including Power Supply); Savers;
Signal Processing Unit (FSSPU)							
SPU_10	Signal Processing Unit		IAC	IAC	IAC	IAC (Parts)	Signal Processing Unit; Savers;
Warm Interconnect Harness (FSHAR)							
HAR_10	Warm Interconnect Harness		TBD	TBD	TBD	TBD	DPU to SPU harness; SPU to DRCU harness; Savers; Breakout Box(es)
On Board Software (FSOBS)							
OBS_10	DPU On Board Software		IFSI	IFSI	IFSI	IFSI	DPU On Board Software
OBS_20	SPU On Board Software		SAp	SAp	SAp	SAp	SPU On Board Software

3.2 Support Items

ID	Product Item	Other Units	AV M	CQM	PFM	FS	Description
Mechanical Ground Support Equipment (FSMGS)							
Electrical Ground Support Equipment (FSEGS)							
EGS_10	EGSE	UofS (4)					Simulates S/C interface to allow testing of DPU; includes: S/C Interface Hardware; EGSE Software;
EGS_20	Quick Look Facility	RAL (4)					QLF Hardware; Documentation
EGS_30	Digital Instrument Simulator	IFSI (3)					Simulates SPIRE 1, 2, 3 and 4 for testing operation of DPU; includes: DIS Hardware; DIS Software;
EGS_40	Analogue Instrument Simulator	SAp (3)					Simulates SPIRE 1, 2 and 3 for testing operation of SPU; includes: AIS Hardware; AIS Software;
EGS_50	FPU Simulator	SAp (3)					Simulates SPIRE 1 and 2 for testing operation of DRCU; includes: FPUS Hardware; FPUS Software;
Optical Ground Support Equipment (FSOGS)							
OGS_10	Optical Alignment Jig	TBD					Optical Alignment Jig
OGS_20	Throughput Detector Assembly	QMW					Throughput Detector Assembly EGSE for Detector MGSE for mounting assembly
Facilities (FSFAC)							
FAC_10	AIV Facility	RAL					Instrument Cryostat; Facility Electronics; Clean Room; Infrastructure;
FAC_20	Test Harness	TBD					Test Harness
FAC_30	Calibration Facility	RAL					Calibration Optics; Calibration Sources; Facility Electronics
FAC_40	Thermal Vacuum Facility	RAL					
FAC_50	EMC Test Facility	SAp					
FAC_60	Cold Vibration Facility	TBD					
FAC_70	Warm Vibration Facility	RAL					

FSFPU	Focal Plane Unit	Responsible
FSFPUC1100	CQM Structure	MSSL
FSFPUC2100	CQM Optics	LAS
FSFPUC2200	CQM Filters	QMW
FSFPUC3100	CQM Baffling	
FSFPUC4100	CQM Photometer Arrays	GSFC/JPL/SAp
FSFPUC4200	CQM Spectrometer Arrays	GSFC/JPL/Sap
FSFPUC5100	CQM Cooler	Grenoble
FSFPUC6100	CQM Chopper	ATC
FSFPUC7100	CQM Spectrometer	LAS
FSFPUC8100	CQM Photometer Calibration Source	QMW
FSFPUC8200	CQM Spectrometer Calibration Source	ATC
FSFPUC9100	CQM JFET Module	JPL
FSFPUCA100	CQM Shutter	
FSFPUP1100	PFM Structure	MSSL
FSFPUP2100	PFM Optics	LAS
FSFPUP2200	PFM Filters	QMW
FSFPUP3100	PFM Baffling	
FSFPUP4100	PFM Photometer Arrays	GSFC/JPL/Sap
FSFPUP4200	PFM Spectrometer Arrays	GSCF/JPL/Sap
FSFPUP5100	PFM Cooler	Grenoble
FSFPUP6100	PFM Chopper	ATC
FSFPUP7100	PFM Spectrometer	LAS
FSFPUP8100	PFM Photometer Calibration Source	QMW
FSFPUP8200	PFM Spectrometer Calibration Source	ATC
FSFPUP9100	PFM JFET Module	JPL
FSFPUPA100	PFM Shutter	
FSFPUS1100	FS Structure	MSSL
FSFPUS2100	FS Optics	LAS
FSFPUS2200	FS Filters	QMW
FSFPUS3100	FS Baffling	
FSFPUS4100	FS Photometer Arrays	GSFC/JPL/Sap
FSFPUS4200	FS Spectrometer Arrays	GSFC/JPL/Sap
FSFPUS5100	FS Cooler	Grenoble
FSFPUS6100	FS Chopper	ATC
FSFPUS7100	FS Spectrometer	LAS
FSFPUS8100	FS Photometer Calibration Source	QMW
FSFPUS8200	FS Spectrometer Calibration Source	ATC
FSFPUS9100	FS JFET Module	JPL
FSFPUSA100	FS Shutter	
FSBAU	**Buffer Amplifier Unit**	
FSBAUC1000	CQM Buffer Amplifier Unit	SAp
FSBAUP1000	PFM Buffer Amplifier Unit	SAp
FSBAUS1000	FS Buffer Amplifier Unit	SAp
FSDRC	**Detector Read-out and Control Electronics**	
FSDRCC1000	CQM Detector Read-out and Control Electronics	SAp
FSDRCP1000	PFM Detector Read-out and Control Electronics	SAp
FSDRCS1000	FS Detector Read-out and Control Electronics	SAp
FSDPU	**Digital Processing Unit**	
FSDPUC1000	CQM Digital Processing Unit	IFSI
FSDPUP1000	PFM Digital Processing Unit	IFSI
FSDPUS1000	FS Digital Processing Unit	IFSI

Project Management Summary

Project Teams

Design development is currently under the guidance of a System/Project team which meets regularly to assess progress towards a system design. It is supported by working groups setup to address particular problem areas.

It is now time to start to put into place the management structure defined in the Management Plan. The proposed organisation differs from the original plan.

Interface Control

The System Team is responsible for putting into effect a system for control of the instrument interfaces. This will be based on a matrix of interfaces maintained by the System Team. This matrix covers all of the instrument systems (FPU, Electronics, Instrument Simulator, GSE, Ground segment and ICC).

Each interface will be documented by one of the two groups involved and agreed by both.

Documentation

We propose to use the ESA Document Management System (DMS) for distribution of all SPIRE documentation until FINDAS becomes available for this.

The SPIRE domains have been created, a set of guidelines for their use has been agreed and the system will be opened for general use shortly.

We will issue a Document Management Plan and a set of procedures.

Reporting

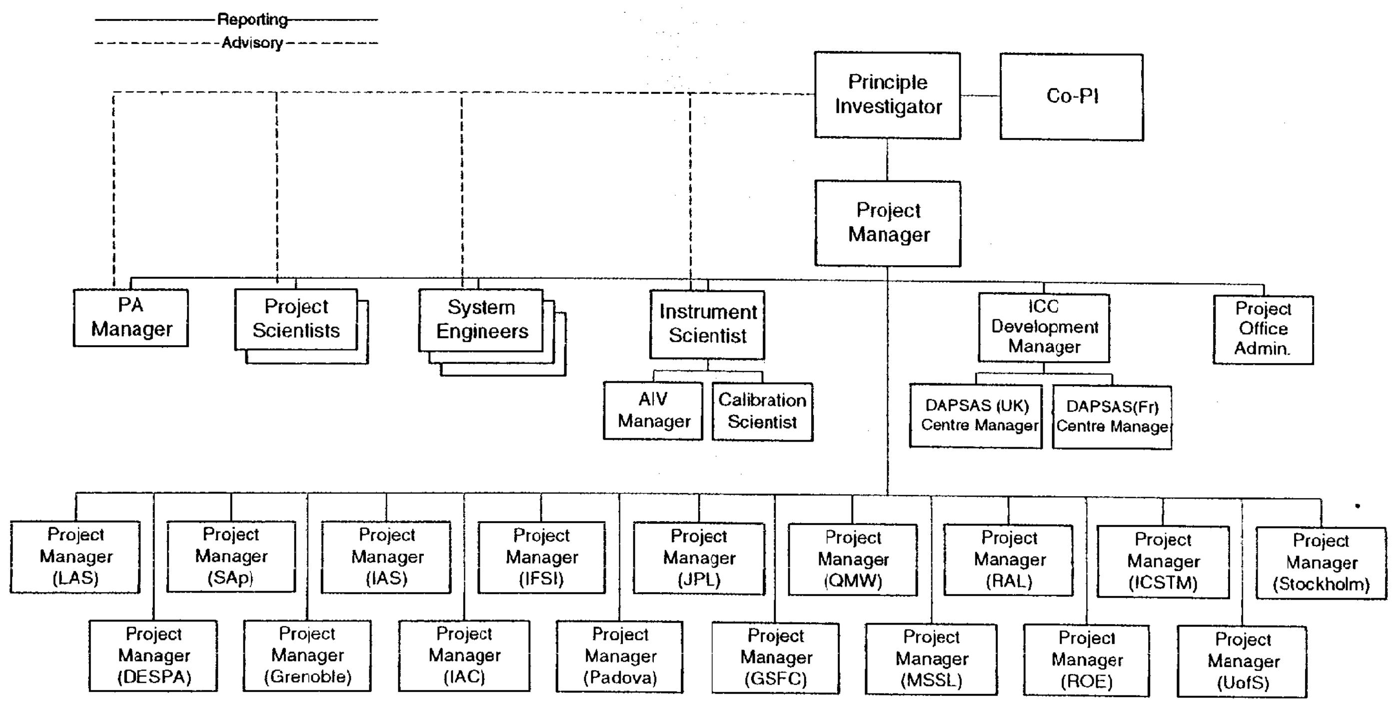
ESA will be expecting monthly (and quarterly) reports from the consortium, starting in January 1999.

Institute Managers
It is now time for the local project managers to take responsibility for the work that is being undertaken at their institutes.

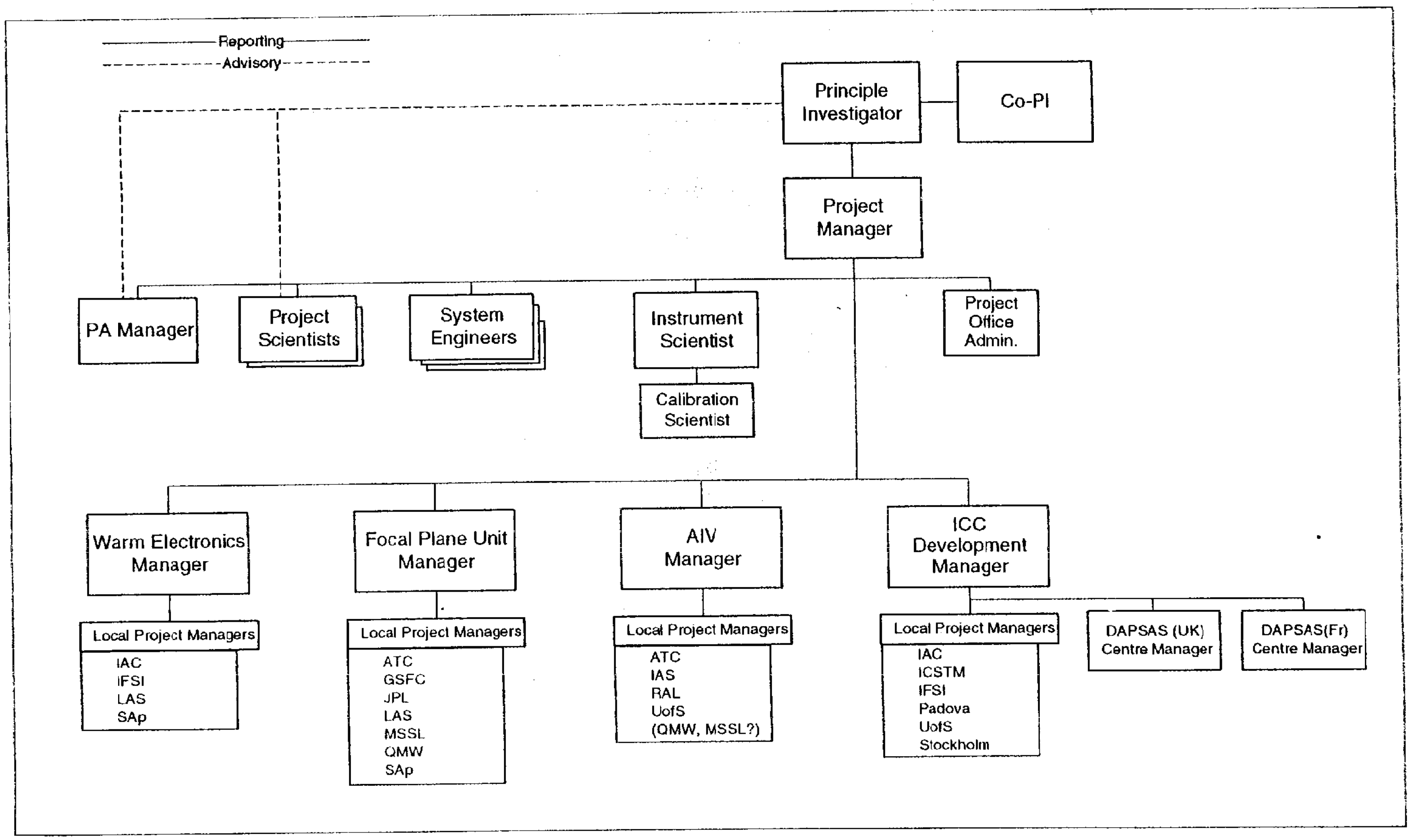
The splinter session at this meeting will address:

- Schedule for the review and production of Management Documentation
- Configuration Control of SPIRE Documents
- Definition of work packages and schedule
- Reporting lines and the format for monthly/quarterly reports
- Product Assurance

SPIRE Organisation



SPIRE Organisation



APPENDIX A

SPIRE Project Posts

PI	Matt Griffin, QMW, London
Co-PI	Laurent Vigroux, SAp, Saclay
Project Manager	Ken King, RAL, Oxfordshire
ICC Scientist	Seb Oliver, ICSTM, London
P.A. Manager	Geoff Douglas, RAL, Oxforshire
Project Scientist	Walter Gear, MSSL, Surrey
Project Scientist	Jean-Paul Baluteau, LAS, Marseille
Instrument Scientist	Bruce Swinyard, RAL, Oxfordshire
Calibration Scientist	TBD
System Engineer (Electronics)	Louis Rodriguez, SAp, Saclay
System Engineer (FPU)	Colin Cunningham, ATC, Edinburgh
System Scientist (Ground Segment)	Sarah Unger, QMW, London
Warm Electronics Manager	Jean-Louis Augueres, SAp, Saclay (TBC)
Focal Plane Unit Manager	Ken King, RAL, Oxfordshire (TBC)
AIV Manager	TBD
ICC Development Manager	Trevor Dimbylow, RAL, Oxfordshire (TBC)
DAPSAS Centre (UK) Manager	TBD
DAPSAS Centre (Fr) Manager	TBD
Project Office Administrator	Judy Long, RAL, Oxfordshire

SPIRE Steering Group

PI	
Co-PI	
Canada (TBC)	TBD
France	Jean-Paul Baluteau, LAS, Marseille
Italy	Gianni Tofani, Osservatorio di Arcetri, Firenze
Spain	Ismael Perez-Fournon, IAC, Tenerife
Sweden	Göran Olofsson, Stockholm Observatory
UK	Michael Rowan-Robinson, Imperial College, London
USA	Andrew Lange, Caltech, Pasadena

SPIRE Co-Investigators

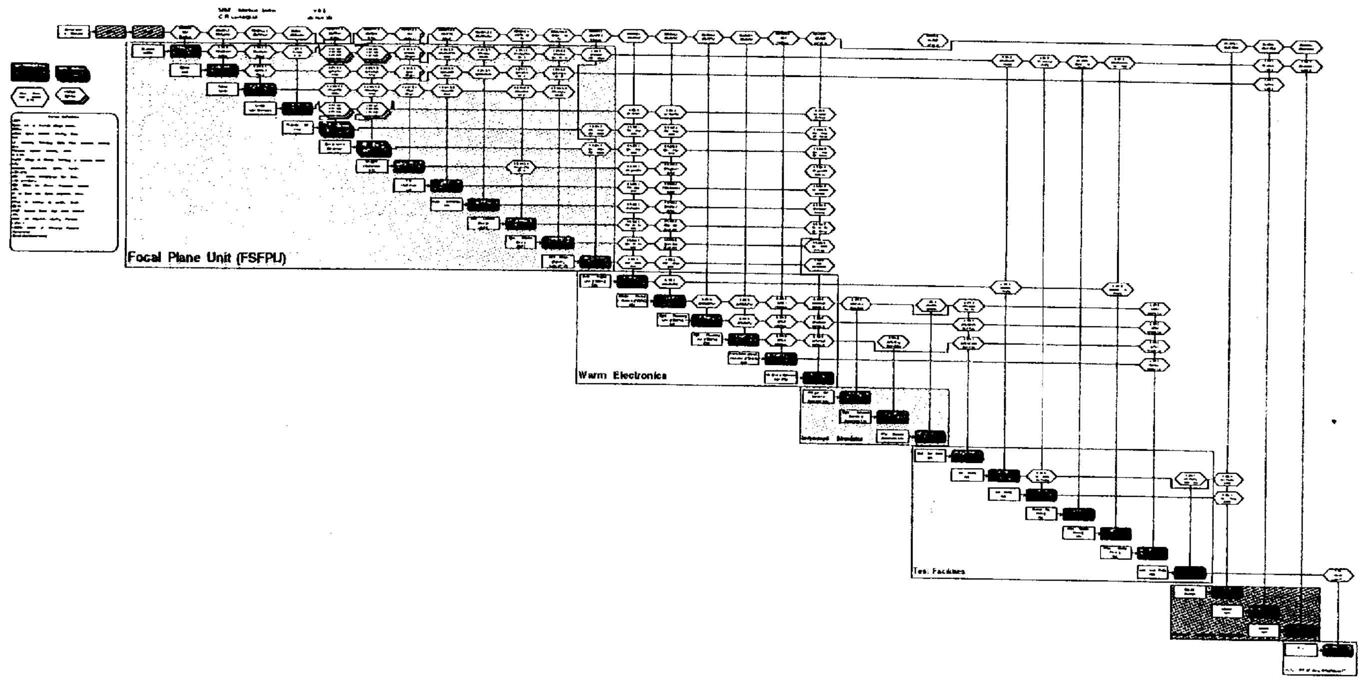
ATC	G. Wright
DESPA	E. Lellouch
GSFC	H. Moseley
IAC	I. Perez-Fournon
IAS	P. Cox
ICSTM	M. Rowan-Robinson
IFSI	P. Saraceno
JPL	J. Bock
LAS	J-P Baluteau
MSSL	W. Gear
Padova	A. Franceschini
QMW	P.A.R. Ade
RAL	R.J. Emery
SAp	P. André
Stockholm	G. Olofsson
UofS (TBC)	G. Davis

SPIRE Local Project Managers

ATC	F. Morrison
GSFC	J. Roman
IAC	J. Herreros
IAS	F. Pajot
ICSTM	T. Sumner
IFSI	R. Cerulli
JPL	W. Gray
LAS	D. Pouliquen
MSSL	W. Oliver
Padova	P. Andreanni
QMW	P. Hargrave
RAL	K.J. King
SAp	J-L. Augueres
Stockholm	H.G. Floren
UofS (TBC)	TBD

SPIRE Local PA Managers

ATC	TBD
GSFC	TBD
IAC	TBD
IAS	TBD
ICSTM	TBD
IFSI	TBD
JPL	TBD
LAS	TBD
MSSL	TBD
Padova	TBD
QMW	TBD
RAL	G. Douglas.
SAp	TBD
Stockholm	TBD
UofS (TBC)	TBD



Focal Plane Unit (FSFPU)
Warm Electronics
Test Facilities

SPIRE Document Management I

DMS Facilities

Created by ESA SSD for circulation of documents, not development – single files, no strict Config. Cntrl.

Located on server outside ESA firewall which allows access via WWW interface (could be replicated)

Requires V4 of IE or Netscape to search, but Netscape more reliable for retrieval

Documents are held in 'domains' - each group will have two domains e.g. SPIRE & SPIRE_internal etc.

Each domain has a set of users with privileges (read, read/write) and access levels – each document also has an access level assigned

All members of SPIRE consortium will have read access to 'external' domains (e.g. SPIRE, PACS, HIFI etc) and read/write access to SPIRE_internal.

All users will have an access level of 50 and documents will have an access level of 30 – users can, by default, read any document in the domains they have read access to.

SPIRE Document Management II

FIRST use of DMS

All documents entered into DMS must be provided with the following information:

- Author(s)
- Title
- Type of Document
- Reference Designation
- Issue
- Date
- Keywords
- Custodian

When a document is added to DMS, all users are notified by email

Document formats will be limited to:

- ASCII
- PDF
- HTML

Documents will be maintained by a custodian

All documents will have a unique Reference Designator
FIRST-SPI-yyy-nnnnn
SPIRE-iii-yyy-nnnn

SPIRE Document Management III

SPIRE Guidelines

Normally all SPIRE documentation will be put into the SPIRE_internal domain.

The SPIRE domain will be used for documents to be distributed to the rest of satellite teams (formal project documents, reports etc).

Documents will be placed in the SPIRE domain and controlled by the project office

Project documents will be written using templates – these will be provided in the SPIRE_internal domain.

Documents of type 'document' will be reserved for formal project documents. These will only be entered by the project office and will be maintained under configuration control by the project office.

9.1

REPORT FROM SYSTEM TEAM

FPU

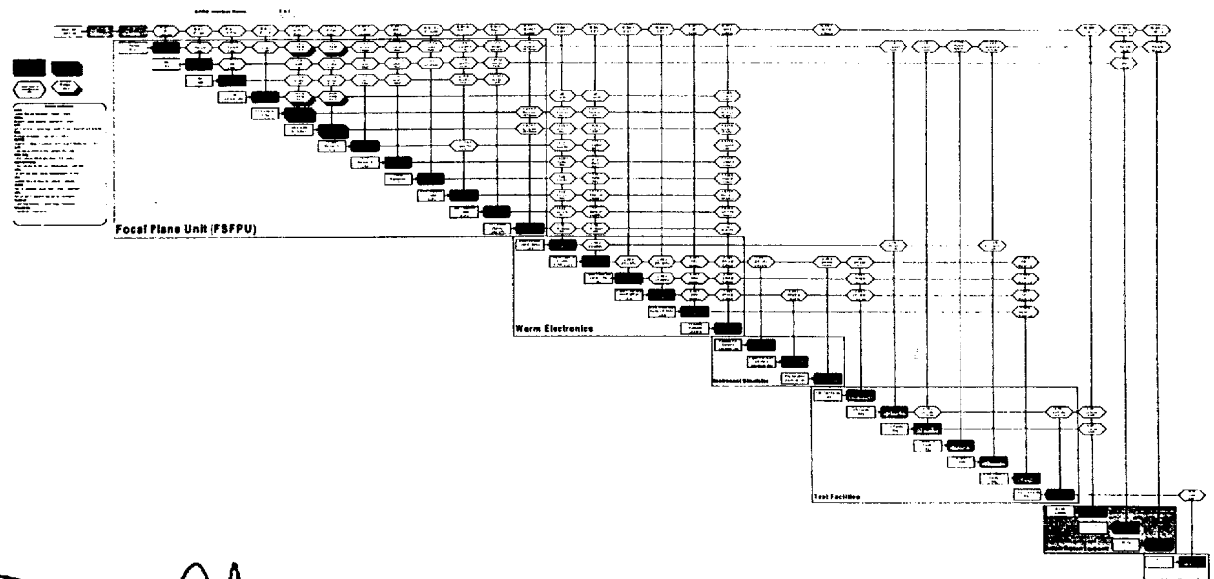
C. CUNNINGHAM

SYSTEMS: FPU

- Interface Matrix
- Structure
- Photometer Optical layout
- Spectrometer Optical layout
- Mass & Thermal budgets
- JFET Box
- Internal Cable harness

SYSTEMS: FPU

- The Interface Matrix has now been developed to a working level



SYSTEMS: FPU

- Structure

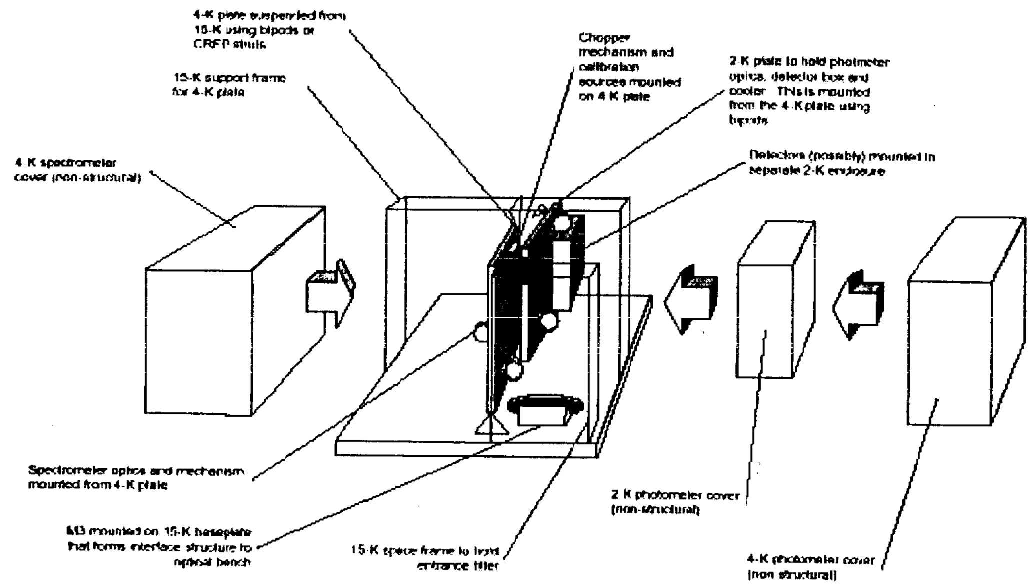


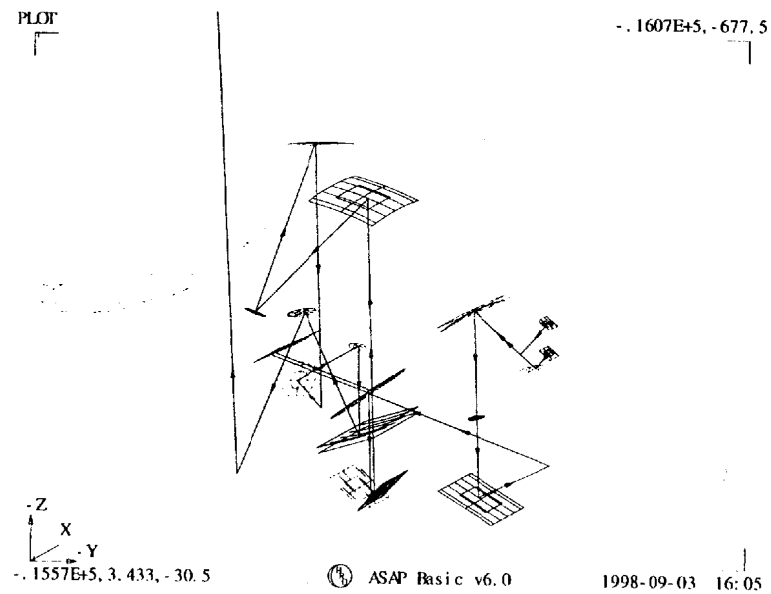
Figure 1: Conceptual layout for the SPIRE structure based on non structural covers (15-K cover not shown)

SYSTEMS: FPU

- Photometer Optical layout
  - Kjetel has cleaned up the pupil imaging
  - Further changes may be needed once the sharing of the FIRST focal plane is decided: it is likely that SPIRE & PACS will share the central portion of the FOV
  - This may result in one array moving out of plane

SYSTEMS: FPU

- Spectrometer Optical Layout



SYSTEMS: FPU

SPIRE

- Mass Budgets

Project code	Instrument unit	# off	Dimensions (mm) *	Mass (kg)
FSFPU	Cold Focal Plane Unit	1	690 x 410 x 410 Irregular shape	33 (TBC) (including JFET box)
FSBAU	Buffer Amplifier Unit	1	200 x 150 x 120 (TBC)	2.5 (TBC)
FSDRC	Detector Read-out and Control Unit	1	285 x 256 x 234	12 (TBC)
FSSPU	Signal Processing Unit	1	240 x 218 x 239	9 (TBC)
FSDPU	Digital Processing Unit	1	200 x 200 x 160	5 (TBC)
FSHAR	Warm interconnect harnesses: FSDRC-FSSPU, FSSPU-FSDPU	3		2 (TBC)
TOTAL				**63.5** (TBC)

* Dimensions are given as Length x Width x Height. Length and Width define the fixation baseplate.

Note

1 Dimensions and mass do not include margins

2 Harness FSFPU-FSBAU, FSBAU-FSDRC, FSFPU-FSDRC FSDPU-S/C will be ESA responsibility.

UK Astronomy Technology Centre

Royal Observatory Edinburgh

SYSTEMS: FPU

- Thermal Budgets

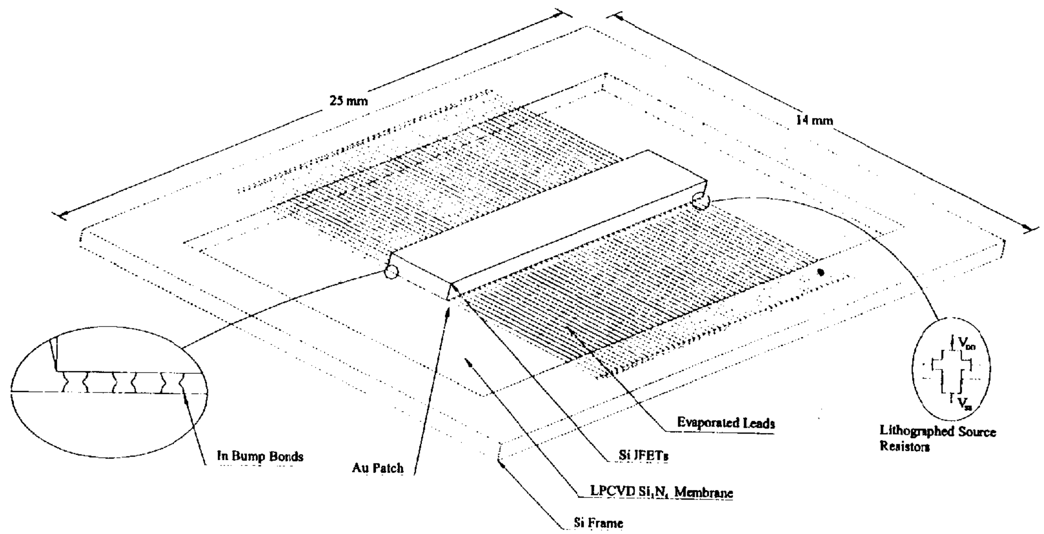
Temp. Stage	Item	CEA/TES				Feedhorn (150 dets)			
		ON	OFF	PHOT	SPEC	ON	OFF	PHOT	SPEC
"15-K"		0	0	0	0	15	0	15	15
"4-K"	Wires	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
	Radiation	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Mechanisms	0.0	0.0	2.0	7.4	0.0	0.0	2.0	7.4
	Structure	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Total	3.7	3.7	5.7	11.1	3.7	3.7	5.7	11.1
"2-K"	Wires	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Dissipation	2.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0
	Cooler	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Structure	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Total	4.1	2.1	4.1	4.1	2.1	2.1	2.1	2.1

Notes:
All figures are in mW
Structure: Figures assume temperature of "15-K" shield is 11 K
Cooler: This is the continuous power load of the cooler when at 0.3 K
Feedhorn option: FET box only interfaces to "15-K" stage.

SYSTEMS: FPU

SPIRE

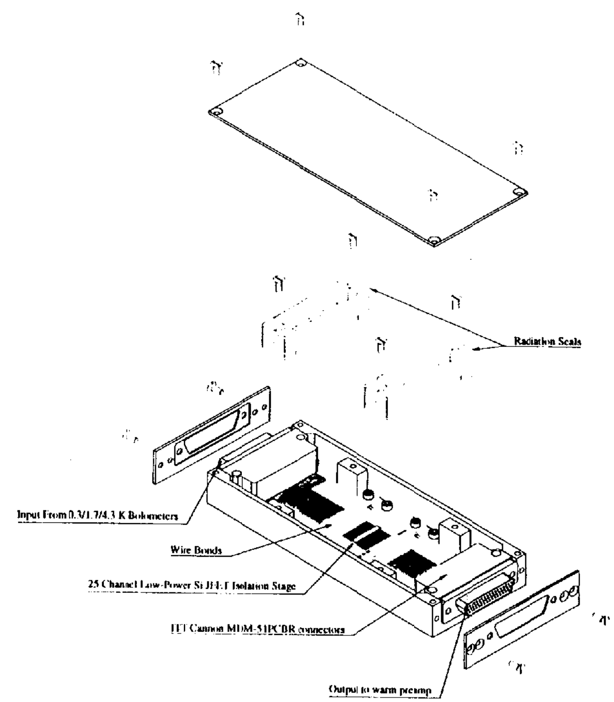
- JFETs on Silicon Nitride Film JPL/Caltech



Low-Power Si JFET Isolation Stage
25 Channel

SYSTEMS: FPU

- JFET Modules

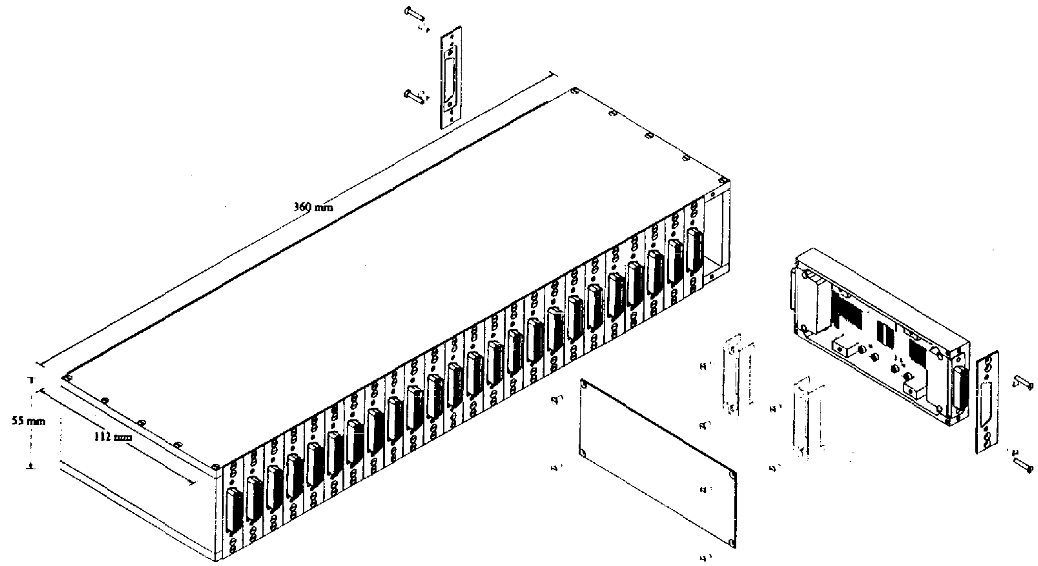


25 Channel Low-Power
Si JFET Module

4

SYSTEMS: FPU

- JFET Assembly



Low-Power Si JFETs
Twenty Five, 25 Channel Modules

SYSTEMS: FPU

• Proposed Internal wiring assemblies

Number of cables (JFETs to 2 K I/F)	12 ea + 3 ea spares = 15 total
Number of cables (JFETs to dewar wall)	12 ea + 3 ea spares = 15 total
Length (JFETs to 2 K I/F)	15 cm (6 in)
Length (JFETs to dewar wall)	1 m (40 in)
Conductors/cable	51
Conductor material	manganin
Conductor diameter	0.0075 cm (0.003 in)
Conductor spacing	0.002 cm centers (0.008 in)
Cover layers	0.005 cm (0.002 in) thick polyimide
Adhesive	0.0025 cm (0.001 in) thick Teflon
Shields (JFETs to 2 K I/F)	300 angstroms vapor-deposited Titanium
Shields (JFETs to dewar wall)	300 angstroms Titanium (plus 300 angstroms Au in warm section)
Connectors	Canon MDM 51-pin, Canon MDM 100-pin, Canon or Nanonics nanominiature

SYSTEMS: FPU

- Jamie Bock is pressing for as many bolometers as possible, filling the focal plane
- Current feed-horn option has 173 2Fλ horns
- Possible 1Fλ horns

Wavelength (μm)	Number of 2Fλ detectors	Max array dimension		
		(pixels)	(arcmin)	(mm)
250	61	9	4.7	22.5
350	37	7	5.1	24.5
500	19	5	5.2	25.0

Wavelength (μm)	Number of 1Fλ detectors	Max array dimension		
		(pixels)	(arcmin)	(mm)
250	169	15	3.9	18.7
350	127	13	4.7	22.5
500	91	11	5.7	27.4

SYSTEMS: FPU

Jamie Bock proposes to fill the focal plane as much as possible with up to 600 horns & bolometers

- Some areas **may** be feasible
  - Spider Bolometers easily replicated
  - Ribbon cables may be possible
  - 600 channel JFET amps seem possible
- But:
  - Horns would be very difficult
  - Data rate may be limitation
  - Connectors and harness physical space & mass

SYSTEMS: FPU

Major Systems Issues:

- Structural & Thermal design
- Finalised Optical designs
- Photometer: Horn option focal plane population
- FTS: broad-band horn design for
- Internal wiring proposals for all array options
- Finalise Interface control system

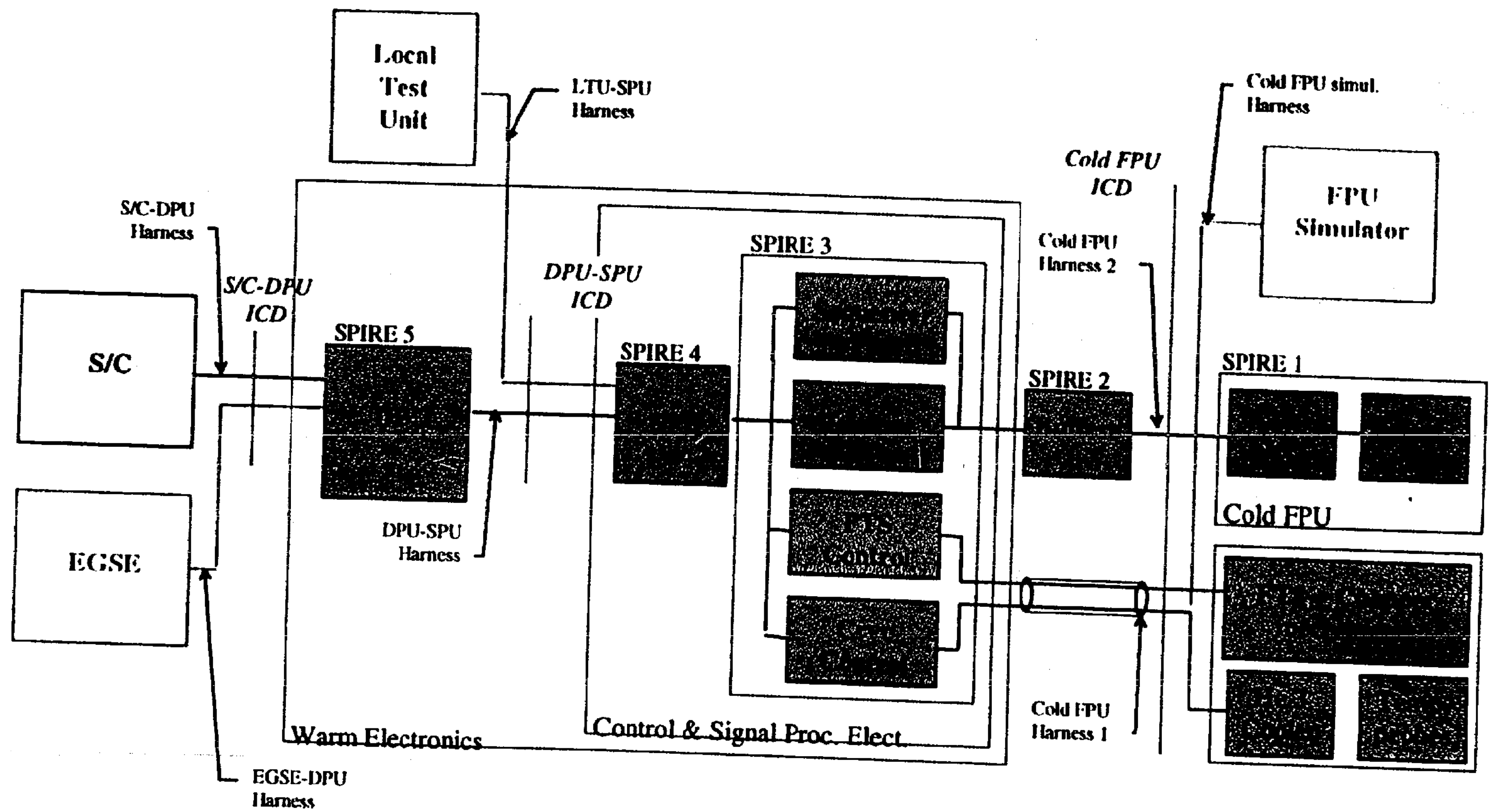
9.2 REPORT FROM SYSTEM TEAM

ELECTRONICS

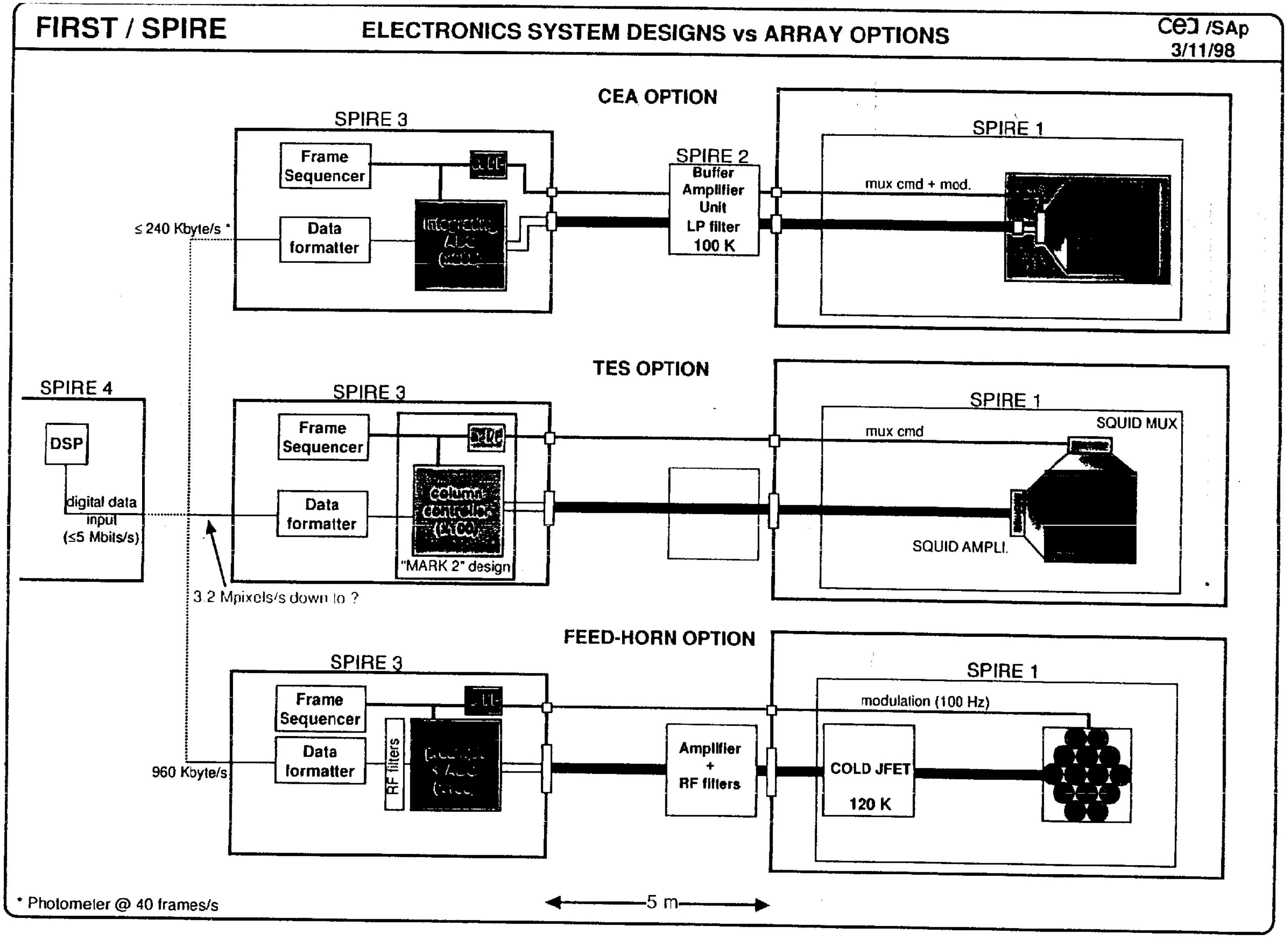
L. RODRIGUEZ

FIRST/SPIRE

Electronics Block Diagram

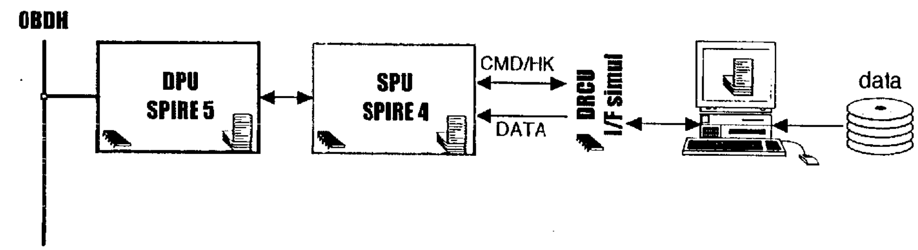


27/7/98

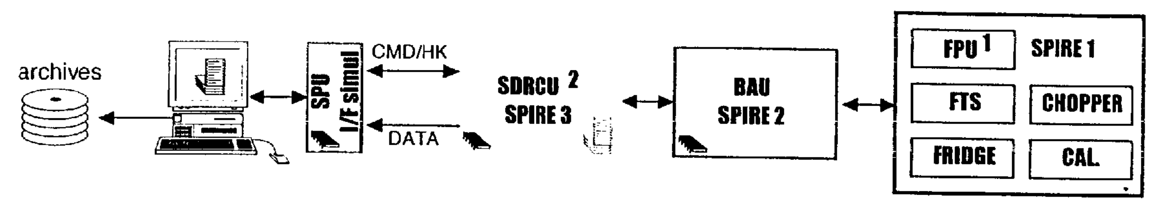

FIRST / SPIRE
ELECTRONICS SYSTEM DESIGNS vs ARRAY OPTIONS
cea /SAp
3/11/98
CEA OPTION
SPIRE 3
Frame Sequencer
Data formatter
≤ 240 Kbyte/s *
SPIRE 2
Buffer Amplifier Unit
LP filter
100 K
SPIRE 1
mux cmd + mod.
TES OPTION
SPIRE 4
DSP
digital data input (≤5 Mbits/s)
SPIRE 3
Frame Sequencer
Data formatter
"MARK 2" design
3.2 Mpixels/s down to ?
SPIRE 1
mux cmd
SQUID MUX
SQUID AMPLI.
FEED-HORN OPTION
SPIRE 3
Frame Sequencer
Data formatter
RF filters
960 Kbyte/s
Amplifier + RF filters
SPIRE 1
modulation (100 Hz)
COLD JFET
120 K
5 m
* Photometer @ 40 frames/s

SPIRE ELECTRONICS SYSTEM
MODEL DESCRIPTIONS

AVM : test S/C hardware/software interfaces

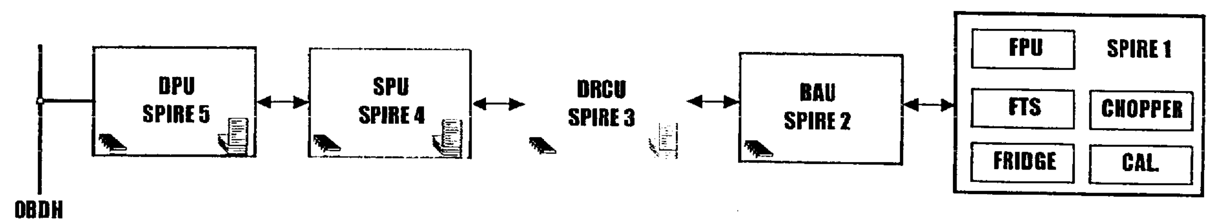


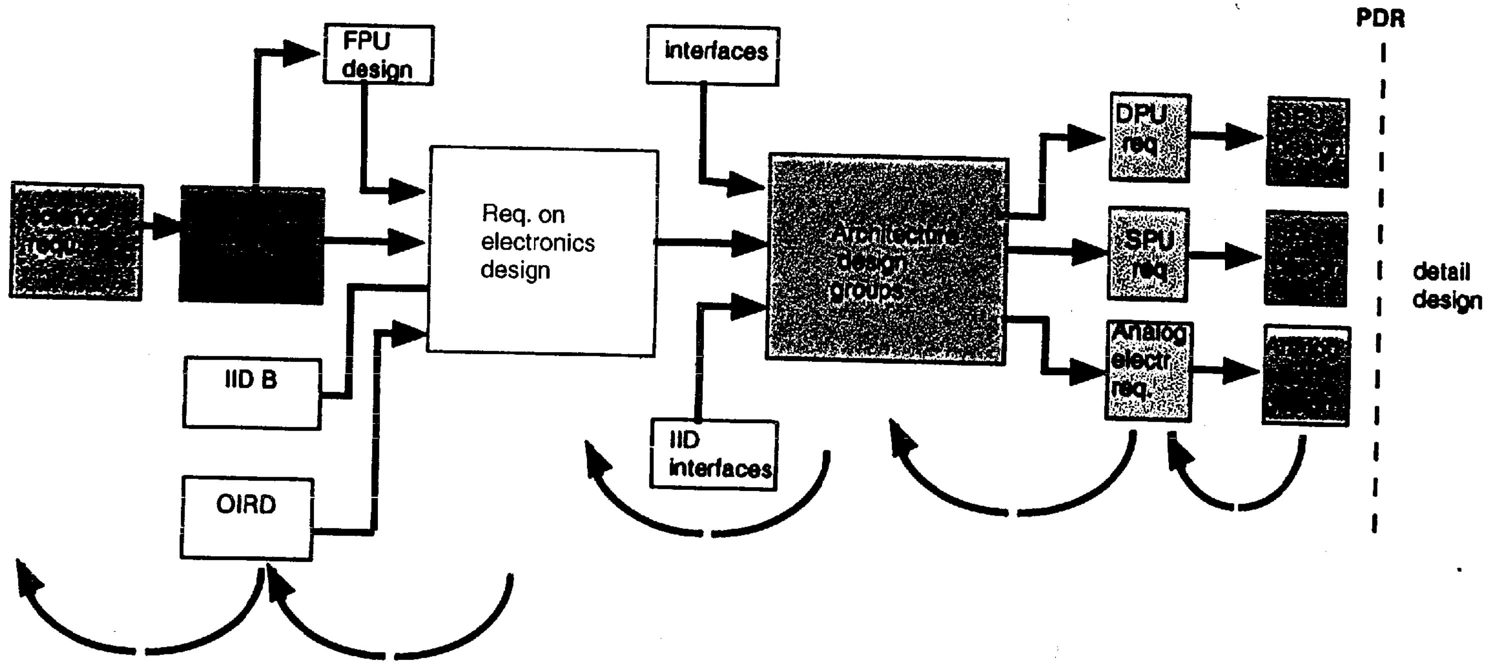
CQM : mechanical, thermal & EMC tests



1 : reduced number of pixels
2 : simplified DRCU

PFM




FPU design
interfaces
PDR
DPU req.
Req. on electronics design
Architecture design groups
SPU req.
detail design
Analog electr req.
IID B
IID interfaces
OIRD

COLD & WARM ELECTRONICS STATUS

COLD ELECTRONICS STATUS:

3 OPTIONS DIRECTLY RELATED TO DETECTOR TECHNOLOGY.

Feed Horns arrays:
1 double JFET/ detector self heated to 100K in a box as close as possible to the focal plane (inside the 15 K shield). No multiplexing foreseen. Part of the detector package.

Transition Edge Superconductor arrays:
Each pixel is connected to a SQUID R/O circuit.
Multiplexing by SQUIDs 1 by row (max 32->1).
location: on e_boards behind the the focal plane @ 300 mK.
Included in the detector package.

CEA option arrays:
Each pixel is connected to a CMOS MUX input @300 mK.
MUX factor: max 16->1.
MUX output connected to a MOS folower operating @ 1.5 K.
Integrated in the detector assemby.

COLD & WARM ELECTRONICS STATUS

FRÓNT END ELECTRONICS:

3 OPTIONS DIRECTLY RELATED TO DETECTOR TECHNOLOGY.

Feed Horns arrays:

Bias modulation at detector level. Lock in amplifier. Typical operating frequency ~100 Hz.
Sine or square modulation adventages and drawbacks to be evaluated at systems level.
Will be manufactured by Saclay Group .

Transition Edge Superconductor arrays:

Currently a MARK1.8 electronic board is available.
The MARK 2 suitable for SPIRE in under developement.
Electronics run at very high speed (today 3.2 MHz) will be adapted for SPIRE to few 100 kHz.
Will be provided by US groups.

CEA option arrays:

Read out principles under modelling and tests.
DC Bias, lock in amplifier with CMOS switch to a reference level. typ frequency 50Hz frame (1-2 kHz lock in).
Saclay.

COLD & WARM ELECTRONICS STATUS

FRAME SEQUENCER:
INDEPENDENT OF DETECTOR TECHNOLOGY.

We are currently checking the compatybility of the sequencer wit FTS and Chopper drive mechanism.

FTS CONTROL ELECTRONICS:
A system group (DESPA-LAS-Saclay) started performances evaluation tests for LVDT: linearisation, short term drifts. A drive will be purchased to ETEL company (CH) to make evaluation of a brassboard drive electronics.

DATA FORMATTER:
Writing the requirements of data format including scientific Housekeeping: sampling datation, glitches flags, integrity of the interferograms, etc.

SIGNAL PROCESSING UNIT.
The IAC group started the design of the SPU board, proposed communication solutions (serial link between SPU<-> DPU and SPU<-> DRCU). Evaluation of proposed components started at Saclay.

Problem: commonality and design groups started without any requirement.

SPU performances are very dependent of downlink. All the data compression will be done at this level. In the compression option we will have to do a phase correction associated to oversampling, decimation and degliching.

Major need to requirements to share work between SPU and DPU and optimise solutions.

9.3 REPORT FROM SYSTEMS TEAM

TECHNICAL MEETING WITH ESA.

B. SWINYARD

Technical Meetings With ESA

- Two “IID” meetings so far – about one every 3-months planned from now on.
- One meeting on the telescope specification and one on the focal plane sharing – both these with all instruments present.
- In the technical meetings ESA are pressing us to detail the entries in the IID-B ahead of the ITT for the prime contractor next year – mass; power; numbers of wires etc.... (see CRC’s presentation). Basically they are keen to see our instrument defined in as much detail as possible ahead of the ITT.
- Other issues are also addressed – management plan etc.
- The telescope meeting dealt with two major issues: the effect of going from 3.5 to 3.8 m and the requirement (or otherwise) for a re-focussing mechanism for the telescope.

THINGS NOT MENTIONED

- FLIGHT SPARE – WE WANT TO HAVE SUB-SYSTEMS ONLY + PROMISE 6 WK TURNROUND

  ⇒ ESA DON'T LIKE IT.

- SHUTTER – IF THE ESA MGSE CAN'T DELIVER T ≲ 10K WE NEED A SHUTTER → UNALLOCATED WP

- COLD VIBRATION – NO-ONE WANTS TO DO THIS! ESA ARE TRYING TO CO-ORDINATE SETTING UP A CENTRAL FAC.

- TELESCOPE – JPL HAVE PROPOSED GOING TO 3.8m → WE NEED TO ASSESS IMPACT ON OUR DESIGN

  – REFOCUSSING MECH. – WE ARE SURPRISINGLY SENSITIVE TO OUT OF FOCUS

10.

OVERVIEW OF DETECTOR ARRAY TEST PROGRAMME

P. HARGRAVE

QUEEN MARY
AND WESTFIELD COLLEGE
UNIVERSITY OF LONDON

BACUS Status & Array Test Plan

P.Hargrave, B.Maffei, F.Gannaway,
G.Gannaway, M.Griffin & P.Ade

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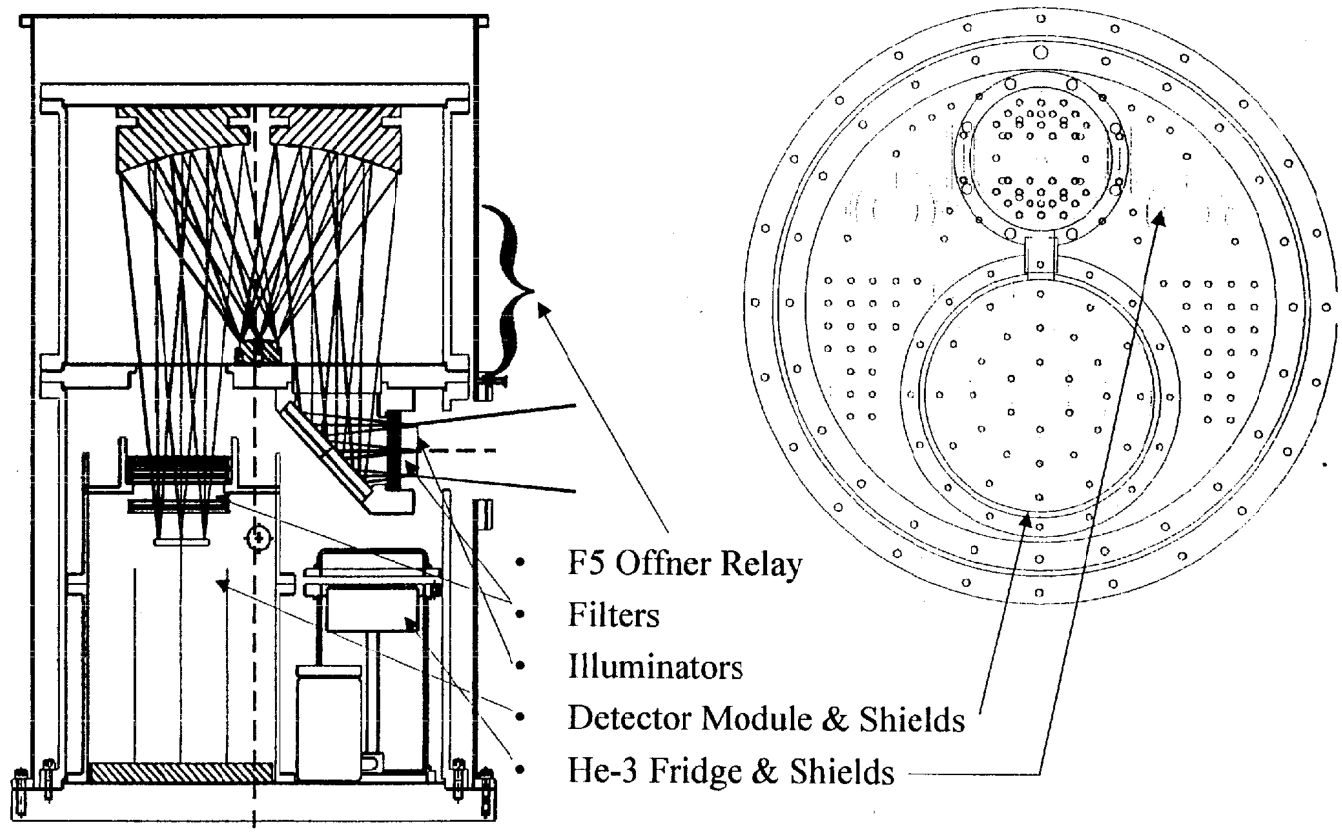
Design of BACUS Module



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Optics

- F5 Offner Relay
- Mirrors from Symons Mirror Technology (diamond turned Al-6061)
- All optics at 1.5K
- Baffling scheme will be finalised once stray light analysis is completed

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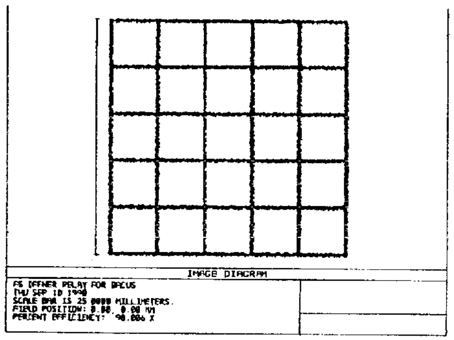
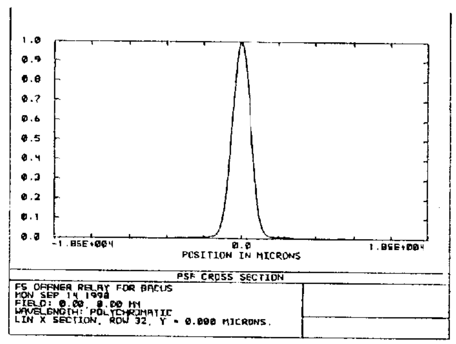
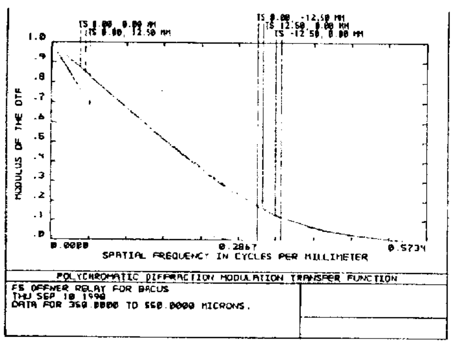
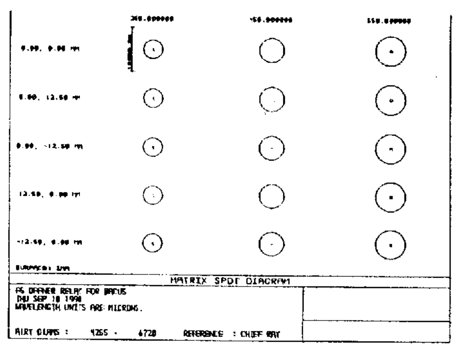
Optics









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Connectors

- 1x79 way - for detector arrays
- 1x32 way - for illuminators
- 1x26 way - for housekeeping
- All connectors are box flange mount conforming to MIL-C-38999/21

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Cryogenics

- Cryostat from Precision Cryogenics (Indiana)
- Optics at 1.5K (Pumped L^4He Bath)
- Detector stage at 300mK - Kevlar isolated stage linked to ^3He fridge (Chase Research)
- Array providers will supply 300mK detector shields

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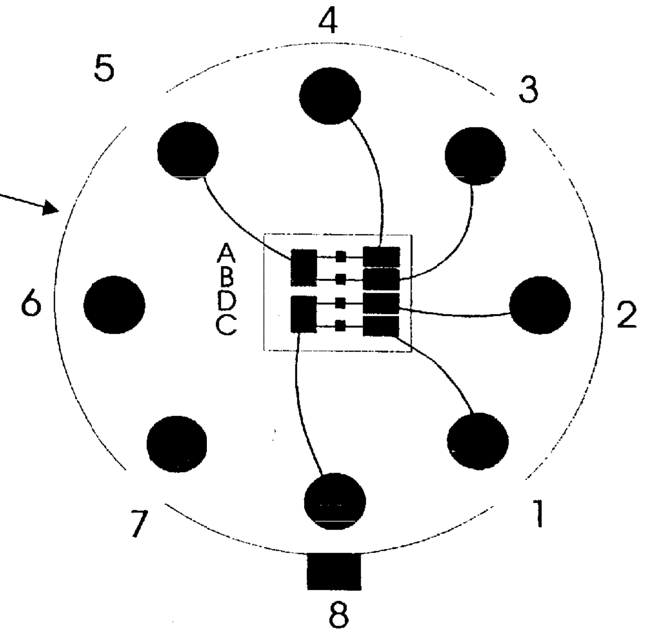
- ND + Edge filters for work in R-J region
- GSFC illuminator evaluated - new design being built for optimisation at 350 μm
- Need to be modulated up to ~10Hz
- Uniform source plate - variable temp.
- QMW dewar will have window to outside



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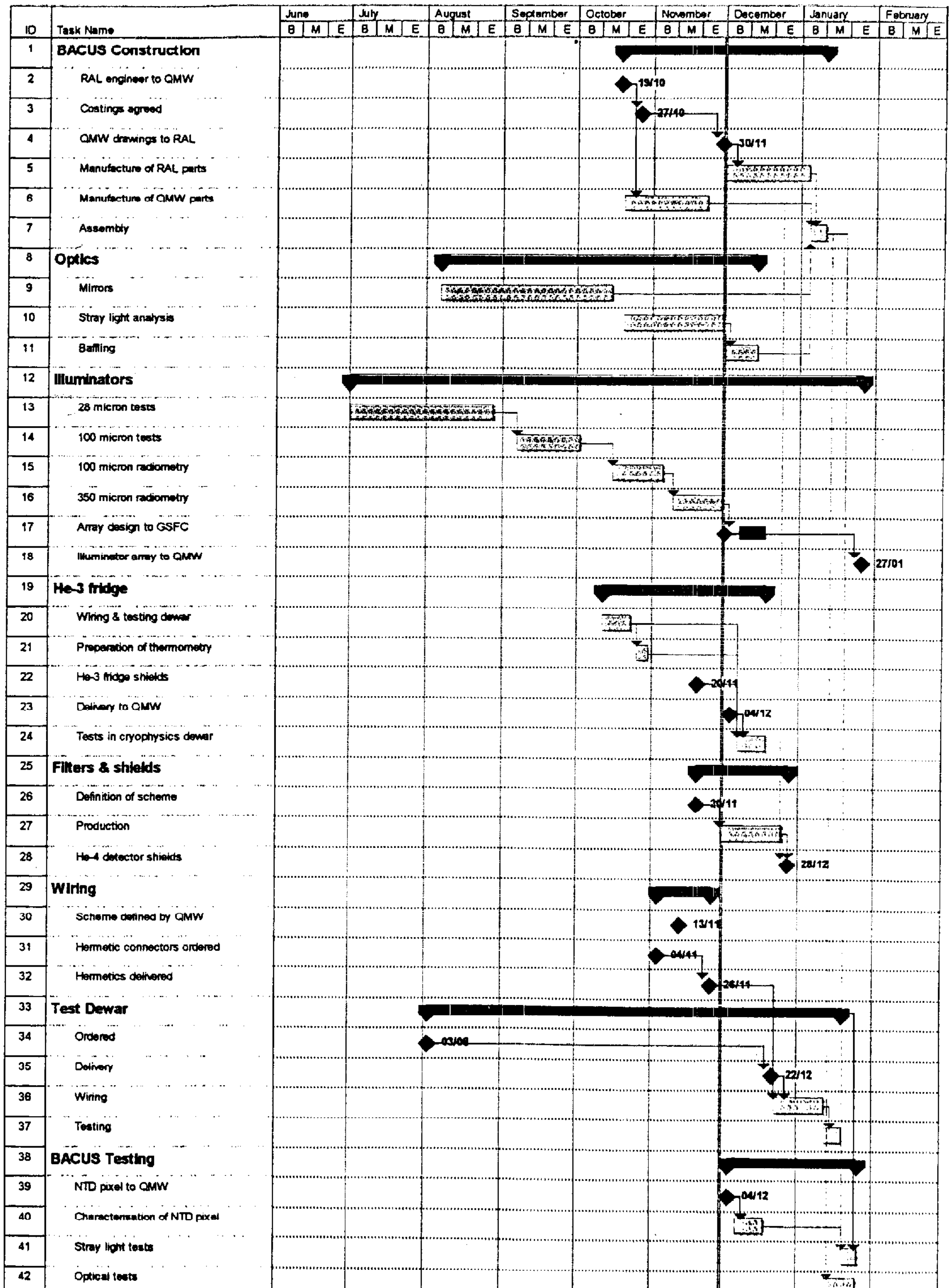
BACUS Capabilities

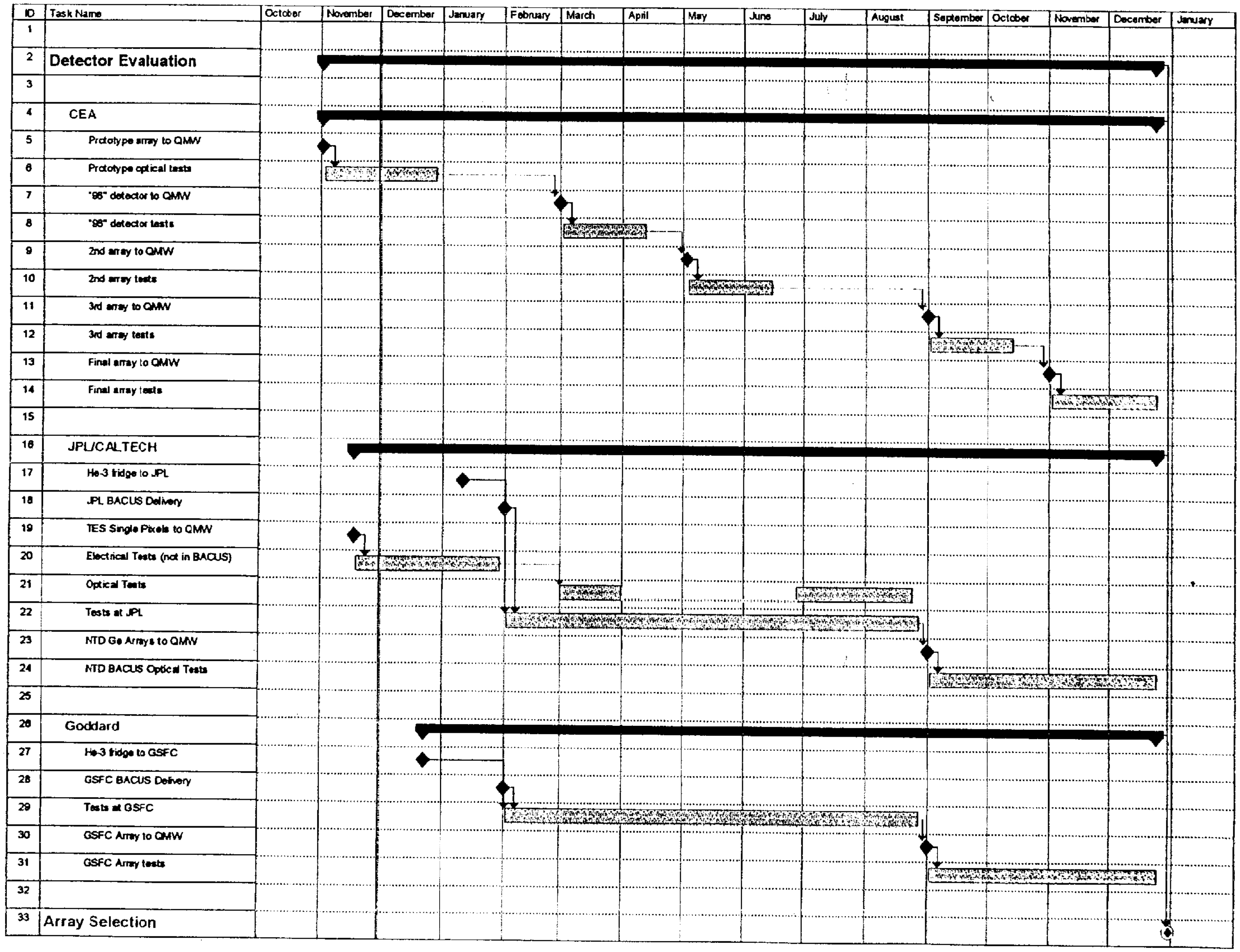
- V-Is - blanked or with uniform background
- Speed of response
- Flat fielding / array uniformity
- Cross talk
- Sensitivity
- Dynamic Range
- Linearity

- Optical NEP
- Spectral response
- Fringing between optical elements
- Calibration of detector responsivity (external black body)
- Connection to telescope simulator



ID
Task Name
June
July
August
September
October
November
December
January
February
B M E
1 BACUS Construction
2 RAL engineer to QMW
3 Costings agreed
4 QMW drawings to RAL
5 Manufacture of RAL parts
6 Manufacture of QMW parts
7 Assembly
8 Optics
9 Mirrors
10 Stray light analysis
11 Baffling
12 Illuminators
13 28 micron tests
14 100 micron tests
15 100 micron radiometry
16 350 micron radiometry
17 Array design to GSFC
18 Illuminator array to QMW
19 He-3 fridge
20 Wiring & testing dewar
21 Preparation of thermometry
22 He-3 fridge shields
23 Delivery to QMW
24 Tests in cryophysics dewar
25 Filters & shields
26 Definition of scheme
27 Production
28 He-4 detector shields
29 Wiring
30 Scheme defined by QMW
31 Hermetic connectors ordered
32 Hermetics delivered
33 Test Dewar
34 Ordered
35 Delivery
36 Wiring
37 Testing
38 BACUS Testing
39 NTD pixel to QMW
40 Characterisation of NTD pixel
41 Stray light tests
42 Optical tests
13/10
27/10
30/11
27/01
20/11
04/12
30/11
28/12
13/11
04/11
26/11
03/08
22/12
04/12

- 3 X BACUS MODULES (QMW, JPL, GSFC)
  - QMW/RAL TO BUILD.
  - CALIBRATION AT QMW
- CEA TESTS (@QMW)
  - PROTOTYPE SINGLE PIXEL DEVICE BEING TESTED @ QMW
  - ITERATIVE TESTS THROUGH '99.
- JPL/CALTECH
  - WILL PROVIDE NTD PIXEL FOR CHARACTERISATION OF BACUS STRAY LIGHT ENVIRONMENT
  - ~~SINGLE PIXEL TES → QMW END '98~~
  - FINAL NTD ARRAY → QMW SEPT/OCT '99
- GSFC
  - DELIVERY OF FINAL ARRAY IN TEST DEWAR SEPT/OCT '99
  - SUPPLY ILLUMINATOR MODULES END JAN. '99.
- ALL ARRAY GROUPS
  - EXPECTING FINAL ARRAYS @ QMW BETWEEN AUG. + NOV. '99.
  - GROUPS TO SUPPLY STAFF EFFORT TO ASSIST WITH TESTS.



ID
Task Name
October
November
December
January
February
March
April
May
June
July
August
September
October
November
December
January
1
2 Detector Evaluation
3
4 CEA
5 Prototype array to QMW
6 Prototype optical tests
7 "96" detector to QMW
8 "96" detector tests
9 2nd array to QMW
10 2nd array tests
11 3rd array to QMW
12 3rd array tests
13 Final array to QMW
14 Final array tests
15
16 JPL/CALTECH
17 He-3 fridge to JPL
18 JPL BACUS Delivery
19 TES Single Pixels to QMW
20 Electrical Tests (not in BACUS)
21 Optical Tests
22 Tests at JPL
23 NTD Ge Arrays to QMW
24 NTD BACUS Optical Tests
25
26 Goddard
27 He-3 fridge to GSFC
28 GSFC BACUS Delivery
29 Tests at GSFC
30 GSFC Array to QMW
31 GSFC Array tests
32
33 Array Selection

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Potential Delays

- Delivery of test dewars
- Delivery of He-3 fridges
- Delivery of GSFC/JPL optical components
- Construction & testing of illuminator arrays

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Summary

- BACUS should be operational by end January 1999
- Preliminary tests (CEA & JPL) can be carried out in another dewar once He-3 fridges & shields are ready (mid-December)
- Schedule is <u>very</u> tight - we need realistic estimates for when we can expect devices at QMW
- "Pre-prototype" devices could be sent to QMW for pre-tests to familiarize QMW staff and avoid subsequent delays.

11.

SPIRE PERFORMANCE MODELLING

L. VIGROUX

- Aussel, Vigroux, Andreani
- Comments by Griffin, Oliver, Elbaz

Models for SPIRE surveys

3 detectors are tested

1. **Fλ square pixels with flat transmission :**
   16 $\times$ 16 array of 18"$\times$18" pixels at 250 μm.
   8 $\times$ 8 array of 36"$\times$36" pixels at 500 μm
2. **Fλ/2 square pixels with flat transmission :**
   32 $\times$ 32 array of 9"$\times$9" pixels at 250 μm.
   16 $\times$ 16 array of 18"$\times$18" pixels at 500 μm
3. **2Fλ horns (backup option) with gaussian transmission (FWHM = Fλ) :**
   61 horns of 18" of radius at 250 μm.
   27 horns of 36" at 500 μm

Sources

Number counts prediction of Franceschini et al. (97) are used to simulated a 20'×20' field, diffracted by the circular aperture of the telescope (3.5 m).

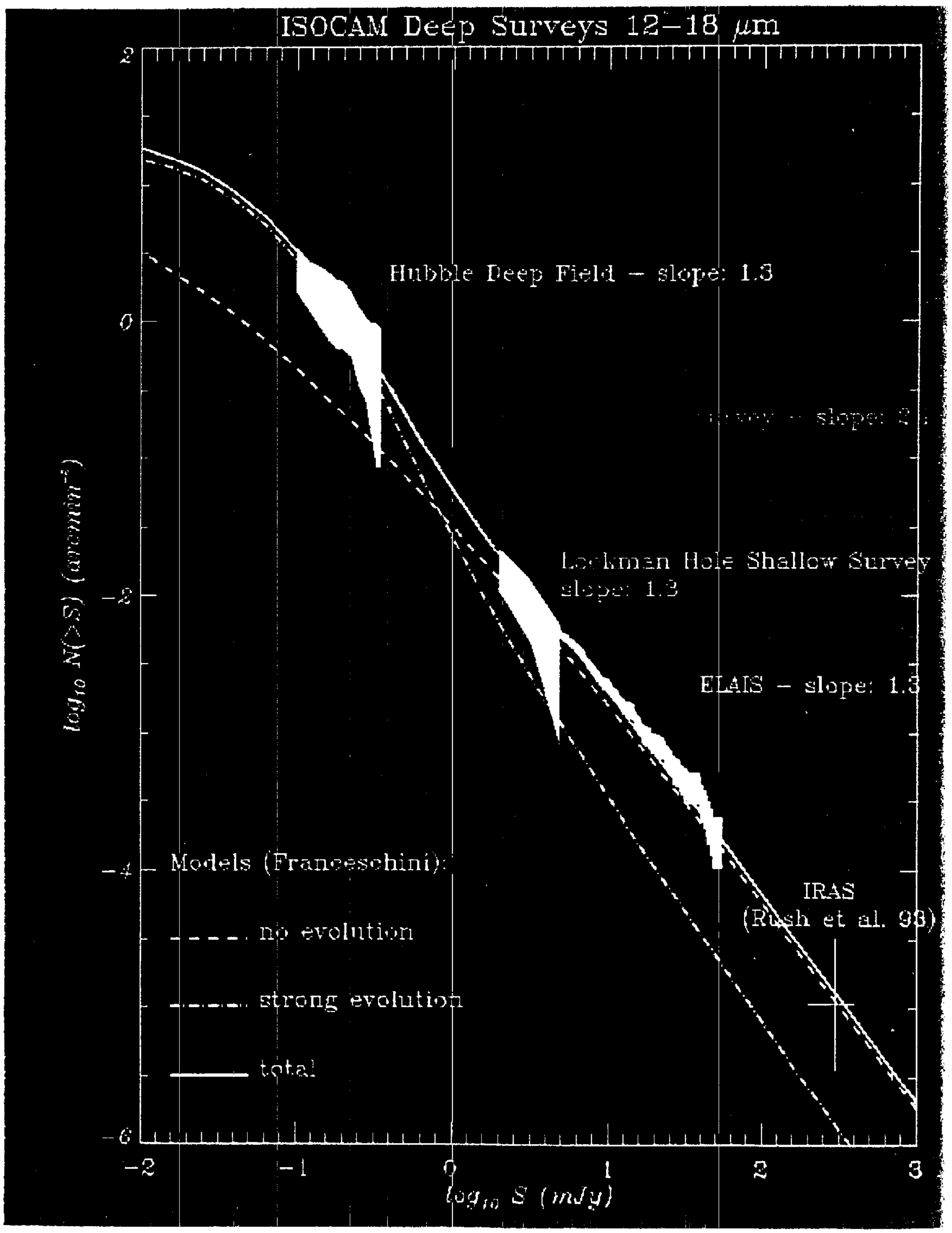
Observations

All detectors are tested with :

- Same surveyed area (10'×10' by 4 patches of 5'×5')
- Same observation time : 1.07 hour by patch
- Same final resolution.

Two resolutions are tested :

1. $\lambda/2$ at 250 μm $\longrightarrow$ $\lambda/4$ at 500 μm
2. $\lambda/4$ at 250 μm $\longrightarrow$ $\lambda/8$ at 500 μm


ISOCAM Deep Surveys 12–18 μm
Hubble Deep Field – slope: 1.3
Lockman Hole Shallow Survey
slope: 1.3
ELAIS – slope: 1.3
IRAS
(Rush et al. 93)
Models (Franceschini):
no evolution
strong evolution
total
log10 N(>S) (arcmin⁻²)
log10 S (mJy)

Noise model

- Detector. NEP $= 3 \times 10^{-17} W.Hz^{-1/2}$ for all detectors.
- Photon noise. Origin : the telescope mirror at 80 K. Varies with wavelength and detector throughput.

Noise 1σ/pix. for 15 min. exposure

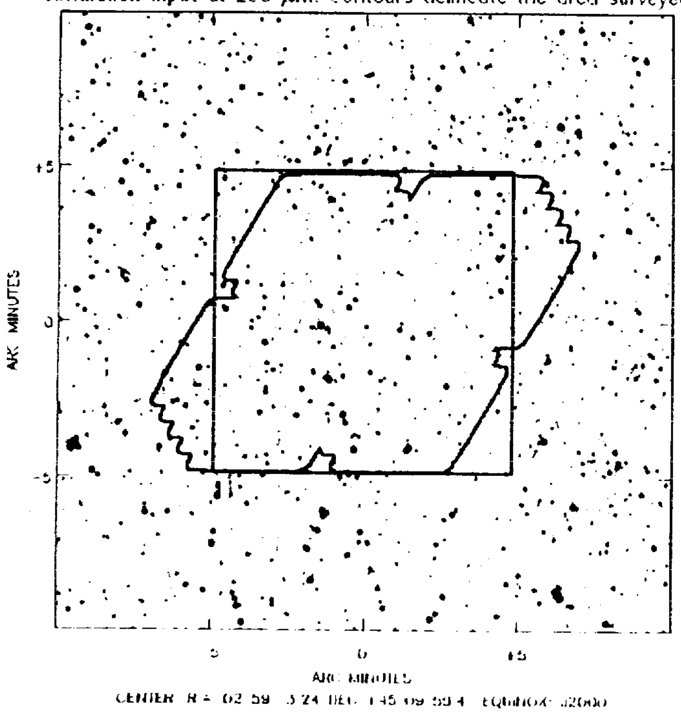
	$F\lambda/2$	$F\lambda$	$2F\lambda$
250μ	0.36	0.63	0.63
500μ	0.52	0.77	0.78

Noise level (mJy/pixel/hour)

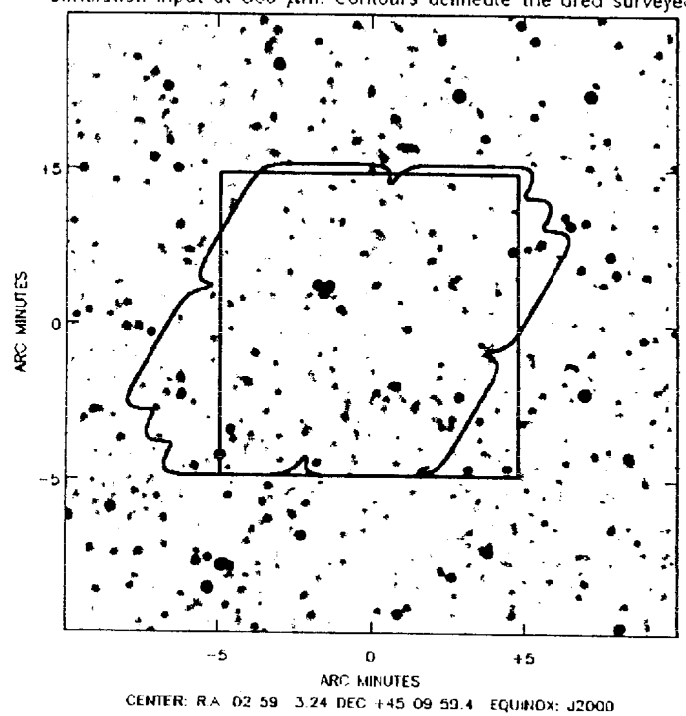
	Fλ	Fλ/2	2Fλ
250 μm	0.8	0.64	0.42
500 μm	0.8	0.73	0.76

Input field of the simulations, using counts prediction of Franceschini et al. (97)

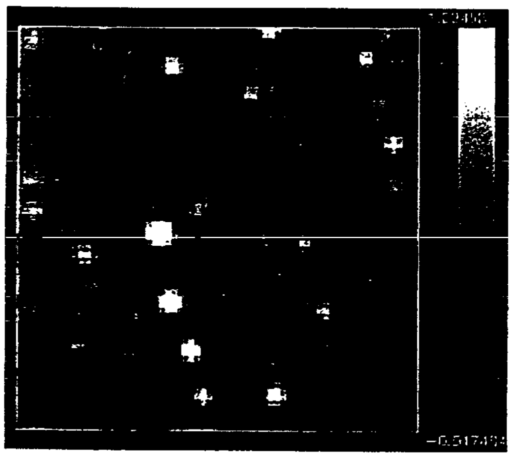
Simulation input at 250 μm. Contours delineate the area surveyed



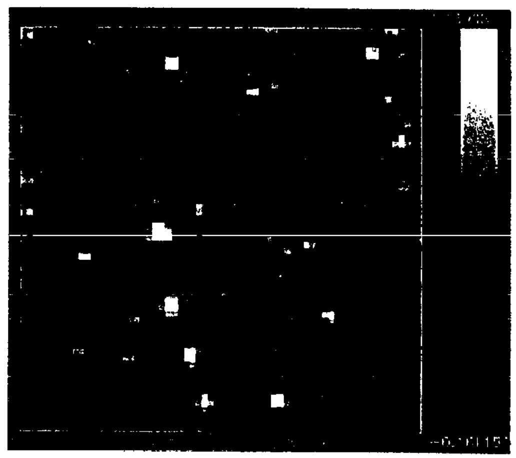
Simulation input at 500 μm. Contours delineate the area surveyed



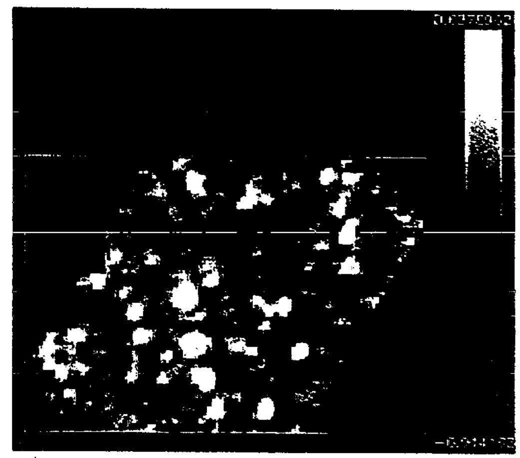
Result at 250 μm for a λ/2 resolution



F λ Square pixels



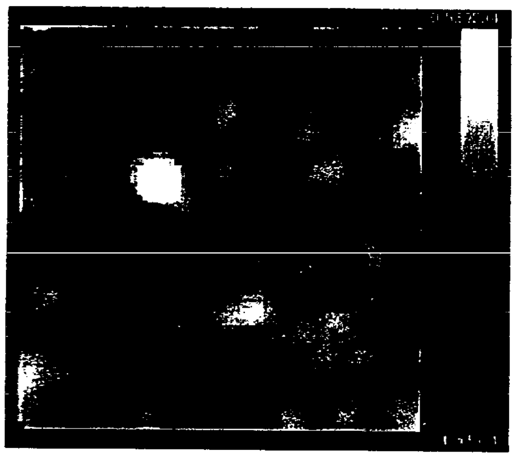
F λ/2 Square Pixels



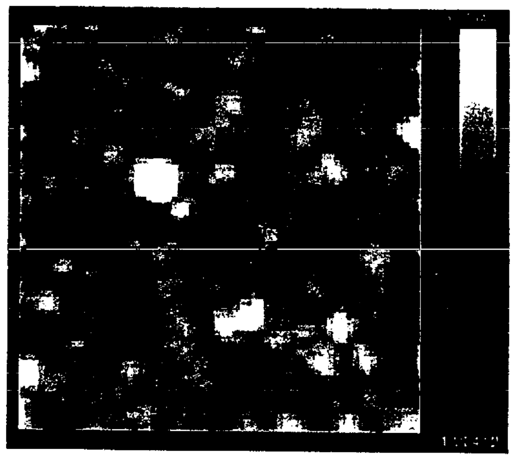
2 F λ Horns

Displays are Log (f mJy/pixel)

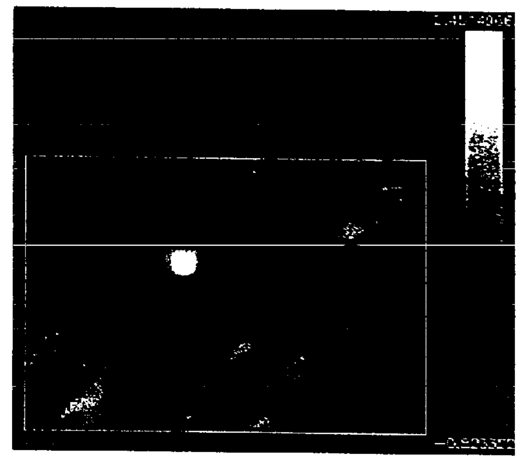
Result at 500 μm for a λ/4 resolution



Fλ Square pixels



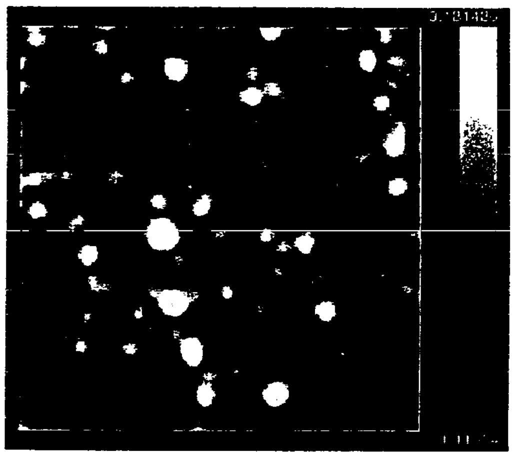
Fλ/2 Square Pixels



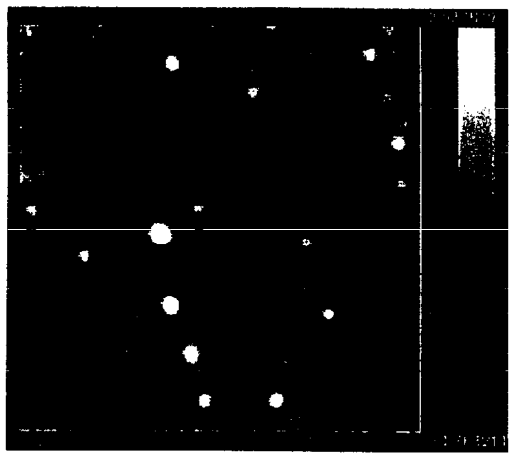
2 Fλ Horns

Displays are Log (f mJy/pixel)

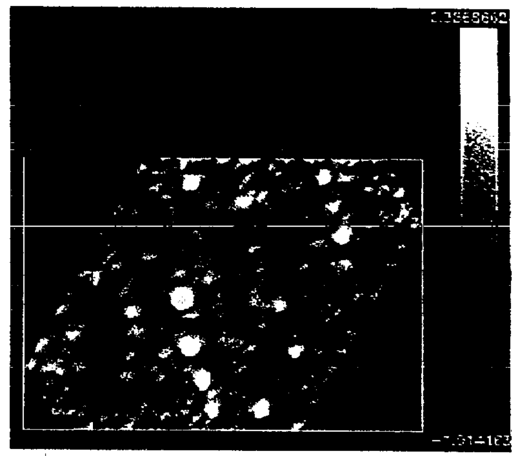
Result at 250 μm for a λ/4 resolution



F .. Square pixels



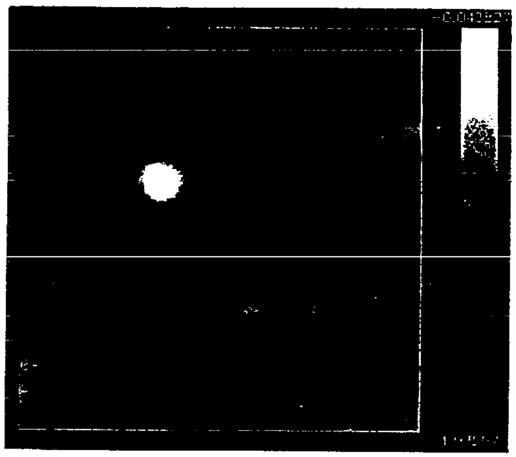
F λ/2 Square Pixels



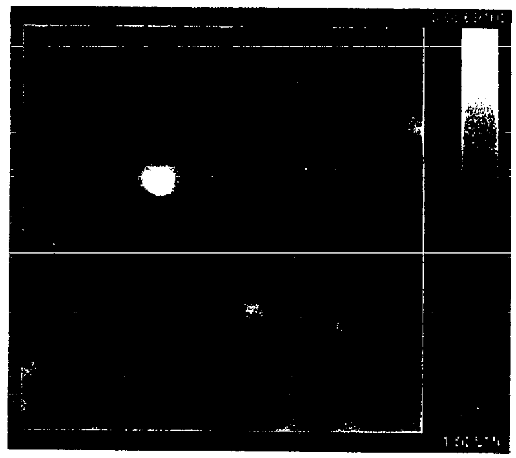
2 F λ Horns

Displays are Log (f mJy/pixel)

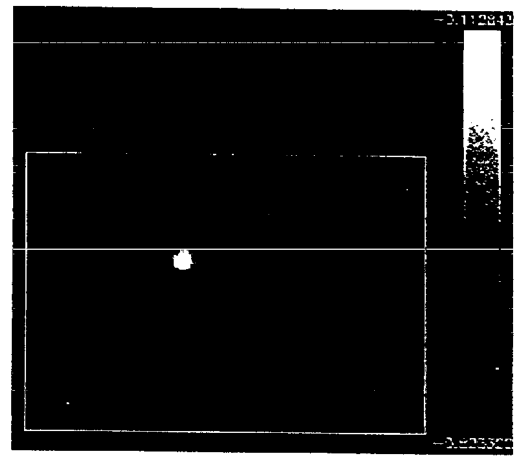
Result at 500 μm for a λ/8 resolution



F λ Square pixels



F λ/2 Square Pixels



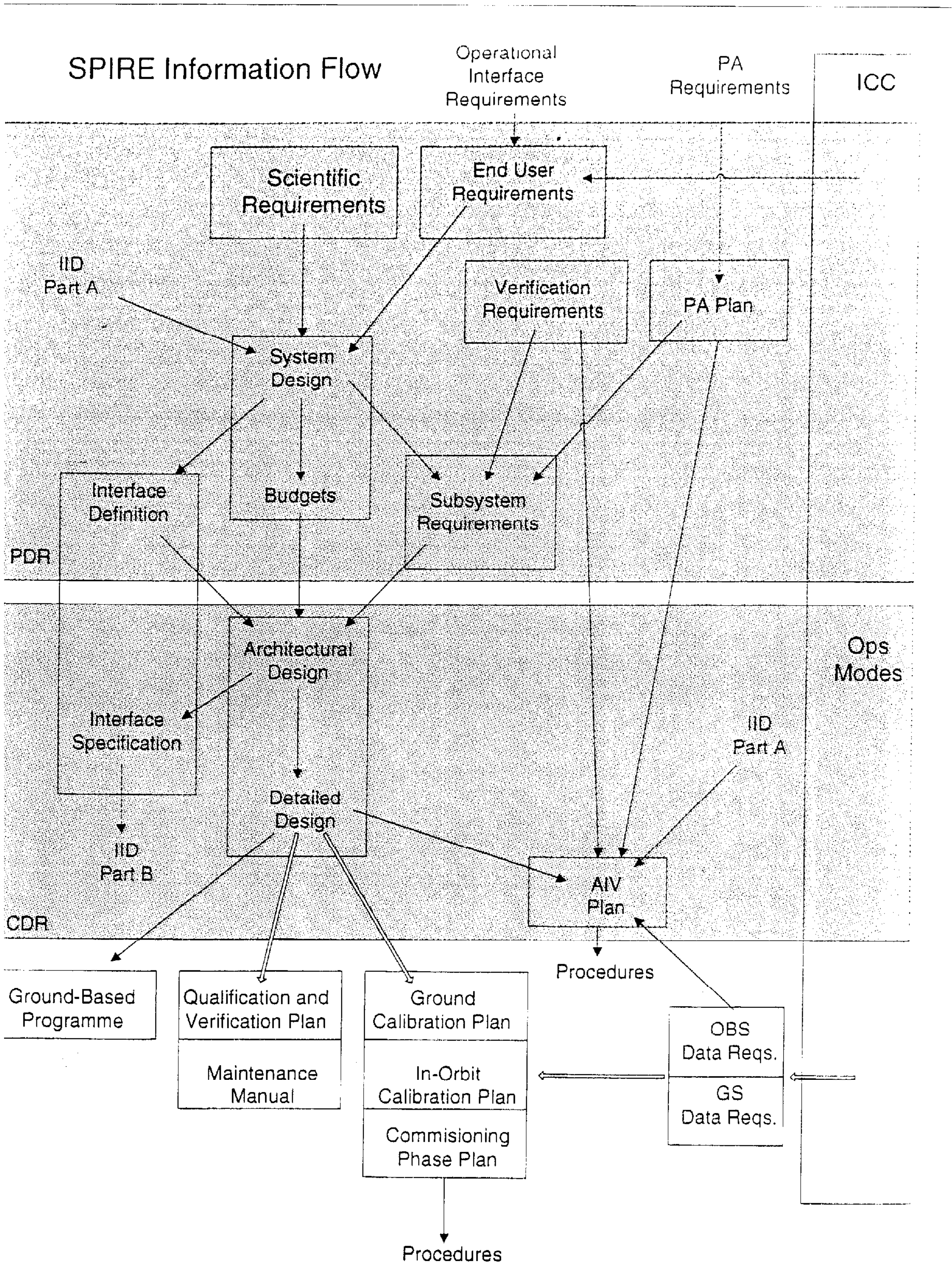
2 Fλ Horns

Displays are Log (f mJy/pixel)

12.

SCHEDULE AND PLANNING OF ACTIVITIES FOR SPIRE PRELIMINARY AND CRITICAL DESIGN REVIEWS, CQM AND AVM MANUFACTURE, AND AIV.

K. KING.



SPIRE Information Flow
Operational Interface Requirements
PA Requirements
ICC
Scientific Requirements
End User Requirements
IID Part A
Verification Requirements
PA Plan
System Design
Budgets
Interface Definition
Subsystem Requirements
PDR
Ops Modes
Architectural Design
Interface Specification
IID Part A
Detailed Design
IID Part B
AIV Plan
CDR
Procedures
Ground-Based Programme
Qualification and Verification Plan
Maintenance Manual
Ground Calibration Plan
In-Orbit Calibration Plan
Commisioning Phase Plan
OBS Data Reqs.
GS Data Reqs.
Procedures