CMS ECAL Cost Review - 1st Meeting
The Coseners House - 1/7/98

Present: G J Barber, D I Britton, R M Brown, D J A Cockerill, J F Connolly, G J Davies, G P Heath, P R Hobson

Agenda

1.	Introduction	RMB	10'
2.	Supercrystal prototype activities - What is needed - What can the university workshops provide? - What will the cost be?	JFC + Univ. reps	40'
3.	VPT prototypes - Iterations required and likely cost	 PRH	 15'
4.	Capital expenditure - Definition of items for which the UK should take procurement responsibility - Assignment of budget estimates to these items	JFC	40'
5.	Regional Centre activities - Cost of infrastructure - Cost of instrumentation and tooling - Cost of operation and consumables	Univ. reps	40'
6.	Conclusions and future actions	RMB	5'

1 Introduction

RMB opened the meeting, explaining that this was intended to be a first step in assigning 'budget cost estimates' to each area of UK ECAL activity. The ultimate goal was to produce a complete set of detailed costings.

There were several factors to be taken into consideration in deciding how to deploy the UK ECAL funds:

- It must be possible to assign a plausible value of 2.7 MSF to 'Cost Book items' (including a significant amount for hired effort)
- The list of deliverables should be consistent with the list given in the MoU (although the 'qualifying remarks' allowed some latitude)
- The items covered should correspond to the 'responsibilities' assigned to the UK in the TDR.

The sum of money which would be available for procuring construction items would be, by definition, the sum remaining from the PPESP allocation earmarked for the ECAL, after subtracting all other costs. The sum set aside for the Global Calorimeter Trigger (£40k prototyping + £180k construction) was assumed to be fixed.

A comparison of the budget figures presented to the PPESP in June 1997 (these are the only figures officially on record) and the current planning figures was shown (Appendix 1). RMB emphasised that we must strive to maximise the sum of money available for construction. Not only was there a limit on the total money that would be available to the Endcap project from all sources, but more importantly, it seemed likely that any short fall from UK + Russia could not be covered before 2005 and would therefore delay the project.

2 Supercrystal prototype activities

JFC summarised the elements that would be needed to construct the first supercrystal. Responsibilities were then assigned for each of the items. The exercise was then repeated for the four 'pre-production prototypes'.

Bristol undertook to provide the back inserts, the front inserts, the interface plate and the back housings for both the 1x5x5 and the 4x5x5 arrays. IC agreed to take responsibility for the positioning plates and the environmental enclosures, but warned of a possible problem in allocating suitably qualified effort to the work.

It was assumed that the Russians would provide the alveolas and a some of the VPTs. It would be important to ensure that the alveolas met the specification. Lecoq had agreed that CERN would arrange for Bogoroditsk to supply the crystals for the first 5x5, but it might be necessary to involve SIC in the production of crystals for the 4x5x5 array.

It was agreed that tooling would be required for mounting the supercrystals. For the 1x5x5 this would not necessarily be the same as the tooling eventually required for production, and was not considered to be a significant item. For the 4x5x5 it was assumed that the final tooling **would** be used, and the cost of this would come under 'Regional Centre'.

According to the above plan most of the mechanical items would be constructed in university workshops, and the cost to the budget would be small. However, it was noted that the sum set aside for 'prototyping' had also to cover modifications to the mechanical model, and the construction of a wooden mock-up. It was agreed that the current budget figure of £100k currently shown against this heading should be kept for the time being.

Bristol volunteered to supply a physicist who would take responsibility for the two prototyping projects, working closely with BJS and supported when necessary (for example in interfacing with the Russians) by DJAC. (It was announced after the meeting that Helen Heath had agreed to take on the task.)

3 VPT Prototypes

PRH proposed a strategy for future VPT prototyping, which included estimated costs. Brunel had discussed the next round of prototyping with ET. It was suggested that 25 -30 1" tubes would be produced, of which 5 would have radiation resistant face plates, for a total cost of £20k. In the following discussion it was pointed out that £20k was a significant sum compared to other prototyping costs, and the possibility of obtaining a smaller number at a lower price should be investigated.

ET estimated that the price for 100 tubes to be delivered in July 1999 for the 4x5x5 array would be £10k. They had confirmed their estimate of £50 per tube for eventual production devices.

PRH proposed that 12 VPTs, some with rad-hard faceplates, should also be obtained from Hamamatsu, and incorporated in the 1x5x5. He pointed out that Hamamatsu had so far not charged for the prototype tubes they had supplied, but he suggested that £2k should be set aside, to be used for this if needed.

Although the plan presented did not appear to saturate the budget figure of £104k currently allowed for VPT prototyping, it was agreed that this amount should be left for the time being. However, it was also agreed that this sum would have to cover the cost of the pre-production tubes required for the 4x5x5 array.

4 Capital Expenditure

JFC presented current estimates of the costs of mechanical items (Appendix 2). He proposed that the first priority for the UK should be to purchase all the mechanical items (except the alveolas) for the supercrystals, to guarantee timely delivery of the components needed for regional centre operation. The cost of these items was estimated to be £600k (including £87k for coating/wrapping, which it is hoped will not be necessary). He had added 30% to the cost estimate for the standard supercrystals to allow for the non-standard ones.

The next step is to discuss with the Russians and determine which of the 'major items' (backplates, calibration stage, assembly stage, transfer frames etc.) they could undertake to provide, emphasising that the alveolas should have high priority. **(Action DJAC.)** The UK could then consider how to deploy the funds not yet allocated under this heading (£400k - £500k). A high priority would be to increase the sum for VPT procurement from £100k to £200k, to allow the procurement of sufficient VPTs for one complete Dee.

5 Regional Centre Activities

DIB presented a list of items required to equip the crystal lab at IC. The total cost was approximately £36k. The list was accepted in principle, although there was some discussion on which items had to be purchased, and which already existed or could be found elsewhere. A high priority was the purchase of a spectrometer and associated equipment, required to measure light collection uniformity. This was needed urgently in order to establish whether or not it would be necessary to grind/coat/wrap crystals: an issue which has major implications for the overall design and construction of the supercrystals, requiring a decision by the autumn.

It was agreed that purchasing could start for items where it had been established that no suitable equipment was already available.

PRH presented an estimate of the money required to equip the Brunel 4.7T magnets for batch testing of VPTs and to operate them (Appendix 3). The sum required for this and for instrumentation to evaluate photocathodes was £27k. This amount was accepted as a reasonable budget estimate. Allowing for the cost of equipping the 1.8T magnet at RAL for batch testing, it appeared that the sum of £40k currently set aside for 'VPT acceptance testing' would not be sufficient. However, it was felt that the total sum of £140k budgeted under 'Instrumentation/robotics' and 'VPT acceptance' would be sufficient, even if the balance between them was not correct.

It was agreed that procurement of items for photocathode evaluation could go ahead.

6 Conclusions and Future Actions

- The current budget figures appearing under each of the major headings in Appendix 1 has been confirmed for the time being.
- A Bristol physicist would take lead responsibility for the production and testing of the 1x5x5 and 4x5x5 arrays.
- The mechanical components for these arrays would be produced by Bristol and IC.
- Purchase of items required to equip the IC Crystal Laboratory and to evaluate photocathodes at Brunel could start.
- Confirmation should be sought from the Russians concerning which items they would procure.

It was proposed that the next meeting be held at IC on Tuesday, 1 September. However, it transpires that this date is not convenient for Bristol.

It is therefore suggested that the meeting be **at IC on Wedneday 2nd September.**

RMB 7/7/98

Appendix 1

Total ECAL Cash Allocation (in cash kilo-pounds):

	June 1997	Now
	3007.5	2950.0

Budget figures:

	June 1997	Now	
PROTOTYPING			
Alveolas	183.0	0.0	(Russians have taken this on)
Mock-ups/prototypes	183.0	100.0	(Univ. workshops making big contrib.)
VPTs	104.0	104.0	(Including 5x5 and 4x5x5 prototypes?)
H4 and APDs	23.0	23.0	(Already spent)
Global Cal. Trig	40.0	40.0	(Sacred?)
Sub-Total	**533.0**	**267.0**	
REGIONAL CENTRE			
Instrumentation/Robotics	158.0	100.0	(CERN will do ACCOS Measuring)
VPT Acceptance	53.0	40.0	(More use of existing equipment)
Jigs/tools	37.0	37.0	
Data basery	26.0	26.0	
Sub-Total	**274.0**	**203.0**	
MANPOWER	**1218.0**	**1218.0**	(3/4 Ds of 'simpler' SC instead of 2?)
GCT	**180.0**	**180.0**	
CONSTRUCTION ITEMS			
F/E Housings (2 Dees	663.0		
S/C Connectors (2 Dees)	40.0		
VPTs for 1/2 Dee	102.0		(It would be 'nice' to double this)
Sub-Total	**805.0**	**1082.0**	(New figure is just 'sum available')
GRAND TOTAL	**3010.0**	**2950.0**	

Note: Planning in June '97 was based on a total PPESP allocation of £6900k - this was subject to a rounding error - the correct sum is £6870k. Therefore £15k has to be subtracted from both the Tracker and the ECAL allocations.

The Common Fund contribution was £1202.5k. This has increased to £1287.6 because the CMS 'Tax' has increased from 28.8% to 31.5%. (The cost increase would have been greater, but PPARC use an exchange rate of 2.37 SF/£, rather than 2.32 SF/£ previously assumed by us.)

Appendix 2

ECAL End Cap Cost Estimates

Item	Cost Estimate	Number Required	Cost £K
Mechanical Support Equipment			
Back Support Plate	40	4	160
Positioning Plate	0.065	697	45.35
Support Ring Flange	26	4	104
Mounting Ring Flange for HE Face	10.5	2	21
Environmental Shield	50	4	200
Overall Cost			**530.35**

Super Crystal	Per Ch (£)	5*5 (£)		5*5(£) UK
Crystal	200	5000		
VPT	60	1500		
Alveolar	20	500		
Reflective Wrapping	5	125		125
Back Inserts	10	250		250
Front Inserts	1	25		25
Interface Plate	2	50		50
Back Housing	1.24	31		31
VPT/Cable Interconnect	5	125		125
Distribution PCB with Components	7	175		175
Umbilical Connection (Electrical)	3	75		75
FO Monitor Items	*			
LED Test Items	*			
Total Cost/SC	314	7856		856
Total Cost Standard SC's			* 536	458,816
Est Deconsructed SC's			* 536x0.3	137,645
Overall Cost SC's				**596461**

Appendix 3

Capital costs - Items on CMS-UK budget

Description	Use	Cost (exc. VAT)
SRS PS310-01	IEEE controlled HT supply	£1500x2= £3000
Thrurlby 1906-GP	IEEE voltmeter for on-line monitoring	£570x2= £1140
Hamamatsu calibrated pn diode	QA	£300
Bar-code reader for workstation	Mandatory for CRISTAL	£800
VPT magazines plus two step-motor drive systems	Automated VPT test system	£5000
Pulsed LED system	Automated VPT test system	£800x2= £1600
Temperature and intensity stabilised LED	Tests of photocathode uniformity	£300
Optical bench, translation stage, rotation stage, mounts etc.	Optical tests of photocathode	£900
Set of 6 interference filters, rotating mount and stable lamp	Tests of wavelength sensitivity of photocathode	£500

Capital costs- Items not on CMS - UK budget

Description	Use	Cost (exc. VAT)	Source
12-bit 12 channel CAMAC ADC (e.g. LeCroy 2249)	VPT electronic tests	£2000	Brunel/RAL-pool
NT workstation with IEEE controller and LabView	Control of automated tests and CRISTAL interface	£3000	Brunel
CAMAC crate, IEEE controller, CAMAC step-motor driver	CAMAC readout and VPT magazine control.	£5000	Brunel/RAL-pool

Consumables - Items on CMS-UK budget

- The annual SC magnet running costs (continuous operation) are currently £2000 for helium and nitrogen combined **per magnet**
- Annual NAMAS calibration costs average £130 per item for the IEEE HT PSU and the IEEE DVM

The **total** consumable costs for three years of operation will thus be **£13560**

Summary of cost to CMS-UK budget:

capital £13540 **consumables £13560**

TOTAL £27100