

Response to PPESP questions regarding reduced funding and staff allocation for “A Fast Track Trigger with High Resolution for H1”

H1 Collaboration

Proposal 750

The Universities of Birmingham, Lancaster, Liverpool and Manchester,
Queen Mary and Westfield College of the University of London
and the Rutherford Appleton Laboratory

with

RWTH Aachen (I and III Institutes), Humboldt University Berlin, Universities of Brussels, Cracow and Dortmund, CEA Saclay, DESY-Hamburg, DESY-Zeuthen, Universities of Hamburg (I and II Institutes) and Heidelberg, MPI Heidelberg, Universities of Kiel, Košice and Lund, CPPM-Marseille, ITEP Moscow, LPI Moscow, MPI Munich, LAL Orsay, Ecole Polytechnique, Universities of Paris VI and Paris VII, Institute of Physics, Czech Academy of Sciences, Prague, Nuclear Center, Charles University of Prague, University of Rome, PSI-Villigen, University of Wuppertal, ETH Zürich and University of Zürich.

The H1-UK collaboration was asked to inform the Panel what they would do with £150K and 2 staff years of effort.

Addressing the funding first we note the Panel's comments on considerable savings being possible on the FPGA's if they were to be purchased late and that this leads to the maximum possible offer of £200K. With suitably aggressive purchasing for the whole project we agree that this may indeed be the case and that with timely delivery the impact on physics would be minimal, although funding would remain critical.

Further reduction to £150K is however very difficult.

We see two scenarios for achieving this, either delaying the project even further or reducing the number of layers.

The former was explicitly addressed in the initial questions from the Panel in October and on discussion with the referees the conclusion was that should the trigger only be installed for 4 years luminosity running the loss in physics potential would not be critical but that a more extensive delay would not be realistic. It is therefore not very likely that sufficient savings would be possible on a reasonable time-scale. Although the recently announced delay in the start of the long HERA shutdown until the 4th September 2000 is at least a step in the right direction, the restart of HERA operation will still be before any currently proposed delivery date for the FTT L1 system.

The latter scenario of reducing the number of instrumented layers to only those in CJC1 would decrease the number of Analogue DC ϕ Plug-through Cards to 90 and L1 Front-end Modules to 18. Assuming a full cost of £200K and a linear relationship between quantity and cost for these devices this would at face value provide sufficient saving.

However the reduction to 3 layers increases the sensitivity of the track finding efficiency to the single hit efficiency and as yet unknown background. The effect of this as a function of the single hit efficiency can be seen in Figure 1 where the results for a track at the $\eta = 1.5$ limit correspond to just this situation, measurements from CJC1 alone. Furthermore, for central tracks the fourth layer in CJC2 provides the most precise momentum measurement because of the long lever arm when including the vertex constraint. Indeed it was this extended lever arm that made using triplets of wires in layers competitive with the information from the full detector which has resulted in this proposal reaching fruition. An FTT without a fourth layer could be operated but life would be much harder.

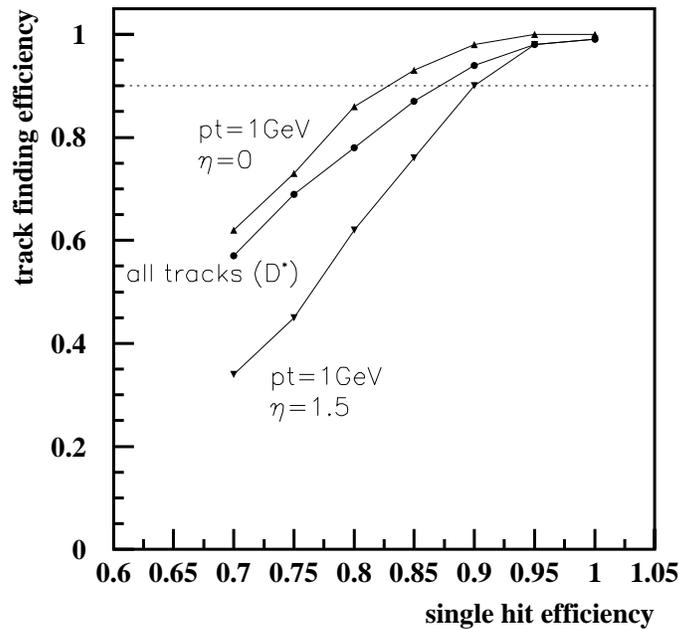


Figure 1 - FTT track reconstruction efficiencies as a function of the single hit efficiency. Results are shown for tracks with $p_t = 1$ GeV in the centre of the CJC acceptance ($\eta = 0$) and at its extreme limit ($\eta = 1.5$) and for an average over all tracks arising from $D^* \rightarrow K\pi\pi_{\text{slow}}$ decay candidates in 1997 data.

Secondly addressing the reduction in the staff years of effort required from RAL Instrumentation Department, further discussion has resulted in the detailed breakdown itemised in Table 1, which now totals 2.5 staff years. This has reduced in two main ways; firstly the effort requested for integration into H1 and control (previously listed as ‘Control software and interfaces’ as a joint RAL ID and Manchester responsibility) has now become a central DESY responsibility along with the analogue plug-through card becoming entirely a Manchester responsibility; secondly the numbers for the FEM design have been reduced by 6 months to reflect the competencies of the identified staff. Should less experienced staff be used then the numbers would increase.

This total could be reduced to near the target 2 staff years by contracting out the PCB layout to industry, but this of course would incur additional direct costs and preclude iteration of the design.

Task	Staff months	Name
1. Analogue design	2	AB & DL
2. Digital design	4	AB & DL
3. PCB layout	6	BC
4. Debug	4	AB & DL & Technician
5. Firmware	4	DL
6. Production	4	Technician
7. Commissioning and installation	2	AB & DL
8. Control software	4	Real-time Systems Group
Total	30	

Table 1 - Detailed breakdown of effort from RAL Instrumentation Department for construction of the H1 Fast Track Trigger L1 Front-end Module. The key for names is AB - Adam Baird, DL - transfer from Daresbury (tbc) and BC - Brian Claxton.

The Panel also raised concerns regarding the level of involvement of the UK University groups and noted the original restricted commitment to programming the FPGA’s. Birmingham will now perform the coding of the FPGA both for the track segment finding and for the trigger functionality, with some interaction with DESY on the details of the algorithm. This has been made possible by the commitment of a graduate student full-time and 1 staff year from a new technician guided by a senior electronic engineer (Richard Staley), with the Birmingham

responsibilities on the service module and trigger card being subsumed by Manchester. Although rearranged within the project, the overall level of commitment from Manchester remains broadly similar to that previously proposed.

In the mean time additional effort has now been identified at Liverpool which could relieve Murrough Landon (QMW) of his existing commitment to the Forward Tracker Upgrade. He is currently on holiday in India but on his return we propose to offer him the possibility of becoming involved in the FTT instead. The remainder of the effort and particularly the system integration would be provided by graduate students from the various institutes including Liverpool.

This results in the commitment from the UK Universities now amounting to some 8.6 staff years, detailed in Table 2 with the commitment from overseas remaining at a similar level to that previously proposed, but now focused on the integration of the trigger into H1, where long term on-site expertise is essential. The ratio between the UK Universities (and RAL PPD) and that requested from RAL ID is now 8.6:2.5 compared to the original 6:4.

Item	RAL ID	Other UK	Non-UK	Source of Effort
1. Analogue DCr ϕ Plug-through Card		0.6		Manchester
2. a) L1 Front-end Module design	2.5			RAL ID
b) Coding QT algorithm		0.25		RAL PPD
c) Coding track segment finding algorithm		2.2	0.3	Birmingham/DESY
d) Integration into H1 and control			1	DESY
3. a) L1 service module/trigger card design		0.8		Manchester
b) Coding trigger algorithm		1		Birmingham
4. Trigger algorithms and simulation		1	1	Birmingham/DESY
5. Monitoring software		1.5		UK universities
6. System integration		0.5		UK universities
7. Project management		0.75		RAL PPD
Total	2.5	8.6	2.3	

Table 2 - Revised schedule in staff years for UK involvement in Fast Track Trigger project .

We consider that as out-lined above and with the University and German effort identified the project will be feasible with 2.5 staff years of effort from RAL Instrumentation Department. There is however no identified acceptable strategy for de-scoping or delaying the project such that a budget of only £150K would not seriously degrade the physics potential.

There is an indivisible core of 2.5 staff years of effort and cost of some £125K¹ for the Front-end Module that can not be spread sensibly amongst different institutes or indeed collaborating nations in the larger Fast Track Trigger project. This remains as the request for staff effort from RAL ID and the core of the funding request. The remaining £75K is the minimum for the University involvement and is equally unavoidable.

¹ This is the figure of £135K + VAT scaled in the light of the Panel's comments regarding pricing trends.