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SPSC/M 365  
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MEMORANDUM



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To: The SPSC  
From: The NA4 Collaboration  
Subject: Extension of NA4 Running in 1985

At the end of 1981, the NA4 collaboration proposed<sup>1</sup> a program to measure the nucleon structure function  $F_2(x, Q^2)$ , the QCD scale parameter  $\Lambda$  and  $R = \sigma_1/\sigma_t$  to high accuracy with hydrogen and deuterium targets and at beam energies of 100, 120 and 200 GeV, requesting  $1.5 \times 10^{13}$  incident muons for each energy and target. The SPSC in its 85th meeting approved<sup>2</sup> the hydrogen measurement, allocating to NA4 150 days of main user time during the years 1982/84.

Since then, data taking has suffered badly from a modest performance of the accelerators and from various other incidents beyond our control. To be more specific:

- The rescheduling of the SPS at the beginning of 1982 - after the UA1 accident - and a fire in the EMC spectrometer forced us to start data taking as main users in P2A/82 (i.e. in April instead of September as originally planned) on very short notice. At this time, both our apparatus and the muon beam line were not yet optimised and most of the period had to be sacrificed for running in.
- Following a decision of the CERN management, the muon beam was shut down during most of P3A/82 - originally scheduled to be an NA4 period - for reinstallation of the EMC forward magnet.

<sup>1</sup> CERN/SPSC/81-97 (SPSC/M 306)

<sup>2</sup> CERN/SPSC/82-16 (SPSC 85)

- Substantial beam time was lost due to a bad start-up of the SPS in P4A/82 and the disaster of P3A/83, followed by another bad start of P3B/83. Unfortunately, most of these incidents also coincided with NA4 main user time.

On the other hand, the performance of our spectrometer has been exceptionally stable from P2B/82 onwards and we have lost only negligible beam time due to problems with our apparatus.

In table 1 we summarise the amount of incident beam and the days of running which were available to us for data taking in 1982/83. It is evident from this table that after 2 out of 3 years of running time we were delivered only 40% of the allocated beam. This means that, with any reasonable sharing of beam time between NA2 and NA4 in 1984, and even under the most optimistic assumptions about the performance of the accelerators, we will have missed the SPSC allocation at the end of 1984 by a substantial fraction. This applies in particular to the 100 and 120 GeV data since it is likely that 1984 will be mainly devoted to data taking at 200 GeV for the NA2 polarised target program. If we terminated the hydrogen measurement under these circumstances, we would have to compromise substantially on the quality of our expected physics results, in particular on the measurement of R for which the low energy data and high statistics are of crucial importance.

Also, our measurement of the EMC effect with deuterium, nitrogen and iron targets approved for Period 5/1983 has already suffered from severe losses of beam time due to a delayed start-up of the SPS in P5A, various breakdowns in the EMC spectrometer and SPS critical periods.

Considering any further cut into our original physics program unacceptable, we wish to notify the SPSC well in advance that we intend to ask for an appropriate extension of running time in 1985 in order to complete our currently approved program. However, we prefer to postpone a detailed request until the data taking in 1984 has been finished.

Table 1: Muons on target and running time in 1982/83

Beam Energy (GeV)	1982/83	SPSC Allocation
100	$0.60 \times 10^{13}$ (20 days)	$1.5 \times 10^{13}$ (50 days)
120	$0.70 \times 10^{13}$ (19 days)	$1.5 \times 10^{13}$ (50 days)
200	$0.55 \times 10^{13}$ (21 days)	$1.5 \times 10^{13}$ (50 days)

In addition there were  $30 \times 10^{11}$  muons at 280 GeV from parasitic running parallel to NA9/NA28.