CERN/SPSC/85-27
SPSC/M 405
March 21, 1985

M E M O R A N D U M

To: The SPSC

From: R. Voss, NA4 Spokesman

Subject: NA4 Data Taking in 1985

The NA4 collaboration is presently approved[1] to measure the proton structure function $F_2(x,Q^2)$ with a hydrogen target at beam energies of 100, 120 and 200 GeV, using $1.5 \cdot 10^{13}$ incident muons at each energy. For a variety of reasons beyond our responsability[2] it has not been possible to complete this program in 1984 as originally foreseen; the situation at the end of last year is summarized in Table 1. As a consequence of the EMC polarized target program, which required extensive data taking at 200 GeV and high intensities, we have now collected even more data than requested at 200 GeV. On the other hand, we are still lacking severely the low energy data which are important for the measurement of $R = \sigma_L/\sigma_T$.

We do therefore plan to continue data taking in 1985. However, to ensure compatibility with the EMC program and to profit as much as possible from the amount of protons which we can expect for 1985, we foresee two modifications to our original proposal:

1. The EMC will finalize their polarized target program in period 2/85, again mostly with 200 GeV beam energy. Since any more data taking at 200 GeV with the hydrogen target is of no use to us, we intend to spend this period for data taking with a deuterium target. These data would yield an improved measurement of the neutron/proton structure function ratio (Fig.

---

1 CERN/SPSC/82-16 (SPSC 85)

2 CERN/SPSC/83-76 (SPSC/M 365)

1); in combination with our D_2 data at 280 GeV taken in 1983 to measure the EMC effect, they can also be used for an independent measurement of R and A_{QCD}, albeit with lower accuracy. The deuterium fill needed for our target is readily available at CERN.

2. The shutdown of the neutrino beam in 1985, with the exception of a test run for WA79, allows for extended running at 280 GeV beam energy and with high intensity ($4 \cdot 10^7$ μ/pulse, requiring 10^{13} protons per pulse). In agreement with the EMC, and after consultation with the SPS coordinators, we therefore plan to complete our hydrogen program in period 3 with ~30 days of running under these conditions (corresponding to ~$7 \cdot 10^{12}$ incident μ at 100% efficiency) and ~10 days of running at 100 GeV.

   Compared to our original proposal, such a scenario would preserve the total statistical error of the R measurement ($\Delta R = 0.02$) but extend the measurement to a much wider kinematic range (Fig. 2). Also, the additional beam energy would give us improved redundancy and a better control over systematic errors. Similar arguments apply to the measurement of A_{QCD}.

A more detailed intensity request, which has been agreed upon among the two muon collaborations, has been submitted earlier to the SPS coordinators.

Table 1: Muons on target and running time in 1982/84 (H_2 running)

Beam Energy (GeV)	1982/84	SPSC Allocation
100	0.6×10^{13}	1.5×10^{13}
120	0.9×10^{13}	1.5×10^{13}
200	1.9×10^{13}	1.5×10^{13}

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

Figure Captions

Fig. 1: Expected statistical errors for the neutron/proton structure function ratio vs. the Bjorken scaling variable, compared to published SLAC and EMC data. Our estimate is based on the EMC parametrization $F_2^n(x)/F_2^p(x) = (1 - 0.75 \cdot x)$. For $0.1 < x < 0.4$, error bars are smaller than the size of the points.

Fig. 2: Expected statistical errors on $R = \sigma_L/\sigma_T$ as a function of the energy transfer ν to the nucleon system, compared to published EMC and CDHS data. Without 280 GeV data, the measurement would be limited to $\nu < 90$ GeV.

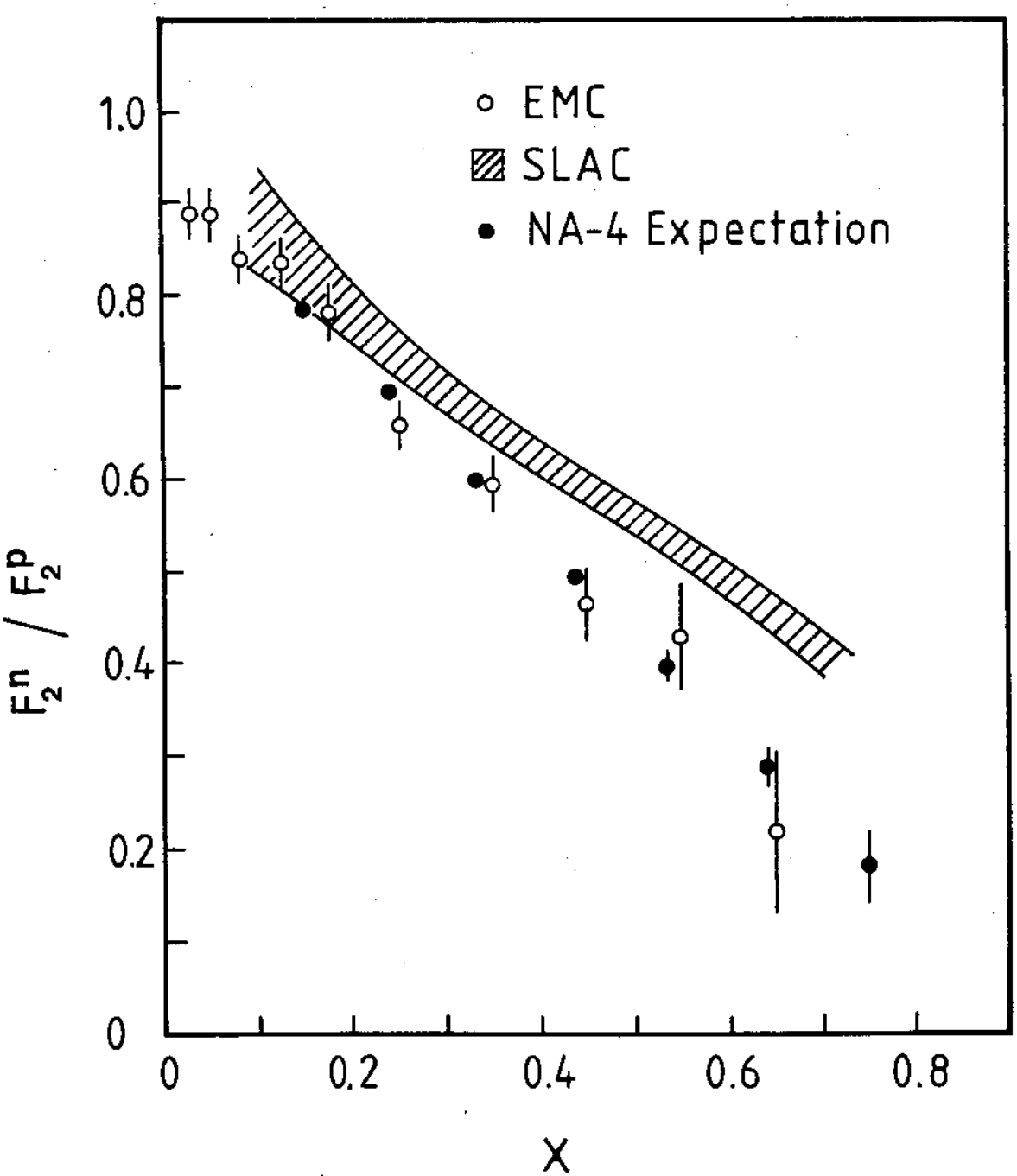

Fig. 1

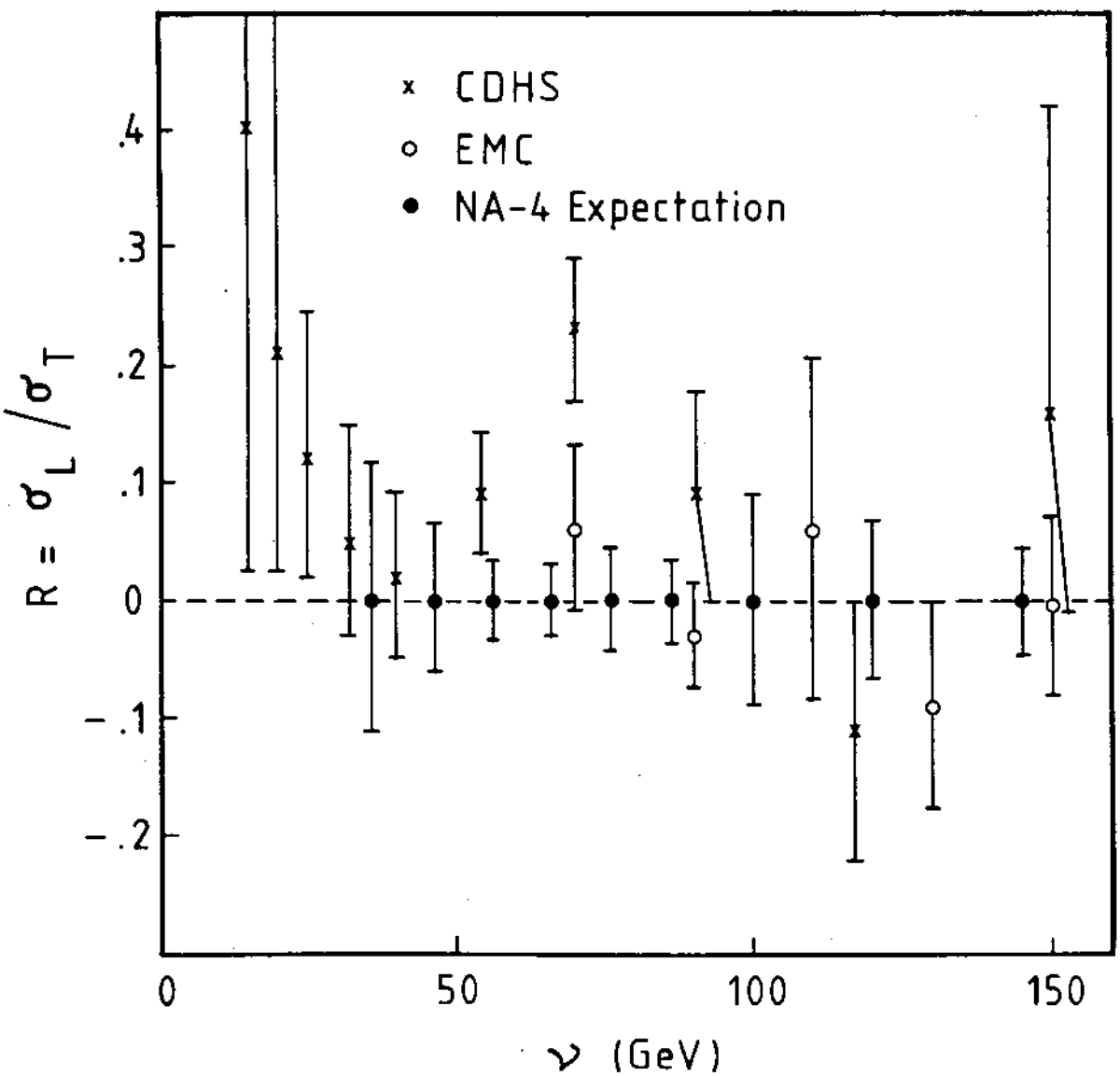
CDHS
EMC
NA-4 Expectation
$R = \sigma_L / \sigma_T$
.4
.3
.2
.1
0
-.1
-.2
0
50
100
150
ν (GeV)

Fig. 2