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1 February, 1967.

LETTER OF INTENTION

(This letter replaces our letter of intention of 2 December, 1966).

To : EEC

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Subject : MAGNETIC MESON SPECTROMETER FOR SINGLY AND DOUBLY CHARGED STATES (I = 1 and 2) AND MASSES UP TO 4 GeV

We propose a magnetic missing-mass spectrometer and decay analyser of resonances, using the wide-gap magnet No. 2 of the NP Division, and wide-gap magnetostrictive wire-chambers. The magnet (gap: $1.50 \times 1.00 \times 0.50$ m^3) with H_{max} = 18 kilogauss has already been delivered and is about to be tested by the NP magnet group. The wire-chambers have been successfully tested in operational conditions recently. The proposed meson spectrometer would have two branches (see figure):

BRANCH 1

Momenta and angles of the recoil protons will be measured in the reactions:

$$\pi^+ + p \rightarrow p + X^+$$

$$K^+ + p \rightarrow p + K^*$$

and, as a byproduct, the reaction:

$$p + p \rightarrow p + p^* \ .$$

Due to the accurate proton momenta measurements, $\Delta p/p = \pm 0.5\%$, the system will be able to work at small angles, outside the Jacobian-peak region, thus reaching the heaviest possible meson masses (M_X = 4.0 GeV

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at p_π = 15 GeV/c, while in Jacobian-peak region a pion momentum of ~ 25 GeV/c would be needed for M_X = 4 GeV)*). In addition, the directions of all charged decay particles will be measured by a magnetostrictive wire spark-chamber system enclosing the target with a 4π geometry. This geometry will be rendered possible mainly by using a helium-cooled liquid-H_2 target. Also, the momenta of a certain fraction of the charged decay particles will be measured. Combining the information on the direction of some decay pions with the information on the direction and momentum of those decay pions that entered the magnet, it is hoped that in favourable cases Dalitz plots could be obtained, as well as the effective mass distributions.

BRANCH 2

A neutron MM spectrometer working in the Jacobian-peak region and consisting of 20 large neutron counters ($150 \times 20 \times 20$ cm^3) (of the type developed by the Karlsruhe Group) will be placed on the opposite side of the proton branch. It will investigate the mass spectrum of doubly charged states, X^{++} in the reaction:

$$\pi^+ + p \rightarrow n + X^{++}$$
$$\hookrightarrow \pi^+\pi^+ + \text{possible neutrals}$$

Since the direction of the two pions, $\pi^+\pi^+$, determines the production vertex, a long, liquid-H_2 target (high counting rate) can be used without loss of the mass resolution. The $\pi^+\pi^+$ effective mass will be determined from the π momentum and/or direction measurement which, in turn, will determine if there was a missing neutral in the decay.

We would like to use the positive d_{25} beam (π^+, K^+, and p) for the main run, preceded by the test runs with the π^- beam. The detailed proposal is under study.

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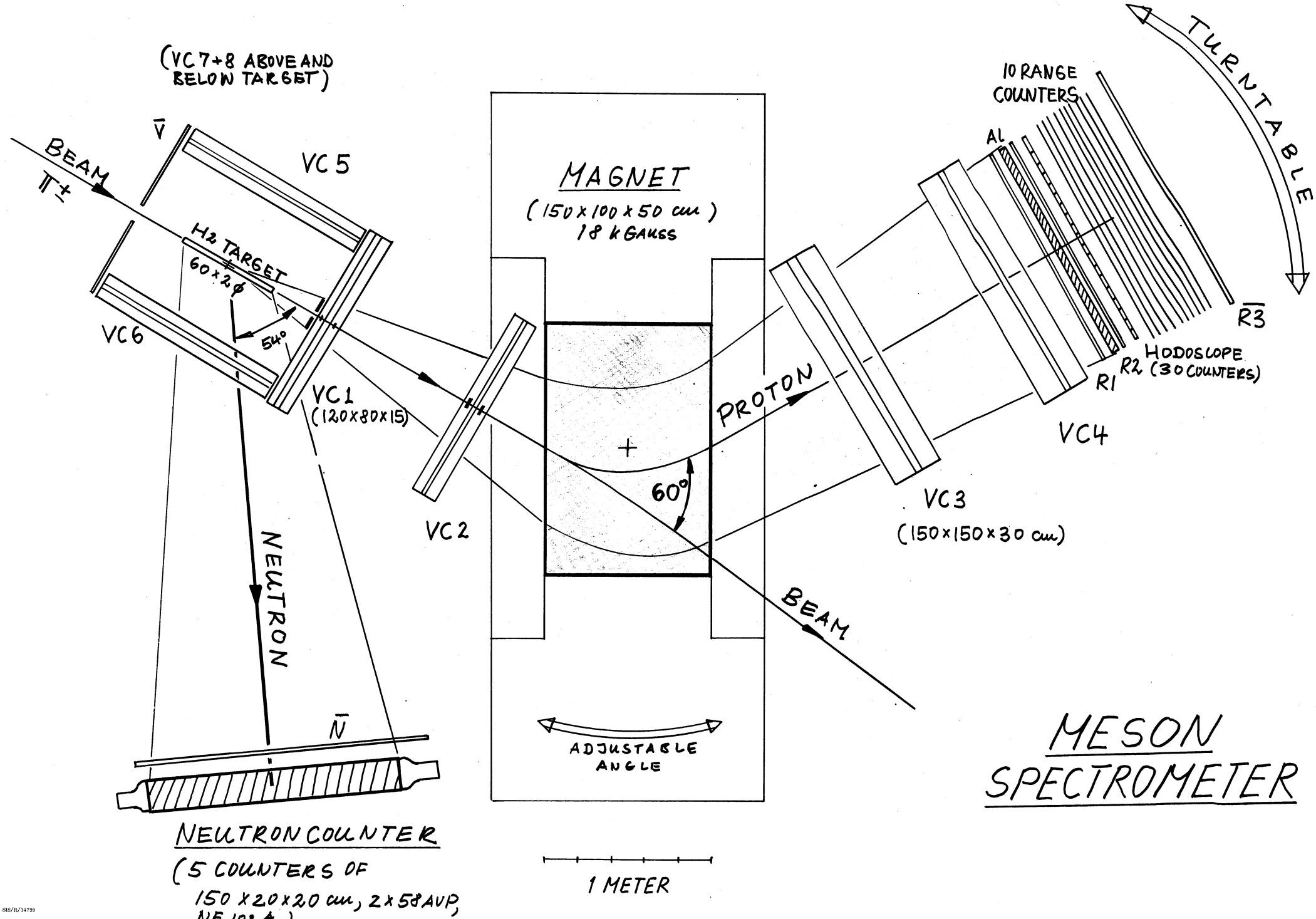
*)Mass bites and resolutions, see table.

Mass bites and resolutions

p_1 = 6, 12, 18 GeV/c ($\Delta p_1/p_1$ = 1%); p_3 = 0.4 - 0.6 GeV/c ($\Delta p_3/p_3$ = 1%)

p_1 (GeV/c)	$E^{c.m.}$ (GeV)	Jacobian peak method		Magnetic spectrometer	
		M_X(GeV)	Γ_{exp}	M_X(GeV)	Γ_{exp}
6	2.5	<u>1.30</u> 0.85 - 1.55	± 13 MeV	<u>2.10</u> 1.90 - 2.20 (max 2.4 at p_3=1GeV/c)	± 6 MeV
12	3.9	<u>1.90</u> 1.40 - 2.30	± 12 MeV	<u>3.00</u> 2.7 - 3.2 (max 3.6)	± 9 MeV
18	5.0	<u>2.20</u> 1.40 - 2.70	± 12 MeV	<u>3.70</u> 3.4 - 4.0 (max 4.5)	± 11 MeV


(VC 7+8 ABOVE AND BELOW TARGET)
BEAM
π±
V̄
VC 5
H2 TARGET
60×2φ
54°
VC 6
VC 1
(120×80×15)
MAGNET
(150×100×50 cm)
18 kGAUSS
VC 2
PROTON
60°
VC 3
(150×150×30 cm)
10 RANGE COUNTERS
Al
R̄3
HODOSCOPE
R2 (30 COUNTERS)
R1
VC4
TURNTABLE
NEUTRON
N̄
BEAM
ADJUSTABLE ANGLE
1 METER
NEUTRON COUNTER
(5 COUNTERS OF
150×20×20 cm, 2×58AVP,
NE 102 A).
MESON SPECTROMETER

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