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CM P00052322

PHYSICS I  
ELECTRONICS EXPERIMENTS COMMITTEE

To : Members of the Electronics Experiments Committee  
From : Allaby et al ,  
Binon et al  
Re : Measurement of the Proton-Proton Elastic Differential Cross Section  
between  $|t| = 1$  and  $|t| = 6.5 \text{ GeV}^2$  at  $19.2 \text{ GeV}/c$  Incident Momentum

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A recent experiment<sup>2)</sup> has shown the existence of a diffraction-like structure in elastic proton-proton scattering between 8 and 12 GeV/c. The structure exhibited itself by an oscillatory behaviour, as demonstrated in Fig 1

In our present experiment (S61, beam s<sub>4</sub>) we have measured elastic proton-proton scattering between  $|t| = 0.1$  and  $|t| = 2.0 \text{ GeV}^2$ , both at  $19.2 \text{ GeV}/c$  and  $21.1 \text{ GeV}/c$  incoming momentum. These data extend appreciably beyond the existing data<sup>2)</sup>, which end essentially at  $|t| = 0.8 \text{ GeV}^2$ . The  $21.1 \text{ GeV}/c$  data have been plotted in Fig 1, under the reference Allaby and Binon. The  $19.2 \text{ GeV}/c$  are very similar but have not been plotted in order to avoid confusion. The figure suggests that there must be considerable structure for the new data to join on to the existing data near  $\sin\theta = 1$ .

The type of behaviour exhibited here finds its simplest explanation in optical or diffraction models. A promising version of a diffraction model is one of Durand and Lipes,<sup>3)</sup> who elaborated on previous ideas of Wu and Yang<sup>4)</sup> and Chou and Yang<sup>4)</sup>. In this model one starts with a protonic matter distribution very similar to the charge distribution found in electron-proton scattering. The absorption taking place when two of these matter distributions pass through each other results in an elastic angular distribution resembling the one shown in Fig 1 at  $12 \text{ GeV}/c$ . It is possible,<sup>3)</sup> and Fig 1 suggests it, that the diffraction-like structure becomes more prominent with increasing energy. Hence an accurate measurement at as high an energy as possible seems to be necessary.

