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Zürich, 28 November, 1985 il

Re: LEAR proposal P90/The Crystal Barrel

After having contacted our referees and read the PSCC minutes we would like to comment on the open points which might help speed up the discussions.

1) Role of the XDC

It is essential to distinguish between s- and p-wave annihilations at rest. In gas the occurence of p/s-annihilation is about 50/50. In liquid s-wave annihilation dominates. Clearly a comparison of liquid and gaseous H_2 without L X-ray tag already helps in identifying new states. This is however not true for an event-by-event analysis, necessary for a spin-parity determination. Here, events with tags on p-annihilation are easier to analyze than with 50/50 p/s. The rate reduction by the factor of ten for an L X-ray tagged event will influence the data taking rate only for very rare events. With the tag we will obtain high statistics samples with less than 5 % s-wave contamination. Also gaseous data without tag lead to 50 % useless events on tape. In addition the technique is standard in ASTERIX and we foresee no problems in constructing and operating the XDC.

2) Hybrid states lighter than 1900 MeV and their spin-parity determination

The mc-simulations in our proposal for a hybrid state at 1900 MeV show a very unfavorable case. A hybrid state below 1600 MeV would be measured with stopped antiprotons, where the background is lower compared to measurements in flight at 2 GeV/c. This is illustrated in table 10 which shows that the separation of channels at rest is always better than at 2 GeV/c. The quality of a spin-parity analysis, which is important for the selection of states with exotic quantum numbers depends essentially on the peak/background ratio (see e.g. C. Amsler et al., Durham proceedings for an analysis of

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the $\rho\pi$ system). This ratio, is not predictable as long as the yields for the hybrid states and the background are unknown. We expect with our apparatus very good channel seperations which should enable us to do the most efficient spin-parity analyses.

3) Use of slow gas

The longitudinal diffusion of electrons in slow gases is about a factor of four smaller than in fast gases, leading to a spatial resolution of better than 100 microns. Resolutions much better than this were achieved in chambers in construction for L3, SLD, etc. The magnetic field of 1.5 T leads in fast gases to a Lorentz angle of ~ 50 degrees in contrast to 7 degrees in our slow gas. The electrostatics in the slow gas avoids the problems of highly distorted electron orbits, which would occur in a fast gas and would worsen the spatial resolution. Solutions for the stabilization of pressure/temperature/gas mixture are identified and are achievable with conventional techniques. Very similar problems occured for the SLD design and are technically solved. Our spatial resolution of 100 microns seems to be conservative (G. Charpak, private communication).

4) Computer time

Our computer time estimates are based on ASTERIX, an experiment of comparable complexity. ASTERIX needs at CERN 300 IBM-hours per year for monitoring the experiment, development of programs, mc-simulations and part of the data analysis.

The heavy CPU load comes from the reduction of raw data tapes to data summary tapes. This is done at the home institutions. For 1000 tapes ($\simeq 10^8$ events) ASTERIX requires 1500 CPU hours on a CERN IBM equivalent machine (50 ms per event). We intend to follow the same procedure. For 500 spills we expect about 500 high density tapes the reduction of which will take about 1500 IBM-hours. There is enough time available in our home institutions (2000/year). The 400 IBM-hours/year requested from CERN will be used for the monitoring/program development/etc. tasks to be performed at CERN.

From the discussions with our referees we got the impression that no major points were raised against the realisation of our project. Thus we feel that at least the decision on a principal go for the experiment could be taken already at the December PSCC meeting, which would be very important for the continuation of the preparation of the experiment. Waiting for the OBELIX proposal could bring untolerable delay, which is not justified in view of the positive and encouraging statements we have received.

Yours sincerely,

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