Experiment E99-117 Run Plan Update

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http://hallaweb.jlab.org/physics/experiments/he3/A1n/update_june27.ps.gz

This is an update of experiment E99-117 runplan. Run time estimation is presented, based on real event rate from data taking runs (x=0.6) between June 11 and June 26. It has also been taken into account the target polarization difference between transverse and longitudinal settings.

Contents

1 Kinematics and Rate

Estimation of single arm rate, π^-/e^- and e^+/e^- are shown in Table 1. It is the same as the original runplan. Kinematic variables α and β are also listed. During data taking at $x = 0.6$,

Table 1: e^- rate for E99-117

kine #	x	rate (Hz)	π^-/e^-	e^+/e^-	α	β
1	0.610	0.1410	$\sim$10	$\sim 0.2\%$	2.5554	0.5628
2	0.475	0.9522	$\sim$20	$\sim 0.5\%$	3.4869	0.8017
3	0.331	1.2805	$\sim$100	$\sim 3\%$	3.9670	0.6503

real rate is about 520 good electrons per hour per spectrometer, e.g., 0.14 Hz per arm, with beam efficiency 75%. Since real rate agrees well with the runplan, original estimation of event rate will be used in the following sections.

2 Run Plan Optimization

We aim to achieve a statistical error of $\Delta A_1^n = 5.0\%$, e.g., $\Delta A_1^{^3He} = \frac{5.0\%}{3} = 1.667\%$.
For each setting, $\Delta A_1^2 = \alpha^2 \Delta A_{\|}^2 + \beta^2 \Delta A_{\perp}^2 = \frac{\alpha^2}{N_{\|}} + \frac{\beta^2}{N_{\perp}}$. To optimize statistical error, beam time is distributed as: $t_{\|} = \frac{\alpha}{\beta} \times t_{\perp}$, so the event number is $N_{\|} = \frac{\alpha}{\beta} \times N_{\perp}$, or $N_{\|} = \frac{\alpha}{\alpha+\beta} \times N$ and $N_{\perp} = \frac{\beta}{\alpha+\beta} \times N$, where $N = N_{\|} + N_{\perp}$.

For each kinematics,
$N = (\frac{\alpha+\beta}{\Delta A_1})^2 \times \frac{1}{(P_t P_b f)^2} = (\frac{\alpha+\beta}{5.0\%/3})^2 \times \frac{1}{(0.4\times0.8\times0.9)^2} = (\alpha+\beta)^2 \times 43403.$

$N_{||} = \alpha(\alpha+\beta) \times 43403$, $N_{\perp} = \beta(\alpha+\beta) \times 43403$.

By 6pm, June 26, total event number we have taken at x=0.6 is: transverse 27K, longitudinal 194K. These numbers have been subtracted from total time. Target polarization is measured to be $P_{t,\perp} = 40\%$ and $P_{t,||} = 37\%$, which has been taken into account by adding a polarization correction to the longitudinal setting. Accelerator efficiency is assumed to be 60%. Final total number of events for each kinematics setting is shown in table 2.

Table 2: Run time optimization for E99-117, $P_{t,\perp} = 40\%$, $P_{t,||} = 37\%$, accelerator efficiency 60%

kine #	x	$N_{\vert\vert}$	$N_{\perp}$	$t_{\vert\vert}$ (hours)	$t_{\perp}$ (hours)
1	0.610	385K-194K=191K	76K-27K=49K	481-242=239	95-34=61
2	0.475	722K	149K	132	28
3	0.331	884K	130K	121	18

We will need (239+61+132+28+121+18) = 599 hours = 25 days (starting from June 27) to complete the experiment.

3 Experiment Schedule and Run Plan Update

Beam energy 5.734 GeV, 10 μA. Based on the result of online analysis for $x = 0.33$ e^+ run,

Table 3: Experiment Schedule and Run Plan Update

From	To	Hall-A Status	HRS angle	E99-117	Time (days)
06/03/01	06/08/01	1.198/10μA	20°	Commission	6
06/09/01	06/11/01	5.734/10μA	45°	x=0.61 $\perp$	3
06/12/01	06/12/01	maintainance			1
06/13/01	06/15/01	5.734/10μA	45°	x=0.61 $\vert\vert$	3
06/16/01	06/16/01	5.734/10μA	45°	x=0.61 $\perp$	0.5
06/16/01	06/26/01	5.734/10μA	45°	x=0.61 $\vert\vert$	10.5
06/27/01	06/30/01	5.734/10μA	45°	x=0.61 $\vert\vert$	3.8
06/30/01	07/03/01	5.734/10μA	45°	x=0.61 $\perp$	2.6
07/03/01	07/08/01	Holiday		target tests	5.5
07/09/01	07/12/01	Maintenance		target tests	4
07/13/01	07/13/01	5.734/10μA	35°	x=0.33 $\vert\vert$ e^+	0.1
(07/13/01)	(07/13/01)	5.734/15μA	35°	(x=0.48 $\vert\vert$ e^+)	(0.1)
07/13/01	07/14/01	5.734/10μA	35°	x=0.33 $\perp$	0.8
07/14/01	07/19/01	5.734/10μA	35°	x=0.33 $\vert\vert$	5.0
07/19/01	07/24/01	5.734/10μA	35°	x=0.48 $\vert\vert$	5.5
07/25/01	07/26/01	5.734/10μA	35°	x=0.48 $\perp$	1.2
07/26/01	07/31/01	5.734/10μA	45°	x=0.61 $\vert\vert$	6.2

will decide whether $x = 0.48$ e^+ run is necessary or not.