E07-007/E08-025 runplan

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This is a draft runplan for DVCS experiments E07-007/E08-025. Kinematics have been revised in order to match the low energy constraint imposed by the simultaneous running of Q-weak.

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I. DVCS KINEMATICS

For reference, the appendix summarizes the beamtime approved by the PAC for E07-007 and E08-025, which required a 5-pass beam of 6 GeV.

Due to the low energy beam available during the running of Q-weak, DVCS kinematics have been revised. Tab. I shows kinematics compatible with a beam energy of 5.552/4.454/3.356 GeV for 5/4/3 passes respectively.

The energy limitation has the following impact on the physics reach of the experiments:

- Reduced lever arm in Q^2: 1.5–2.0 GeV^2 (instead of 1.5–2.3 GeV^2).
- The first Q^2-setting (at 1.5 GeV^2) will be closer to the nucleon resonance region $W^2 = 3.55$ GeV^2 (it was planned at $W^2 = 3.78$ GeV^2).

	KIN I		KIN II		KIN III	
Q^2 (GeV^2)	1.5		1.75		2.0	
x_B	0.36		0.36		0.36	
W^2 (GeV^2)	3.55		3.99		4.44	
q' (GeV)	2.22		2.59		2.96	
k (GeV)	5.552	3.356	5.552	4.454	5.552	4.454
k' (GeV)	3.332	1.136	2.962	1.864	2.591	1.494
θ_e (deg)	16.37	36.56	18.78	26.55	21.49	31.82
θ_q (deg)	-21.74	-15.47	-19.13	-16.64	-16.82	-13.89
θ_{Calo} (deg)	-19.39	-14.78	-16.79	-14.78	-14.78	-14.78

TABLE I: Revised DVCS kinematics. Neutron DVCS will run at KIN II only.

II. RUNPLAN

Beam energy change takes between 4 and 8 hours, and it is intrusive to all Halls. We want to minimize to the best degree possible the number of beam energy changes. Additionally, only 1 single Hall can run at a number of passes different from 5.

In order to minimize the number of energy changes, but still get some statistics in every kinematics as soon as possible, we propose to take half of the approved beamtime per energy at a time. Tab. II shows the proposed runplan. In order to meet our statistical goals, we need the accelerator to continue running over Thanksgiving.

This proposed runplan includes 4 beam energy changes (so 2 additional changes wrt to the minimum possible). It allows to make elastic calibrations at the beginning and end of the experiment at 5 passes, and twice more if necessary before and after changing to/from 4 passes. We may also want to explore the possibility of doing elastic calibrations at 4 passes.

III. R-HRS

We were planning to use the right HRS for luminosity monitoring at a fixed angle of 70 deg. However, we are considering giving it up if that helps to run the Møller polarimeter frequently (see below).

IV. BEAM POLARIZATION

We require a beam longitudinal polarization higher than $> 70\%$. With balanced linacs, Hall A will get 85, 80 and 75% polarization at respectively 3, 4 and 5 pass running, assuming that Hall B has no polarization request. The polarization to Hall A could be further increased if the linacs could be unbalanced slightly.

We need continuous measurement of the polarization with 2% accuracy. In order to accomplish this, we would like to make several Møller measurements (at least one at the beginning, once half-way, and one at the end of the experiment), and continuously run the Compton polarimeter.

If necessary, we are ready to give up running the R-HRS in order to run Møller frequently.

Dates	Calendar days	Kinematic name	E_{beam} (GeV)	# pass	I (μA)	θ_{L-HRS} (deg)	HRS Pol.	P_{L-HRS} (GeV)	θ_{calo} (deg)	Calo dis. (m)	Target
9/27–10/4	7	Commission	5.552	5	2–10	16.37–36.56	+/-	1.14–3.33	14.78–19.39	1.1/5.5	LH2/LD2
	1	Møller	-	5	-	-	-	-	-	-	-
10/5–10/20	2	Kin 3-high	5.552	5	2–10	21.49	-	2.591	14.78	1.1	LH2
	10.5	Kin 2-high	5.552	5	2–10	18.78	-	2.962	16.79	1.1	LH2/LD2
	1	Kin 1-high	5.552	5	2–10	16.37	-	3.332	19.39	1.1	LH2
	1.5	Elastic 1	5.552	5	2	37.00/34.76/33.29	+	2.406/2.607/2.748	22.6	5.5	LH2
10/21–11/10	13	Kin 2-low	4.454	4	2–10	26.55	-	1.864	14.78	1.1	LH2/LD2
	7	Kin 3-low	4.454	4	2–10	31.82	-	1.494	14.78	1.1	LH2
	1	Møller	-	4	-	-	-	-	-	-	-
11/11–11/16	5	Kin 1-low	3.356	3	2–10	36.56	-	1.136	14.78	1.1	LH2
	1	Elastic 3	4.454	3	2	40.00/37.86/36.30	+	1.981/2.131/2.245	24.3	5.5	LH2
11/17–12/07	7	Kin 3-low	4.454	4	2–10	31.82	-	1.494	14.78	1.1	LH2
	13	Kin 2-low	4.454	4	2–10	26.55	-	1.864	14.78	1.1	LH2/LD2
	1	Elastic 2	4.454	4	2	40.00/37.86/36.30	+	1.981/2.131/2.245	24.3	5.5	LH2
12/08–12/23[a]	1	Kin 1-high	5.552	5	2–10	16.37	-	3.332	19.39	1.1	LH2
	10.5	Kin 2-high	5.552	5	2–10	18.78	-	2.962	16.79	1.1	LH2/LD2
	2	Kin 3-high	5.552	5	2–10	21.49	-	2.591	14.78	1.1	LH2
	1.5	Elastic 1	5.552	5	2	37.00/34.76/33.29	+	2.406/2.607/2.748	22.6	5.5	LH2
	1	Møller	-	5	-	-	-	-	-	-	-

[a]We assumed running during Thanksgiving

TABLE II: DVCS/Hall A E07-007/E08-025 run plan

Proton DVCS approved beamtime

	KIN I		KIN II		KIN III	
Q^2 (GeV^2)	1.5		1.9		2.3	
x_B	0.36		0.36		0.36	
W^2 (GeV^2)	3.78		4.26		4.96	
q' (GeV)	2.14		2.73		3.32	
k (GeV)	6.00	3.64	6.00	4.82	6.00	4.82
ϵ	0.873	0.566	0.792	0.652	0.683	0.473
k' (GeV)	3.78	1.42	3.19	2.01	2.59	1.41
θ_e (deg)	14.77	31.26	18.13	25.60	22.16	32.22
θ_q (deg)	-22.3	-16.89	-18.45	-16.07	-15.22	-12.18
θ_{Calo} (deg)	-22.3	-16.89	-18.45	-16.23	-16.23	-16.23
$\Gamma\Delta k'$	5.29 10^{-4}	3.86 10^{-5}	2.28 10^{-4}	6.74 10^{-5}	9.94 10^{-5}	2.20 10^{-5}
$d\sigma_{DIS}$ (nb)	69.1	12.5	26.2	11.9	11.0	4.32
Beam time (h)	**20**	**60**	**30**	**90**	**50**	**150**
Total beam time requested : 400 h + 72 h (calib.) + 72 h (calo. curing) = **544 h**						

Neutron DVCS approved beamtime

	LH_2 target **E07-007**		LD_2 target	
Q^2 (GeV^2)	1.9		1.9	
x_B	0.36		0.36	
W^2 (GeV^2)	4.26		4.26	
q' (GeV)	2.73		2.73	
k (GeV)	6.00	4.82	6.00	4.82
k' (GeV)	3.19	2.01	3.19	2.01
θ_e (deg)	18.13	25.60	18.13	25.60
θ_q (deg)	-18.45	-16.07	-18.45	-16.07
θ_{Calo} (deg)	-18.45	-16.23	-18.45	-16.23
Beam time (h)	30	90	**200**	**200**
Total beam time requested : 200 h + 200 h = **400 h**				