Hall A "LEDEX" RunPlan
3rd draft – Revision 2
(11 July 2006)

1. 1st Low-Energy Beam Period (E_o = 362 MeV): July 21 – Aug. 15, 2006

E05-103

THE FOLLOWING SUB-SECTIONS CONTAIN:

- **START-OF-RUN SETUP**
- **PROCEDURES TO BE DONE AT BEGINNING OF BEAM PERIOD**
- **PROCEDURES THAT NEED TO BE DONE PERIODICALLY THROUGHOUT PERIOD.**

1.1 Prestarting Conditions (to be setup on 24 July 2006, following completion of CSR tests)

Prior to beam start, the LEFT spectrometer (with the FPP!) should be set to the following angle. The spectrometers should remain off. A **survey** of the HRS-L spectrometer is required after they are set, and before beam comes. The spectrometers should not be moved after the survey until and the hydrogen elastic measurement of Section **1.8**.

Spectrometer	Angle (deg)	Polarity
HRS-L	14.00	Positive
HRS-R	33.09	Negative

1.2 Beam-Wait Conditions

Set spectrometers to momenta prescribed in Table below while waiting for beam, after Hall is put into Beam Permit status. Follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum. *(HRS-R won't be used for the first couple of weeks, so no need to set its momentum right away.)*

HRS-L		**HRS-R**		**Target**
p_h (GeV/c)	**θ_h (deg)**	**p_e (GeV/c)**	**θ_e (deg)**	
0.5577	14.00	0.3407	33.09	NONE

This sets HRS-L at the kinematics for the first needed DAQ: hydrogen elastic kinematics, with the central-angle elastic peak at δ = -2 % *(KIN #1 on kinplot)* - see section **1.8** below.

1.3 BCM Calibration **

- *This is to cross-calibrate our Hall A BCMs to BCM OLO2 so MCC can judge how much current is coming into the Hall (all calibration constants will have changed because of the addition of amplifiers we put in to improve low-current accuracy).*

- *The procedure outlined here is from Summer 2000, and we'll need to double-check with Arun Saha to see if this is still all applicable.*
  - **Note that no other Hall can have beam for the duration of this test. This must be coordinated with Hall C.**
  - Ensure no target ("empty") is in, and also no radiator is in place ("radiator out").
  - Make sure MCC has recently calibrated BCM OLO2.
    1. Prescale all triggers away (PS values = 65535), and start DAQ.
    2. Have MCC put **0.5 μA** into BCM OLO2.
    3. Have MCC place the Faraday Cup in for 1 minute.
    4. Have MCC remove Faraday Cup.
    5. Take data for 1 minute.
  - Repeat above steps **1-5** for increasing values of beam current; suggestions:
    - 1.0 μA, 2.0 μA, 5.0 μA, 7.0 μA, 10.0 μA, 20.0 μA, 30.0 μA
    - NOTE: we may be restricted to currents smaller than this – go up to however high we are allowed (50 μA should be absolute max we'll need).

1.4 Beam Calorimeter Calibration

- *Need to refer here to Calibration procedure developed by Arne, Jonathon, Ron, et al.*
- *This calibration will need to be done frequently (maybe once per day?) for the first week or so of running until Arne et al. are comfortable of the stability of the calibration.*

1.5 Pedestal Runs

- *Should do a separate "pedrun" just once per day (with no beam on).*

1.6 Verification ("Commissioning") of Radiator Functioning

- *Shortly after beam in Hall, this needs to be done.*
- *Need to have Ron Gilman run through quick commissioning of Radiator (~30 minutes?):*
    - *Make sure "empty" position is truly empty (even with Raster On 2x2 mm)*
    - *Measure temperature rise on foils with beam to understand what maximum current we will be able to have.*

1.7 Moller Measurement & FPP Straight-Throughs

- *Need to do this at the very beginning, before using Polarized beam for any physics - could be done after BCM (1.3) and Beam Calorimeter (1.4) calibrations, and after Radiator Commissioning (1.6)*

- Setup for Moller measurement (call Eugene).
- Take Moller measurement with liquid Hydrogen target in place – time likely to be 6-8 hours.
- Check FPP HV and LV settings.
- Make sure all FPP carbon doors are OUT.
- Set prescale T3=1. All others infinite (65535). Disregard deadtime.
- Turn on DAQ while Moller measurement is in progress.
- Analyze the data for FPP detectors and VDCs. Other detectors are not crucial.
- Take data with the following spectrometer kinematics (*this is where HRS-L should have been left anyway from "beam wait" prescription)*:

p_h (GeV/c)	**θ_h (deg)**	**Target**	**Time (hr)**
0.5577	14.0	LH_2	3

1.8 Beam Helicity Verification:

- *See Bob Michael's notes at http://www.jlab.org/~rom/g0helicity.html*
- *Should do this verification following Moller measurement.*

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THE FOLLOWING SUB-SECTIONS CONTAIN:

- **PROCEDURES FOR FIRST HYDROGEN ELASTIC SEQUENCE (KIN #1, #2, AND #3 ON KINPLOT)**

- **INCLUDES:**
    - **Polarization measurements for Elastic Peak centered (for central angle) at δ = -2%, 0%, +2%**
    - **Cross Section measurement for δ = 0% setting (with need for Accesses to insert/remove S0 and Small Collimator)**

1.9 <u>HYDROGEN ELASTIC</u>: FPP False Asym & A_c for p_h = 0.5468 GeV/c (and cross sections)
(T_p = 147.7 MeV, Q = 0.5265 GeV)

1.9.0 Ensure Spectrometer Set Properly

- If spectrometer not already set, ensure HRS-L is at settings specified in Table below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).

p_h (GeV/c)	θ_h (deg)	Target
0.5577	14.0	LH_2

1.9.1 Spectrometer Pointing Measurements

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Beam current of a few microamps (up to max DAQ rate of 2-3 kHz)
- Set spectrometers and target to following settings, and take 5 minutes of pointing data at each setting (separate run for each target).

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0.5577	14.0	C	5
		4 cm Dummy	5
		15 cm Dummy	5
		10 cm Dummy	5

1.9.2 Hydrogen Elastic Measurement: p_h = 0.5468 GeV/c @ δ = -2% *(KIN #1 in kinplot)*

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Ask MCC for Beam current of about 1.5 microamps ; adjust current to give max DAQ rates (2-3 kHz, with "acceptable" deadtime).
- Place **1.5" Carbon Door into FPP**.

p_h (GeV/c)	θ_h (deg)	Target	Time (hr)
0.5577	14.0	LH_2	4

1.9.3 Hydrogen Elastic Measurement: p_h = 0.5468 GeV/c @ δ = 0% *(KIN #2 in kinplot)*

- Same as previous measurement, except with HRS-L momentum setting LOWERED to value in table below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).

p_h (GeV/c)	θ_h (deg)	Target	Time (hr)
0.5468	14.0	LH_2	4

- *Cross Section Measurement:*
  - **Get access** to **insert S0 scintillator layer, and put in small collimator to HRS-L.**
  - Download new trigger for T4 (that is 2 out of the 3 S0, S1, S2), and ensure running with PS4=1.

p_h (GeV/c)	θ_h (deg)	Target	Rate/Current	Time (min)
0.5468	14.0	LH_2	High as possible, keeping Deadtime less than 10%	20 (2 M events)

  - **Get access** to **remove S0 scintillator layer, and remove collimator from HRS-L.**
  - Re-Download standard trigger again for T4 (T4 becomes S1 or S2, since S0 no longer in place).

1.9.4 Hydrogen Elastic Measurement: p_h = 0.5468 GeV/c @ δ = +2 % *(KIN #3 in kinplot)*

- Same as previous measurement, except with HRS-L momentum setting LOWERED to value in table below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).

p_h (GeV/c)	θ_h (deg)	Target	Time (hr)
0.5359	14.0	LH_2	4

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THE FOLLOWING SUB-SECTIONS CONTAIN:

- **PROCEDURES FOR PHOTODISINTEGRATION PRODUCTION POINT KIN #4 ON KINPLOT**
  - **This is the first, most forward production point.**

- **INCLUDES:**
  - **Standard procedure for photodisintegration production run, with background measurements.**
  - **ONE TIME ONLY "RADIATOR THICKNESS SCAN" TO DETERMINE THICKEST USABLE RADIATOR THICKNESS (NOTE: this could possibly be done before 24 July 2006 using HRS-R set at same kinematics outlined for this point)**

1.10 Deuteron Photodisintegration Production Point: θ_{cms} = 20°, E_γ = 342.2 MeV (318 – 367) (Including Radiator Thickness scan)
(KIN #4 in kinplot)

1.10.1 Change Spectrometer Settings and Take Pointing Measurements

- Set HRS-L spectrometer to momentum and angle given in Table just below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).
- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Beam current of a few microamps ? (up to max DAQ rate of 2-3 kHz)
- Set target to following settings, and take 5 minutes of pointing data at each setting:

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0. 7341	15.15	C	5
		4 cm Dummy	5
		15 cm Dummy	5
		10 cm Dummy	5

1.10.2 Radiator Thickness Scan

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Place **3.0" Carbon Door into FPP**.
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Pre-run estimates are that the Beam Current of 2.0 microamps for the first run (LD_2 target, 4% R.L. Radiator In) would provide the max DAQ rate of between 2-3 kHz. In each case, the current should be adjusted to give max DAQ rate between 2-3 kHz.
- Set target/radiator to settings indicated in Table below, and take data for times indicated.
- GOAL: check linearity of rates with Radiator Thickness; check quality of **background-subtracted** photon-energy spectrum (should be no counts above endpoint).

p_h (GeV/c)	θ_h (deg)	Target	Radiator	DAQ Rate (kHz)	Time (min)
0. 7341	15.15	LD_2	1 % R.L.	2-3 (max)	20
		LD_2	2 % R.L.	2-3 (max)	20
		LD_2	3 % R.L.	2-3 (max)	20
		LD_2	4 % R.L.	2-3 (max)	20
		LD_2	5 % R.L.	2-3 (max)	20
		LD_2	NONE	2-3 (max)	10
		LH_2	NONE	2-3 (max)	5
		LH_2	1 % R.L.	2-3 (max)	10
		LH_2	2 % R.L.	2-3 (max)	20
		LH_2	3 % R.L.	2-3 (max)	20
		LH_2	4 % R.L.	2-3 (max)	20
		LH_2	5 % R.L.	2-3 (max)	20

- **Following this scan/evaluation: a choice of which Radiator Thickness is most appropriate will be made; for the rest of this RunPlan, "Radiator=IN" means to use whichever radiator thickness is chosen from this process.**

1.10.3 Production Measurement:

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Place **<u>3.0" Carbon Door into FPP</u>**.
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Pre-run estimates are that the Beam Current of 2.0 microamps for the first run (LD_2 target, 4% R.L. Radiator In) would provide the max DAQ rate of between 2-3 kHz. In each case, the current should be adjusted to give max DAQ rate between 2-3 kHz.
- Set target/radiator to settings indicated in Table below, and take data for times indicated
- NOTE: split of times between four different runs below ASSUMES the following:
    - Equal currents for each run-type.
    - Rule-of-thumb split of luminosity into 50%-25%-25%-short.
    - This above split is for the ratio of integrated (dead-time corrected) luminosity, not simply time…since we should be able to run the "D target, Radiator OUT" and "H target, Radiator IN" at higher currents, the actual time spent on these should be reduced (smaller fraction of the 12 hours spent on them). The "H target, Radiator OUT" run should be short (~10 minutes) just to confirm there really is essentially no rate there.
    - Gilman's "esterr.f" program can be used to modify/optimize this split once rates from each run-type are known: THIS WILL BE KNOWN FROM PREVIOUS RADIATOR SCAN!!

p_h (GeV/c)	θ_h (deg)	Target	Radiator	DAQ Rate (kHz)	Time (hr)
0. 7341	15.15	LD_2	IN	2-3 (max)	~6
		LD_2	NONE	2-3 (max)	~3
		LH_2	IN	2-3 (max)	~3
		LH_2	NONE	2-3 (max)	0.2

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THE FOLLOWING SUB-SECTIONS CONTAIN:

- **PROCEDURES FOR PHOTODISINTEGRATION PRODUCTION POINT KIN #5 ON KINPLOT**

- **INCLUDES:**
  - **Standard procedure for photodisintegration production run, with background measurements.**

1.11 Deuteron Photodisintegration Production Point: θ_{cms} = 40°, E_γ = 341.6 MeV (314 – 368) *(KIN #5 in kinplot)*

1.11.1 Change Spectrometer Settings and Take Pointing Measurements

- Set HRS-L spectrometer to momentum and angle given in Table just below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).
- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Beam current of a few microamps ? (up to max DAQ rate of 2-3 kHz)
- Set target to following settings, and take 5 minutes of pointing data at each setting (one run for each target):

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0. 7085	30.59	C	5
		4 cm Dummy	5
		15 cm Dummy	5
		10 cm Dummy	5

1.11.2 Production Measurement:

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Place **3.0" Carbon Door into FPP**.
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Pre-run estimates are that the Beam Current of 2.0 microamps for the first run (LD_2 target, 4% R.L. Radiator In) would provide the max DAQ rate of between 2-3 kHz. In each case, the current should be adjusted to give max DAQ rate between 2-3 kHz.
- Set target/radiator to settings indicated in Table below, and take data for times indicated
- NOTE: split of times between four different runs below ASSUMES the following:
    - Equal currents for each run-type.
    - Rule-of-thumb split of luminosity into 50%-25%-25%-short.
    - This above split is for the ratio of integrated (dead-time corrected) luminosity, not simply time…since we should be able to run the "D target, Radiator OUT" and "H target, Radiator IN" at higher currents, the actual time spent on these should be reduced (smaller fraction of the 12 hours spent on them). The "H target, Radiator OUT" run should be short (~10 minutes) just to confirm there really is essentially no rate there.
    - Gilman's "esterr.f" program can be used to modify/optimize this split once rates from each run-type are known….SO: **FIRST** TAKE A FEW MINUTES OF DATA AT EACH TARGET/RADIATOR COMBINATION IN TABLE BELOW IN ORDER TO DETERMINE RATES (AND/OR CURRENT THAT CAN BE USED FOR BACKGROUND RUNS) – THEN HAVE "esterr.f" RUN TO DETERMINE MODIFIED TIMES FOR EACH RUN TYPE.

p_h (GeV/c)	θ_h (deg)	Target	Radiator	DAQ Rate (kHz)	Time (hr)
0. 7085	30.59	LD_2	IN	2-3 (max)	~6
		LD_2	NONE	2-3 (max)	~3
		LH_2	IN	2-3 (max)	~3
		LH_2	NONE	2-3 (max)	0.2

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THE FOLLOWING SUB-SECTIONS CONTAIN:

- **PROCEDURES FOR PHOTODISINTEGRATION PRODUCTION POINT KIN #6 ON KINPLOT**

- **INCLUDES:**
  - **Standard procedure for photodisintegration production run, with background measurements.**

1.12 Deuteron Photodisintegration Production Point: θ_{cms} = 60°, E_γ = 340.5 MeV (314 – 368) *(KIN #6 in kinplot)*

1.12.1 Change Spectrometer Settings and Take Pointing Measurements

- Set HRS-L spectrometer to momentum and angle given in Table just below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).
- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Beam current of a few microamps ? (up to max DAQ rate of 2-3 kHz)
- Set target to following settings, and take 5 minutes of pointing data at each setting (one run for each target):

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0. 6681	46.64	C	5
		4 cm Dummy	5
		15 cm Dummy	5
		10 cm Dummy	5

1.12.2 Production Measurement:

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Place **3.0" Carbon Door into FPP**.
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Pre-run estimates are that the Beam Current of 2.0 microamps for the first run (LD_2 target, 4% R.L. Radiator In) would provide the max DAQ rate of between 2-3 kHz. In each case, the current should be adjusted to give max DAQ rate between 2-3 kHz.
- Set target/radiator to settings indicated in Table below, and take data for times indicated
- NOTE: split of times between four different runs below ASSUMES the following:
    - Equal currents for each run-type.
    - Rule-of-thumb split of luminosity into 50%-25%-25%-short.
    - This above split is for the ratio of integrated (dead-time corrected) luminosity, not simply time…since we should be able to run the "D target, Radiator OUT" and "H target, Radiator IN" at higher currents, the actual time spent on these should be reduced (smaller fraction of the 12 hours spent on them). The "H target, Radiator OUT" run should be short (~10 minutes) just to confirm there really is essentially no rate there.
    - Gilman's "esterr.f" program can be used to modify/optimize this split once rates from each run-type are known. ….SO: **FIRST** TAKE A FEW MINUTES OF DATA AT EACH TARGET/RADIATOR COMBINATION IN TABLE BELOW IN ORDER TO DETERMINE RATES (AND/OR CURRENT THAT CAN BE USED FOR BACKGROUND RUNS) – THEN HAVE "esterr.f" RUN TO DETERMINE MODIFIED TIMES FOR EACH RUN TYPE.

p_h (GeV/c)	**θ_h (deg)**	**Target**	**Radiator**	**DAQ Rate (kHz)**	**Time (hr)**
0. 6681	46.64	LD_2	IN	2-3 (max)	~6
		LD_2	NONE	2-3 (max)	~3
		LH_2	IN	2-3 (max)	~3
		LH_2	NONE	2-3 (max)	0.2

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THE FOLLOWING SUB-SECTIONS CONTAIN:

- **PROCEDURES FOR PHOTODISINTEGRATION PRODUCTION POINT KIN #7 ON KINPLOT**

- **INCLUDES:**
  - **Standard procedure for photodisintegration production run, with background measurements.**

1.13 Deuteron Photodisintegration Production Point: θ_{cms} = 90°, E_γ = 337.6 MeV (308 – 368) *(KIN #7 in kinplot)*

1.13.1 Change Spectrometer Settings and Take Pointing Measurements

- Set HRS-L spectrometer to momentum and angle given in Table just below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).
- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Beam current of a few microamps ? (up to max DAQ rate of 2-3 kHz)
- Set target to following settings, and take 5 minutes of pointing data at each setting (one run for each target):

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0. 5874	72.71	C	5
		4 cm Dummy	5
		15 cm Dummy	5
		10 cm Dummy	5

1.13.2 Production Measurement:

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Place **1.5" Carbon Door into FPP**.
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Pre-run estimates are that the Beam Current of 3.0 microamps for the first run (LD_2 target, 4% R.L. Radiator In) would provide the max DAQ rate of between 2-3 kHz. In each case, the current should be adjusted to give max DAQ rate between 2-3 kHz.
- Set target/radiator to settings indicated in Table below, and take data for times indicated
- NOTE: split of times between four different runs below ASSUMES the following:
  - Equal currents for each run-type.
  - Rule-of-thumb split of luminosity into 50%-25%-25%-short.
  - This above split is for the ratio of integrated (dead-time corrected) luminosity, not simply time…since we should be able to run the "D target, Radiator OUT" and "H target, Radiator IN" at higher currents, the actual time spent on these should be reduced (smaller fraction of the 12 hours spent on them). The "H target, Radiator OUT" run should be short (~10 minutes) just to confirm there really is essentially no rate there.
  - Gilman's "esterr.f" program can be used to modify/optimize this split once rates from each run-type are known. ….SO: **FIRST** TAKE A FEW MINUTES OF DATA AT EACH TARGET/RADIATOR COMBINATION IN TABLE BELOW IN ORDER TO DETERMINE RATES (AND/OR CURRENT THAT CAN BE USED FOR BACKGROUND RUNS) – THEN HAVE "esterr.f" RUN TO DETERMINE MODIFIED TIMES FOR EACH RUN TYPE.

p_h (GeV/c)	**θ_h (deg)**	**Target**	**Radiator**	**DAQ Rate (kHz)**	**Time (hr)**
0. 5874	72.71	LD_2	IN	2-3 (max)	~6
		LD_2	NONE	2-3 (max)	~3
		LH_2	IN	2-3 (max)	~3
		LH_2	NONE	2-3 (max)	0.2

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THE FOLLOWING SUB-SECTIONS CONTAIN:

- **PROCEDURES FOR SECOND HYDROGEN ELASTIC SEQUENCE (KIN #8, #9, AND #10 ON KINPLOT)**

- **INCLUDES:**
  - **Polarization measurements for Elastic Peak centered (for central angle) at δ = -2%, 0%, +2%**
  - **Cross Section measurement for δ = 0% setting (with need for Accesses to insert/remove S0 and Small Collimator)**

1.14 HYDROGEN ELASTIC: FPP False Asym & A_c for p_h = 0.5313 GeV/c (and cross sections)

(T_p = 140.0 MeV, Q = 0.513 GeV)

1.14.1 Spectrometer Pointing Measurements

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Beam current of a few microamps ? (up to max DAQ rate of 2-3 kHz)
- Set spectrometers and target to following settings, and take 5 minutes of pointing data at each setting (one run for each target):

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0.5421	18.14	C	5
		4 cm Dummy	5
		15 cm Dummy	5
		10 cm Dummy	5

1.14.2 Hydrogen Elastic Measurement: p_h = 0.5313 GeV/c @ δ = -2% *(KIN #8 in kinplot)*

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Ask MCC for Beam current of about 1.4 microamps ; adjust current to give max DAQ rates (2-3 kHz, with "acceptable" deadtime).
- Place **<u>1.5" Carbon Door into FPP</u>**.

p_h (GeV/c)	θ_h (deg)	Target	Time (hr)
0.5421	18.14	LH_2	4

1.14.3 Hydrogen Elastic Measurement: p_h = 0.5313 GeV/c @ δ = 0% *(KIN #9 in kinplot)*

- Same as previous measurement, except with HRS-L momentum setting LOWERED to value in table below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).

p_h (GeV/c)	θ_h (deg)	Target	Time (hr)
0.5313	18.14	LH_2	4

- *<u>Cross Section Measurement:</u>*
  - **Get access** to **insert S0 scintillator layer, <u>and</u> put in small collimator to HRS-L.**
  - Download new trigger for T4 (that is 2 out of the 3 S0, S1, S2), and ensure running with PS4=1.

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0.5313	18.14	LH_2	20 (2 M events)

  - **Get access** to **remove S0 scintillator layer, <u>and</u> remove collimator from HRS-L.**
  - Re-Download standard trigger again for T4 (T4 becomes S1 or S2, since S0 no longer in place).

1.14.4 Hydrogen Elastic Measurement: p_h = 0.5313 GeV/c @ δ = +2 % *(KIN #10 in kinplot)*

- Same as previous measurement, except with HRS-L momentum setting LOWERED to value in table below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).

p_h (GeV/c)	θ_h (deg)	Target	Time (hr)
0.5209	18.14	LH_2	4

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THE FOLLOWING SUB-SECTIONS CONTAIN:

- **PROCEDURES FOR PHOTODISINTEGRATION PRODUCTION POINT KIN #11 ON KINPLOT**

- **INCLUDES:**
  - **Standard procedure for photodisintegration production run, with background measurements.**

1.15 Deuteron Photodisintegration Production Point: θ_{cms} = 30°, E_γ = 342.0 MeV (317 - 367) *(KIN #11 in kinplot)*

1.15.1 Change Spectrometer Settings and Take Pointing Measurements

- Set HRS-L spectrometer to momentum and angle given in Table just below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).
- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Beam current of a few microamps ? (up to max DAQ rate of 2-3 kHz)
- Set target to following settings, and take 5 minutes of pointing data at each setting (one run for each target):

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0.7233	22.81	C	5
		4 cm Dummy	5
		15 cm Dummy	5
		10 cm Dummy	5

1.15.2 Production Measurement:

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Place **<u>3.0" Carbon Door into FPP</u>**.
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Pre-run estimates are that the Beam Current of 2.0 microamps for the first run (LD_2 target, 4% R.L. Radiator In) would provide the max DAQ rate of between 2-3 kHz. In each case, the current should be adjusted to give max DAQ rate between 2-3 kHz.
- Set target/radiator to settings indicated in Table below, and take data for times indicated
- NOTE: split of times between four different runs below ASSUMES the following:
    - Equal currents for each run-type.
    - Rule-of-thumb split of luminosity into 50%-25%-25%-short.
    - This above split is for the ratio of integrated (dead-time corrected) luminosity, not simply time…since we should be able to run the "D target, Radiator OUT" and "H target, Radiator IN" at higher currents, the actual time spent on these should be reduced (smaller fraction of the 12 hours spent on them). The "H target, Radiator OUT" run should be short (~10 minutes) just to confirm there really is essentially no rate there.
    - Gilman's "esterr.f" program can be used to modify/optimize this split once rates from each run-type are known. ….SO: **<u>FIRST</u>** TAKE A FEW MINUTES OF DATA AT EACH TARGET/RADIATOR COMBINATION IN TABLE BELOW IN ORDER TO DETERMINE RATES (AND/OR CURRENT THAT CAN BE USED FOR BACKGROUND RUNS) – THEN HAVE "esterr.f" RUN TO DETERMINE MODIFIED TIMES FOR EACH RUN TYPE.

p_h (GeV/c)	θ_h (deg)	Target	Radiator	DAQ Rate (kHz)	Time (hr)
0.7233	22.81	LD_2	IN	2-3 (max)	~6
		LD_2	NONE	2-3 (max)	~3
		LH_2	IN	2-3 (max)	~3
		LH_2	NONE	2-3 (max)	0.2

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THE FOLLOWING SUB-SECTIONS CONTAIN:

- **PROCEDURES FOR PHOTODISINTEGRATION PRODUCTION POINT KIN #12 ON KINPLOT**

- **INCLUDES:**
  - **Standard procedure for photodisintegration production run, with background measurements.**

1.16 Deuteron Photodisintegration Production Point: θ_{cms} = 50°, E_γ = 341.0 MeV (315 - 367) *(KIN #12 in kinplot)*

1.16.1 Change Spectrometer Settings and Take Pointing Measurements

- Set HRS-L spectrometer to momentum and angle given in Table just below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).
- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Beam current of a few microamps ? (up to max DAQ rate of 2-3 kHz)
- Set target to following settings, and take 5 minutes of pointing data at each setting (one run for each target):

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0.6899	38.51	C	5
		4 cm Dummy	5
		15 cm Dummy	5
		10 cm Dummy	5

1.16.2 Production Measurement:

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Place **3.0" Carbon Door into FPP**.
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Pre-run estimates are that the Beam Current of 2.0 microamps for the first run (LD_2 target, 4% R.L. Radiator In) would provide the max DAQ rate of between 2-3 kHz. In each case, the current should be adjusted to give max DAQ rate between 2-3 kHz.
- Set target/radiator to settings indicated in Table below, and take data for times indicated
- NOTE: split of times between four different runs below ASSUMES the following:
  - Equal currents for each run-type.
  - Rule-of-thumb split of luminosity into 50%-25%-25%-short.
  - This above split is for the ratio of integrated (dead-time corrected) luminosity, not simply time…since we should be able to run the "D target, Radiator OUT" and "H target, Radiator IN" at higher currents, the actual time spent on these should be reduced (smaller fraction of the 12 hours spent on them). The "H target, Radiator OUT" run should be short (~10 minutes) just to confirm there really is essentially no rate there.
  - Gilman's "esterr.f" program can be used to modify/optimize this split once rates from each run-type are known. ….SO: **FIRST** TAKE A FEW MINUTES OF DATA AT EACH TARGET/RADIATOR COMBINATION IN TABLE BELOW IN ORDER TO DETERMINE RATES (AND/OR CURRENT THAT CAN BE USED FOR BACKGROUND RUNS) – THEN HAVE "esterr.f" RUN TO DETERMINE MODIFIED TIMES FOR EACH RUN TYPE.

p_h (GeV/c)	θ_h (deg)	Target	Radiator	DAQ Rate (kHz)	Time (hr)
0.6899	38.51	LD_2	IN	2-3 (max)	~6
		LD_2	NONE	2-3 (max)	~3
		LH_2	IN	2-3 (max)	~3
		LH_2	NONE	2-3 (max)	0.2

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THE FOLLOWING SUB-SECTIONS CONTAIN:

- **PROCEDURES FOR PHOTODISINTEGRATION PRODUCTION POINT KIN #13 ON KINPLOT**

- **INCLUDES:**
  - **Standard procedure for photodisintegration production run, with background measurements.**

1.17 Deuteron Photodisintegration Production Point: θ_{cms} = 20°, E_γ = 296.0 MeV (275 - 318) *(KIN #13 in kinplot)*

1.17.1 Change Spectrometer Settings and Take Pointing Measurements

- Set HRS-L spectrometer to momentum and angle given in Table just below (follow Counting House “Whiteboard” instructions from J. Lerose for cycling quads when setting momentum).
- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Beam current of a few microamps ? (up to max DAQ rate of 2-3 kHz)
- Set target to following settings, and take 5 minutes of pointing data at each setting (one run for each target):

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0.6709	15.15	C	5
		4 cm Dummy	5
		15 cm Dummy	5
		10 cm Dummy	5

1.17.2 Production Measurement:

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Place **3.0" Carbon Door into FPP**.
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Pre-run estimates are that the Beam Current of 2.0 microamps for the first run (LD_2 target, 4% R.L. Radiator In) would provide the max DAQ rate of between 2-3 kHz. In each case, the current should be adjusted to give max DAQ rate between 2-3 kHz.
- Set target/radiator to settings indicated in Table below, and take data for times indicated
- NOTE: split of times between four different runs below ASSUMES the following:
  - Equal currents for each run-type.
  - Rule-of-thumb split of luminosity into 50%-25%-25%-short.
  - This above split is for the ratio of integrated (dead-time corrected) luminosity, not simply time…since we should be able to run the "D target, Radiator OUT" and "H target, Radiator IN" at higher currents, the actual time spent on these should be reduced (smaller fraction of the 12 hours spent on them). The "H target, Radiator OUT" run should be short (~10 minutes) just to confirm there really is essentially no rate there.
  - Gilman's "esterr.f" program can be used to modify/optimize this split once rates from each run-type are known. ….SO: **FIRST** TAKE A FEW MINUTES OF DATA AT EACH TARGET/RADIATOR COMBINATION IN TABLE BELOW IN ORDER TO DETERMINE RATES (AND/OR CURRENT THAT CAN BE USED FOR BACKGROUND RUNS) – THEN HAVE "esterr.f" RUN TO DETERMINE MODIFIED TIMES FOR EACH RUN TYPE.

p_h (GeV/c)	θ_h (deg)	Target	Radiator	DAQ Rate (kHz)	Time (hr)
0.6709	15.15	LD_2	IN	2-3 (max)	~6
		LD_2	NONE	2-3 (max)	~3
		LH_2	IN	2-3 (max)	~3
		LH_2	NONE	2-3 (max)	0.2

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THE FOLLOWING SUB-SECTIONS CONTAIN:

- **PROCEDURES FOR PHOTODISINTEGRATION PRODUCTION POINT KIN #14 ON KINPLOT**

- **INCLUDES:**
  - **Standard procedure for photodisintegration production run, with background measurements.**

1.18 <u>Deuteron Photodisintegration Production Point</u>: θ_{cms} = 90°, E_γ = 288.0 MeV (263 - 314) *(KIN #14 in kinplot)*

1.18.1 Change Spectrometer Settings and Take Pointing Measurements

- Set HRS-L spectrometer to momentum and angle given in Table just below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).
- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Beam current of a few microamps ? (up to max DAQ rate of 2-3 kHz)
- Set target to following settings, and take 5 minutes of pointing data at each setting (one run for each target):

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0.5422	72.71	C	5
		4 cm Dummy	5
		15 cm Dummy	5
		10 cm Dummy	5

1.18.2 Production Measurement:

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Place **<u>1.5" Carbon Door into FPP</u>**.
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Pre-run estimates are that the Beam Current of 3.0 microamps for the first run (LD_2 target, 4% R.L. Radiator In) would provide the max DAQ rate of between 2-3 kHz. In each case, the current should be adjusted to give max DAQ rate between 2-3 kHz.
- Set target/radiator to settings indicated in Table below, and take data for times indicated
- NOTE: split of times between four different runs below ASSUMES the following:
  - Equal currents for each run-type.
  - Rule-of-thumb split of luminosity into 50%-25%-25%-short.
  - This above split is for the ratio of integrated (dead-time corrected) luminosity, not simply time…since we should be able to run the "D target, Radiator OUT" and "H target, Radiator IN" at higher currents, the actual time spent on these should be reduced (smaller fraction of the 12 hours spent on them). The "H target, Radiator OUT" run should be short (~10 minutes) just to confirm there really is essentially no rate there.
  - Gilman's "esterr.f" program can be used to modify/optimize this split once rates from each run-type are known. ….SO: **<u>FIRST</u>** TAKE A FEW MINUTES OF DATA AT EACH TARGET/RADIATOR COMBINATION IN TABLE BELOW IN ORDER TO DETERMINE RATES (AND/OR CURRENT THAT CAN BE USED FOR BACKGROUND RUNS) – THEN HAVE "esterr.f" RUN TO DETERMINE MODIFIED TIMES FOR EACH RUN TYPE.

p_h (GeV/c)	θ_h (deg)	Target	Radiator	DAQ Rate (kHz)	Time (hr)
0.5422	72.71	LD_2	IN	2-3 (max)	~6
		LD_2	NONE	2-3 (max)	~3
		LH_2	IN	2-3 (max)	~3
		LH_2	NONE	2-3 (max)	0.2

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THE FOLLOWING SUB-SECTIONS CONTAIN:

- **PROCEDURES FOR SECOND HYDROGEN ELASTIC SEQUENCE (KIN #15, #16, AND #17 ON KINPLOT)**

- **INCLUDES:**
  - **Polarization measurements for Elastic Peak centered (for central angle) at δ = -2%, 0%, +2%**
  - **Cross Section measurement for δ = 0% setting (with need for Accesses to insert/remove S0 and Small Collimator)**

1.19 HYDROGEN ELASTIC: FPP False Asym & A_c for p_h = 0.5107 GeV/c (and cross sections)

(T_p = 130.0 MeV, Q = 0.494 GeV)

1.19.1 Spectrometer Pointing Measurements

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Check beam position on BPMs; set Raster ON (± 2 mm in X and Y)
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Beam current of a few microamps ? (up to max DAQ rate of 2-3 kHz)
- Set spectrometers and target to following settings, and take 5 minutes of pointing data at each setting (one run for each target):

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0.5211	23.90	C	5
		4 cm Dummy	5
		15 cm Dummy	5
		10 cm Dummy	5

1.19.2 Hydrogen Elastic Measurement: p_h = 0.5107 GeV/c @ δ = -2% *(KIN #15 in kinplot)*

- No collimator in HRS-L (ensure small collimator has been removed after last elastic cross section measurement).
- Set prescales T3=low; other prescales set high (65535) for low deadtime.
- Ask MCC for Beam current of about 1.4 microamps ; adjust current to give max DAQ rates (2-3 kHz, with "acceptable" deadtime).
- Place **<u>1.5" Carbon Door into FPP</u>**.

p_h (GeV/c)	θ_h (deg)	Target	Time (hr)
0.5211	23.90	LH_2	4

1.19.3 Hydrogen Elastic Measurement: p_h = 0.5107 GeV/c @ δ = 0% *(KIN #16 in kinplot)*

- Same as previous measurement, except with HRS-L momentum setting LOWERED to value in table below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).

p_h (GeV/c)	θ_h (deg)	Target	Time (hr)
0.5107	23.90	LH_2	4

- <u>*Cross Section Measurement:*</u>
  - **Get access** to **insert S0 scintillator layer, <u>and</u> put in small collimator to HRS-L.**
  - Download new trigger for T4 (that is 2 out of the 3 S0, S1, S2), and ensure running with PS4=1.

p_h (GeV/c)	θ_h (deg)	Target	Time (min)
0.5107	23.90	LH_2	20 (2 M events)

  - **Get access** to **remove S0 scintillator layer, <u>and</u> remove collimator from HRS-L.**
  - Re-Download standard trigger again for T4 (T4 becomes S1 or S2, since S0 no longer in place).

1.19.4 Hydrogen Elastic Measurement: p_h = 0.5107 GeV/c @ δ = +2 % *(KIN #17 in kinplot)*

- Same as previous measurement, except with HRS-L momentum setting LOWERED to value in table below (follow Counting House "Whiteboard" instructions from J. Lerose for cycling quads when setting momentum).

p_h (GeV/c)	θ_h (deg)	Target	Time (hr)
0.5007	23.90	LH_2	4