

Hall A Moller Polarimeter Update

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Jefferson Lab

Overview

- Superconducting Magnet
- DAQ and Analysis
- Summary – To Do

Target Magnet: Functionality/Controls

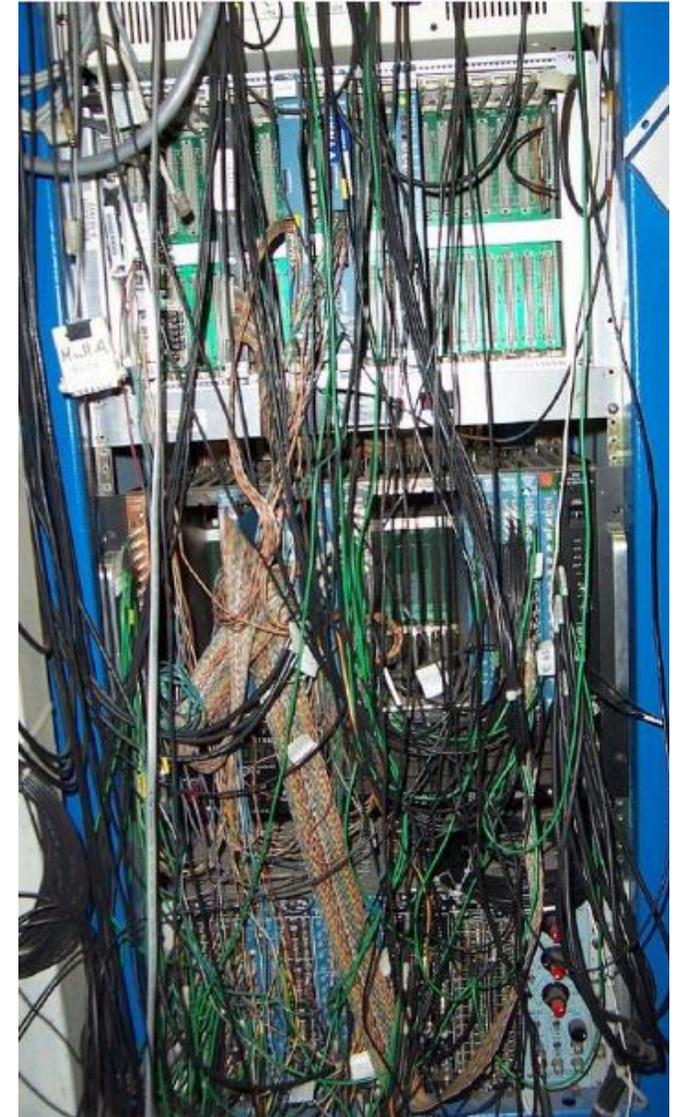
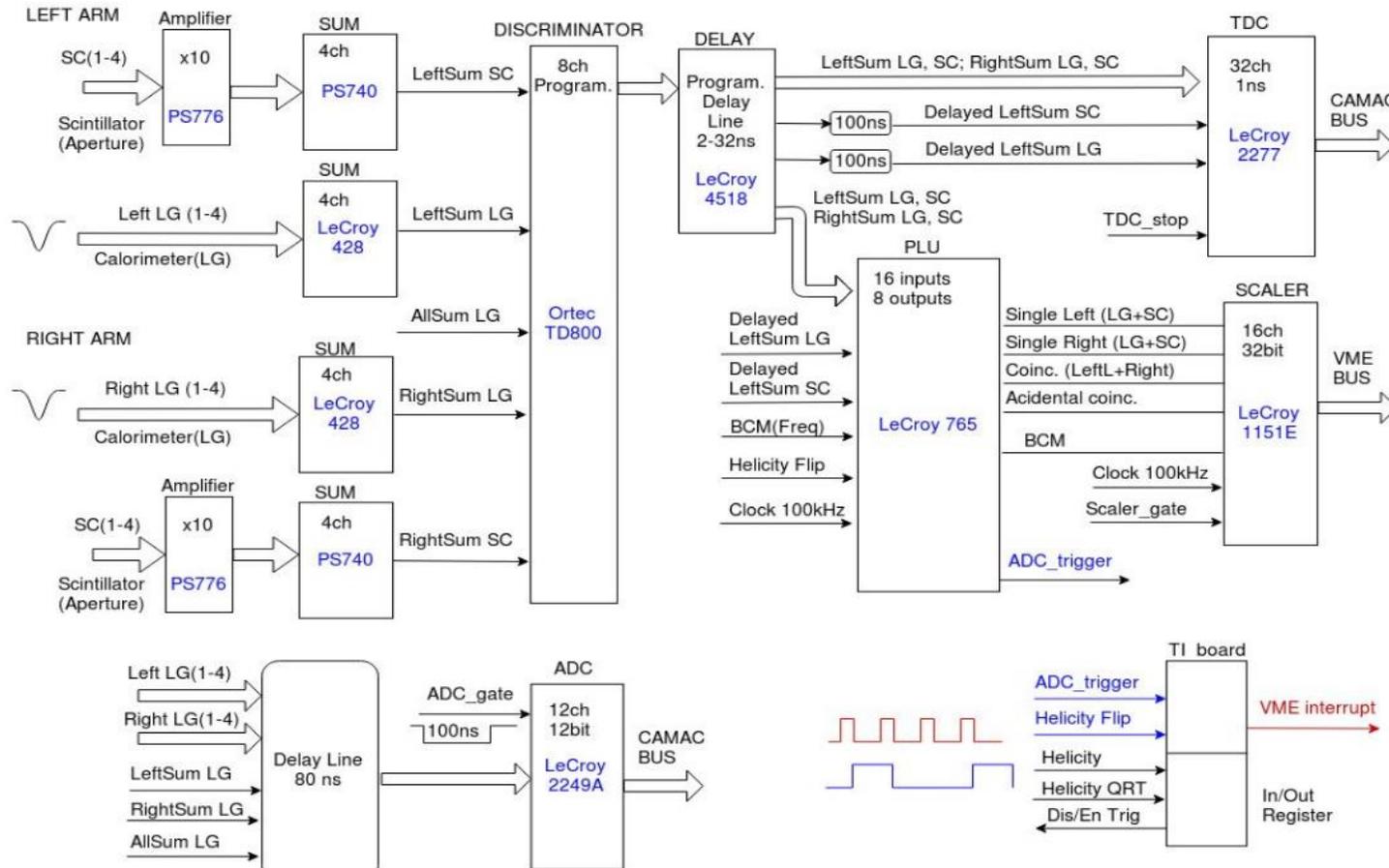
- Target magnet is O.K.
 - “There is nothing wrong with the system and all we have to do is to increase the static pressure of the compressor to 220 psig”
 - The magnet stayed cold for more than 2 weeks and was ran at 4 T few times without problems
 - Ethan and Jack monitored the temperature of the magnet with sensors placed on the exterior to check for abnormalities – none were found
 - The compressor needs to be refilled with high-purity helium; Ethan with support from the target group is taking care of that (as of one week ago the helium delivery was imminent)
- EPICS controls (compressor, temperature readout, power supply and hall probe): issues were found while data were taken to check the magnet functionality and it was decided that Ethan would re-write the software for the EPICS controls – I will follow up with Ethan and make sure that we have up-to-date documentation

Target Magnet: Installation/Alignment

- Installation
 - The magnet will be moved to the hall soon after the hall opens
 - It will be installed in the beamline in December to leave time for cool down tests and alignment
 - The target ladder will be installed once the magnet is in the beamline
- Beam deflection test/Re-alignment
 - In contact with Yves to have a plan for checking the beam deflection by the target magnet
 - I will be coordinating with Jessie and the alignment group to be ready for re-alignment, if needed

DAQ and Analysis

- CODA 2.5 and analyzer (fortran and kumacs) run on adaq1
- CODA has been tested in May 2018 and it worked; it will be tested again once Hall A opens
- Electronics and helicity/BCM signals will be tested
- Analysis package is being tested now by Bill/Cameron/Simona



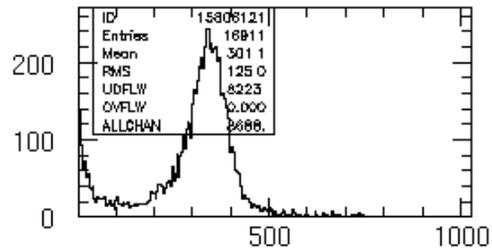
Analysis

- How-to at [hallaweb.jlab.org/wiki/index.php/Beam_Polarization_Measurement_\(How_to\)](http://hallaweb.jlab.org/wiki/index.php/Beam_Polarization_Measurement_(How_to)); a more descriptive how-to will be produced by Bill/Cameron/Simona
- A really good log of all polarization measurements taken at hallaweb.jlab.org/equipment/moller/raw_results.html
- Raw coda files in `/adaq1/data1/moller/`
- Analysis is done on adaq1 in `/home/moller/paw/moller`
- Analysis codes (per wiki instructions):
 - `rawread.com` decodes the data in the coda file
 - `lg_spectra.kumac` plots the ADC distributions
 - `time.kumac` plots the TDC distributions
 - `an_pow.kumac` will plot the analyzing power vs beam energy and the phi and theta acceptance vs beam energy (the values are entered by hand in the kumac from the output of the simulation)
 - `asym18.kumac` plots the asymmetry and produces a table with information on rates, asymmetries and polarization

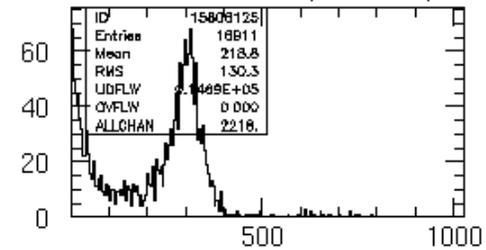
Analysis – ADC Distributions

2018/11/11 17.23

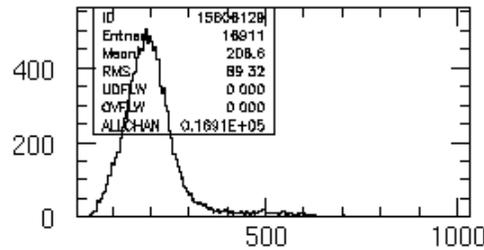
Moeller run=15806 ADC spectra – pedestals



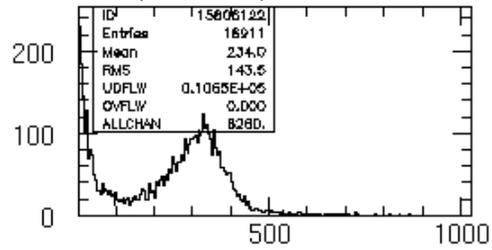
ADC 1 spectrum, pedestal subtracted



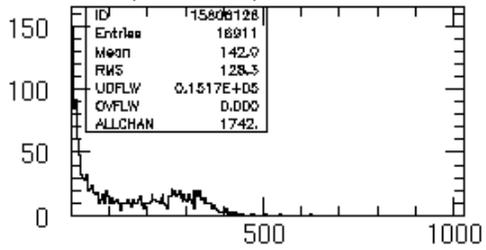
ADC 5 spectrum, pedestal subtracted



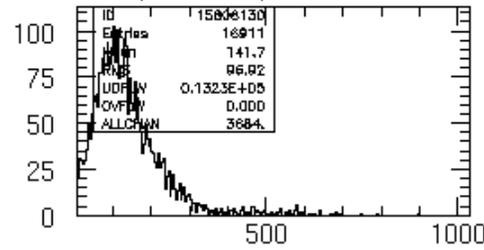
ADC 9 spectrum, pedestal subtracted



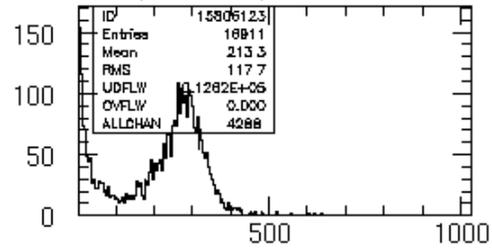
ADC 2 spectrum, pedestal subtracted



ADC 6 spectrum, pedestal subtracted



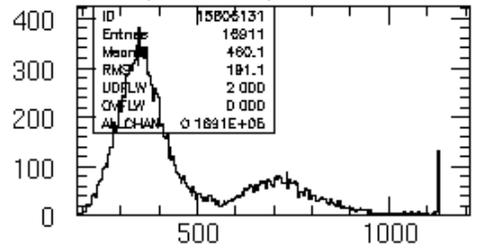
ADC 10 spectrum, pedestal subtracted



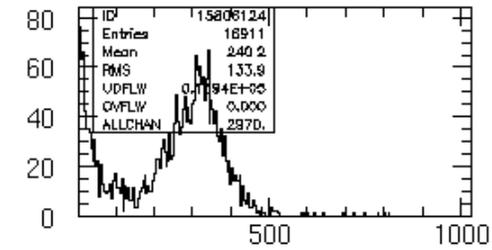
ADC 3 spectrum, pedestal subtracted



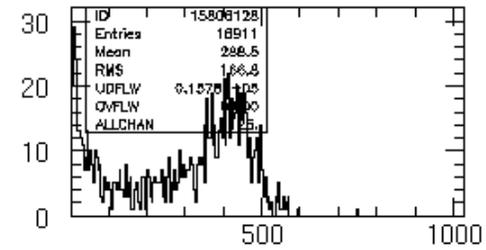
ADC 7 spectrum, pedestal subtracted



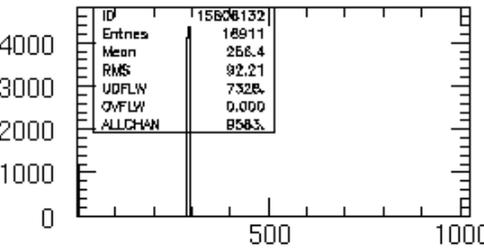
ADC 11 spectrum, pedestal subtracted



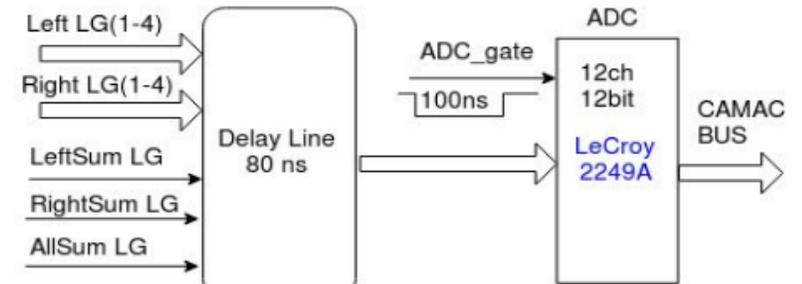
ADC 4 spectrum, pedestal subtracted



ADC 8 spectrum, pedestal subtracted

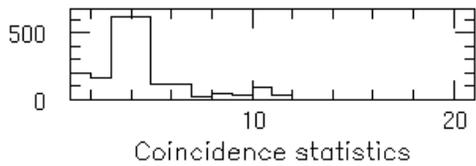
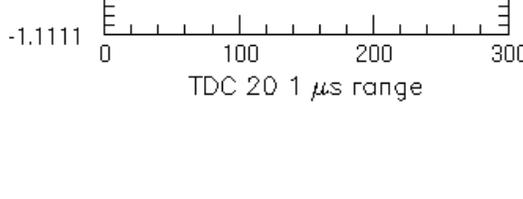
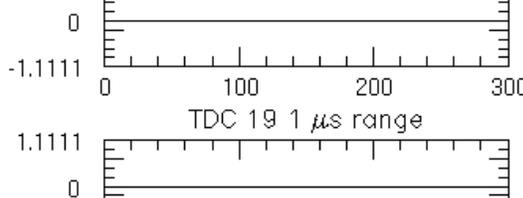
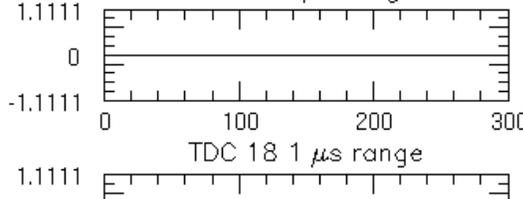
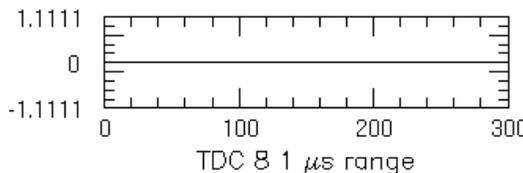
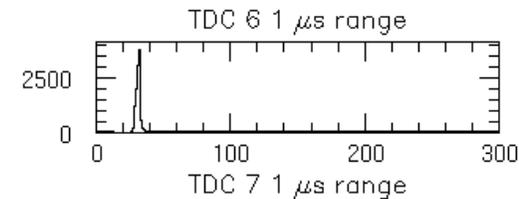
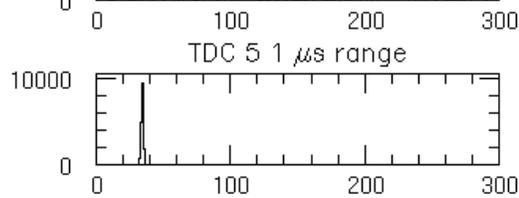
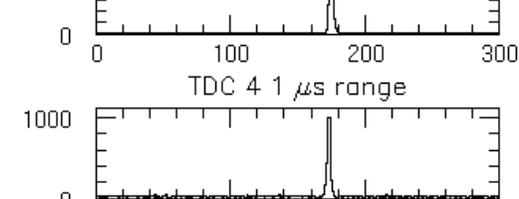
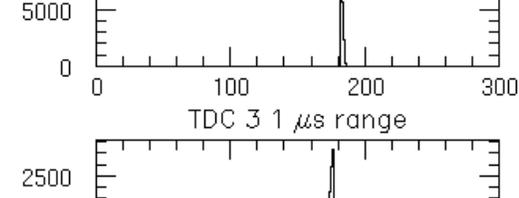
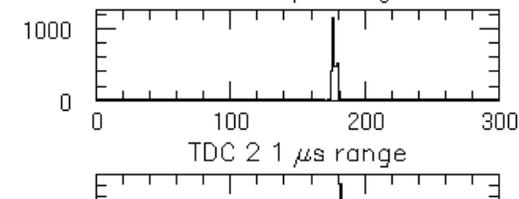
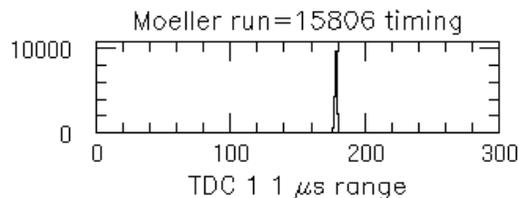
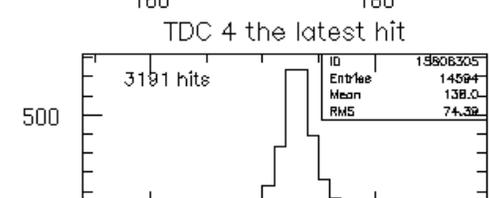
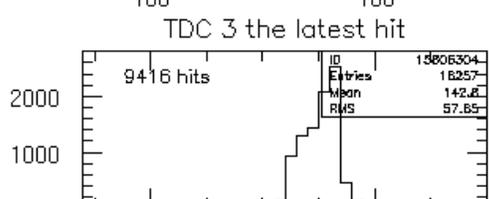
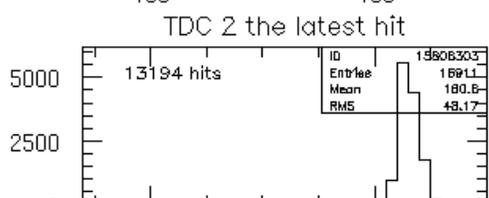
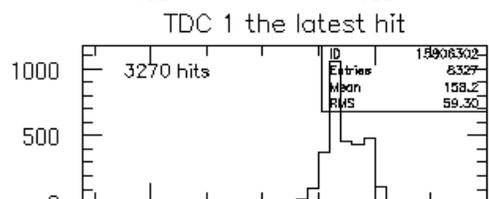
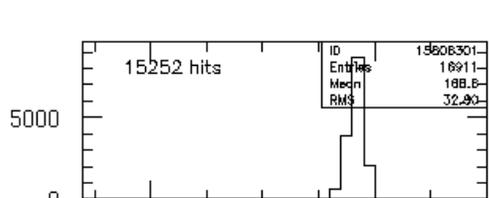


ADC 12 spectrum, pedestal subtracted

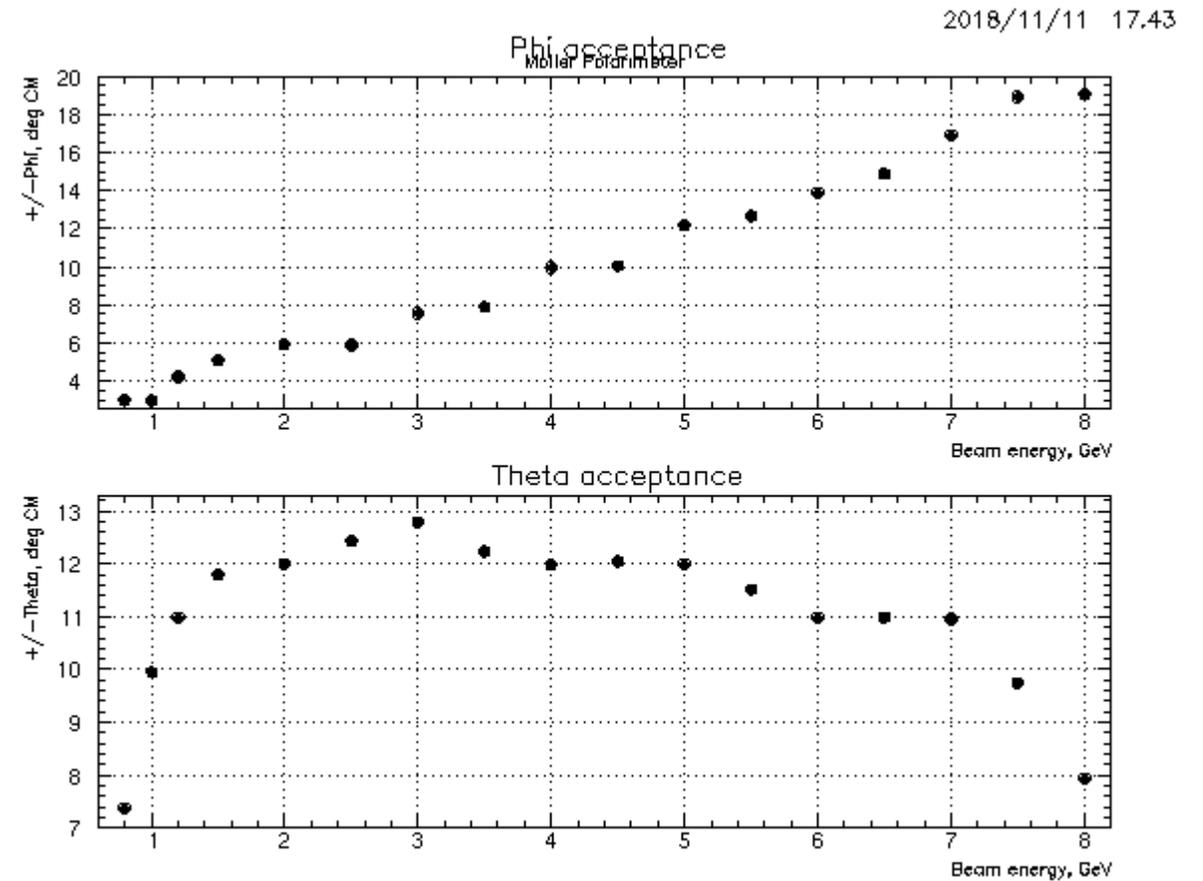
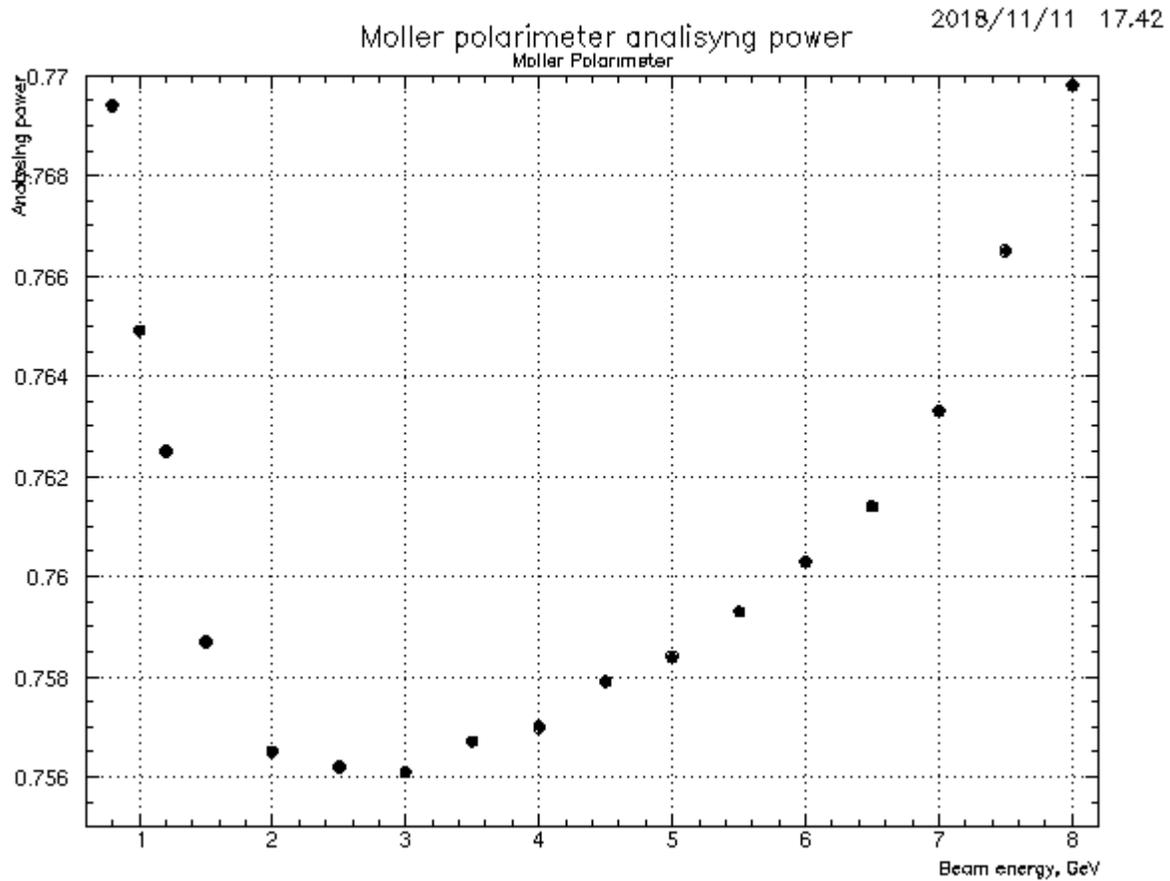


Analysis – TDC Distributions

2018/11/11 17.45

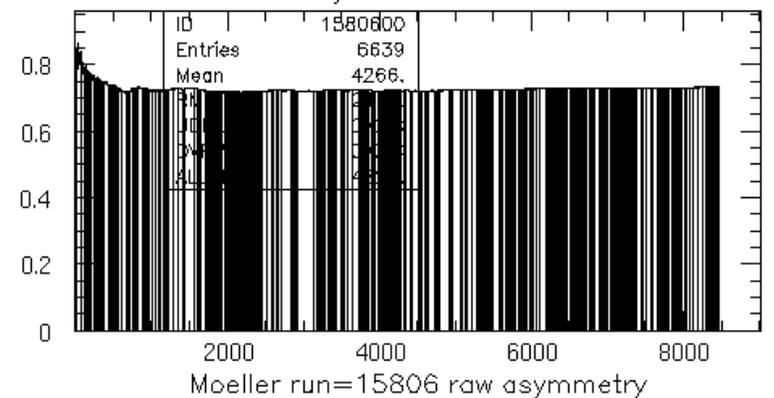
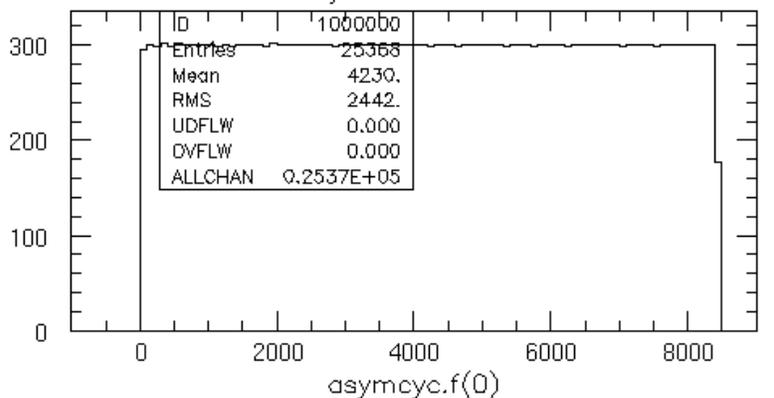
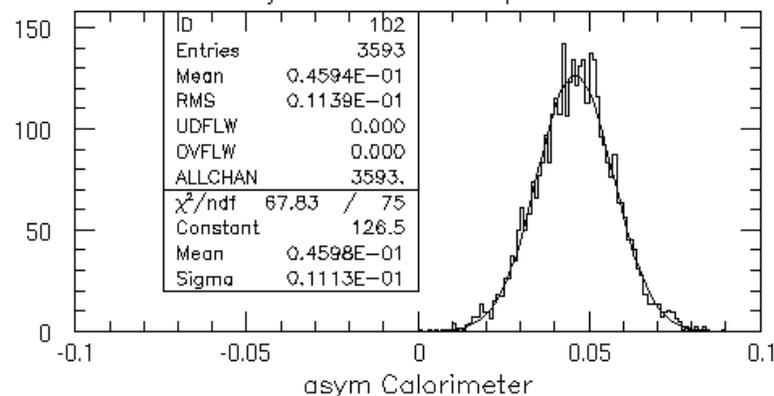
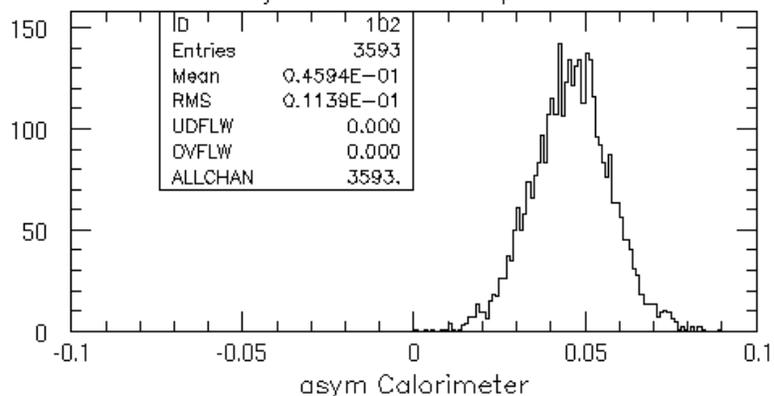
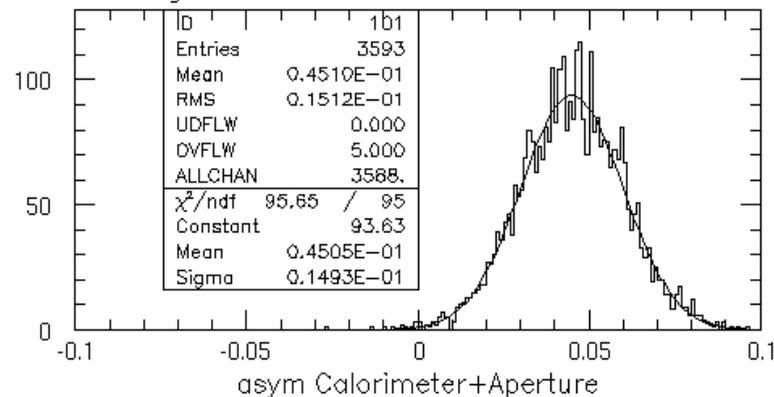
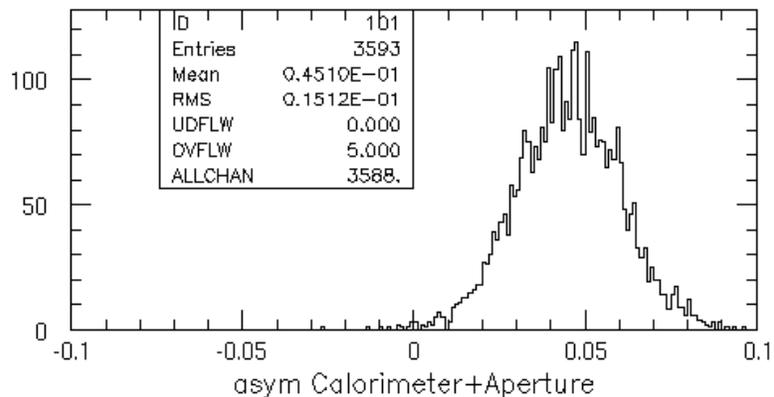


Analysis – Analyzing Power and Acceptance



Analysis – Asymmetry

Moeller run=15806 timing



Analysis – Asymmetry and Polarization

Summary for run= 15806 Cycles: all= 8457 H+= 3311 H-= 3328

T.angle= 0.00 An.power= 0.7675 T.pol= 0.0804 Norm= 1. NormBCM= 1. Coils= 0.0 A gate= 0.0330 RunType= 0. Factor= 16.2143

no	Meaning	rate/cycle	rate/sec	raw asymmetry	corrected asymmetry	Polarization
1	Left arm	<u>15553.6</u>	<u>471321.9</u> +/-	<u>4812.6</u> <u>0.0193</u> +/-	<u>0.0072</u> <u>0.0194</u> +/-	<u>0.0001</u> <u>0.3144</u> +/- 0.0016
2	Right arm	<u>15637.9</u>	<u>473876.8</u> +/-	<u>4713.9</u> <u>0.0251</u> +/-	<u>0.0070</u> <u>0.0252</u> +/-	<u>0.0001</u> <u>0.4080</u> +/- 0.0016
3	Coincidence	<u>2527.8</u>	<u>76601.0</u> +/-	<u>1613.7</u> <u>0.0450</u> +/-	<u>0.0149</u> <u>0.0451</u> +/-	<u>0.0003</u> <u>0.7312</u> +/- 0.0042
4	Coincidence accidentals	<u>113.5</u>	<u>3438.4</u> +/-	<u>326.1</u> <u>0.0449</u> +/-	<u>0.0670</u> <u>0.0449</u> +/-	<u>0.0012</u> <u>0.0000</u> +/- 0.0000
5	BCM	<u>456.5</u>	<u>13834.0</u> +/-	<u>114.8</u> <u>-0.0001</u> +/-	<u>0.0059</u> <u>-0.0001</u> +/-	<u>0.0001</u> <u>0.0000</u> +/- 0.0000
6	Left arm accidentals / LED puls	<u>4194.4</u>	<u>127103.3</u> +/-	<u>2168.5</u> <u>0.0458</u> +/-	<u>0.0120</u> <u>0.0458</u> +/-	<u>0.0002</u> <u>0.0000</u> +/- 0.0000
7	Timer	<u>3303.6</u>	<u>100108.7</u> +/-	<u>23.5</u> <u>-0.0000</u> +/-	<u>0.0002</u> <u>-0.0000</u> +/-	<u>0.0002</u> <u>0.0000</u> +/- 0.0000
8	Timer no helicity window in PLU	<u>3303.6</u>	<u>100108.8</u> +/-	<u>23.5</u> <u>-0.0000</u> +/-	<u>0.0002</u> <u>-0.0000</u> +/-	<u>0.0002</u> <u>0.0000</u> +/- 0.0000
9	Left arm 2-nd	<u>15538.1</u>	<u>470851.3</u> +/-	<u>4802.6</u> <u>0.0193</u> +/-	<u>0.0072</u> <u>0.0194</u> +/-	<u>0.0001</u> <u>0.3141</u> +/- 0.0016
10	Right arm 2-nd	<u>15631.0</u>	<u>473667.0</u> +/-	<u>4725.1</u> <u>0.0251</u> +/-	<u>0.0070</u> <u>0.0252</u> +/-	<u>0.0001</u> <u>0.4080</u> +/- 0.0016
11	Coincidence 2-nd	<u>2525.1</u>	<u>76517.2</u> +/-	<u>1614.0</u> <u>0.0450</u> +/-	<u>0.0149</u> <u>0.0451</u> +/-	<u>0.0003</u> <u>0.7313</u> +/- 0.0042
12	Coincidence accidentals 2-nd	<u>108.5</u>	<u>3286.9</u> +/-	<u>319.7</u> <u>0.0450</u> +/-	<u>0.0687</u> <u>0.0451</u> +/-	<u>0.0012</u> <u>0.0000</u> +/- 0.0000
13	Left LG delayed	<u>20004.0</u>	<u>606181.2</u> +/-	<u>5581.0</u> <u>0.0218</u> +/-	<u>0.0065</u> <u>0.0219</u> +/-	<u>0.0001</u> <u>0.0000</u> +/- 0.0000
14	Right LG	<u>17278.4</u>	<u>523586.9</u> +/-	<u>5018.5</u> <u>0.0244</u> +/-	<u>0.0068</u> <u>0.0244</u> +/-	<u>0.0001</u> <u>0.0000</u> +/- 0.0000
15	Sum LG	<u>45940.8</u>	<u>1392146.2</u> +/-	<u>9714.1</u> <u>0.0160</u> +/-	<u>0.0049</u> <u>0.0161</u> +/-	<u>0.0001</u> <u>0.0000</u> +/- 0.0000
16	Left App	<u>69031.9</u>	<u>2091876.6</u> +/-	<u>14239.7</u> <u>0.0070</u> +/-	<u>0.0048</u> <u>0.0071</u> +/-	<u>0.0000</u> <u>0.0000</u> +/- 0.0000
17	Right App	<u>59772.0</u>	<u>1811272.9</u> +/-	<u>12093.7</u> <u>0.0083</u> +/-	<u>0.0047</u> <u>0.0084</u> +/-	<u>0.0001</u> <u>0.0000</u> +/- 0.0000

Factor=16.2143

Asymmetry(Calorimeter+Aperture)=0.0450953

Asymmetry (Calorimeter only)=0.0459439

Polarization (Calorimeter)=-74.4948

Polarization(Calorimeter+Aperture)=-73.1189+/-0.42315

Moller measurements: rates/sec and asymmetries

run	Left	Right	Coinc.	Accid.	BCM	Clock	Cor.Asymm	Polarization	angl	An.Pow	Pol.Targ	PolarizationL/R	Asym BCM	coil	Factor				
<u>15806</u>	<u>471321</u>	<u>473876</u>	<u>76600</u>	<u>3438.</u>	<u>13834.</u>	<u>100108</u>	<u>0.0451</u> +/-	<u>0.0003</u>	<u>0.7312</u> +/-	<u>0.0042</u>	<u>0.00</u>	<u>0.7675</u>	<u>0.0804</u>	<u>0.3144</u>	<u>0.4080</u>	<u>-0.00007</u>	<u>0.00010</u>	<u>0.0</u>	<u>16.214</u>

DAQ, Analysis – To Do/In Progress

Most tasks before commissioning:

- Check signals in the hall and counting house as soon as Hall A opens and update the documentation
- Prepare spares (PLU and programmable discriminator mostly) – *this one before PREX runs*
- Make sure the analyzer can be compiled (there is no plan to re-write this short term)
- Rewrite the analysis package that extracts the asymmetry and the polarization using the ntuple created by the analyzer (it will be done in C, ntuples will be converted to root file)
- We will use git for version control – I created a git repo for the Hall A Moller and will push the re-written analysis code as it becomes available: https://github.com/simonamp/Hall_A_Moller_sane
- Document the analysis flow
- Make sure there is documentation on how to run the simulation(s) and run the simulation(s) for the commissioning and PREX energies to get the polarization factor
- Understand/document the dead time calculation

Summary – To Do/In Progress

- Install target magnet in the beam line (December) and align, cool down, test (EPICS controls included) – January (will coordinate with Jessie, Javier)
- Install target ladder with foils – January (coordinating with Dave Meekins)
- Surveys (got a list from the collaboration) – January? (will coordinate with Jessie and the survey group)
- Test target motion system and controls – coordinate with Javier
- Beam deflection test (possibly re-alignment) – during commissioning (will coordinate with Yves, Jessie, survey group)
- DAQ/Analysis – see prev. slide – November/December/January and beyond

Come up with a detailed commissioning run plan – see Don's talk