Update on GMn Analysis and Thesis Progress

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Background of Myself

- Graduate student at Hampton University
- Matriculated in 2016
- Originally worked with Dr. Tang studying hypernuclear physics
- Joined the SBS collaboration in August 2021
- First time seeing many of the SBS collaboration in person as last SBS collaboration meeting was in 2019

Thesis Scope & Progress

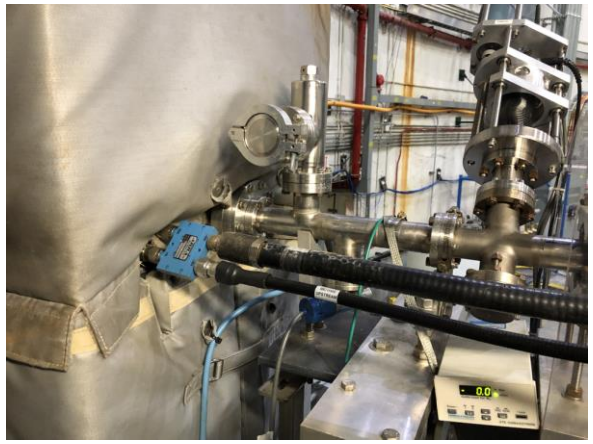
- Title: “PRECISE MEASUREMENT OF THE NEUTRON MAGNETIC FORM FACTOR USING SUPER-BIGBITE SPECTROMETER AT JEFFERSON LAB”
- Chapters

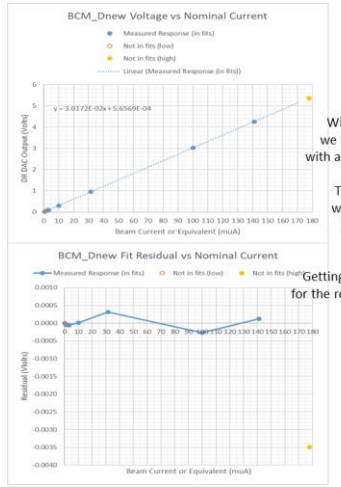
1. Introduction (drafted)
2. The E12-09-019 Apparatus (drafted)
3. Data Analysis (work in progress)
4. Preliminary Results and Discussions (work in progress)
5. Summary and Conclusion (work in progress)

Beamline Setup

BCM checkout

- Performed power scan on the digital receiver channels (Unew and Dnew) to check linearity
- Had to adjust attenuation for Unew and Dnew to 16 dB and 20 dB respectively

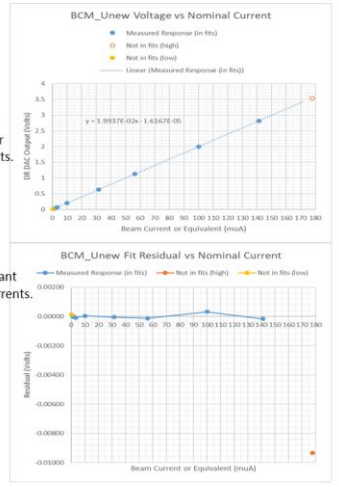


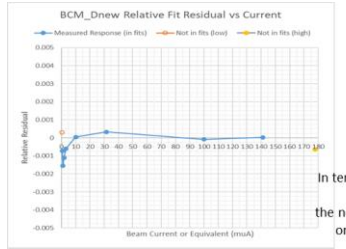


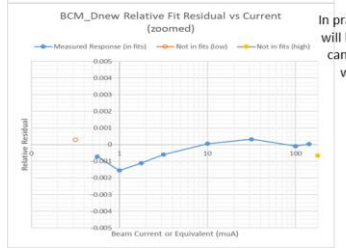
With attenuators optimized, we have highly linear behavior with a tiny roll-off at high currents.

The highest current point was removed from the fits so that it wouldn't bias the fitted offset.

Getting the offset right is important for the relative residuals at low currents. (next slide)

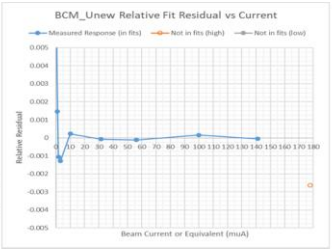


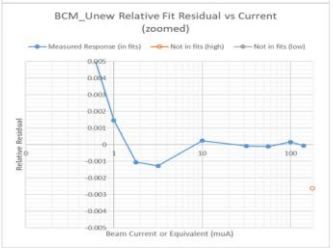




In terms of relative residuals, ie (data – fit)/fit , the nonlinearity is at the level of only 0.1% for 1-150 muA.

In practical terms, performance will be limited by how well we can calibrate these channels with the Unser monitor.





Beamline Setup

BCM checkout

- Checked the BCM VtoF signal outputs and removed unneeded fan outs
- Mapped the cables from CH01B04 patch panel,

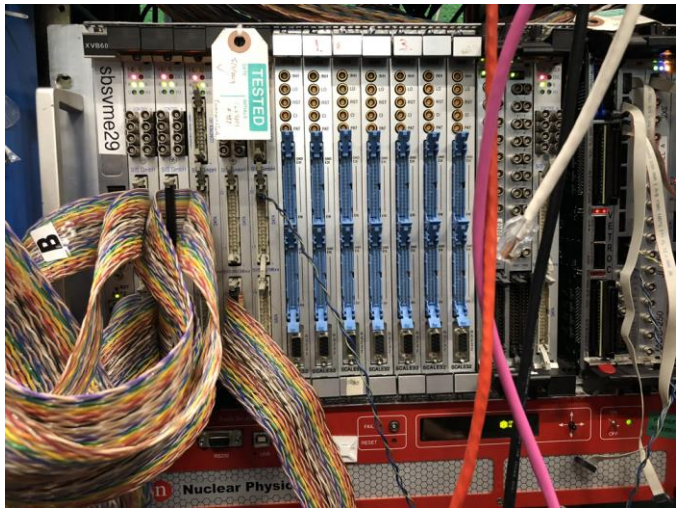
BCM Signal Mapping

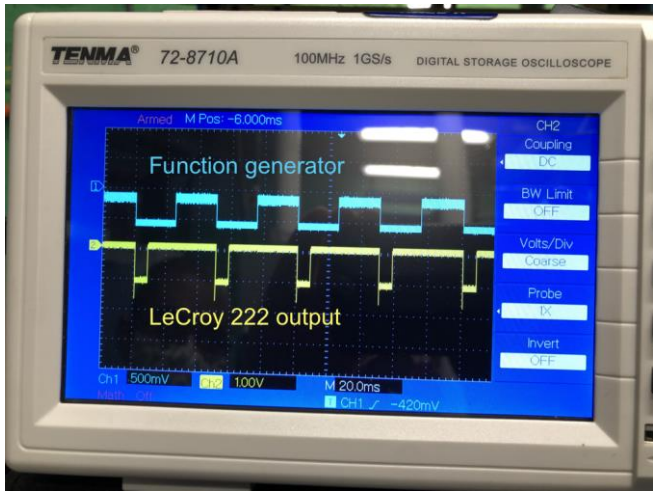
Device/ Signal	CH01B04 (Counting House)	1H75B03 (Hall A)	Betty (LHRS)	Helicity Scaler Channel (LHRS)	xscaler Scaler Channel (LHRS)
Ux1	30, 31	30, 31(T)	A16	5	24
Dx1	29, 32	29, 32(T)	B14	6	26
Dx3	10, 12	10, 12(T)	B15	7	28
Dx10	9, 11	9, 11(T)	B16	8	30
Unser	23, 24	23, 24(T)	A15	3	22
U_new	5, 6	5, 6(T)	A9	1	18
D_new	13, 14	13, 14(T)	B9	2	20

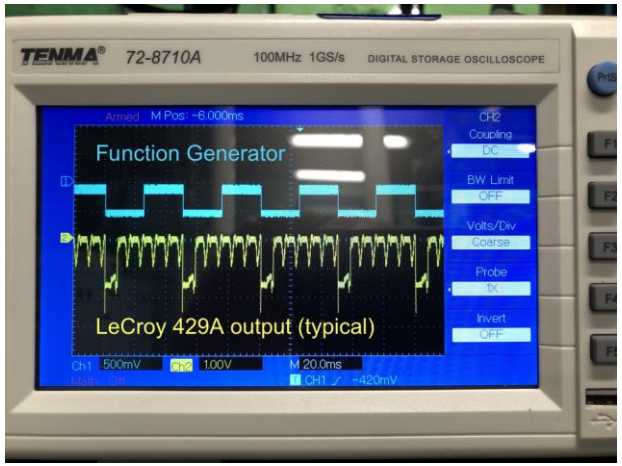
Note: First number => LHRS, second => SBS; T = 50 Ω termination; eventually to SBS DAQ

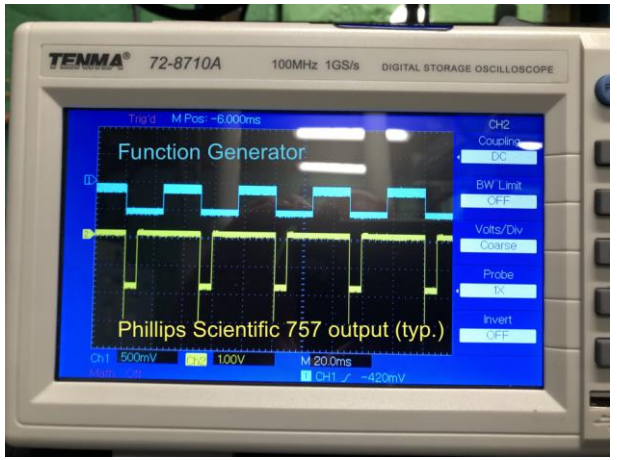
Beamline Setup

- Arrangement of the ssbvme29 scaler crate including Helicity scaler, multiple G0 scalers, discriminator units, FADC, etc
- Tested with a “fake” helicity signal and an LNE to test the Helicity scaler
- Then checked NIM units that would generate copies by sending the generated output a Fan-in/Fan-out unit to find noisy and good modules





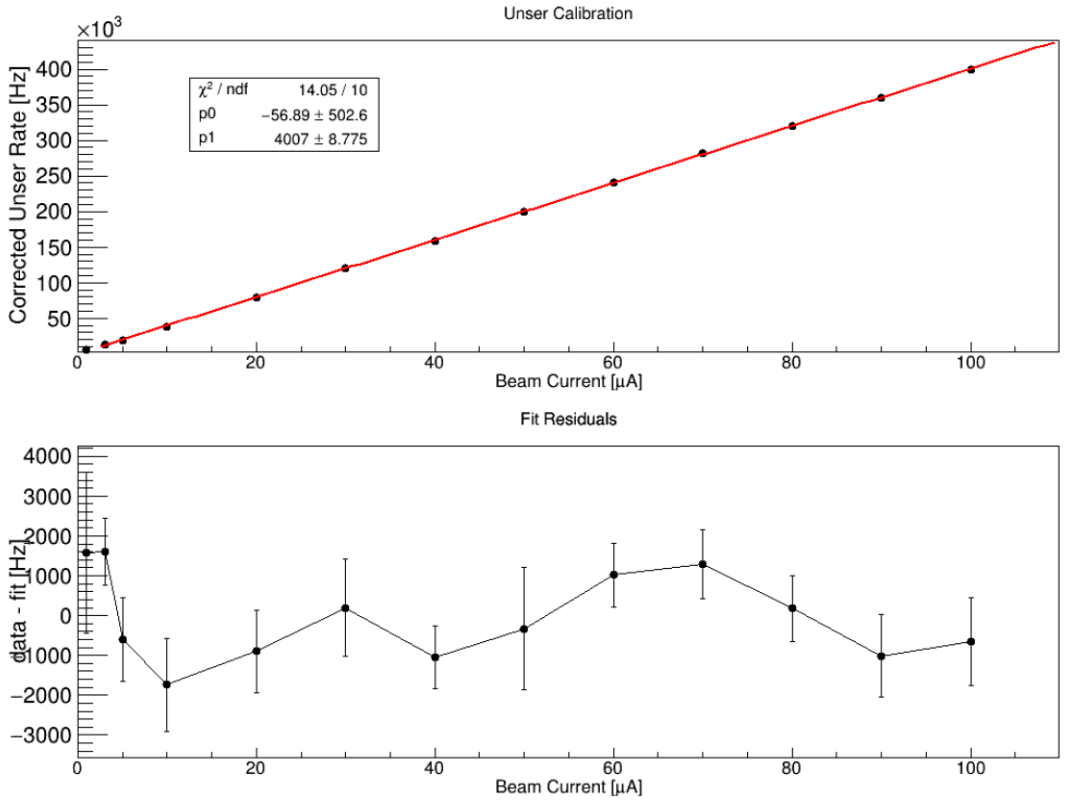




Beamline Analysis

Unser Calibration

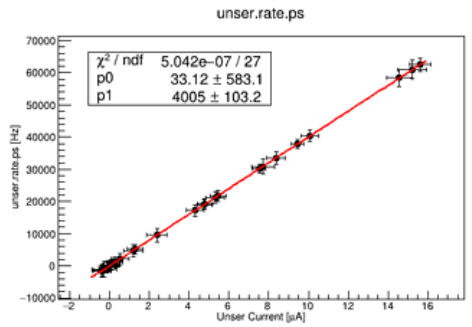
- Calibrated the Unser using a precision current source to obtain offset and gain

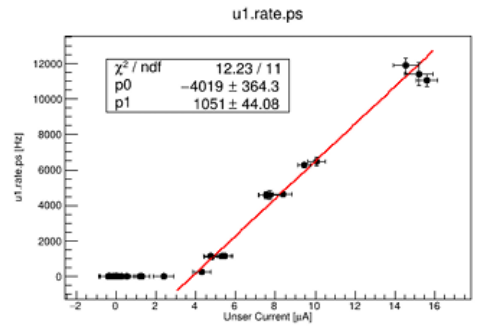


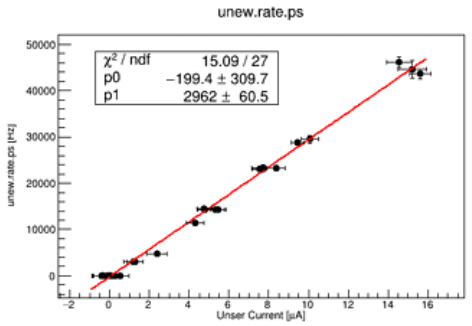
Beamline Analysis

BCM Calibration

- Was done by fitting the BCM rate as a function of Unser current to find the offset and gain







Beamline Analysis

BPM Calibration

- BPM calibration was attempted but it later found out that they were broken
- The BPM were fixed after GMn and a bullseye scan was taken during GEn

GMn Physics Analysis

- Tasked with data analysis for sbs7 and sbs11
- Currently working on obtaining proton and neutron yields
- Learning to utilize Monte Carlo simulation to obtain detector efficiencies
- Other corrections will come later: Radiative corrections, neutron/proton misidentification, neutron/proton charge exchange

Timeline for Analysis and Thesis completion

- Finish drafting thesis - September
- Send thesis to committee for comments - October
- Submit thesis to graduate college – November
- Plan is to continue working on the physics analysis as Dr. Tang’s postdoc

Thank You!