Overview, General Requirements, Equipment, Manpower

Tanja Horn



NPS Experimental Readiness Review







Overview

- Neutral Particle Spectrometer replaces one of the Hall C focusing spectrometers in the experiments
 - Angle reach between 5.5 and 60 degrees
 - > allows for precision (coincidence) cross section measurements of neutral particles (γ and π^0).
- □ HMS (existing 6 GeV era)
 - Has been recommissioned for 12 GeV
- □ Beam line and beam line instrumentation
- Cryogenic liquid hydrogen and solid targets
- Data acquisition, counting house, computing

Hall C focusing spectrometers



Neutral Particle Spectrometer





- E12-17-008 Polarization Observables in Wide-Angle Compton Scattering
- **Conditionally approved experiments: TCS with transverse target**

Experimental Techniques



E_e=6.6, 8.8, 11 GeV

	E12-13-010	E12-13-007	E12-14-003	E12-14-005
Angular resolution(mrad)	0.5-0.75	0.5-0.75	1-2	1-2
Energy resolution (%)	(1-2)/VE	(1-2)/√E	5/√E	5/√E
Photon energies	2.6-7.6	0.5-5.7	1.1-3.4	1.1-3.4
Luminosity (cm ⁻² cm ⁻¹)	~10 ³⁸	~10 ³⁸	~1.5x10 ³⁸	~1.5x10 ³⁸
Acceptance	60%/25msr	10-60%/25msr		
Beam current (uA)	5-50	5-50	~40; +6% Cu radiator	~40; +6% Cu radiator
Targets	10cm LH2	10cm LH2	10cm LH2	10cm LH2

□ Suppress and eliminate charged background – sweeping magnet

□ Resolution for photon detection – good light yield, fine granularity

- Expected rates: up to 1MHz fast response PMT, low gain, low anode current
- □ Radiation hardness integrated doses 20-30kRad, monitoring and curing systems

Photon angles and distances of calorimeter from target cover a range

E12-13-010 and E12-13-007

E12-14-003 and E12-14-005

Set	NPS angle	HMS angle	D _{magnet}	D _{calorimeter}	Magnet Angle (from Calo)	Set	NPS angle	HMS angle	D _{magnet}	D _{calorimeter}	Magnet Angle (from Calo)
3/B	16.2	11.7	1.6	3.0	5.5	4A	14.2	40.1	1.85	9.0	5.5
5/C	12.4	15.3	1.6	3.0	5.5	4B	17.9	33.7	1.85	7.0	5.5
7	21.7	11.7	1.6	3.0	5.5	4C	22.5	27.8	1.85	5.0	5.5
D	7.9	24.2	1.6	3.0	5.5	4D	26.9	23.7	1.40	3.5	5.5
8/E	16.6	15.6	1.6	3.0	5.5	4E	34.0	18.9	1.40	3.0	5.5
13	6.3	27.9	1.6	6.0	4.0	5A	11.0	41.7	1.85	11.0	5.5
16	6.3	17.3	1.6	6.0	4.0	5B	13.8	35.3	1.85	9.0	5.5
F	17.2	17.8	1.6	6.0	4.0	5C	16.9	30.0	1.85	7.5	5.5
						5D	19.7	26.3	1.85	6.0	5.5
						5E	29.9	17.8	1.40	3.3	5.5

Two configurations are needed for angles $<=23^{\circ}$ (SHMS right) and angles $>23^{\circ}$ (SHMS left)

Equipment to achieve science goals

- ~25 msr neutral particle detector consisting of ~1080
 PbWO₄ crystals in a temperature-controlled frame including gain monitoring and curing systems outer layers of 30x36 crystal matrix only to catch showers
- HV distribution bases with built-in amplifiers for operation in a high-rate environment
- Essentially deadtime-less digitizing electronics to independently sample the entire pulse form for each crystal – JLab-developed Flash ADCs
- 0.3Tm sweeping magnet allowing for small-angle and large angle operation at 0.6 Tm. The magnet is compatible with existing JLab power supplies.
- Cantelevered platforms off the SHMS carriage to allow for remote rotation (in the small angle range), and platforms to be on the SHMS carriage (in the large angle range)
- A beam pipe with as large critical angle as possible to reduce beamline-associated backgrounds – only a small section needs modification



ERR Talks

Magnet – C. Hyde

Detector – C. Munoz-Camacho

Electronics, DAQ – B. Sawatzky

Mechanical structures, installation – S. Lassiter

Beam pipe – J. Benesch

Software, analysis – G. Niculescu

NPS collaboration

Consists of members involved in NPS construction plus additional collaborators on the four experiments
A Proposal to JLab PAO 42, a companion to the WACS Proposal

- 1. Ibrahim Albayrak
 ☐ (Akdeniz Univ/Turkey)
- 2. Salina Ali 🗹 (CUA)
- 3. Moskov Amaryan 🗹 (ODU)
- 4. Vladimir Berdnikov 🗹 (CUA)
- 5. William J. Briscoe ☑ (GWU)
- 6. John R.M. Annand
 ^I (U Glasgow)
- 7. Arshak Asaturyan ☑ (AANL, YerPhI)
- 8. Vincenzo Bellini 🗹 (INFN-Catania)
- 9. Kai Brinkmann 🗹 (Giessen U.)
- 10. Marie Boer ☑ (CUA)
- 11. Alex Camsonne M (JLab)
- 12. Marco Carmignotto 🗹 (JLab)
- 13. Donal Day 🗹 (UVa)
- 14. Dipangkar Dutta 🗹 (MSU)
- 16. Rolf Ent
 ^I (JLab)
- 17. Michel Guidal ☑ (IPN-Orsay)
- 18. David J. Hamilton 🗹 (U Glasgow)
- 19. Tanja Horn 🗹 (CUA)
- 20. Charles Hyde 🗹 (Old Dominion University)
- 21. Dustin Keller 🗹 (UVa)
- 22. Cynthia Keppel 🗹 (JLab)
- 23. Mitchell Kerver 🗹 (ODU)
- 24. Edward Kinney 🗹 (U. of Colorado)
- 25. Greg Kalicy 🗹 (CUA)
- 26. Ho-San Ko 🗹 (IPN-Orsay)

27. Mireille Muhoza 🖾 (CUA) 28. Arthur Mkrtchyan ☐ (AANL, YerPhI) of kin wil wil eau wil Pawel Nadel-Turonski (Stonybrook) cri 32. Gabriel Niculescu ☑ (James Madison U.) 33. Rainer Novotny ≥ (Giessen U.) 35. Ian Pegg ☑ (CUA) А 36. Hashir Rashad ☐ (Old Dominion University) 37. Julie Roche (Ohio University) Μ A 38. Oscar Rondon ☑ (UVa) Simon Sirca (U Ljubljana) 40. Alex Somov ☑ (JLab) 41. Igor Strakovsky ☑ (GWU) 42. Vardan Tadevosyan ☑ (AANL, YerPhI) 43. Richard Trotta M (CUA) 44. Hakob Voskanyan ☑ (AANL, YerPhI) 45. Rong Wang ☑ (IPN-Orsay) 46. Bogdan Wojtsekhowski ☐ (JLab) 47. Steve Wood ☑ (JLab) 48. Simon Zhamkochyan ☑ (AANL, YerPhI) 49. Carl Zorn (JLab) 50. Jixie Zhang ☑ (UVa)

	A Proposal to JLab PAC 42, a companion to the WACS Proposal						
	Wid	e Angle, Exclusive	e Photoproduc	tion of π^0 Mesons			
Exclusive Deepl	ly Virtual Compton and Ne	eutral Pion	son and contact persor	i), L. El Fassi, J. Madsen,			
Cross-Se	ection Measurements in Ha	ll C	Ndukum, A. Subedi,	L. Ye			
	(Datad: Mar 6 2012)		University, Mississippi	n State, MS			
	(Later, May 6, 2013)		n) M Huang G Lask	aris X. Li. M. Mexiane			
We propose to us	(Proposal to Jef	ferson Lab PAC 40)	Zhang				
the Deeply Virtu ematics accessibl Mea	surement of Semi-Inclusive π° Pr	, roduction as Validation	n of Factorization	Lob, Durham, NC			
ll be covered. The	M-	M. e mu					
ll all be exploited : th of the Fourier i	May 6, 2013			Ljubljana, Rovenia			
ll be measured ind ass section will als rformed. The tot	Å. Camsonne, S. Covrig, P. Degtiare D. W. Higinbotham, M.K. Jones, C.E. J B. Sawataky, P. Solvignon,	tel (Co-spokesperson) VA					
	Vefferson Lab, Ne	nport Mans, 194 253076		ry (Co mokemeren)			
A. Camsonn	i. Albayrak, M. Carmignotto, J. Dénes-C F. Klein, M.	.outo, 14. Hiavin, T. Horn (co-sj . Mets, B. Nepal	bourderson)	A los monoperant			
C. Kedde	The Catholic University of s	4	ton, DC				
	C. Chen, M.E. Christy, Y. Han, N. B	ialantarians, M. Kohl, L. Tang,	J. Taylor	· · · · · · · · · · · · · · · · · · ·			
1	Hongton Universit	ty Namenton Vil Strass	ter mo Immennacia	M K Jones C Keppel			
	A. Asaturyan, M. Khachatryan, A. MJ V. Tadevosvan (co-stok	Wide and	al To JEFFERSON	Scottoring of			
. Asaturyan, A.	A. I. A Micharagon National Science	CoN Dist.	ton Enormica				
A.I. Alikhany	C. Hyde, M	Hyde, M. 8 and 10 Gev Photon Energies					
Boar C Desna	OM Donvinion Units	D. J. Hamilton (co-sp	okesperson), J. R. M. Ar	mand, D. I. Glazier, D. G. Ireland,			
Martí Jimenez-J	M. Guidal, C. Munos Institut de Physique Nuclouire d'Os	C K. Livingston, I.J.D. MscGregor, B. McKinnon, B. Seitz, D. Sokhan so University of Clasgow, Glasgow, Scotland					
Institut de Physi	A. Ahmidoud North Carolina A & Unit	3. S. Širca (co-spokesperson), J. Beričič, M. Mihovilovič, S. Štajner in J. Stefan Institute and Dept. of Physics, University of Ljubljana, Slovenia					
SPhN (i	G.M.H University of Regime, Regime, D.D.ett Mississippi State Unive D.D	B. Wojtsekhowski (spola R. Ent, D. Gaskell, D. D. Mack, P. Nade Thomas Jefferson No. I. Albayrak, M.	Vojtsokhowski (spolaspemon-contact), A. Camsonna, S. Corrig, P. Degiazen, R. Smi, D. Gashull, D. Higabotham, M. K. Jones, C. Karpesi, V. Kubarokey, D. Mack, P. Madch Turothki, B. Sawakity, M. Bugao, S. A. Wood Thoma Jefferon Bational Academics Testing, Neuror Henn, VA 5306 I. Alboyre, M. A. Pannmuro Carmigneto, J. Dones-Costo,				
	Florida International	N.	, B. Nepal				
	P. King	I he Catholic C	Inversity of America, V	s, washington, DC 20004			
	Oltio Undersity	S. Abrahamyan, A. Asaturyan, A. Mkrichyan, H. Mkrichyan, V. Tadevosyan, A. Shahinyan, H. Voskanyan, S. Zhamkochyan					
	D. Day, D. K.	A.I. Alikhanyan N	ational Science Laborator	al Science Laboratory, Yerevan 0036, Armenia			
	D.F Underswith of Floreson Underswith of Gloreson	V. Bellini, M. Capog S. Frullani, F. Mamm 9,	gni, E. Cirbani, A. Del Dotto, C. Fanelli, F. Garibaldi, moliti, F. Noto, G. Salmé, M. C. Sutera, G. M. Urciuoli INFN, Itely				
	S. University of Lipski	g G. ⇔ Carnegie	B. Franklin, V. Mamyan, Mellon University, Pitts	n, B. Quinn tsburgh, PA 15213			
	F. R. V Xasiar University of L	R. Gilman, K. Myers, R. Ransome Rutgers, The State University of New Jersey, Piscataway, NJ 08854.					
	F. Be	D. Nikolenko, I. Rashek, Yu. Shestakov Budker Institute, Novosibirisk, Russia					
		Florida Is	W. Boeglin, P. Marks aternational University,	witz Miami, FL 33199			
		L					

ERR Talk Track record – G. Niculescu