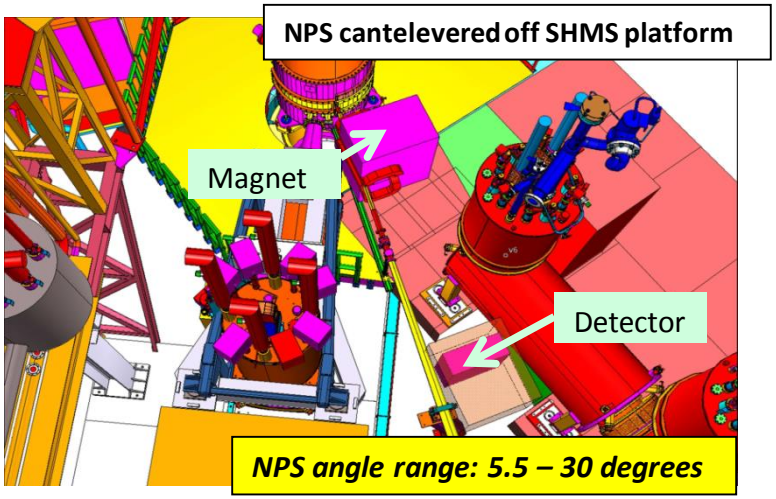
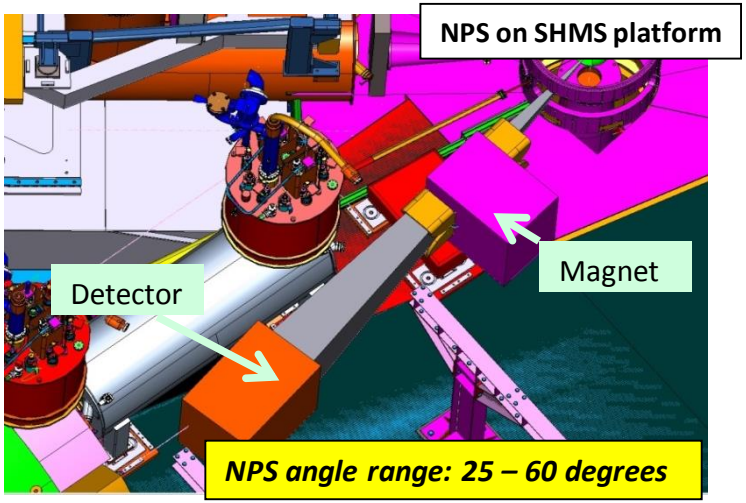
The Neutral-Particle Spectrometer (NPS)

- The NPS is envisioned as a facility in Hall C, utilizing the well-understood HMS and the SHMS infrastructure, to allow for precision (coincidence) cross section measurements of neutral particles (γ and π^0).

- The basic concept for the NPS is a highly segmented EM calorimeter based on $PbWO_4$ preceded by a compact sweeping magnet





- The NPS will be remotely rotatable off the SHMS platform.

NPS Collaboration

30 April 2015

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Univ. Ljubljana, Univ. of Virginia/USA

Overview Scientific Program

- 5 experiments approved by PAC (40, 42) to date
  - E12-13-007: Measurement of Semi-inclusive π^0 production as Validation of Factorization
  - E12-13-010 – Exclusive Deeply Virtual Compton and π^0 Cross Section Measurements in Hall C
  - E12-14-003 – Wide-angle Compton Scattering at 8 and 10 GeV Photon Energies
  - E12-14-005 – Wide Angle Exclusive Photoproduction of π^0 Mesons
  - E12-14-006 – Initial State Helicity Correlation in Wide-Angle Compton Scattering

- 1 LOI and one proposal submitted to PAC43
  - LOI12-15-007 – Timelike Compton Scattering with transverse target
  - PR12-15-XXX – Double Polarization Observables in WACS at Photon Energies up to 8 GeV

- Ideas exist for future experiments and new scientific directions taking advantage of the compatibility of NPS with Hall infrastructure
  - DVCS with polarized targets
  - Possibilities for correlation experiments
  - …

EXP. NO.	Hall	Title	Spokespersons	Institutions	Beam Days	Rating	PAC	Run Group
E12-13-007	C	Measurement of Semi-Inclusive π^o Production as Validation of Factorization	R. Ent	JLab	25	A-	40	A
			T. Horn	CUA				
			H. Mkrtchyan	Yerevan				
			V. Tadevosyan	Yerevan				
E12-13-010	C	Exclusive Deeply Virtual Compton and Neutral Pion Cross-Section Measurements in Hall C	C. Munoz Camacho	IPN Orsay	53	A	40	A
			R. Paremuzyan	IPN Orsay				
			T. Horn	CUA				
			C. Hyde	ODU				
			J. Roche	Ohio U				
E12-14-003	C	Wide-angle Compton Scattering at 8 and 10 GeV Photon Energies	B. Wojtsekhowski	JLab	18	A-	42	B
			D. Hamilton	Glasgow				
			S. Sirca	Ljubljana				
E12-14-005	C	Wide Angle Exclusive Photoproduction of π^o Mesons	D. Dutta	Miss. State	18	B	42	B
			M. Amaryan	ODU				
			H. Gao	Duke				
			M. Kunkel	ODU				
			S. Sirca	Ljubljana				
			I. Strakovsky	GWU				
E12-14-006	C	Initial State Helicity Correlation in Wide-Angle Compton Scattering	D. Keller	UVa	15	B	42	C
			D. Day	UVa				
			J. Zhang	UVa				
				Approved PAC days	***129***			
				Run Group days				***86***

PROP. NO.	Hall	Title	Spokespersons	Institutions	Beam Days	Rating	PAC	Run Group
LOI12-15-007	C	Timelike Compton Scattering with transverse target	A. Mkrtchyan	CUA			43	
			M. Boer	IPN Orsay				
			V. Tadevosyan	Yerevan				
			P. Nadel-Turonski	JLab				
E12-15-XXX	A	Double Polarization Observables in WACS	B. Wojtsekhowski	JLab			43	
			S. Abrahamyan	Yerevan				
			G. Niculescu	JMU				

NPS status

- Global design has been frozen for last three years and reviewed well
  - In the ideal case would use new $PbWO_4$ crystals
    - Global availability of high quality crystals needs to be taken into account

    → *See slides by R. Novotny*
  - Taking advantage of existing $PbWO_4$ crystals from HyCAL, one arrangement is in a 36x30 matrix covering 25 msr at distance of 4 m from target (~1100 crystals)
    - Could use PbF_2 crystals from DVCS/Hall A to fill out solid angle
  - Note: TCS experiment would require additional crystals and detectors (tracker, recoil)

- Studies related to $PbWO_4$ crystals
  - 10+5 PbWO4 crystals produced by SIC have been tested for optical properties and radiation hardness; 30 more crystals were ordered from SIC in 2015
  - Infrastructure for crystal testing at universities

    → *See slides by C. Munoz-Camacho*

    → *See slides by M. Carmignotto*

- 2015 NSF/MRI funding application submitted (CUA, OU, ODU, JLAB, Yerevan)
  - Additional funding application with emphasis on WACS requirements in preparation

Goals of this meeting

- Overview of the global status on $PbWO_4$ crystals
- Summary of tests of systematic and radiation damage effects of 2014 produced SIC crystals
  - Irradiation studies with beam at Idaho Accelerator Facility
  - Optical properties and light yield
  - Comparison to results from BNL, Caltech, and Giessen
- Overview of facilities for crystal testing at universities
  - IPN-Orsay
  - CUA
- Discussion of what tests we should do to fully understand crystal quality
- Discussion of possible options for NPS $PbWO_4$ crystals