NPS Collaboration Meeting

Jefferson Lab, Newport News, VA
19 January 2017

Tanja Horn
History of NPS Meetings

- 10 November 2012: Workshop on Opportunities for DVCS and other physics with NPS (IPN-Orsay)

- 14 November 2013: NPS Collaboration Meeting (JLab)

- 19 November 2014: NPS Collaboration Meeting (JLab)

- 15-16 June 2015: NPS and PbWO₄ Meeting (JLab)

- 21 January 2016: NPS Collaboration Meeting (JLab)

- 19 January 2017: NPS Collaboration Meeting (JLab)

- 6-7 February 2017: High-Intensity Photon Sources Workshop (CUA)
NPS Project Status

- **Magnet**: design drawings finalized, procurement of main coil awarded to Buckley Systems, quotation requests for yoke and corrector coil nearly final

- **PMT and HV bases**: comparative studies of alternative base designs completed, design drawings final, vendor selection for boards ongoing, magnetic shielding concept selected, tests of PMT magnetic field shielding

- **Frame and integrated systems**: initial design drawings completed, specifications for Light Monitoring System and curing system ongoing

- **Crystals**: characterization of systematic dependencies, irradiation studies, chemical analysis and crystal growing in collaboration with the VSL, synergy with EIC crystal calorimeter R&D
PMT shielding concept

- Transverse fields at calorimeter are on order 20-25 Gauss – shield with mu metal around PMT

- External soft iron shielding of wall thickness 3 mm shields out additional fields

Tests of PMT shielding concept

500 um mu-metal around PMT

Axial field – expect 0.5 Gauss at NPS

Transverse field – expect 20-25 Gauss at NPS

Shielding concept works
Chemical Analysis

In collaboration with the Vitreous State Laboratory (VSL)

- Two analysis methods established with fragments of SICCAS01
- Initial results available – some mysteries
- Developing non-destructive sampling method – optimize for testing large number of crystals
  - Different techniques available, e.g., laser ablation
- Also have been developing setup for growing crystals and investigating methods for cutting/polishing
Review of 2016 Action Items

- NPS Magnet
  - Check magnet design with use of BNL ex-MPS steel
    See talk by M. Fowler/B. Wojtsekhowski
    DONE
  - Check for mechanical interferences
    DONE
  - Provide detailed design drawings for magnet steel cuts
    DONE
  - Design infrastructure for support and mounting the sweeper magnet
    DONE?
  - Secure G0 experiment rails for magnet and detector longitudinal motion
    DONE
    SOS detector
  - Secure G0 experiment rails for magnet and detector longitudinal motion

- NPS High-Voltage Bases
  - Optimize the C-W design and provide update for final selection
    DONE
  - Decide on final HV base design
    DONE
  - Start HV base construction
    Ongoing
Review of 2016 Action Items

NPS Frame and Support

- Start on design drawings for NPS calorimeter frame and cooling mechanism  **DONE**
- Decide on crystal configuration in terms of PbWO4 and/or PbF2  **DONE**
- Start on design of support structure – cantilevered platform for small angle access, support on SHMS deck for large-angle access, use of G0 rails for long. motion
  
  **Started procurement for initial (310) PbWO\textsubscript{4} crystals**

- Start work on integration of required monitoring systems  **NOT DONE**

NPS Crystals and readout

- Finalize setting up infrastructure for crystal tests at IPNO and CUA  **Ongoing**
  
  **See talks by R. Trotta/A. Vargas**

- Characterize SICCAS crystals and investigate crystal-to-crystal variations and systematic uncertainties between tests at different facilities  **Ongoing**

- Decide on PMT readout and magnetic shielding and test it  **DONE**

- Decide on PbWO4 crystal dimensions and requirements for NPS  **DONE**
  
  \textit{2.05 by 2.05 by 20 cm}^{3}
Review of 2016 Action Items

NPS and Photon Source

- Continue work towards an optimized compact photon source design

- From previous meeting, there seemed to be consensus that this source requires roughly 2Tm magnet field with 1m length, as close to the polarized target as possible (~1m), with about 2-3 mm collimator

- Radiation control issues of compact magnet source and backgrounds needs to be worked out

Future NPS experiments

- Work out the case of Timelike Compton Scattering with a transversely polarized target. What is unique of the NPS for this physics?
  See talk by V. Tadevosyan

- Possible enhancement of FOM of proposal with polarized Wide-Angle Compton Scattering using optimized photon source and setup
  See talk by B. Wojtsekhowski
This workshop aims at producing an optimized photon source concept with potential increase of scientific output at Jefferson Lab, and at refining the science for hadron physics experiments benefitting from such a high-intensity photon source. The workshop is dedicated to bringing together the communities directly using such sources for photo-production experiments, for conversion into $K^*$ beams. The combination of high precision calorimetry and high intensity photon sources can provide greatly enhanced scientific benefit to (deep) exclusive processes like wide-angle and time-like Compton scattering. Potential prospects of such a high-intensity source with modern polarized targets will also be discussed. The availability of $K^*$ beams would open new avenues for hadron spectroscopy, for example for the investigations of "missing" hyperon resonances, with potential impact on QCD thermodynamics and on freeze-out both in heavy ion collisions and the early universe.
Goals of this meeting

- Formulate 2017 action items for NPS construction and science

- Discuss the timeline of engineering and design for NPS

- Discuss optimization of NPS components
  - Discussion of PbWO4 and PMT and QA planning
  - Frame design and cooling

- Discuss activities related to cabling, DAQ and electronics

- Discuss path forward for photon source and future experiments with NPS

- Publication of crystal testing results
UPDATES


3:45 – 4:10 – Magnet Design and Field Calculations – Mike Fowler/Bogdan Wojtsekhowski

4:10 – 4:35 – PbWO₄ crystal characterization – Richard Trotta/Andres Vargas

4:35 – 5:00 – Novel large-aperture polarized target – Bogdan Wojtsekhowski

5:00 – 5:20 – Coffee Break

PHOTON SOURCE AND FUTURE EXPERIMENTS

5:20 – 5:35 – Compact Photon Source Option I – Donal Day

5:35 – 5:50 – Compact Photon Source Option II – Gabriel Niculescu

5:50 – 6:15 – TCS with transverse pol. target – Vardan Tadevosyan

6:15 – 6:45 – Polarized Wide-Angle Compton Scattering at large angles - All
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<th>Spokespersons</th>
<th>Institutions</th>
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<td>E12-13-007</td>
<td>C</td>
<td>Measurement of Semi-Inclusive $\pi^o$ Production as Validation of Factorization</td>
<td>R. Ent, T. Horn, Ed Kinney, H. Mkrtchyan, V. Tadevosyan</td>
<td>JLab, CUA, Yerevan</td>
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<td>Exclusive Deeply Virtual Compton and Neutral Pion Cross-Section Measurements in Hall C</td>
<td>C. Munoz Camacho, R. Paremuzyan, T. Horn, C. Hyde, J. Roche</td>
<td>IPN Orsay, CUA, ODU, Ohio U</td>
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<td>Wide Angle Exclusive Photoproduction of $\pi^o$ Mesons</td>
<td>D. Dutta, M. Amaryan, H. Gao, M. Kunkel, S. Sirca, I. Strakovsky</td>
<td>Miss. State, ODU, Duke, ODU, Ljubljana, GWU</td>
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<td>Initial State Helicity Correlation in Wide-Angle Compton Scattering</td>
<td>D. Keller, D. Day, J. Zhang</td>
<td>UVa, UVa, UVa</td>
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Approved PAC days 129
Run Group days 86