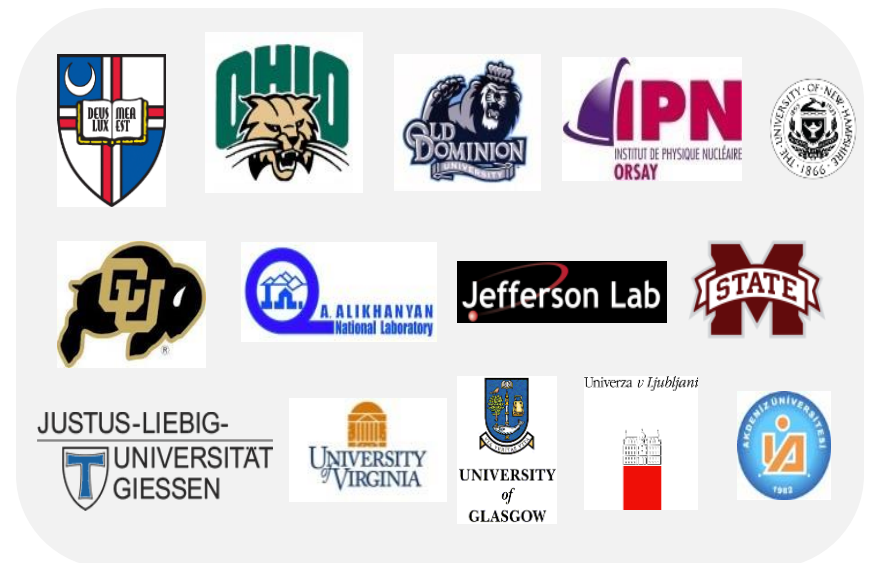


# NPS Collaboration Meeting

Jefferson Lab, Newport News, VA

3 February 2020

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 PbWO<sub>4</sub> 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](#))
- ❑ *23 January 2018*: NPS Collaboration Meeting ([JLab](#))
  - ❑ *13-15 November 2018*: NPS Frame Meeting ([JLab](#))
- ❑ *1 February 2019*: NPS Collaboration Meeting ([JLab](#))
  - ❑ *25-26 June 2019*: NPS Frame Meeting ([JLab](#))
-  ❑ *3 February 2020*: NPS Collaboration Meeting ([JLab](#))

# Experiment Readiness Review: 15 May 2019

Experiment	Exp #	Beam	Target	PAC Days	Rating
$\pi^0$ SIDIS	<a href="#">E12-13-007</a>	$\vec{e}^-$	L H <sub>2</sub>	(26)	A <sup>-</sup>
DVCS and Exclusive $\pi^0$	<a href="#">E12-13-010</a>	$\vec{e}^-$	L H <sub>2</sub>	53	A
Wide Angle Compton Scattering (WACS)	<a href="#">E12-14-003</a>	$e^-, \gamma$	L H <sub>2</sub>	18	A <sup>-</sup>
Wide Angle Exclusive $\pi^0$ photoproduction	<a href="#">E12-14-005</a>	$e^-, \gamma$	L H <sub>2</sub>	(18)	B
DVCS – days moved from Hall A	<a href="#">E12-06-114</a>	$\vec{e}^-$	L H <sub>2</sub>	35	A
$A_{LL}$ & $A_{LS}$ Polarization Observables in WACS at large s, t, and u	<a href="#">E12-17-008</a>	CPS: $\vec{\gamma}$	$N\vec{H}_3$	46	A <sup>-</sup>
Timelike Compton Scattering (TCS) off a Transversely Polarized Proton	<a href="#">C12-18-005</a>	CPS: $\vec{\gamma}$	$[N\vec{H}_3]_T$	35	C2

- ERR passed – great success!
- Scheduling request submitted for E12-13-010/E12-13-007
- Could run as soon as 2022

# NPS Project Status Overview

See talks by:

❑ Magnet – mapping at 25% of max current complete, central part only

Charles

❑ Frame – planned delivery to JLab Summer 2020

Emmanuel

❑ Infrastructure Hall C – cables, mechanical design, platforms, etc.

Mike/Paulo

❑ Infrastructure Hall C – HV, DAQ and electronics

Brad

❑ Infrastructure Hall C – installation planning

❑ Crystal – characterization, beam tests, NIMA publication

Vladimir

❑ HV Dividers

Julie/Fernando

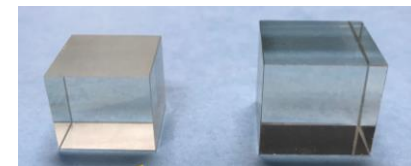
❑ Controls and monitoring

❑ Simulations and software development – background, calibration, etc

Ho-San/Jacob

❑ Prospects glass scintillators

## STTR Phase 1 was awarded!



- ❑ Progress with scale-up –  $2 \times 2 \times 20 \text{cm}^3$  samples produced, issues associated with further scale-up identified, solutions are being implemented and tested

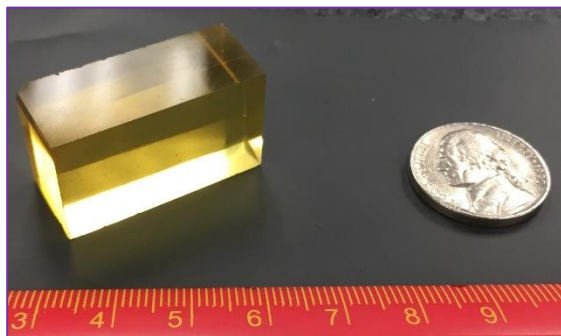
### Example: SC1 glass

1cm x 1cm x 0.5cm  
(test size)

2cm x 2cm x 4cm (medium size)

2cm x 2cm x 20cm (large size)

- Unpolished, Bubbles on surface only – will be removed during cutting and polishing



2019

1cm x 1cm x 0.5cm



2023

Up to 4cm x 4cm x 40cm

# NPS 2019 Action Items (1)



- ✓ • Prepare documentation
  - Collect descriptions and manuals
  - Draft COO
  - Preliminary rad form
  - OSP magnet and detector
  
- ✓ • Finalize design and construct NPS detector frame
  - **Specify Timeline for construction and assembly, and required resources**
  - **Define alignment and survey requirements**
  - Finalize PCB interface – box size
  - Finalize PMT assembly, calorimeter design
  - Finalize integration of temperature-stabilization system at 18° C
  - Test radiation hardness of carbon structure
  
- ✓ • NPS magnet - mapping and running
  - **Specify written plan for mapping and running (Hi-pot testing, hydro testing, checklists, 5 G boundaries and field measurements, controls pre-checked out, measured vs calculated results, safety checks and controls, back out procedures)**
  - **Write safety and operation documents**
  - Map NPS magnet at low current – summer 2019
  - ✗ ○ Map NPS magnet to confirm fringe fields     **Not clear if needed**

# NPS 2019 Action Items (2)

- Hall C infrastructure - mechanical

- ✓
  - **Specify installation plan**
  - Finalize designs for fringe field mitigation for PMTs including the beam dump line, for NPS at small angles, and the HMS snout, for both NPS and HMS at small angles **NPS DONE, HMS: NOT YET DONE**
- ✗
  - Finalize design of fringe field of sweep magnet on HMS optics
    - Complete design of platform for NPS, both the cantilevered support at small angles, and the platform on the SHMS carriage for NPS at large angles.
    - Complete design of support of cantilevered platform for NPS at small angles Complete design for cooling water and power lines for the magnet, and electrical power on the NPS detector platform
    - Complete design of removable guard (personnel safety) rails as needed for NPS detector frame access at small angles during maintenance periods

- ?
  - Finalize cabling concept, DAQ and electronics
    - **Specify timeline for decisions and planning**
    - Complete final cabling layout for high-voltage and signal cables
    - Complete layout of patch panels and DAQ/electronics racks in SHMS hut
    - **Specify trigger bandwidth (highest rate expected from NPS) and dynamic range expected from signals**
    - **Specify how software chain handles data rates – online monitoring**
    - Specify fADC threshold
    - Specify additional slow controls, e.g. temperature

# NPS 2019 Action Items (3)



- ✓ • PbWO<sub>4</sub> crystals
  - **Specify expected number of crystals from each vendor and when will have them**
  - **Finalize layout with final number of CRYTUR and SICCAS crystals**
  - Quantify shower leakage – make photon energy spectrum for crystals next to the one hit
  - ✗ ○ Send 10 crystals to IPN for irradiation **In preparation**
  - Characterize 400 crystals
  - Further investigate glass scintillator option
  
- ✓ • PMT and HV bases
  - Production of dividers
  - **Check dynamic range at 600-700 V**
  - **Test divider with bypassed amplifier**
  - ? ○ Prepare assembly manual in collaboration with JLab
  - ? ○ Determine voltage margin and study temperature stability with gain
  
- ✓ • Software and simulation development **Focus on simulations – much progress there**
  - Online software
  - ? ○ Offline software: reconstruction - **2019**



# NPS 2019 Action Items (4)



- ✓ • Compact optimized High-Intensity Photon Source
  - Write and submit an article describing science and concept of the CPS
  - Submit preliminary proposal for funding
  - Further optimize target scenarios with split coil and large acceptance
  - ? ○ Define engineering changes for CPS concept transfer from Hall A/ to Hall D
  
- Future physics with NPS and CPS
  - ? ○ For TCS, address three points:
    - does experiment with NPS and transverse target provide unique access to GPD E/orbital angular momentum
    - is it competitive with other methods on the market, e.g., HDICE,
    - Impact of secondaries on detector operation
  - Consider further high-quality unique science that could be considered with the NPS, with availability of intense electron and photon sources.

**Spectroscopy with secondary KL beam  
approved for Hall D**

# Goals of this meeting



- ❑ Formulate 2020 action items for NPS installation and science
- ❑ Discuss To-Do list for completion and assembly of NPS
- ❑ Path forward towards commissioning of NPS