NPS Collaboration Meeting

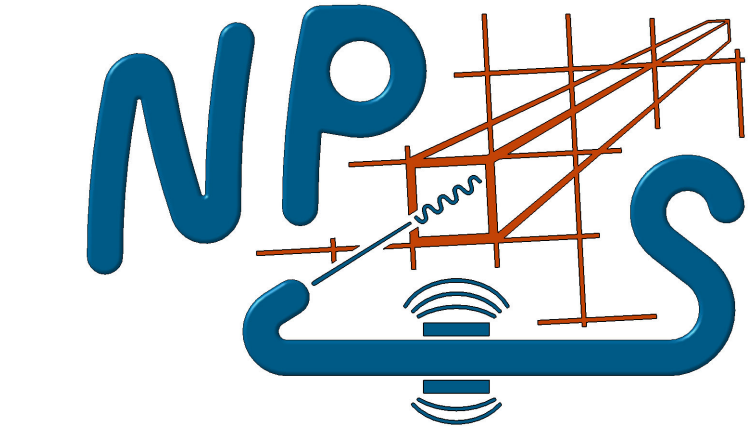


Photo from Paulo taken at Fort Monroe

Remote due to Covid-19

16 February 2022

Tanja Horn

History of NPS Meetings

- *10 November 2012*: 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 $PbWO_4$ 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)
- *1-2 February 2021*: NPS Collaboration Meeting (Remote due to Covid-19)
- *16 February 2022*: NPS Collaboration Meeting (Remote due to Covid-19)

NPS passed the ERR in 2019

2021 Assembly postponed due to Covid

Experiments Overview

Experiment	Exp #	Beam	Target	PAC Days	Rating
π^0 SIDIS	E12-13-007	$\vec{e}^-$	L H_2	(26)	A$^-$
DVCS and Exclusive π^0	E12-13-010	$\vec{e}^-$	L H_2	53	A
Wide Angle Compton Scattering (WACS)	E12-14-003	e^-, γ	L H_2	18	A$^-$
Wide Angle Exclusive π^0 photoproduction	E12-14-005	e^-, γ	L H_2	(18)	B
DVCS – days moved from Hall A	E12-06-114	$\vec{e}^-$	L H_2	35	A
A_{LL} & A_{LS} Polarization Observables in WACS at large s, t, and u	E12-17-008	CPS: $\vec{\gamma}$	$N\vec{H}_3$	46	A$^-$
Timelike Compton Scattering (TCS) off a Transversely Polarized Proton	C12-18-005	CPS: $\vec{\gamma}$	$[N\vec{H}_3]_T$	35	C2

- ❑ Scheduling request submitted for E12-13-010/E12-13-007 (NPS Phase-I)
- ❑ Assembly out of the hall now in June/July 2022
- ❑ Could run as soon as 2023
- ❑ Discussion: what needs to be done for NPS Phase-2? Scheduling request?

NPS Project Status Overview

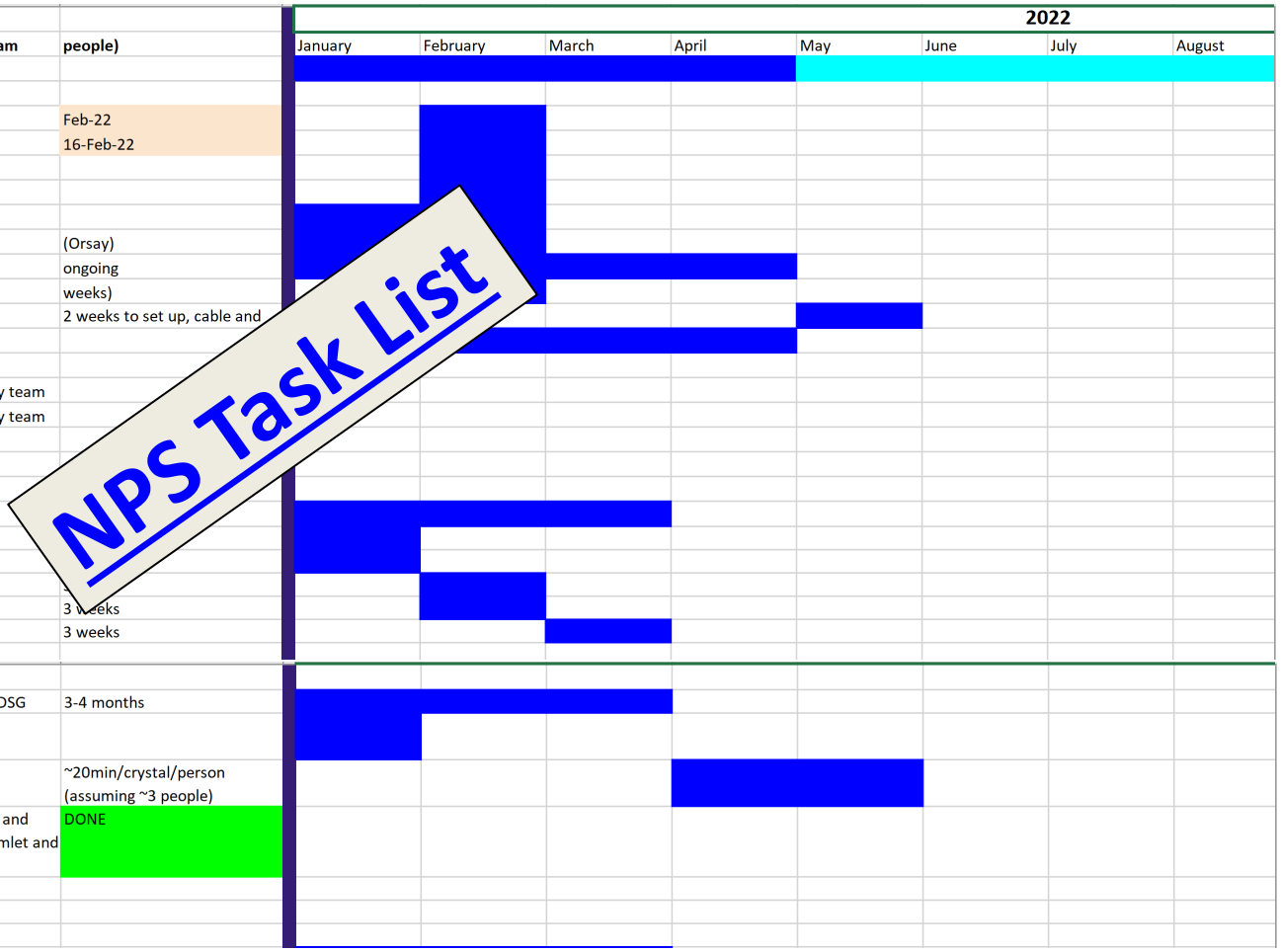
See talks by:

- Magnet – mapping at 25% of max current complete, central part only
- Frame – delivered at Jlab in January 2021
- Crystals – characterization, stacking strategy — Vladimir
- Infrastructure Hall C – cables, mechanical design, platforms, etc. — Paulo/Steven
- Infrastructure Hall C – Assembly space, support hardware, DAQ and electronics — Brad
- Infrastructure Hall C - HV Dividers — Fernando
- Infrastructure Hall C - Controls and monitoring — Aaron
- Analyzer software development – background, calibration, etc — Carlos Y.
- Assembly and installation – assembly procedure — Carlos M.
- Pre-Assembly Tasks – Reflector pre-shaping — Charles

NPS 2021 (now 2022) Pre-Assembly List

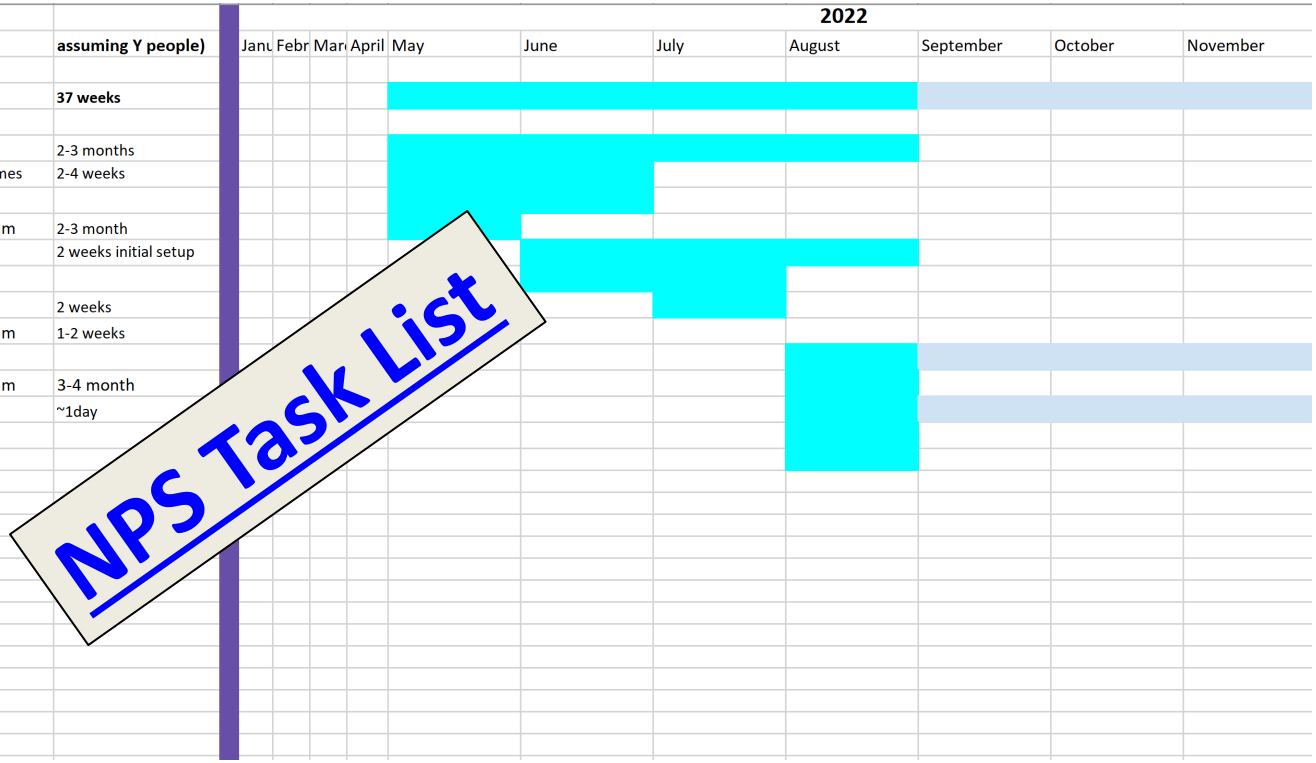
- Pre-October 2021 (now pre-June 2022)
  - Prepare at least one fully instrumented crate for readout testing
  - ? Pre-shape crystal wrapping material and store
    - This meeting
    - Coordinate resources
  - ✓ **High priority:** Identify location and number of all components (crystals, PMTs, dividers, …)
  - Ship all components to JLab

	NPS Tasklist - Pre-assembly 2022		
2		**Responsible Team**	**people)**
3	**NPS Preassembly (dark blue) + Assembly (light blue)**		
4	**General Pre-Assembly Tasks**		
5	Check on progress with NPS Final Assembly Space	Facilities	Feb-22
6	NPS Planning Meeting	All	16-Feb-22
7	Cleanroom)	Brad, Vladimir	
8	Decide on travel plans for NPS assembly	All	
9	Identify location and number of all components (crystals,	Vladimir, Brad	
10	Ship all components to JLab	All	(Orsay)
11	Document electronics/DAQ items in Wiki	Brad, Tanja	ongoing
12	Organize test lab, initial unpacking, etc.		weeks)
13	Prepare at least one fully instrumented crate for readout	Brad	2 weeks to set up, cable and
14	Preparation of assembly, docs, and test plan development		
15	Counting House - DAQ/electronics	Brad	
16	Mechanical mounting detector	Carlos and Orsay team	
17	Crystal wrapping	Carlos and Orsay team	
18	Detector calibrations	team	
19	Cable maps	Brad+designers	
20	Resources - onsite personnel	Tanja	
21	**HV Dividers Tasks**	Fernando + FEG	
22	Component orders	Fernando + FEG	
23	Contract assembly	Fernando + FEG	
24	PMT socket removal	Fernando + FEG	
25	PMT socket installation	Fernando + FEG	3 weeks
26	Testing	Fernando + FEG	3 weeks
27	Document number of available HV dividers	Fernando + FEG	
28	**Crystals/Glass Tasks**		
29	Pre-shape crystal wrapping material and store	Vladimir, ODU, DSG	3-4 months
30	Storage space in EEL126/NPS Cleanroom (shelves, cabinet etc.)	Brad, Vladimir	
31	Crystal wrapping		~20min/crystal/person (assuming ~3 people)
32	Decide on final stacking configuration - 3 options	Vladimir, Carlos and Orsay team, Hamlet and AANL team	DONE
33	1) 30 x 36 – 1080 CRYTUR		
34	2) 26 x 32 – 832 CRYTUR, 248 SICCAS		
35	3) 28 x 34 – 952 CRYTUR, 148 SICCAS		



NPS 2021 (now 2022) Assembly List

	NPS Tasklist		
2		**Responsible Team**	**assuming Y people)**
3			
4	**NPS Assembly**		**37 weeks**
5	4/28/22)	Facilities JLab	
6	**Tests before moving into the hall**		2-3 months
7	Crystal stacking	start Orsay team, assumes	2-4 weeks
8	Mu metal shield test - using Hall A Helmholtz coil setup?		
9	HV calibration PMT	JLab/Orsay/AANL team	2-3 month
10	DAQ/Electronics - LED, cluster trigger checking		2 weeks initial setup
11	Cooling tests	Orsay team	
12	Slow controls, interlocks		2 weeks
13	**Tests after moving into the hall**	JLab/Orsay/AANL team	1-2 weeks
14	Fringe fields		
15	Crystal/PMT calibrations	JLab/Orsay/AANL team	3-4 month
16	Test mechanical movement (lateral)		~1day
17	DAQ/Electronics - OR, VTP		



- Main assembly activities planned for June/July – pre-assembly has started
- Split into two parts: Tasks 1) outside Hall C and 2) after moving to Hall C

NPS 2021 To Do List (1)

- ✓ Mechanical Design
  - ✓ Revisit and make an updated detailed installation list
  - ✓ Check with suitable office (facilities?) on approval of staircase design
  - ✓ Complete cable routing to patch panel
    - Check and document latest requirements for interferences, e.g. shelf plates on SHMS
  - ✓ Document time estimate for rotating the magnet, moving the NPS detector and cabling, moving NPS from one side to the other
  - ? (This meeting) Identify and document items that can be done in advance, e.g. weld plates on SHMS

- ✓ Detector Frame (delivered to JLab January 2021)
  - ✓ Add cooling/pressure tests early in the mechanical mounting plan
  - ✓ Add checking for bubbles between PMT and block in the mechanical mounting plan
  - ✓ Post (link to the) mechanical mounting plan under Assembly in the Wiki
  - ? (This meeting) Test stand availability in test lab

- ✓ Crystals/glass
  - ✓ Irradiate 10 CRYTUR crystals and full-size glass at Orsay
  - ✓ Decide on final stacking configuration – currently three options:
    - Option 1: 30 x 36 – 1080 CRYTUR
    - Option 2: 26 x 32 – 832 CRYTUR, 248 SICCAS
    - Option 3: 28 x 34 – 952 CRYTUR, 148 SICCAS

NPS 2021 To Do List (2)

- NPS Magnet – mapping and running
  - ✓ Check measurements vs 3D calculations (takes ~1-2 months)
  - ? This meeting
    - Make table of fringe fields vs. current and check simulations for physics impact
    - Decide on what fraction of maximum current to run the magnet for first run group – will also determine impact on HMS optics and mitigation needs

- ✓ Sensors/HV boards and cables/Slow Controls
  - ? This meeting **High priority:** Test and document Samtec connectors up to 1100 V
  - ✓ Test HV cables
  - ✓ Design LED control board GUI

NPS 2021 To Do List (3)

- DAQ/Electronics/Cabling/LCW
  - Document or link documentation on electronics/DAQ items to the Assembly and/or Documents Wiki page
  - This meeting Prepare an assembly plan for DAQ/electronics similar to the one for NPS mechanical mounting plan
  - Work with designers on cable runs and cable motion strategy
  - Check with designers on need for feedthrough cabling, decide on modification of existing roof block or new roof block with penetration
  - FEG: Develop DAQ firmware (VTP, F250, TI/TM, CODA ROC driver) – **high priority item**: get started on sparsification firmware
  - Develop LED control system (HW interface, firmware+SW) – FE/DAQ group
  - This meeting **High priority item:** Start Analyzer development (multi-block decoding, high level NPS class integration)
  - Double check required magnet current – LCW and power supply available for 800A

- High voltage dividers – complete by summer 2020
  - **High priority:** Develop procedure to measure anode current
  - **High priority:** Decide on final on HV divider, including gain
  - Include availability of bases in the assembly schedule
  - Determine need for additional resources and/or funding beyond what was planned to make changes to HV dividers

NPS 2021 To Do List (3)

- Simulation and software development
  - Include mu metal shielding details in simulation
  - Continue studies of calibration methods
    - Elastics: determine where the proton goes with NPS/electron angle fixed – can one place an additional small detector at backward angles?
    - Optimize kinematics if this is possible

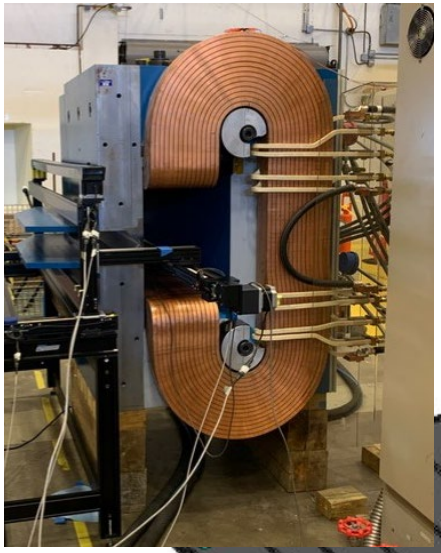
NPS Science – Timelike Compton Scattering

This meeting

- Determine quantitatively if low energy protons can be measured after the polarized target high magnetic field – do they leave the field? Do they leave the scattering chamber?
  - Make a 3D simulation and for selected bins show the trajectories of proton (and electron) and where they hit the detector in t, phi, etc., in particular at low momentum
  - Check the simple example of phi plot correlations: plot phi=0/theta=0, phi=0/theta=45, phi=0/theta=90deg, etc., and see if the correlation, and where the detector is hit, changes
- Show how one can select exclusive TCS events with photon beam energy unknown and detection of positron, electron and proton in area of large background.
- Show how certain particle backgrounds can be reduced in the data analysis (π^0, γ, $\pi^{+/-}$)
- Quantify the unique impact of TCS with polarized target on hadron imaging studies
- Show how TCS with polarized target complements other approved Compton Scattering experiments (DVCS, TCS, WACS) at JLab.
- See if other group of people is interested to see if small TCS experiment with unpolarized target adds value as compared to approved Hall B and Hall A/SoLID experiments

Goals of this meeting

- Discuss status and To-Do list for pre-assembly and assembly of NPS
- Getting Ready for the first NPS run
  - Discuss test plans 1) before moving to the hall, 2) in the hall
  - Path forward towards commissioning of NPS
  - Discuss start of run plan for NPS Phase-I
- Discuss what needs to be done for an NPS Phase-2 (scheduling request, ERR, unpolarized WACS only, with CPS?).
  - Transverse Polarized Target magnet ordered, at lab late 2021
- Formulate 2022 action items for NPS assembly, installation and science



F156