NPS TO DO LIST 2020

Mechanical Design (start in May)

- Check and document all kinematics with latest requirements for interferences, e.g. shelf plates on SHMS and new experiment DVCS from Hall A
- Document time estimate for rotating the magnet, moving the NPS detector and cabling, moving NPS from one side to the other
- Identify and document items that can be done in advance, e.g. weld plates on SHMS

Magnet

- Check measurements vs 3D calculations (takes ~1-2 months)
- 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

Detector Frame (goal: delivery to JLab August 2020)

- Finalize quotes, e.g. for quartz and mu metal
- Implement the new magnetic shielding design – includes ordering all parts (honeycomb, mu metal, iron shielding, aluminum plates, supports), assembly, and testing
- Re-check the center of gravity of the updated design
- Decide on how to attach the NPS frame to the JLab fixture, e.g. bolts, weld
- Send temperature control information to Brad to figure out readout (include in alarm handler, but no feedback, no interlock)
- Determine needs for operating chiller in Hall C, e.g. radiation hardness, shielding, order spares
- Send crystal wrapping material for pre-shaping to JLab
- Check uniformity of fiber transmittance after cut/polish
- Test for LED system cross talk for adjacent PMTs
- Check if Kapton tape should be used around the PMT to insulate it from the mu metal cylinder
- Determine if there is a way to monitor thickness increase of crystals when adding tape

Crystals/glass

- Send 10 CRYTUR crystals and full-size glass to Orsay for irradiation test
- Should have 650 CRYTUR crystals at JLab by August 2020, then 30 per month more. Should have 250 more (900 total) CRYTUR crystals by April 2021.
- Check with CRYTUR if they can expedite outstanding crystal delivery for 250 crystals purchased recently and possible early FY21 procurement for 200 more
- Decide on final stacking configuration – current nominal configuration is two outer layers on top, bottom and ‘away-from-beam’ side SICCAS, rest CRYTUR (184 and 896 crystals, respectively)

HV Dividers (complete by summer 2020)

- Check on the method to measure anode current, e.g. in Hall C
- Further analyze existing anode current data from Hall D
- Decide on final HV divider gain

- Determine need for additional resources and/or funding beyond what was planned to make changes to HV dividers

DAQ, Electronics, HV, Cabling, LCW

- Continue procurements (computer hardware, VXS crates, modules, patch panel hardware)
- HV cabling/connectors: count available channels from, e.g. G0, BigCAL, and decide on type of connectors to procure
- Decide on patch panel location
- 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
- Develop DAQ firmware (VTP, F250, TI/TM, CODA ROC driver) – FE/DAQ group
- Develop LED control system (HW interface, firmware+SW) – FE/DAQ group
- Confirm with DSG the development of slow control SW (start from Comcal GUI, HV, temp display, calo protection)
- Start Analyzer development (multi-block decoding, high level NPS class integration)
- Double check required magnet current – LCW and power supply available for 800A

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

- 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

NPS ASSEMBLY TO DO LIST

pre-October 2020

- Complete frame construction and assembly with new magnetic shielding design
    - Assemble mu metal tube assemblies
    - Assemble reference and support PMT plates in box
    - Assembly rails for PCB
    - Mount 1st vertical PVS and final adjustment of fiber length
    - Cut and polish fibers – test uniformity of transmittance
    - Mount heat exchanger and cooling tubes
    - Machine additional tools for pre-shaping reflective sheets
    - Adjust shielding in box
    - Different assembly tests
    - Mount back temperature sensors
    - Machine plastic scintillators and light guides and test mounting
    - Pack assembly
    - Ship assembly to JLab
- Develop documentation for the mounting process
- Request space for NPS assembly and storage – should be climate controlled
- Prepare at least one fully instrumented crate for readout testing
- Pre-shape crystal wrapping material and store
    - Identify additional oven
    - Coordinate resources
- Identify location and number of all components (crystals, PMTs, dividers, …)
- Ship all components to JLab

October-December 2020

- Start assembling PMT+divider modules
    - Wrap crystals
    - Assemble block with PMT and HV divider
- Assemble the first row of crystals and its plastic front parts (mount spacer between reference plate and crystal)
    - Adjust crystal size with tape as needed
- Start stacking and cabling
    - Mount the next rows of crystals
    - Mount the front PE plastic and sensors
    - Mount cooling plates, tubes, and leakage test
    - Mount external shielding
    - Assembly fibers on PCB or block PMT
    - First column block PMT on left side from back
    - Mount first PCB and connect HV cable and fibers
    - Assemble all PCBs
    - Connect signal cables
    - Finalize insulation
    - Mount cosmic scintillators
- Setup DAQ, readout hardware and software for testing
    - Full crate with VTP
    - Readout
    - Cables

- Reasonable computer, disk space