

June 10, 2024

These are the milestones given in the FWP for the project. These milestones are updated from the proposal and were sent in as part of the FWP in June 2023. The dates here are shifted by several months from what was sent in the FWP to account for the late start date. Funding delays caused the actual work to start Mar. 1st, 2024. The scope of work was reduced from the original proposal when writing the FWP to account for the reduced funding awarded.

| POLARIZED TARGET MILESTONES | |
|-----------------------------|---|
| 3/31/2024 (1 month) | Identify and curate appropriate historical data sets of measured polarization. This will include the CLAS12 Run Group C archives. |
| 6/30/2024 (3 months) | Develop simulation of target polarization behavior based on historical archives that can be used for AI/ML model development. |
| 7/31/2024 (1 month) | Collect historical waveform data for NMR signal from polarized target and prepare for use in model training. |
| 11/30/2024 (4 months) | Implement signal extraction technique for accurate extraction of NMR signal from electronics background. |
| 2/28/2025 (3 months) | Identify and train an appropriate model for controlling microwave frequency based on historical data and direct NMR feedback. This should start with a Deep Reinforcement Learning model. |
| 6/30/2025 (4 months) | Test model against simulation and adjust to optimize performance. |
| 11/30/2025 (5 months) | Utilize the Polarized Target Group's test facility to test the model and further refine it. |
| 2/28/2026 (3 months) | Integrate models and appropriate codes into the AI/ML controls ecosystem and deploy in Hall-B. |

| POLARIZED SOURCE MILESTONES | |
|-----------------------------|--|
| 3/31/2024 (1 month) | Identify all potentially relevant parameters (e.g. beam positions, energy, collimator, etc..) and gather historical data. Curate into form suitable for processing with modern data science tools. |
| 5/31/2024 (2 months) | Identify "nudge" events and responses to build data set for training. |
| 6/30/2024 (1 month) | Perform Shapley analysis based on polarization FOM (= pol2 × photonenergy) to determine most relevant parameter set. |
| 11/30/2024 (5 months) | Develop and train model to predict polarization FOM based on available inputs. |
| 3/31/2024 (4 months) | Connect AI/ML model from the larger lab DS ecosystem to the control system for the goniometer. Include appropriate elements into the standard control system GUIs. |
| 6/30/2025 (3 months) | Develop safety policies for operation of the system. Interface with the EPICS alarm system. |
| 8/31/2025 (2 months) | Create outward facing monitoring pages for the system using Grafana or similar. |
| 11/30/2024 (3 months) | Create simulation of realistic operating conditions that includes regular beam trips, DAQ transitions and configuration changes. |
| 2/28/2026 (3 months) | Refine model and deployment to operate in continuous mode. |