

MOLLER Tasks List – Version 4 – Dec. 17, 2017

Subsystem	Task	Description	Comments	“Owner” (if more than one, primary contact designated by *)
Target	Window design	Optimization of wall thickness, mechanics	Silviu working on it	Silviu
Target	Target Chamber	Cost-benefit analysis comparing the E158 chamber with one purpose-built for this target	Silviu working with JLab’s target group	Silviu*, C. Keith
Detectors	Radiation hardness of detector components	Investigate which detector components need radiation testing and carry out 50 MRad test	Michael and Dustin devise a plan. Status: Initial list being established.	Dustin
Detectors	Main detector stand mechanical assembly	Engineering design of lightweight support structure to hold main integrating detectors	Enquire with SU if engineer Lou Buda is available? Not yet started.	KK
Detectors	QC plan for main detector quartz	Devise plan to evaluate robustness of main detector quartz (Redundant with “radiation hardness of detector components”)	Michael and Dustin to devise a plan? Not yet started.	Dustin
Detectors	LG assembly event signals.	Investigate the background from particles moving through the light guide assembly. This combines simulations and beam tests of primarily scintillation and Cherenkov generation in the LG.	SBU group: Nearly completed.	KK
Detectors	Quartz, PMT and LG assembly soft photon background signals.	This combines simulations and beam tests of soft photon background in the quartz detector assembly. This is the dominant detector background.	U. of Manitoba group working on this. Should have first results soon.	Michael
Detectors	Thin detector module geometric design and mechanical assembly design	Design of the thin quartz detector geometry and mechanical assembly, incorporating quartz, LG, and PMT	Advanced state of progress. We have a well tested suitable geometry (multiple prototypes have been tested with beam), but still need to decide on materials and structure of the mechanical assembly.	KK
Detectors	Shower-Max module mechanical assembly design	This task incorporates the physical design and prototyping of the shower max detector, as well as the associated mechanical mounting structure.	Advanced state of first prototype design, including mechanical assembly.	Dustin
Detectors	PMT base electronics	Develop PMT base design through multiple prototype cycles	Started to revise initial Mainz prototype.	Michael
Detectors	Preamplifier design	Develop preamp design through multiple prototype cycles	Started to develop new preamp design, based on QWeak design.	Michael

Detectors	Integrating ADC design	Develop the integrating ADCs for all integrating mode detectors in the experiment.	Operational design criteria have been established. Candidate ADC and FPGA chip/architecture have been identified. Initial discussion regarding readout architecture and protocol completed.	Michael
Target/ Simulation	O-ring radiation load	Determine neutron and EM flux, and neutron dose at clamshell O-ring	Rakitha (LaTech) working on it. Expect results in one month (Rakitha Priority 1)	Rakitha
Simulation/ General	Radiation impact	Irradiation from moves in and out of the beamline and during storage	Need to develop working FLUKA simulation and benchmark with remoll simulation. Simulation development on going, will take couple of months for first results. (Rakitha Priority 4)	Rakitha
Simulation/ General	Radiation impact	Optimize shielding for MOLLER apparatus	LaTech working on target region and SBU (Cameron) working on downstream shielding. Detector shielding has some dependence on this item. Expect results in one month (Rakitha Priority 2)	Rakitha
Spectrometer /Simulation	Material Irradiation/Activation	Quantify radiation load and activation of primary components	Rakitha (LaTech) working on it, Juliette will tabulate materials, components and regions to be evaluated. Depends on complete FLUKA simulation to get this results. Simulation development on going, will take couple of months for first results. (Rakitha Priority 5)_	<u>Juliette*</u> , Rakitha
Spectrometer /Simulation	Radiation load on hybrid toroid nose	More careful evaluation of local radiation load to determine survival of epoxy	Rakitha (LaTech) working on it. Feedback from Juliette and MIT engineers on epoxy specification. Analysis on going and expect results in one month. (Rakitha Priority 3)	Juliette*, Rakitha
Simulation: 1	PMT double-differences	Using Qweak experience, evaluate upper limit to possible systematic from A_T in thin quartz and shower-max	UVa group has agreed to work on this over the next few months Dep: {4}	Ciprian*, Kent

Detectors: 2	Main detector geometries	Optimize the ring radial and azimuthal dimensions to optimize background asymmetry correction determination and systematic	UVa group working on this; Ciprian in process of reproducing Yuxiang's work; then start optimizing	Ciprian
Detectors/ Simulation: 3	Shower-max splashback	Estimate possible background in main detector PMTs from shower-max splashback	SBU undergraduate and graduate students will work on this Dep: {2}	KK*, student
Detectors/ Simulation: 4	PMT backgrounds	A comprehensive estimate of all backgrounds at the main detector PMTs	Manitoba and SBU to improve these estimates; Sakib will work on this Dep: {2}	Juliette*, Sakib
Detectors/ Simulation: 5	Detector Shielding Optimization	Figure out the configuration of heavy-Z and light-Z shielding required in front of and around the PMTs to minimize soft background	SBU will work on this after shielding geometry optimization is complete	KK*, Cameron
Detectors/ Simulation: 6	Slit scattering background	A comprehensive note summarizing the elimination of all 1-bounce sources and the leading 2-bounce sources	To be assigned once further progress is made on other background tasks? Dep: {2,3,4; 5}	KK*, student
Detectors/ Simulation: 7	Crosstalk evaluation	Evaluate impact on specific detector measurements of background from other detectors	Main source is lightguide background from primary flux. SBU undergraduate project Dep: {2,4}	KK*, student
General/ Simulation: 8	Radiative corrections for all physics processes	Incorporate radiative corrections for e-e and inelastic e-p scattering	Seamus and Yury to devise a plan of action	Seamus*, Yury
Pion/ Simulation: 9	Muon pair production	Muon pair production in the target might be significant for pion detector asymmetry measurements	Wouter is working on it; use MadGraph5 generator but need to translate generator output for remoll compatibility {No dependencies} (3 weeks) --experienced researcher project	Wouter
Pion/ Simulation: 10	Beam dump background impact	beamdump backgrounds may affect some detectors	Pion group is looking at impact on pion detector Dep: {Implement hall A geometry based on PREx (Rakitha project—not listed)} (6 weeks) --undergrad project	Wouter
Simulation/ Pion: 11	Hyperon background estimation	Strategy to evaluate the hyperon background using the full suite of detectors	Pion and simulation groups should coordinate this task and build on Konrad's previous work Dep: {2, pion wall and shower-max geometry, 5, baseline pion det. design and implement Hyperon generator (new tasks –not listed)} (12 weeks) --summer project	Wouter

Simulation/ Tracking: 12	Optics Collimator for Q2	Simulated Q2 analysis and the use of tracking and special collimation	David and Seamus should devise a plan, building on Rupesh's previous work	Seamus*, David
Target/ Tracking	Solid Targets	Determine the list of solid targets based on various physics requirements	David A. and Seamus to lead a group to study this?	Seamus*, David
Spectrometer	Tolerance analysis	Based on physics requirements to control systematics	Juliette working on it	Juliette
Spectrometer	Impact of environmental variations	Evaluate potential variation in performance and impact on physics requirements over time	Juliette and MIT to strategize and evaluate?	Juliette
Spectrometer /General	Floor loading	Map of floor loading to evaluate possible impact on physics performance	MIT to collaborate with JLab engineering?	Juliette
Tracking/ General	Downstream beamline and supports	Mechanical design of downstream beamline satisfying physics requirements	Sandesh (designer) working on it, important input for 1-bounce evaluation	David, KK*
Polarized Beam/ Detectors	Large Angle Monitors	Based on Qweak experience, devise locations for monitoring background asymmetries	Mark has agreed to run a taskforce for this	Mark*, Kent
Polarized Beam/ Detectors	New Pockels cell	Test the new (RTP) Pockels cell and extract polarized beam.	This is in progress by UVA group and lab.	Kent*
Polarized Beam/ Detectors	BCM noise level	Demonstrate the noise level of the beam monitors in combination. In particular, continue to investigate the sources of noise in the BCMS including, but not limited to, that from the local oscillator.	Parts of this already being addressed by PREX/CREX preparations. Remaining needs for higher frequency data-taking to be evaluated.	Mark*, Kent
Polarized Beam/ Monitoring	Beam dispersion	Is dispersion on target a problem for the design?	Mark and Kent to understand question and strategize.	Mark*, Kent
General	Staged running plan	Strategy for multiple year runs with assembly/disassembly	KK, Mark and Kent will review plan	Mark, KK*
General/ Spectrometer	Fringe field impact	Evaluate possible background from fringe fields in the primary beam path	Juliette working on this, will involve Jay when appropriate	Juliette
General	2-loop theory calculation	Evaluate systematic error in theory prediction	KK to work with theorists to evaluate status and plan	KK
Tracking/ General	Mechanics of GEM tracker assembly	Engineering input for GEM "wheel" and rotation assembly and remote control	Will need engineering/designer input, KK to chase	David*, KK