From:	Georg Heinz Hoffstaetter
To:	Capasso, Frances
Cc:	Brown, Kevin A; Shaftan, Timur; Fischer, Wolfram
Subject:	Re: FY2023 LDRD Call for Type A Proposals
Date:	Friday, May 27, 2022 1:46:44 PM

Dear Frances,

We plan to submit a proposal to the LDRD call for Type A.

Title: Particle Accelerator Self-Evaluation by Machine Learning

Abstract: To maintain optimal accelerator conditions, e.g., in RHIC, the AGS, or NSLS-II, it is necessary to constantly monitor, analyze, and adjust the accelerator's operational state. Human intervention is often required despite automation of many complex control processes. The feedback systems of these control processes only function optimally when they are based on an accurate virtual model of the accelerator. It is often the creation and verification of this virtual model that requires human intervention or even dedicated accelerator study time, forgoing user operation. Artificial Intelligence and Machine Learning (AI/ML) techniques provide the novel opportunity to not only automate these traditional methods, reducing the need for time consuming and error prone human intervention, but they have the potential to assemble the virtual accelerator model (VAM) without dedicated accelerator study time but rather parasitically during user operation. The ML-created VAM describes the physics in the accelerator more accurately with every successive measurement that is performed on the accelerator, e.g., during routine closed-orbit correction. As the VAM improves it can then better inform the machine operations and feedback systems. Today's techniques do not have this capability, as they require many dedicated measurements, e.g., to obtain the full Orbit Response Matrix.

The here proposed work intends to do just that: develop and use ML techniques to obtain and maintain a VAM automatically, without human interaction and without dedicated and costly accelerator study time. This VAM is then used for the mentioned feedback processes to optimize accelerator performance, and it will also contribute to the long-term health and safety of the accelerator by early warnings for component deterioration, for motion in accelerator components, or for the trustworthiness of detectors. In our implementation, AI/ML methods can also provide virtual diagnostics at locations and times where measured data is not available but can be deduced from the VAM.

We propose to establish and test these techniques at RHIC, the AGS, and NSLS-II. These circular accelerators are well-equipped to test the proposed AI methods. We believe that adoption of these methods at the LHC and other large future HEP accelerators like the FCC are highly likely.

PIs: Georg Hoffstaetter C-AD and Cornell, Karl Brown C-AD and Stony Brook, Timur Shaftan NSLS-II

BNL organizations involved: C-AD, NSLS-II, and CSI (through postdoc Natalie Isenberg)

Please let me know if you need any additional information.

Thanks and all the best,

Georg

On May 16, 2022, at 7:16 AM, Capasso, Frances <capasso@bnl.gov> wrote:

To the Members of the Nuclear and Particle Physics Directorate,

Attached is the BNL FY2023 LDRD Call for Type A Proposals with four (4) attachments. In keeping with the guidance, this process will be coordinated through the Office of the NPP ALD to develop, pre-review, and provide feedback before preparation of a full proposal. Prior to the final submittal to the Director's Office by the COB on June 24, 2022, a schedule is provided below with a few items to note so we can have a successful submittal. We expect proposals to be aligned with one or more of eight priority areas outlined in the LDRD Type A call and encourage PI's to contact appropriate POC's to coordinate. This year the NPP quota is submission of four proposals with some proposals potentially split with other organizations. PI's are encouraged to consider cross directorate LDRD Type A proposals where an expanded range of expertise can be utilized to improve proposal strength and potential. Also attached is a template for the NPP proposal pre-review presentation. Please take the time to read attached items and familiarize yourself with the requirements of this LDRD Type A proposal call. As we have done in previous proposal calls, Fran Capasso will provide the coordination of an Indico site that she will share with the group once established and set the timeframes for the presentations.

A few things to note:
This is a call for Type A proposals only.
Please take note of the selection criteria provided in the call to calibrate your work to the scope, duration, size, and funding limits. Type A proposals have a duration limit of 36 Months and a dollar limit of $500K per year. Any amount larger than this should be discussed with your Department Chair and the NPP ALD.

The PIQ form has been revised, make sure you use the one provided. Pay particular attention to sections 8, 9 and 10. PI's are requested to obtain signatures on the PIQ from the BOM and the Department Chair BEFORE they upload the proposal onto Indico. All proposals should be vetted within your department prior to pre-review.

Proposals that involve cross - directorate work should be identified, and a decision made as to which directorate will submit the proposal.

Schedule:
May 16, 2022: Details emailed to the Directorate for the NPP LDRD Type A proposals with LDRD Call guidance, and PowerPoint template for the initial proposal pre-review, along with all attachments necessary for the process.
May 27, 2022: An email should be sent to Fran Capasso of intent to submit a proposal. Please be sure to include a title, abstract, list of PI's and other BNL organizations involved, if any.
June 1, 2022: A Zoom virtual meeting to pre-review the proposals. A PowerPoint template is attached and should be used.

June 6, 2022: Feedback will be sent to PI's about proceeding or not toward development of full proposals.
June 17, 2022: PI's should upload close to final proposals on Indico for the NPP management to review and provide feedback to PI's.
June 23, 2022: PI's are requested to obtain signatures on the PIQ from the BOM and the Dept Chair BEFORE they upload the final proposal on Indico by noon on June 23rd.

June 24, 2022: Fran Capasso submits for NPP Directorate to the Director's Office.

Thank you,
Fran

Fran Capasso
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