

October 26, 2011

To Whom It May Concern:

I would like to express my strong support for the application of Yulia Trenikhina to the Fermilab-University Joint PhD Program. Yulia was introduced to me by one of the colleagues and I had a chance to discuss with her in detail her background and research interests. Yulia has impressed me as a very knowledgeable and motivated person. Her background in experimental physics, and specifically her experience in materials characterization, which included state of the art absorption and photoemission spectroscopic techniques, fits extremely well with the needs of the research program I am leading.

Superconducting RF (SRF) is at the heart of the laboratory effort towards realizing Project X and enabling other future accelerators such as International Linear Collider (ILC). Among the challenges to enhance further gradients and quality factors in superconducting cavities and make the technology simpler and cheaper one main issue is clearly standing out. In SRF only a very thin layer on the surface of the cavity of about 40 nanometers thick determines completely the performance. This is a direct consequence of the Meissner effect, in which the magnetic field is expelled from the bulk of the superconductor. The problem slowing down further advances is the lack of full understanding of the evolution of the niobium nanostructure in this thin layer throughout different processing steps niobium SRF cavities are going through (plastic deformation, heat treatments, chemical etching and polishing, mechanical polishing). For example, a simple anneal of the cavity in UHV at about 120°C for 48 hours results in the drastic improvement of its high field performance.

I have offered Yulia several possible PhD projects directly related to this problem, and she got especially interested in the nanoscale investigations of near-surface structure of niobium by the transmission electron microscopy (TEM) coupled with the focused ion beam (FIB) preparation of the samples. The significant part of these studies will be performed at ANL and Northwestern University where the TEM and FIB instruments are located. Over the course of the studies, other techniques relevant to the problem will likely be applied as dictated by the findings. The project is novel and will result in the material-level understanding of the connection between the RF performance and the nanostructure. Yulia's background will allow her to succeed in leading this project to completion under the guidance of me and Prof. Zasadzinski.

In summary, I strongly endorse Yulia's application and would like to request the starting date, if approved, to be as soon as possible.

Sincerely,



Alexander Romanenko
Peoples Fellow, Associate Scientist