Application to join the SHiP Collaboration

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Statement of Interest

We express our interest to join SHiP and actively take part in the collaboration. The SHiP physics program is a natural extension of the planned beam-dump program of the NA62 collaboration, of which some of us are members, and an orthogonal search for new physics to the LHC and other experiments.

On the side of detector development and construction our interests are focussed on calorimetry, where we believe to have a lot of practical experience (see below). A contribution to the electromagnetic or hadron calorimeter would therefore seem natural. One idea would e.g. be the exploitation of the possibility to obtain directional information on electromagnetic showers for the reconstruction of neutral decays. In addition, we could also think of participating in the background tagger to join efforts within the German groups. Of course, any possible participation would be a matter of discussion with the members of the collaboration.

Planned Group Strength

Apart from bachelor and master students, we plan to initially have one post-doc and one PhD position working for SHiP. This is complemented by an engineer, a technician, and two electronic technicians of our group. The technician was the main responsible in the construction of the new NA62 muon veto module. In addition, we have access to the mechanical workshop of the Physics Institute.

Funding of both personnel and investments is planned to be provided by the PRISMA Cluster of Excellence at the University of Mainz. Other options for long-term funding will be investigated.

Expertise of the Mainz Group

The group of Experimental Particle and Astroparticle Physics (ETAP) at the Institute of Physics consists of more than 100 scientists, including 8 full professors. Within particle physics we are members of the ATLAS, NA62, and CALICE Collaborations, within astroparticle and neutrino physics we take part in XENON, IceCube, Borexino, Juno, ALPS, and related experiments. The ETAP group has strong expertise in the construction of a variety of particle detectors and in particular in scintillators and calorimeters, but also in data analysis.

- Development, construction, and running of the front module of the NA62 muon veto detector, a 40 t iron-scintillator sandwich calorimeter with plastic scintillator strips

and WLS-fibre read-out (R. Wanke). The second NA62 muon veto module, a part of the former NA48 hadron calorimeter, was also built by the Mainz group.

- About five years ago, the group joined the CALICE Collaboration and since then is strongly involved in the development of an analogue hadron calorimeter (AHCAL) for a future e^+e^- collider experiment (V. Büscher, R. Wanke), an iron-scintillator sandwich calorimeter with very high granularity of about 10 million $30 \times 30 \times 3$ mm^3 tiles, read out by SiPMs. Apart from read-out electronics we developed a new tile design, and prepare for the mass assembly and testing of the calorimeter tiles with the read-out boards.

- Due to an active involvement in both Borexino and Juno we do have a strong expertise not only in plastic, but also in liquid scintillators (M. Wurm).

- Within ATLAS, NA48, and NA62 we are and always have been very strong in data analysis. Among others, we have e.g been involved in the NA48/2 dark photon search in the decay $\pi^0 \to A'\gamma$ with $A' \to e^+e^-$ (PLB 746 (2015)).

Infrastructure in Mainz

We have access to the following infrastructure of the PRISMA Cluster of Excellence and the University:

- PRISMA Detector Lab: The PRISMA detector lab was founded in 2013. It consists of both core personnel (physicists and engineers) and laboratory space, including a photon detector lab with the corresponding infrastructure. In addition a large construction hall is being built, allowing large-scale detector construction in the near future.

- MOGON Cluster: The ETAP group has a share of the high-performance computing cluster MOGON of the University of Mainz, which is a system with about 35000 cores and more than 1000 TB storage space.