

Feasibility Study for an EDM Storage Ring - Addendum

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for the Charged Particle Electric Dipole Moment Collaboration



A Interested Community

The search for charged particle EDMs in storage rings was originally pursued at Brookhaven National Laboratory (BNL, USA) [srEDM collaboration¹] and is currently essentially driven by the JEDI (“Jülich Electric Dipole moment Investigations”) collaboration, working at the COSY cooler synchrotron of the Forschungszentrum Jülich (FZJ, Germany) [JEDI²]. The JEDI collaboration comprises about 100 members from 29 institutions. In response to the “Physics Beyond Colliders” (PBC) initiative of CERN, the “Charged Particle EDM” project [CPEDM³] was initiated, which in addition to the JEDI collaboration involves CERN as an important new institution. Naturally, the EDM community at large is intrigued by CPEDM [see the corresponding ESPP contribution]. In addition, the hadron physics community and NuPECC (“Nuclear Physics European Collaboration Committee”) are also interested in CPEDM [see their respective ESPP papers].

Finally, there is a theoretical community working in the field of discrete symmetries and symmetry violations as well as in searches for physics beyond the Standard Model (BSM) that expresses a huge interest in CPEDM.

B Timeline

As shown in Fig. 3 of the CPEDM input to ESPP (“Feasibility Study for an EDM Storage Ring”), a staged approach is pursued with step-1 (“Precursor Experiment”) currently ongoing. This is partially funded by an ERC Advanced Grant, which runs until September 2021. The next inevitable stage (step-2, “Prototype Ring”) has started last year (2017) and a CPEDM task force is working on the “Conceptual Design Report” (CDR, due in 2020) and will subsequently finalize the “Technical Design Report” (TDR, ready in 2022). If funding can be secured, construction could start beyond 2022. Currently, about 5 years are foreseen for building and operation of the prototype. Only after that does it seem conceivable to design, build and operate the final ring (step-3, “All-electric Ring”).

C Construction and Operational Costs

In Table 1, the cost for the prototype ring is given. Note that this is for the EDM ring only. If the host will be COSY-Jülich, the building and injector are available; if built elsewhere, corresponding costs will have to be added. Currently there is no estimate for the operational cost, but a guess might be that the order of 10% of the investment cost will be needed.

Table 1: Prototype Construction Costs

bends	6.6	M€
e-quads	2.8	M€
vacuum	3.0	M€
intrumentation	1.0	M€
control	2.0	M€
polarimeter	1.5	M€
sum machine	16.9	M€

D Computing Requirements

Computing is required for the analysis of data obtained from the storage ring and polarimeter systems, both in real time and afterwards in greater depth. Storage ring control is also managed with the aid of a number of networked computer systems. In addition, machine simulations including multi-

¹ <https://www.bnl.gov/edm/>

² <http://collaborations.fz-juelich.de/ikp/jedi/>

³ <http://pbc.web.cern.ch/edm/edm-default.htm>

particle spin tracking are needed to quantify many aspects of the machine design and to understand the appearance of both an EDM signal and various systematic backgrounds.