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A cold neutron beam facility for particle physics at the ESS

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Pulsed beams have tremendous advantages for precision experiments with cold neutrons. In order to minimize and measure systematic effects, they are used at continuous sources in spite of the related substantial decrease in intensity. At the pulsed neutron source ESS, such experiments will gain up to a factor of 30 in event rate, and novel concepts become feasible. Therefore, the cold neutron beam facility for particle physics ANNI was proposed as part of the ESS instrument suite.
ANNI's pulse structure will be particularly useful for three classes of experiments:
- Precision measurements of correlations in neutron beta decay will probe a broad band of new physics models beyond the Standard Model at mass scales from 1 to 100 TeV. To this end, ANNI will include an ep/n separator that collects charged neutron decay products from a long volume and guides them to secondary spectrometers (and that can be installed at the users' discretion).
- For the first time, the tiny effects of hadronic weak interaction will be resolved for calculable systems and studied systematically.
- Beam methods to measure electromagnetic properties of the neutron will provide a systematically different and competitive approach to measurements with ultracold neutrons.
Scientific case, design considerations, concept and expected performances of ANNI will be presented and ways towards a possible realization discussed.

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