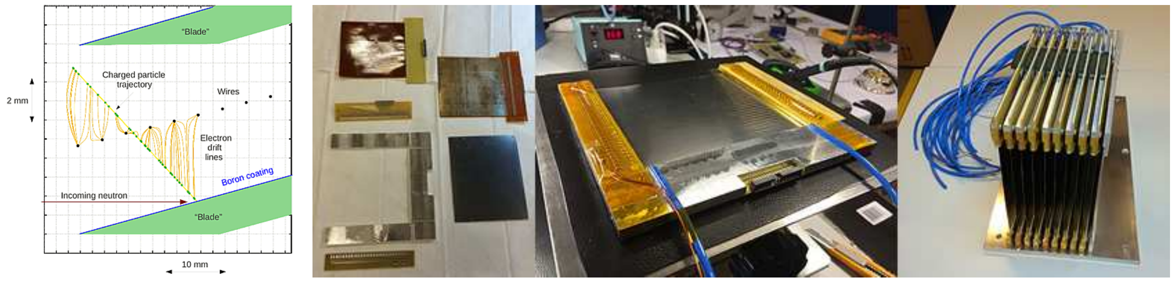

Figure 6.2.: Multi-blade detector concept (left) and components developed by ESS

the attachment for the detectors, analyzer modules and flight tube elements, that will be placed on air feet.

During typical experiments the arm will be attached to the omega base stage of the sample, where the exact detector angle will be measured using an optical encoder. The detector motion will be driven by a wheel attached close to the far end side of the arm.

To accommodate bulky user supplied sample environment the central connection to the rotation center will be removable with an alternative rotation arc to be put into place, that will be mounted on the dace floor with vacuum feet and allow limited rotation without direct connection to the rotation center. This way, the sample stage can completely be removed, opening a space larger than $1\,m^2$ for SE equipment, for the cost of lower positional accuracy.

6.1.2. Multi-Blade Detectors

Detectors for *Estia* are developed by the ESS detector group based on ^{10}B absorption within a detection gas atmosphere using a concept coined multi-blade. Neutrons hit a thin B_4C coated substrate under a grazing angle (5°) and the charged particle cloud created in the detection gas is measured with a grid of wires, allowing a 2D position sensitivity. Several of these coated "blades" are placed in one detector vessel to achieve a coverage of the full detector size. The advantage of this grazing angle technique is the enhanced detection probability, large saturation count rate per area and increased resolution in on direction (horizontal in case of *Estia*). Detection can be performed with ambient pressure gas, allowing very thin windows to avoid scattering of neutrons at the entrance.

Although these systems are still under active development, it is expected to achive detection efficiencies of $\approx 60\%$ at 4Å and a resolution of $0.5\text{x}2\,mm^2$. Two of these detectors with $500\text{x}250\,mm^2$ detection surface will be installed in the full-scope instrument, allowing the simultaneous detection of specular and off-specular beams from both vertical paths as well as the reflections from the polarization analyzers. The initial instrument will be built with a single detector and analyzer, sufficient for one beam path, but the

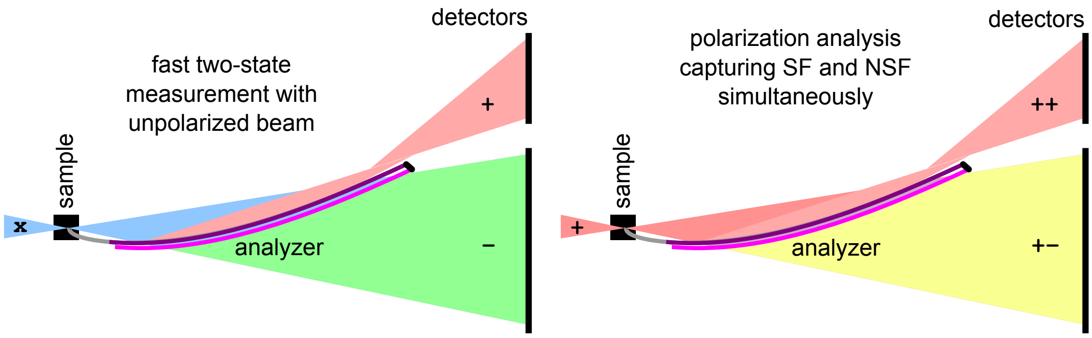

Figure 6.3.: Polarization analysis concept for fast half-polarized measurements (left) or two state polarization analysis (right).

design will be optimized to accomodate two systems without large modifications. Neutron absorbing material will be placed on all sides of the detectors not facing the sample to reduce background from neutrons entering the detector from arbitrary directions.

6.2. Polarization Analyzer System (13.6.9.3.4)

The polarization analyzer for *Estia* uses a similar approach as the polarizers descibed in section 4.5.1. A polarizing supermirror with spiral shape intersects the beam after the sample under constant angle. In contrast to the polarizers a set of two subsequent mirrors is used and the geometry allows to also capture the reflected beam with the detector (Figure 6.3). To achive good polarization for both spin-states, the first mirror is only coated on one side as a reflection polarizer while the second is inclined with a slighly larger angle and double sided coating. The reflection of the second mirror is captured by an absorbing layer at the end of the system.

With this configuration the spin-up state is only reflected once by the first mirror, which leads to good polarization, while the transmitted beam passes through 3 polarizing layers. To adept to the different inclination angles the two systems will have different coatings, m=4 and m=5 are estimated with the current geometry.

6.3. Flight Tube System (13.6.9.3.2.3)

The flight path between sample position and detectors will be filled with Ar gas to reduce intensity loss and background from air scattering. This will be achieved by having a tapered, rectangular flight tube with thin aluminum foil windows installed on the detector arm, filled with a constant flow of Ar gas. The sides of the flight tube and the entrance window geometry will be chosen to allow any beam path from the sample to the detector and avoid reflections from these walls back into the detector.