Self-Modulation Of A Long Proton Bunch in Plasma ANNA-MARIA BACHMANN, JOHN FARMER, PATRIC MUGGLI, Max Planck Institute for Physics, Munich, Germany, AWAKE COLLABORATION — The self-modulation (SM) of a long proton bunch in plasma was recently demonstrated experimentally[1] at AWAKE[2]. Time-resolved images of the modulated proton bunch after 10 m of plasma reveal many details of the SM process, especially near its seed point, the start of the modulation. We look at micro-bunches and defocused proton regions along the bunch acquired with different experimental parameters (seed wakefields' amplitude, plasma density, plasma density gradient, beam density, etc.) to study the wakefields they have experienced and that the bunch is driving. Understanding the self-modulation process and wakefields' development is not only interesting, but also important for future experiments that will rely on a self-modulated proton bunch to drive wakefields in a second plasma, an accelerator. Analysis of the experimental results and comparison with theory and simulation results will be presented.

[1]AWAKE Collaboration, Phys. Rev. Lett. 122, 054802 (2019), M. Turner et al. (AWAKE Collaboration), Phys. Rev. Lett. 122, 054801 (2019)
[2]P. Muggli et al. (AWAKE Collaboration), Plasma Physics and Controlled Fusion, 60(1) 014046 (2017)

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