This manuscript provides a novel and necessary technique to improve the finding and targeting of tephra layers (and other particle types) in ice core samples. The authors did a rigorous analysis by imaging synthetic and natural particles and used machine learning to identify the different particle groups. The size of the particles that they can image is greater than most other grain size analysis techniques being used today in ice core research. Marine particles (diatoms and sponge spicules) are a little underrepresented but can sometimes be larger than the tubing diameter (80 microns). Complex rock fragments (i.e. lava flows) are also not really identified in this study. Many particulate layers in Antarctica are wind-blow rock fragments and would have a distinctive shape when compared to mineral fragments and glass shards. This along with adding more types of pollen to their image dataset could be an area for future improvement.

There are a number of comments in the attached pdf that need some clarification or elaboration. Many of my comments deal with the FlowCam setup. It would be really helpful if there was a picture or diagram of the FlowCam setup, even if in the appendix. I was confused by the orientation of the tubing and the gravitational settling of larger particles. A cross-section diagram of the tube would help explain the imaging volume (41.8%) and the problem with large and blurry particles.

Being able to image particles assess their grain size and give them a particle type (e.g. tephra, dust, etc.) before a tephra specialist gets the samples is extremely helpful and will improve the number of tephra found in ice cores and will decrease the time needed to find said tephra. However, the authors do not discuss how to physically capture the particles after FlowCam analysis. Capturing these particles so that they can be analyzed by SEM or EMPA is the most important part of this type of work. It is great to know the particle type and grain-size distribution but this method falls short if geochemistry on the particles is not obtained. It would be great if the authors would elaborate on capturing these particles. Their goal is to help both the CFA and the tephra communities. The CFA community doesn’t like to run particles through their MS and the tephra community wants those particles. This method can be extremely helpful in spotting these interesting
Overall this is an excellent paper that addresses a need in the ice core community. With some minor corrections and a few elaborations, this manuscript is ready to publish. I hope to see this type of FlowCam analysis being used in more labs and on more cores.

Please also note the supplement to this comment: https://tc.copernicus.org/preprints/tc-2022-148/tc-2022-148-RC1-supplement.pdf