Purpose: Positron emission mammography (PEM) improves spatial resolution and sensitivity, making it suitable for early breast tumours detection. The aim of this study is to evaluate the limits of a dedicated breast PET in terms of tumour-size, tumour-to-background activity concentration ratio (TBR) and activity concentration.

Methods: A dedicated PEM is evaluated. To characterize the device, we use a phantom of 15 cm of diameter containing 6 inserts of inner diameters 18, 15, 11, 8, 5 and 3 mm.

To evaluate the detectability limits images are acquired by varying the TBR from 10 to 2 and without background activity concentration. In all the studies the activity concentration for the 6 inserts is the same (3.7 kBq/ml). To assess the activity concentration limit, the SBR is maintained fixed and acquisitions at different times are performed.

Results: When there is not background, all the inserts are visible in the PEM. Increasing the background decreases the detectability. With a SBR of 10, the smaller insert is still visible. For TBR between 10, inserts \( \geq 5 \) mm can be seen. With a TBR of 2, only inserts with a diameter higher than 5 mm are visible. When the TBR is fixed, decreasing the activity concentration, decreases the capability of detectability.

Conclusions: The results suggest that PEM can be used for diagnosis of small lesions when TBR is higher than 2. Further clinical studies need to be carried out in order to validate these results.