Abstract: Functional limit theorems are presented for the rescaled occupation time fluctuation process of a critical finite variance branching particle system in $\mathbb{R}^d$ with symmetric $\alpha$-stable motion starting off from either a standard Poisson random field or from the equilibrium distribution for intermediate dimensions $\alpha < d < 2\alpha$. The limit processes are determined by sub-fractional and fractional Brownian motions, respectively.

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Key words and phrases: Functional central limit theorem; branching particles systems; occupation time fluctuations; fractional Brownian motion; sub-fractional Brownian motion; equilibrium distribution.