For a fusion category $C$, the Brauer-Picard 2-group $\text{BrPic}(C)$ of invertible $C - C$-bimodules controls, among other things, the possible extensions of $C$ by a finite group $G$: these are in bijection with homotopy classes of maps $[BG, B\text{BrPic}(C)]$, by a theorem of Etingof, Nikshych and Ostrik. This reduces constructing $G$-extensions of $C$ to computing obstructions lying in various $H^n(G, \pi_n(B\text{BrPic}(C)))$.

We study the functor $M : \text{Eq}(C) \to \text{BrPic}(C)$, which sends a tensor auto-equivalence $F$ of $C$ to the $C - C$-bimodule category $M_F$, which is $C$ as a left module category, with right action twisted by $F$. We compute the homotopy fiber of $M$ to be $\text{Inv}(C)$, the groupoid of invertible objects of $C$. We apply the resulting long exact sequence in homotopy groups to solve several extension problems arising in the theory of subfactors. (Received September 20, 2011)