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We call a Hamiltonian N -space *primary* if its equivariant momentum map is onto a single coadjoint orbit, U . In other words, such a space is as far as can be from multiplicity-free. When N is a Heisenberg group, Souriau's 'barycentric decomposition theorem' shows that all primary spaces are products of (coverings of) U with trivial N -spaces. For general N , the question whether such a factorization survives has long been open. In the present work we give 1) examples where factorization fails, and 2) a structure theorem extending Souriau's to general N . This provides the missing piece for a full 'Mackey theory' of Hamiltonian G -spaces, where G is an overgroup in which N is normal. (Received January 19, 2011)