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Signatures of quasi-steady and inductive ion acceleration in the distant magnetotail: Geotail observations.

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Field-aligned beams of accelerated ions are often observed in the PSBL of magnetotail. In spite of their common feature - field-aligned velocity distribution at the lobeward edge of the PSBL, our analysis of PSBL crossings by Geotail spacecraft revealed two different types of ion distributions. The first type represents energy collimated ion beams which may have a rather long duration (up to 20min). The energy of these ion beams usually does not exceed ten keV. We suggested that the ions forming such beams were quasi-steady accelerated by dawn-dusk electric field in course of their resonant interaction with the CS in spatially localized sources. Another type of distributions represents rather wide in energy sense ion beams which may be generated in some spatially extended (along the electric field direction) source. The maximum energy of ions forming such kind of distributions always exceeds the energy threshold of the instrument (30 keV). We have analyzed 400 field-aligned ion distributions observed by Geotail in the PSBL at the different distances from the Earth (at -100Re$<$X$<$-20Re). Statistical analysis of the occurrence frequency of both types of ion beams showed that the quasi-steady energy collimated beams were observed in 30% of cases. Ion beams of the second type were observed in 48% of events and in 22% of cases we observed the transient acceleration superimposed on quasi-steady accelerated ion beam. The analysis of the direction of ion beam propagation (earthward or tailward) in dependence on spacecraft X-location provided different results for two types of beams. Collimated ion beams (first type) mostly are moving earthward even in the distant part of the tail (at X˜-100Re the portion of earthward moving beams exceeds 80%). This corroborates the theory prediction about ion resonant acceleration in the wide vicinity of the distant X-line. Contrary, the earthward portion of ion beams

with the second-type of velocity distributions decreases tailward. The small portion of tailward moving beams of this type is already observed at X˜-30Re (which may indicate on their acceleration near NENL). At the distant tail almost no earthward moving ion beams of this type are observed.