The reversed field pinch (RFP) is one of the magnetic confinement systems for high beta plasmas. When a single (resonant) mode grows, closed magnetic surfaces are recovered inside the magnetic island associated with the dominant mode. As a result of magnetic reconnection, the configuration sometimes evolves to a RFP state with 3-D helical magnetic axis. The configuration is referred to as the Quasi-Single Helicity (QSH) state. In a low-aspect-ratio RFP machine RELAX (R/a = 0.5 m/0.25 m, Ip ∼ 100kA), we have wide space in the core without major m = 1 resonant surfaces, which allows a dominant island to grow without interacting the neighboring islands. We have observed easy transition to either QSH or helical RFP states particularly in shallow-reversal regions, where the edge toroidal field is weakly reversed (or almost zero). In order to understand the physical mechanism of transition in detail, it is important to measure the time evolution of the 2-D electron temperature profile with high time resolution enough to resolve magnetic reconnection process. We report on the initial results of two-dimensional electron temperature profile. We have used two pin holes to form two soft-X ray (SXR) pin-hole images on a single MCP plate, and two thin-foil films with different absorption coefficient are used for each pin hole. In the present system, we have used a 1.0 µm thick aluminum filter and a 0.5 µm thick Polyimide filter. Combination of the SXR imaging and the double-filter techniques provide the chord-averaged 2-D electron temperature profile. The experimental arrangement is shown in Fig.1. We have installed the system to observe the vertical image of the plasma. Figure 2 shows the snapshots of 2-D electron temperature profiles from two different kinds of RFP plasmas. The right-hand side figure was taken in a discharge with many m = 1 magnetic fluctuations excited (so called multiple helicity (MH) state), where we cannot identify characteristic structure. The electron temperature is the highest in the center, decreasing gradually towards the edge. On the other hand, the left-hand side image, observed in a QSH discharge, shows some structure. Detailed analysis of this structure has suggested that high temperature region is concentrated in the core region, and the structure is deformed.

Figure 1: Arrangement of SXR pin-hole camera and high speed camera.

Figure 2: 2-D electron temperature profiles: left for QSH state, and right for MH state.