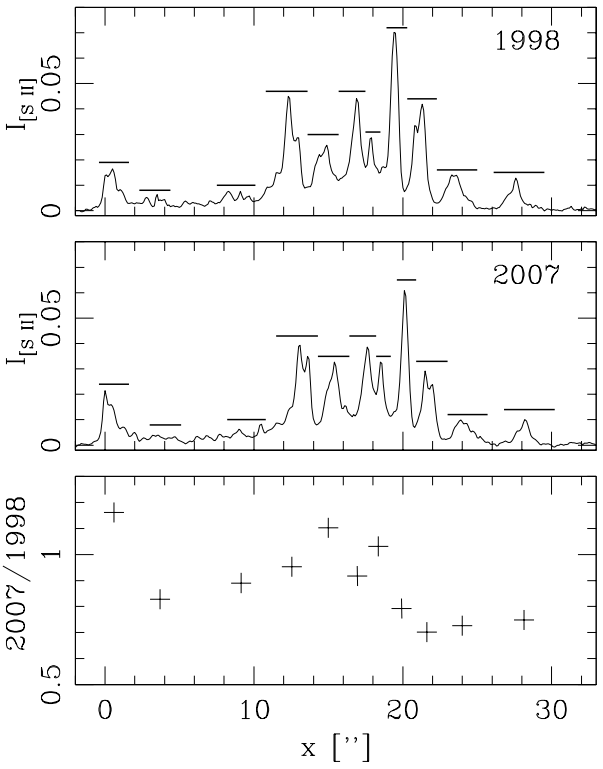

Fig. 10. [S II] tracings along the HH 34 jet for the 1998 (top) and 2007 (center) epochs, obtained by averaging over $3''$ across the jet axis. The adjacent background emission has been subtracted. We have integrated the intensity over segments along the tracings. The lenghts and positions of the segments are shown on the two intensity tracings, with a displacement of $+0''.7$ along the x-axis for the 2007 epoch, (except for the segment incorporating the source, which was not displaced). The ratios between the integrated intensities (in the segments defined above) in the two epochs are shown in the bottom plot. The x-axis is the distance (in arcseconds) from the HH 34 source.

the HH 34 jet, and that the predicted structures show variabilities over ≈10 yr intervals which are consistent with the observed variability of the knots in HH 34.

The success we have obtained in reproducing the chain of knots within the first $\sim 1'$ of the HH 34 jet is limited, as we are clearly not yet able to even attempt to carry out a quantitative comparison between the predicted and the observed emission structures. Nevertheless, the results are reasonably encouraging, because the predicted knot structures do show general morphologies and time-variabilities which appear to be consistent with the properties of the HH 34 knots. Also, the simulations approximately reproduce the shape of the HH 34S bow shock, and the intensity contrast between this bow shock and the chain of aligned knots. In particular, we find that including a non-top hat ejection velocity cross section (with a moderate edge-to-center velocity ratio) improves the qualitative similarity between predicted and observed knot structures. If this result is to be taken at face value, it would imply that the HH 34 jet has a centrally peaked velocity profile, with a drop of ∼25% towards the edge of the jet (this outer edge representing a sharp boundary at which the jet beam is interrupted).

This result, however, is uncertain. It has been shown that the presence of a toroidal magnetic field (De Colle et al. 2008), and/or the presence of a multi-mode (possibly chaotic) ejection variability can lead to the formation of elongated IWS (De Colle 2011). In future work, it will be necessary to explore whether or not these possibilities produce knot morphologies and time-variations similar to the ones observed in the HH 34 jet.

This work is part of an ongoing effort to attempt to reproduce the observational chatacteristics of a set of specific HH jets with variable jet models. We have previously presented models for HH 34 (Raga & Noriega-Crespo 1998; Raga et al. 2002; Masciadri et al. 2002a), HH 111 (Masciadri et al. 2002b), HH 32 (Raga et al. 2004), HH 30 (Esquivel, Raga, & De Colle 2007), the DG Tau microjet (Raga et al. 2001) and the photoionized jet HH 444 (López Martín et al. 2001; Raga, Riera, & González-Gómez 2010). This kind of comparison between predictions from numerical simulations and observations should eventually provide the grounds for deciding which HH objects have emitting structures that are definitely the result of an ejection time-variability. It should also provide constraints on models for the ejection of HH jets and at the same time give us an understanding of the mechanisms by which the emitting structures are formed.

As a final point, we should note that our study of non-top hat ejection velocity jets is limited to quadratic cross sections. The choice of a quadratic velocity cross section is to some extent natural, because it can be thought of as a second order Taylor series of an arbitrary, flat-topped function. For this reason, most of the previous papers on HH jet models with non-top hat velocity cross sections have considered quadratic profiles (for example, Völker et al. 1999; Rosen & Smith 2003, 2004). Another natural choice for the functional form of the ejection velocity cross section would be a Gaussian, as this is the form of the velocity cross section of turbulent labo-