$\boxed{|\tau| = T}$

$$
\begin{array}{rcl}
|\alpha| & = & \alpha \\
|\tau_1| \to |\tau_2| & = & |\tau_1| \to |\tau_2| \\
|\forall \alpha.\, \tau| & = & \forall \alpha.\, |\tau| \\
|\tau_1 \,\&\, \tau_2| & = & (|\tau_1|, |\tau_2|) \\
|\{l : \tau\}| & = & |\tau|
\end{array}
$$

Figure 1: Type translation.

$\boxed{\tau <: \tau \hookrightarrow C}$

$$\frac{}{\alpha <: \alpha \hookrightarrow \lambda(x{:}|\alpha|).\, x}\ \texttt{sub}\text{var}$$

$$\frac{\tau_3 <: \tau_1 \hookrightarrow C_1 \qquad \tau_2 <: \tau_4 \hookrightarrow C_2}{\tau_1 \to \tau_2 <: \tau_3 \to \tau_4 \hookrightarrow \lambda(f{:}|\tau_1 \to \tau_2|).\, \lambda(x{:}|\tau_3|).\, C_2\ (f\ (C_1\ x))}\ \texttt{sub}\text{fun}$$

$$\frac{\tau_1 <: [\alpha_1/\alpha_2]\tau_2 \hookrightarrow C}{\forall \alpha_1.\, \tau_1 <: \forall \alpha_2.\, \tau_2 \hookrightarrow \lambda(f{:}|\forall \alpha.\, \tau_1|).\, \lambda \alpha.\, C\ (f\ \alpha)}\ \texttt{sub}\text{forall}$$

$$\frac{\tau_1 <: \tau_2 \hookrightarrow C_1 \qquad \tau_1 <: \tau_3 \hookrightarrow C_2}{\tau_1 <: \tau_2 \,\&\, \tau_3 \hookrightarrow \lambda(x{:}|\tau_1|).\, (C_1\ x, C_2\ x)}\ \texttt{sub}\text{and}$$

$$\frac{\tau_1 <: \tau_3 \hookrightarrow C}{\tau_1 \,\&\, \tau_2 <: \tau_3 \hookrightarrow \lambda(x{:}|\tau_1 \,\&\, \tau_2|).\, C\ (\texttt{proj}_1 x)}\ \texttt{sub}\text{and}_1$$

$$\frac{\tau_2 <: \tau_3 \hookrightarrow C}{\tau_1 \,\&\, \tau_2 <: \tau_3 \hookrightarrow \lambda(x{:}|\tau_1 \,\&\, \tau_2|).\, C\ (\texttt{proj}_2 x)}\ \texttt{sub}\text{and}_2$$

$$\frac{\tau_1 <: \tau_2 \hookrightarrow C}{\{l{:}\tau_1\} <: \{l{:}\tau_2\} \hookrightarrow \lambda(x{:}|\{l{:}\tau_1\}|).\, C\ x}\ \texttt{sub}\text{rec}$$

Figure 2: Coersive subtyping.

$$\boxed{\gamma \vdash e : \tau \hookrightarrow E} \qquad \frac{(x, \tau) \in \gamma}{\gamma \vdash x : \tau \hookrightarrow x}\ \textsf{Evar}$$

$$\frac{\gamma, x{:}\tau \vdash e : \tau_1 \hookrightarrow E \qquad \gamma \vdash \tau}{\gamma \vdash \lambda(x{:}\tau).\, e : \tau \to \tau_1 \hookrightarrow \lambda(x{:}|\tau|).\, E}\ \textsf{Elam}$$

$$\frac{\gamma \vdash e_1 : \tau_1 \to \tau_2 \hookrightarrow E_1 \qquad \gamma \vdash e_2 : \tau_3 \hookrightarrow E_2 \qquad \tau_3 <: \tau_1 \hookrightarrow C}{\gamma \vdash e_1\ e_2 : \tau_2 \hookrightarrow E_1\ (C\ E_2)}\ \textsf{Eapp}$$

$$\frac{\gamma, \alpha \vdash e : \tau \hookrightarrow E}{\gamma \vdash \lambda\alpha.\, e : \forall\alpha.\, \tau \hookrightarrow \lambda\alpha.\, E}\ \textsf{Eblam} \qquad \frac{\gamma \vdash e : \forall\alpha.\, \tau_1 \hookrightarrow E \qquad \gamma \vdash \tau}{\gamma \vdash e\ \tau : [\tau/\alpha]\tau_1 \hookrightarrow E\ |\tau|}\ \textsf{Etapp}$$

$$\frac{\gamma \vdash e_1 : \tau_1 \hookrightarrow E_1 \qquad \gamma \vdash e_2 : \tau_2 \hookrightarrow E_2}{\gamma \vdash e_1 ,, e_2 : \tau_1 \,\&\, \tau_2 \hookrightarrow (E_1, E_2)}\ \textsf{Emerge}$$

$$\frac{\gamma \vdash e : \tau \hookrightarrow E}{\gamma \vdash \{l = e\} : \{l{:}\tau\} \hookrightarrow E}\ \textsf{Erec-con} \qquad \frac{\gamma \vdash e : \tau \hookrightarrow E \qquad \tau \bullet l = \tau_1 \hookrightarrow C}{\gamma \vdash e.l : \tau_1 \hookrightarrow C\ E}\ \textsf{Erec-sel}$$

$$\frac{\begin{array}{c}\gamma \vdash e : \tau \hookrightarrow E \qquad \gamma \vdash e_1 : \tau_1 \hookrightarrow E_1 \\ \tau \blacktriangleleft \{l{:}\tau_1 \hookrightarrow E_1\} = \tau_2\lfloor\tau_3\rfloor \hookrightarrow C \qquad \tau_1 <: \tau_3\end{array}}{\gamma \vdash e \text{ with } \{l = e_1\} : \tau_2 \hookrightarrow C\ E}\ \textsf{Erec-upd}$$

$$\boxed{\tau_1 \bullet l = \tau_2 \hookrightarrow C} \qquad \frac{}{\{l{:}\tau\} \bullet l = \tau \hookrightarrow \lambda(x{:}|\{l{:}\tau\}|).\, x}\ \textsf{get}$$

$$\frac{\tau_1 \bullet l = \tau \hookrightarrow C}{\tau_1 \,\&\, \tau_2 \bullet l = \tau \hookrightarrow \lambda(x{:}|\tau_1 \,\&\, \tau_2|).\, C\ (\mathtt{proj}_1 x)}\ \textsf{get}_1$$

$$\frac{\tau_2 \bullet l = \tau \hookrightarrow C}{\tau_1 \,\&\, \tau_2 \bullet l = \tau \hookrightarrow \lambda(x{:}|\tau_1 \,\&\, \tau_2|).\, C\ (\mathtt{proj}_2 x)}\ \textsf{get}_2$$

$$\boxed{\tau \blacktriangleleft \{l{:}\tau \hookrightarrow E\} = \tau_2\lfloor\tau_3\rfloor \hookrightarrow C}$$

$$\frac{}{\{l{:}\tau\} \blacktriangleleft \{l{:}\tau_1 \hookrightarrow E\} = \{l{:}\tau_1\}\lfloor\tau\rfloor \hookrightarrow \lambda(\_{:}|\{l{:}\tau\}|).\, E}\ \textsf{put}$$

$$\frac{\tau_1 \blacktriangleleft \{l{:}\tau \hookrightarrow E\} = \tau_3\lfloor\tau_4\rfloor \hookrightarrow C}{\tau_1 \,\&\, \tau_2 \blacktriangleleft \{l{:}\tau \hookrightarrow E\} = \tau_3 \,\&\, \tau_2\lfloor\tau_4\rfloor \hookrightarrow \lambda(x{:}|\tau_1 \,\&\, \tau_2|).\, C\ (\mathtt{proj}_1 x)}\ \textsf{put}_1$$

$$\frac{\tau_2 \blacktriangleleft \{l{:}\tau \hookrightarrow E\} = \tau_3\lfloor\tau_4\rfloor \hookrightarrow C}{\tau_1 \,\&\, \tau_2 \blacktriangleleft \{l{:}\tau \hookrightarrow E\} = \tau_1 \,\&\, \tau_3\lfloor\tau_4\rfloor \hookrightarrow \lambda(x{:}|\tau_1 \,\&\, \tau_2|).\, C\ (\mathtt{proj}_2 x)}\ \textsf{put}_2$$

Figure 3: Elaboration typing from $F_{\&}$ to System F.