Ω_{cam}
Ω_{NDC}
$x, y, z[-1, 1]$
$(x, y, x)(x_p, y_p, z_p)$
$(x_N, y_N, z_N)filmDisfovyfilmDisaspect$
$[l, r][b, t]M_{proj}:$
$\Omega_{cam} \rightarrow$
$\Omega_{NDC}x =$
$[x, y, z, 1]^T x_p =$
$[x_p, y_p, z_p, 1]^T x_N =$
$[x_N, y_N, z_N, 1]^T$
$x_N =$
$M_{proj}xn, f$
$_p =$
$y_p =$
x_p
$\leq$
$x_p \leq$
r
$0 \leq$
$x_p -$
$l \leq$
$r -$
l
$0 \leq$
$\frac{x_p - l}{r - l} \leq$
1
$0 \leq$
$2\frac{x_p - l}{r - l} \leq$
2
$-$
$1 \leq$
$\frac{2x_p}{r - l} -$
$\frac{r + l}{r - l} \leq$
1

$$-1 \leq \frac{2y_p}{t-b} - \frac{t+b}{t-b} \leq 1$$

$$x, y$$

$$\begin{cases} -1 \leq \frac{2}{r-l} \cdot x - \frac{r+l}{r-l} \leq 1 \\ -1 \leq \frac{2}{t-b} \cdot y - \frac{t+b}{t-b} \leq 1 \end{cases}$$

$$M_{proj} = \frac{2}{r-l} 0 - \frac{r+l}{r-l} 00 \frac{2}{t-b} - \frac{t+b}{t-b} 000AC00BD$$

$$A, B, C, D$$

$$M_{proj}x = \frac{2}{r-l} 00 - \frac{r+l}{r-l} 0 \frac{2}{t-b} 0 - \frac{t+b}{t-b} 00AC00BDxyz1 = \frac{2}{r-l} \cdot x - \frac{r+l}{r-l} \frac{2}{t-b} \cdot y - \frac{t+b}{t-b} Az + CBz + D = x_N y_N Az + CBz +$$

$B \equiv$
$0, D =$
1

$$M_{proj}x = x_N y_N Az + C1 = x_N y_N z_N 1$$

$$\frac{x_p}{x} = \frac{y_p}{y} = \frac{filmDis}{z}$$

$_p =$
$\frac{filmDis}{z} \cdot$
x
$y_p =$
$\frac{filmDis}{z} \cdot$
y
x_p
$\leq$
$x_p \leq$
r
$0 \leq$
$x_p -$
$l \leq$
$r -$
l
$0 \leq$
$\frac{x_p - l}{r - l} \leq$
1
$0 \leq$
$2\frac{x_p - l}{r - l} \leq$