

David Kastrup

Is $2\text{in} = 1\text{in} + 1\text{in}$?

$\text{T}_{\text{E}}\text{X}$'s arithmetic forgets to round when dealing with units. For example, 1in is defined to be exactly 72.27pt . We can check that by writing `\dimen0=100in \the\dimen0` and getting 7227.0pt . So far, so good. But when we write `\dimen0=1in \the\dimen0`, we get 72.26999pt . Oops. This becomes worse since a number called 72.27pt actually exists, as witnessed by `\dimen0=72.27pt \the\dimen0` which gives us 72.27pt .

So we have the unfortunate situation that 1in (which should be exactly 72.27pt) gives a number different from the number actually called 72.27pt . This is because $\text{T}_{\text{E}}\text{X}$ truncates when working with the fractions representing exact units, but rounds when working with decimal fractions.

$\text{T}_{\text{E}}\text{X}$ calculates 1in as

$$\left[1 \times \frac{7227}{100} \times 2^{16} \right] 2^{-16}$$

namely truncating the fractional calculation rather than rounding it.

Other artifacts of $\text{T}_{\text{E}}\text{X}$'s fractional representation of units mean that $2\text{in} \neq 1\text{in} + 1\text{in}$: Indeed

```
\dimen0=1in \advance\dimen0 1in \the\dimen0 \dimen0=2in =\the\dimen0
```

leaves us with $144.53998\text{pt} = 144.54\text{pt}$.