1 CASINO v2 Beam Size

The radius r_B define in CASINO define a beam diameter d_B^{CASINO} that contains more than 99.999 % of the electrons. This radius is 4.667 ($n = 2\sqrt{2 \cdot \ln 2}$) larger than the σ of the Gaussian distribution used to calculate the beam position in CASINO.

$$\sigma = \frac{r_B}{2\sqrt{2 \cdot \ln 2}} \tag{1}$$

Other useful definition of beam size are:

- d_σ which contains 68% of all electrons.
- $d_{2\sigma}$ which contains 95% of all electrons.
- $d_{3\sigma}$ which contains 99.7% of all electrons.
- d_{FWHM} which contains 76.1% of all electrons.

$$\begin{aligned} d_\sigma &= 2.0 \cdot \sigma \\ &= 2\frac{r_B}{2\sqrt{2 \cdot \ln 2}} \\ &= 0.849 \cdot r_B \end{aligned}$$

$$\begin{aligned} d_{2\sigma} &= 4.0 \cdot \sigma \\ &= 4\frac{r_B}{2\sqrt{2 \cdot \ln 2}} \\ &= 1.699 \cdot r_B \end{aligned}$$

$$\begin{aligned} d_{3\sigma} &= 6.0 \cdot \sigma \\ &= 6\frac{r_B}{2\sqrt{2 \cdot \ln 2}} \\ &= 2.548 \cdot r_B \end{aligned}$$

$$
\begin{aligned}
d_{FWHM} &= 2\sqrt{2\ln 2}\cdot\sigma \\
&= 2\sqrt{2\ln 2}\frac{r_B}{2\sqrt{2\cdot\ln 2}} \\
&= r_B
\end{aligned}
$$

The beam size does not have an universally accepted definition, but the d_{FWHM} is often used (see Williams and Carter, 1996). The previous equations can be used to convert from the radius r_B used in CASINO v2 to a beam size.

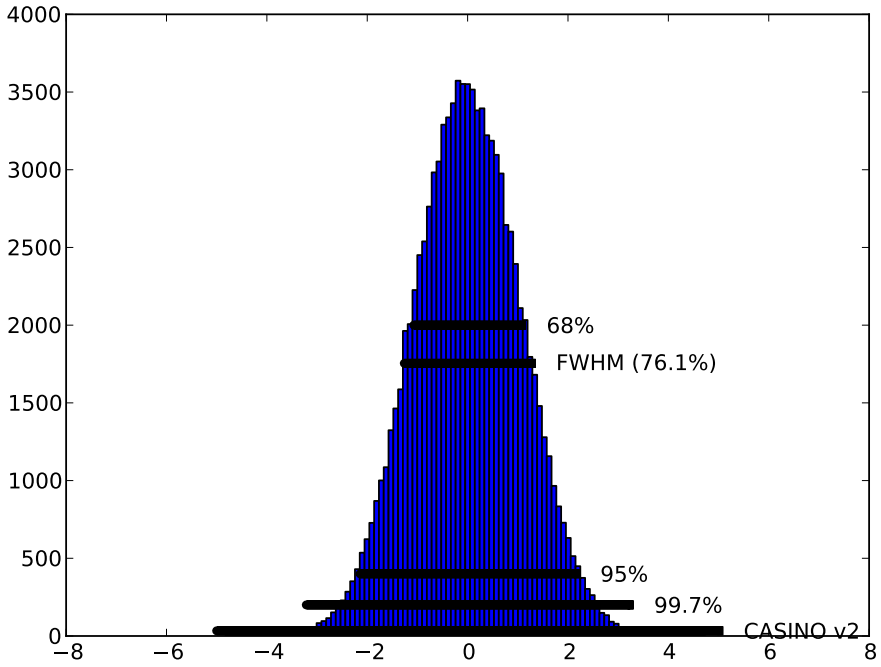

Figure 1: Different definitions of beam size for a Gaussian beam. Linear vertical scale.