Calculations for THU in S-44

S-44

- *”Within this standard, for ease of use, allowable horizontal uncertainty is assumed to be equal in both dimensions. Therefore, assuming a normal distribution of error, the position uncertainty is expressed as a single number.”*

- *”It must be noted that confidence levels (e.g. 95%) depend on the assumed statistical distribution of the data and are calculated differently for one-dimensional (1D) and two-dimensional (2D) quantities. In the context of this standard, which assumes normal distribution of error, the 95% confidence level for 1D quantities (e.g. depth) is defined as 1.96 x standard deviation, and the 95% confidence level for 2D quantities (e.g. position) is defined as 2.45 x standard deviation.”*

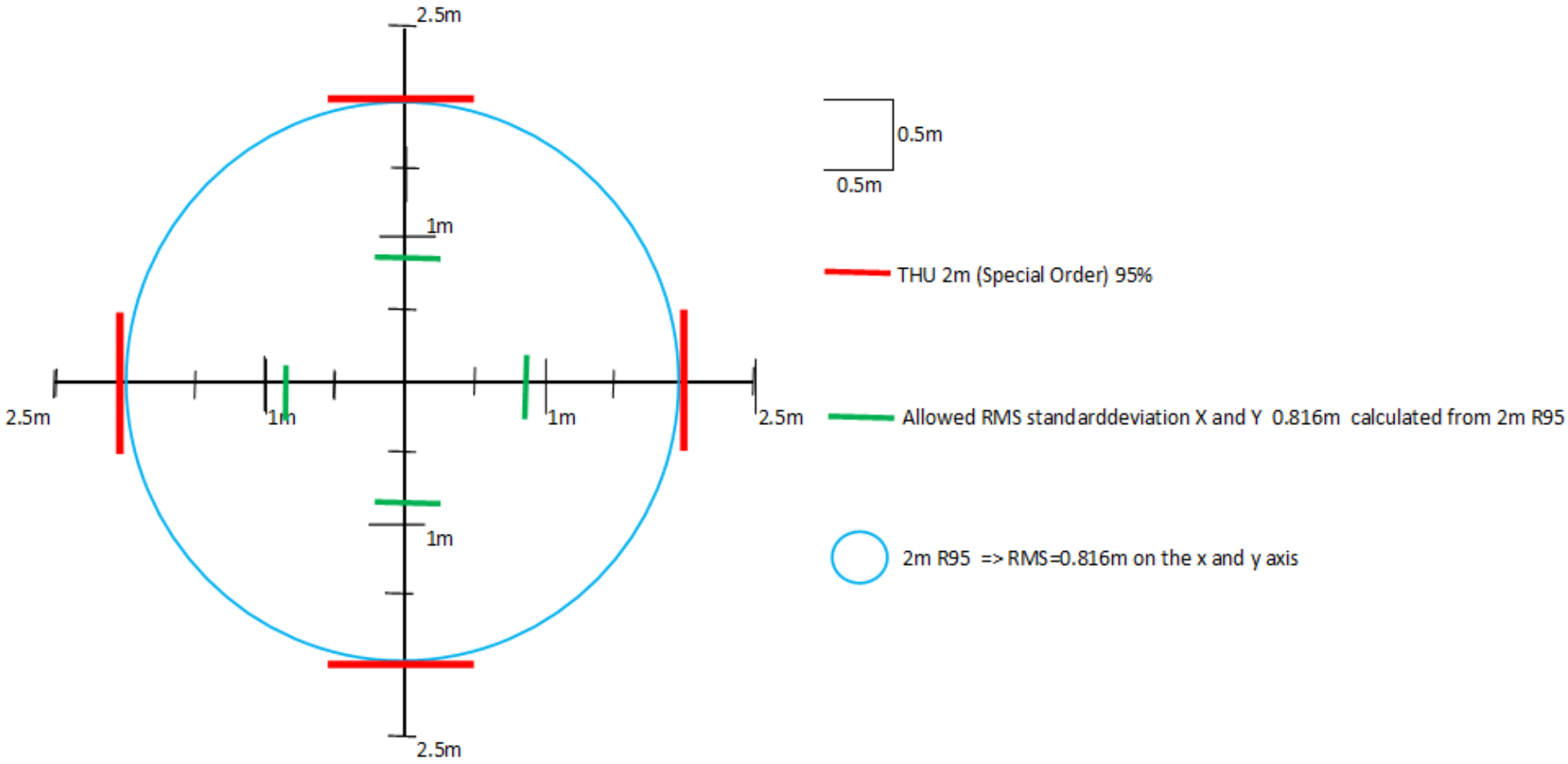
S-44

- ***The formula we use (normally called R95) is not at all discussed in C-13, but under the chapter for positioning formulas for CEP and DRMS is presented in a general overview.***

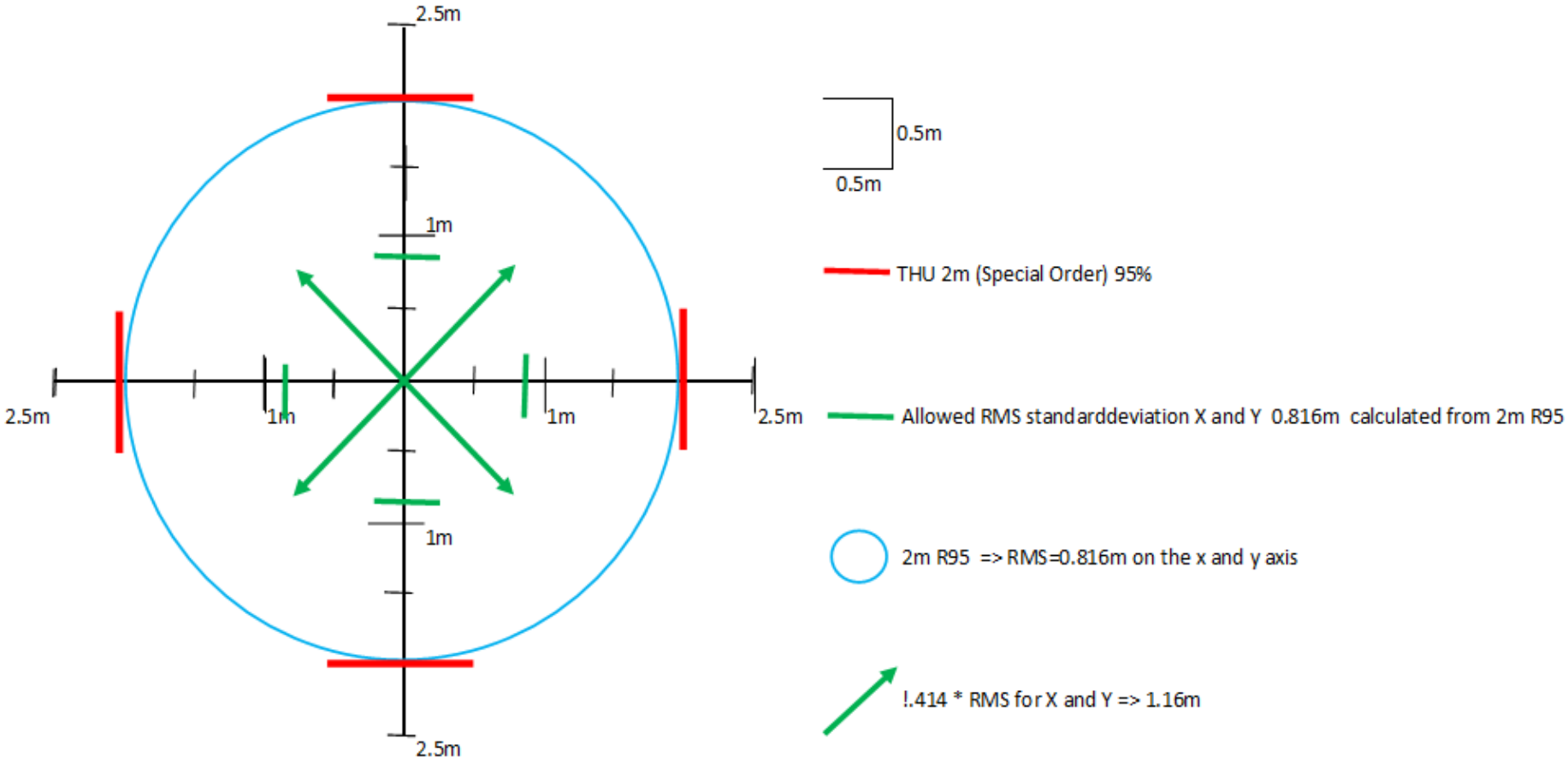
- ***In S-44 we give no guidance whether we are supposed to use the sigma value for the largest of x/y, or use an average.***

- ***Some might even use the size of the error vector with the formula.***

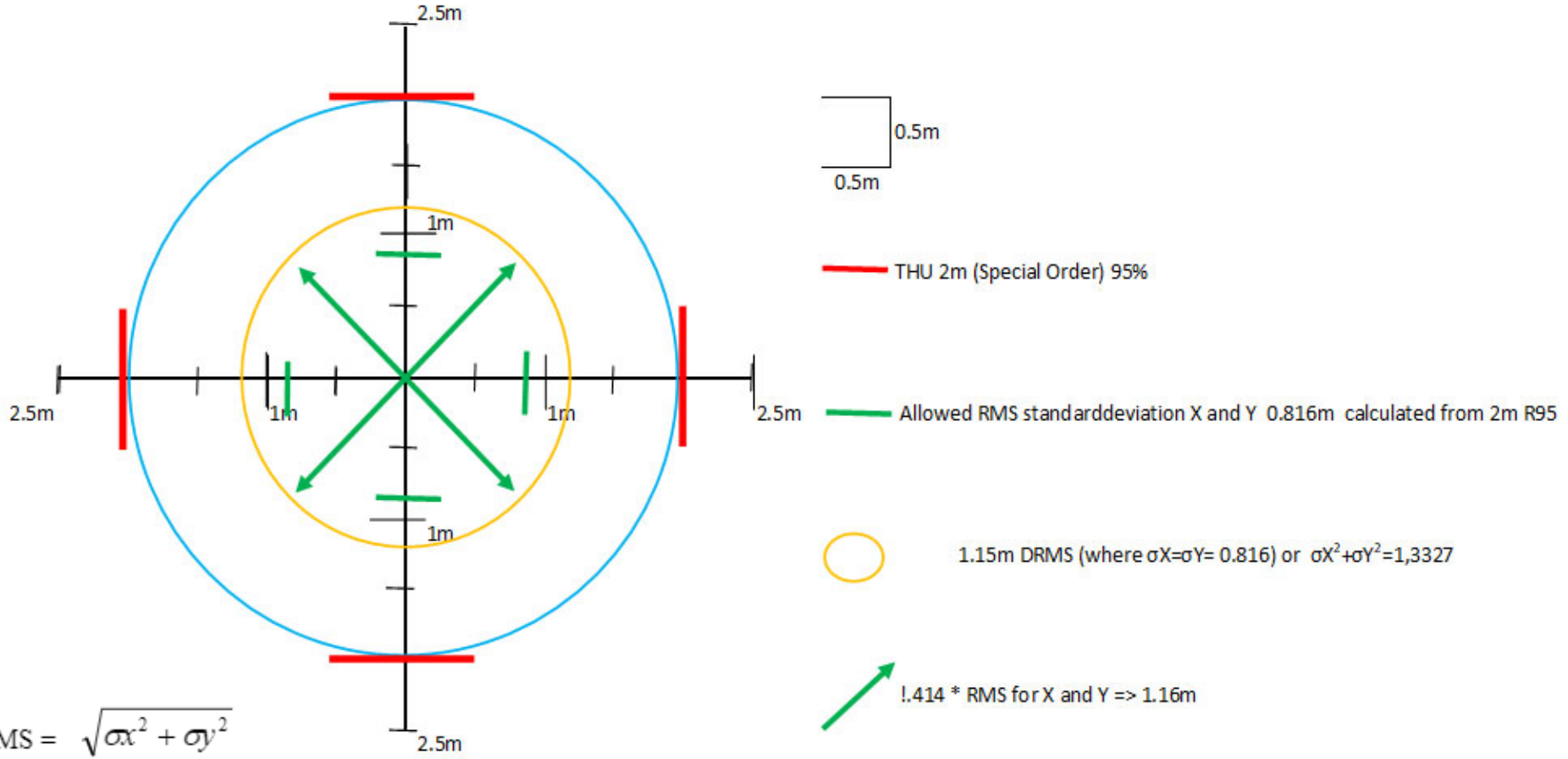
Example based on Special Order THU=2m



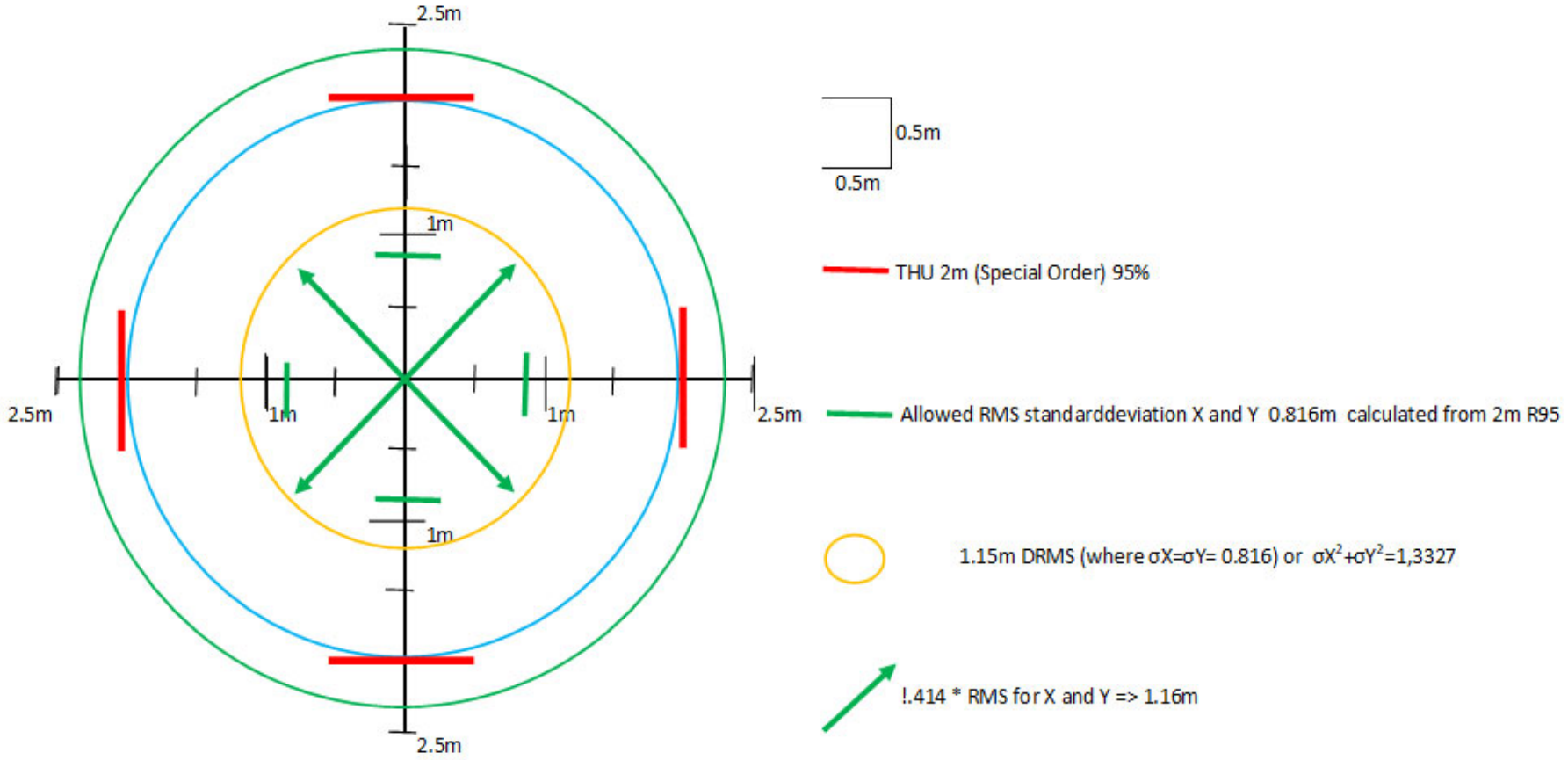
Our present formula is a simplification assuming that the uncertainties in X and Y always are equal and the allowed RMS standard deviation (sigma) is 0.816m for Special Order



We actually calculate the Hypothenus of a square triangle and our uncertainty is within one of four vectors. Wy not allow any vector of the same size?



If we use the formula for DRMS 63% and apply 0.816 for both values we get the same 1.15m (= 0.816*1.414)
To get to 2DRMS it is just to multiply DRMS by 1.73 = 2m DRMS= Distance Root Mean Square



2DRMS = 2*DRMS => 2.3m, but at 98.2% Confidence

BUT 1.73*DRMS => 2.0m, AT 95 Confidence

It is possible to calculate between different uncertainty calculations and confidence levels

Measure of Q	Probability F (%)
DRMS	63.213...
CEP	50
2DRMS	98.169...
R95	95
R99.7	99.7

In C13 today

From $X \downarrow$ to $Y \rightarrow$	RMS (σ)	CEP	DRMS	R95	2DRMS	R99.7
RMS (σ)	1.00	1.18	1.41	2.45	2.83	3.41
CEP	0.849	1.00	1.20	2.08	2.40	2.90
DRMS	0.707	0.833	1.00	1.73	2.00	2.41
R95	0.409	0.481	0.578	1.00	1.16	1.39
RMS	0.354	0.416	0.500	0.865	1.00	1.21
R99.7	0.293	0.345	0.415	0.718	0.830	1.00

Alternatives

- Keep the present THU Values, but **change the calculation for the R95 to be:**
  1.73*DRMS (using the DRMS= Distance Root Mean Square formula), then the RMS uncertainties x or y will be allowed to be larger than 0.816 as long as the opposite axis are considdrably smaller to “stay within the circle”.

- Keep the calculation as it is today, being slightly stricter than if we allowed the use of RMS for both axis separate.
  Would though need some rewording to clarify that it is the maximum of X or Y uncertainty to use.

- Do nothing at all.