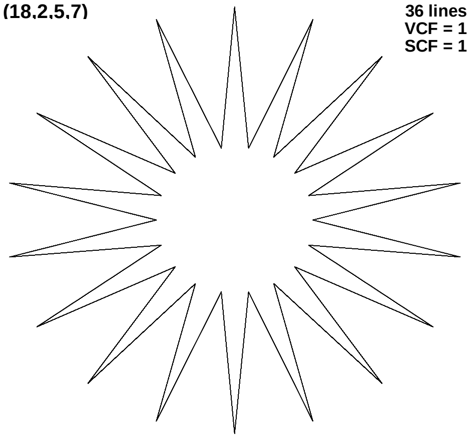
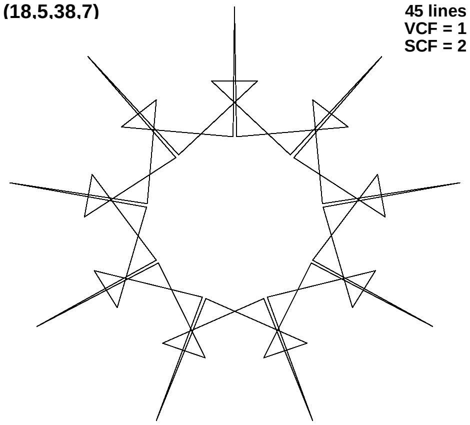
$n = 4k+2$, $J = 2k-1$ Sharpest Central Needles Stars

When $n = 4k+2$, halfway around is an odd vertex. If J is one vertex less, then $J = 2k$ so J is even, VCF =2 and the image simplifies to an odd needle star. Therefore, we restrict our analysis to $J = 2k-1$ which is odd with VCF = 1. One can obtain images with n = 10 and 14 but in this instance, n-4 (which is the end of the second line of the VF) is in quadrant III not II.

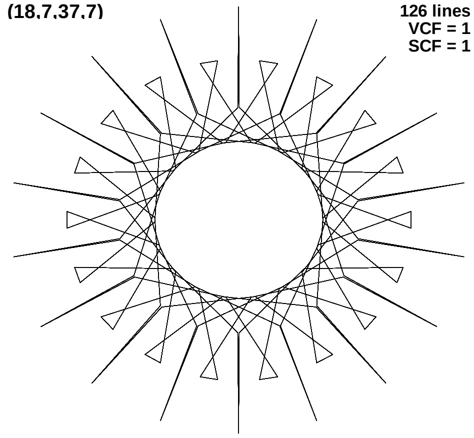
(18,2,5,7) 36 lines, VCF = 1, SCF = 1



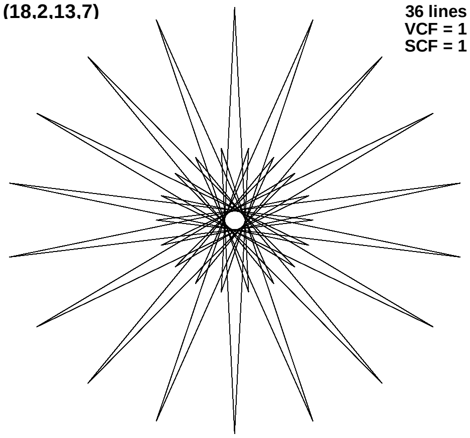
(18,5,38,7) 45 lines, VCF = 1, SCF = 2



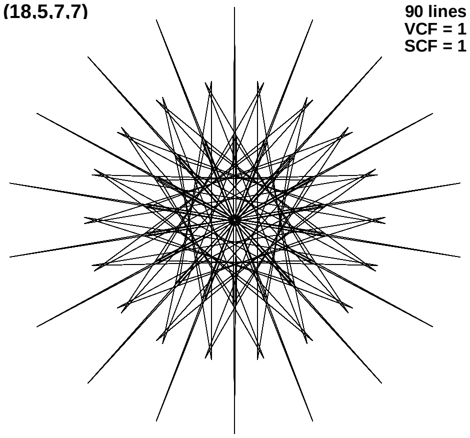
(18,7,37,7) 126 lines, VCF = 1, SCF = 1



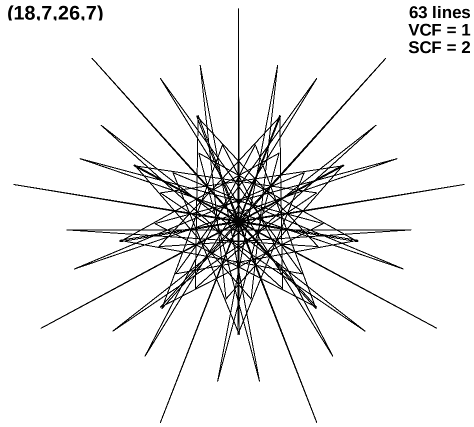
(18,2,13,7) 36 lines, VCF = 1, SCF = 1



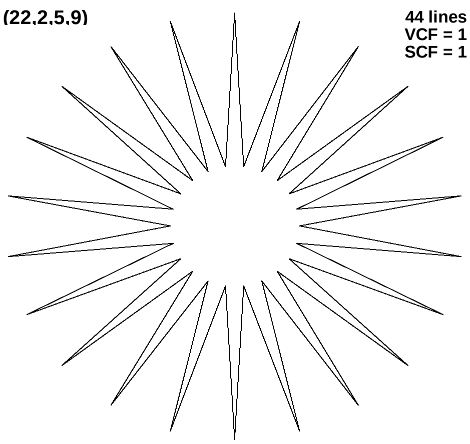
(18,5,7,7) 90 lines, VCF = 1, SCF = 1



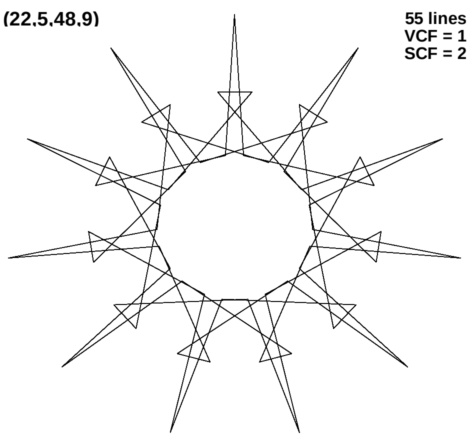
(18,7,26,7) 63 lines, VCF = 1, SCF = 2



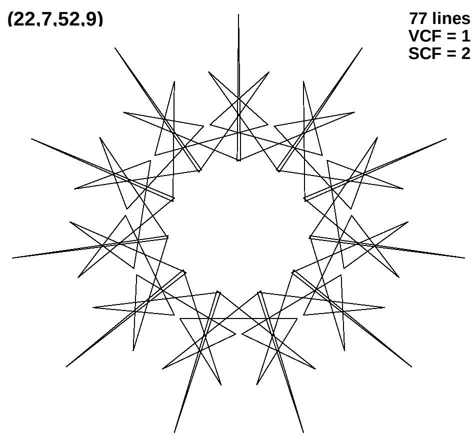
(22,2,5,9) 44 lines, VCF = 1, SCF = 1



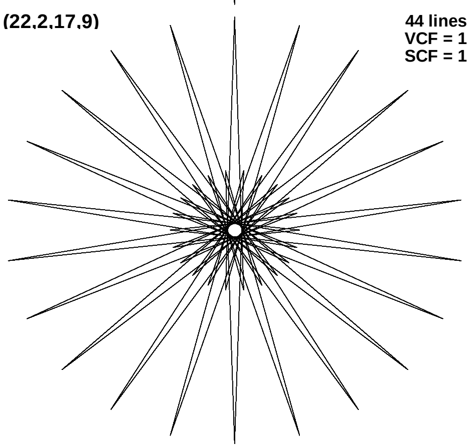
(22,5,48,9) 55 lines, VCF = 1, SCF = 2



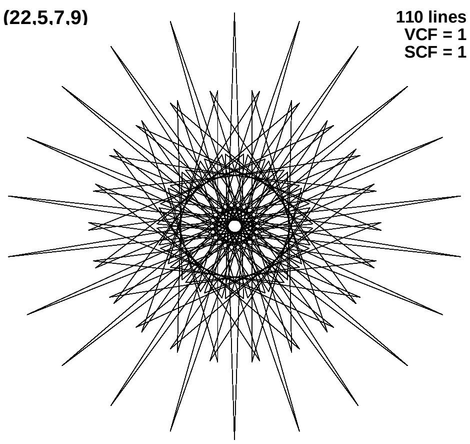
(22,7,52,9) 77 lines, VCF = 1, SCF = 2



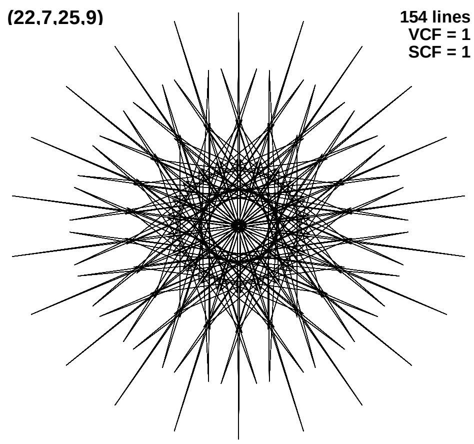
(22,2,17,9) 44 lines, VCF = 1, SCF = 1



(22,5,7,9) 110 lines, VCF = 1, SCF = 1



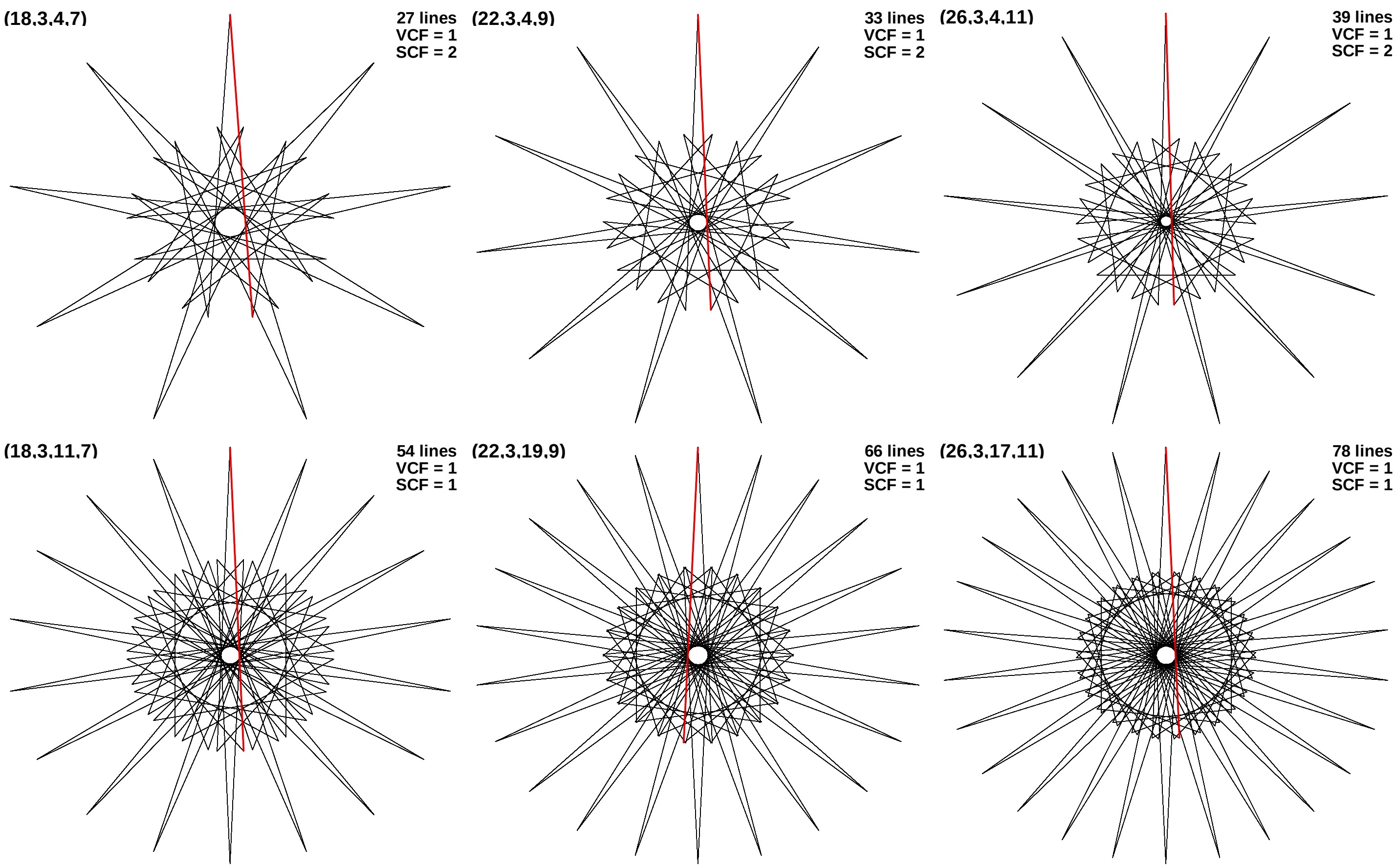
(22,7,25,9) 154 lines, VCF = 1, SCF = 1



The two sets of 6 images above differ by ***n*** (18 and 22) but use the same ***S*** by column. Four of the 12 images have SCF = 2 but only the open donut hole ***S*** = 5 version maintained it across ***n***. (*Note:* SCF = 2 if ***P*** is even since ***n*** = 4***k***+2.) The ***P*** values for these images and ***n*** = 26 are summarized in the table. The important thing to notice is that is no clear pattern emerges in ***P*** values. The simplest of patterns, the open donut ***S*** = 2 and closed donut ***S*** = 5 are not maintained when ***n*** = 26.

Sharpest Central Needles ***P*** values from ***n*** = 18 and 22 for various ***S***								
n = 26 images are not shown, but are easy to verify via *Excel* or web								
	Open Donut Hole				Closed Donut Hole			
n	Row	***S*** = 2	***S*** = 5	***S*** = 7	Row	***S*** = 2	***S*** = 5	***S*** = 7
18	**1**	**5**	**38**	**37**	**2**	**13**	**7**	**26**
22	**3**	**5**	**48**	**52**	**4**	**17**	**7**	**25**
26		**19**	**23**	**32**		**7**	**42**	**40**

Compare ***S*** = 3, ***P*** = 4 which has SCF = 2 with sharpest SCF = 1 ***P*** images. From a theoretical perspective, ***S*** = 3, ***P*** = 4 produces a closed donut hole image which has sharper and sharper needles, the first line of which is always just to the right of the vertical diameter. [**MA.** The reasoning is very similar to what was done for odd sharpest central needles (based on 3rds) and for the ***n*** = 4***k*** analysis (based on 5ths). The unit of ***x*** measurement here is 2 vertex jumps from the vertical diameter (rather than half a jump like the odd needles analysis). The ***x*** coordinate of the point one third of the way from vertex ***J*** = 2***k***-1 = ***n***/2-2 to 2***J*** = ***n***-4 is asymptotically close to 0 from above as ***n*** = 4***k***+2 increases.]



Focus attention on the size of the hole in the center by column because a smaller hole in the center means a sharper needle. For ***n*** = 18, ***P*** = 11 is sharper than ***P*** = 4 but for the next two ***n***, ***P*** = 4 has a smaller hole than the larger ***P*** value.

A similar result occurs for the open donut hole images (not shown but links provided) given ***S*** = 3. When ***n*** = 18, the sharpest central needle is ***P* = 16** but SCF = 2, the SCF = 1 version is ***P* = 23**. But from ***n*** = 22 on, the SCF = 1 version is sharper. For ***k*** > 4, ***n*** = 4***k***+2, ***J*** = 2***k***-1 and ***S*** = 3 has sharpest central needles open donut hole if ***P*** = 6***k***-1 (for ***n*** = 26 compare ***P* = 35** with ***P* = 22**). Since each VF line has 3 subdivisions, this means that the endpoint is the second subdivision on the 2***k***th VF line. This VF line starts four vertices to the left of the bottom at ***n***/2+4 and ends at vertex 2 (two to the right of the top). Just like ***P*** = 4 discussed above, this endpoint is just to the right of the vertical centerline. Notice that these two vertices are mirror reflections across the horizontal diameter of the second VF line from ***n***/2-2 to ***n***-4. Both ***P*** values (***P*** = 4 for closed donut, ***P*** = 6***k***-1 for open donut) have the same ***x*** value, just to the right of ***x*** = 0.