STT Doubles with Large ΔM – Part VIII: Tau Per Ori Cam Mon Cnc Peg

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Abstract: The results of visual double star observing sessions suggested a pattern for STT doubles with large delta_M of being harder to resolve than would be expected based on the WDS catalog data. It was felt this might be a problem with expectations on one hand, and on the other might be an indication of a need for new precise measurements, so we decided to take a closer look at a selected sample of STT doubles and do some research. Again like for the other STT objects covered so far several of the components show parameters quite different from the current WDS data.

1. Introduction

As follow up to our reports so far we finish this STT series with objects in the constellations Tau, Per, Ori, Cam, Mon, Cnc and Peg (see Table1). All values based on WDS data as of beginning of 2016.

Table 1. WDS catalog data per begin of 2016 for the selected STT objects

WDS ID	Name		RA	Dec	Sep	M1	M2	PA	Δ_M	Con
05417+1614	STT114	AB	05:41:40.770	+16:14:02.4	3.0	8.40	10.60	278	2.20	Tau
03334+2322	STT57	CD	03:33:26.530	+23:23:03.5	9.9	7.67	12.00	320	4.33	Tau
05272+1758	STT107	AB	05:27:10.090	+17:57:44.0	10.0	5.39	10.10	306	4.71	Tau
05272+1758	STT107	AC	05:27:10.090	+17:57:44.0	10.0	5.39	11.80	347	6.41	Tau
05459+2555	STT116	AC	05:45:55.390	+25:54:49.3	17.9	7.27	12.90	65	5.63	Tau
04162+3452	STT76	AB	04:16:10.609	+34:52:07.7	3.8	7.7	12.40	210	4.70	Per
02533+4834	STT48	AB	02:53:21.070	+48:34:11.9	6.6	6.5	10.60	318	4.10	Per
03483+5044	STT63	AB	03:48:18.080	+50:44:12.4	6.8	6.2	11.20	270	5.00	Per
05379+0715	STT518	AB	05:37:55.590	+07:14:55.5	2.1	8.8	12.80	240	4.00	Ori
05135+0158	STT517	AB,C	05:13:31.550	+01:58:03.7	6.5	6.13	13.00	138	6.87	Ori
06282+7032	STT136	AB	06:28:14.490	+70:32:07.0	5 5.0	6.04	11.00	82	5.00	Cam
07012+1146	STT163	AB,C	07:01:09.851	+11:46:28.7	14.5	6.41	12.00	165	5.59	Mon
09162+2324	STT198	AB	09:16:11.281	+23:24:10.4	14.6	7.74	12.00	121	4.50	Cnc
23074+2035	STT488	AB	23:07:25.502	+20:34:53.802	14.6	6.7	10.40	335	3.70	Peg
22148+2231	STT467	AB	22:14:48.567	+22:31:24.299	23.9	6.7	10.70	274	4.00	Peg

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2. Further Research

Following the procedure for the earlier parts of our report we concluded again that the best approach would be to check historical data on all objects, observe them visually with the target of comparing with the existing data and obtain as many images as possible suitable for photometry.

2.1 Historical Research and Catalog Comparisons

Quite a few of the stars in this survey have notable historical aspects which merit some comment. Three main research sources were used for this section of this paper, the first of which was W.J. Hussey's *Micrometrical Observations of the Double Stars Discovered at Pulkowa*, published in 1901, which provided preliminary historical information on each of the stars. Hussey's book includes his observations and measures of all the stars originally listed in Otto Wilhelm Struve's 1845 Pulkovo Catalog, as well as data beginning with the date of first measure and continuing through the following years up to 1900. That data, plus inclusion of the background for the Pulkovo Catalog, makes Hussey's book a valuable source of reference. Another source consulted were the two volumes (*Part I and Part II*) which make up S.W. Burnham's *A General Catalogue of Double Stars Within 121° of the North Pole.* The third source consulted was Otto Struve's 1845 *Catalogue de 514 Étoiles Doubles et Multiples*. In addition, Bill Hartkopf of the USNO graciously provided the text files for STT 57, STT 116, STT 467, and STT 518.

Several of the stars mentioned below were dropped from the second edition of Otto Struve's Pulkovo Catalogue (published in 1850) because the separations exceeded 16", which was the maximum catalog separation established for stars with companions fainter than ninth magnitude (Hussey, 1901, p. 16). Fortunately, Hussey included all of the rejected stars in his 1901 book.

STT 198 (Cnc): Otto Struve's 1845 catalog shows an estimated separation of ten seconds for this pair, but no exact measure. Apparently he decided the separation of this pair exceeded 16" since it was dropped from his 1850 catalog. Dembowski reported he was unable to see the secondary in 1865 and 1866. Interestingly, according to S.W. Burnham, the only measures of STT 198 as of the time of Hussey's writing are those of Hussey and Burnham.

STT 163 (Mon): The C component was added by S.W. Burnham in 1879, with measures of 14.18" and 155.5 degrees, later supplemented with another measure by him in 1905 of 14.33" and 160.4 degrees.

STT 517 (Ori): The C component was added in 1878 by Asaph Hall, using the 26 inch USNO Clark refractor, with measures of 6.74" and 134.7 degrees, later supplemented with an 1888 measure of 6.90" and 138.3 degrees. Burnham refers to it as Hl 2 on p. 51 of his 1906 Catalog, Part I.

STT 518 (Ori): Hussey states that because of the faintness of the B component (WDS magnitude is 12.8), neither Otto Struve nor Dembowski attempted measurements of it. The first known measure of the AB pair was made by Hussey in 1898 while using the Lick 36 inch refractor, with a separation of 1.49" and a position angle of 281.7 degrees. The C component was first measured by Burnham in 1905 at 40.21" and 238.4 degrees, but the WDS text file for STT 518 also shows an 1898 measure of 40.405" and 238.6 degrees which was made from a photographic plate, and is the one listed as Obs1 in the WSD catalog.

STT 467 (Peg): This is another pair which was rejected by Otto Struve in his 1850 catalog because the distance exceeded the 16" limit. His 1845 catalog shows an estimated separation of 16", and a look at the WDS text file for STT 467 shows Mädler provided measures in 1843 of 22.95" and 272.5 degrees. The first recorded observation of this pair was made in 1827 by Nanson Herschel, who estimated a separation of 20" and a position angle of 270 degrees, which also comes from the STT 467 WDS text file.

STT 488 (Peg): According to Hussey, Otto Struve rejected this pair because the companion was considered too faint to measure. Struve's 1845 catalog shows an estimated distance of 12 seconds, with magnitudes of 7 and 11. Hussey shows Mädler also looked at this pair in 1845 and estimated a distance of 14". The first actual measure of STT 488 appears to have been made in 1865 by Dembowski, who recorded a separation of 13.46" and a position angle of 335.0 degrees. Both Burnham and Hussey refer to this pair as HO 486, attributing it to G.W. Hough, who measured the two stars in 1892 at 14.0" and 334.0 degrees.

STT 57 (Tau): What is now the CD pair was originally the AB pair, first measured by Otto Struve in 1854 at 10.0" and 319 degrees. See Figure 1. What is now the AC pair was first measured F.G.W. Struve in 1823 at 71.64" and 34.6 degrees. That pair is identified by both Hussey and Burnham as σ 95, and was also assigned by Otto Struve to the appendix of his 1845 catalog as number 35. The WDS text file for STT 57 shows what is now the AB pair was added to this system in 1907 by S.W. Burnham with measures of 34.95" and 169.6 degrees

STT 107 (Tau): See Figure 2. Hussey notes the C component was first seen in 1850 by Otto Struve, but

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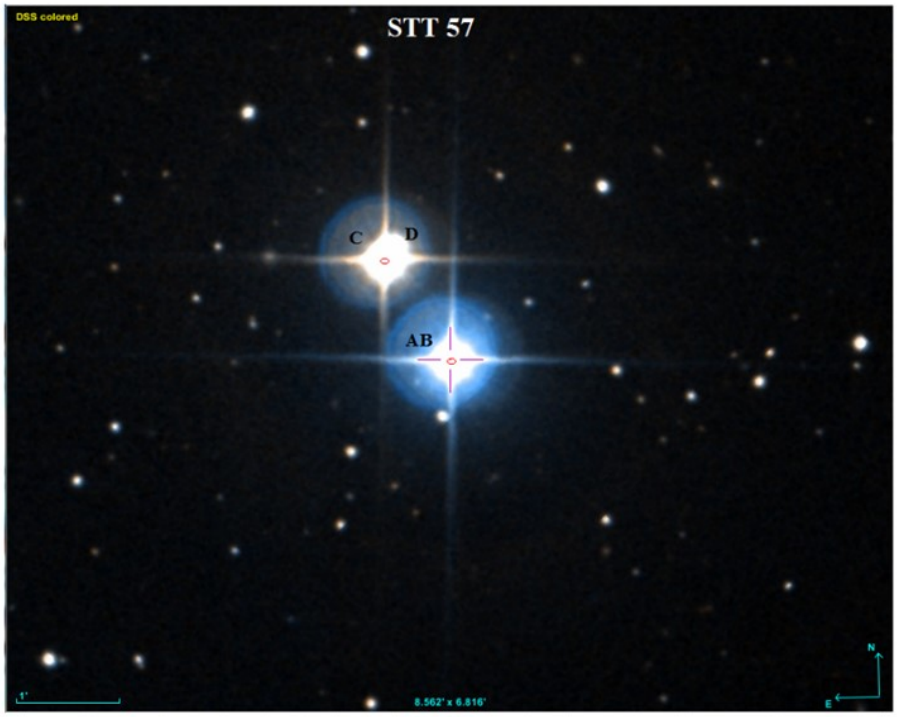
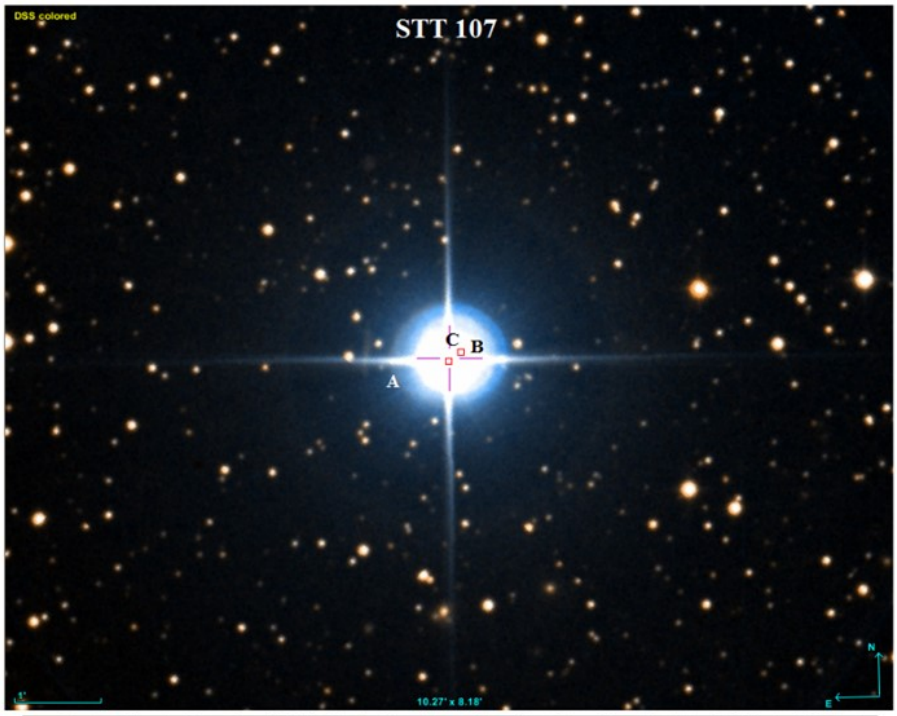


V	WDS	Disc	Comp	Obs1	Obs2	pa1	pa2	sep1	sep2	mag1	mag2	DM	No...	n	RAJ2000	DEJ2000
VizieR	03334+2322	STT 57	AB	1907	2000	170	170	35.0	33.50	7.17	12.80	+22 504	N		03 33 23.73	+23 22 05.6
VizieR	03334+2322	STT 57	AC	1854	2013	35	34	71.4	69.00	7.17	7.67		N D		03 33 23.73	+23 22 05.6
VizieR	03334+2322	STT 57	CD	1854	2014	319	320	10.0	9.90	7.67	12.00	+22 505	N		03 33 26.53	+23 23 03.5

Figure 1. Aladin image with component labels of STT 57 added.



V	WDS	Disc	Comp	Obs1	Obs2	pa1	pa2	sep1	sep2	mag1	mag2	DM	No...	n	RAJ2000	DEJ2000
VizieR	05272+1758	MCA 19	Aa,Ab	1979	2015	80	163	0.1	0.00	5.80	6.80		NO		05 27 10.09	+17 57 44.0
VizieR	05272+1758	STT 107	AB	1843	2015	317	306	10.7	10.00	5.39	10.10	+17 928	N		05 27 10.09	+17 57 44.0
VizieR	05272+1758	STT 107	AC	1899	2015	341	347	10.0	10.00	5.39	11.80		N		05 27 10.09	+17 57 44.0
VizieR	05272+1758	STT 107	BC	1899	2015	58	57	5.8	7.00	10.10	11.80		N		05 27 09.51	+17 57 49.9

Figure 2. Aladin image with component lables of STT 107 added.

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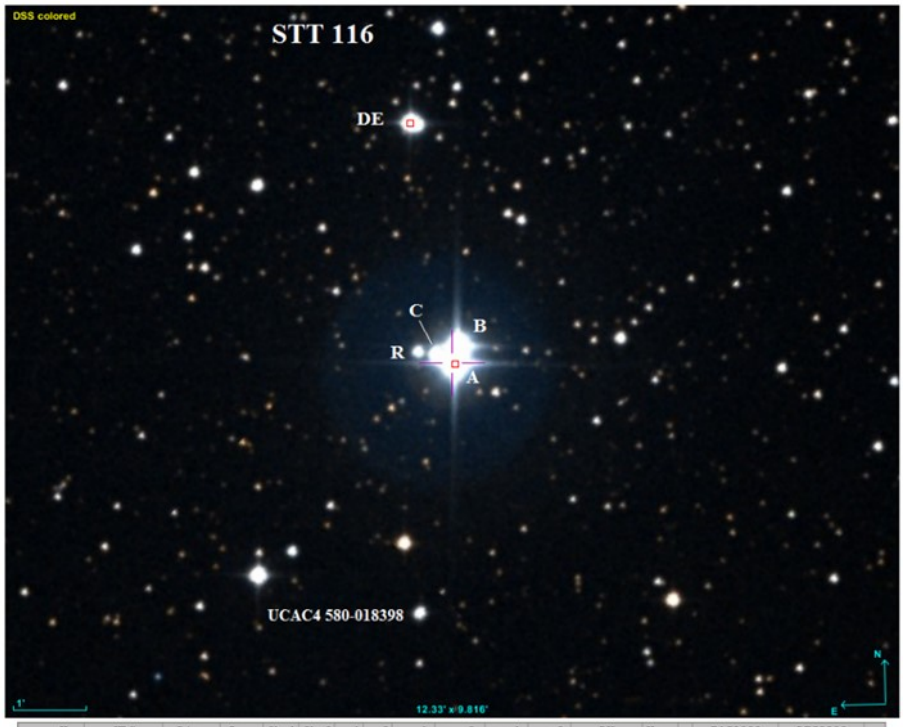

	V	WDS	Disc	Comp	Obs1	Obs2	pa1	pa2	sep1	sep2	mag1	mag2	DM	No	n	RAJ2000	DEJ2000
☑	VizieR	05459+2555	STT 785	AB	1830	2011	349	348	13.8	14.70	7.27	8.32	+25 963	N D		05 45 55.39	+25 54 49.3
☑	VizieR	05459+2555	STT 116	AC	1846	2011	66	65	18.3	17.90	7.27	12.90		N		05 45 55.39	+25 54 49.3
☑	VizieR	05459+2555	STT 116	AD	1898	2010	10	11	201.2	201.50	7.27	10.22		N		05 45 55.39	+25 54 49.3
☑	VizieR	05459+2555	STT 116	AR	1908	2011	72	73	31.3	31.90	7.27	13.25		N		05 45 55.39	+25 54 49.3
☑	VizieR	05459+2555	STT 116	DE	1890	2009	250	253	6.9	5.90	10.23	11.90	+25 964	N		05 45 58.11	+25 58 07.6

Figure 3. Aladin image with components of STT 116 labeled.

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not measured, although Struve noted it was closer to B than to A. He left a sketch showing a position angle of about 335 degrees. Hussey provided the first measures for the AC pair, measuring it once at the end of 1898 and twice at the beginning of 1899, resulting in an averaged separation of 10.0" and averaged position angle of 341.1 degrees.

STT 116 (Tau): See Figure 3. The AB pair, STF 785, was first measured by F.G.W. Struve in 1830 at 13.81" and 348.6 degrees. The AC, AD, AR, and DE components are all labeled as STT 116 in the WDS, but the AC pair is the only one that was discovered by Otto Struve, who measured it at 18.26" and 66 degrees in 1846. AD was first measured by S. W. Burnham in 1911 at 201.40" and 9.8 degrees. The WDS text file shows the 1898 Obs1 measure for AD was made on a photographic plate of that date. Two other measures are also listed in the text file which were made from 1908 and 1909 plates. The AR pair received its first measure of 31.93" and 72.1 degrees in 1908, by Erich Przybyllok, who was associated with the Heidelberg Observatory, while using a 12.5 inch refractor. The WDS Obs1 measure for the AR pair, which is also from 1908, was made from a photographic plate. And the last pair, DE, was first measured in 1890 by Kenneth J. Tarrant at 6.89" and 250.4 degrees according to the WDS text file.

2.2 Visual Observations

Both John Nanson and Wilfried Knapp made visual observations of the stars included in this report. Nanson used a 127mm f/9.3 refractor, a 152mm f/10 refractor, and a 235mm SCT, while Knapp utilized 140mm and 185mm refractors as well as a masking device to evaluate what could be seen at lesser apertures.

STT 136 (Cam): Nanson made one observation of this pair with the 152mm refractor and may have had a glimpse of B, but it was far from definitive. The best result was at 152x, which seemed to show a faint speck of a light on the edge of the primary at the correct PA. An attempt was made to resolve B at 607x, but it would not come to focus because of poor seeing. Thus, no conclusion was reached on the magnitude of B. Knapp made one observation with the 185mm refractor and was able to resolve B with the aperture reduced to 140mm, suggesting a magnitude much fainter than the WDS value of 11.0.

STT 198 (Cnc): Knapp was unable to resolve this pair with both the 140mm and 185mm refractors, suggesting the magnitude of B is much fainter than the

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WDS value of 12.0, a conclusion reinforced by being able to easily see a 12.36 magnitude star in the 140mm refractor. Nanson found B very tough to see in the 152mm refractor, able to detect it only with averted vision, which also indicates a magnitude fainter than the WDS value, especially when the 14.6" separation of the pair is taken into consideration.

STT 163 (Mon): Using the 152mm refractor, Nanson observed C with averted vision, which was made more difficult than normal because the first quarter moon was slightly less than 10 degrees to the north with haze in the sky. UCAC4 509-033885 was of similar difficulty (Vmag 11.890), suggesting the WDS magnitude of 12.0 for C is close. Knapp used the 185mm refractor to observe C and found it was still visible with the aperture reduced to 140mm, which also indicates the WDS value for C is close.

STT 517 (Ori): Knapp detected C as a spot of light at 360x in the 185mm refractor in difficult seeing, indicating C might be a bit brighter than the WDS value of 13.0. Nanson caught the C component at 152x, 203x, and 253x with the 152mm refractor. Averted vision was needed at 152x, but C was seen with direct vision several times at 203x and 253x. The first quarter moon was about 35 degrees to the northeast with some haze in the air, which would make it very unlikely the star is as faint as 13.0. No obvious comparison stars seen.

STT 518 (Ori): Nanson needed magnifications of 487x and 607x to detect the B component of STT 518 in the 152mm refractor. Based on that, the WDS listed separation of 2.1" is probably about right, but given the interference from the moon, it's possible B is about half a magnitude brighter than the WDS value of 12.8. C was rather difficult to see at 203x and 253x, and not visible at 152x. It seemed to be just slightly brighter (slightly easier to see) than STT 517 C above, suggesting the magnitudes for one of the two stars is wrong (the WDS value for STT 518 C is 12.25). Knapp was unable to resolve B definitively in the 185mm refractor under difficult seeing conditions, but was able to detect the much wider separated C (39.5") with the aperture reduced to 100mm.

STT 467 (Peg): Using the 235mm SCT, Nanson Found B to be about half a magnitude brighter than a 12.8 magnitude comparison star, indicating B may be in the 12.2 to 12.3 range. At a minimum, B certainly seemed fainter than the WDS 10.7 magnitude.

STT 488 (Peg): Nanson found B appeared slightly brighter in the 235mm SCT than a 12.6 magnitude comparison star, and noted it appeared distinctly fainter than the WDS value of 10.4.

STT 48 (Per): Magnifications of 152x, 253x, and 380x may have resulted in a glimpse of the secondary, but it was far from conclusive. This observation, as well as the next one, were made by Nanson with the 152mm refractor under difficult seeing conditions.

STT 63 (Per): A clear elongation of the secondary was seen by at 253x, followed by a brief glimpse of the secondary, which wasn't seen again with the further observation.

STT 76 (Per): No observations made for this pair be either observer.

STT 57 (Tau): Knapp was unable to definitively resolve the B component with the 185mm refractor, suggesting it's fainter than the 12.8 magnitude listed for it in the WDS. D could be seen with the aperture reduced to 140mm, which seems to confirm the WDS value of 12.0 for it. Nanson was able to detect B with averted vision while using the 152mm refractor at 253x, which suggested the 12.8 magnitude is probably close. The much tighter D was seen at 152x with averted vision, again suggesting the WDS listed magnitude of 12.0 is about right.

STT 107 (Tau): Nanson detected the B component with averted vision in the 152mm refractor at 152x, 190x, and 253x, but found it was very tough and somewhat indistinct, which would seem to indicate a fainter magnitude for it than the 10.10 magnitude listed in the WDS. On the same night, C (WDS magnitude of 11.8) was impossible to detect in the glare caused by the primary. However, in a prior observation of STT 107 on 1-15-2015 during better seeing conditions, Nanson detected both the B and C components with a 127mm refractor at 295x, which would indicate the WDS values for both stars are about right. Using the 185mm refractor, Knapp observed B with the aperture reduced to 150mm, but was unable to detect C, leading to the conclusion both stars are fainter than the WDS listed values.

STT 114 (Tau): Knapp was able to resolve B with the aperture of the 185mm refractor reduced to 110mm, leading to the conclusion the WDS magnitude of 10.6 is about right. Nanson had a glimpse of the secondary in the 152mm refractor at 152x and consistently detected an elongation of the primary, which seems consistent with the 3.0" separation and the 2.6 magnitudes of difference between the primary and the secondary.

STT 116 (Tau): Nanson found C was easily seen in the 152mm refractor at 152x and appeared similar in magnitude to a comparison star of 12.3 magnitude, suggesting it may be about half a magnitude brighter than the WDS value of 12.90. The DE pair appeared distinctly elongated at 152x and was easily split at 253x, though in the poor seeing it was blurred more often than not. Knapp resolved C and E with the aperture of

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the 185mm refractor reduced to 110mm, and also resolved R at 250x with the aperture reduced to 150mm, all of which led to the conclusion that each of the three stars seems to be a bit brighter than the WDS values.

2.3 Photometry and Astrometry Results

Several hundred images taken with iTelescope remote telescopes were, in a first step, plate solved and stacked with AAVSO VPhot. The stacked images were then plate solved with Astrometrica with URAT1 reference stars with Vmags in the range 10.5 to 14.5mag. The RA/Dec coordinates resulting from plate solving with URAT1 reference stars in the 10.5 to 14.5mag range were used to calculate Sep and PA using the formula provided by R. Buchheim (2008). *Err_PA* is the error estimation for PA in degrees calculated as assuming the worst case that *Err_Sep* points perpendicular to the separation vector. Mag is the photometry result based on UCAC4 reference stars with Vmags between 10.5 and 14.5mag. *Err_Mag* is calculated as with *dVmag* as the average *Vmag* error over all used reference stars and *SNR* is the signal to noise ratio for the given star. The results are shown in Table 2.

$$Err\_PA = \arctan\left(\frac{Err\_Sep}{Sep}\right)$$

$$Err\_Mag = \sqrt{dV_{mag}{}^2 + \left[2.5\log_{10}\left(1+\frac{1}{SNR}\right)\right]^2}$$

3. Summary

Tables 3 and 4 below compare the final results of our research with the WDS data that was current at the time we began working on our current group of stars.

In Table 3 the results of our photometry have been averaged for each star. Because we're aware that both the NOMAD-1 and the UCAC4 catalogs are frequently consulted when making WDS evaluations of magnitudes changes, the data from those catalogs has also been included for each of the stars.

Red type has been used in Tables 3 and 4 to call attention to significant differences from the WDS data. With regard to Table 3 those magnitudes that differ by two tenths of a magnitude or more from the WDS values have been highlighted. In Table 4 differences in separation in excess of two-tenths of an arc second are highlighted as are all position angles which differ by more than a degree.

Subsequent to our measures, as a quality check for our astrometry results we turned to the URAT1 catalog for the most recent precise professional measurements available. We used its coordinates to calculate the Sep and PA for all objects in this report for which URAT1 data was available and compared these values with our results, which are shown in Table 5.

Global Summary

As this report is our last in this sequence of wide STT doubles we take this opportunity for a summary over all eight reports:

1) In total we checked about 100 objects and suggested WDS catalog visual magnitude changes for most of them based on own measurements from images specifically taken for this project.
2) We soon found that for many objects also the astrometry data given in the WDS catalog needed an update so we extended our reports to include RA/Dec coordinates, separation and position angle with the corresponding error estimations. Some objects also show significant different proper motion for the components demonstrating the need of frequent measurements to keep the catalog values up to date.
3) We also made visual observations for all objects to counter-check visual impression with measurement results and got a mixed bag of often different impressions by different observers and in several cases the visual impressions regarding magnitudes did not match at all the measurement results.

Follow Up

The images we took for this series of reports include besides so far not measured components of the covered STT objects other double stars as well – in these cases we do not suspect any issues with the current WDS catalog data but any double star visited is worth just another recent measurement. We intend to use the available material for another report covering the mentioned additional objects.

Acknowledgements:

The following tools and resources have been used for this research:

- Washington Double Star Catalog as data source for the selected objects
- iTelescope: Images were taken with
    - iT24: 610mm CDK with 3962mm focal length. CCD: FLI-PL09000. Resolution 0.62 arcsec/pixel. V-filter. Located in Auberry. California. Elevation 1405m
    - iT11: 510mm CDK with 2280mm focal length. CCD: FLI ProLine PL11002M. Resolution 0.81 arcsec/pixel. B- and V-Filter. Located in Mayhill. New Mexico.

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Table 2. Photometry and astrometry results for the selected STT objects. Date is the Bessel epoch and N is the number of images used for the reported values. iT in the Notes column indicates the telescope used with number of images and exposure time given (Specifications of the used telescopes: See Acknowledgements). The average results over all used images are given in the line below the individual stacks in bold. The error estimation over all used images is calculated as root mean square over the individual Err values. The N column in the summary line gives the total number of images used and Date the average Bessel epoch.

STT 114	RA	Dec	dRA	dDec	Sep	Err Sep	PA	Err PA	Mag	Err Mag	SNR	dVmag	Date	N	Notes
A	05 41 40.778	16 14 02.37	0.07	0.05	2.997	0.086	281.355	1.644	7.877	0.090	136.87	0.09	2016.093	4	iT18 stack 4x3s. Overlapping star disks
B	05 41 40.574	16 14 02.96							9.338	0.092	56.54				
A	05 41 40.777	16 14 02.47	0.08	0.08	2.807	0.113	277.987	2.308	7.862	0.081	106.77	0.08	2016.085	5	iT18 stack 5x3s. Overlapping star disks. SNR B<20
B	05 41 40.584	16 14 02.86							9.679	0.102	16.52				
A	**05 41 40.777**	**16 14 02.42**	**0.075**	**0.067**	**2.900**	**0.100**	**279.726**	**1.984**	**7.870**	**0.086**			**2016.089**	**9**	**Overlapping star disks. Both stars too bright for reliable photometry**
B	**05 41 40.579**	**16 14 02.91**							**9.509**	**0.097**					
STT 57	**RA**	**Dec**	**dRA**	**dDec**	**Sep**	**Err Sep**	**PA**	**Err PA**	**Mag**	**Err Mag**	**SNR**	**dVmag**	**Date**	**N**	**Notes**
C	03 33 26.531	23 23 03.09	0.07	0.07	9.932	0.099	319.657	0.571	7.510	0.080	230.47	0.08	2016.090	3	iT18 stack 3x3s. C too bright for reliable photometry
D	03 33 26.064	23 23 10.66							11.532	0.085	36.08				
C	03 33 26.533	23 23 03.12	0.10	0.05	10.003	0.112	319.796	0.640	7.511	0.080	221.06	0.08	2016.085	4	iT18 stack 4x3s. C too bright for reliable photometry
D	03 33 26.064	23 23 10.76							11.545	0.086	33.48				
C	03 33 26.522	23 23 03.23	0.04	0.09	9.983	0.098	320.112	0.565	7.513	0.070	175.07	0.07	2016.093	5	iT18 stack 5x3s. C too bright for reliable photometry
D	03 33 26.057	23 23 10.89							11.516	0.081	26.70				
C	03 33 26.475	23 23 03.32	0.15	0.10	9.727	0.180	321.479	1.062	7.414	0.071	75.45	0.07	2016.023	5	iT27 stack 5x3s. C too bright for reliable photometry. Component B resolved with 14.566Vmag (compared with 12.8mag in WDS)
D	03 33 26.035	23 23 10.93							11.482	0.077	34.65				
C	03 33 26.529	23 23 03.03	0.16	0.07	10.033	0.175	319.422	0.997	7.488	0.060	165.74	0.06	2016.026	5	iT27 stack 5x3s. C too bright for reliable photometry. Component B resolved with 14.659Vmag (compared with 12.8mag in WDS)
D	03 33 26.055	23 23 10.65							11.552	0.061	85.67				
C	**03 33 26.518**	**23 23 03.16**	**0.114**	**0.078**	**9.935**	**0.138**	**320.086**	**0.795**	**7.487**	**0.073**			**2016.064**	**22**	**C too bright for reliable photometry**
D	**03 33 26.055**	**23 23 10.78**							**11.525**	**0.078**					

Table 2 continues on the next page.

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Table 2 (continued). Photometry and astrometry results for the selected STT objects. Date is the Bessel epoch and N is the number of images used for the reported values. iT in the Notes column indicates the telescope used with number of images and exposure time given (Specifications of the used telescopes: See Acknowledgements). The average results over all used images are given in the line below the individual stacks in bold. The error estimation over all used images is calculated as root mean square over the individual Err values. The N column in the summary line gives the total number of images used and Date the average Bessel epoch.

STT 107	RA	Dec	dRA	dDec	Sep	Err Sep	PA	Err PA	Mag	Err Mag	SNR	dVmag	Date	N	Notes
A	05 27 10.104	17 57 43.70	0.07	0.08	10.176	0.106	305.854	0.599	5.336	0.060	511.81	0.06	2016.090	4	iT18 stack 4x3s. A too bright for reliable photometry
B	05 27 09.526	17 57 49.66							11.066	0.066	40.18				
A	05 27 10.105	17 57 43.72	0.07	0.09	10.152	0.114	305.809	0.643	5.362	0.090	435.83	0.09	2016.093	5	iT18 stack 5x3s. A too bright for reliable photometry
B	05 27 09.528	17 57 49.66							11.164	0.099	26.60				
A	05 27 10.109	17 57 43.70	0.06	0.07	10.193	0.092	305.852	0.518	5.340	0.080	502.15	0.08	2016.085	5	iT18 stack 5x3s. A too bright for reliable photometry
B	05 27 09.530	17 57 49.67							11.098	0.086	34.59				
A	05 27 10.089	17 57 44.26	0.11	0.12	9.837	0.163	303.784	0.948	6.059	0.092	53.70	0.09	2016.023	4	iT27 stack 4x3s. A too bright for reliable photometry
B	05 27 09.516	17 57 49.73							11.099	0.094	39.73				
A	05 27 10.088	17 57 44.05	0.11	0.12	10.053	0.163	305.444	0.928	6.380	0.061	111.35	0.06	2016.026	4	iT27 stack 4x3s. A too bright for reliable photometry
B	05 27 09.514	17 57 49.88							11.100	0.062	65.33				
A	**05 27 10.099**	**17 57 43.89**	**0.087**	**0.098**	**10.081**	**0.131**	**305.359**	**0.744**	**5.695**	**0.078**			**2016.064**	**22**	**A too bright for reliable photometry**
B	**05 27 09.523**	**17 57 49.72**							**11.105**	**0.083**					
STT 107	**RA**	**Dec**	**dRA**	**dDec**	**Sep**	**Err Sep**	**PA**	**Err PA**	**Mag**	**Err Mag**	**SNR**	**dVmag**	**Date**	**N**	**Notes**
A	05 27 10.104	17 57 43.70	0.07	0.08	9.939	0.106	346.889	0.613	5.336	0.060	511.81	0.06	2016.090	4	iT18 stack 4x3s. A too bright for reliable photometry. SNR C<20
C	05 27 09.946	17 57 53.38							12.604	0.102	12.63				
A	05 27 10.105	17 57 43.72	0.07	0.09	10.092	0.114	346.675	0.647	5.362	0.090	435.83	0.09	2016.093	5	iT18 stack 5x3s. A too bright for reliable photometry. SNR C<10
C	05 27 09.942	17 57 53.54							12.845	0.138	9.95				
A	05 27 10.109	17 57 43.70	0.06	0.07	10.030	0.092	346.927	0.527	5.340	0.080	502.15	0.08	2016.085	5	iT18 stack 5x3s. A too bright for reliable photometry. SNR C<10
C	05 27 09.950	17 57 53.47							12.765	0.143	8.68				
A	05 27 10.089	17 57 44.26	0.11	0.12	9.442	0.163	346.721	0.988	6.059	0.092	53.70	0.09	2016.023	4	iT27 stack 4x3s. A too bright for reliable photometry. SNR C<20
C	05 27 09.937	17 57 53.45							12.738	0.128	11.39				
A	05 27 10.088	17 57 44.05	0.11	0.12	9.570	0.163	346.110	0.975	6.380	0.061	111.35	0.06	2016.026	4	iT27 stack 4x3s. A too bright for reliable photometry. SNR C<20
C	05 27 09.927	17 57 53.34							13.077	0.118	10.20				
A	**05 27 10.099**	**17 57 43.89**	**0.087**	**0.098**	**9.814**	**0.131**	**346.669**	**0.765**	**5.695**	**0.078**			**2016.064**	**22**	**A too bright for reliable photometry. SNR C<20**
C	**05 27 09.940**	**17 57 53.44**							**12.806**	**0.127**					

Table 2 continues on the next page.

STT Doubles with Large ΔM – Part VIII: Tau Per Ori Cam Mon Cnc Peg

Table 2 (continued). Photometry and astrometry results for the selected STT objects. Date is the Bessel epoch and N is the number of images used for the reported values. iT in the Notes column indicates the telescope used with number of images and exposure time given (Specifications of the used telescopes: See Acknowledgements). The average results over all used images are given in the line below the individual stacks in bold. The error estimation over all used images is calculated as root mean square over the individual Err values. The N column in the summary line gives the total number of images used and Date the average Bessel epoch.

STT 116	RA	Dec	dRA	dDec	Sep	Err Sep	PA	Err PA	Mag	Err Mag	SNR	dVmag	Date	N	Notes
A	05 45 55.397	25 54 49.25	0.08	0.07	17.783	0.106	64.735	0.342	7.237	0.090	269.89	0.09	2016.090	4	iT18 stack 4x3s: A too bright for reliable photometry. Component R measured with 12.814Vmag with SNR 20.47
C	05 45 56.589	25 54 56.84							11.675	0.095	36.33				
A	05 45 55.400	25 54 49.24	0.06	0.06	17.787	0.085	64.812	0.273	7.244	0.070	281.94	0.07	2016.085	5	iT18 stack 5x3s: A too bright for reliable photometry. Component R measured with 12.948Vmag with SNR 19.65
C	05 45 56.593	25 54 56.81							11.679	0.076	37.07				
A	05 45 55.399	25 54 49.26	0.08	0.08	17.772	0.113	64.504	0.365	7.249	0.080	172.94	0.08	2016.093	5	iT18 stack 5x3s: A too bright for reliable photometry. Component R measured with 13.089Vmag with SNR 8.68
C	05 45 56.588	25 54 56.91							11.661	0.095	20.52				
A	**05 45 55.399**	**25 54 49.25**	**0.074**	**0.070**	**17.781**	**0.102**	**64.684**	**0.329**	**7.2433 333**	**0.081**			**2016.089**	**14**	**A too bright for reliable photometry. Component R measured with averaged 12.950Vmag**
C	**05 45 56.590**	**25 54 56.85**							**11.671 667**	**0.089**					
STT 76	**RA**	**Dec**	**dRA**	**dDec**	**Sep**	**Err Sep**	**PA**	**Err PA**	**Mag**	**Err Mag**	**SNR**	**dVmag**	**Date**	**N**	**Notes**
A	04 16 10.639	34 52 07.29	0.03	0.03	3.550	0.042	211.099	0.685	7.501	0.030	354.56	0.03	2016.236	5	iT24 stack 5x3s. A too bright for reliable photometry. Overlapping star disks. SNR B<20
B	04 16 10.490	34 52 04.25							12.489	0.079	14.34				
A	**04 16 10.639**	**34 52 07.29**	**0.030**	**0.030**	**3.550**	**0.042**	**211.099**	**0.685**	**7.501**	**0.030**			**2016.236**	**5**	**A too bright for reliable photometry. Overlapping star disks. SNR B<20**
B	**04 16 10.490**	**34 52 04.25**							**12.489**	**0.079**					
STT 48	**RA**	**Dec**	**dRA**	**dDec**	**Sep**	**Err Sep**	**PA**	**Err PA**	**Mag**	**Err Mag**	**SNR**	**dVmag**	**Date**	**N**	**Notes**
A	02 53 21.068	48 34 11.82	0.16	0.12	6.526	0.200	316.327	1.755	6.167	0.100	194.65	0.10	2016.172	5	iT18 stack 5x3s. A too bright for reliable photometry. Overlapping star disks. SNR B <20
B	02 53 20.614	48 34 16.54							11.498	0.118	16.73				
A	02 53 21.070	48 34 11.73	0.10	0.10	6.609	0.141	317.597	1.226	6.165	0.080	395.94	0.08	2016.258	5	iT24 stack 5x3s. A too bright for reliable photometry. Overlapping star disks
B	02 53 20.621	48 34 16.61							11.357	0.094	21.93				
A	**02 53 21.069**	**48 34 11.78**	**0.133**	**0.110**	**6.567**	**0.173**	**316.966**	**1.511**	**6.166**	**0.091**			**2016.215**	**10**	**A too bright for reliable photometry. Overlapping star disks**
B	**02 53 20.618**	**48 34 16.58**							**11.428**	**0.107**					

Table 2 continues on the next page.

STT Doubles with Large ΔM – Part VIII: Tau Per Ori Cam Mon Cnc Peg

Table 2 (continued). Photometry and astrometry results for the selected STT objects. Date is the Bessel epoch and N is the number of images used for the reported values. iT in the Notes column indicates the telescope used with number of images and exposure time given (Specifications of the used telescopes: See Acknowledgements). The average results over all used images are given in the line below the individual stacks in bold. The error estimation over all used images is calculated as root mean square over the individual Err values. The N column in the summary line gives the total number of images used and Date the average Bessel epoch.

STT 63	RA	Dec	dRA	dDec	Sep	Err Sep	PA	Err PA	Mag	Err Mag	SNR	dVmag	Date	N	Notes
A	03 48 18.072	50 44 12.50	0.11	0.10	6.324	0.149	271.359	1.347	6.100	0.070	349.80	0.07	2016.172	4	iT18 stack 4x3s. A too bright for reliable photometry. Overlapping star disks. SNR B <10
B	03 48 17.406	50 44 12.65							11.573	0.137	8.69				
A	03 48 18.067	50 44 12.35	0.12	0.11	6.894	0.163	268.753	1.353	6.225	0.100	303.25	0.10	2016.255	1	iT24 1x3s. A too bright for reliable photometry. Overlapping star disks. SNR B <20
B	03 48 17.341	50 44 12.20							11.438	0.116	18.24				
A	03 48 18.068	50 44 12.18	0.09	0.08	6.959	0.120	270.494	0.991	6.212	0.090	348.90	0.09	2016.258	5	iT24 stack 5x1s. A too bright for reliable photometry. Overlapping star disks
B	03 48 17.335	50 44 12.24							11.190	0.093	42.48				
A	03 48 18.025	50 44 12.61	0.04	0.04	6.644	0.057	267.153	0.488	7.021	0.050	187.41	0.05	2016.236	5	iT24 stack 5x3s. A too bright for reliable photometry. Overlapping star disks
B	03 48 17.326	50 44 12.28							11.314	0.053	59.40				
A	**03 48 18.058**	**50 44 12.41**	**0.095**	**0.087**	**6.703**	**0.129**	**269.423**	**1.100**	**6.390**	**0.080**			**2016.230**	**15**	**A too bright for reliable photometry. Overlapping star disks**
B	**03 48 17.352**	**50 44 12.34**							**11.379**	**0.105**					
STT 518	**RA**	**Dec**	**dRA**	**dDec**	**Sep**	**Err Sep**	**PA**	**Err PA**	**Mag**	**Err Mag**	**SNR**	**dVmag**	**Date**	**N**	**Notes**
A															**No resolution of B in any of the images taken**
B															
STT 517	**RA**	**Dec**	**dRA**	**dDec**	**Sep**	**Err Sep**	**PA**	**Err PA**	**Mag**	**Err Mag**	**SNR**	**dVmag**	**Date**	**N**	**Notes**
AB	05 13 31.509	01 58 03.43	0.12	0.11	7.110	0.163	132.795	1.312	6.388	0.100	153.04	0.10	2016.026	5	iT27 stack 5x3s. A too bright for reliable photometry. Overlapping star disks. SNR B <20
C	05 13 31.857	01 57 58.60							11.522	0.115	18.87				
AB	05 13 31.527	01 58 03.67	0.12	0.12	7.362	0.170	135.044	1.320	6.483	0.080	162.27	0.08	2016.032	5	iT27 stack 5x3s. A too bright for reliable photometry. Overlapping star disks
C	05 13 31.874	01 57 58.46							11.457	0.091	24.16				
AB	05 13 31.545	01 58 03.73	0.12	0.12	7.017	0.170	137.702	1.385	6.313	0.081	111.63	0.08	2016.035	5	iT27 stack 5x3s. A too bright for reliable photometry. Overlapping star disks. SNR B <20
C	05 13 31.860	01 57 58.54							11.448	0.105	15.55				
AB	05 13 31.550	01 58 03.51	0.10	0.08	6.727	0.128	135.770	1.091	6.143	0.090	161.50	0.09	2016.031	4	iT24 stack 4x3s. A too bright for reliable photometry. Overlapping star disks. SNR B <20
C	05 13 31.863	01 57 58.69							11.519	0.117	13.91				
AB	**05 13 31.533**	**01 58 03.59**	**0.115**	**0.109**	**7.051**	**0.159**	**135.311**	**1.288**	**6.332**	**0.088**			**2016.031**	**19**	**A too bright for reliable photometry. Overlapping star disks. SNR B <20**
C	**05 13 31.863**	**01 57 58.57**							**11.487**	**0.108**					

Table 2 continues on the next page.

STT Doubles with Large ΔM – Part VIII: Tau Per Ori Cam Mon Cnc Peg

Table 2 (continued). Photometry and astrometry results for the selected STT objects. Date is the Bessel epoch and N is the number of images used for the reported values. iT in the Notes column indicates the telescope used with number of images and exposure time given (Specifications of the used telescopes: See Acknowledgements). The average results over all used images are given in the line below the individual stacks in bold. The error estimation over all used images is calculated as root mean square over the individual Err values. The N column in the summary line gives the total number of images used and Date the average Bessel epoch.

STT 136	RA	Dec	dRA	dDec	Sep	Err Sep	PA	Err PA	Mag	Err Mag	SNR	dVmag	Date	N	Notes
A	06 28 14.458	70 32 07.41	0.12	0.14	5.373	0.184	80.789	1.966	5.811	0.130	218.05	0.13	2016.194	2	iT18 stack 2x3s. SNR B<20. A too bright for reliable photometry
B	06 28 15.519	70 32 08.27							10.806	0.152	13.26				
A	06 28 14.545	70 32 07.41	0.08	0.08	5.334	0.113	83.865	1.215	6.016	0.080	402.55	0.08	2016.258	4	iT24 stack 4x1s. SNR B<20. A too bright for reliable photometry. Overlapping star disks
B	06 28 15.606	70 32 07.98							10.616	0.097	19.30				
A	06 28 14.490	70 32 07.25	0.06	0.07	5.466	0.092	81.689	0.966	5.970	0.070	517.69	0.07	2016.236	5	iT24 stack 5x3s. A too bright for reliable photometry. Overlapping star disks
B	06 28 15.572	70 32 08.04							10.757	0.087	20.78				
A	06 28 14.452	70 32 07.28	0.10	0.08	5.593	0.128	83.120	1.312	5.828	0.080	168.06	0.08	2016.247	5	iT24 stack 5x3s. A too bright for reliable photometry. Overlapping star disks
B	06 28 15.563	70 32 07.95							10.315	0.085	37.58				
A	06 28 14.475	70 32 07.50	0.14	0.11	5.504	0.178	85.624	1.853	5.899	0.080	183.76	0.08	2016.247	5	iT24 stack 5x3s. A too bright for reliable photometry. Overlapping star disks
B	06 28 15.573	70 32 07.92							10.334	0.084	39.76				
A	**06 28 14.484**	**70 32 07.37**	**0.104**	**0.099**	**5.452**	**0.144**	**83.025**	**1.511**	**5.905**	**0.091**			**2016.237**		**A too bright for reliable photometry. Overlapping star disks**
B	**06 28 15.567**	**70 32 08.03**							**10.566**	**0.104**					
STT 163	**RA**	**Dec**	**dRA**	**dDec**	**Sep**	**Err Sep**	**PA**	**Err PA**	**Mag**	**Err Mag**	**SNR**	**dVmag**	**Date**	**N**	**Notes**
AB	07 01 09.858	11 46 28.35	0.09	0.06	14.235	0.108	165.970	0.435	6.707	0.080	334.27	0.08	2016.194	4	iT18 stack 4x3s. AB too bright for reliable photometry
C	07 01 10.093	11 46 14.54							11.767	0.086	33.50				
AB	07 01 09.824	11 46 28.40	0.04	0.04	14.436	0.057	164.483	0.225	7.020	0.040	318.94	0.04	2016.236	5	iT24 stack 5x3s. AB too bright for reliable photometry
C	07 01 10.087	11 46 14.49							11.778	0.041	111.68				
AB	07 01 09.855	11 46 28.11	0.11	0.11	13.885	0.156	165.296	0.642	6.718	0.061	133.17	0.06	2016.247	5	iT24 stack 5x3s. AB too bright for reliable photometry
C	07 01 10.095	11 46 14.68							11.721	0.061	91.17				
AB	07 01 09.829	11 46 28.25	0.11	0.11	14.268	0.156	164.357	0.625	6.721	0.050	153.43	0.05	2016.247	5	iT24 stack 5x3s. AB too bright for reliable photometry
C	07 01 10.091	11 46 14.51							11.733	0.052	78.84				
AB	07 01 09.848	11 46 28.36	0.09	0.10	14.216	0.135	165.769	0.542	6.793	0.060	307.52	0.06	2016.258	5	iT24 stack 5x3s. AB too bright for reliable photometry
C	07 01 10.086	11 46 14.58							11.788	0.061	90.92				
AB	**07 01 09.843**	**11 46 28.29**	**0.092**	**0.089**	**14.207**	**0.128**	**165.172**	**0.515**	**6.792**	**0.060**			**2016.237**		**AB too bright for reliable photometry**
C	**07 01 10.090**	**11 46 14.56**							**11.757**	**0.062**					

Table 2 continues on the next page.

STT Doubles with Large ΔM – Part VIII: Tau Per Ori Cam Mon Cnc Peg

Table 2 (continued). Photometry and astrometry results for the selected STT objects. Date is the Bessel epoch and N is the number of images used for the reported values. iT in the Notes column indicates the telescope used with number of images and exposure time given (Specifications of the used telescopes: See Acknowledgements). The average results over all used images are given in the line below the individual stacks in bold. The error estimation over all used images is calculated as root mean square over the individual Err values. The N column in the summary line gives the total number of images used and Date the average Bessel epoch.

STT 198	RA	Dec	dRA	dDec	Sep	Err Sep	PA	Err PA	Mag	Err Mag	SNR	dVmag	Date	N	Notes
A	09 16 11.137	23 24 08.77	0.04	0.06	14.994	0.072	115.141	0.276	7.632	0.080	241.96	0.08	2016.194	5	iT18 stack 5x3s. A too bright for reliable photometry
B	09 16 12.123	23 24 02.40							12.864	0.095	20.71				
A	09 16 11.143	23 24 08.97	0.08	0.09	15.019	0.120	115.348	0.459	7.623	0.041	147.39	0.04	2016.247	5	iT24 stack 5x3s. A too bright for reliable photometry
B	09 16 12.129	23 24 02.54							12.980	0.045	51.04				
A	09 16 11.146	23 24 08.76	0.05	0.05	14.944	0.071	115.104	0.271	7.664	0.060	168.26	0.06	2016.258	4	iT24 stack 4x3s. A too bright for reliable photometry
B	09 16 12.129	23 24 02.42							13.019	0.063	52.52				
A	09 16 11.137	23 24 08.83	0.03	0.03	15.077	0.042	115.202	0.161	7.666	0.040	452.98	0.04	2016.236	5	iT24 stack 5x3s. A too bright for reliable photometry
B	09 16 12.128	23 24 02.41							12.977	0.043	71.78				
A	**09 16 11.141**	**23 24 08.83**	**0.053**	**0.061**	**15.008**	**0.081**	**115.199**	**0.311**	**7.646**	**0.058**			**2016.234**	**19**	**A too bright for reliable photometry**
B	**09 16 12.127**	**23 24 02.44**							**12.960**	**0.065**					
STT 488	**RA**	**Dec**	**dRA**	**dDec**	**Sep**	**Err Sep**	**PA**	**Err PA**	**Mag**	**Err Mag**	**SNR**	**dVmag**	**Date**	**N**	**Notes**
A	23 07 25.489	20 34 53.50	0.13	0.13	14.888	0.184	334.704	0.708	6.706	0.110	498.01	0.11	2015.637	4	iT11 stack 4x3s. A too bright for reliable photometry
B	23 07 25.036	20 35 06.96							11.976	0.112	48.39				
A	23 07 25.482	20 34 53.35	0.04	0.06	14.897	0.072	334.900	0.277	6.649	0.060	363.13	0.06	2015.639	5	iT18 stack 5x3s. A too bright for reliable photometry
B	23 07 25.032	20 35 06.84							11.958	0.068	34.23				
A	23 07 25.482	20 34 53.15	0.07	0.08	14.954	0.106	334.884	0.407	6.406	0.110	506.90	0.11	2015.700	5	iT21 stack 5x3s. A too bright for reliable photometry
B	23 07 25.030	20 35 06.69							11.898	0.112	47.27				
A	23 07 25.482	20 34 53.32	0.02	0.04	14.909	0.045	334.802	0.172	6.695	0.050	412.76	0.05	2015.615	5	iT24 stack 5x3s. A too bright for reliable photometry
B	23 07 25.030	20 35 06.81							11.964	0.052	78.81				
A	23 07 25.484	20 34 53.42	0.03	0.05	14.782	0.058	334.571	0.226	6.684	0.060	388.37	0.06	2015.620	5	iT24 stack 5x3s. A too bright for reliable photometry
B	23 07 25.032	20 35 06.77							11.950	0.062	76.69				
A	23 07 25.480	20 34 53.33	0.06	0.04	14.858	0.072	334.949	0.278	6.627	0.090	401.71	0.09	2015.632	5	iT24 stack 5x3s. A too bright for reliable photometry
B	23 07 25.032	20 35 06.79							11.903	0.091	74.40				
A	**23 07 25.483**	**20 34 53.345**	**0.069**	**0.074**	**14.881**	**0.101**	**334.802**	**0.388**	**6.628**	**0.084**			**2015.640**	**29**	**A too bright for reliable photometry**
B	**23 07 25.032**	**20 35 06.810**							**11.942**	**0.086**					

Table 2 concludes on the next page.

STT Doubles with Large ΔM – Part VIII: Tau Per Ori Cam Mon Cnc Peg

Table 2. (conclusion). Photometry and astrometry results for the selected STT objects. Date is the Bessel epoch and N is the number of images used for the reported values. iT in the Notes column indicates the telescope used with number of images and exposure time given (Specifications of the used telescopes: See Acknowledgements). The average results over all used images are given in the line below the individual stacks in bold. The error estimation over all used images is calculated as root mean square over the individual Err values. The N column in the summary line gives the total number of images used and Date the average Bessel epoch.

STT 467	RA	Dec	dRA	dDec	Sep	Err Sep	PA	Err PA	Mag	Err Mag	SNR	dVmag	Date	N	Notes
A	22 14 48.588	22 31 24.42	0.13	0.16	23.011	0.206	273.289	0.513	6.654	0.090	492.60	0.09	2015.637	5	iT11 stack 5x3s. A too bright for reliable photometry
B	22 14 46.930	22 31 25.74							11.083	0.091	79.18				
A	22 14 48.580	22 31 24.19	0.19	0.07	23.051	0.202	273.233	0.503	6.626	0.070	328.88	0.07	2015.639	5	iT18 stack 5x3s. A too bright for reliable photometry
B	22 14 46.919	22 31 25.49							11.012	0.073	55.25				
A	22 14 48.576	22 31 24.01	0.08	0.12	22.986	0.144	273.417	0.359	6.394	0.110	509.10	0.11	2015.700	5	iT21 stack 5x3s. A too bright for reliable photometry
B	22 14 46.920	22 31 25.38							10.901	0.111	84.98				
A	22 14 48.579	22 31 24.14	0.03	0.03	23.025	0.042	273.311	0.106	6.708	0.040	441.06	0.04	2015.615	5	iT24 stack 5x3s. A too bright for reliable photometry
B	22 14 46.920	22 31 25.47							11.038	0.041	120.59				
A	22 14 48.579	22 31 24.43	0.02	0.02	23.039	0.028	272.662	0.070	6.852	0.030	509.59	0.03	2015.620	5	iT24 stack 5x3s. A too bright for reliable photometry
B	22 14 46.918	22 31 25.50							11.036	0.031	134.65				
A	22 14 48.578	22 31 24.17	0.03	0.02	23.025	0.036	273.287	0.090	6.747	0.040	444.94	0.04	2015.632	5	iT24 stack 5x3s. A too bright for reliable photometry
B	22 14 46.919	22 31 25.49							11.024	0.041	123.19				
A	**22 14 48.580**	**22 31 24.227**	**0.101**	**0.088**	**23.023**	**0.134**	**273.200**	**0.334**	**6.664**	**0.070**			**2015.640**	**30**	**A too bright for reliable photometry**
B	**22 14 46.921**	**22 31 25.512**							**11.016**	**0.071**					

Table 3. Photometry and Visual Results Compared to WDS

	WDS Mag	NOMAD-1 VMag	UCAC4 VMag	UCAC4 f. mag	Average of Photometry Measures	Results of Visual Observations
STT 114 B	10.6	-	-	-	9.509	Two observations suggesting the WDS value of 10.6 for B is about right.
STT 57 D	12.0	-	-	-	11.525	Two observations suggesting the WDS value of 12.0 for D is about right.
STT 107 B	10.1	-	-	-	11.105	Three observations of B suggesting it's fainter than the WDS value of 10.1.
STT 107 C	11.8	-	-	-	12.806	One observation suggesting C is fainter than the WDS value of 11.8, one suggesting it's close to the WDS value.
STT 116 C	12.9	-	-	11.684	11.672	Two observations suggesting C is about half a magnitude brighter than the WDS value of 12.9.
STT 76 B	12.4	-	-	-	12.489	No observations made of this pair.
STT 48 B	10.6	-	10.548	-	11.428	One inconclusive observation.
STT 63 B	11.2	-	-	-	11.379	One inconclusive observation.
STT 518 B	12.8	-	-	-	Not Resolved	One observation suggesting the magnitude of B lies somewhere between the WDS value of 12.8 and a bit brighter than that value.
STT 517 C	13.0	-	-	-	11.487	Two observations suggesting C is brighter than the WDS value of 13.0.
STT 136 B	11.0	-	10.506	-	10.566	One inconclusive observation and one suggesting C is much fainter than the WDS value of 11.0.
STT 163 C	12.0	-	-	11.366	11.757	Two observations suggesting the WDS value of 12.0 for C is reasonably close.
STT 198 B	12.0	-	-	12.872	12.960	Two observations suggesting B is notably fainter than the WDS value of 12.0.
STT 488 B	10.4	-	-	12.022	11.942	One observation suggesting B is distinctly fainter than the WDS value of 10.4.
STT 467 B	10.7	11.5	-	10.969	11.016	One observation suggesting a value for B in the 12.2 to 12.3 range.

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Table 4. Astrometry Results Compared to WDS

	WDS Coordinates	WDS Sep	WDS PA	Astrometry Coordinates	Astrometry Sep	Astrometry PA
STT 114 AB	05:41:40.770 +16:14:02.4	3.0	278	05 41 40.777 +16 14 02.42	2.9	279.726
STT 57 CD	03:33:26.530 +23:23:03.5	9.9	320	03 33 26.518 +23 23 03.16	9.935	320.086
STT 107 AB	05:27:10.090 +17:57:44.0	10.0	306	05 27 10.099 +17 57 43.89	10.081	305.359
STT 107 AC	05:27:10.090 +17:57:44.0	10.0	347	05 27 10.099 +17 57 43.89	9.814	346.669
STT 116 AC	05:45:55.390 +25:54:49.3	17.9	65	05 45 55.399 +25 54 49.25	17.781	64.684
STT 76 AB	04:16:10.609 +34:52:07.7	3.8	210	04 16 10.639 +34 52 07.29	**3.550**	**211.099**
STT 48 AB	02:53:21.070 +48:34:11.9	6.6	318	02 53 21.069 +48 34 11.78	6.567	**316.966**
STT 63 AB	03:48:18.080 +50:44:12.4	6.8	270	03 48 18.058 +50 44 12.41	6.703	269.423
STT 517 AB,C	05:13:31.550 +01:58:03.7	6.5	138	05 13 31.533 +01 58 03.59	**7.051**	**135.311**
STT 136 AB	06:28:14.490 +70:32:07.0	5.0	82	06 28 14.484 +70 32 07.37	**5.452**	**83.025**
STT 163 AB,C	07:01:09.851 +11:46:28.7	14.5	165	07 01 09.843 +11 46 28.29	**14.207**	165.172
STT 198 AB	09:16:11.281 +23:24:10.4	14.6	121	09 16 11.141 +23 24 08.83	**15.008**	**115.199**
STT 488 AB	23:07:25.502 +20:34:53.802	14.6	335	23 07 25.483 +20 34 53.345	**14.881**	334.802
STT 467 AB	22:14:48.567 +22:31:24.299	23.9	274	22 14 48.580 +22 31 24.227	**23.023**	273.200

Table 5 Astrometry Results Compared with URAT1 Coordinates

Object	URAT1 Sep	iTelescope Sep	Err Sep	Within Error Range?	URAT1 PA	iTelescope PA	Err PA	Within Error Range?
STT 57CD	9.929	9.935	0.138	Yes	319.955	320.086	0.795	**Yes**
STT 107AB	10.211	10.081	0.131	**Yes**	305.795	305.359	0.744	**Yes**
STT 107AC	10.114	9.814	0.131	**No (1)**	346.461	346.669	0.765	**Yes**
STT 116AC	17.770	17.781	0.102	**Yes**	64.783	64.684	0.329	**Yes**
STT 63AB	7.090	6.703	0.129	**No (2)**	270.137	269.423	1.100	**Yes**
STT 163AB,C	14.221	14.207	0.128	**Yes**	165.748	165.172	0.515	**No (3)**
STT 198AB	14.909	15.008	0.081	**No (3)**	115.630	115.199	0.311	**No (3)**
STT 488AB	14.944	14.881	0.101	**Yes**	334.847	334.802	0.388	**Yes**
STT 467AB	22.992	23.023	0.134	**Yes**	273.384	273.200	0.334	**Yes**

Notes: All astrometry results in this report are to some degree influenced by the difficulty of centroid detection due to the brightness of the primaries, so the calculated error range is probably a bit on the optimistic side.

(1) Two measurements based on iT27 images regarding separation are obviously outliers, without them the averaged separation would be 10.020" and thus within the error range

(2) One iT18 image delivered an outlier result here, but even without this outlier the comparison with URAT1 stays outside the error range. Given the brightness of the primary the reason for this might be a less than perfect URAT1 centroid detection as our result here corresponds very well with the current WDS catalog value

(3) Result only slightly outside the given error range.

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Elevation 2225m

  - iT18: 318mm CDK with 2541mm focal length. CCD: SBIG-STXL-6303E. Resolution 0.73 arcsec/pixel. V-filter. Located in Nerpio. Spain. Elevation 1650m
  - iT21: 431mm CDK with 1940mm focal length. CCD: FLI-PL6303E. Resolution 0.96 arcsec/pixel. V-filter. Located in Mayhill. New Mexico. Elevation 2225m
- AAVSO VPhot for initial plate solving
- AAVSO APASS providing Vmags for faint reference stars (indirect via UCAC4)
- UCAC4 catalog (online via the University of Heidelberg website and Vizier and locally from USNO DVD) for counterchecks
- URAT1 catalog for high precision plate solving
- Aladin Sky Atlas v8.0 for counterchecks
- SIMBAD. VizieR for counterchecks
- 2MASS All Sky Catalog for counterchecks
- URAT1 Survey (preliminary) for counterchecks
- AstroPlanner v2.2 for object selection. session planning and for catalog based counterchecks
- MaxIm DL6 v6.08 for plate solving on base of the UCAC4 catalog
- Astrometrica v4.9.1.420 for astrometry and photometry measurements

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$$Sep = \sqrt{\left[\left(RA_2 - RA_1\right)\cos\left(Dec_1\right)\right]^2 + \left(Dec_2 - Dec_1\right)^2}$$

in radians and

$$RA = \arctan\left[\frac{\left(RA_2 - RA_1\right)\cos\left(Dec_1\right)}{Dec_2 - Dec_1}\right]$$

in radians depending on quadrant

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