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# Supplementary Materials for

# Measles virus nucleo- and phosphoproteins form liquid-like phase-separated compartments that promote nucleocapsid assembly

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### The PDF file includes:

Table S1 Figs. S1 to S8 Legends for movies S1 and S2 Data S1

# Other Supplementary Material for this manuscript includes the following:

(available at advances.sciencemag.org/cgi/content/full/6/14/eaaz7095/DC1)

Movie S1 and S2

Table S1

Ptot (μM)	Ntot (μM)	Ρ <sub>D</sub> (μM)	N <sub>D</sub> (μM)	ratio
75	7,5	43,23	5,77	0,13
75	15	54,60	8,64	0,16
75	37,5	72,3	13,49	0,19
75	75	75	26,74	0,36

Calculated ratio of [N]/[P] in liquid droplets as determined from NMR (see main text)

Fig. S1 SDS-PAGE (15%) with Coomassie staining of purified truncated constructs of P and  $P_{1-507}$ .





# Fig. S2

Fluorescent images overlaid with DIC show the salt dependence of LLPS formation.  $P_{50}N_{525}$  (100  $\mu$ M, 1% fluorescently labelled) and  $P_{304-507}$  (100  $\mu$ M) were used, NaCl concentration in buffer was increased linearly from 25 mM to 400 mM.



# Fig. S3

Fluorescence image of a droplet formed by  $P_{50}N_{525}$  (25  $\mu$ M, 0.04% labelled) and  $P_{304-507}$  (50  $\mu$ M) and its intensity profile represent homogeneous protein distribution within the droplet.



#### Fig. S4. Secondary structural propensity of PLOOP

Population of  $\alpha$ -helical secondary structure of P<sub>LOOP</sub> showing 15% and 10% difference between the statistical coil ensemble (black line) and the selected ensemble using ASTEROIDS (red bars) for regions 405-411 and 433-438 respectively.



# Fig. S5. Dynamic behaviour of PLOOP

<sup>15</sup>N  $R_{1\rho}$  of  $P_{LOOP}$  (concentration 500µM),  $P_{XD}$  (concentration 500µM),  $P_{377-507}$  (concentration 100 µM) and  $P_{304-507}$  (concentration 100 µM) measured at 25°C, <sup>1</sup>H frequency of 850MHz. Information about the tetramerization domain is not available as resonances for this region are not observable under these experimental conditions.



Fig. S6 PLOOP remains unfolded in the context of phase separating protein constructs

 $^{1}$ H- $^{15}$ N HSQC spectrum of P<sub>304-507</sub> (red) (298K, phosphate buffer, 150mM salt and pH 6.0, 240  $\mu$ M, 200 increments, 20 scans) overlapped with P<sub>LOOP</sub> (orange, 100  $\mu$ M, 200 increments, 20 scans) and P<sub>XD</sub> (blue, 100  $\mu$ M, 400 increments, 16 scans), all spectra were recorded at  $^{1}$ H frequency of 700 MHz.



# Fig. S7 Sequence analysis of PLOOP

Measles virus phosphoprotein homologs were found using The Basic Local Alignment Search Tool (BLAST) from the Swiss-Prot database, non-truncated sequences were chosen for further analysis (110 sequences) and visualised using <u>https://weblogo.berkeley.edu</u> for residues 377-460.



**Fig. S8** NMR signals of both  $P_{50}N_{525}$  and  $P_{304-507}$  at phase separating conditions exhibit similar characteristics as for the same proteins in the dilute phase.  $R_{1\rho}$  profiles at 25°C 700 MHz for (A)  $P_{304-507}$  alone (100  $\mu$ M, grey) and with  $P_{50}N_{525}$  (10  $\mu$ M, salmon pink); (B)  $P_{50}N_{525}$  alone (100  $\mu$ M, grey) and with  $P_{304-507}$  (10  $\mu$ M, blue) measured at 25°C 850 MHz. Translational diffusion for (C)  $P_{304-507}$  alone (75  $\mu$ M, grey) and with  $P_{50}N_{525}$  (7.5  $\mu$ M salmon pink); (D)  $P_{50}N_{525}$  alone (75  $\mu$ M, grey) and with  $P_{304-507}$  (37.5  $\mu$ M, blue).

# Movie S1.

Droplets formed by  $P_{50}N_{525}$  (10  $\mu$ M) and  $P_{304-507}$  (100  $\mu$ M) highlighting examples of fusion upon touching within several seconds. The video speed is accelerated by a factor of 2. Scale bar is 24  $\mu$ M.

# Movie S2.

Fluorescence microscopy images showing RNA diffusing into droplets pre-formed by mixing  $P_{50}N_{525}$  (20  $\mu$ M) and  $P_{304-507}$  (80  $\mu$ M). Concentration of RNA was 200  $\mu$ M (with 10% labelled RNA-FAM). RNA was added on one side of the coverslip and spontaneously diffused in the sample, the time gap between images is 2 seconds. Scale bar is 240  $\mu$ m.

# Data S1. Chemical shift assignment of PLOOP

Phosphate buffer 50 mM, pH 6.0 NaCl 150 mM DTT 2 mM 298K

378110.825 $8.547$ 173.598 $45.1$ 379120.357 $8.075$ $176.122$ $55.6725$ 380124.46 $8.585$ - $51.967$ 381 $176.947$ $63.866$ 382116.607 $8.56$ $174.73$ $53.2185$ 383121.187 $7.868$ $174.841$ $51.963$ 384 $177.501$ $63.791$ 385 $112.628$ $8.307$ $174.57$ $62.221$ 386 $125.898$ $7.931$ $177.289$ $52.525$ 387 $120.012$ $8.261$ $176.157$ $54.3155$ 388 $119.453$ $7.975$ $175.915$ $62.016$ 389 $124.335$ $8.404$ $176.204$ $56.325$ 390 $122.421$ $8.158$ $175.570$ $60.769$ $391$ $123.769$ $8.544$ $175.475$ $50.978$ $392$ $176.839$ $63.799$ $393$ $118.767$ $8.237$ $176.206$ $54.675$ $394$ $121.208$ $7.801$ $176.957$ $54.8565$ $395$ $123.226$ $8.057$ $174.311$ $54.424$ $496$ $176.76$ $62.97$ $397$ $121.527$ $8.27$ $176.414$ $61.1525$ $398$ $125.462$ $8.209$ $176.664$ $61.0285$ $399$ $113.247$ $8.308$ $174.497$ $59.009$ $403$ $110.679$ $8.52$ - $45.643$ $404$ $120.718$ <th></th> <th>Ν</th> <th>Н</th> <th>СО</th> <th>CA</th>		Ν	Н	СО	CA
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394121.2087.801176.95754.8565395123.2268.057174.31154.424396176.7662.97397121.5278.27176.41461.1525398125.4628.209176.66461.0285399113.2478.508-45.27400120.7728.211175.36956.342401121.188.484176.52754.325402116.7918.308174.49759.009403110.6798.52-45.643404120.7188.015176.27756.2955405124.7628.311178.06452.741406121.3928.145177.41255.471407123.5438.137178.09252.8755408119.3728.186176.85456.8525409120.9598.032176.29962.8285410124.7258.154177.17255.149411122.0848.115176.17656.105412123.7818.196174.40454.235413176.95663.005414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419	393	118.767	8.237	176.206	54.675
395 $123.226$ $8.057$ $174.311$ $54.424$ $396$ $176.76$ $62.97$ $397$ $121.527$ $8.27$ $176.414$ $61.1525$ $398$ $125.462$ $8.209$ $176.664$ $61.0285$ $399$ $113.247$ $8.508$ - $45.27$ $400$ $120.772$ $8.211$ $175.369$ $56.342$ $401$ $121.18$ $8.484$ $176.527$ $54.325$ $402$ $116.791$ $8.308$ $174.497$ $59.009$ $403$ $110.679$ $8.52$ - $45.643$ $404$ $120.718$ $8.015$ $176.277$ $56.2955$ $405$ $124.762$ $8.311$ $178.064$ $52.741$ $406$ $121.392$ $8.145$ $177.412$ $55.471$ $407$ $123.543$ $8.137$ $176.299$ $62.8285$ $408$ $119.372$ $8.186$ $176.854$ $56.8525$ $409$ $120.959$ $8.032$ $176.299$ $62.8285$ $410$ $124.725$ $8.154$ $177.172$ $55.149$ $411$ $122.084$ $8.115$ $176.176$ $56.105$ $412$ $123.781$ $8.196$ $174.404$ $54.235$ $413$ $176.956$ $63.005$ $414$ $120.81$ $8.238$ $176.162$ $62.334$ $415$ $127.802$ $8.409$ $177.804$ $52.554$ $416$ $115.276$ $8.258$ $174.830$ $58.399$ $417$ $122.887$ $8.355$ $1$	394	121.208	7.801	176.957	54.8565
396 $176.76$ $62.97$ $397$ $121.527$ $8.27$ $176.414$ $61.1525$ $398$ $125.462$ $8.209$ $176.664$ $61.0285$ $399$ $113.247$ $8.508$ - $45.27$ $400$ $120.772$ $8.211$ $175.369$ $56.342$ $401$ $121.18$ $8.484$ $176.527$ $54.325$ $402$ $116.791$ $8.308$ $174.497$ $59.009$ $403$ $110.679$ $8.52$ - $45.643$ $404$ $120.718$ $8.015$ $176.277$ $56.2955$ $405$ $124.762$ $8.311$ $178.064$ $52.741$ $406$ $121.392$ $8.145$ $177.412$ $55.471$ $407$ $123.543$ $8.137$ $178.092$ $52.8755$ $408$ $119.372$ $8.186$ $176.854$ $56.8525$ $409$ $120.959$ $8.032$ $176.299$ $62.8285$ $410$ $124.725$ $8.154$ $177.172$ $55.149$ $411$ $122.084$ $8.115$ $176.176$ $56.105$ $412$ $123.781$ $8.196$ $174.404$ $54.235$ $413$ $176.956$ $63.005$ $414$ $120.81$ $8.238$ $176.162$ $62.334$ $415$ $127.802$ $8.409$ $177.804$ $52.554$ $416$ $115.276$ $8.258$ $174.830$ $58.399$ $417$ $122.887$ $8.355$ $176.364$ $56.477$ $418$ $121.129$ $8.35$ $17$	395	123.226	8.057	174.311	54.424
397 $121.527$ $8.27$ $176.414$ $61.1525$ $398$ $125.462$ $8.209$ $176.664$ $61.0285$ $399$ $113.247$ $8.508$ - $45.27$ $400$ $120.772$ $8.211$ $175.369$ $56.342$ $401$ $121.18$ $8.484$ $176.527$ $54.325$ $402$ $116.791$ $8.308$ $174.497$ $59.009$ $403$ $110.679$ $8.52$ - $45.643$ $404$ $120.718$ $8.015$ $176.277$ $56.2955$ $405$ $124.762$ $8.311$ $178.064$ $52.741$ $406$ $121.392$ $8.145$ $177.412$ $55.471$ $407$ $123.543$ $8.137$ $178.092$ $52.8755$ $408$ $119.372$ $8.186$ $176.854$ $56.8525$ $409$ $120.959$ $8.032$ $176.299$ $62.8285$ $410$ $124.725$ $8.154$ $177.172$ $55.149$ $411$ $122.084$ $8.115$ $176.176$ $56.105$ $412$ $123.781$ $8.196$ $174.404$ $54.235$ $413$ $176.956$ $63.005$ $414$ $120.81$ $8.238$ $176.162$ $62.334$ $415$ $127.802$ $8.409$ $177.804$ $52.554$ $416$ $115.276$ $8.258$ $174.830$ $58.399$ $417$ $122.887$ $8.355$ $176.364$ $56.477$ $418$ $121.129$ $8.35$ $176.079$ $56.0555$ $419$ $123.42$ $8.$	396	-	-	176.76	62.97
398 $125.462$ $8.209$ $176.664$ $61.0285$ $399$ $113.247$ $8.508$ - $45.27$ $400$ $120.772$ $8.211$ $175.369$ $56.342$ $401$ $121.18$ $8.484$ $176.527$ $54.325$ $402$ $116.791$ $8.308$ $174.497$ $59.009$ $403$ $110.679$ $8.52$ - $45.643$ $404$ $120.718$ $8.015$ $176.277$ $56.2955$ $405$ $124.762$ $8.311$ $178.064$ $52.741$ $406$ $121.392$ $8.145$ $177.412$ $55.471$ $407$ $123.543$ $8.137$ $178.092$ $52.8755$ $408$ $119.372$ $8.186$ $176.854$ $56.8525$ $409$ $120.959$ $8.032$ $176.299$ $62.8285$ $410$ $124.725$ $8.154$ $177.172$ $55.149$ $411$ $122.084$ $8.115$ $176.176$ $56.105$ $412$ $123.781$ $8.196$ $174.404$ $54.235$ $413$ $176.956$ $63.005$ $414$ $120.81$ $8.238$ $176.162$ $62.334$ $415$ $127.802$ $8.409$ $177.804$ $52.554$ $416$ $115.276$ $8.258$ $174.830$ $58.399$ $417$ $122.887$ $8.355$ $176.364$ $56.477$ $418$ $121.129$ $8.35$ $176.079$ $56.0555$ $419$ $123.42$ $8.248$ $177.496$ $55.307$	397	121.527	8.27	176.414	61.1525
399 $113.247$ $8.508$ $ 45.27$ $400$ $120.772$ $8.211$ $175.369$ $56.342$ $401$ $121.18$ $8.484$ $176.527$ $54.325$ $402$ $116.791$ $8.308$ $174.497$ $59.009$ $403$ $110.679$ $8.52$ $ 45.643$ $404$ $120.718$ $8.015$ $176.277$ $56.2955$ $405$ $124.762$ $8.311$ $178.064$ $52.741$ $406$ $121.392$ $8.145$ $177.412$ $55.471$ $407$ $123.543$ $8.137$ $178.092$ $52.8755$ $408$ $119.372$ $8.186$ $176.854$ $56.8525$ $409$ $120.959$ $8.032$ $176.299$ $62.8285$ $410$ $124.725$ $8.154$ $177.172$ $55.149$ $411$ $122.084$ $8.115$ $176.176$ $56.105$ $412$ $123.781$ $8.196$ $174.404$ $54.235$ $413$ $  176.956$ $63.005$ $414$ $120.81$ $8.238$ $176.162$ $62.334$ $415$ $127.802$ $8.409$ $177.804$ $52.554$ $416$ $115.276$ $8.258$ $174.830$ $58.399$ $417$ $122.887$ $8.355$ $176.364$ $56.477$ $418$ $121.129$ $8.35$ $176.079$ $56.0555$ $419$ $123.42$ $8.248$ $177.496$ $55.307$	398	125.462	8.209	176.664	61.0285
400 $120.772$ $8.211$ $175.369$ $56.342$ $401$ $121.18$ $8.484$ $176.527$ $54.325$ $402$ $116.791$ $8.308$ $174.497$ $59.009$ $403$ $110.679$ $8.52$ - $45.643$ $404$ $120.718$ $8.015$ $176.277$ $56.2955$ $405$ $124.762$ $8.311$ $178.064$ $52.741$ $406$ $121.392$ $8.145$ $177.412$ $55.471$ $407$ $123.543$ $8.137$ $178.092$ $52.8755$ $408$ $119.372$ $8.186$ $176.854$ $56.8525$ $409$ $120.959$ $8.032$ $176.299$ $62.8285$ $410$ $124.725$ $8.154$ $177.172$ $55.149$ $411$ $122.084$ $8.115$ $176.176$ $56.105$ $412$ $123.781$ $8.196$ $174.404$ $54.235$ $413$ $176.956$ $63.005$ $414$ $120.81$ $8.238$ $176.162$ $62.334$ $415$ $127.802$ $8.409$ $177.804$ $52.554$ $416$ $115.276$ $8.258$ $174.830$ $58.399$ $417$ $122.887$ $8.355$ $176.364$ $56.477$ $418$ $121.129$ $8.248$ $177.496$ $55.307$	399	113.247	8.508	-	45.27
401121.188.484176.52754.325402116.7918.308174.49759.009403110.6798.52-45.643404120.7188.015176.27756.2955405124.7628.311178.06452.741406121.3928.145177.41255.471407123.5438.137178.09252.8755408119.3728.186176.85456.8525409120.9598.032176.29962.8285410124.7258.154177.17255.149411122.0848.115176.17656.105412123.7818.196174.40454.235413176.95663.005414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	400	120.772	8.211	175.369	56.342
402 $116.791$ $8.308$ $174.497$ $59.009$ $403$ $110.679$ $8.52$ - $45.643$ $404$ $120.718$ $8.015$ $176.277$ $56.2955$ $405$ $124.762$ $8.311$ $178.064$ $52.741$ $406$ $121.392$ $8.145$ $177.412$ $55.471$ $407$ $123.543$ $8.137$ $178.092$ $52.8755$ $408$ $119.372$ $8.186$ $176.854$ $56.8525$ $409$ $120.959$ $8.032$ $176.299$ $62.8285$ $410$ $124.725$ $8.154$ $177.172$ $55.149$ $411$ $122.084$ $8.115$ $176.176$ $56.105$ $412$ $123.781$ $8.196$ $174.404$ $54.235$ $413$ $176.956$ $63.005$ $414$ $120.81$ $8.238$ $176.162$ $62.334$ $415$ $127.802$ $8.409$ $177.804$ $52.554$ $416$ $115.276$ $8.258$ $174.830$ $58.399$ $417$ $122.887$ $8.355$ $176.079$ $56.0555$ $419$ $123.42$ $8.248$ $177.496$ $55.307$	401	121.18	8.484	176.527	54.325
403 $110.679$ $8.52$ $ 45.643$ $404$ $120.718$ $8.015$ $176.277$ $56.2955$ $405$ $124.762$ $8.311$ $178.064$ $52.741$ $406$ $121.392$ $8.145$ $177.412$ $55.471$ $407$ $123.543$ $8.137$ $178.092$ $52.8755$ $408$ $119.372$ $8.186$ $176.854$ $56.8525$ $409$ $120.959$ $8.032$ $176.299$ $62.8285$ $410$ $124.725$ $8.154$ $177.172$ $55.149$ $411$ $122.084$ $8.115$ $176.176$ $56.105$ $412$ $123.781$ $8.196$ $174.404$ $54.235$ $413$ $176.956$ $63.005$ $414$ $120.81$ $8.238$ $176.162$ $62.334$ $415$ $127.802$ $8.409$ $177.804$ $52.554$ $416$ $115.276$ $8.258$ $174.830$ $58.399$ $417$ $122.887$ $8.355$ $176.079$ $56.0555$ $419$ $123.42$ $8.248$ $177.496$ $55.307$	402	116.791	8.308	174.497	59.009
404120.7188.015176.27756.2955405124.7628.311178.06452.741406121.3928.145177.41255.471407123.5438.137178.09252.8755408119.3728.186176.85456.8525409120.9598.032176.29962.8285410124.7258.154177.17255.149411122.0848.115176.17656.105412123.7818.196174.40454.235413176.95663.005414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	403	110.679	8.52		45.643
405124.7628.311178.06452.741406121.3928.145177.41255.471407123.5438.137178.09252.8755408119.3728.186176.85456.8525409120.9598.032176.29962.8285410124.7258.154177.17255.149411122.0848.115176.17656.105412123.7818.196174.40454.235413176.95663.005414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	404	120.718	8.015	176.277	56.2955
406121.3928.145177.41255.471407123.5438.137178.09252.8755408119.3728.186176.85456.8525409120.9598.032176.29962.8285410124.7258.154177.17255.149411122.0848.115176.17656.105412123.7818.196174.40454.235413176.95663.005414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	405	124.762	8.311 0.145	177 410	52.741
407123.5438.137178.09252.8755408119.3728.186176.85456.8525409120.9598.032176.29962.8285410124.7258.154177.17255.149411122.0848.115176.17656.105412123.7818.196174.40454.235413176.95663.005414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	406	121.392	8.145	170.000	55.4/1
408119.3728.186176.83456.8325409120.9598.032176.29962.8285410124.7258.154177.17255.149411122.0848.115176.17656.105412123.7818.196174.40454.235413176.95663.005414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	407	123.543	8.13/	176.092	52.8/55
409120.9598.032176.29962.8285410124.7258.154177.17255.149411122.0848.115176.17656.105412123.7818.196174.40454.235413176.95663.005414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	408	119.372	0.100	176.834	56.8525
410124.7258.154177.17255.149411122.0848.115176.17656.105412123.7818.196174.40454.235413176.95663.005414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	409	120.959	8.U3Z	170.299	62.8283 EE 140
411122.0848.113176.17656.103412123.7818.196174.40454.235413176.95663.005414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	410 411	124.725	8.104 0.115	$\perp$ / / · $\perp$ / Z	55.149
412123.7818.196174.40434.233413176.95663.005414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	411 410	122.004	0.115	174 404	50.105
413176.93663.003414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	412 /12	123./01	0.190	176 056	54.255 62.005
414120.818.238176.16262.334415127.8028.409177.80452.554416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	413 /1/	120 81	6 730 -	176 162	62 334
415127.8028.409177.80452.534416115.2768.258174.83058.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	717 715	127 802	0.230 8 //Q	177 804	02.JJ4 52 551
410113.2700.230174.03038.399417122.8878.355176.36456.477418121.1298.35176.07956.0555419123.428.248177.49655.307	416	115 276	0.409 8 258	174 830	52.JJ4 58 300
417122.0070.333170.30430.477418121.1298.35176.07956.0555419123.428.248177.49655.307	417	122 887	0.200 8 355	176 36/	56 477
419 123.42 8.248 177.496 55.307	418	121 129	8 35	176 079	56 0555
119 120.12 0.210 1/1.190 00.001	419	123 42	8 248	177 496	55 307
420 120.78 8.343 176 515 56 2045	420	120.78	8.343	176.515	56.2045

421	109.802	8.418	174.26	45.393
422	119.745	8.205	176.704	55.594
423	114.736	8.223	174.476	61.8445
424	120.912	8.501	175.683	53.414
425	108.94	8.403	174.228	53.7865
426	120.423	8.187	176.710	56.241
427	114.908	8.237	174.672	61.821
428	118.005	8.367	174.731	58.2235
429	118.119	8.451	174.817	58.525
430	122.69	8.385	177.03	56.721
431	109.341	8.398	174.29	45.52
432	119.83	8.141	176.09	55.967
433	123.153	8.263	177.379	55.401
434	122.777	8.158	177.498	55.2965
435	121.688	8.193	176.799	56.7215
436	120.792	8.358	176.455	57.0605
437	120.096	8.107	175.580	57.8815
438	121.372	8.069	175.441	55.6295
439	123.226	8.121	176.98	55.143
440	123.287	8.188	174.287	54.016
441	_	_	176.959	63.176
442	121.382	8.249	176.902	61.241
443	112.707	8.41	173.911	53.479
444	121.208	8.16	176.546	56.162
445	122.953	8.381	176.632	56.408
446	122.294	8.461	176.3	47.0785
447	117.099	8.336	174.536	58.301
448	117.699	8.32	174.152	58.23
449	125.997	8.287	177.706	52.516
450	119.024	8.046	176.698	62.557
451	112.3	8.384	173.454	53.363
452	120.551	8.035	175.076	57.809
453	125.899	8.014	173.687	59.259
454	-	_	176.44	62.95
455	120.785	8.452	176.577	54.386
456	113.322	8.066	174.994	61.418
457	111.182	8.317	-	44.798
458	-	_	177.126	63.412
459	123.569	8.419	177.996	52.58
460	114.92	8.183	174.749	58.295