



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 05:01 PM UTC

PDB ID : 7VVA / pdb_00007vva
Title : Pseudouridine bound structure of Pseudouridine kinase (PUKI) from Escherichia coli strain B
Authors : Kim, S.H.; Rhee, S.
Deposited on : 2021-11-05
Resolution : 2.75 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

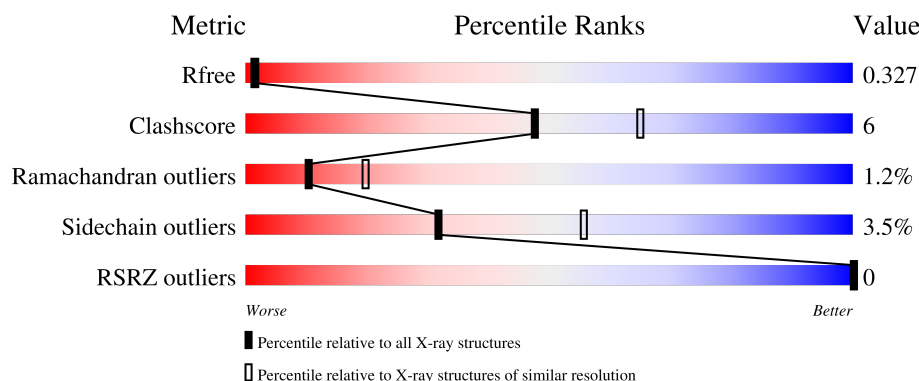
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.75 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1009 (2.76-2.76)
Clashscore	190562	1044 (2.76-2.76)
Ramachandran outliers	187476	1024 (2.76-2.76)
Sidechain outliers	187428	1024 (2.76-2.76)
RSRZ outliers	180081	1009 (2.76-2.76)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	313	 83% 12% . .
1	B	313	 77% 17% . .
1	C	313	 80% 14% . 5%
1	D	313	 80% 14% . .
1	E	313	 76% 18% . .

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Mol	Chain	Length	Quality of chain
1	F	313	 73%10% • 16%
1	G	313	 52%11% • 36%
1	H	313	 35%9%55%

2 Entry composition

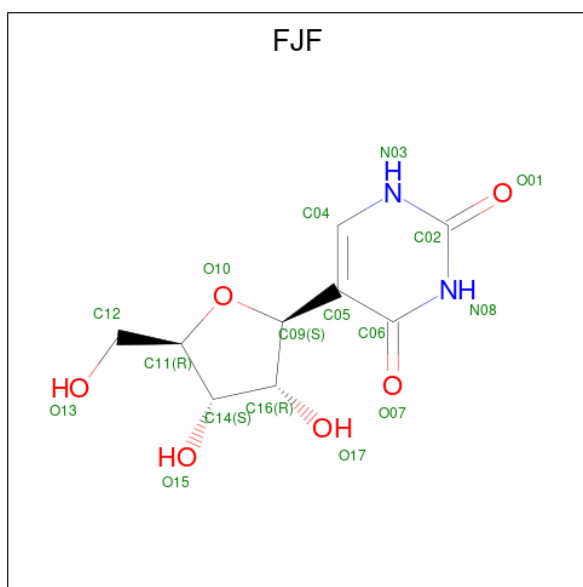
There are 3 unique types of molecules in this entry. The entry contains 15761 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Pseudouridine kinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	303	Total	C	N	O	S	0	0	0
			2272	1428	392	440	12			
1	B	299	Total	C	N	O	S	0	0	0
			2243	1410	389	432	12			
1	C	298	Total	C	N	O	S	0	0	0
			2231	1404	385	430	12			
1	D	302	Total	C	N	O	S	0	0	0
			2256	1421	387	436	12			
1	E	300	Total	C	N	O	S	0	0	0
			2222	1400	384	426	12			
1	F	262	Total	C	N	O	S	0	0	0
			1917	1205	326	375	11			
1	G	201	Total	C	N	O	S	0	0	0
			1468	926	240	296	6			
1	H	140	Total	C	N	O	S	0	0	0
			1050	670	172	205	3			

- Molecule 2 is 5-[(2 {S},3 {R},4 {S},5 {R})-5-(hydroxymethyl)-3,4-bis(oxidanyl)oxolan-2-yl]-1 {H}-pyrimidine-2,4-dione (CCD ID: FJF) (formula: C₉H₁₂N₂O₆) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			17	9	2	6		
2	B	1	Total	C	N	O	0	0
			17	9	2	6		
2	C	1	Total	C	N	O	0	0
			17	9	2	6		
2	D	1	Total	C	N	O	0	0
			17	9	2	6		

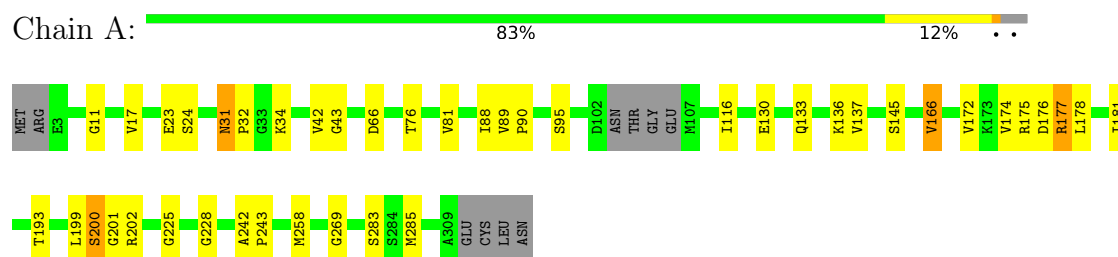
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	7	Total	O	0	0
			7	7		
3	B	11	Total	O	0	0
			11	11		
3	C	4	Total	O	0	0
			4	4		
3	D	5	Total	O	0	0
			5	5		
3	E	3	Total	O	0	0
			3	3		
3	G	1	Total	O	0	0
			1	1		
3	H	3	Total	O	0	0
			3	3		

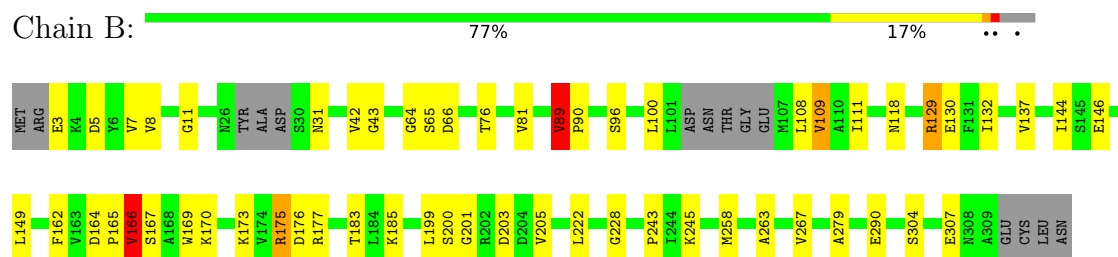
3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

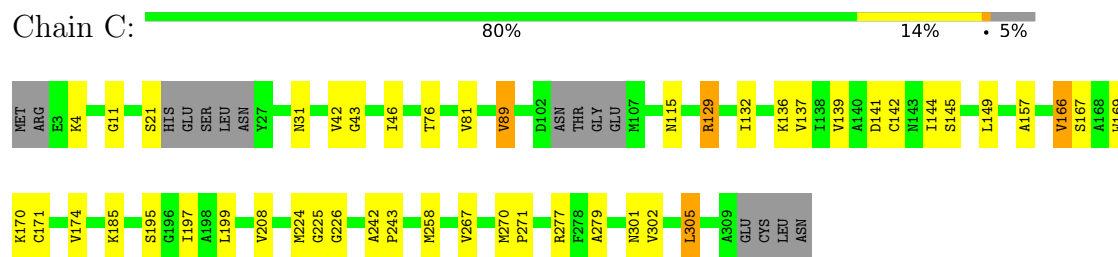
• Molecule 1: Pseudouridine kinase



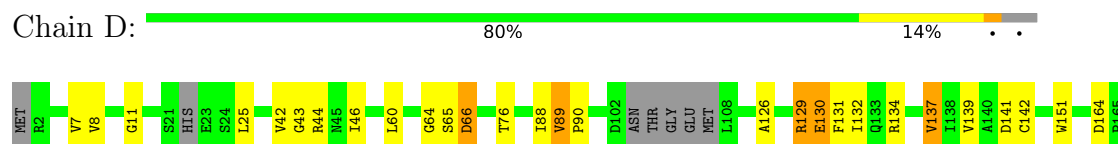
• Molecule 1: Pseudouridine kinase



• Molecule 1: Pseudouridine kinase



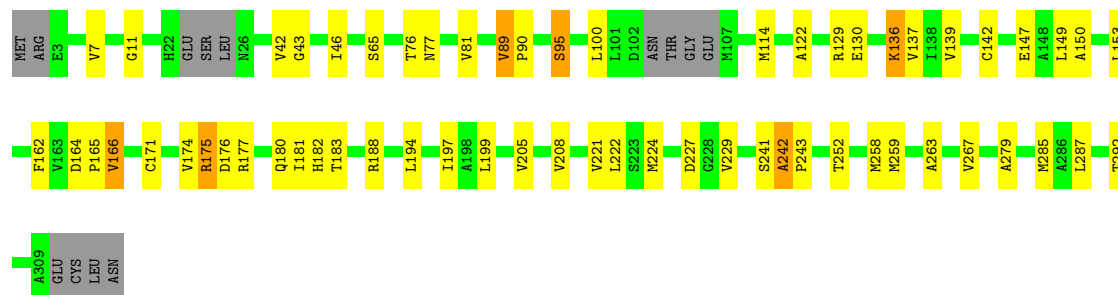
• Molecule 1: Pseudouridine kinase





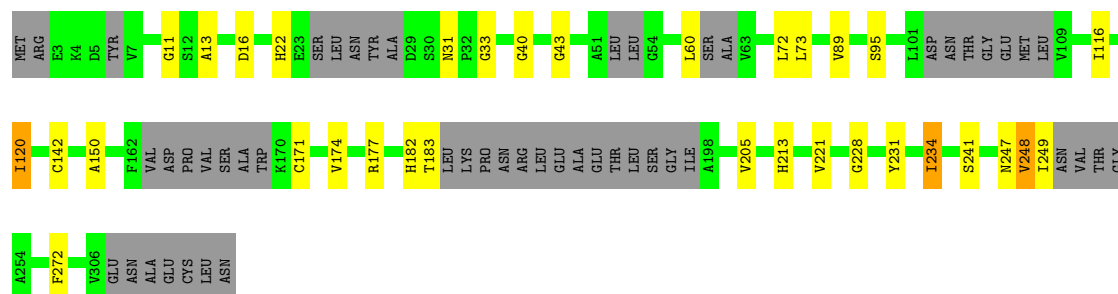
- Molecule 1: Pseudouridine kinase

Chain E: 76% 18% . .



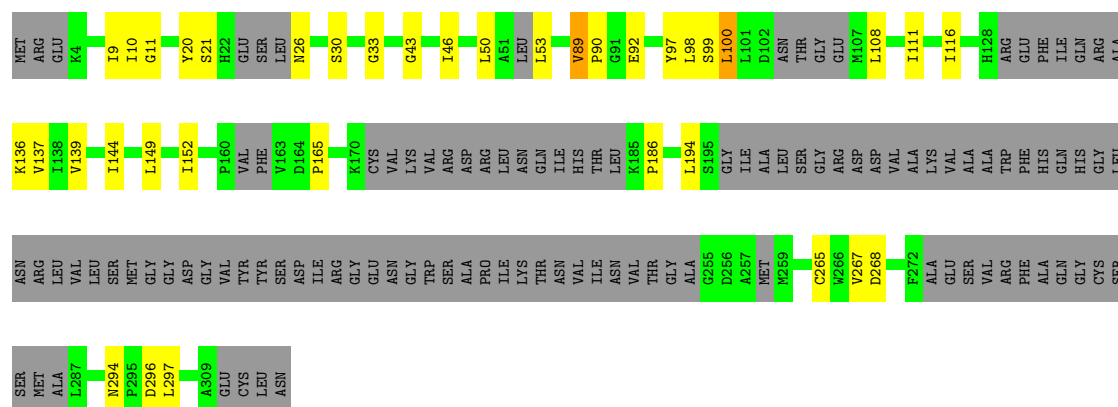
- Molecule 1: Pseudouridine kinase

Chain F: 73% 10% . 16%



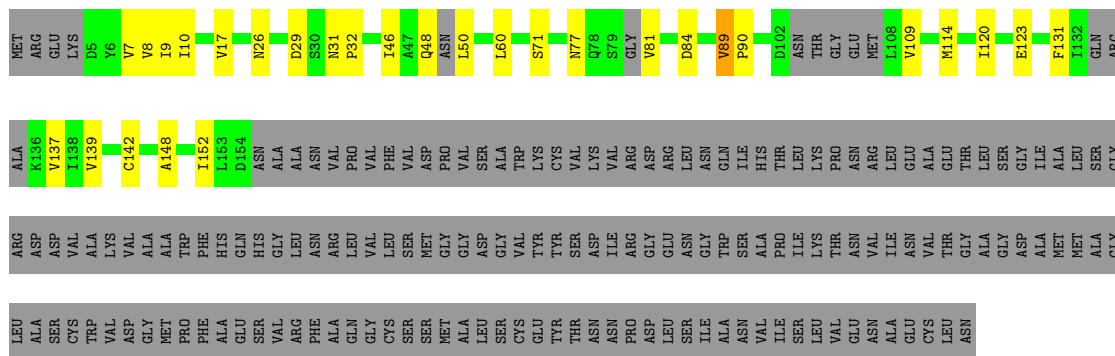
- Molecule 1: Pseudouridine kinase

Chain G: 52% 11% . 36%



- Molecule 1: Pseudouridine kinase

Chain H: 35% 9% 55%



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	71.95Å 271.89Å 101.20Å 90.00° 110.91° 90.00°	Depositor
Resolution (Å)	33.64 – 2.75 33.64 – 2.75	Depositor EDS
% Data completeness (in resolution range)	98.2 (33.64-2.75) 91.7 (33.64-2.75)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.51 (at 2.76Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.296 , 0.325 0.302 , 0.327	Depositor DCC
R_{free} test set	1993 reflections (2.16%)	wwPDB-VP
Wilson B-factor (Å ²)	44.8	Xtriage
Anisotropy	0.210	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 25.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.40$, $\langle L^2 \rangle = 0.22$	Xtriage
Estimated twinning fraction	0.410 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	15761	wwPDB-VP
Average B, all atoms (Å ²)	69.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.86% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: FJF

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# $ Z > 5$	RMSZ	# $ Z > 5$
1	A	0.30	0/2313	0.79	3/3149 (0.1%)
1	B	0.32	0/2281	0.78	1/3101 (0.0%)
1	C	0.31	0/2269	0.81	1/3086 (0.0%)
1	D	0.31	0/2295	0.81	7/3124 (0.2%)
1	E	0.37	0/2262	0.88	6/3084 (0.2%)
1	F	0.32	0/1945	0.85	3/2643 (0.1%)
1	G	0.26	0/1487	0.71	1/2027 (0.0%)
1	H	0.26	0/1064	0.73	1/1446 (0.1%)
All	All	0.31	0/15916	0.81	23/21660 (0.1%)

There are no bond length outliers.

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	F	31	ASN	CA-C-N	6.71	126.70	119.78
1	F	31	ASN	C-N-CA	6.71	126.70	119.78
1	B	89	VAL	N-CA-C	6.70	114.53	107.76
1	C	89	VAL	N-CA-C	6.48	113.45	107.56
1	D	89	VAL	N-CA-C	6.22	113.22	107.56
1	E	181	ILE	N-CA-C	6.08	116.68	108.17
1	G	89	VAL	N-CA-C	6.08	113.90	107.76
1	E	221	VAL	N-CA-C	5.77	114.66	106.53
1	A	202	ARG	N-CA-C	-5.56	106.55	113.38
1	F	205	VAL	N-CA-C	-5.46	105.03	113.16
1	E	164	ASP	CA-C-N	5.33	124.99	119.56
1	E	164	ASP	C-N-CA	5.33	124.99	119.56
1	E	242	ALA	CA-C-N	5.29	125.05	119.76
1	E	242	ALA	C-N-CA	5.29	125.05	119.76
1	D	89	VAL	CA-C-N	5.13	126.26	119.84
1	D	89	VAL	C-N-CA	5.13	126.26	119.84

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	226	GLY	N-CA-C	-5.11	104.74	112.41
1	D	164	ASP	CA-C-N	5.10	124.76	119.56
1	D	164	ASP	C-N-CA	5.10	124.76	119.56
1	A	31	ASN	CA-C-N	5.10	125.03	119.78
1	A	31	ASN	C-N-CA	5.10	125.03	119.78
1	D	205	VAL	N-CA-C	-5.08	105.59	113.16
1	H	89	VAL	N-CA-C	5.06	113.43	107.77

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2272	0	2216	24	0
1	B	2243	0	2210	29	0
1	C	2231	0	2193	23	0
1	D	2256	0	2202	29	0
1	E	2222	0	2149	34	0
1	F	1917	0	1807	14	0
1	G	1468	0	1387	20	0
1	H	1050	0	1027	9	0
2	A	17	0	0	0	0
2	B	17	0	0	0	0
2	C	17	0	0	0	0
2	D	17	0	0	0	0
3	A	7	0	0	0	0
3	B	11	0	0	0	0
3	C	4	0	0	1	0
3	D	5	0	0	0	0
3	E	3	0	0	0	0
3	G	1	0	0	0	0
3	H	3	0	0	0	0
All	All	15761	0	15191	173	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including

hydrogen atoms). The all-atom clashscore for this structure is 6.

All (173) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:213:HIS:HB3	1:F:234:ILE:HD13	1.57	0.85
1:E:129:ARG:NH1	1:E:130:GLU:OE2	2.21	0.73
1:E:188:ARG:HG2	1:E:199:LEU:HD22	1.71	0.72
1:F:11:GLY:HA3	1:F:43:GLY:HA3	1.75	0.68
1:D:129:ARG:O	1:D:132:ILE:N	2.28	0.66
1:F:142:CYS:HB2	1:F:171:CYS:HB3	1.78	0.66
1:D:42:VAL:HG21	1:D:166:VAL:HG13	1.76	0.65
1:E:197:ILE:HB	1:E:208:VAL:HG22	1.77	0.65
1:G:165:PRO:HG2	1:G:186:PRO:HB3	1.79	0.65
1:D:46:ILE:HG21	1:D:139:VAL:HG11	1.78	0.65
1:B:8:VAL:HG11	1:B:132:ILE:HG12	1.78	0.64
1:C:167:SER:HG	1:C:169:TRP:CD1	2.16	0.64
1:D:44:ARG:HH11	1:D:76:THR:HG22	1.63	0.64
1:A:42:VAL:HG21	1:A:166:VAL:HG13	1.79	0.64
1:A:258:MET:HG3	1:A:283:SER:HB2	1.81	0.63
1:D:64:GLY:O	1:D:66:ASP:N	2.32	0.62
1:D:64:GLY:C	1:D:66:ASP:H	2.07	0.62
1:D:248:VAL:HG11	1:D:251:VAL:HG12	1.81	0.62
1:G:294:ASN:HB2	1:G:297:LEU:HB2	1.81	0.62
1:E:65:SER:HB3	1:E:90:PRO:HA	1.82	0.61
1:B:185:LYS:HD2	1:B:258:MET:HE3	1.82	0.61
1:G:11:GLY:HA3	1:G:43:GLY:HA3	1.81	0.61
1:A:193:THR:O	1:D:172:VAL:HG21	2.01	0.61
1:B:228:GLY:HA2	1:B:243:PRO:HG3	1.82	0.60
1:D:7:VAL:HG13	1:D:137:VAL:HG12	1.85	0.59
1:D:11:GLY:HA3	1:D:43:GLY:HA3	1.84	0.59
1:E:76:THR:HG22	1:E:81:VAL:HB	1.84	0.59
1:D:258:MET:HG2	1:D:283:SER:HB2	1.85	0.59
1:A:174:VAL:HB	1:A:181:ILE:HD11	1.86	0.58
1:C:76:THR:HG22	1:C:81:VAL:HB	1.86	0.58
1:G:89:VAL:HB	1:G:116:ILE:HD11	1.86	0.57
1:E:46:ILE:HG21	1:E:139:VAL:HG11	1.86	0.57
1:C:242:ALA:O	1:C:277:ARG:NH1	2.37	0.57
1:F:150:ALA:HA	1:F:177:ARG:HH12	1.69	0.57
1:C:42:VAL:HG21	1:C:166:VAL:HG13	1.86	0.56
1:B:167:SER:HB3	1:B:170:LYS:HG2	1.87	0.56
1:B:258:MET:HG3	1:B:279:ALA:HB1	1.88	0.56
1:G:144:ILE:HB	1:G:149:LEU:HG	1.87	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:42:VAL:HG21	1:E:166:VAL:HG13	1.87	0.56
1:C:302:VAL:O	1:C:305:LEU:HD22	2.06	0.55
1:B:129:ARG:O	1:B:132:ILE:N	2.39	0.55
1:H:9:ILE:HG13	1:H:139:VAL:HB	1.88	0.55
1:F:247:ASN:O	1:F:249:ILE:HG13	2.07	0.54
1:D:11:GLY:HA2	1:D:141:ASP:OD1	2.06	0.54
1:C:301:ASN:O	1:C:305:LEU:HD13	2.08	0.54
1:E:258:MET:HG3	1:E:279:ALA:HB1	1.88	0.54
1:G:136:LYS:HG3	1:G:137:VAL:HG23	1.90	0.54
1:H:26:ASN:ND2	1:H:29:ASP:OD2	2.41	0.54
1:B:165:PRO:O	1:B:167:SER:N	2.40	0.54
1:C:11:GLY:HA2	1:C:141:ASP:OD1	2.08	0.53
1:C:195:SER:O	3:C:501:HOH:O	2.18	0.53
1:C:226:GLY:O	1:C:243:PRO:HG3	2.08	0.53
1:E:153:LEU:HD12	1:E:177:ARG:NH1	2.24	0.53
1:E:174:VAL:HG13	1:E:194:LEU:HD11	1.91	0.53
1:D:171:CYS:O	1:D:174:VAL:HG22	2.09	0.52
1:A:11:GLY:HA3	1:A:43:GLY:HA3	1.91	0.52
1:H:46:ILE:O	1:H:50:LEU:N	2.42	0.52
1:C:136:LYS:HD3	1:C:267:VAL:HB	1.93	0.51
1:E:150:ALA:HA	1:E:177:ARG:HH12	1.76	0.51
1:A:23:GLU:HG3	1:A:24:SER:H	1.76	0.51
1:C:171:CYS:O	1:C:174:VAL:HG22	2.11	0.51
1:F:120:ILE:HG13	1:F:120:ILE:O	2.11	0.51
1:G:100:LEU:HD12	1:G:108:LEU:HD12	1.92	0.51
1:B:100:LEU:HD11	1:G:100:LEU:HD23	1.92	0.50
1:C:11:GLY:HA3	1:C:43:GLY:HA3	1.92	0.50
1:D:129:ARG:O	1:D:131:PHE:N	2.45	0.50
1:F:228:GLY:HA3	1:F:241:SER:O	2.12	0.50
1:C:197:ILE:HB	1:C:208:VAL:HG22	1.93	0.49
1:E:136:LYS:HG2	1:E:267:VAL:HG13	1.95	0.49
1:D:8:VAL:HG13	1:D:60:LEU:HD13	1.95	0.48
1:E:162:PHE:HB3	1:E:259:MET:HE1	1.95	0.48
1:H:10:ILE:HG12	1:H:60:LEU:HB2	1.94	0.48
1:B:11:GLY:HA3	1:B:43:GLY:HA3	1.94	0.48
1:F:72:LEU:HD23	1:F:73:LEU:HD23	1.96	0.48
1:G:9:ILE:HG23	1:G:139:VAL:HB	1.95	0.48
1:D:142:CYS:HB3	1:D:170:LYS:O	2.14	0.48
1:B:64:GLY:C	1:B:66:ASP:H	2.22	0.47
1:B:3:GLU:HG2	1:B:5:ASP:H	1.79	0.47
1:B:144:ILE:HD11	1:B:149:LEU:HG	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:258:MET:HG3	1:C:279:ALA:HB1	1.96	0.47
1:D:64:GLY:C	1:D:66:ASP:N	2.72	0.47
1:E:11:GLY:HA3	1:E:43:GLY:HA3	1.97	0.47
1:B:304:SER:O	1:B:307:GLU:HB3	2.15	0.47
1:C:129:ARG:O	1:C:132:ILE:N	2.48	0.47
1:G:97:TYR:CE2	1:G:99:SER:HB3	2.50	0.47
1:F:182:HIS:ND1	1:F:183:THR:HG23	2.30	0.47
1:E:252:THR:HG22	1:E:292:THR:HG23	1.96	0.47
1:G:20:TYR:O	1:G:33:GLY:HA3	2.15	0.47
1:H:77:ASN:HA	1:H:81:VAL:O	2.16	0.46
1:B:111:ILE:HG12	1:G:21:SER:HB2	1.96	0.46
1:B:199:LEU:O	1:B:201:GLY:N	2.49	0.46
1:F:95:SER:HB3	1:F:116:ILE:HG22	1.97	0.46
1:A:199:LEU:C	1:A:201:GLY:H	2.24	0.45
1:F:13:ALA:HB1	1:F:72:LEU:HD21	1.98	0.45
1:F:16:ASP:CG	1:F:40:GLY:HA3	2.41	0.45
1:A:130:GLU:HA	1:A:133:GLN:HB2	1.99	0.45
1:A:200:SER:HB2	1:F:33:GLY:HA2	1.99	0.45
1:A:178:LEU:HD23	1:A:181:ILE:HD12	1.99	0.45
1:B:89:VAL:HA	1:B:90:PRO:HD3	1.79	0.45
1:G:10:ILE:N	1:G:139:VAL:O	2.48	0.45
1:D:129:ARG:O	1:D:130:GLU:C	2.60	0.45
1:E:188:ARG:HG2	1:E:199:LEU:CD2	2.45	0.44
1:D:185:LYS:HE3	1:D:185:LYS:HB3	1.84	0.44
1:G:265:CYS:HA	1:G:268:ASP:HB2	1.99	0.44
1:A:228:GLY:HA2	1:A:243:PRO:HG3	2.00	0.44
1:B:76:THR:HG22	1:B:81:VAL:HB	2.00	0.44
1:G:296:ASP:OD1	1:G:296:ASP:N	2.51	0.44
1:B:42:VAL:HG21	1:B:166:VAL:HB	1.99	0.44
1:E:171:CYS:O	1:E:194:LEU:HD21	2.18	0.44
1:D:89:VAL:HA	1:D:90:PRO:HD3	1.72	0.43
1:E:95:SER:OG	1:E:114:MET:HG2	2.18	0.43
1:E:122:ALA:HB2	1:E:147:GLU:HG2	1.98	0.43
1:E:153:LEU:HB3	1:E:180:GLN:HB3	2.00	0.43
1:H:89:VAL:HA	1:H:90:PRO:HD3	1.81	0.43
1:B:263:ALA:O	1:B:267:VAL:HG23	2.17	0.43
1:E:142:CYS:HB2	1:E:166:VAL:HG23	2.01	0.43
1:H:31:ASN:HA	1:H:32:PRO:HD3	1.93	0.43
1:A:199:LEU:O	1:A:201:GLY:N	2.49	0.43
1:D:137:VAL:HG11	1:D:263:ALA:HB1	2.01	0.43
1:A:172:VAL:HG21	1:D:193:THR:O	2.18	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:185:LYS:HB3	1:C:185:LYS:HE3	1.81	0.43
1:D:197:ILE:HB	1:D:208:VAL:HG22	2.00	0.43
1:F:231:TYR:HB2	1:F:272:PHE:CE2	2.54	0.43
1:A:175:ARG:C	1:A:177:ARG:H	2.27	0.43
1:D:204:ASP:O	1:D:208:VAL:HG23	2.18	0.43
1:E:175:ARG:C	1:E:177:ARG:H	2.27	0.43
1:A:88:ILE:O	1:A:90:PRO:HD3	2.19	0.42
1:C:142:CYS:HB3	1:C:170:LYS:O	2.19	0.42
1:B:7:VAL:HG13	1:B:137:VAL:HG23	2.00	0.42
1:B:162:PHE:CD2	1:B:183:THR:HB	2.55	0.42
1:E:188:ARG:HG2	1:E:199:LEU:HD13	2.01	0.42
1:B:175:ARG:C	1:B:177:ARG:H	2.28	0.42
1:E:242:ALA:HA	1:E:243:PRO:HD3	1.76	0.42
1:A:76:THR:HG22	1:A:81:VAL:HB	2.01	0.42
1:B:31:ASN:O	1:G:111:ILE:HA	2.19	0.42
1:E:77:ASN:HA	1:E:81:VAL:O	2.19	0.42
1:E:222:LEU:HB3	1:E:224:MET:HE1	2.01	0.42
1:B:205:VAL:HG13	1:B:222:LEU:HD23	2.01	0.42
1:E:142:CYS:SG	1:E:165:PRO:HA	2.60	0.42
1:A:136:LYS:HB3	1:A:136:LYS:HE2	1.88	0.42
1:A:269:GLY:HA3	1:C:157:ALA:HB1	2.01	0.42
1:E:263:ALA:O	1:E:267:VAL:HG23	2.20	0.42
1:A:31:ASN:HA	1:A:32:PRO:HD3	1.78	0.42
1:E:89:VAL:HA	1:E:90:PRO:HD3	1.88	0.42
1:B:64:GLY:O	1:B:66:ASP:N	2.53	0.41
1:H:148:ALA:O	1:H:152:ILE:HG23	2.20	0.41
1:B:164:ASP:HA	1:B:165:PRO:HD3	1.90	0.41
1:D:285:MET:HE2	1:D:285:MET:HB3	1.86	0.41
1:G:152:ILE:HD12	1:G:152:ILE:HA	1.81	0.41
1:A:285:MET:HE2	1:A:285:MET:HB3	1.88	0.41
1:D:204:ASP:HA	1:D:207:LYS:HG3	2.02	0.41
1:B:108:LEU:HG	1:B:109:VAL:HG23	2.02	0.41
1:C:199:LEU:HB3	1:C:224:MET:HE1	2.02	0.41
1:C:46:ILE:HG21	1:C:139:VAL:HG11	2.03	0.41
1:E:182:HIS:C	1:E:183:THR:HG1	2.28	0.41
1:A:242:ALA:HA	1:A:243:PRO:HD3	1.95	0.41
1:B:245:LYS:HD2	1:B:245:LYS:HA	1.78	0.41
1:E:149:LEU:HG	1:E:177:ARG:HH11	1.85	0.41
1:G:100:LEU:HD22	1:G:100:LEU:HA	1.83	0.41
1:A:17:VAL:HG11	1:H:17:VAL:HG21	2.02	0.41
1:A:95:SER:OG	1:A:116:ILE:HG22	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:270:MET:HA	1:C:271:PRO:HD3	1.93	0.41
1:B:146:GLU:HG3	1:B:173:LYS:HB2	2.02	0.40
1:C:21:SER:OG	1:C:31:ASN:HB3	2.21	0.40
1:C:144:ILE:HD11	1:C:149:LEU:HG	2.03	0.40
1:D:44:ARG:NH2	1:D:293:ASN:OD1	2.54	0.40
1:E:7:VAL:HG13	1:E:137:VAL:HG23	2.03	0.40
1:D:178:LEU:HA	1:D:181:ILE:HD12	2.02	0.40
1:D:126:ALA:HA	1:D:151:TRP:CZ2	2.57	0.40
1:G:46:ILE:O	1:G:50:LEU:HG	2.22	0.40
1:A:88:ILE:HG13	1:G:90:PRO:HG3	2.04	0.40
1:E:229:VAL:HB	1:E:241:SER:OG	2.22	0.40
1:E:285:MET:HE2	1:E:285:MET:HB3	1.90	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	299/313 (96%)	276 (92%)	19 (6%)	4 (1%)	9	18
1	B	293/313 (94%)	271 (92%)	14 (5%)	8 (3%)	4	7
1	C	292/313 (93%)	269 (92%)	20 (7%)	3 (1%)	12	24
1	D	296/313 (95%)	277 (94%)	15 (5%)	4 (1%)	9	17
1	E	294/313 (94%)	272 (92%)	18 (6%)	4 (1%)	9	17
1	F	244/313 (78%)	233 (96%)	10 (4%)	1 (0%)	30	50
1	G	181/313 (58%)	167 (92%)	13 (7%)	1 (1%)	21	38
1	H	130/313 (42%)	119 (92%)	11 (8%)	0	100	100
All	All	2029/2504 (81%)	1884 (93%)	120 (6%)	25 (1%)	10	20

All (25) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	129	ARG
1	B	130	GLU
1	D	65	SER
1	D	129	ARG
1	D	130	GLU
1	A	200	SER
1	A	225	GLY
1	B	65	SER
1	B	109	VAL
1	B	176	ASP
1	C	129	ARG
1	C	225	GLY
1	E	175	ARG
1	A	176	ASP
1	B	175	ARG
1	E	176	ASP
1	G	30	SER
1	B	200	SER
1	E	227	ASP
1	F	248	VAL
1	B	166	VAL
1	A	166	VAL
1	C	166	VAL
1	D	166	VAL
1	E	166	VAL

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	241/255 (94%)	235 (98%)	6 (2%)	42	64
1	B	240/255 (94%)	233 (97%)	7 (3%)	37	61
1	C	237/255 (93%)	231 (98%)	6 (2%)	42	64
1	D	238/255 (93%)	232 (98%)	6 (2%)	42	64
1	E	231/255 (91%)	225 (97%)	6 (3%)	40	63

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	F	197/255 (77%)	189 (96%)	8 (4%)	27	49
1	G	155/255 (61%)	148 (96%)	7 (4%)	24	46
1	H	112/255 (44%)	100 (89%)	12 (11%)	6	12
All	All	1651/2040 (81%)	1593 (96%)	58 (4%)	32	56

All (58) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	34	LYS
1	A	66	ASP
1	A	89	VAL
1	A	137	VAL
1	A	145	SER
1	A	177	ARG
1	B	89	VAL
1	B	96	SER
1	B	118	ASN
1	B	166	VAL
1	B	169	TRP
1	B	203	ASP
1	B	290	GLU
1	C	4	LYS
1	C	89	VAL
1	C	115	ASN
1	C	137	VAL
1	C	145	SER
1	C	305	LEU
1	D	25	LEU
1	D	66	ASP
1	D	88	ILE
1	D	134	ARG
1	D	137	VAL
1	D	277	ARG
1	E	89	VAL
1	E	95	SER
1	E	100	LEU
1	E	136	LYS
1	E	205	VAL
1	E	287	LEU
1	F	22	HIS
1	F	60	LEU

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Mol	Chain	Res	Type
1	F	89	VAL
1	F	120	ILE
1	F	174	VAL
1	F	221	VAL
1	F	234	ILE
1	F	248	VAL
1	G	26	ASN
1	G	53	LEU
1	G	92	GLU
1	G	98	LEU
1	G	100	LEU
1	G	194	LEU
1	G	267	VAL
1	H	7	VAL
1	H	8	VAL
1	H	48	GLN
1	H	71	SER
1	H	84	ASP
1	H	109	VAL
1	H	114	MET
1	H	120	ILE
1	H	123	GLU
1	H	131	PHE
1	H	137	VAL
1	H	142	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (26) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	55	ASN
1	B	55	ASN
1	B	70	GLN
1	B	155	ASN
1	C	155	ASN
1	C	218	ASN
1	C	308	ASN
1	D	55	ASN
1	D	77	ASN
1	D	78	GLN
1	D	213	HIS
1	D	218	ASN
1	E	55	ASN

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Mol	Chain	Res	Type
1	E	78	GLN
1	E	180	GLN
1	E	182	HIS
1	F	31	ASN
1	F	55	ASN
1	F	238	ASN
1	G	26	ASN
1	G	31	ASN
1	G	308	ASN
1	H	22	HIS
1	H	70	GLN
1	H	127	GLN
1	H	143	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

4 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	FJF	A	401	-	18,18,18	4.32	10 (55%)	22,26,26	1.94	6 (27%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	FJF	B	401	-	18,18,18	4.35	10 (55%)	22,26,26	2.01	6 (27%)
2	FJF	D	401	-	18,18,18	4.34	9 (50%)	22,26,26	2.06	7 (31%)
2	FJF	C	401	-	18,18,18	4.34	9 (50%)	22,26,26	2.03	6 (27%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	FJF	A	401	-	-	4/6/22/22	0/2/2/2
2	FJF	B	401	-	-	6/6/22/22	0/2/2/2
2	FJF	D	401	-	-	4/6/22/22	0/2/2/2
2	FJF	C	401	-	-	4/6/22/22	0/2/2/2

All (38) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	401	FJF	O10-C09	-11.70	1.27	1.43
2	C	401	FJF	O10-C09	-11.65	1.27	1.43
2	D	401	FJF	O10-C09	-11.53	1.27	1.43
2	A	401	FJF	O10-C09	-11.35	1.28	1.43
2	A	401	FJF	C14-C11	-9.49	1.28	1.53
2	C	401	FJF	C14-C11	-9.40	1.29	1.53
2	D	401	FJF	C14-C11	-9.39	1.29	1.53
2	B	401	FJF	C14-C11	-9.38	1.29	1.53
2	A	401	FJF	O10-C11	7.75	1.62	1.45
2	D	401	FJF	O10-C11	7.69	1.62	1.45
2	C	401	FJF	O10-C11	7.64	1.62	1.45
2	B	401	FJF	O10-C11	7.62	1.61	1.45
2	D	401	FJF	C04-C05	3.80	1.39	1.35
2	A	401	FJF	C04-C05	3.75	1.39	1.35
2	C	401	FJF	C04-C05	3.73	1.39	1.35
2	B	401	FJF	C04-C05	3.73	1.39	1.35
2	C	401	FJF	O15-C14	3.42	1.51	1.43
2	B	401	FJF	O15-C14	3.41	1.51	1.43
2	D	401	FJF	O15-C14	3.41	1.51	1.43
2	A	401	FJF	O15-C14	3.34	1.51	1.43
2	B	401	FJF	C06-N08	-2.66	1.33	1.38
2	A	401	FJF	C06-N08	-2.65	1.33	1.38
2	D	401	FJF	C09-C05	2.64	1.56	1.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	401	FJF	C06-N08	-2.62	1.33	1.38
2	C	401	FJF	C06-N08	-2.62	1.34	1.38
2	C	401	FJF	C09-C05	2.61	1.56	1.50
2	A	401	FJF	C09-C05	2.60	1.56	1.50
2	B	401	FJF	O17-C16	-2.58	1.36	1.43
2	D	401	FJF	O17-C16	-2.57	1.36	1.43
2	A	401	FJF	O17-C16	-2.57	1.36	1.43
2	B	401	FJF	C09-C05	2.52	1.56	1.50
2	C	401	FJF	O17-C16	-2.51	1.36	1.43
2	C	401	FJF	C02-N08	-2.13	1.34	1.37
2	B	401	FJF	C02-N08	-2.11	1.34	1.37
2	D	401	FJF	C02-N08	-2.09	1.34	1.37
2	A	401	FJF	C02-N08	-2.04	1.34	1.37
2	B	401	FJF	C06-C05	-2.00	1.38	1.44
2	A	401	FJF	C06-C05	-2.00	1.38	1.44

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	401	FJF	N03-C02-N08	4.90	120.33	115.17
2	A	401	FJF	N03-C02-N08	4.87	120.31	115.17
2	C	401	FJF	N03-C02-N08	4.79	120.22	115.17
2	D	401	FJF	N03-C02-N08	4.77	120.20	115.17
2	B	401	FJF	C06-N08-C02	-4.20	120.59	126.37
2	C	401	FJF	C06-N08-C02	-4.11	120.70	126.37
2	D	401	FJF	C06-N08-C02	-4.10	120.72	126.37
2	A	401	FJF	C06-N08-C02	-4.06	120.78	126.37
2	D	401	FJF	C16-C14-C11	3.00	108.40	102.61
2	D	401	FJF	C14-C16-C09	2.98	105.21	101.69
2	C	401	FJF	C16-C14-C11	2.80	108.01	102.61
2	C	401	FJF	C14-C16-C09	2.76	104.94	101.69
2	B	401	FJF	C16-C14-C11	2.73	107.88	102.61
2	A	401	FJF	O01-C02-N03	-2.65	120.06	122.79
2	B	401	FJF	C05-C04-N03	-2.60	118.53	122.14
2	B	401	FJF	O01-C02-N03	-2.53	120.18	122.79
2	C	401	FJF	O01-C02-N03	-2.51	120.20	122.79
2	C	401	FJF	C05-C04-N03	-2.51	118.66	122.14
2	D	401	FJF	O01-C02-N03	-2.50	120.21	122.79
2	D	401	FJF	C05-C04-N03	-2.46	118.73	122.14
2	A	401	FJF	C05-C04-N03	-2.36	118.87	122.14
2	A	401	FJF	C14-C16-C09	2.29	104.39	101.69
2	B	401	FJF	C14-C16-C09	2.13	104.21	101.69

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	401	FJF	C16-C14-C11	2.10	106.66	102.61
2	D	401	FJF	O10-C09-C16	2.01	107.93	105.15

There are no chirality outliers.

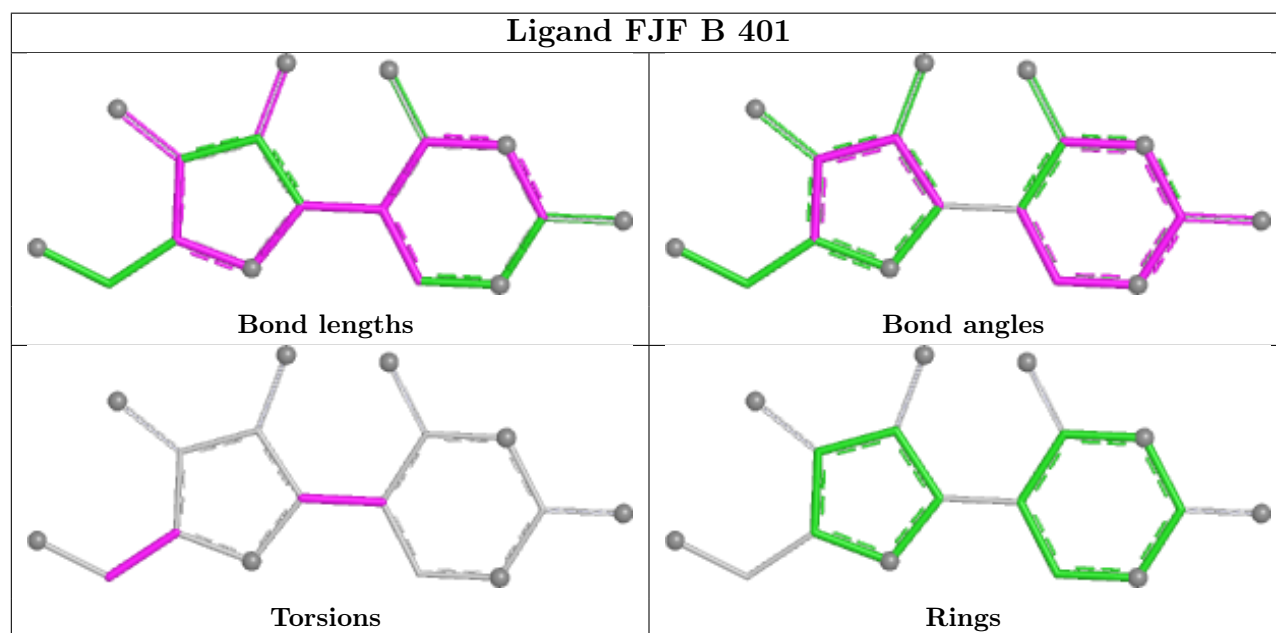
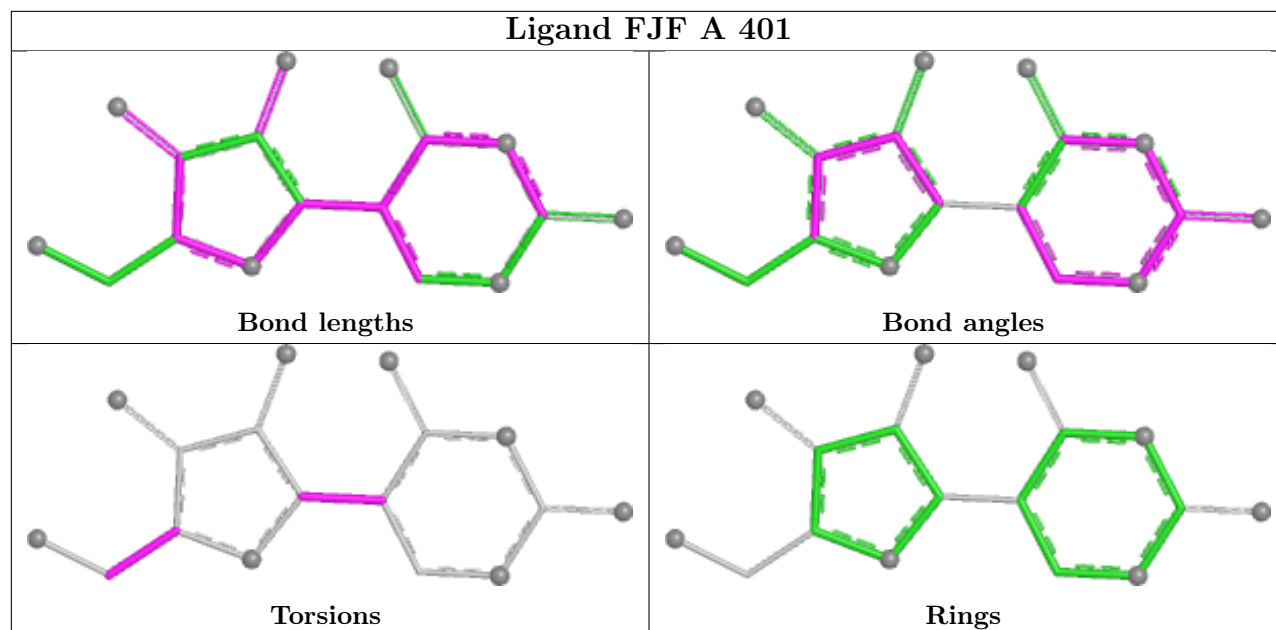
All (18) torsion outliers are listed below:

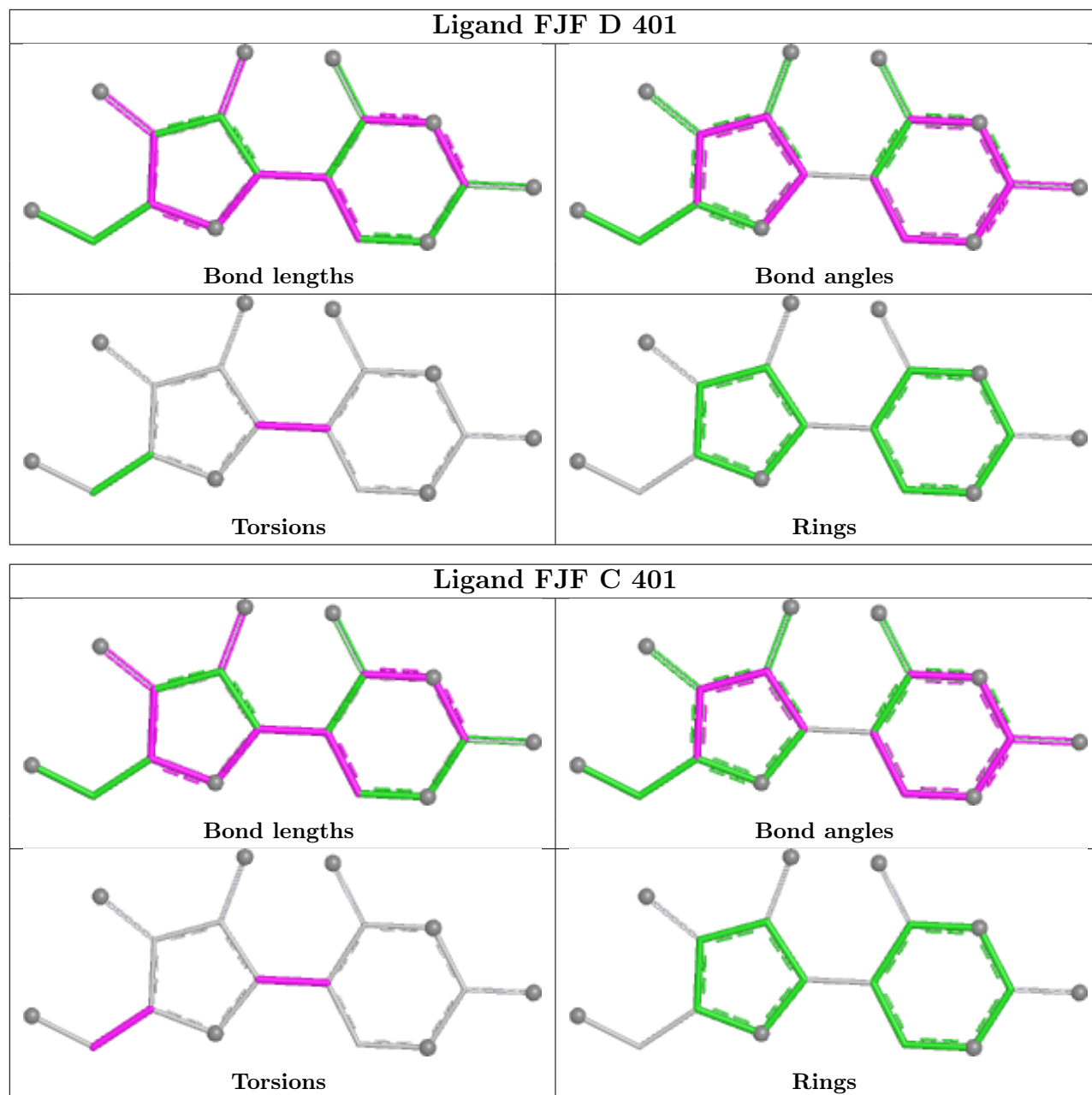
Mol	Chain	Res	Type	Atoms
2	A	401	FJF	C04-C05-C09-C16
2	A	401	FJF	C06-C05-C09-C16
2	A	401	FJF	O10-C11-C12-O13
2	B	401	FJF	C04-C05-C09-C16
2	B	401	FJF	C06-C05-C09-O10
2	B	401	FJF	C06-C05-C09-C16
2	B	401	FJF	O10-C11-C12-O13
2	C	401	FJF	C04-C05-C09-C16
2	C	401	FJF	C06-C05-C09-C16
2	D	401	FJF	C04-C05-C09-C16
2	D	401	FJF	C06-C05-C09-C16
2	A	401	FJF	C14-C11-C12-O13
2	B	401	FJF	C14-C11-C12-O13
2	C	401	FJF	C14-C11-C12-O13
2	D	401	FJF	C06-C05-C09-O10
2	B	401	FJF	C04-C05-C09-O10
2	D	401	FJF	C04-C05-C09-O10
2	C	401	FJF	O10-C11-C12-O13

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	303/313 (96%)	-1.47	0 100 100	26, 48, 84, 132	0
1	B	299/313 (95%)	-1.48	0 100 100	38, 53, 87, 122	0
1	C	298/313 (95%)	-1.45	0 100 100	24, 48, 80, 131	0
1	D	302/313 (96%)	-1.45	0 100 100	28, 54, 94, 130	0
1	E	300/313 (95%)	-1.29	0 100 100	47, 83, 112, 126	0
1	F	262/313 (83%)	-1.20	0 100 100	50, 96, 121, 138	0
1	G	201/313 (64%)	-1.21	0 100 100	39, 88, 118, 132	0
1	H	140/313 (44%)	-1.26	0 100 100	48, 80, 110, 139	0
All	All	2105/2504 (84%)	-1.37	0 100 100	24, 65, 112, 139	0

There are no RSRZ outliers to report.

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

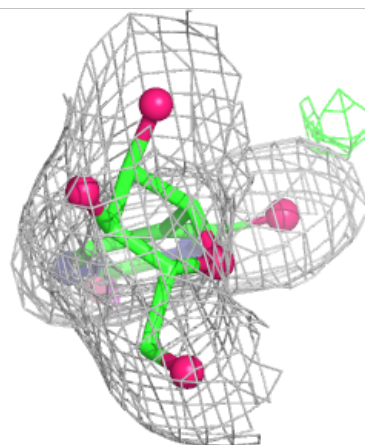
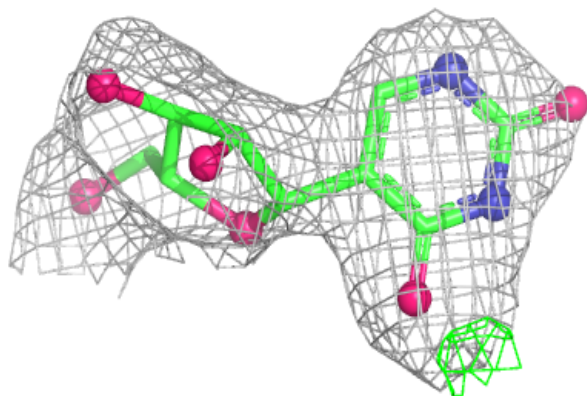
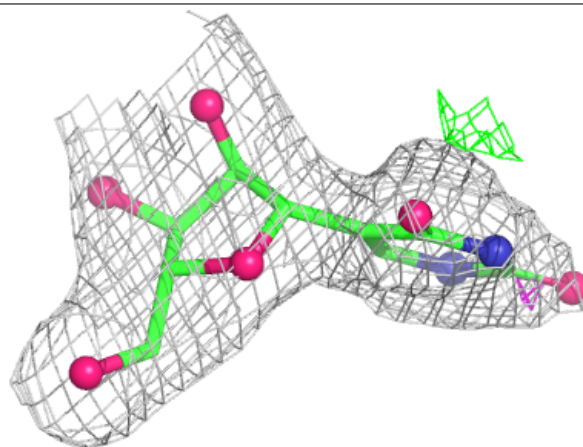
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	FJF	A	401	17/17	0.99	0.04	32,52,85,86	0
2	FJF	B	401	17/17	0.99	0.03	33,48,65,79	0
2	FJF	C	401	17/17	0.99	0.04	32,49,67,67	0
2	FJF	D	401	17/17	0.99	0.03	45,52,60,60	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

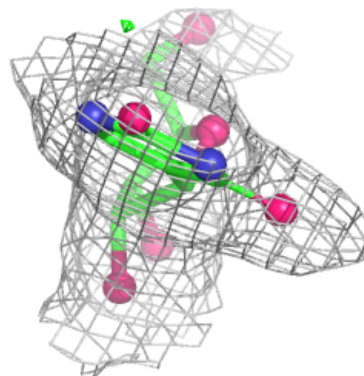
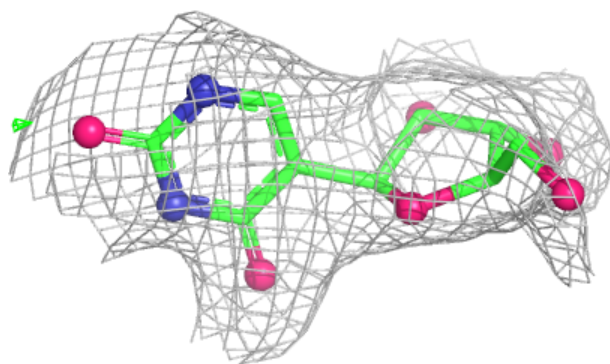
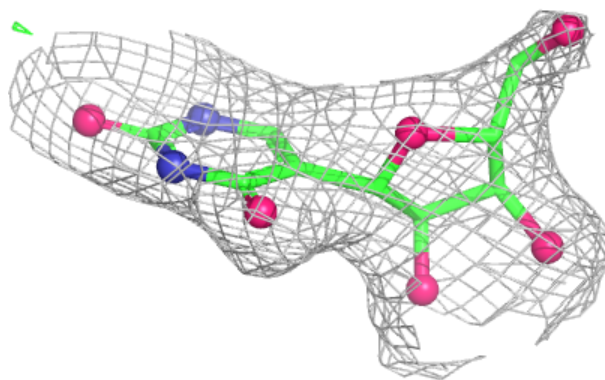
Electron density around FJF A 401:

2mF_o-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



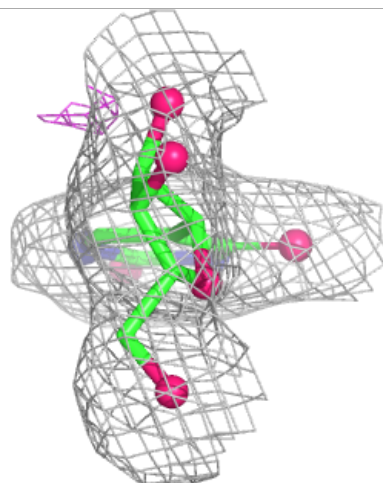
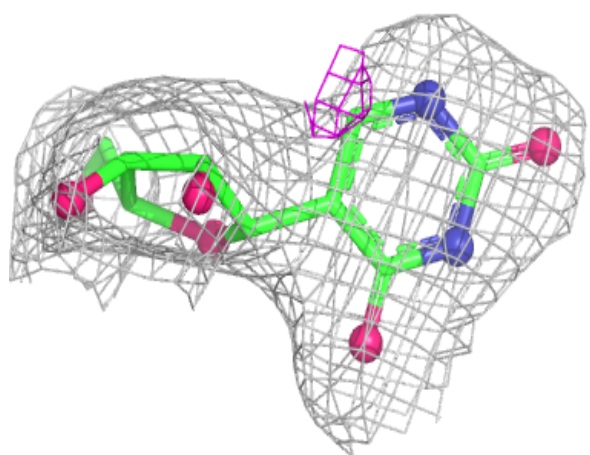
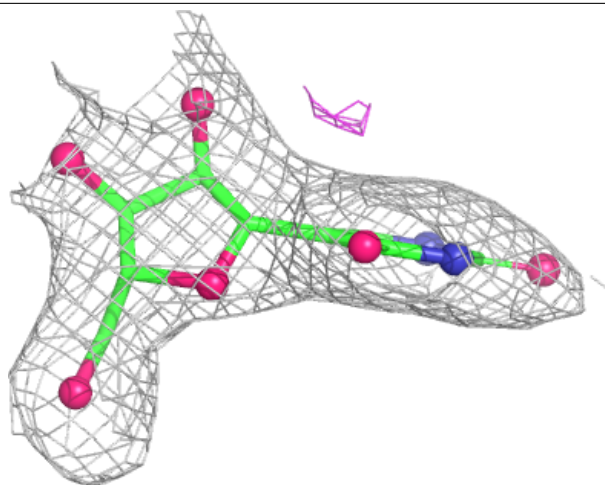
Electron density around FJF B 401:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



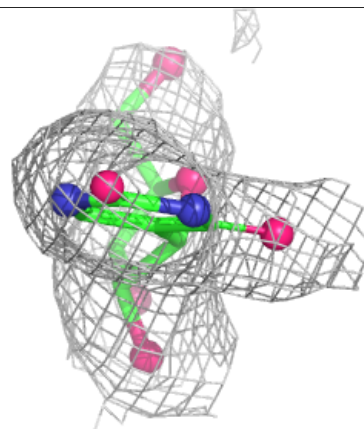
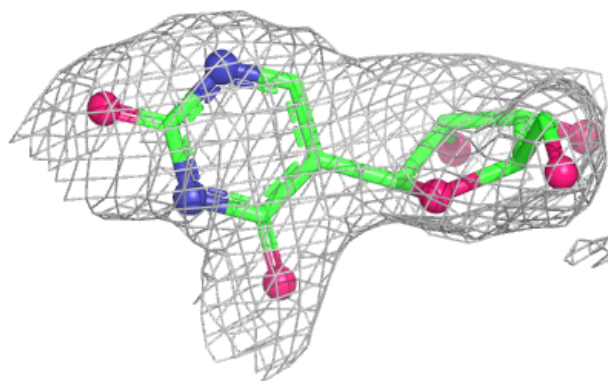
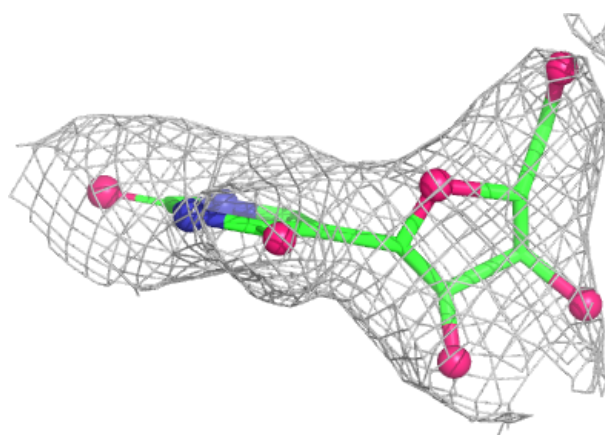
Electron density around FJF C 401:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around FJF D 401:

$2mF_o - DF_c$ (at 0.7 rmsd) in gray
 $mF_o - DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)



6.5 Other polymers [i](#)

There are no such residues in this entry.