



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 02:22 AM UTC

PDB ID : 6QXS / pdb_00006qxs
Title : Crystal structure of Enterococcus faecalis thymidylate synthase (EfTS) in complex with FdUMP
Authors : Pozzi, C.; Mangani, M.
Deposited on : 2019-03-07
Resolution : 2.88 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

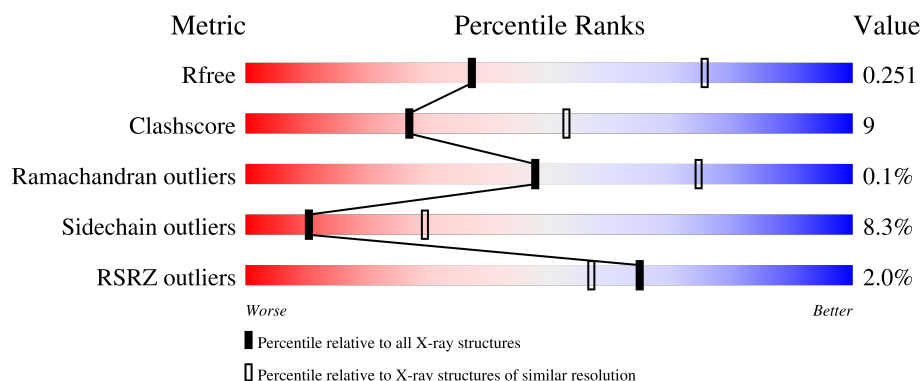
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

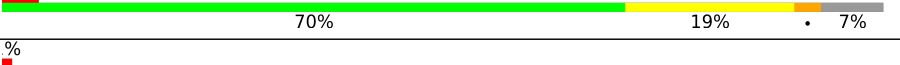
The reported resolution of this entry is 2.88 Å.

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	3557 (2.90-2.86)
Clashscore	190562	3801 (2.90-2.86)
Ramachandran outliers	187476	3699 (2.90-2.86)
Sidechain outliers	187428	3702 (2.90-2.86)
RSRZ outliers	180081	3558 (2.90-2.86)

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	315	 2% 72% 19% 7%
2	B	315	 77% 22%
2	C	315	 4% 70% 19% 7%
2	D	315	 % 73% 24%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	UFP	D	401	-	-	X	-

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 10117 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.

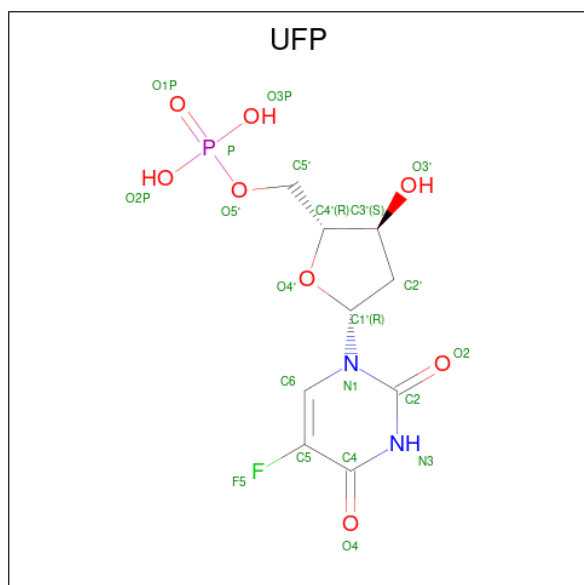
- Molecule 1 is a protein called Thymidylate synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	292	Total	C	N	O	S	0	0	0
			2311	1488	386	426	11			

- Molecule 2 is a protein called Thymidylate synthase.

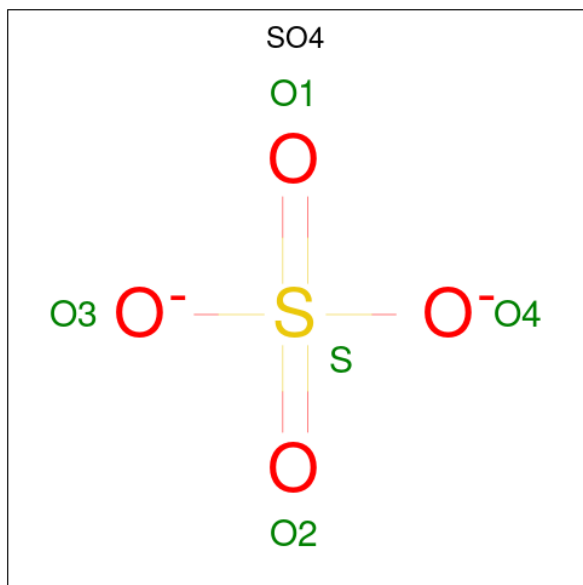
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	315	Total	C	N	O	S	0	0	0
			2546	1639	422	474	11			
2	C	292	Total	C	N	O	S	0	0	0
			2297	1485	381	421	10			
2	D	315	Total	C	N	O	S	0	0	0
			2516	1626	420	459	11			

- Molecule 3 is 5-FLUORO-2'-DEOXYURIDINE-5'-MONOPHOSPHATE (CCD ID: UFP) (formula: C₉H₁₂FN₂O₈P).



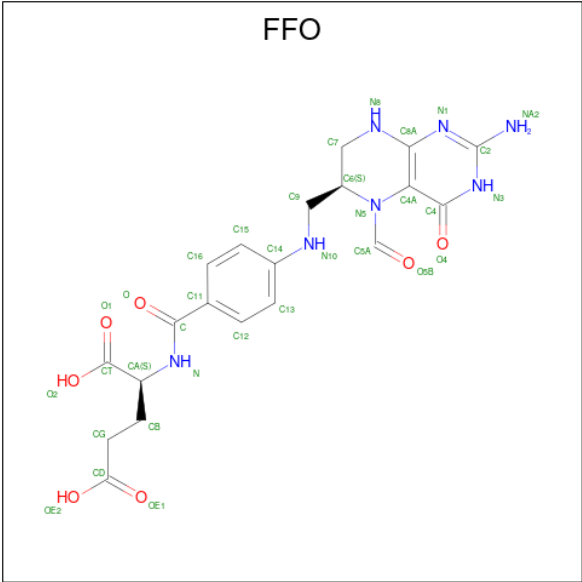
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	B	1	Total	C	F	N	O	P	0	0
			21	9	1	2	8	1		
3	D	1	Total	C	F	N	O	P	0	0
			21	9	1	2	8	1		

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is N-[4-({[(6S)-2-amino-5-formyl-4-oxo-3,4,5,6,7,8-hexahydropteridin-6-yl]methyl}amino)benzoyl]-L-glutamic acid (CCD ID: FFO) (formula: C₂₀H₂₃N₇O₇).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	B	1	Total	C	N	O	0	0
			34	20	7	7		
5	D	1	Total	C	N	O	0	0
			34	20	7	7		

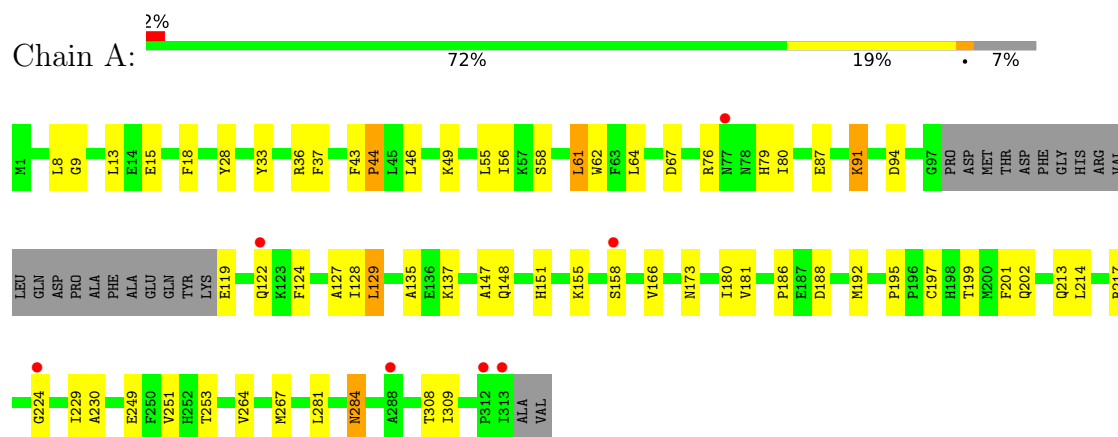
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	85	Total	O	0	0
			85	85		
6	B	94	Total	O	0	0
			94	94		
6	C	69	Total	O	0	0
			69	69		
6	D	79	Total	O	0	0
			79	79		

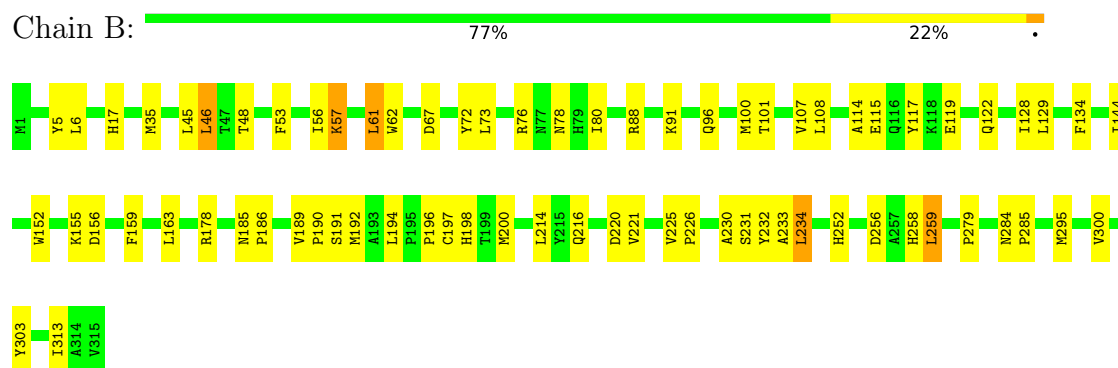
3 Residue-property plots [i](#)

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.

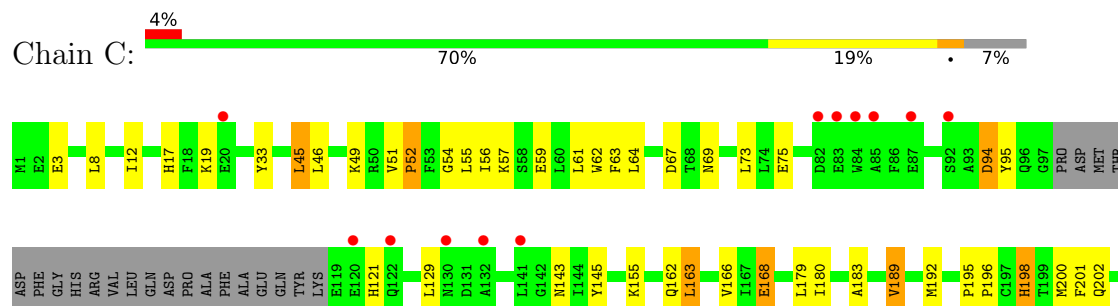
• Molecule 1: Thymidylate synthase



• Molecule 2: Thymidylate synthase

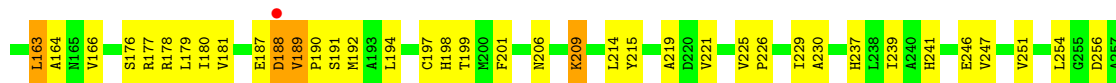
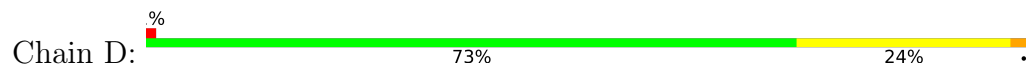


• Molecule 2: Thymidylate synthase





• Molecule 2: Thymidylate synthase



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	72.04Å 94.84Å 97.00Å 90.00° 94.01° 90.00°	Depositor
Resolution (Å)	96.76 – 2.88 96.76 – 2.88	Depositor EDS
% Data completeness (in resolution range)	94.4 (96.76-2.88) 94.4 (96.76-2.88)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.93 (at 2.86Å)	Xtriage
Refinement program	REFMAC 5.8.0238	Depositor
R, R_{free}	0.200 , 0.252 0.200 , 0.251	Depositor DCC
R_{free} test set	1350 reflections (4.55%)	wwPDB-VP
Wilson B-factor (Å ²)	36.4	Xtriage
Anisotropy	0.274	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 52.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	10117	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.85% 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: FFO, SO4, UFP, CME

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	0.61	1/2363 (0.0%)	1.23	10/3208 (0.3%)
2	B	0.63	0/2618	1.21	0/3553
2	C	0.59	0/2360	1.19	1/3209 (0.0%)
2	D	0.63	1/2588 (0.0%)	1.23	4/3514 (0.1%)
All	All	0.61	2/9929 (0.0%)	1.22	15/13484 (0.1%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	158	SER	C-N	-5.34	1.26	1.33
2	D	258	HIS	CE1-NE2	5.11	1.37	1.32

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	224	GLY	CA-C-N	8.43	125.55	120.24
1	A	224	GLY	C-N-CA	8.43	125.55	120.24
2	D	188	ASP	CA-CB-CG	7.70	120.30	112.60
1	A	195	PRO	N-CA-CB	6.63	106.91	103.19
2	D	280	THR	CB-CA-C	6.19	120.91	109.70
1	A	158	SER	CA-C-N	-5.58	113.08	122.29
1	A	158	SER	C-N-CA	-5.58	113.08	122.29
2	D	31	PHE	CB-CA-C	-5.28	101.69	110.14
2	C	52	PRO	N-CA-C	5.12	118.54	110.50
1	A	44	PRO	N-CA-C	5.09	119.36	112.48
1	A	281	LEU	CA-C-N	-5.08	116.52	123.12
1	A	281	LEU	C-N-CA	-5.08	116.52	123.12
1	A	188	ASP	CA-C-N	5.07	125.30	120.43
1	A	188	ASP	C-N-CA	5.07	125.30	120.43
2	D	101	THR	CB-CA-C	5.00	117.71	109.90

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	2311	0	2140	38	0
2	B	2546	0	2414	43	0
2	C	2297	0	2143	36	0
2	D	2516	0	2378	54	0
3	B	21	0	10	5	0
3	D	21	0	10	7	0
4	B	5	0	0	0	0
4	D	5	0	0	0	0
5	B	34	0	21	6	0
5	D	34	0	21	4	0
6	A	85	0	0	3	0
6	B	94	0	0	5	0
6	C	69	0	0	3	0
6	D	79	0	0	3	0
All	All	10117	0	9137	174	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 9.

All (174) 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)
2:D:197:CYS:SG	3:D:401:UFP:C6	2.63	0.87
2:C:220:ASP:OD1	2:C:223:LEU:HB2	1.80	0.80
2:C:168:GLU:HG2	6:C:437:HOH:O	1.86	0.76
2:D:78:ASN:OD1	2:D:80:ILE:HG12	1.84	0.76
2:B:197:CYS:SG	3:B:401:UFP:C6	2.74	0.76
2:B:221:VAL:HG23	2:B:258:HIS:O	1.88	0.73
1:A:37:PHE:CZ	1:A:229:ILE:HD13	2.24	0.73
2:D:107:VAL:HG12	2:D:114:ALA:HA	1.72	0.70
2:B:91:LYS:HD2	6:B:547:HOH:O	1.92	0.67

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:198:HIS:HB2	2:B:214:LEU:HD11	1.78	0.66
2:D:56:ILE:HD13	2:D:230:ALA:HB3	1.78	0.66
2:B:78:ASN:OD1	2:B:80:ILE:HG12	1.96	0.66
1:A:192:MET:HE3	6:A:410:HOH:O	1.96	0.65
2:B:101:THR:HG23	6:B:555:HOH:O	1.97	0.64
1:A:199:THR:HG21	1:A:217:ARG:HB3	1.81	0.62
2:C:218:SER:OG	2:D:177:ARG:HD2	1.99	0.62
2:B:128:ILE:HD13	2:B:134:PHE:CD2	2.35	0.61
2:D:62:TRP:CD1	2:D:67:ASP:HB3	2.36	0.61
1:A:147:ALA:HB1	6:A:461:HOH:O	2.01	0.61
1:A:135:ALA:C	1:A:137:LYS:H	2.07	0.61
2:C:62:TRP:CD1	2:C:67:ASP:HB3	2.36	0.61
2:C:213:GLN:HA	2:C:251:VAL:O	1.99	0.60
2:B:62:TRP:CE3	2:B:73:LEU:HD11	2.36	0.60
1:A:213:GLN:NE2	1:A:253:THR:OG1	2.32	0.60
2:B:128:ILE:HD13	2:B:134:PHE:HD2	1.67	0.59
2:B:313:ILE:HD12	6:B:521:HOH:O	2.01	0.59
2:B:198:HIS:CD2	2:B:232:TYR:OH	2.55	0.59
2:C:180:ILE:HD13	2:C:202:GLN:HG3	1.83	0.59
2:D:145:TYR:CE1	2:D:198:HIS:CE1	2.91	0.59
2:D:12:ILE:CD1	2:D:221:VAL:HG21	2.34	0.58
5:B:403:FFO:H5A	5:B:403:FFO:O4	2.03	0.58
2:D:307:PRO:HB2	6:D:524:HOH:O	2.04	0.58
2:D:256:ASP:C	2:D:256:ASP:OD1	2.47	0.58
2:B:5:TYR:CE2	2:B:46:LEU:HD21	2.40	0.57
2:C:45:LEU:HD22	2:C:51:VAL:HB	1.87	0.56
2:D:72:TYR:CE2	2:D:76:ARG:CZ	2.90	0.55
2:C:200:MET:HE1	2:D:199:THR:HG22	1.90	0.54
1:A:213:GLN:HA	1:A:251:VAL:O	2.07	0.54
1:A:87:GLU:O	1:A:91:LYS:HD3	2.07	0.54
2:D:198:HIS:CD2	3:D:401:UFP:O4	2.61	0.54
2:B:107:VAL:HG12	2:B:114:ALA:HA	1.89	0.53
2:C:52:PRO:HB2	2:C:55:LEU:HD13	1.91	0.53
1:A:197:CME:HE3	1:A:197:CME:H	1.74	0.52
2:C:235:LEU:O	2:C:239:ILE:HG12	2.10	0.52
2:C:264:VAL:O	2:C:268:GLN:HG3	2.09	0.52
1:A:62:TRP:CD1	1:A:67:ASP:HB3	2.45	0.51
1:A:49:LYS:HB3	1:A:309:ILE:HD12	1.93	0.51
1:A:199:THR:CG2	1:A:217:ARG:HG2	2.41	0.51
2:C:155:LYS:HG3	2:D:187:GLU:OE1	2.11	0.51
2:D:99:ASP:OD1	2:D:101:THR:HG22	2.11	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:191:SER:HB3	6:D:549:HOH:O	2.10	0.51
2:D:166:VAL:HG21	2:D:181:VAL:HG23	1.93	0.51
2:B:88:ARG:HB2	6:B:505:HOH:O	2.12	0.50
1:A:9:GLY:HA3	1:A:267:MET:HE2	1.94	0.50
2:D:176:SER:HB3	2:D:179:LEU:HD21	1.92	0.50
2:C:121:HIS:CE1	6:C:425:HOH:O	2.64	0.49
1:A:181:VAL:HB	1:A:201:PHE:CZ	2.47	0.49
2:B:119:GLU:O	2:B:122:GLN:HB3	2.12	0.49
2:B:53:PHE:O	2:B:57:LYS:HB2	2.12	0.49
2:D:56:ILE:HD13	2:D:230:ALA:CB	2.43	0.49
2:D:237:HIS:CE1	2:D:247:VAL:HG11	2.47	0.49
2:C:189:VAL:HA	2:C:192:MET:HG2	1.95	0.49
2:D:90:VAL:HG11	2:D:100:MET:HG3	1.95	0.49
2:B:56:ILE:HD13	2:B:230:ALA:HB3	1.95	0.49
2:D:197:CYS:SG	3:D:401:UFP:C5	3.01	0.49
2:B:62:TRP:CD1	2:B:67:ASP:HB3	2.49	0.48
5:B:403:FFO:O4	5:B:403:FFO:C5A	2.60	0.48
5:D:403:FFO:O4	5:D:403:FFO:H5A	2.12	0.48
2:B:198:HIS:ND1	3:B:401:UFP:O4	2.46	0.48
2:D:261:GLN:O	2:D:264:VAL:HG22	2.13	0.48
2:D:189:VAL:N	2:D:190:PRO:CD	2.76	0.48
1:A:13:LEU:CD2	1:A:264:VAL:HG13	2.43	0.48
2:C:303:TYR:CE2	2:C:305:PRO:HG3	2.49	0.48
2:D:188:ASP:O	2:D:192:MET:HG3	2.14	0.48
1:A:124:PHE:CE1	1:A:128:ILE:HD11	2.50	0.47
2:D:225:VAL:O	2:D:229:ILE:HG13	2.14	0.47
3:D:401:UFP:H1'	5:D:403:FFO:C4	2.44	0.47
2:C:192:MET:HE2	2:C:195:PRO:HA	1.96	0.47
1:A:76:ARG:HH11	1:A:76:ARG:HG3	1.79	0.47
1:A:180:ILE:HD13	1:A:202:GLN:HG3	1.95	0.47
2:C:155:LYS:N	2:D:187:GLU:OE1	2.40	0.47
2:C:201:PHE:HB3	2:C:214:LEU:HD23	1.97	0.47
2:D:12:ILE:HD12	2:D:221:VAL:HG21	1.95	0.47
1:A:79:HIS:O	1:A:80:ILE:C	2.58	0.47
2:C:206:ASN:C	2:C:206:ASN:ND2	2.72	0.47
1:A:76:ARG:HG3	1:A:76:ARG:NH1	2.29	0.47
3:B:401:UFP:H1'	5:B:403:FFO:C4	2.45	0.46
1:A:87:GLU:HG2	1:A:91:LYS:HE2	1.97	0.46
2:C:59:GLU:O	2:C:62:TRP:HB3	2.15	0.46
2:C:63:PHE:CE1	2:C:145:TYR:HB2	2.50	0.46
1:A:135:ALA:C	1:A:137:LYS:N	2.73	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:56:ILE:HD13	2:B:230:ALA:CB	2.46	0.46
2:C:56:ILE:HD13	2:C:230:ALA:HB3	1.98	0.46
2:C:183:ALA:O	2:C:196:PRO:HG3	2.16	0.46
2:D:197:CYS:HB2	3:D:401:UFP:C4	2.46	0.46
1:A:8:LEU:HD13	1:A:33:TYR:CD2	2.51	0.46
2:D:159:PHE:C	2:D:159:PHE:CD1	2.93	0.46
2:D:43:PHE:O	2:D:279:PRO:HD2	2.16	0.46
2:B:233:ALA:O	2:B:234:LEU:C	2.59	0.45
2:D:209:LYS:HA	2:D:246:GLU:O	2.16	0.45
2:D:239:ILE:HG12	2:D:290:VAL:HG21	1.99	0.45
1:A:284:ASN:C	1:A:284:ASN:OD1	2.59	0.45
2:B:152:TRP:O	2:B:159:PHE:HA	2.16	0.45
2:B:279:PRO:HG3	2:B:303:TYR:CD1	2.52	0.45
2:D:214:LEU:HD12	2:D:215:TYR:N	2.32	0.45
2:D:283:LEU:O	2:D:285:PRO:HD3	2.17	0.45
2:D:12:ILE:HG21	2:D:259:LEU:HB2	1.99	0.45
2:D:60:LEU:O	2:D:63:PHE:HB2	2.17	0.45
2:D:163:LEU:O	2:D:164:ALA:C	2.59	0.45
1:A:124:PHE:O	1:A:127:ALA:HB3	2.16	0.45
2:B:221:VAL:HB	2:B:259:LEU:HD12	1.98	0.44
2:B:225:VAL:N	2:B:226:PRO:CD	2.80	0.44
1:A:49:LYS:CB	1:A:309:ILE:HD12	2.47	0.44
2:C:54:GLY:HA2	2:C:57:LYS:HG2	1.99	0.44
2:B:279:PRO:HB2	2:B:300:VAL:HG22	2.00	0.44
2:C:198:HIS:HB3	2:C:214:LEU:HD21	1.98	0.44
2:C:94:ASP:OD1	2:C:94:ASP:N	2.51	0.44
2:D:62:TRP:CZ3	2:D:73:LEU:HD11	2.53	0.44
2:D:36:ARG:HG2	2:D:251:VAL:HG22	2.00	0.44
2:D:241:HIS:HE1	2:D:285:PRO:HA	1.81	0.43
1:A:43:PHE:HA	1:A:44:PRO:HD3	1.78	0.43
2:B:220:ASP:OD1	2:B:220:ASP:C	2.61	0.43
2:C:225:VAL:HA	2:C:228:ASN:HB2	2.01	0.43
2:B:100:MET:HE1	2:B:117:TYR:HA	2.01	0.43
2:B:198:HIS:CE1	3:B:401:UFP:O4	2.72	0.43
2:D:219:ALA:HB1	2:D:225:VAL:CG2	2.49	0.43
3:D:401:UFP:N3	5:D:403:FFO:C5A	2.82	0.43
2:C:225:VAL:O	2:C:229:ILE:HG13	2.18	0.43
2:C:19:LYS:HD2	6:C:410:HOH:O	2.18	0.43
2:D:178:ARG:O	2:D:180:ILE:N	2.51	0.43
1:A:155:LYS:HG2	2:B:155:LYS:HA	2.01	0.43
2:D:225:VAL:HG12	2:D:229:ILE:HD11	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:44:PRO:HB2	1:A:229:ILE:HG22	2.00	0.42
1:A:56:ILE:HD13	1:A:230:ALA:HB3	2.02	0.42
2:B:61:LEU:HD12	2:B:61:LEU:HA	1.83	0.42
2:D:12:ILE:CG2	2:D:259:LEU:HB2	2.49	0.42
1:A:18:PHE:HD2	1:A:28:TYR:CE1	2.38	0.42
2:B:313:ILE:HD11	5:B:403:FFO:C2	2.48	0.42
2:C:163:LEU:HD23	2:C:163:LEU:HA	1.87	0.42
2:D:103:PHE:O	2:D:107:VAL:HG22	2.20	0.42
1:A:129:LEU:HD12	1:A:129:LEU:HA	1.77	0.42
2:D:63:PHE:HB3	2:D:149:TRP:CZ3	2.54	0.42
2:C:62:TRP:CE3	2:C:73:LEU:HD11	2.55	0.42
2:C:237:HIS:CG	2:C:281:LEU:HD23	2.55	0.42
2:D:62:TRP:CE3	2:D:73:LEU:HD11	2.55	0.42
3:D:401:UFP:C2	5:D:403:FFO:C5A	2.98	0.42
2:C:162:GLN:O	2:C:163:LEU:C	2.62	0.42
1:A:186:PRO:HD2	2:B:152:TRP:CZ2	2.54	0.42
2:B:6:LEU:HD11	2:B:48:THR:HG21	2.02	0.42
2:B:178:ARG:HD3	6:B:562:HOH:O	2.19	0.42
2:B:185:ASN:O	2:B:186:PRO:C	2.61	0.42
1:A:308:THR:HA	6:A:405:HOH:O	2.20	0.41
2:B:284:ASN:HA	2:B:285:PRO:HD2	1.96	0.41
2:D:241:HIS:CE1	2:D:285:PRO:HA	2.55	0.41
2:B:192:MET:SD	2:B:196:PRO:HD3	2.60	0.41
3:B:401:UFP:C4	5:B:403:FFO:C5A	2.98	0.41
2:D:225:VAL:N	2:D:226:PRO:CD	2.84	0.41
2:B:256:ASP:OD1	2:B:256:ASP:C	2.63	0.41
2:C:49:LYS:O	2:C:49:LYS:HG3	2.20	0.41
2:D:209:LYS:HE3	2:D:209:LYS:HB2	1.49	0.41
2:B:45:LEU:HD23	2:B:303:TYR:CE1	2.56	0.41
1:A:61:LEU:HD12	1:A:61:LEU:HA	1.85	0.41
2:B:72:TYR:CE2	2:B:76:ARG:NH1	2.89	0.41
2:C:51:VAL:HA	2:C:52:PRO:HD2	1.87	0.41
2:D:237:HIS:NE2	2:D:247:VAL:HG11	2.36	0.41
2:D:201:PHE:HE1	6:D:538:HOH:O	2.04	0.40
1:A:180:ILE:CD1	1:A:202:GLN:HG3	2.52	0.40
2:B:189:VAL:N	2:B:190:PRO:CD	2.84	0.40
2:C:8:LEU:HD13	2:C:33:TYR:CD2	2.56	0.40
1:A:36:ARG:NE	1:A:249:GLU:OE2	2.52	0.40
1:A:197:CME:HE2	1:A:197:CME:HB3	1.71	0.40
2:B:216:GLN:OE1	2:B:252:HIS:NE2	2.52	0.40
5:B:403:FFO:C5A	5:B:403:FFO:N10	2.84	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:9:GLY:O	2:D:10:LYS:C	2.65	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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	287/315 (91%)	267 (93%)	20 (7%)	0	100	100
2	B	313/315 (99%)	297 (95%)	15 (5%)	1 (0%)	36	62
2	C	288/315 (91%)	271 (94%)	17 (6%)	0	100	100
2	D	313/315 (99%)	292 (93%)	21 (7%)	0	100	100
All	All	1201/1260 (95%)	1127 (94%)	73 (6%)	1 (0%)	48	74

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	144	ILE

5.3.2 Protein sidechains [i](#)

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	226/272 (83%)	209 (92%)	17 (8%)	12	34

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	B	265/273 (97%)	247 (93%)	18 (7%)	14	39
2	C	229/273 (84%)	202 (88%)	27 (12%)	5	15
2	D	255/273 (93%)	236 (92%)	19 (8%)	12	34
All	All	975/1091 (89%)	894 (92%)	81 (8%)	10	29

All (81) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	15	GLU
1	A	46	LEU
1	A	55	LEU
1	A	58	SER
1	A	61	LEU
1	A	64	LEU
1	A	91	LYS
1	A	94	ASP
1	A	119	GLU
1	A	122	GLN
1	A	129	LEU
1	A	148	GLN
1	A	151	HIS
1	A	166	VAL
1	A	173	ASN
1	A	214	LEU
1	A	284	ASN
2	B	17	HIS
2	B	35	MET
2	B	46	LEU
2	B	57	LYS
2	B	61	LEU
2	B	96	GLN
2	B	108	LEU
2	B	115	GLU
2	B	129	LEU
2	B	156	ASP
2	B	163	LEU
2	B	191	SER
2	B	194	LEU
2	B	200	MET
2	B	231	SER
2	B	234	LEU

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Mol	Chain	Res	Type
2	B	259	LEU
2	B	295	MET
2	C	3	GLU
2	C	12	ILE
2	C	17	HIS
2	C	45	LEU
2	C	46	LEU
2	C	61	LEU
2	C	64	LEU
2	C	69	ASN
2	C	75	GLU
2	C	94	ASP
2	C	95	TYR
2	C	129	LEU
2	C	143	ASN
2	C	163	LEU
2	C	166	VAL
2	C	168	GLU
2	C	179	LEU
2	C	189	VAL
2	C	198	HIS
2	C	206	ASN
2	C	214	LEU
2	C	264	VAL
2	C	277	SER
2	C	284	ASN
2	C	293	PHE
2	C	300	VAL
2	C	313	ILE
2	D	15	GLU
2	D	17	HIS
2	D	19	LYS
2	D	46	LEU
2	D	61	LEU
2	D	71	ARG
2	D	94	ASP
2	D	163	LEU
2	D	189	VAL
2	D	194	LEU
2	D	206	ASN
2	D	209	LYS
2	D	254	LEU

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Mol	Chain	Res	Type
2	D	259	LEU
2	D	280	THR
2	D	290	VAL
2	D	294	ASP
2	D	300	VAL
2	D	308	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (19) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	17	HIS
1	A	143	ASN
1	A	148	GLN
1	A	213	GLN
1	A	241	HIS
1	A	261	GLN
2	B	77	ASN
2	B	79	HIS
2	B	122	GLN
2	B	198	HIS
2	B	270	GLN
2	C	121	HIS
2	C	216	GLN
2	D	34	GLN
2	D	96	GLN
2	D	105	HIS
2	D	121	HIS
2	D	241	HIS
2	D	306	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is 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	$\# Z > 2$
1	CME	A	197	1	8,9,10	0.35	0	6,9,11	0.52	0

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
1	CME	A	197	1	-	2/5/8/10	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	197	CME	CE-SD-SG-CB
1	A	197	CME	SD-CE-CZ-OH

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	197	CME	2	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

6 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
4	SO4	B	402	-	4,4,4	0.35	0	6,6,6	0.07	0
5	FFO	D	403	-	33,36,36	0.98	1 (3%)	35,50,50	1.91	6 (17%)
4	SO4	D	402	-	4,4,4	0.37	0	6,6,6	0.08	0
3	UFP	B	401	-	22,22,22	1.89	5 (22%)	32,33,33	2.66	8 (25%)
5	FFO	B	403	-	33,36,36	1.05	1 (3%)	35,50,50	1.84	6 (17%)
3	UFP	D	401	-	22,22,22	1.77	4 (18%)	32,33,33	2.70	9 (28%)

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
3	UFP	B	401	-	-	2/10/22/22	0/2/2/2
5	FFO	D	403	-	-	5/24/37/37	0/3/3/3
5	FFO	B	403	-	-	4/24/37/37	0/3/3/3
3	UFP	D	401	-	-	2/10/22/22	0/2/2/2

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	401	UFP	C6-C5	4.92	1.40	1.33
3	B	401	UFP	C4-C5	4.86	1.50	1.44
3	B	401	UFP	C6-C5	4.67	1.39	1.33
3	D	401	UFP	C4-C5	4.47	1.50	1.44
5	D	403	FFO	C4A-N5	3.27	1.43	1.38
3	B	401	UFP	C2-N1	3.19	1.43	1.38
5	B	403	FFO	C4A-N5	3.18	1.43	1.38
3	D	401	UFP	C2-N1	2.47	1.42	1.38
3	B	401	UFP	C4-N3	-2.36	1.34	1.38
3	D	401	UFP	C4-N3	-2.27	1.34	1.38
3	B	401	UFP	O2-C2	2.04	1.26	1.23

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	401	UFP	C5-C4-N3	7.54	119.53	112.64
3	B	401	UFP	F5-C5-C4	7.41	122.97	116.47
3	B	401	UFP	C5-C4-N3	6.86	118.91	112.64
3	D	401	UFP	F5-C5-C4	6.44	122.11	116.47
5	B	403	FFO	C4A-C4-N3	6.01	121.52	110.94
3	D	401	UFP	C6-C5-C4	-5.97	117.12	122.57
5	D	403	FFO	C4A-C4-N3	5.95	121.42	110.94
3	B	401	UFP	C6-C5-C4	-5.35	117.69	122.57
5	D	403	FFO	CB-CA-CT	5.10	122.44	110.35
3	D	401	UFP	O4-C4-C5	-5.06	121.38	125.69
3	D	401	UFP	N3-C2-N1	4.62	120.91	114.89
3	D	401	UFP	C4-N3-C2	-4.62	121.28	127.34
5	D	403	FFO	C2-N1-C8A	4.39	121.11	113.36
3	B	401	UFP	N3-C2-N1	4.39	120.60	114.89
3	B	401	UFP	C4-N3-C2	-4.29	121.72	127.34
5	B	403	FFO	C2-N1-C8A	4.25	120.87	113.36
3	B	401	UFP	O4-C4-C5	-3.65	122.58	125.69
5	B	403	FFO	CB-CA-CT	3.51	118.67	110.35
3	B	401	UFP	O5'-P-O1P	-3.29	97.55	106.44
5	B	403	FFO	C2-N3-C4	-3.18	119.34	125.11
5	D	403	FFO	C2-N3-C4	-3.14	119.41	125.11
5	B	403	FFO	O4-C4-C4A	-2.86	120.60	127.62
3	B	401	UFP	O4'-C1'-N1	2.80	112.83	107.86
3	D	401	UFP	O2-C2-N1	-2.65	119.35	122.80
3	D	401	UFP	O3P-P-O5'	-2.47	100.22	106.67
3	D	401	UFP	O4'-C1'-N1	2.40	112.13	107.86
5	D	403	FFO	O4-C4-C4A	-2.32	121.94	127.62
5	D	403	FFO	CG-CB-CA	2.30	117.40	113.16
5	B	403	FFO	CT-CA-N	2.19	115.64	110.57

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	D	403	FFO	N-CA-CB-CG
3	B	401	UFP	C3'-C4'-C5'-O5'
3	B	401	UFP	O4'-C4'-C5'-O5'
3	D	401	UFP	O4'-C4'-C5'-O5'
3	D	401	UFP	C3'-C4'-C5'-O5'
5	D	403	FFO	N-CA-CT-O1
5	D	403	FFO	N-CA-CT-O2
5	B	403	FFO	C6-C9-N10-C14
5	D	403	FFO	C6-C9-N10-C14

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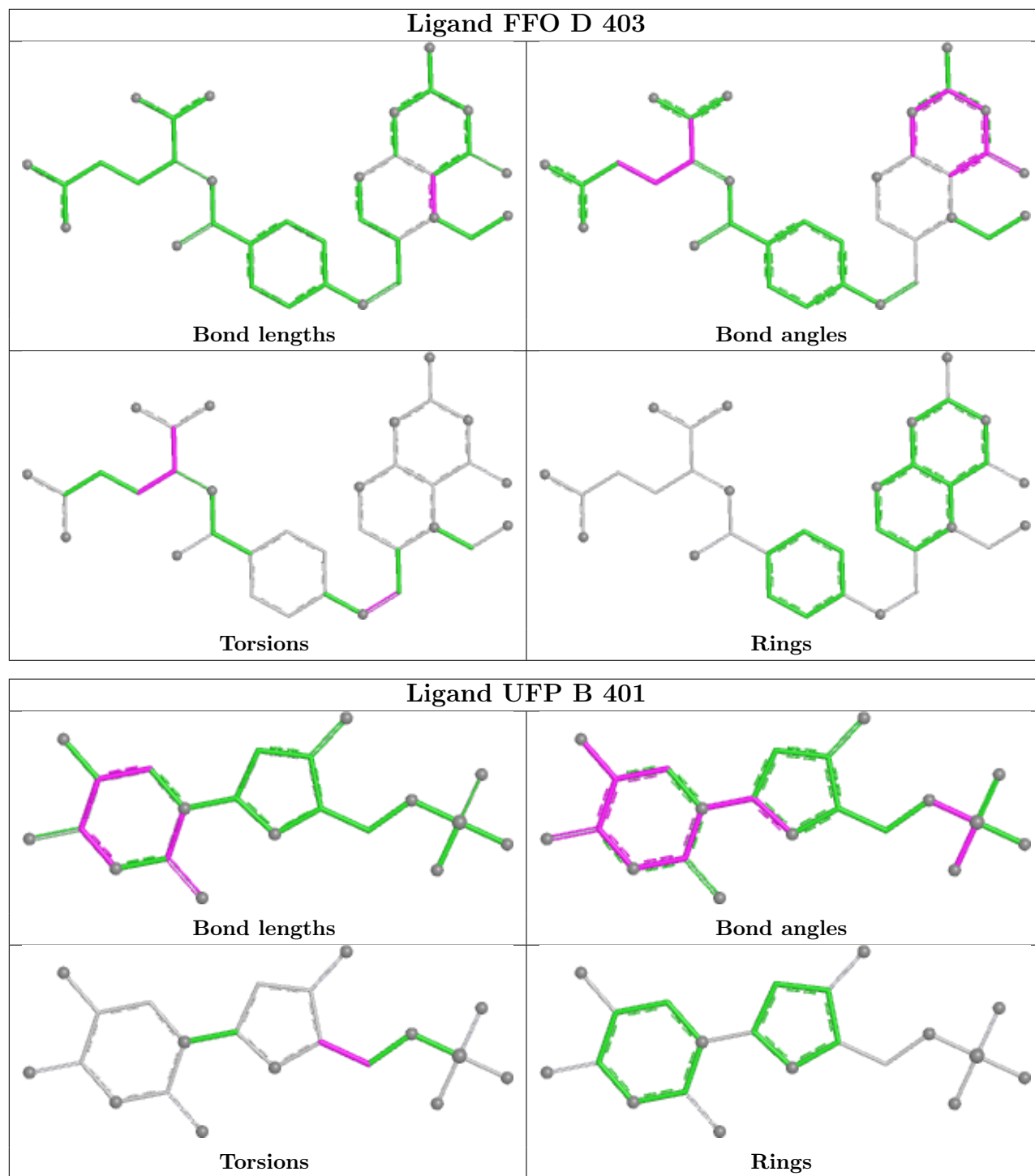
Mol	Chain	Res	Type	Atoms
5	B	403	FFO	N-CA-CB-CG
5	D	403	FFO	CT-CA-CB-CG
5	B	403	FFO	N-CA-CT-O2
5	B	403	FFO	N-CA-CT-O1

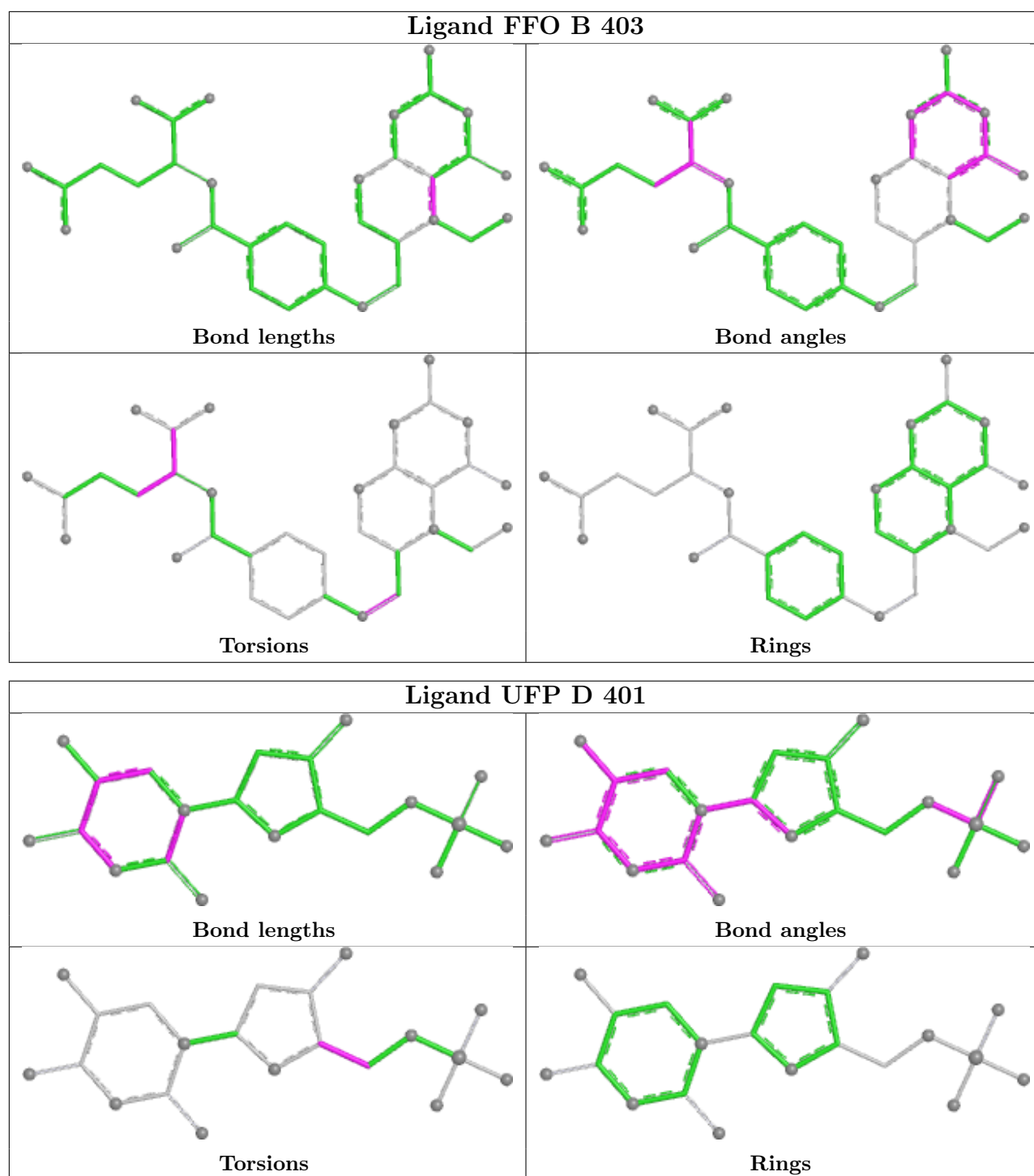
There are no ring outliers.

4 monomers are involved in 17 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	D	403	FFO	4	0
3	B	401	UFP	5	0
5	B	403	FFO	6	0
3	D	401	UFP	7	0

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 ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

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	291/315 (92%)	0.31	7 (2%) 59 50	18, 41, 75, 97	0
2	B	315/315 (100%)	-0.07	0 100 100	17, 31, 50, 67	0
2	C	292/315 (92%)	0.40	14 (4%) 35 28	14, 43, 90, 111	0
2	D	315/315 (100%)	0.08	3 (0%) 79 73	15, 33, 60, 86	0
All	All	1213/1260 (96%)	0.17	24 (1%) 65 57	14, 37, 74, 111	0

All (24) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	C	84	TRP	4.2
1	A	313	ILE	4.0
2	C	288	ALA	3.7
2	C	87	GLU	3.2
1	A	288	ALA	3.1
2	C	130	ASN	2.8
2	C	82	ASP	2.7
2	D	20	GLU	2.7
1	A	224	GLY	2.6
2	D	315	VAL	2.5
2	C	20	GLU	2.4
2	C	120	GLU	2.4
1	A	312	PRO	2.4
1	A	77	ASN	2.3
2	C	92	SER	2.3
2	C	122	GLN	2.2
2	C	83	GLU	2.2
1	A	122	GLN	2.2
2	D	188	ASP	2.2
2	C	296	GLU	2.2
1	A	158	SER	2.2

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Mol	Chain	Res	Type	RSRZ
2	C	141	LEU	2.2
2	C	132	ALA	2.2
2	C	85	ALA	2.1

6.2 Non-standard residues in protein, DNA, RNA chains [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(Å ²)	Q<0.9
1	CME	A	197	10/11	0.91	0.12	33,38,54,56	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

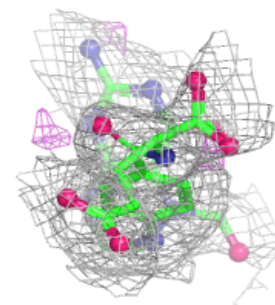
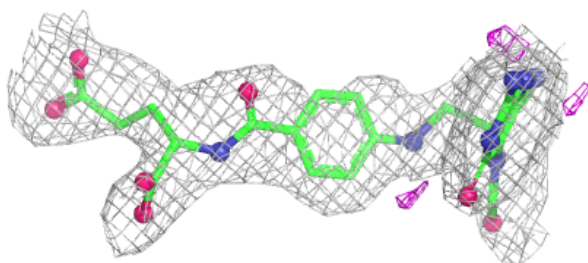
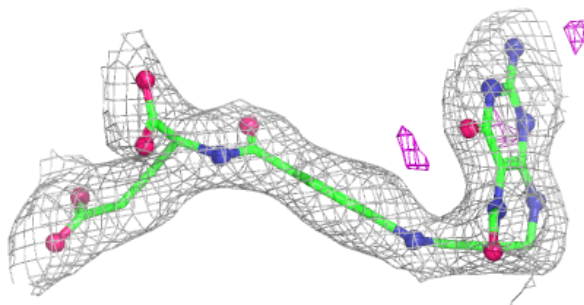
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	FFO	D	403	34/34	0.88	0.13	44,50,59,61	0
5	FFO	B	403	34/34	0.90	0.12	35,43,52,57	0
3	UFP	D	401	21/21	0.93	0.13	47,60,93,97	0
3	UFP	B	401	21/21	0.94	0.13	44,56,66,77	0
4	SO4	B	402	5/5	0.94	0.08	58,58,61,67	0
4	SO4	D	402	5/5	0.96	0.08	49,52,55,57	0

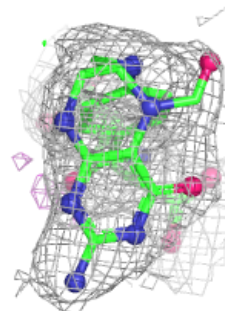
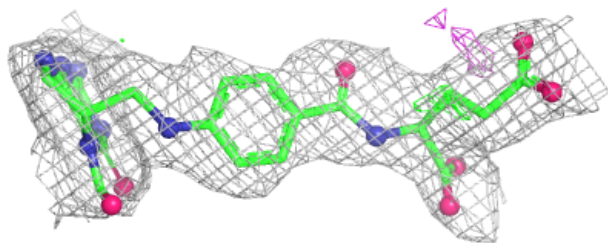
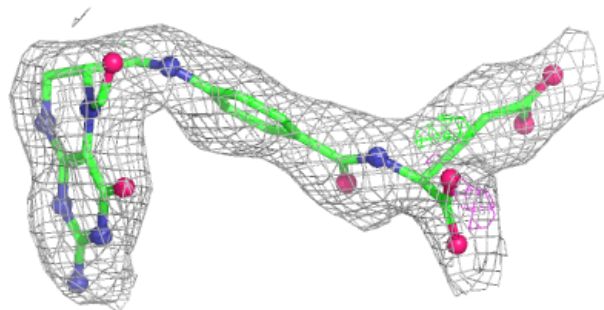
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around FFO D 403:

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

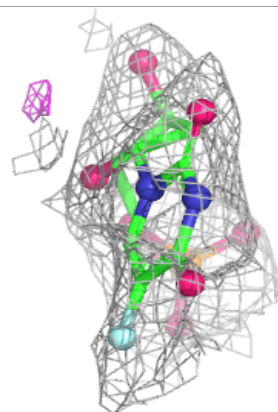
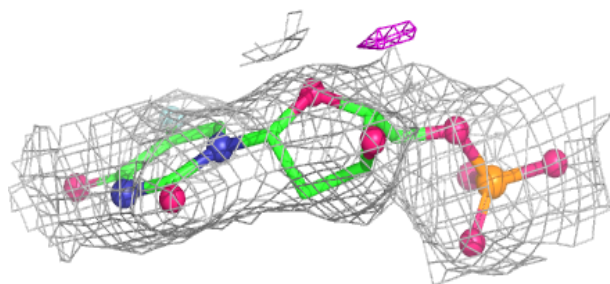
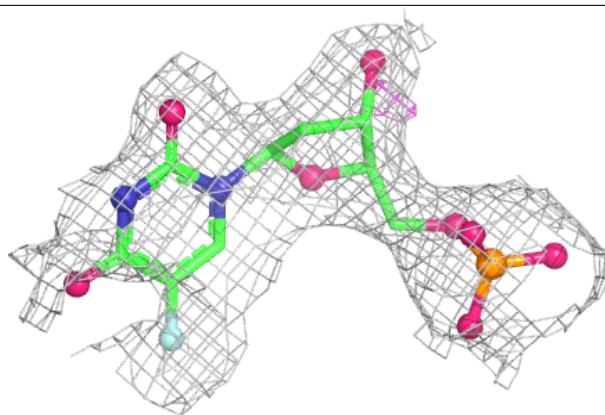
**Electron density around FFO B 403:**

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

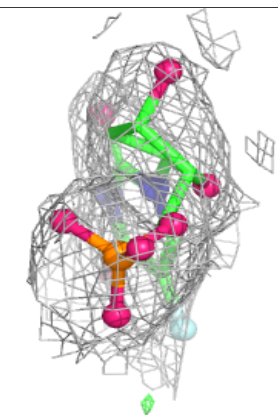
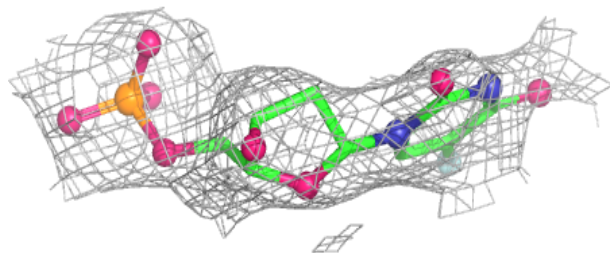
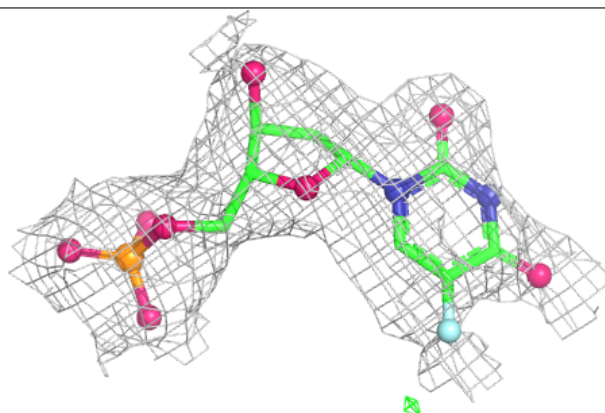


Electron density around UFP D 401:

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

**Electron density around UFP 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)



6.5 Other polymers [i](#)

There are no such residues in this entry.