Full wwPDB X-ray Structure Validation Report ⓘ

Mar 28, 2023 – 04:03 AM EDT

PDB ID	:	4RPP
Title	:	crystal structure of PKM2-K422R mutant bound with FBP
Authors	:	Wang, P.; Sun, C.; Zhu, T.; Xu, Y.
Deposited on	:	2014-10-31
Resolution	:	2.58 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:

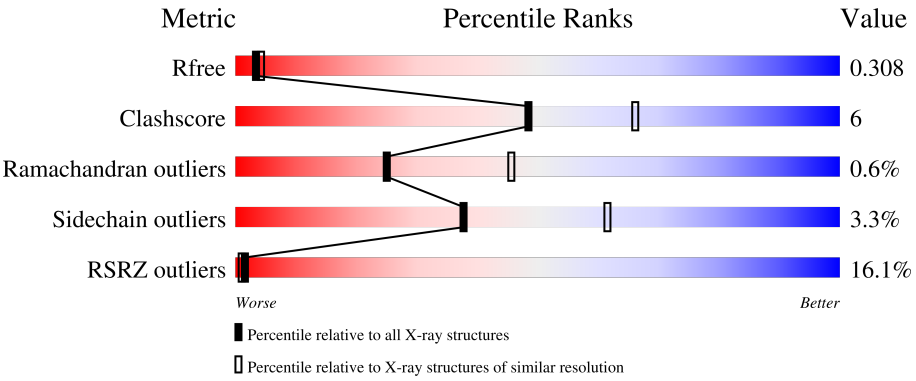
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.32.2
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.32.2

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.58 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}	130704	3676 (2.60-2.56)
Clashscore	141614	4049 (2.60-2.56)
Ramachandran outliers	138981	3979 (2.60-2.56)
Sidechain outliers	138945	3979 (2.60-2.56)
RSRZ outliers	127900	3614 (2.60-2.56)

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 <=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	535	10% 63% 13% · 23%
1	B	535	13% 63% 12% · 24%
1	C	535	13% 63% 11% 26%
1	D	535	12% 64% 11% · 24%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 12596 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.

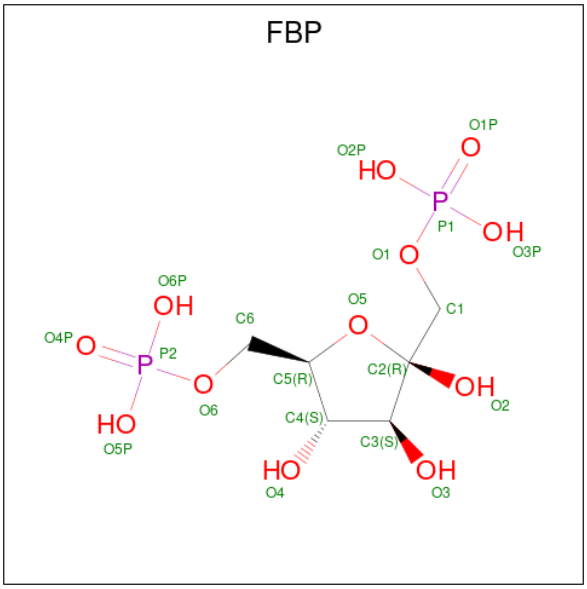
- Molecule 1 is a protein called Pyruvate kinase PKM.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	411	Total	C	N	O	S	0	0	0
			3153	1978	568	586	21			
1	B	408	Total	C	N	O	S	0	0	0
			3140	1970	568	581	21			
1	C	396	Total	C	N	O	S	0	0	0
			3050	1912	552	565	21			
1	D	408	Total	C	N	O	S	0	0	0
			3143	1973	568	581	21			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	PRO	-	expression tag	UNP P14618
A	-2	LEU	-	expression tag	UNP P14618
A	-1	GLY	-	expression tag	UNP P14618
A	0	SER	-	expression tag	UNP P14618
A	422	ARG	LYS	engineered mutation	UNP P14618
B	-3	PRO	-	expression tag	UNP P14618
B	-2	LEU	-	expression tag	UNP P14618
B	-1	GLY	-	expression tag	UNP P14618
B	0	SER	-	expression tag	UNP P14618
B	422	ARG	LYS	engineered mutation	UNP P14618
C	-3	PRO	-	expression tag	UNP P14618
C	-2	LEU	-	expression tag	UNP P14618
C	-1	GLY	-	expression tag	UNP P14618
C	0	SER	-	expression tag	UNP P14618
C	422	ARG	LYS	engineered mutation	UNP P14618
D	-3	PRO	-	expression tag	UNP P14618
D	-2	LEU	-	expression tag	UNP P14618
D	-1	GLY	-	expression tag	UNP P14618
D	0	SER	-	expression tag	UNP P14618
D	422	ARG	LYS	engineered mutation	UNP P14618

- Molecule 2 is 1,6-di-O-phosphono-beta-D-fructofuranose (three-letter code: FBP) (formula: $C_6H_{14}O_{12}P_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C O P 20 6 12 2	0	0
2	B	1	Total C O P 20 6 12 2	0	0
2	C	1	Total C O P 20 6 12 2	0	0
2	D	1	Total C O P 20 6 12 2	0	0

- Molecule 3 is water.

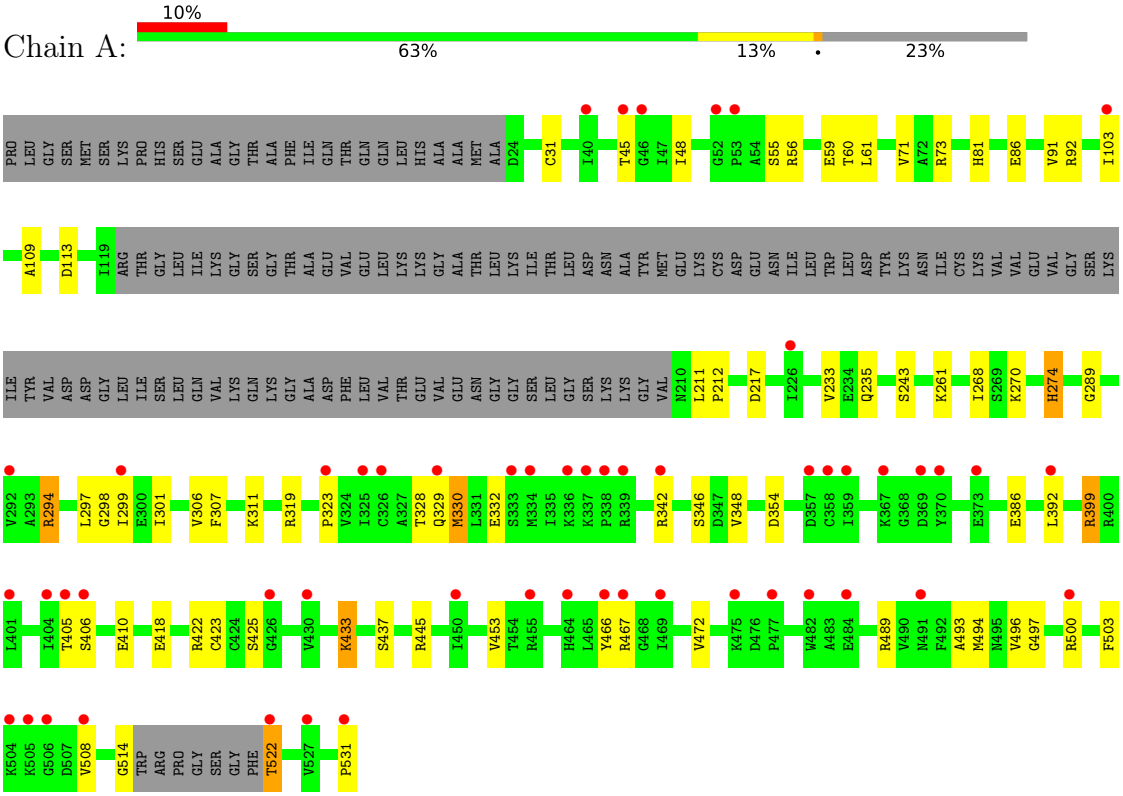
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	7	Total O 7 7	0	0
3	B	7	Total O 7 7	0	0
3	C	8	Total O 8 8	0	0
3	D	8	Total O 8 8	0	0

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.

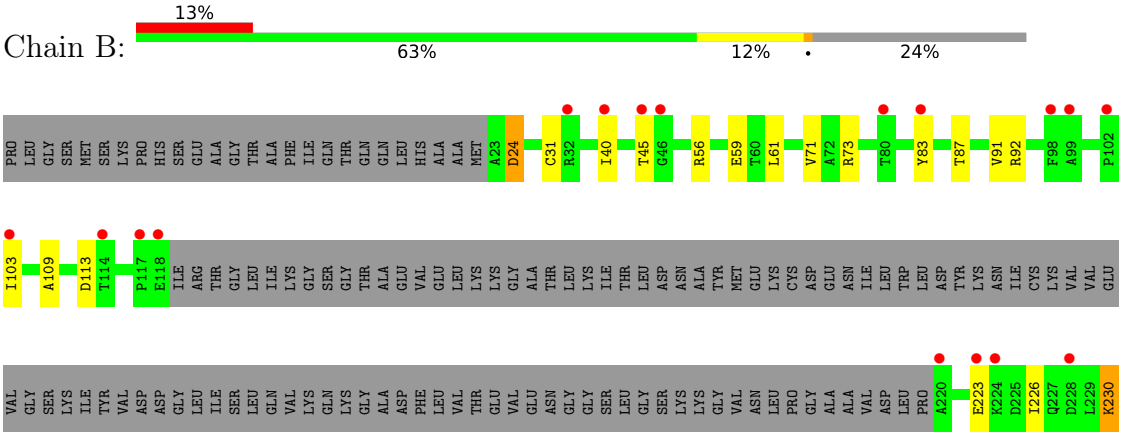
• Molecule 1: Pyruvate kinase PKM

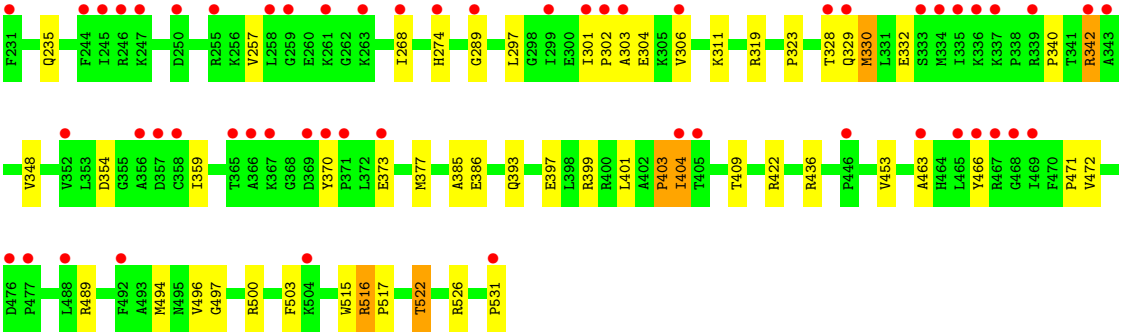
Chain A:



• Molecule 1: Pyruvate kinase PKM

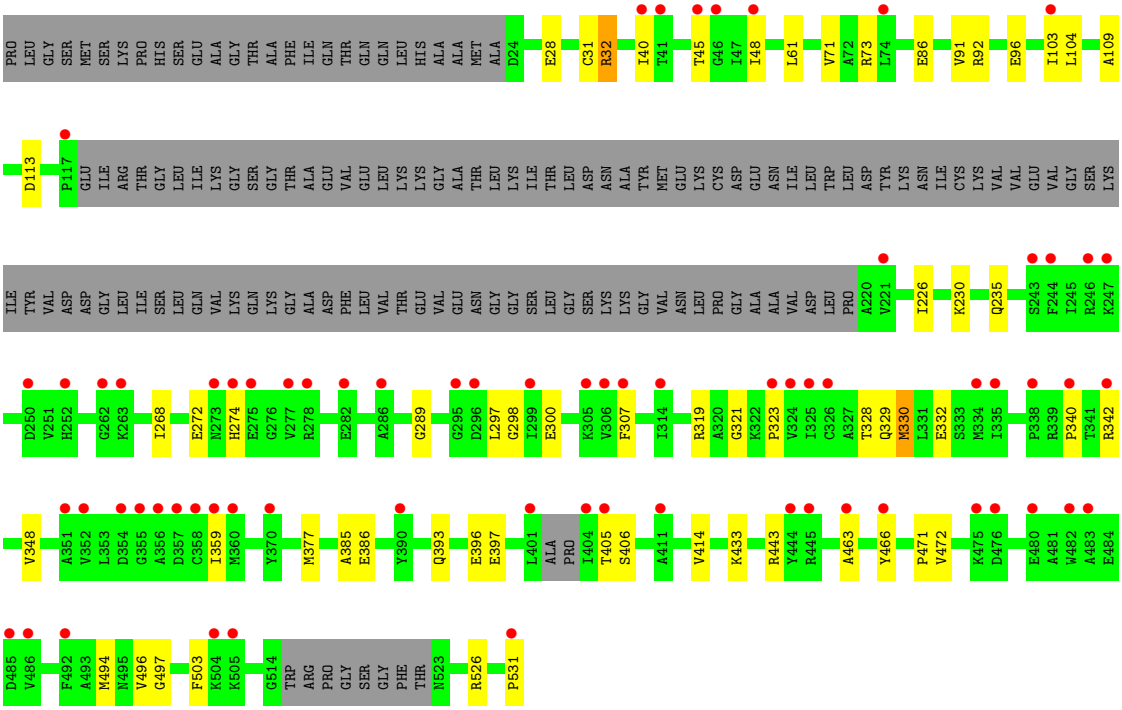
Chain B:





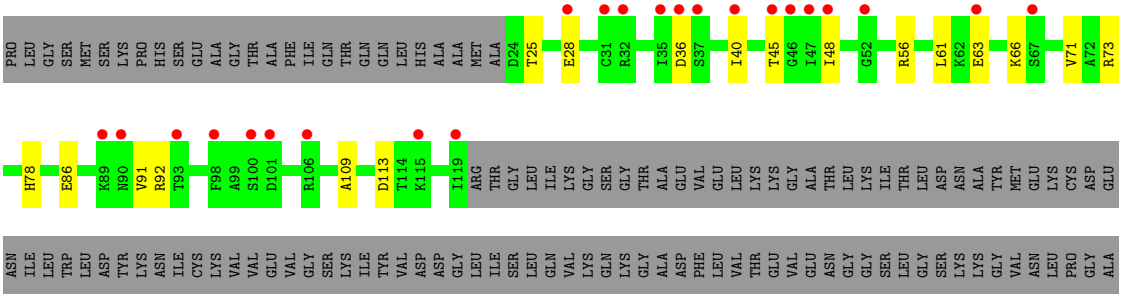
• Molecule 1: Pyruvate kinase PKM

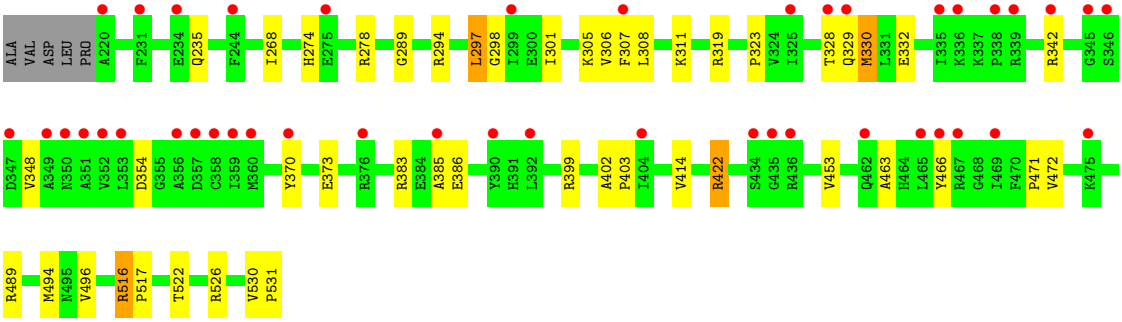
Chain C:



• Molecule 1: Pyruvate kinase PKM

Chain D:




ALA
VAL
ASP
LEU
PRO
A220
F231
E234
Q235
F244
I268
H274
E275
R278
G289
R294
L297
G298
I299
E300
I301
K305
V306
F307
L308
K311
R319
P323
V324
I325
T328
Q329
M330
L331
E332
I335
K336
K337
P338
R339
R342
G345
S346
D347
V348
A349
N350
A351
V352
L353
D354
G355
A356
D357
C358
I359
M360
Y370
E373
R376
R383
E384
A385
E386
Y390
H391
L392
R399
A402
P403
I404
V414
R422
S434
G435
R436
V453
Q462
A463
H464
L465
Y466
R467
G468
I469
F470
P471
V472
K475
R489
M494
N495
V496
R516
P517
T522
R526
V530
P531

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	81.67Å 152.55Å 97.68Å 90.00° 104.24° 90.00°	Depositor
Resolution (Å)	38.31 – 2.58 38.31 – 2.58	Depositor EDS
% Data completeness (in resolution range)	97.6 (38.31-2.58) 97.6 (38.31-2.58)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	4.52 (at 2.58Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.274 , 0.308 0.281 , 0.308	Depositor DCC
R_{free} test set	3466 reflections (4.90%)	wwPDB-VP
Wilson B-factor (Å^2)	66.4	Xtriage
Anisotropy	0.141	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 53.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.51$, $< L^2 > = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.91	EDS
Total number of atoms	12596	wwPDB-VP
Average B, all atoms (Å^2)	90.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.17% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: FBP

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	0.24	0/3204	0.45	0/4330
1	B	0.23	0/3194	0.46	1/4315 (0.0%)
1	C	0.23	0/3097	0.43	0/4178
1	D	0.22	0/3197	0.41	0/4319
All	All	0.23	0/12692	0.44	1/17142 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	342	ARG	CG-CD-NE	-5.17	100.95	111.80

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	3153	0	3214	53	0
1	B	3140	0	3191	55	0
1	C	3050	0	3109	35	0
1	D	3143	0	3197	40	0
2	A	20	0	10	1	0
2	B	20	0	10	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	20	0	10	0	0
2	D	20	0	10	0	0
3	A	7	0	0	0	0
3	B	7	0	0	0	0
3	C	8	0	0	0	0
3	D	8	0	0	1	0
All	All	12596	0	12751	153	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 (153) 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:A:306:VAL:HG11	1:B:342:ARG:HH22	1.37	0.88
1:A:342:ARG:NH2	1:B:302:PRO:O	2.06	0.88
1:B:56:ARG:NH2	1:B:83:TYR:O	2.17	0.75
1:A:494:MET:HG2	1:A:531:PRO:HD2	1.69	0.74
1:B:274:HIS:CE1	1:B:301:ILE:HG22	2.25	0.71
1:D:494:MET:HG2	1:D:531:PRO:HD2	1.73	0.70
1:A:422:ARG:HG3	1:C:414:VAL:HG11	1.72	0.70
1:A:306:VAL:HG11	1:B:342:ARG:NH2	2.06	0.70
1:C:494:MET:HG2	1:C:531:PRO:HD2	1.74	0.69
1:B:494:MET:HG2	1:B:531:PRO:HD2	1.75	0.68
1:B:301:ILE:HD11	1:B:306:VAL:HG22	1.76	0.67
1:A:298:GLY:HA3	1:B:342:ARG:NH1	2.10	0.67
1:A:342:ARG:NE	1:B:306:VAL:HB	2.11	0.66
1:A:342:ARG:CZ	1:B:306:VAL:H	2.08	0.66
1:C:298:GLY:HA3	1:D:342:ARG:NH2	2.10	0.66
1:B:399:ARG:HG2	1:D:422:ARG:HH22	1.61	0.66
1:A:342:ARG:NH2	1:B:306:VAL:H	1.94	0.66
1:A:294:ARG:HB3	1:B:342:ARG:HH21	1.61	0.63
1:D:25:THR:HG23	1:D:28:GLU:H	1.63	0.63
1:A:433:LYS:NZ	2:A:600:FBP:O3P	2.31	0.62
1:C:321:GLY:HA3	1:C:443:ARG:HD2	1.81	0.62
1:A:399:ARG:NH2	1:C:396:GLU:OE2	2.34	0.61
1:A:472:VAL:HG21	1:A:496:VAL:HG11	1.82	0.61
1:D:71:VAL:HG22	1:D:109:ALA:HB3	1.83	0.61
1:B:403:PRO:O	1:B:404:ILE:HG13	2.01	0.61
1:C:342:ARG:HH12	1:D:306:VAL:HG21	1.66	0.61
1:A:405:THR:O	1:A:406:SER:OG	2.15	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:342:ARG:HH12	1:B:304:GLU:C	2.04	0.60
1:D:92:ARG:NH1	1:D:235:GLN:O	2.31	0.60
1:B:71:VAL:HG22	1:B:109:ALA:HB3	1.85	0.59
1:B:522:THR:HG22	2:B:600:FBP:H4	1.85	0.59
1:D:383:ARG:NH2	3:D:706:HOH:O	2.34	0.58
1:C:92:ARG:NH1	1:C:235:GLN:O	2.31	0.57
1:A:103:ILE:O	1:A:500:ARG:NH2	2.38	0.57
1:B:496:VAL:HG13	1:B:500:ARG:NH1	2.20	0.57
1:B:73:ARG:NH1	1:B:113:ASP:OD2	2.38	0.56
1:A:233:VAL:HG11	1:A:261:LYS:HB3	1.88	0.55
1:C:28:GLU:O	1:C:32:ARG:HG2	2.06	0.55
1:B:329:GLN:HA	1:B:332:GLU:HG2	1.88	0.54
1:B:56:ARG:NH2	1:B:87:THR:OG1	2.40	0.54
1:C:71:VAL:HG22	1:C:109:ALA:HB3	1.89	0.54
1:D:73:ARG:NH1	1:D:113:ASP:OD2	2.41	0.54
1:A:445:ARG:HD2	1:A:467:ARG:HH21	1.73	0.53
1:C:342:ARG:CD	1:D:294:ARG:HB3	2.39	0.53
1:A:342:ARG:O	1:A:346:SER:N	2.29	0.53
1:A:294:ARG:HB3	1:B:342:ARG:NH2	2.24	0.53
1:D:274:HIS:CD2	1:D:301:ILE:HG22	2.44	0.53
1:C:31:CYS:HB3	1:D:319:ARG:HH21	1.74	0.53
1:C:73:ARG:NH1	1:C:113:ASP:OD2	2.41	0.53
1:A:71:VAL:HG22	1:A:109:ALA:HB3	1.91	0.53
1:D:329:GLN:HA	1:D:332:GLU:HG2	1.91	0.52
1:A:298:GLY:HA3	1:B:342:ARG:HH12	1.74	0.52
1:B:393:GLN:O	1:B:397:GLU:HG3	2.09	0.52
1:A:497:GLY:HA3	1:A:503:PHE:CZ	2.44	0.52
1:A:31:CYS:HB3	1:B:319:ARG:HH21	1.73	0.52
1:C:342:ARG:HH22	1:D:298:GLY:HA3	1.75	0.52
1:B:422:ARG:HG3	1:D:414:VAL:HG11	1.93	0.51
1:A:243:SER:HA	1:A:270:LYS:HD3	1.92	0.51
1:A:330:MET:HG3	1:A:348:VAL:HG22	1.92	0.51
1:A:342:ARG:CD	1:B:306:VAL:HB	2.41	0.51
1:A:472:VAL:HG11	1:A:496:VAL:HG21	1.91	0.51
1:B:472:VAL:HG21	1:B:496:VAL:HG11	1.92	0.51
1:D:40:ILE:O	1:D:40:ILE:HG22	2.11	0.51
1:C:385:ALA:HA	1:D:307:PHE:HZ	1.76	0.51
1:D:330:MET:HG3	1:D:348:VAL:HG22	1.93	0.51
1:B:24:ASP:OD1	1:B:24:ASP:N	2.43	0.50
1:C:329:GLN:HA	1:C:332:GLU:HG2	1.93	0.50
1:B:340:PRO:HG3	1:B:377:MET:HG2	1.95	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:496:VAL:HG13	1:A:500:ARG:NH1	2.27	0.49
1:A:493:ALA:HA	1:A:496:VAL:HB	1.95	0.49
1:D:61:LEU:HD13	1:D:91:VAL:HA	1.95	0.49
1:C:342:ARG:NH1	1:D:306:VAL:HG21	2.28	0.48
1:D:516:ARG:NE	1:D:517:PRO:O	2.41	0.48
1:D:274:HIS:O	1:D:278:ARG:HG3	2.13	0.47
1:A:307:PHE:HZ	1:B:385:ALA:HA	1.78	0.47
1:C:272:GLU:O	1:C:300:GLU:HG3	2.14	0.47
1:C:48:ILE:HG12	1:C:71:VAL:HB	1.97	0.47
1:C:319:ARG:O	1:C:443:ARG:NH1	2.35	0.47
1:C:393:GLN:O	1:C:397:GLU:HG3	2.15	0.47
1:B:496:VAL:HG13	1:B:500:ARG:HH11	1.79	0.46
1:D:311:LYS:NZ	1:D:354:ASP:OD1	2.48	0.46
1:C:307:PHE:HZ	1:D:385:ALA:HA	1.80	0.46
1:A:61:LEU:HD13	1:A:91:VAL:HA	1.96	0.46
1:C:61:LEU:HD13	1:C:91:VAL:HA	1.98	0.46
1:D:63:GLU:HA	1:D:66:LYS:HE3	1.97	0.46
1:A:211:LEU:HD13	1:A:299:ILE:HG21	1.98	0.46
1:C:268:ILE:HD13	1:C:289:GLY:HA3	1.98	0.46
1:A:319:ARG:HH21	1:B:31:CYS:HB3	1.80	0.45
1:A:405:THR:HG21	1:A:410:GLU:HG2	1.99	0.45
1:A:48:ILE:HG12	1:A:71:VAL:HB	1.97	0.45
1:B:453:VAL:HG11	1:B:489:ARG:HB3	1.98	0.45
1:B:463:ALA:HB3	1:B:471:PRO:HB3	1.98	0.45
1:A:56:ARG:NH2	1:A:86:GLU:HB3	2.32	0.45
1:A:268:ILE:HD13	1:A:289:GLY:HA3	1.99	0.45
1:A:329:GLN:HA	1:A:332:GLU:HG2	1.98	0.45
1:A:274:HIS:CE1	1:A:301:ILE:HG22	2.51	0.45
1:A:437:SER:OG	1:A:522:THR:HG21	2.16	0.45
1:A:453:VAL:HG11	1:A:489:ARG:HB3	1.99	0.45
1:A:342:ARG:O	1:A:342:ARG:HG2	2.17	0.45
1:B:61:LEU:HD13	1:B:91:VAL:HA	1.98	0.45
1:B:268:ILE:HD13	1:B:289:GLY:HA3	1.99	0.45
1:C:472:VAL:HG21	1:C:496:VAL:HG11	1.98	0.44
1:A:73:ARG:NH1	1:A:113:ASP:OD2	2.50	0.44
1:C:298:GLY:HA3	1:D:342:ARG:HH21	1.82	0.44
1:B:92:ARG:NH1	1:B:235:GLN:O	2.40	0.44
1:C:340:PRO:HG3	1:C:377:MET:HG2	1.99	0.44
1:D:297:LEU:O	1:D:301:ILE:HG12	2.18	0.44
1:D:402:ALA:HA	1:D:403:PRO:HD3	1.87	0.44
1:D:472:VAL:HG21	1:D:496:VAL:HG11	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:223:GLU:HA	1:B:226:ILE:HD12	2.00	0.43
1:A:92:ARG:NH1	1:A:235:GLN:O	2.40	0.43
1:A:311:LYS:NZ	1:A:354:ASP:OD1	2.51	0.43
1:B:409:THR:HG23	1:B:522:THR:OG1	2.18	0.43
1:C:323:PRO:HD3	1:C:466:TYR:CE2	2.54	0.43
1:C:330:MET:HG3	1:C:348:VAL:HG22	2.00	0.43
1:D:323:PRO:HD3	1:D:466:TYR:CE2	2.54	0.43
1:B:230:LYS:HE3	1:B:257:VAL:O	2.19	0.43
1:A:423:CYS:SG	1:A:425:SER:OG	2.77	0.43
1:B:401:LEU:HD23	1:B:401:LEU:HA	1.89	0.43
1:B:515:TRP:CZ3	1:B:516:ARG:HG3	2.54	0.42
1:C:274:HIS:CE1	1:D:36:ASP:OD1	2.72	0.42
1:A:418:GLU:O	1:A:422:ARG:HG2	2.20	0.42
1:B:302:PRO:C	1:B:304:GLU:H	2.22	0.42
1:B:497:GLY:HA3	1:B:503:PHE:CZ	2.55	0.42
1:C:463:ALA:HB3	1:C:471:PRO:HB3	2.02	0.42
1:C:226:ILE:HG22	1:C:230:LYS:NZ	2.35	0.42
1:B:311:LYS:NZ	1:B:354:ASP:OD1	2.52	0.42
1:C:497:GLY:HA3	1:C:503:PHE:CZ	2.55	0.42
1:D:274:HIS:NE2	1:D:301:ILE:HG22	2.34	0.42
1:D:453:VAL:HG11	1:D:489:ARG:HB3	2.02	0.42
1:A:298:GLY:CA	1:B:342:ARG:HH12	2.33	0.42
1:B:370:TYR:HB3	1:B:373:GLU:HB2	2.01	0.41
1:A:514:GLY:CA	1:A:522:THR:HA	2.50	0.41
1:C:40:ILE:HG22	1:C:40:ILE:O	2.21	0.41
1:A:55:SER:HA	1:A:60:THR:HG21	2.03	0.41
1:B:56:ARG:HH22	1:B:83:TYR:C	2.19	0.41
1:B:436:ARG:HE	1:B:436:ARG:HB2	1.67	0.41
1:C:92:ARG:O	1:C:96:GLU:HG2	2.20	0.41
1:B:330:MET:HG3	1:B:348:VAL:HG22	2.01	0.41
1:D:463:ALA:HB3	1:D:471:PRO:HB3	2.03	0.41
1:A:323:PRO:HD3	1:A:466:TYR:CE2	2.55	0.41
1:D:268:ILE:HD13	1:D:289:GLY:HA3	2.03	0.41
1:D:494:MET:HG3	1:D:530:VAL:HG13	2.02	0.41
1:B:302:PRO:O	1:B:304:GLU:N	2.53	0.40
1:D:48:ILE:HG12	1:D:71:VAL:HB	2.03	0.40
1:A:392:LEU:HA	1:A:392:LEU:HD13	1.83	0.40
1:B:40:ILE:O	1:B:40:ILE:HG22	2.22	0.40
1:B:103:ILE:O	1:B:500:ARG:NH1	2.48	0.40
1:B:323:PRO:HD3	1:B:466:TYR:CE2	2.56	0.40
1:D:305:LYS:O	1:D:308:LEU:HB2	2.21	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:103:ILE:HG23	1:C:104:LEU:HG	2.03	0.40
1:D:56:ARG:NH2	1:D:86:GLU:HB3	2.37	0.40
1:D:370:TYR:HB3	1:D:373:GLU:HB2	2.03	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	405/535 (76%)	393 (97%)	10 (2%)	2 (0%)	29	50
1	B	404/535 (76%)	391 (97%)	8 (2%)	5 (1%)	13	26
1	C	388/535 (72%)	380 (98%)	6 (2%)	2 (0%)	29	50
1	D	404/535 (76%)	397 (98%)	6 (2%)	1 (0%)	47	69
All	All	1601/2140 (75%)	1561 (98%)	30 (2%)	10 (1%)	25	45

All (10) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	404	ILE
1	B	303	ALA
1	B	403	PRO
1	C	406	SER
1	A	212	PRO
1	A	328	THR
1	B	328	THR
1	C	328	THR
1	D	328	THR
1	B	517	PRO

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	339/439 (77%)	326 (96%)	13 (4%)	33	57
1	B	336/439 (76%)	325 (97%)	11 (3%)	38	61
1	C	328/439 (75%)	318 (97%)	10 (3%)	41	65
1	D	337/439 (77%)	327 (97%)	10 (3%)	41	65
All	All	1340/1756 (76%)	1296 (97%)	44 (3%)	38	61

All (44) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	45	THR
1	A	59	GLU
1	A	81	HIS
1	A	217	ASP
1	A	274	HIS
1	A	294	ARG
1	A	297	LEU
1	A	330	MET
1	A	386	GLU
1	A	399	ARG
1	A	433	LYS
1	A	508	VAL
1	A	522	THR
1	B	24	ASP
1	B	45	THR
1	B	59	GLU
1	B	230	LYS
1	B	297	LEU
1	B	330	MET
1	B	359	ILE
1	B	386	GLU
1	B	516	ARG
1	B	522	THR
1	B	526	ARG

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Mol	Chain	Res	Type
1	C	32	ARG
1	C	45	THR
1	C	86	GLU
1	C	297	LEU
1	C	330	MET
1	C	359	ILE
1	C	386	GLU
1	C	405	THR
1	C	433	LYS
1	C	526	ARG
1	D	45	THR
1	D	78	HIS
1	D	297	LEU
1	D	330	MET
1	D	386	GLU
1	D	399	ARG
1	D	422	ARG
1	D	516	ARG
1	D	522	THR
1	D	526	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	D	379	HIS

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

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	FBP	C	600	-	18,20,20	0.93	1 (5%)	23,32,32	0.70	0
2	FBP	A	600	-	18,20,20	0.93	1 (5%)	23,32,32	0.67	0
2	FBP	B	600	-	18,20,20	0.93	1 (5%)	23,32,32	0.67	0
2	FBP	D	600	-	18,20,20	0.93	1 (5%)	23,32,32	0.65	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
2	FBP	C	600	-	-	2/13/32/32	0/1/1/1
2	FBP	A	600	-	-	8/13/32/32	0/1/1/1
2	FBP	B	600	-	-	4/13/32/32	0/1/1/1
2	FBP	D	600	-	-	5/13/32/32	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	600	FBP	O2-C2	2.78	1.45	1.40
2	D	600	FBP	O2-C2	2.76	1.45	1.40
2	C	600	FBP	O2-C2	2.75	1.45	1.40
2	B	600	FBP	O2-C2	2.73	1.45	1.40

There are no bond angle outliers.

There are no chirality outliers.

All (19) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	600	FBP	C1-O1-P1-O2P
2	A	600	FBP	C1-O1-P1-O3P
2	A	600	FBP	O1-C1-C2-O2
2	A	600	FBP	O1-C1-C2-C3
2	A	600	FBP	O1-C1-C2-O5
2	A	600	FBP	C4-C5-C6-O6
2	A	600	FBP	O5-C5-C6-O6
2	B	600	FBP	O1-C1-C2-O2
2	B	600	FBP	O1-C1-C2-O5
2	B	600	FBP	C4-C5-C6-O6
2	C	600	FBP	C4-C5-C6-O6
2	D	600	FBP	C6-O6-P2-O4P
2	D	600	FBP	C4-C5-C6-O6
2	B	600	FBP	O5-C5-C6-O6
2	C	600	FBP	O5-C5-C6-O6
2	D	600	FBP	O5-C5-C6-O6
2	A	600	FBP	C6-O6-P2-O5P
2	D	600	FBP	C1-O1-P1-O1P
2	D	600	FBP	C6-O6-P2-O6P

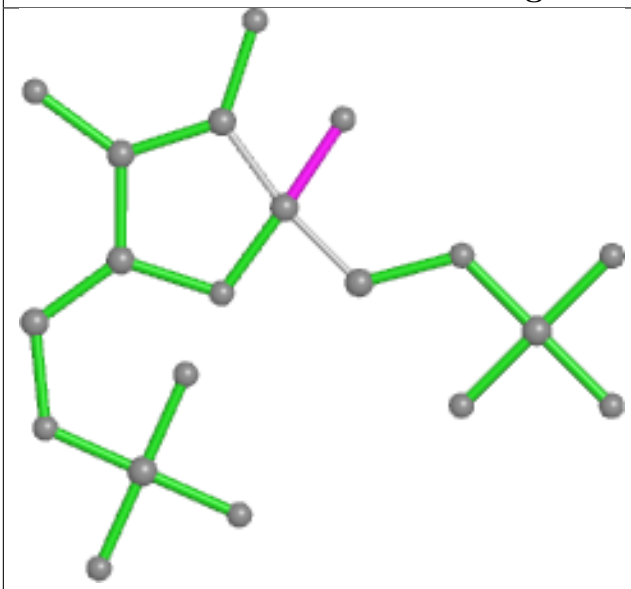
There are no ring outliers.

2 monomers are involved in 2 short contacts:

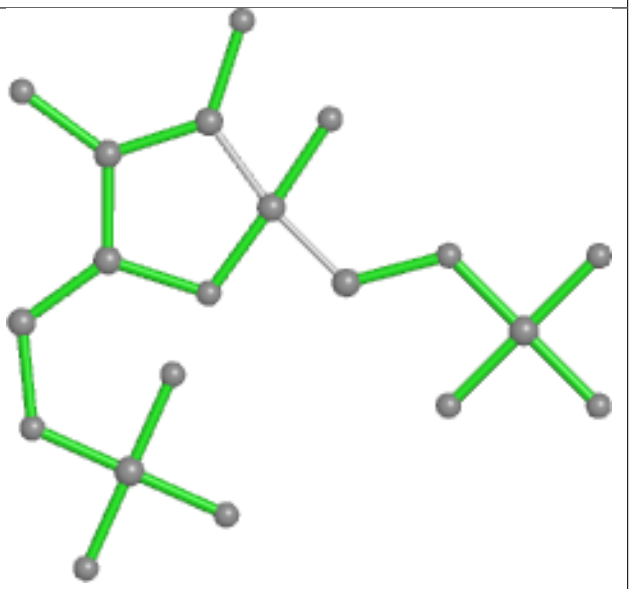
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	600	FBP	1	0
2	B	600	FBP	1	0

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 then 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.

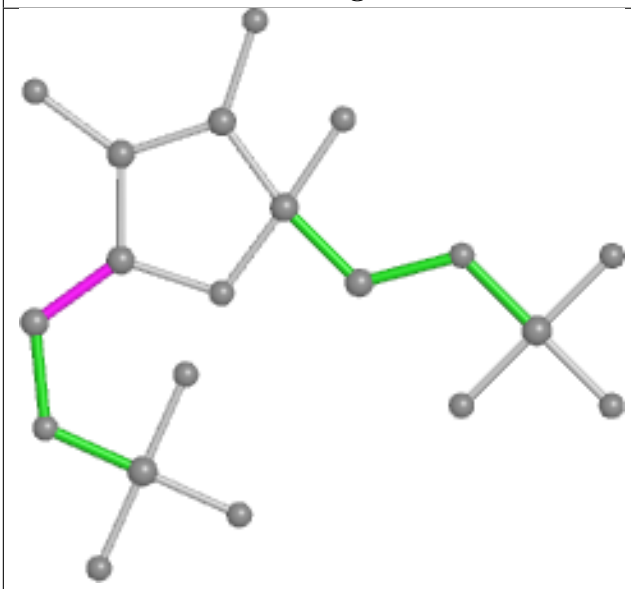
Ligand FBP C 600



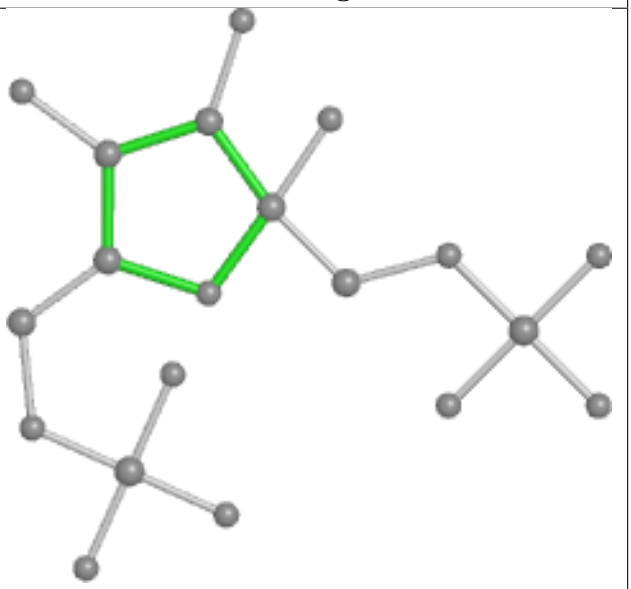
Bond lengths



Bond angles

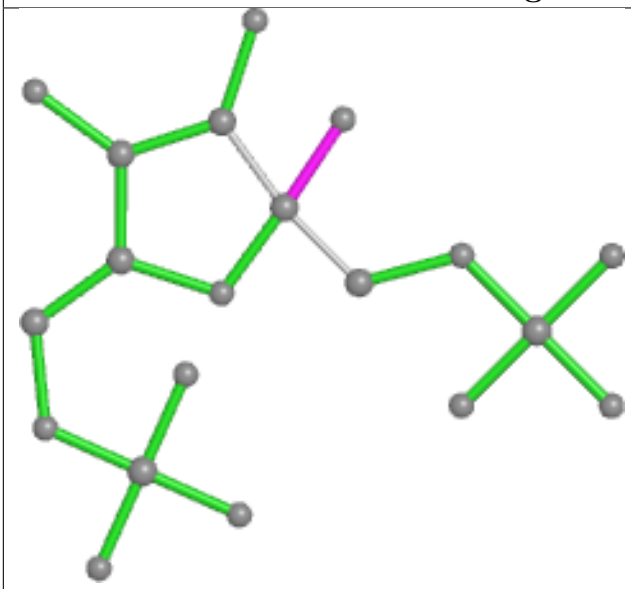


Torsions

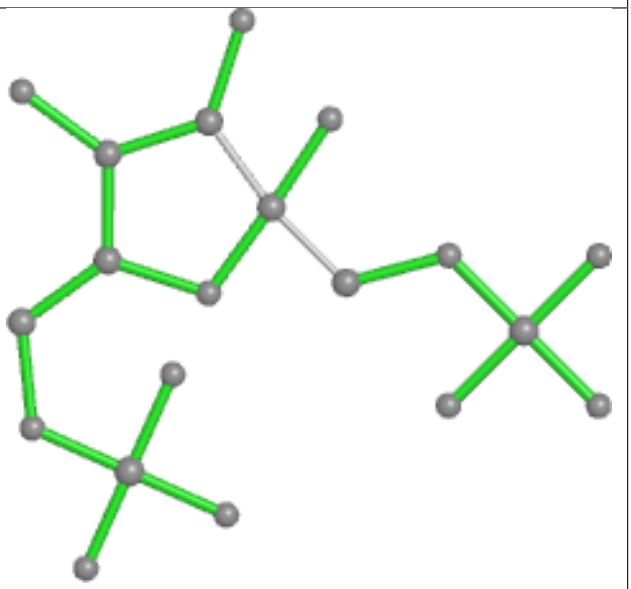


Rings

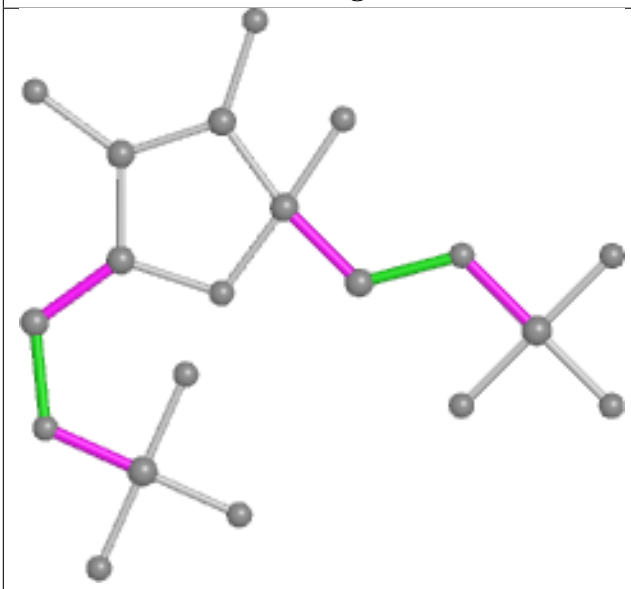
Ligand FBP A 600



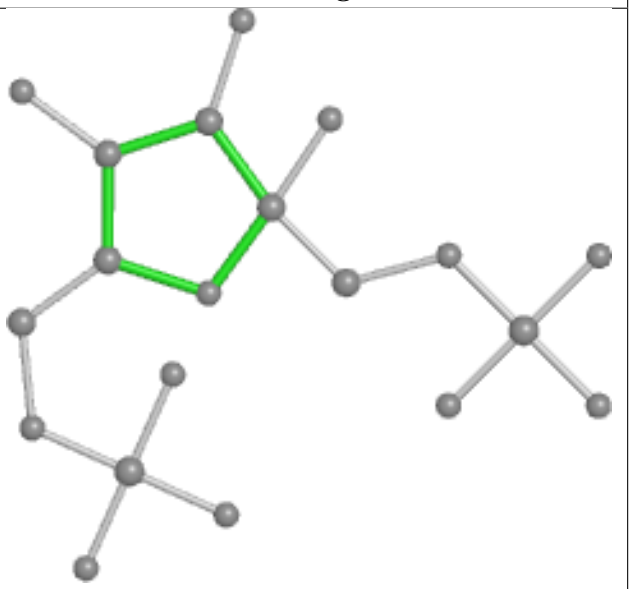
Bond lengths



Bond angles

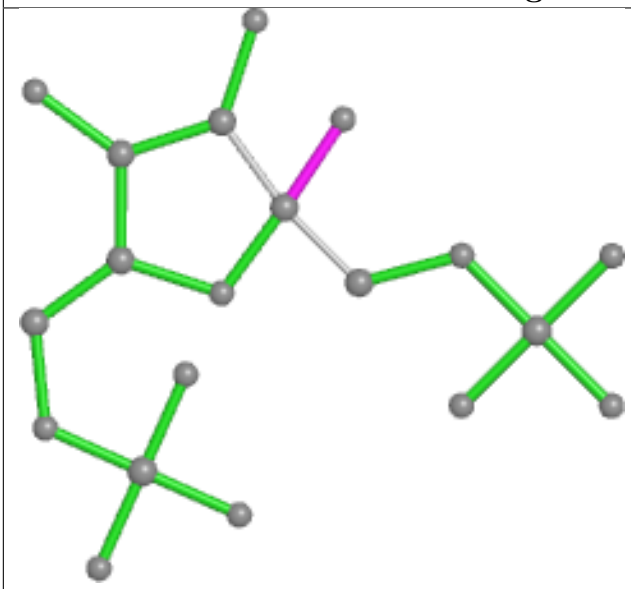


Torsions

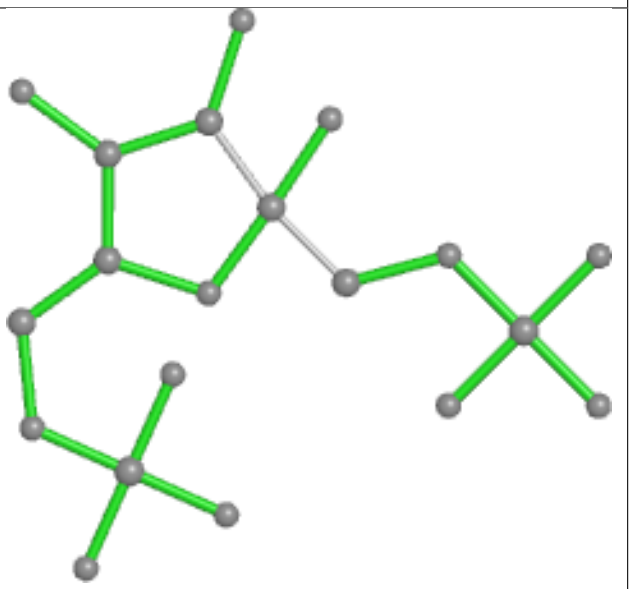


Rings

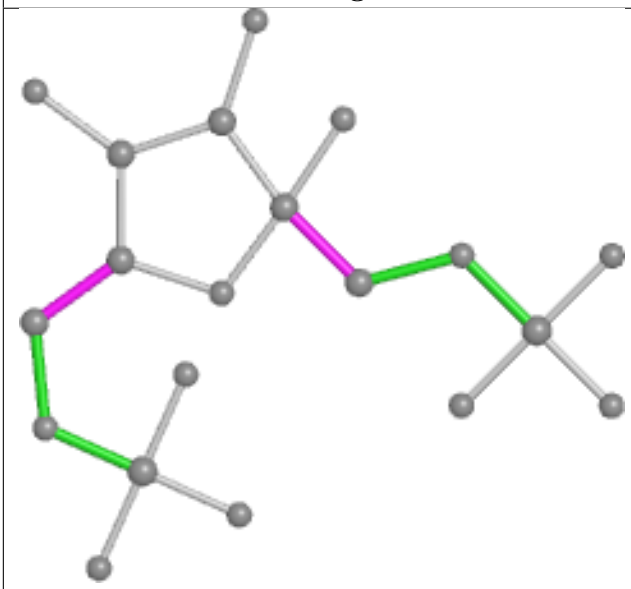
Ligand FBP B 600



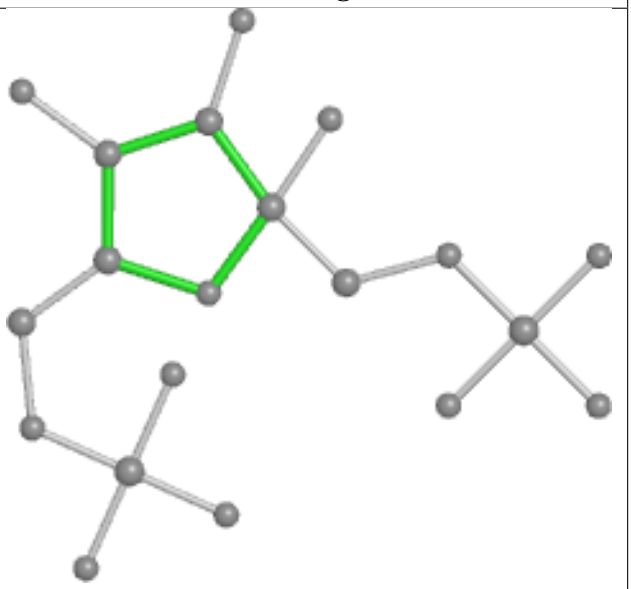
Bond lengths



Bond angles

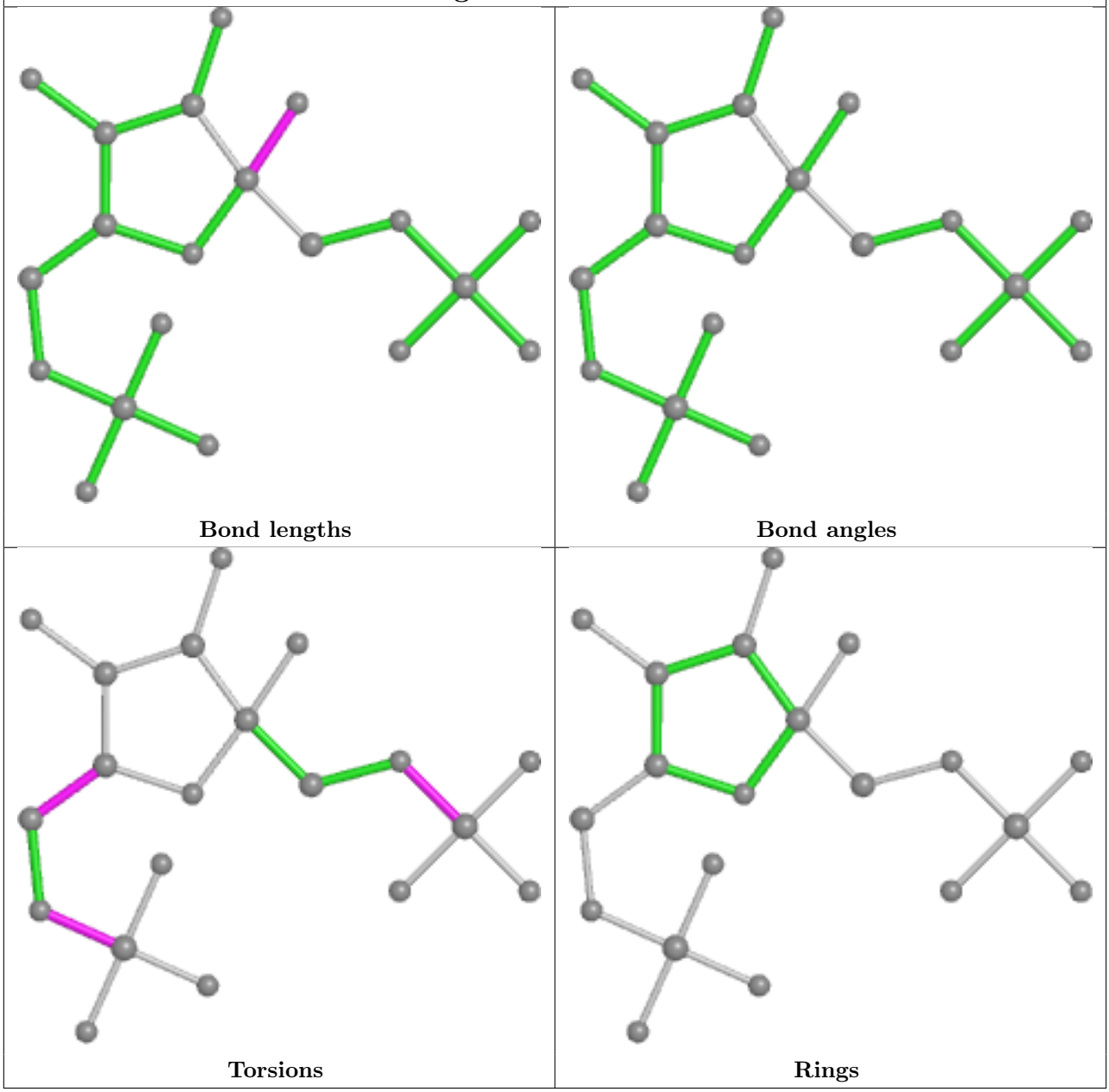


Torsions



Rings

Ligand FBP D 600



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

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, 95^{th} 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	411/535 (76%)	0.83	53 (12%)	3 2	47, 80, 131, 203	0
1	B	408/535 (76%)	1.09	72 (17%)	1 1	55, 88, 134, 167	0
1	C	396/535 (74%)	1.07	70 (17%)	1 1	68, 95, 130, 167	0
1	D	408/535 (76%)	0.93	66 (16%)	1 1	50, 82, 121, 155	0
All	All	1623/2140 (75%)	0.98	261 (16%)	1 1	47, 87, 129, 203	0

All (261) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	336	LYS	9.4
1	D	40	ILE	7.9
1	B	244	PHE	7.7
1	C	41	THR	7.5
1	B	303	ALA	7.1
1	B	117	PRO	7.1
1	B	228	ASP	5.6
1	D	335	ILE	5.5
1	C	404	ILE	5.4
1	C	40	ILE	5.0
1	B	118	GLU	5.0
1	C	326	CYS	4.8
1	B	333	SER	4.7
1	B	302	PRO	4.6
1	A	527	VAL	4.5
1	C	340	PRO	4.5
1	B	335	ILE	4.3
1	A	334	MET	4.3
1	B	231	PHE	4.3
1	A	326	CYS	4.3
1	A	338	PRO	4.2

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Mol	Chain	Res	Type	RSRZ
1	B	102	PRO	4.2
1	C	505	LYS	4.2
1	D	370	TYR	4.2
1	D	345	GLY	4.1
1	A	336	LYS	4.1
1	B	306	VAL	4.1
1	A	504	LYS	4.0
1	A	342	ARG	4.0
1	B	466	TYR	4.0
1	B	83	TYR	3.9
1	C	342	ARG	3.9
1	A	370	TYR	3.9
1	D	220	ALA	3.9
1	D	46	GLY	3.8
1	D	244	PHE	3.8
1	A	40	ILE	3.8
1	B	365	THR	3.8
1	B	258	LEU	3.8
1	C	244	PHE	3.8
1	A	505	LYS	3.7
1	A	339	ARG	3.7
1	C	475	LYS	3.7
1	D	358	CYS	3.7
1	B	274	HIS	3.6
1	D	119	ILE	3.6
1	B	250	ASP	3.6
1	C	466	TYR	3.6
1	C	355	GLY	3.6
1	D	342	ARG	3.6
1	A	53	PRO	3.5
1	C	531	PRO	3.5
1	D	392	LEU	3.5
1	B	463	ALA	3.5
1	C	48	ILE	3.5
1	D	346	SER	3.5
1	C	262	GLY	3.4
1	A	45	THR	3.4
1	A	531	PRO	3.4
1	C	504	LYS	3.4
1	C	334	MET	3.4
1	A	358	CYS	3.3
1	C	338	PRO	3.3

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Mol	Chain	Res	Type	RSRZ
1	B	246	ARG	3.3
1	C	278	ARG	3.3
1	D	336	LYS	3.3
1	A	426	GLY	3.3
1	A	333	SER	3.3
1	B	337	LYS	3.3
1	C	117	PRO	3.2
1	D	352	VAL	3.2
1	B	220	ALA	3.2
1	D	98	PHE	3.2
1	C	250	ASP	3.2
1	C	401	LEU	3.2
1	B	356	ALA	3.2
1	B	468	GLY	3.2
1	C	325	ILE	3.2
1	D	89	LYS	3.2
1	D	353	LEU	3.1
1	B	98	PHE	3.1
1	B	261	LYS	3.1
1	D	404	ILE	3.1
1	A	373	GLU	3.1
1	A	405	THR	3.1
1	B	531	PRO	3.1
1	A	522	THR	3.1
1	D	307	PHE	3.1
1	A	103	ILE	3.1
1	B	40	ILE	3.1
1	D	47	ILE	3.1
1	A	484	GLU	3.0
1	B	469	ILE	3.0
1	A	299	ILE	3.0
1	C	335	ILE	3.0
1	A	467	ARG	3.0
1	B	334	MET	3.0
1	A	500	ARG	3.0
1	B	371	PRO	3.0
1	B	477	PRO	3.0
1	D	350	ASN	3.0
1	C	103	ILE	2.9
1	B	263	LYS	2.9
1	B	467	ARG	2.9
1	C	359	ILE	2.9

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Mol	Chain	Res	Type	RSRZ
1	C	273	ASN	2.9
1	B	299	ILE	2.9
1	B	504	LYS	2.9
1	C	323	PRO	2.9
1	B	488	LEU	2.9
1	D	359	ILE	2.9
1	A	482	TRP	2.9
1	A	401	LEU	2.9
1	C	286	ALA	2.9
1	D	93	THR	2.9
1	A	477	PRO	2.8
1	C	352	VAL	2.8
1	B	404	ILE	2.8
1	A	508	VAL	2.8
1	C	282	GLU	2.8
1	B	247	LYS	2.8
1	C	482	TRP	2.8
1	B	32	ARG	2.8
1	D	339	ARG	2.8
1	B	45	THR	2.8
1	D	351	ALA	2.8
1	A	475	LYS	2.7
1	C	46	GLY	2.7
1	D	390	TYR	2.7
1	A	404	ILE	2.7
1	B	328	THR	2.7
1	D	37	SER	2.7
1	D	234	GLU	2.7
1	D	48	ILE	2.7
1	D	360	MET	2.7
1	D	347	ASP	2.6
1	C	411	ALA	2.6
1	B	245	ILE	2.6
1	D	465	LEU	2.6
1	C	486	VAL	2.6
1	A	455	ARG	2.6
1	D	475	LYS	2.6
1	A	392	LEU	2.6
1	C	299	ILE	2.6
1	C	463	ALA	2.6
1	A	357	ASP	2.6
1	D	328	THR	2.6

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Mol	Chain	Res	Type	RSRZ
1	B	268	ILE	2.6
1	B	370	TYR	2.6
1	C	263	LYS	2.5
1	B	224	LYS	2.5
1	C	444	TYR	2.5
1	A	359	ILE	2.5
1	B	259	GLY	2.5
1	C	274	HIS	2.5
1	B	114	THR	2.5
1	D	349	ALA	2.5
1	D	329	GLN	2.5
1	C	351	ALA	2.5
1	B	339	ARG	2.5
1	D	467	ARG	2.5
1	D	35	ILE	2.5
1	B	342	ARG	2.4
1	C	277	VAL	2.4
1	A	506	GLY	2.4
1	B	329	GLN	2.4
1	C	45	THR	2.4
1	B	358	CYS	2.4
1	C	324	VAL	2.4
1	C	480	GLU	2.4
1	D	462	GLN	2.4
1	A	369	ASP	2.4
1	A	337	LYS	2.4
1	B	301	ILE	2.4
1	A	323	PRO	2.4
1	A	406	SER	2.4
1	D	436	ARG	2.4
1	A	450	ILE	2.4
1	C	360	MET	2.4
1	C	358	CYS	2.4
1	D	52	GLY	2.4
1	C	354	ASP	2.4
1	D	36	ASP	2.4
1	D	357	ASP	2.4
1	D	45	THR	2.4
1	C	275	GLU	2.4
1	A	46	GLY	2.3
1	B	255	ARG	2.3
1	C	307	PHE	2.3

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Mol	Chain	Res	Type	RSRZ
1	C	296	ASP	2.3
1	A	491	ASN	2.3
1	A	292	VAL	2.3
1	B	103	ILE	2.3
1	B	80	THR	2.3
1	B	405	THR	2.3
1	C	74	LEU	2.3
1	C	390	TYR	2.3
1	B	369	ASP	2.2
1	D	434	SER	2.2
1	D	63	GLU	2.2
1	A	325	ILE	2.2
1	C	252	HIS	2.2
1	C	483	ALA	2.2
1	C	295	GLY	2.2
1	D	101	ASP	2.2
1	A	367	LYS	2.2
1	C	243	SER	2.2
1	C	247	LYS	2.2
1	C	476	ASP	2.2
1	C	246	ARG	2.2
1	B	373	GLU	2.2
1	B	357	ASP	2.2
1	C	357	ASP	2.2
1	D	32	ARG	2.2
1	A	469	ILE	2.2
1	D	299	ILE	2.2
1	C	445	ARG	2.2
1	C	305	LYS	2.1
1	B	366	ALA	2.1
1	C	356	ALA	2.1
1	D	115	LYS	2.1
1	D	31	CYS	2.1
1	D	90	ASN	2.1
1	A	430	VAL	2.1
1	A	464	HIS	2.1
1	D	435	GLY	2.1
1	A	329	GLN	2.1
1	B	99	ALA	2.1
1	D	385	ALA	2.1
1	B	446	PRO	2.1
1	D	338	PRO	2.1

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Mol	Chain	Res	Type	RSRZ
1	C	314	ILE	2.1
1	D	325	ILE	2.1
1	D	469	ILE	2.1
1	C	492	PHE	2.1
1	D	231	PHE	2.1
1	D	67	SER	2.1
1	A	52	GLY	2.1
1	B	46	GLY	2.1
1	B	289	GLY	2.1
1	C	306	VAL	2.1
1	D	356	ALA	2.1
1	A	466	TYR	2.1
1	D	28	GLU	2.1
1	D	106	ARG	2.1
1	D	466	TYR	2.1
1	B	343	ALA	2.1
1	D	376	ARG	2.1
1	C	221	VAL	2.1
1	C	405	THR	2.1
1	B	476	ASP	2.0
1	D	100	SER	2.0
1	B	465	LEU	2.0
1	D	275	GLU	2.0
1	A	226	ILE	2.0
1	B	367	LYS	2.0
1	B	352	VAL	2.0
1	B	492	PHE	2.0
1	C	370	TYR	2.0
1	B	223	GLU	2.0
1	C	485	ASP	2.0

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 monosaccharides in this entry.

6.4 Ligands (i)

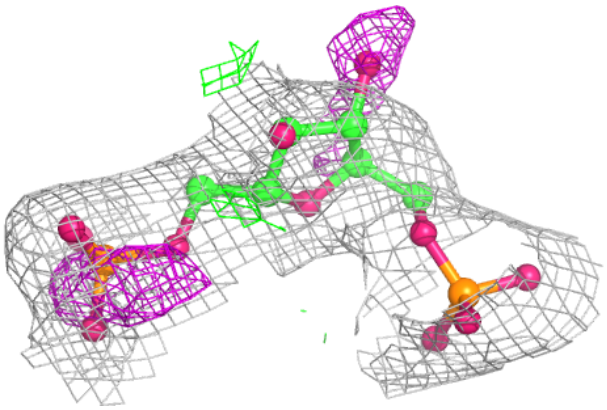
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

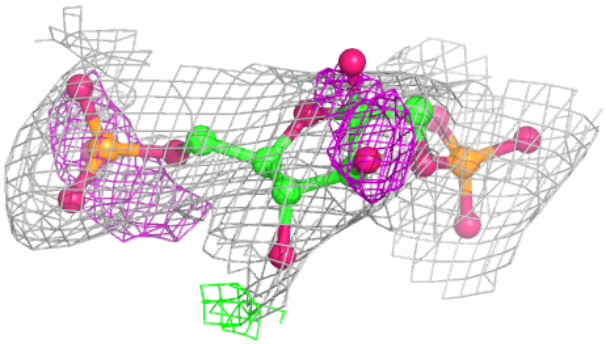
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	FBP	C	600	20/20	0.88	0.22	78,86,103,112	0
2	FBP	B	600	20/20	0.94	0.19	59,74,94,99	0
2	FBP	A	600	20/20	0.94	0.17	70,90,100,102	0
2	FBP	D	600	20/20	0.95	0.19	54,66,83,89	0

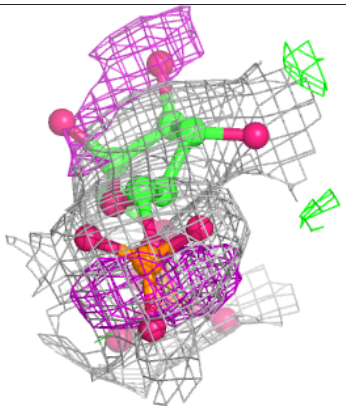
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around FBP C 600:

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

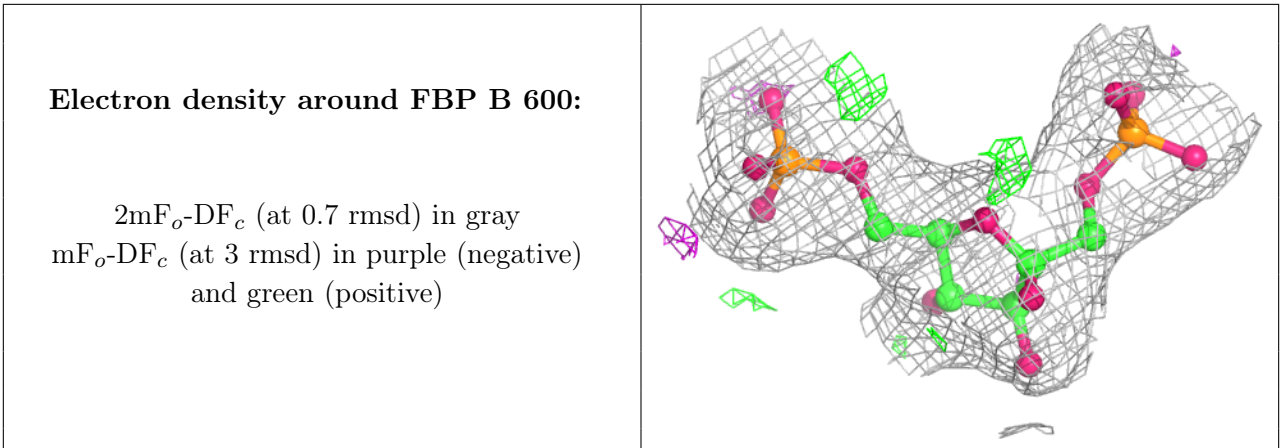


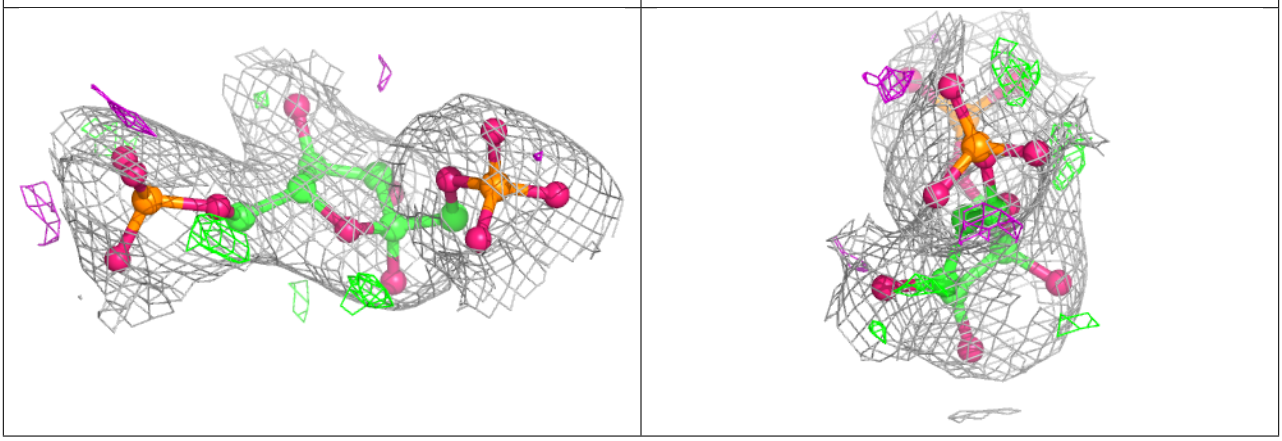




Electron density around FBP B 600:

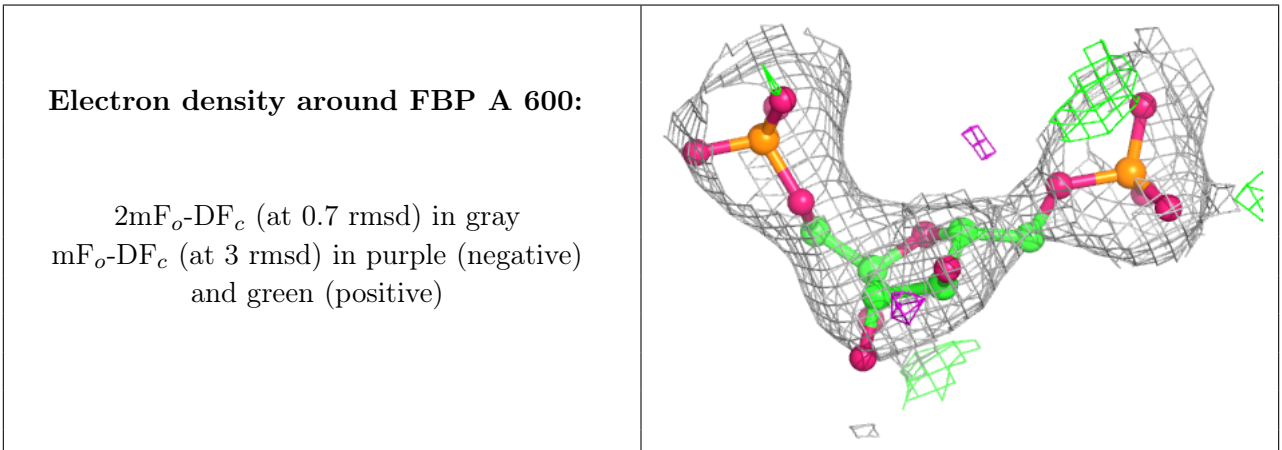
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

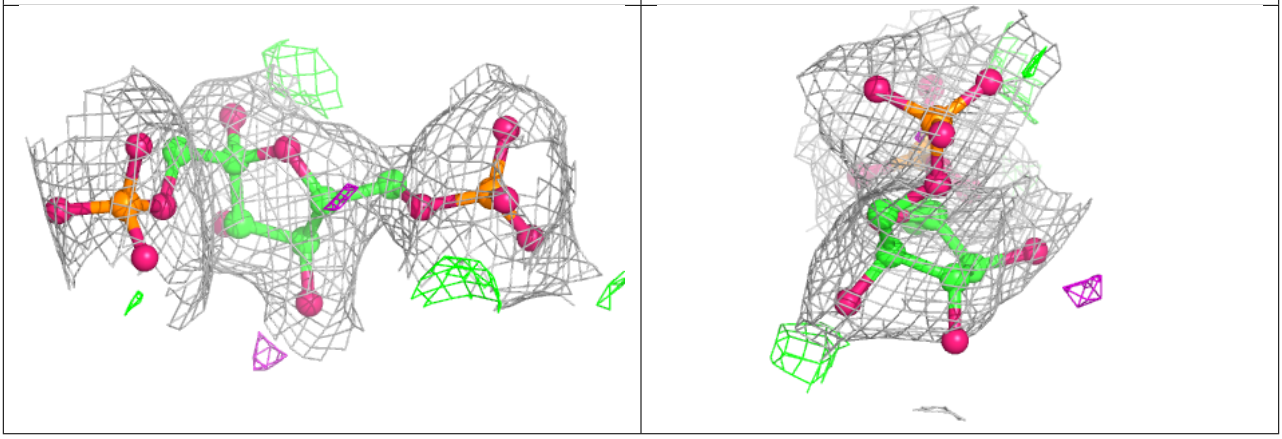




Electron density around FBP A 600:

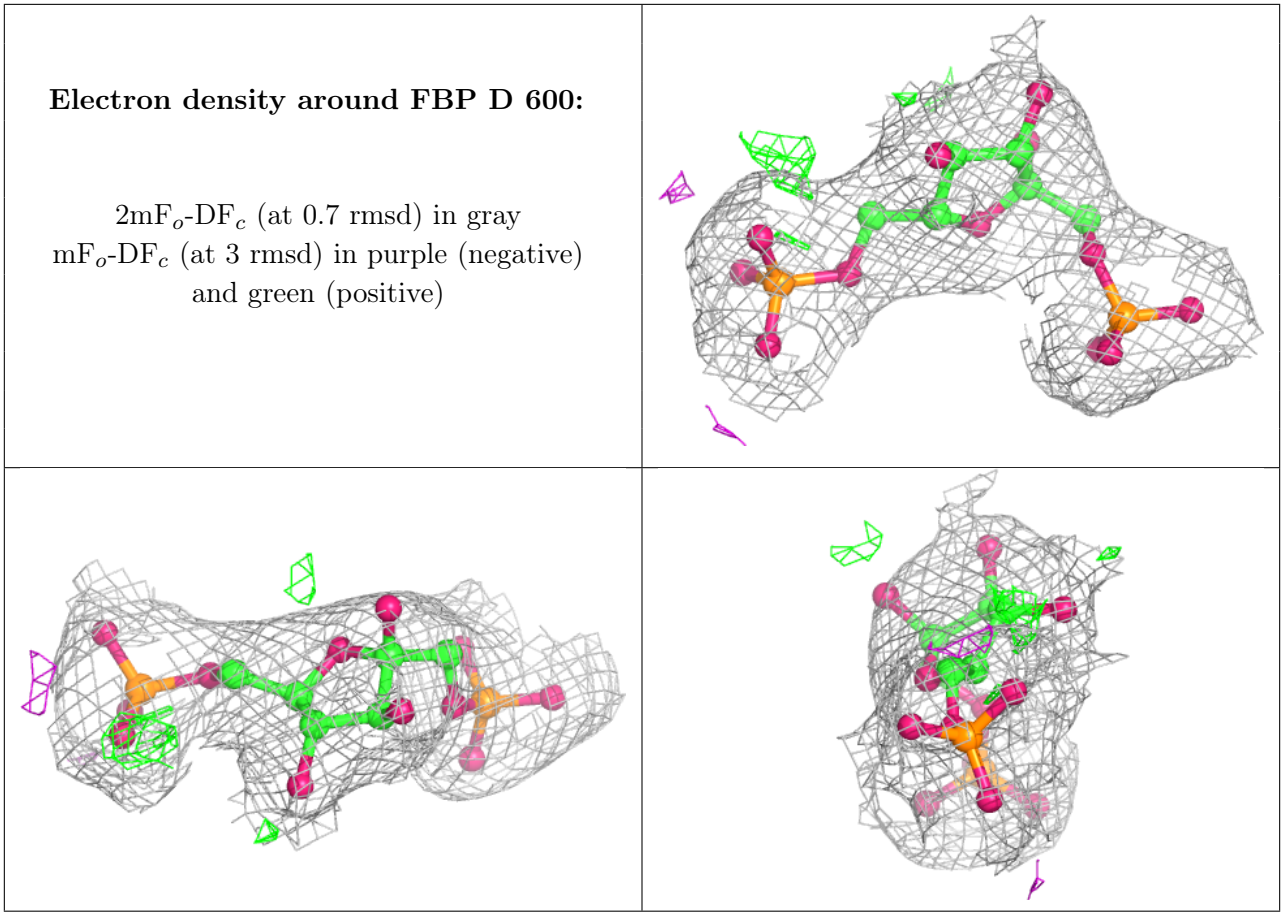
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)





Electron density around FBP D 600:

$2mF_o$-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

There are no such residues in this entry.