



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 14, 2017 – 11:13 am GMT

PDB ID : 5HW8
Title : Candida albicans FKBP12 P104G protein bound with FK506 in C2 space group
Authors : Tonthat, N.K.; Schumacher, M.A.
Deposited on : 2016-01-28
Resolution : 2.86 Å(reported)

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

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

A user guide is available at

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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

MolProbity	:	4.02b-467
Mogul	:	1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix)	:	1.9-1692
EDS	:	trunk28620
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	recalc28949

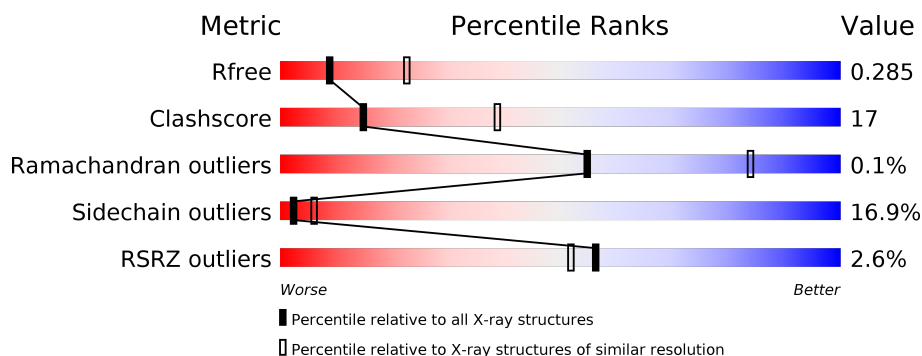
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.86 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}	100719	2469 (2.90-2.82)
Clashscore	112137	2749 (2.90-2.82)
Ramachandran outliers	110173	2687 (2.90-2.82)
Sidechain outliers	110143	2690 (2.90-2.82)
RSRZ outliers	101464	2487 (2.90-2.82)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	122	<div> <div>65%</div> <div>25%</div> <div>9%</div> <div>.</div> </div>
1	B	122	<div> <div>69%</div> <div>30%</div> <div>.</div> </div>
1	C	122	<div> <div>61%</div> <div>33%</div> <div>6%</div> <div>.</div> </div>
1	D	122	<div> <div>%</div> <div>69%</div> <div>26%</div> <div>..</div> </div>
1	E	122	<div> <div>56%</div> <div>34%</div> <div>6%</div> <div>..</div> </div>
1	F	122	<div> <div>3%</div> <div>51%</div> <div>33%</div> <div>7%</div> <div>10%</div> </div>

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Mol	Chain	Length	Quality of chain
1	G	122	<div><div></div><div>5%</div><div>49%</div><div>43%</div><div>7%</div><div></div></div>
1	H	122	<div><div></div><div>11%</div><div>43%</div><div>32%</div><div>7%</div><div>18%</div><div></div></div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 7289 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.

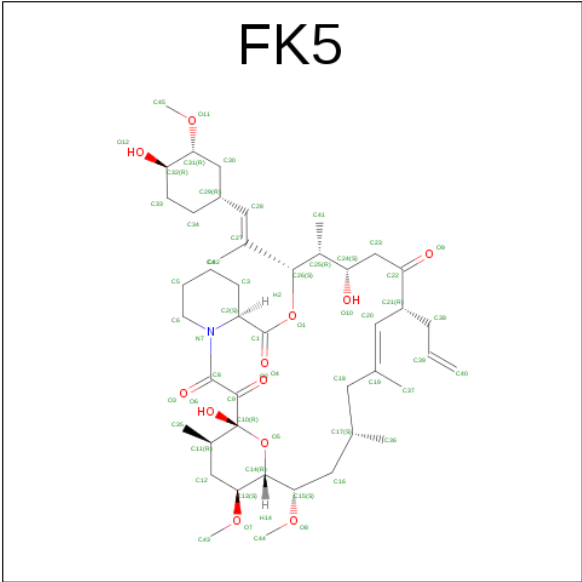
- Molecule 1 is a protein called FK506-binding protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	120	Total	C	N	O	S	0	0	0
			875	558	149	167	1			
1	B	122	Total	C	N	O	S	0	0	0
			902	574	154	173	1			
1	C	121	Total	C	N	O	S	0	0	0
			874	555	148	170	1			
1	D	120	Total	C	N	O	S	0	0	0
			891	567	152	171	1			
1	E	118	Total	C	N	O	S	0	0	0
			860	550	146	163	1			
1	F	110	Total	C	N	O	S	0	0	0
			785	502	129	153	1			
1	G	121	Total	C	N	O	S	0	0	0
			866	552	144	169	1			
1	H	100	Total	C	N	O	S	0	0	0
			716	463	118	134	1			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	104	GLY	PRO	engineered mutation	UNP P28870
B	104	GLY	PRO	engineered mutation	UNP P28870
C	104	GLY	PRO	engineered mutation	UNP P28870
D	104	GLY	PRO	engineered mutation	UNP P28870
E	104	GLY	PRO	engineered mutation	UNP P28870
F	104	GLY	PRO	engineered mutation	UNP P28870
G	104	GLY	PRO	engineered mutation	UNP P28870
H	104	GLY	PRO	engineered mutation	UNP P28870

- Molecule 2 is 8-DEETHYL-8-[BUT-3-ENYL]-ASCOMYCIN (three-letter code: FK5) (formula: C₄₄H₆₉NO₁₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			57	44	1	12		
2	B	1	Total	C	N	O	0	0
			57	44	1	12		
2	C	1	Total	C	N	O	0	0
			57	44	1	12		
2	D	1	Total	C	N	O	0	0
			57	44	1	12		
2	E	1	Total	C	N	O	0	0
			57	44	1	12		
2	F	1	Total	C	N	O	0	0
			57	44	1	12		
2	G	1	Total	C	N	O	0	0
			57	44	1	12		
2	H	1	Total	C	N	O	0	0
			57	44	1	12		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	8	Total	O	0	0
			8	8		
3	B	7	Total	O	0	0
			7	7		
3	C	9	Total	O	0	0
			9	9		
3	D	10	Total	O	0	0
			10	10		

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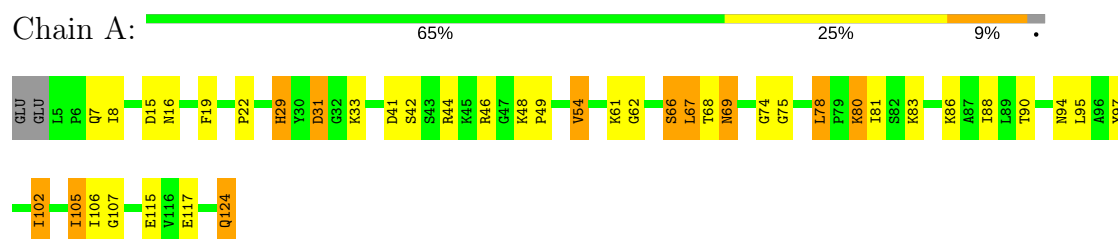
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	E	6	Total 6	O 6	0	0
3	F	8	Total 8	O 8	0	0
3	G	9	Total 9	O 9	0	0
3	H	7	Total 7	O 7	0	0

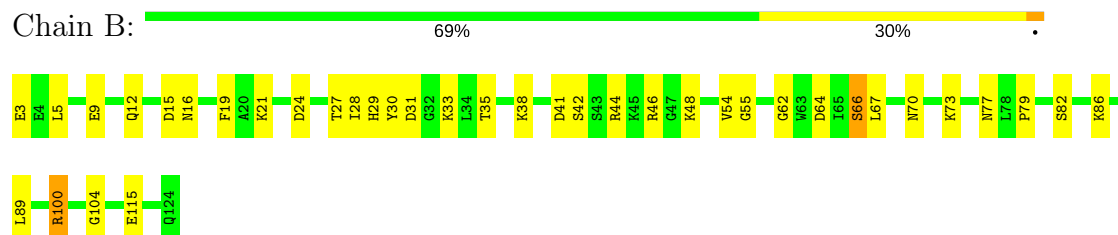
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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.

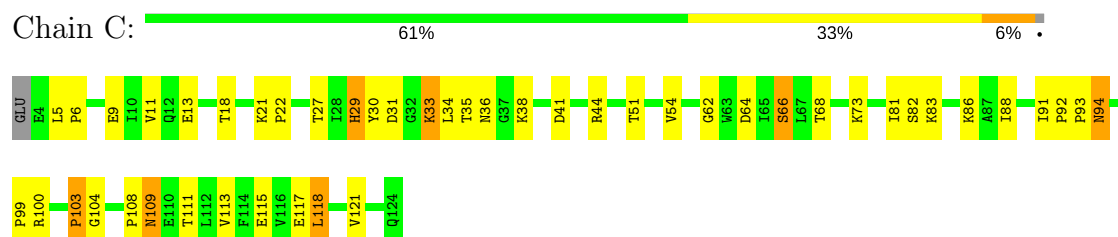
• Molecule 1: FK506-binding protein 1



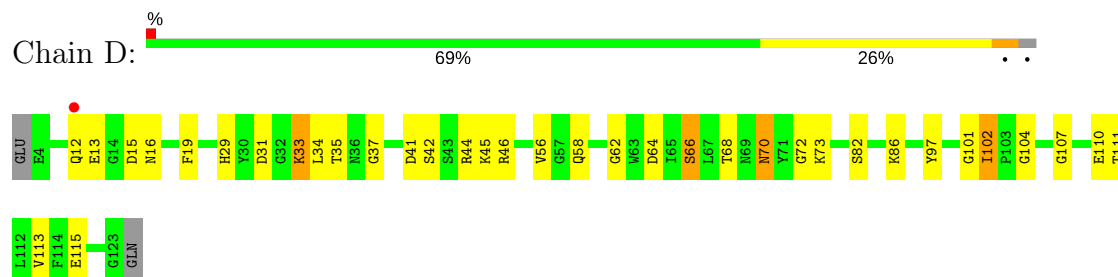
• Molecule 1: FK506-binding protein 1



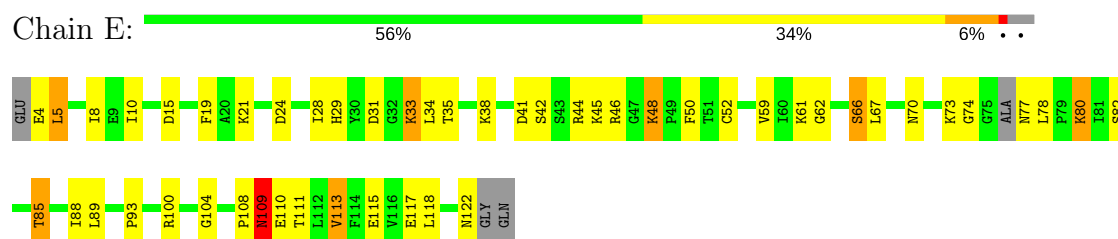
• Molecule 1: FK506-binding protein 1



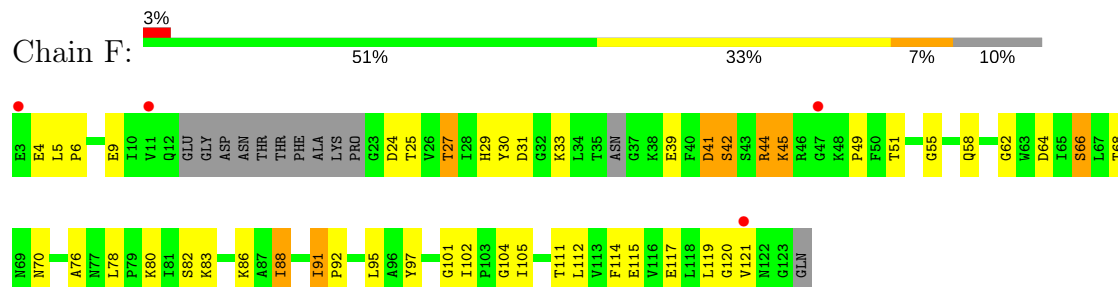
• Molecule 1: FK506-binding protein 1



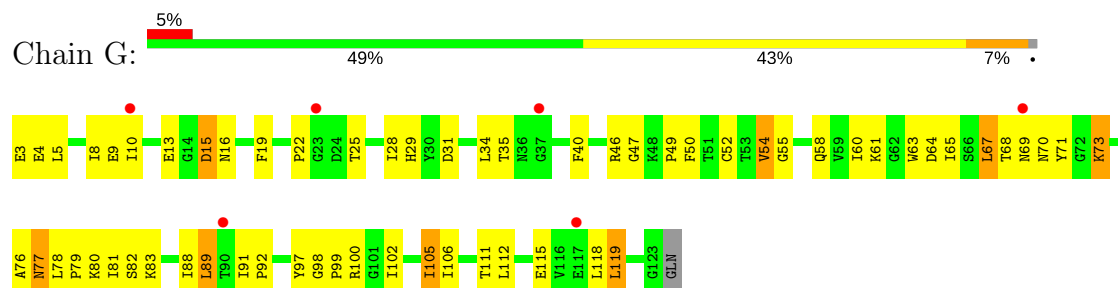
● Molecule 1: FK506-binding protein 1



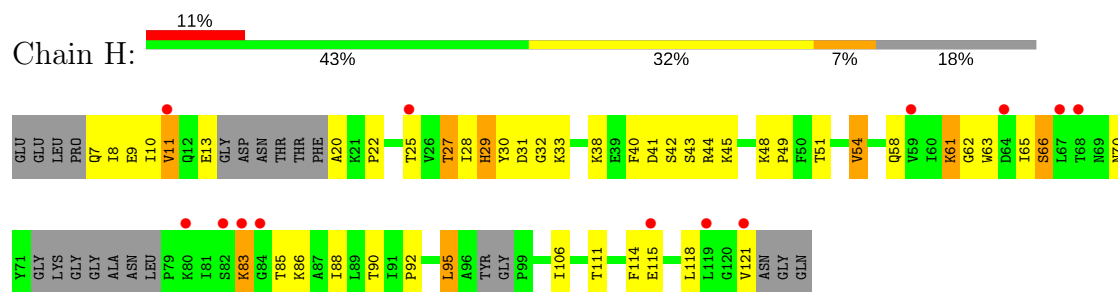
● Molecule 1: FK506-binding protein 1



● Molecule 1: FK506-binding protein 1



● Molecule 1: FK506-binding protein 1



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	115.42Å 84.18Å 116.72Å 90.00° 109.81° 90.00°	Depositor
Resolution (Å)	26.15 – 2.86 47.46 – 2.60	Depositor EDS
% Data completeness (in resolution range)	94.5 (26.15-2.86) 84.1 (47.46-2.60)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.24 (at 2.61Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.244 , 0.285 0.244 , 0.285	Depositor DCC
R_{free} test set	1681 reflections (7.28%)	DCC
Wilson B-factor (Å ²)	47.5	Xtriage
Anisotropy	0.206	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 53.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	7289	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.21% 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: FK5

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	0.40	0/893	0.65	0/1215
1	B	0.36	0/920	0.58	0/1250
1	C	0.39	0/892	0.67	0/1214
1	D	0.39	0/909	0.68	0/1235
1	E	0.49	0/877	0.80	1/1192 (0.1%)
1	F	0.39	0/799	0.76	0/1090
1	G	0.37	0/884	0.73	1/1208 (0.1%)
1	H	0.38	0/727	0.70	0/985
All	All	0.40	0/6901	0.70	2/9389 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	E	0	1
1	F	0	1
All	All	0	2

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	109	ASN	N-CA-C	6.61	128.84	111.00
1	G	89	LEU	CA-CB-CG	6.46	130.17	115.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	E	108	PRO	Peptide
1	F	42	SER	Peptide

5.2 Too-close contacts [i](#)

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	875	0	872	31	0
1	B	902	0	904	23	0
1	C	874	0	852	26	0
1	D	891	0	898	24	0
1	E	860	0	848	28	0
1	F	785	0	755	33	0
1	G	866	0	832	40	0
1	H	716	0	721	31	0
2	A	57	0	69	3	0
2	B	57	0	69	1	0
2	C	57	0	69	5	0
2	D	57	0	69	3	0
2	E	57	0	69	3	0
2	F	57	0	69	4	0
2	G	57	0	69	3	0
2	H	57	0	69	5	0
3	A	8	0	0	2	0
3	B	7	0	0	2	0
3	C	9	0	0	3	0
3	D	10	0	0	4	0
3	E	6	0	0	4	0
3	F	8	0	0	2	0
3	G	9	0	0	6	0
3	H	7	0	0	0	0
All	All	7289	0	7234	246	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 17.

The worst 5 of 246 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:G:76:ALA:O	1:G:77:ASN:ND2	1.85	1.10
1:D:107:GLY:O	3:D:301:HOH:O	1.85	0.94
1:F:45:LYS:NZ	3:F:301:HOH:O	2.02	0.92
1:B:3:GLU:OE1	3:B:301:HOH:O	1.93	0.85
1:E:45:LYS:NZ	3:E:301:HOH:O	2.11	0.82

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	118/122 (97%)	113 (96%)	5 (4%)	0	100	100
1	B	120/122 (98%)	116 (97%)	4 (3%)	0	100	100
1	C	119/122 (98%)	113 (95%)	5 (4%)	1 (1%)	22	52
1	D	118/122 (97%)	113 (96%)	5 (4%)	0	100	100
1	E	114/122 (93%)	112 (98%)	2 (2%)	0	100	100
1	F	104/122 (85%)	100 (96%)	4 (4%)	0	100	100
1	G	119/122 (98%)	116 (98%)	3 (2%)	0	100	100
1	H	92/122 (75%)	90 (98%)	2 (2%)	0	100	100
All	All	904/976 (93%)	873 (97%)	30 (3%)	1 (0%)	55	84

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	103	PRO

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	92/100 (92%)	79 (86%)	13 (14%)	4	10
1	B	96/100 (96%)	87 (91%)	9 (9%)	10	27
1	C	90/100 (90%)	74 (82%)	16 (18%)	2	5
1	D	96/100 (96%)	87 (91%)	9 (9%)	10	27
1	E	89/100 (89%)	68 (76%)	21 (24%)	1	2
1	F	80/100 (80%)	63 (79%)	17 (21%)	1	3
1	G	88/100 (88%)	69 (78%)	19 (22%)	1	2
1	H	75/100 (75%)	60 (80%)	15 (20%)	1	3
All	All	706/800 (88%)	587 (83%)	119 (17%)	2	6

5 of 119 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	59	VAL
1	E	115	GLU
1	H	29	HIS
1	E	66	SER
1	E	88	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	109	ASN
1	D	16	ASN
1	E	109	ASN
1	F	29	HIS

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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

8 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	FK5	A	201	-	55,60,60	3.45	11 (20%)	59,86,86	1.56	11 (18%)
2	FK5	B	201	-	55,60,60	3.49	10 (18%)	59,86,86	1.41	7 (11%)
2	FK5	C	201	-	55,60,60	3.47	11 (20%)	59,86,86	1.69	13 (22%)
2	FK5	D	201	-	55,60,60	3.50	10 (18%)	59,86,86	1.67	11 (18%)
2	FK5	E	201	-	55,60,60	3.39	10 (18%)	59,86,86	1.51	10 (16%)
2	FK5	F	201	-	55,60,60	3.45	10 (18%)	59,86,86	1.61	14 (23%)
2	FK5	G	201	-	55,60,60	3.48	11 (20%)	59,86,86	1.43	9 (15%)
2	FK5	H	201	-	55,60,60	3.55	11 (20%)	59,86,86	1.25	5 (8%)

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	FK5	A	201	-	-	0/68/114/114	0/2/4/4
2	FK5	B	201	-	-	0/68/114/114	0/2/4/4
2	FK5	C	201	-	-	0/68/114/114	0/2/4/4
2	FK5	D	201	-	-	0/68/114/114	0/2/4/4
2	FK5	E	201	-	-	0/68/114/114	0/2/4/4

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	FK5	F	201	-	-	0/68/114/114	0/2/4/4
2	FK5	G	201	-	-	0/68/114/114	0/2/4/4
2	FK5	H	201	-	-	0/68/114/114	0/2/4/4

The worst 5 of 84 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	201	FK5	C8-C9	-11.40	1.38	1.53
2	H	201	FK5	C8-C9	-10.99	1.39	1.53
2	B	201	FK5	C8-C9	-10.75	1.39	1.53
2	G	201	FK5	C8-C9	-10.56	1.39	1.53
2	A	201	FK5	C8-C9	-10.48	1.39	1.53

The worst 5 of 80 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	201	FK5	C17-C16-C15	-3.63	109.75	115.56
2	C	201	FK5	O1-C1-O2	-3.22	117.58	123.90
2	D	201	FK5	O4-C9-C8	-3.16	115.43	119.06
2	D	201	FK5	O2-C1-C2	-2.72	118.43	124.53
2	D	201	FK5	C16-C17-C18	-2.66	107.34	111.49

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

8 monomers are involved in 26 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	201	FK5	3	0
2	B	201	FK5	1	0
2	C	201	FK5	5	0
2	D	201	FK5	3	0
2	E	201	FK5	3	0
2	F	201	FK5	4	0
2	G	201	FK5	3	0
2	H	201	FK5	5	0

5.7 Other polymers ⓘ

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	120/122 (98%)	-0.26	0 100 100	26, 41, 57, 70	0
1	B	122/122 (100%)	-0.22	0 100 100	30, 41, 61, 79	0
1	C	121/122 (99%)	-0.28	0 100 100	29, 44, 76, 89	0
1	D	120/122 (98%)	-0.23	1 (0%) 86 85	26, 40, 57, 80	0
1	E	118/122 (96%)	-0.08	0 100 100	33, 50, 72, 82	0
1	F	110/122 (90%)	0.15	4 (3%) 43 37	48, 71, 101, 117	0
1	G	121/122 (99%)	0.29	6 (4%) 30 25	41, 62, 89, 102	0
1	H	100/122 (81%)	0.68	13 (13%) 4 2	46, 79, 107, 113	0
All	All	932/976 (95%)	-0.01	24 (2%) 56 52	26, 50, 89, 117	0

The worst 5 of 24 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	H	121	VAL	4.5
1	H	67	LEU	4.5
1	H	68	THR	3.5
1	H	11	VAL	3.2
1	H	59	VAL	3.1

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

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

6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

6.4 Ligands

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å ²)	Q<0.9
2	FK5	D	201	57/57	0.90	0.20	1.05	33,41,54,59	0
2	FK5	C	201	57/57	0.89	0.23	0.98	51,61,69,71	0
2	FK5	G	201	57/57	0.86	0.23	0.92	36,51,58,61	0
2	FK5	H	201	57/57	0.84	0.28	0.63	60,66,79,79	0
2	FK5	E	201	57/57	0.89	0.20	0.62	28,41,50,52	0
2	FK5	B	201	57/57	0.92	0.21	0.60	28,42,53,54	0
2	FK5	A	201	57/57	0.91	0.17	0.02	26,35,41,41	0
2	FK5	F	201	57/57	0.90	0.19	-0.12	37,51,62,63	0

6.5 Other polymers

There are no such residues in this entry.