



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 16, 2023 – 01:13 PM EDT

PDB ID : 2E8W
Title : *S. cerevisiae* geranylgeranyl pyrophosphate synthase in complex with magnesium and IPP
Authors : Guo, R.T.; Ko, T.P.; Chen, C.K.-M.; Jeng, W.Y.; Chang, T.H.; Liang, P.H.; Oldfield, E.; Wang, A.H.-J.
Deposited on : 2007-01-24
Resolution : 2.35 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 : 2.36
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) : 2.36

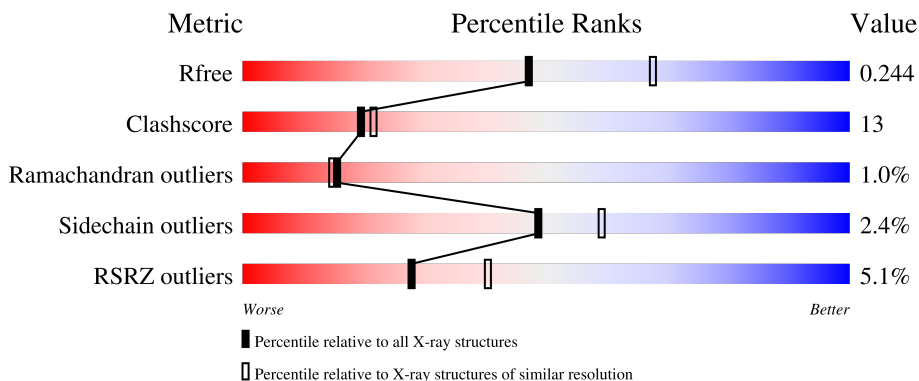
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION


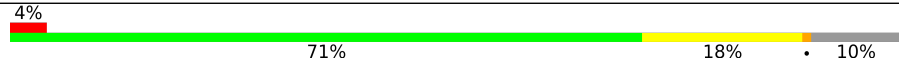
The reported resolution of this entry is 2.35 Å.

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	1164 (2.36-2.36)
Clashscore	141614	1232 (2.36-2.36)
Ramachandran outliers	138981	1211 (2.36-2.36)
Sidechain outliers	138945	1212 (2.36-2.36)
RSRZ outliers	127900	1150 (2.36-2.36)

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	340	 6% 69% 23% • 7%
1	B	340	 4% 71% 18% • 10%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5589 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 Geranylgeranyl pyrophosphate synthetase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	316	2580	1658	434	478	10	0	0	0
1	B	307	2505	1606	427	462	10	0	0	0

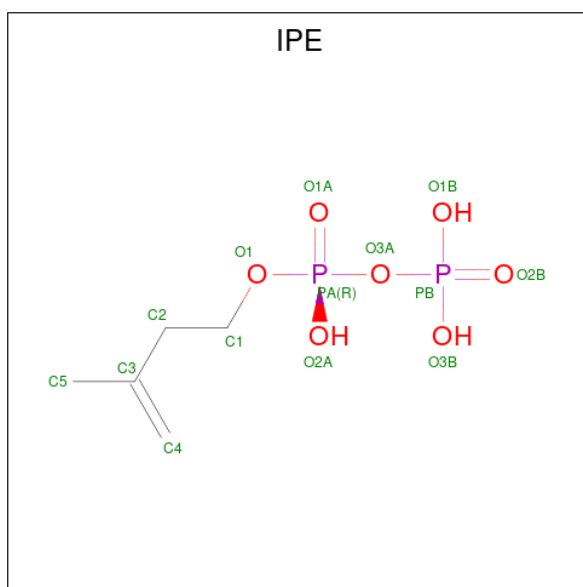
There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	cloning artifact	UNP Q12051
A	2	THR	-	cloning artifact	UNP Q12051
A	3	LYS	-	cloning artifact	UNP Q12051
A	4	ASN	-	cloning artifact	UNP Q12051
A	5	LYS	-	cloning artifact	UNP Q12051
B	1	MET	-	cloning artifact	UNP Q12051
B	2	THR	-	cloning artifact	UNP Q12051
B	3	LYS	-	cloning artifact	UNP Q12051
B	4	ASN	-	cloning artifact	UNP Q12051
B	5	LYS	-	cloning artifact	UNP Q12051

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Mg	0	0
			2	2		
2	B	2	Total	Mg	0	0
			2	2		

- Molecule 3 is 3-METHYLBUT-3-ENYL TRIHYDROGEN DIPHOSPHATE (three-letter code: IPE) (formula: C₅H₁₂O₇P₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	O	P	0	0
			14	5	7	2		
3	B	1	Total	C	O	P	0	0
			14	5	7	2		
3	B	1	Total	C	O	P	0	0
			14	5	7	2		

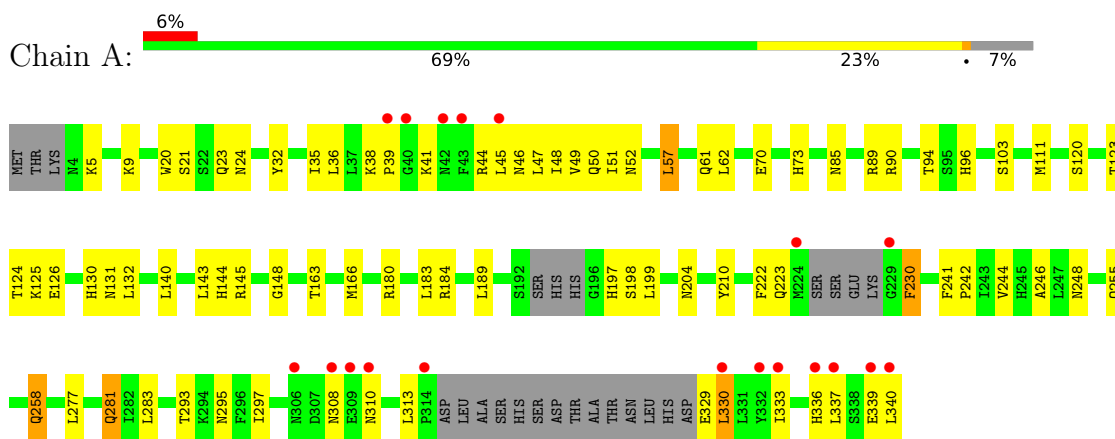
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	238	Total	O	0	0
			238	238		
4	B	220	Total	O	0	0
			220	220		

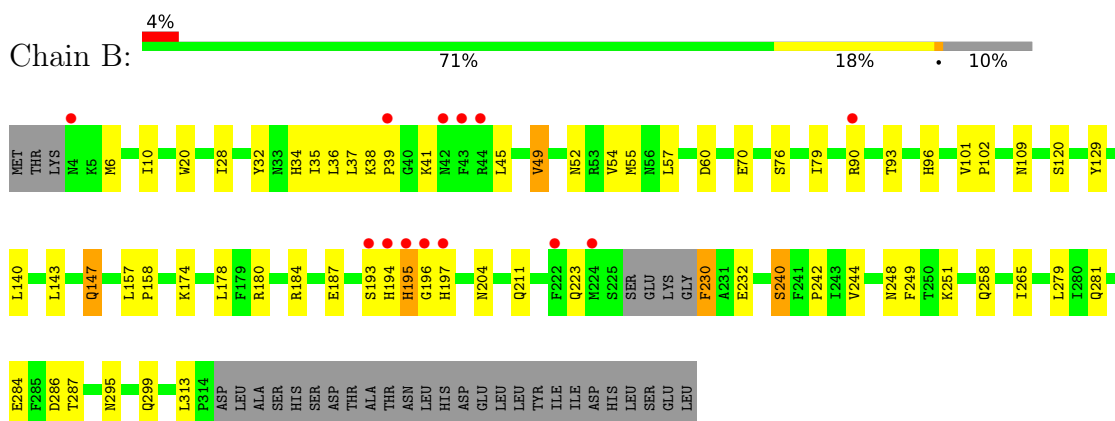
3 Residue-property plots [i](#)

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: Geranylgeranyl pyrophosphate synthetase



- Molecule 1: Geranylgeranyl pyrophosphate synthetase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	47.66Å 116.06Å 128.83Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.11 – 2.35 43.11 – 2.35	Depositor EDS
% Data completeness (in resolution range)	94.0 (43.11-2.35) 93.8 (43.11-2.35)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	0.12	Depositor
$\langle I/\sigma(I) \rangle$ ¹	8.42 (at 2.34Å)	Xtrriage
Refinement program	CNS	Depositor
R, R_{free}	0.188 , 0.246 0.185 , 0.244	Depositor DCC
R_{free} test set	1410 reflections (4.89%)	wwPDB-VP
Wilson B-factor (Å ²)	24.9	Xtrriage
Anisotropy	0.958	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 61.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5589	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.58% 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 i

5.1 Standard geometry i

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

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	0.59	0/2626	0.70	1/3552 (0.0%)
1	B	0.56	0/2553	0.70	1/3457 (0.0%)
All	All	0.57	0/5179	0.70	2/7009 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	140	LEU	CA-CB-CG	-5.11	103.55	115.30
1	A	57	LEU	CA-CB-CG	5.09	127.02	115.30

There are no chirality outliers.

There are no planarity outliers.

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	2580	0	2628	82	0
1	B	2505	0	2548	53	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
3	A	14	0	9	1	0
3	B	28	0	18	3	0
4	A	238	0	0	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	220	0	0	6	0
All	All	5589	0	5203	132	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 13.

All (132) 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:163:THR:H	1:A:166:MET:HE3	1.10	1.13
1:A:38:LYS:HB3	1:A:90:ARG:HD3	1.14	1.08
1:A:143:LEU:HD11	3:A:1001:IPE:H42	1.36	1.07
1:A:258:GLN:HE21	1:A:258:GLN:H	1.20	0.90
1:A:123:THR:HG22	1:A:125:LYS:H	1.36	0.88
1:A:38:LYS:CB	1:A:90:ARG:HD3	2.04	0.86
1:B:258:GLN:HG2	1:B:286:ASP:OD2	1.76	0.85
1:A:52:ASN:HD21	1:A:57:LEU:H	1.28	0.82
1:A:163:THR:N	1:A:166:MET:HE3	1.93	0.81
1:A:38:LYS:HD3	1:A:90:ARG:HD2	1.62	0.81
1:B:52:ASN:HD21	1:B:57:LEU:H	1.29	0.81
1:A:295:ASN:HB2	4:A:779:HOH:O	1.80	0.80
1:B:143:LEU:HD11	3:B:1002:IPE:H42	1.64	0.79
1:A:38:LYS:HB3	1:A:90:ARG:CD	2.06	0.76
1:A:281:GLN:HA	1:A:281:GLN:HE21	1.51	0.75
1:B:45:LEU:O	1:B:49:VAL:HG23	1.86	0.74
1:A:281:GLN:HA	1:A:281:GLN:NE2	2.03	0.73
1:B:223:GLN:NE2	1:B:284:GLU:HG3	2.05	0.72
1:A:94:THR:HG21	1:A:96:HIS:CD2	2.26	0.69
1:A:241:PHE:HB3	1:A:242:PRO:HD3	1.74	0.69
1:A:38:LYS:HE3	1:A:89:ARG:O	1.92	0.69
1:A:45:LEU:O	1:A:49:VAL:HG23	1.93	0.69
1:A:140:LEU:O	1:A:144:HIS:HD2	1.76	0.68
1:A:336:HIS:O	1:A:339:GLU:HG2	1.95	0.66
1:A:94:THR:CG2	1:A:96:HIS:CD2	2.79	0.66
1:A:180:ARG:HH11	1:A:204:ASN:HD21	1.42	0.65
1:B:295:ASN:O	1:B:299:GLN:HG3	1.97	0.64
1:B:52:ASN:ND2	1:B:57:LEU:H	1.95	0.64
1:A:5:LYS:O	1:A:9:LYS:HG3	1.99	0.62
3:B:1003:IPE:H22	3:B:1003:IPE:O1A	1.98	0.62
1:A:50:GLN:HG3	1:A:333:ILE:HD11	1.81	0.62
1:A:21:SER:HB2	1:A:23:GLN:OE1	2.00	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:131:ASN:HB3	4:A:855:HOH:O	2.01	0.61
1:B:180:ARG:HD3	1:B:204:ASN:HD21	1.64	0.61
1:A:281:GLN:HE21	1:A:281:GLN:CA	2.14	0.60
1:B:55:MET:HE2	1:B:187:GLU:HA	1.85	0.59
1:B:120:SER:HB3	4:B:483:HOH:O	2.03	0.58
1:B:240:SER:HB3	1:B:242:PRO:HD2	1.84	0.58
1:B:55:MET:HE1	1:B:187:GLU:HG2	1.86	0.57
1:A:163:THR:HG23	1:A:166:MET:CE	2.34	0.57
1:A:180:ARG:HH11	1:A:204:ASN:ND2	2.03	0.57
1:A:96:HIS:HE1	4:A:448:HOH:O	1.88	0.56
1:A:50:GLN:CD	1:A:329:GLU:HG2	2.26	0.56
1:A:130:HIS:HD2	1:B:129:TYR:CD2	2.23	0.56
1:A:293:THR:O	1:A:297:ILE:HG13	2.05	0.56
1:A:47:LEU:O	1:A:51:ILE:HG13	2.06	0.56
1:A:163:THR:H	1:A:166:MET:CE	2.02	0.56
1:B:180:ARG:HH11	1:B:204:ASN:ND2	2.05	0.54
1:A:144:HIS:HE1	4:B:764:HOH:O	1.90	0.54
1:A:20:TRP:CH2	1:A:24:ASN:HB3	2.42	0.54
1:A:337:LEU:HD12	1:A:340:LEU:HD12	1.90	0.54
1:B:38:LYS:CG	1:B:90:ARG:HG2	2.38	0.54
1:B:36:LEU:C	1:B:38:LYS:H	2.11	0.53
1:A:85:ASN:ND2	4:A:448:HOH:O	2.41	0.53
1:A:123:THR:HG22	1:A:124:THR:H	1.74	0.53
1:B:223:GLN:NE2	1:B:284:GLU:CG	2.72	0.53
1:B:52:ASN:HD21	1:B:57:LEU:N	2.04	0.52
1:A:223:GLN:HE21	1:A:281:GLN:HE22	1.56	0.52
1:A:38:LYS:HB2	1:A:90:ARG:HH11	1.75	0.52
1:B:180:ARG:HH11	1:B:204:ASN:HD21	1.57	0.52
1:B:120:SER:HA	1:B:129:TYR:CE1	2.44	0.52
1:B:96:HIS:HD2	4:B:413:HOH:O	1.93	0.51
1:A:123:THR:HG21	1:A:125:LYS:HB2	1.90	0.51
1:A:148:GLY:HA3	1:B:28:ILE:HD12	1.92	0.51
1:B:32:TYR:O	1:B:35:ILE:HG22	2.11	0.51
1:B:52:ASN:HD22	1:B:55:MET:HB2	1.76	0.51
1:B:197:HIS:CE1	1:B:313:LEU:O	2.64	0.50
1:A:46:ASN:O	1:A:50:GLN:HG2	2.12	0.50
1:B:223:GLN:HE22	1:B:284:GLU:HG3	1.75	0.50
1:B:55:MET:CE	1:B:187:GLU:HA	2.42	0.50
1:B:54:VAL:HG12	1:B:195:HIS:HB2	1.94	0.49
1:B:194:HIS:C	1:B:196:GLY:H	2.16	0.49
1:B:211:GLN:OE1	3:B:1003:IPE:H51	2.12	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:6:MET:O	1:B:10:ILE:HG12	2.13	0.49
1:A:41:LYS:HA	1:A:44:ARG:NH2	2.28	0.49
1:A:281:GLN:NE2	1:A:281:GLN:CA	2.73	0.49
1:A:50:GLN:OE1	1:A:329:GLU:HG2	2.13	0.48
1:B:244:VAL:O	1:B:248:ASN:ND2	2.47	0.48
1:B:38:LYS:HG2	1:B:90:ARG:HG2	1.93	0.48
1:A:255:GLN:HB3	1:A:258:GLN:NE2	2.29	0.48
1:A:308:ASN:C	1:A:310:ASN:H	2.16	0.48
1:B:147:GLN:NE2	1:B:174:LYS:HD2	2.29	0.48
1:A:258:GLN:HE21	1:A:258:GLN:N	2.00	0.48
1:A:123:THR:HG22	1:A:124:THR:N	2.30	0.47
1:B:34:HIS:HE1	1:B:93:THR:O	1.97	0.47
1:B:265:ILE:HG21	1:B:279:LEU:HB2	1.97	0.47
1:B:180:ARG:O	1:B:184:ARG:HG3	2.15	0.47
1:A:44:ARG:HE	1:A:70:GLU:CD	2.19	0.47
1:B:249:PHE:CD2	1:B:287:THR:HG22	2.50	0.46
1:A:94:THR:HG22	1:A:96:HIS:CD2	2.49	0.46
1:B:41:LYS:HG3	1:B:70:GLU:OE2	2.16	0.46
1:B:147:GLN:HE21	1:B:147:GLN:HA	1.81	0.46
1:A:48:ILE:HG22	1:A:62:LEU:HD11	1.98	0.46
1:A:222:PHE:CD1	1:A:230:PHE:HA	2.51	0.46
1:A:197:HIS:HD2	1:A:198:SER:O	1.99	0.46
1:B:96:HIS:HE1	4:B:522:HOH:O	1.98	0.46
1:A:126:GLU:OE2	1:A:126:GLU:HA	2.16	0.45
1:A:246:ALA:HB2	1:A:283:LEU:HD22	1.98	0.45
1:A:94:THR:CG2	1:A:96:HIS:HD2	2.28	0.45
1:B:38:LYS:HE2	1:B:38:LYS:HB3	1.81	0.45
1:A:210:TYR:CD2	1:A:210:TYR:C	2.90	0.45
1:B:101:VAL:N	1:B:102:PRO:CD	2.79	0.44
1:B:223:GLN:HE21	1:B:284:GLU:CD	2.20	0.44
1:A:123:THR:CG2	1:A:125:LYS:HB2	2.48	0.44
1:A:44:ARG:O	1:A:48:ILE:HG13	2.18	0.44
1:A:144:HIS:CE1	4:B:764:HOH:O	2.69	0.43
1:A:330:LEU:HB3	4:A:803:HOH:O	2.17	0.43
1:A:35:ILE:HG13	1:A:38:LYS:HD2	2.01	0.43
1:B:54:VAL:CG1	1:B:195:HIS:HB2	2.48	0.43
1:A:132:LEU:HD11	1:A:189:LEU:HD21	2.00	0.43
1:B:90:ARG:HA	1:B:90:ARG:HD2	1.85	0.43
1:B:157:LEU:HD12	1:B:158:PRO:HA	1.99	0.43
1:B:147:GLN:HE22	1:B:174:LYS:HD2	1.81	0.43
1:B:230:PHE:CE1	1:B:232:GLU:HB2	2.53	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:44:ARG:HA	1:A:340:LEU:HD22	2.01	0.42
1:A:32:TYR:CD1	1:A:111:MET:HG3	2.54	0.42
1:A:183:LEU:HD21	1:A:199:LEU:HB2	2.01	0.42
1:A:222:PHE:HD1	1:A:230:PHE:HA	1.84	0.42
1:A:277:LEU:O	1:A:281:GLN:HG2	2.19	0.42
1:A:36:LEU:C	1:A:38:LYS:H	2.23	0.42
1:A:94:THR:HG23	4:A:672:HOH:O	2.19	0.42
1:A:337:LEU:HD12	1:A:340:LEU:CD1	2.49	0.42
1:B:34:HIS:HD2	4:B:679:HOH:O	2.01	0.42
1:A:130:HIS:CD2	1:B:129:TYR:CE2	3.08	0.42
1:A:145:ARG:HD3	1:B:20:TRP:CD2	2.55	0.42
1:A:44:ARG:HD3	1:A:73:HIS:CD2	2.55	0.41
1:A:180:ARG:O	1:A:184:ARG:HG3	2.19	0.41
1:B:79:ILE:HD11	1:B:109:ASN:ND2	2.35	0.41
1:A:120:SER:HB3	4:A:533:HOH:O	2.21	0.41
1:A:96:HIS:HD2	4:A:449:HOH:O	2.04	0.41
1:A:244:VAL:O	1:A:248:ASN:ND2	2.53	0.40
1:A:313:LEU:HA	1:A:313:LEU:HD23	1.88	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	308/340 (91%)	299 (97%)	8 (3%)	1 (0%)	41	47
1	B	303/340 (89%)	289 (95%)	9 (3%)	5 (2%)	9	7
All	All	611/680 (90%)	588 (96%)	17 (3%)	6 (1%)	15	15

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	193	SER
1	B	195	HIS
1	B	37	LEU
1	B	39	PRO
1	B	49	VAL
1	A	39	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	295/317 (93%)	289 (98%)	6 (2%)	55 66
1	B	287/317 (90%)	279 (97%)	8 (3%)	43 53
All	All	582/634 (92%)	568 (98%)	14 (2%)	49 59

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	61	GLN
1	A	103	SER
1	A	230	PHE
1	A	258	GLN
1	A	281	GLN
1	A	330	LEU
1	B	60	ASP
1	B	76	SER
1	B	147	GLN
1	B	178	LEU
1	B	230	PHE
1	B	240	SER
1	B	251	LYS
1	B	281	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (29) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	52	ASN
1	A	61	GLN
1	A	73	HIS
1	A	85	ASN
1	A	96	HIS
1	A	109	ASN
1	A	130	HIS
1	A	137	ASN
1	A	144	HIS
1	A	164	GLN
1	A	197	HIS
1	A	204	ASN
1	A	255	GLN
1	A	258	GLN
1	A	260	ASN
1	A	281	GLN
1	A	298	ASN
1	B	34	HIS
1	B	52	ASN
1	B	96	HIS
1	B	109	ASN
1	B	131	ASN
1	B	147	GLN
1	B	164	GLN
1	B	204	ASN
1	B	281	GLN
1	B	288	ASN
1	B	298	ASN
1	B	299	GLN

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

Of 7 ligands modelled in this entry, 4 are monoatomic - leaving 3 for Mogul analysis.

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
3	IPE	B	1002	2	11,13,13	2.79	4 (36%)	15,19,19	1.16	1 (6%)
3	IPE	B	1003	-	11,13,13	2.81	4 (36%)	15,19,19	1.19	2 (13%)
3	IPE	A	1001	2	11,13,13	2.86	4 (36%)	15,19,19	1.23	2 (13%)

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	IPE	B	1002	2	-	3/13/13/13	-
3	IPE	B	1003	-	-	1/13/13/13	-
3	IPE	A	1001	2	-	3/13/13/13	-

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1001	IPE	C4-C3	7.37	1.54	1.33
3	B	1002	IPE	C4-C3	7.16	1.53	1.33
3	B	1003	IPE	C4-C3	7.06	1.53	1.33
3	B	1003	IPE	PB-O2B	3.44	1.61	1.50
3	A	1001	IPE	PB-O2B	3.23	1.60	1.50
3	B	1002	IPE	PB-O2B	3.21	1.60	1.50
3	B	1003	IPE	PA-O1A	3.03	1.61	1.50
3	B	1002	IPE	PA-O1A	2.98	1.61	1.50
3	A	1001	IPE	PA-O1A	2.94	1.61	1.50
3	A	1001	IPE	C5-C3	-2.48	1.38	1.48
3	B	1002	IPE	C5-C3	-2.20	1.39	1.48
3	B	1003	IPE	C5-C3	-2.15	1.39	1.48

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1001	IPE	PA-O3A-PB	-2.92	122.80	132.83
3	B	1002	IPE	PA-O3A-PB	-2.75	123.39	132.83
3	B	1003	IPE	PA-O3A-PB	-2.63	123.82	132.83
3	A	1001	IPE	O3B-PB-O3A	2.19	111.97	104.64
3	B	1003	IPE	O3B-PB-O3A	2.08	111.61	104.64

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1001	IPE	C1-O1-PA-O1A
3	B	1002	IPE	C1-O1-PA-O3A
3	B	1002	IPE	PB-O3A-PA-O1
3	B	1003	IPE	C2-C1-O1-PA
3	A	1001	IPE	PB-O3A-PA-O1
3	B	1002	IPE	C1-O1-PA-O2A
3	A	1001	IPE	C1-O1-PA-O3A

There are no ring outliers.

3 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	1002	IPE	1	0
3	B	1003	IPE	2	0
3	A	1001	IPE	1	0

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, 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	316/340 (92%)	-0.02	19 (6%) 21 32	13, 29, 80, 103	0
1	B	307/340 (90%)	0.00	13 (4%) 36 48	14, 31, 66, 88	0
All	All	623/680 (91%)	-0.01	32 (5%) 28 40	13, 30, 71, 103	0

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	333	ILE	6.9
1	B	193	SER	6.2
1	B	194	HIS	4.9
1	A	332	TYR	4.7
1	B	196	GLY	4.7
1	A	340	LEU	4.6
1	A	308	ASN	4.5
1	B	224	MET	4.4
1	B	43	PHE	4.3
1	A	337	LEU	3.9
1	A	42	ASN	3.9
1	B	42	ASN	3.8
1	A	309	GLU	3.7
1	A	43	PHE	3.1
1	A	39	PRO	3.0
1	B	195	HIS	2.8
1	B	90	ARG	2.8
1	A	40	GLY	2.7
1	A	336	HIS	2.6
1	A	229	GLY	2.6
1	A	314	PRO	2.5
1	A	224	MET	2.5
1	B	197	HIS	2.5
1	B	4	ASN	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	306	ASN	2.5
1	B	39	PRO	2.4
1	A	330	LEU	2.3
1	B	44	ARG	2.2
1	A	339	GLU	2.1
1	A	310	ASN	2.0
1	B	222	PHE	2.0
1	A	45	LEU	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, 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
2	MG	B	1203	1/1	0.82	0.23	27,27,27,27	0
3	IPE	B	1003	14/14	0.92	0.23	67,71,75,75	0
2	MG	B	1204	1/1	0.94	0.18	21,21,21,21	0
2	MG	A	1201	1/1	0.94	0.13	21,21,21,21	0
3	IPE	B	1002	14/14	0.97	0.17	28,36,40,41	0
2	MG	A	1202	1/1	0.98	0.13	20,20,20,20	0
3	IPE	A	1001	14/14	0.98	0.13	31,35,40,40	0

6.5 Other polymers [i](#)

There are no such residues in this entry.