



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 13, 2017 – 02:11 am GMT

PDB ID : 1FPS  
Title : CRYSTAL STRUCTURE OF RECOMBINANT FARNESYL DIPHOSPHATE SYNTHASE AT 2.6 ANGSTROMS RESOLUTION  
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Deposited on : 1994-06-30  
Resolution : 2.60 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](mailto: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.

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

MolProbity : 4.02b-467  
Xtriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : recalc28949

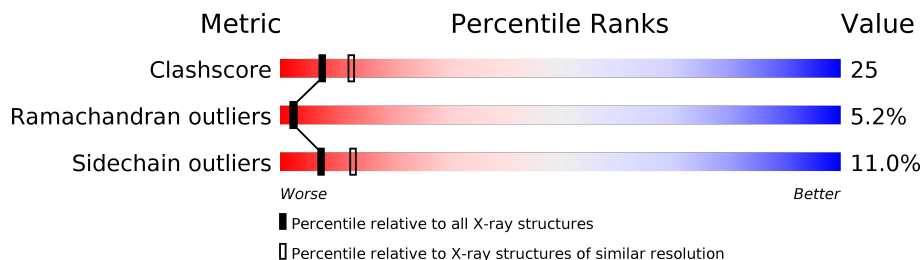
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.60 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))
Clashscore	112137	2895 (2.60-2.60)
Ramachandran outliers	110173	2848 (2.60-2.60)
Sidechain outliers	110143	2848 (2.60-2.60)

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  $\geq 3$ , 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	348	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2894 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 FARNESYL DIPHOSPHATE SYNTHASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	348	Total	C	N	O	S	0	0	0
			2815	1798	477	526	14			

- Molecule 2 is water.

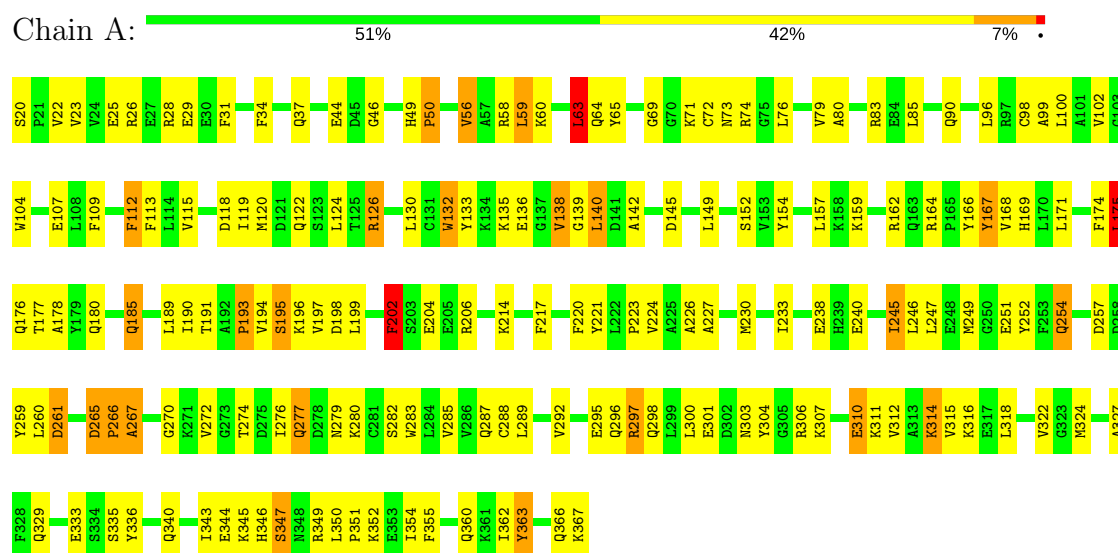
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	79	Total	O	0	0
			79	79		

### 3 Residue-property plots

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.

Note EDS was not executed.

#### • Molecule 1: FARNESYL DIPHOSPHATE SYNTHASE



## 4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	I 41 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	88.60Å 88.60Å 276.10Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.60	Depositor
% Data completeness (in resolution range)	(Not available) (8.00-2.60)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, $R_{free}$	0.194 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2894	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	38.0	wwPDB-VP

## 5 Model quality

### 5.1 Standard geometry

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	0.57	0/2872	0.78	3/3873 (0.1%)

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	A	0	1

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	A	63	LEU	CA-CB-CG	6.51	130.28	115.30
1	A	85	LEU	CA-CB-CG	6.00	129.11	115.30
1	A	175	LEU	CA-CB-CG	5.76	128.54	115.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	167	TYR	Sidechain

### 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	2815	0	2798	138	0
2	A	79	0	0	16	0
All	All	2894	0	2798	138	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 25.

All (138) 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:347:SER:HB2	1:A:352:LYS:HG2	1.47	0.95
1:A:329:GLN:HE22	1:A:333:GLU:HB2	1.41	0.86
1:A:288:CYS:SG	1:A:300:LEU:HD11	2.16	0.85
1:A:254:GLN:HE21	1:A:254:GLN:HA	1.42	0.82
1:A:177:THR:HA	1:A:180:GLN:HE21	1.48	0.78
1:A:185:GLN:HG3	2:A:539:HOH:O	1.84	0.77
1:A:59:LEU:HD22	1:A:63:LEU:HD22	1.66	0.77
1:A:318:LEU:O	1:A:322:VAL:HG23	1.84	0.77
1:A:199:LEU:HD23	1:A:289:LEU:HD21	1.67	0.75
1:A:245:ILE:HD11	1:A:355:PHE:CD1	2.22	0.74
1:A:220:PHE:O	1:A:223:PRO:HD2	1.87	0.73
1:A:327:ALA:HB2	2:A:506:HOH:O	1.87	0.73
1:A:329:GLN:NE2	1:A:333:GLU:HB2	2.02	0.73
1:A:132:TRP:HZ3	1:A:145:ASP:OD2	1.72	0.72
1:A:224:VAL:HG21	1:A:246:LEU:HD11	1.73	0.71
1:A:133:TYR:HB2	1:A:139:GLY:O	1.90	0.71
1:A:226:ALA:O	1:A:230:MET:HG3	1.91	0.71
1:A:311:LYS:O	1:A:315:VAL:HG23	1.90	0.70
1:A:120:MET:SD	2:A:415:HOH:O	2.49	0.70
1:A:60:LYS:HE2	1:A:64:GLN:OE1	1.92	0.69
1:A:245:ILE:HG21	2:A:461:HOH:O	1.93	0.68
1:A:303:ASN:HD22	1:A:314:LYS:HB3	1.60	0.67
1:A:238:GLU:HG3	1:A:349:ARG:HD3	1.76	0.66
1:A:119:ILE:HD11	1:A:142:ALA:HB3	1.78	0.66
1:A:164:ARG:HH11	1:A:164:ARG:HG2	1.61	0.65
1:A:245:ILE:HD11	1:A:355:PHE:CG	2.34	0.62
1:A:133:TYR:HD1	2:A:416:HOH:O	1.81	0.62
1:A:260:LEU:HD21	1:A:366:GLN:H	1.64	0.62
1:A:347:SER:CB	1:A:352:LYS:HG2	2.24	0.62
1:A:20:SER:OG	1:A:23:VAL:HG23	1.99	0.61
1:A:154:TYR:CZ	1:A:175:LEU:HD13	2.34	0.61
1:A:276:ILE:HD12	1:A:316:LYS:NZ	2.16	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:277:GLN:OE1	1:A:307:LYS:HB2	2.01	0.60
1:A:221:TYR:HA	1:A:246:LEU:HD13	1.82	0.60
1:A:261:ASP:HA	2:A:544:HOH:O	2.01	0.60
1:A:71:LYS:O	1:A:72:CYS:HB2	2.03	0.59
1:A:197:VAL:HG13	1:A:279:ASN:ND2	2.18	0.59
1:A:65:TYR:CD1	1:A:132:TRP:CD1	2.90	0.58
1:A:277:GLN:CD	1:A:307:LYS:HB2	2.23	0.58
1:A:252:TYR:HD2	1:A:335:SER:HG	1.51	0.57
1:A:280:LYS:HE3	1:A:282:SER:OG	2.05	0.57
1:A:34:PHE:O	1:A:37:GLN:HB3	2.05	0.57
1:A:28:ARG:HG2	1:A:76:LEU:HD11	1.87	0.57
1:A:157:LEU:HD11	1:A:174:PHE:CD2	2.39	0.56
1:A:191:THR:O	1:A:193:PRO:HD3	2.06	0.56
1:A:277:GLN:HE22	1:A:306:ARG:HD3	1.71	0.56
1:A:65:TYR:CD1	1:A:132:TRP:HD1	2.24	0.55
1:A:133:TYR:HA	1:A:138:VAL:HG12	1.88	0.54
1:A:300:LEU:HG	1:A:318:LEU:HD21	1.89	0.54
1:A:25:GLU:O	1:A:29:GLU:HG3	2.07	0.54
1:A:79:VAL:HG21	1:A:100:LEU:HD23	1.89	0.54
1:A:346:HIS:HB2	2:A:461:HOH:O	2.08	0.54
1:A:191:THR:OG1	1:A:206:ARG:NH1	2.41	0.54
1:A:336:TYR:O	1:A:340:GLN:HG2	2.08	0.54
1:A:58:ARG:HG2	1:A:58:ARG:HH11	1.74	0.53
1:A:202:PHE:HD1	1:A:202:PHE:N	2.07	0.53
1:A:177:THR:HA	1:A:180:GLN:NE2	2.19	0.53
1:A:49:HIS:CD2	1:A:50:PRO:HD2	2.44	0.53
1:A:202:PHE:CD1	1:A:202:PHE:N	2.77	0.52
1:A:109:PHE:HZ	1:A:178:ALA:HA	1.75	0.52
1:A:345:LYS:O	1:A:345:LYS:HG2	2.08	0.52
1:A:164:ARG:HG2	1:A:164:ARG:NH1	2.25	0.51
1:A:132:TRP:CZ3	1:A:145:ASP:OD2	2.60	0.51
1:A:300:LEU:O	1:A:304:TYR:HB3	2.11	0.51
1:A:65:TYR:CE1	1:A:132:TRP:HD1	2.29	0.50
1:A:149:LEU:O	1:A:152:SER:HB2	2.11	0.50
1:A:265:ASP:H	1:A:266:PRO:HD2	1.75	0.50
1:A:336:TYR:HB2	1:A:363:TYR:CD2	2.46	0.50
1:A:115:VAL:HA	2:A:473:HOH:O	2.11	0.49
1:A:196:LYS:O	1:A:197:VAL:HB	2.13	0.49
1:A:28:ARG:NH2	1:A:71:LYS:O	2.45	0.49
1:A:349:ARG:HG3	2:A:463:HOH:O	2.12	0.49
1:A:132:TRP:O	1:A:138:VAL:HG11	2.12	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:276:ILE:HG21	1:A:312:VAL:HG13	1.94	0.49
1:A:300:LEU:HG	1:A:318:LEU:CD2	2.43	0.49
1:A:120:MET:CE	1:A:189:LEU:HD21	2.43	0.48
1:A:270:GLY:C	1:A:272:VAL:H	2.16	0.48
1:A:190:ILE:HG22	1:A:191:THR:N	2.28	0.48
1:A:276:ILE:HD11	1:A:315:VAL:HG21	1.95	0.48
1:A:351:PRO:HG2	1:A:354:ILE:CD1	2.43	0.48
1:A:34:PHE:CE1	1:A:37:GLN:HG2	2.48	0.48
1:A:164:ARG:HD3	2:A:485:HOH:O	2.12	0.48
1:A:265:ASP:HB3	1:A:266:PRO:HD3	1.95	0.48
1:A:214:LYS:HD3	2:A:541:HOH:O	2.14	0.47
1:A:166:TYR:O	1:A:169:HIS:HB2	2.14	0.47
1:A:306:ARG:HD3	1:A:307:LYS:H	1.79	0.47
1:A:197:VAL:HG13	1:A:279:ASN:CG	2.34	0.47
1:A:217:PHE:CE1	1:A:247:LEU:HD11	2.49	0.47
1:A:22:VAL:HG12	1:A:26:ARG:NH2	2.30	0.47
1:A:136:GLU:CD	1:A:136:GLU:H	2.18	0.47
1:A:351:PRO:HG2	1:A:354:ILE:HD11	1.97	0.47
1:A:135:LYS:HB3	1:A:135:LYS:NZ	2.30	0.47
1:A:112:PHE:CZ	1:A:113:PHE:CE2	3.03	0.46
1:A:46:GLY:CA	1:A:56:VAL:HG11	2.46	0.46
1:A:297:ARG:HD2	1:A:301:GLU:OE2	2.15	0.46
1:A:265:ASP:O	1:A:267:ALA:N	2.48	0.46
1:A:224:VAL:CG2	1:A:246:LEU:HD11	2.45	0.46
1:A:46:GLY:HA3	1:A:56:VAL:HG11	1.96	0.46
1:A:252:TYR:CE1	1:A:362:ILE:HG22	2.51	0.45
1:A:138:VAL:HG12	1:A:139:GLY:N	2.31	0.45
1:A:276:ILE:O	1:A:276:ILE:HG12	2.15	0.45
1:A:295:GLU:HG2	1:A:296:GLN:H	1.81	0.45
1:A:171:LEU:O	1:A:175:LEU:HD22	2.17	0.44
1:A:191:THR:C	1:A:193:PRO:HD3	2.37	0.44
1:A:64:GLN:HB3	2:A:469:HOH:O	2.17	0.44
1:A:98:CYS:O	1:A:102:VAL:HG23	2.17	0.44
1:A:194:VAL:O	1:A:195:SER:C	2.55	0.44
1:A:254:GLN:HA	1:A:254:GLN:NE2	2.20	0.44
1:A:220:PHE:C	1:A:223:PRO:HD2	2.37	0.44
1:A:245:ILE:HD13	2:A:461:HOH:O	2.17	0.44
1:A:28:ARG:HG2	1:A:76:LEU:CD1	2.47	0.44
1:A:194:VAL:HG13	1:A:195:SER:N	2.33	0.43
1:A:124:LEU:O	1:A:130:LEU:HD12	2.18	0.43
1:A:224:VAL:O	1:A:227:ALA:N	2.52	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:162:ARG:HD3	2:A:532:HOH:O	2.18	0.43
1:A:140:LEU:HA	1:A:140:LEU:HD12	1.50	0.43
1:A:343:ILE:HA	2:A:461:HOH:O	2.18	0.43
1:A:202:PHE:HD2	1:A:285:VAL:HG11	1.84	0.42
1:A:96:LEU:O	1:A:99:ALA:HB3	2.19	0.42
1:A:80:ALA:HA	1:A:83:ARG:NH1	2.34	0.42
1:A:196:LYS:HA	1:A:196:LYS:HD2	1.83	0.41
1:A:221:TYR:HA	1:A:246:LEU:CD1	2.48	0.41
1:A:31:PHE:CE1	1:A:104:TRP:CD1	3.08	0.41
1:A:295:GLU:HG2	1:A:296:GLN:N	2.35	0.41
1:A:119:ILE:HD11	1:A:142:ALA:CB	2.47	0.41
1:A:259:TYR:HD2	1:A:260:LEU:HD23	1.85	0.41
1:A:246:LEU:HD23	1:A:249:MET:CE	2.51	0.41
1:A:318:LEU:HD12	1:A:322:VAL:HG23	2.02	0.41
1:A:72:CYS:O	1:A:74:ARG:N	2.53	0.41
1:A:118:ASP:HB2	2:A:473:HOH:O	2.20	0.41
1:A:119:ILE:O	1:A:122:GLN:NE2	2.53	0.41
1:A:28:ARG:HA	1:A:76:LEU:HD21	2.02	0.41
1:A:28:ARG:NH2	1:A:71:LYS:HB3	2.36	0.41
1:A:336:TYR:HB2	1:A:363:TYR:HD2	1.86	0.41
1:A:118:ASP:OD1	1:A:126:ARG:NH1	2.54	0.40
1:A:283:TRP:CE2	1:A:287:GLN:HG3	2.55	0.40
1:A:193:PRO:O	1:A:197:VAL:HA	2.22	0.40
1:A:303:ASN:HD22	1:A:314:LYS:CB	2.31	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	346/348 (99%)	286 (83%)	42 (12%)	18 (5%)	<b>2</b> <b>2</b>

All (18) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	138	VAL
1	A	195	SER
1	A	266	PRO
1	A	274	THR
1	A	44	GLU
1	A	198	ASP
1	A	202	PHE
1	A	310	GLU
1	A	69	GLY
1	A	265	ASP
1	A	73	ASN
1	A	167	TYR
1	A	50	PRO
1	A	233	ILE
1	A	257	ASP
1	A	363	TYR
1	A	193	PRO
1	A	267	ALA

### 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	300/300 (100%)	267 (89%)	33 (11%)	<b>7</b> <b>13</b>

All (33) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	56	VAL
1	A	59	LEU
1	A	63	LEU
1	A	90	GLN
1	A	107	GLU
1	A	112	PHE
1	A	126	ARG

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Mol	Chain	Res	Type
1	A	132	TRP
1	A	140	LEU
1	A	159	LYS
1	A	168	VAL
1	A	175	LEU
1	A	176	GLN
1	A	185	GLN
1	A	202	PHE
1	A	204	GLU
1	A	240	GLU
1	A	245	ILE
1	A	251	GLU
1	A	254	GLN
1	A	261	ASP
1	A	277	GLN
1	A	292	VAL
1	A	297	ARG
1	A	298	GLN
1	A	310	GLU
1	A	314	LYS
1	A	324	MET
1	A	344	GLU
1	A	347	SER
1	A	350	LEU
1	A	360	GLN
1	A	367	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	66	ASN
1	A	122	GLN
1	A	180	GLN
1	A	254	GLN
1	A	290	GLN
1	A	298	GLN
1	A	303	ASN
1	A	329	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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 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

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.