



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 25, 2026 – 10:25 AM EDT

PDB ID : 3VUE / pdb_00003vue
Title : Crystal Structure of Rice Granule bound Starch Synthase I Catalytic Domain
Authors : Momma, M.; Fujimoto, Z.
Deposited on : 2012-06-28
Resolution : 2.70 Å(reported)

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

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

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

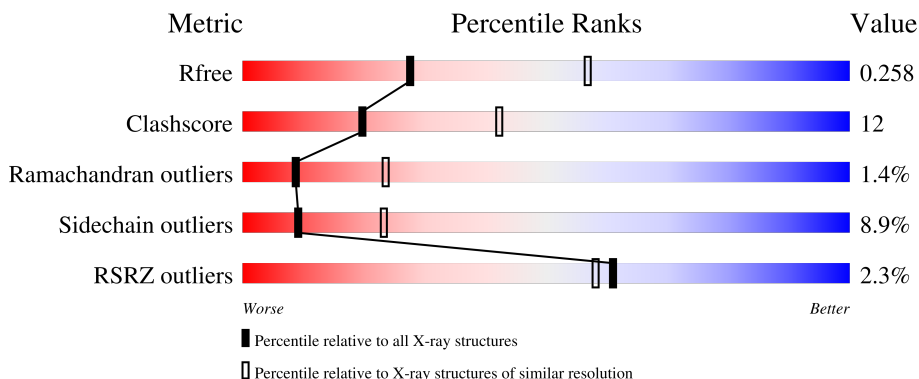
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

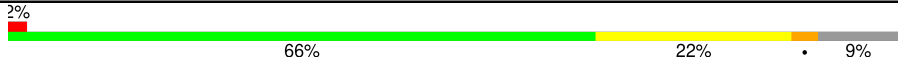
The reported resolution of this entry is 2.70 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	3538 (2.70-2.70)
Clashscore	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)
RSRZ outliers	180081	3538 (2.70-2.70)

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	536	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 3893 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.

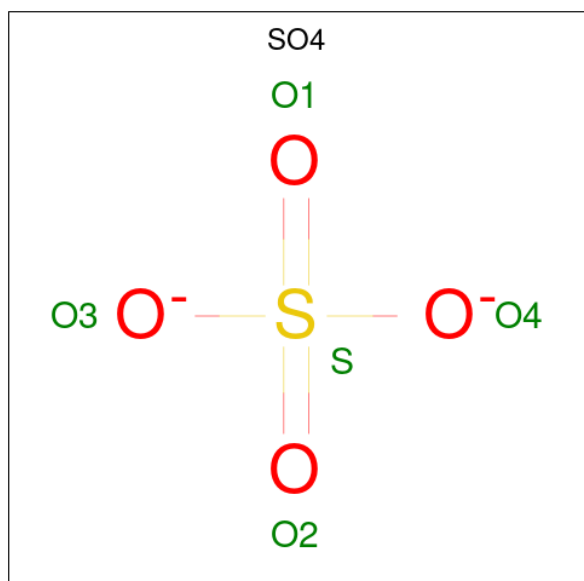
- Molecule 1 is a protein called Granule-bound starch synthase 1, chloroplastic/amyloplastic.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	488	3812	2431	657	698	26	0	0	0

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	74	MET	-	expression tag	UNP Q0DEV5
A	75	ALA	-	expression tag	UNP Q0DEV5
A	76	HIS	-	expression tag	UNP Q0DEV5
A	77	HIS	-	expression tag	UNP Q0DEV5
A	78	HIS	-	expression tag	UNP Q0DEV5
A	79	HIS	-	expression tag	UNP Q0DEV5
A	80	HIS	-	expression tag	UNP Q0DEV5
A	81	HIS	-	expression tag	UNP Q0DEV5
A	82	HIS	-	expression tag	UNP Q0DEV5

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	61	Total	O	0	0
			61	61		

4 Data and refinement statistics

Property	Value	Source
Space group	P 4 3 2	Depositor
Cell constants a, b, c, α , β , γ	152.90Å 152.90Å 152.90Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.70 50.00 – 2.70	Depositor EDS
% Data completeness (in resolution range)	97.0 (50.00-2.70) 97.0 (50.00-2.70)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	6.56 (at 2.68Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.218 , 0.267 0.212 , 0.258	Depositor DCC
R_{free} test set	876 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å ²)	63.5	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 34.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	3893	wwPDB-VP
Average B, all atoms (Å ²)	61.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.19% 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: SO4

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	0.92	0/3896	1.03	2/5271 (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	A	489	LEU	N-CA-C	-7.93	102.64	113.18
1	A	529	CYS	N-CA-C	5.84	119.22	111.75

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	3812	0	3809	88	0
2	A	20	0	0	0	0
3	A	61	0	0	3	0
All	All	3893	0	3809	88	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 12.

All (88) 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:120:MET:HE3	1:A:163:VAL:HG21	1.16	1.10
1:A:120:MET:HE3	1:A:163:VAL:CG2	2.07	0.83
1:A:342:ILE:HG23	1:A:343:MET:H	1.44	0.81
1:A:120:MET:HE1	1:A:208:ALA:HB1	1.62	0.80
1:A:272:PHE:HB2	1:A:305:ILE:HG22	1.64	0.78
1:A:195:GLN:HG3	1:A:307:TRP:HZ2	1.48	0.78
1:A:154:HIS:CG	1:A:155:CYS:H	2.10	0.70
1:A:489:LEU:HG	1:A:493:GLN:NE2	2.07	0.69
1:A:430:VAL:CG1	1:A:548:ILE:HD12	2.23	0.69
1:A:109:PRO:HB2	1:A:110:PRO:HD3	1.79	0.65
1:A:430:VAL:HG11	1:A:548:ILE:CD1	2.27	0.64
1:A:323:PRO:HD2	1:A:511:ASP:OD2	1.99	0.63
1:A:195:GLN:HG3	1:A:307:TRP:CZ2	2.32	0.63
1:A:137:VAL:HG21	1:A:212:LEU:HD23	1.80	0.62
1:A:157:LYS:O	1:A:160:VAL:N	2.28	0.61
1:A:142:LYS:HD2	3:A:847:HOH:O	2.01	0.60
1:A:426:MET:HG2	1:A:453:TYR:CD1	2.36	0.60
1:A:501:CYS:SG	1:A:503:CYS:HB3	2.41	0.60
1:A:197:ARG:O	1:A:200:LEU:HB2	2.02	0.60
1:A:275:GLU:H	1:A:275:GLU:CD	2.09	0.59
1:A:290:PHE:HB3	1:A:305:ILE:HG13	1.85	0.58
1:A:333:ILE:HG22	1:A:333:ILE:O	2.03	0.58
1:A:275:GLU:CD	1:A:275:GLU:N	2.62	0.58
1:A:154:HIS:CG	1:A:155:CYS:N	2.69	0.57
1:A:167:HIS:O	1:A:171:LEU:HD13	2.03	0.57
1:A:401:PRO:HG2	1:A:430:VAL:HG12	1.85	0.57
1:A:172:GLU:HG3	1:A:173:LYS:N	2.21	0.56
1:A:336:GLY:O	1:A:337:CYS:HB3	2.06	0.56
1:A:343:MET:O	1:A:345:LEU:HD12	2.05	0.56
1:A:406:ILE:HD11	1:A:471:ILE:HG21	1.88	0.55
1:A:406:ILE:HD11	1:A:471:ILE:CG2	2.37	0.55
1:A:430:VAL:HG11	1:A:548:ILE:HD12	1.87	0.54
1:A:336:GLY:O	1:A:337:CYS:CB	2.57	0.53
1:A:342:ILE:HG12	1:A:343:MET:HE2	1.91	0.53
1:A:342:ILE:HG23	1:A:343:MET:N	2.19	0.52
1:A:392:ALA:HB1	1:A:458:ARG:HG2	1.91	0.52
1:A:280:LEU:HB3	1:A:282:LEU:HD12	1.90	0.52
1:A:339:LEU:HG	1:A:340:ASP:N	2.25	0.52
1:A:465:ALA:HB3	1:A:466:PRO:HD3	1.92	0.52
1:A:118:ARG:HG2	1:A:224:TYR:CZ	2.46	0.51
1:A:152:PHE:CE2	1:A:208:ALA:HB2	2.46	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:169:SER:OG	1:A:196:MET:HE3	2.10	0.51
1:A:296:TYR:CE2	1:A:297:ASP:HB2	2.46	0.51
1:A:232:CYS:HB3	1:A:237:THR:OG1	2.11	0.50
1:A:208:ALA:N	1:A:209:PRO:CD	2.74	0.50
1:A:430:VAL:HG11	1:A:548:ILE:HD13	1.93	0.50
1:A:342:ILE:CG2	1:A:343:MET:H	2.22	0.50
1:A:92:MET:HE2	1:A:121:VAL:HG12	1.94	0.49
1:A:339:LEU:HG	1:A:340:ASP:H	1.78	0.49
1:A:161:ASP:OD2	1:A:224:TYR:OH	2.26	0.49
1:A:265:ASN:HD21	1:A:267:SER:HB2	1.77	0.49
1:A:319:LEU:HD21	1:A:580:VAL:HG11	1.94	0.49
1:A:252:GLY:HA2	1:A:255:ARG:HD3	1.95	0.48
1:A:112:MET:HE1	1:A:577:TRP:HB3	1.96	0.47
1:A:392:ALA:O	1:A:458:ARG:HD3	2.14	0.47
1:A:265:ASN:ND2	1:A:267:SER:HB2	2.29	0.47
1:A:207:GLU:O	1:A:211:ILE:HG12	2.15	0.47
1:A:137:VAL:HG21	1:A:212:LEU:CD2	2.45	0.47
1:A:142:LYS:HA	3:A:847:HOH:O	2.14	0.47
1:A:317:ARG:HB2	1:A:584:LEU:HD21	1.97	0.47
1:A:120:MET:HE1	1:A:208:ALA:CB	2.41	0.46
1:A:550:VAL:HG12	1:A:556:TYR:HB2	1.97	0.46
1:A:152:PHE:HE2	1:A:208:ALA:HB2	1.81	0.46
1:A:416:ASP:OD1	1:A:416:ASP:N	2.45	0.45
1:A:530:LYS:HB2	1:A:530:LYS:NZ	2.32	0.45
1:A:208:ALA:N	1:A:209:PRO:HD3	2.32	0.45
1:A:365:ASP:OD1	1:A:366:LYS:N	2.50	0.45
1:A:455:GLY:HA2	3:A:807:HOH:O	2.18	0.44
1:A:554:PRO:HA	1:A:557:GLU:HG3	1.98	0.44
1:A:489:LEU:HG	1:A:493:GLN:HE22	1.79	0.44
1:A:124:PRO:HG2	1:A:126:TYR:OH	2.18	0.44
1:A:332:GLY:C	1:A:334:ALA:H	2.25	0.43
1:A:355:MET:HE3	1:A:357:VAL:HG12	2.00	0.43
1:A:514:ILE:HG21	1:A:517:LYS:HD2	2.00	0.43
1:A:83:MET:SD	1:A:582:LEU:HD23	2.59	0.42
1:A:277:TYR:CE2	1:A:287:ARG:HG3	2.54	0.42
1:A:303:ARG:O	1:A:304:LYS:HG2	2.19	0.42
1:A:305:ILE:HD12	1:A:305:ILE:HA	1.90	0.42
1:A:120:MET:HA	1:A:161:ASP:O	2.19	0.42
1:A:340:ASP:O	1:A:342:ILE:N	2.50	0.42
1:A:160:VAL:HG12	1:A:162:ARG:HG3	2.02	0.42
1:A:160:VAL:HG12	1:A:162:ARG:CG	2.50	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:206:LEU:O	1:A:254:TYR:OH	2.38	0.41
1:A:490:ILE:HD12	1:A:490:ILE:HA	1.77	0.41
1:A:94:PRO:HD2	1:A:95:TRP:CZ3	2.55	0.41
1:A:239:PRO:O	1:A:240:LEU:C	2.64	0.41
1:A:92:MET:HE3	1:A:123:SER:OG	2.21	0.40
1:A:217:ASN:HA	1:A:218:PRO:HD3	1.86	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	484/536 (90%)	441 (91%)	36 (7%)	7 (1%)	9	23

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	158	ARG
1	A	155	CYS
1	A	342	ILE
1	A	341	ASN
1	A	337	CYS
1	A	172	GLU
1	A	334	ALA

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	404/438 (92%)	368 (91%)	36 (9%)	9 23

All (36) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	112	MET
1	A	131	ASP
1	A	145	ASP
1	A	192	LYS
1	A	193	ASP
1	A	197	ARG
1	A	200	LEU
1	A	201	LEU
1	A	223	THR
1	A	229	VAL
1	A	253	ILE
1	A	255	ARG
1	A	256	ASN
1	A	275	GLU
1	A	283	SER
1	A	287	ARG
1	A	305	ILE
1	A	346	THR
1	A	355	MET
1	A	383	LEU
1	A	391	GLU
1	A	409	LEU
1	A	410	GLU
1	A	416	ASP
1	A	425	LEU
1	A	426	MET
1	A	428	GLU
1	A	440	LYS
1	A	445	LEU
1	A	447	LYS
1	A	448	SER
1	A	489	LEU
1	A	490	ILE
1	A	524	ARG
1	A	530	LYS
1	A	557	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	194	ASN
1	A	233	ASN
1	A	256	ASN
1	A	265	ASN
1	A	341	ASN
1	A	493	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 oligosaccharides 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	SO4	A	701	-	4,4,4	0.31	0	6,6,6	0.52	0
2	SO4	A	703	-	4,4,4	0.23	0	6,6,6	0.44	0
2	SO4	A	702	-	4,4,4	0.27	0	6,6,6	0.22	0
2	SO4	A	704	-	4,4,4	0.29	0	6,6,6	0.26	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	488/536 (91%)	0.08	11 (2%) 61 58	34, 58, 90, 106	1 (0%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	137	VAL	3.2
1	A	339	LEU	3.1
1	A	133	TRP	3.0
1	A	139	ALA	2.7
1	A	586	VAL	2.6
1	A	252	GLY	2.4
1	A	223	THR	2.3
1	A	342	ILE	2.2
1	A	163	VAL	2.1
1	A	557	GLU	2.1
1	A	116	GLY	2.1

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 oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum,

median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	SO4	A	702	5/5	0.76	0.12	110,111,111,111	0
2	SO4	A	703	5/5	0.80	0.14	108,109,109,110	0
2	SO4	A	704	5/5	0.86	0.12	109,110,111,111	0
2	SO4	A	701	5/5	0.98	0.05	52,54,55,56	0

6.5 Other polymers [i](#)

There are no such residues in this entry.