# Symmetries of all lines in monolayer crystals Supplementary information Bernard Field, Sinéad M. Griffin

#### Scanning tables for the layer groups

Herein we present tables listing the symmetry groups (penetration rod groups) which preserve lines penetrating through each layer group. These tables scan through all possible locations and (in-plane rational) directions of the penetration lines, so are called scanning tables

A machine-readable version of these tables, along with the source code and underlying data, is available at Field (2024).

Each layer group has two tables with similar formats: one for high-symmetry directions, and one for oblique directions (an auxiliary table). The elements of the tables are described below.

#### Elements of the tables

#### 1 Header

Set above each table is the header. It gives the Hermann-Mauguin (HM) symbol and the International Tables (IT) number of the layer group that is being scanned (the "scanned group"). The scanned group is always in its standard, default setting, as defined by the *International Tables for Crystallography* volume E (Kopský and Litvin (2010)). Layer groups L52, L62, and L64 have the standard origin on the inversion centre (origin choice "2") rather than the 4-fold axis.

#### 2 Penetration direction

The first column is the penetration direction. It is the direction of the line penetrating through the rod group. It is given by the integer indices [uv0] and defines the basis vector  $\mathbf{c}$ , which will define the translation basis of the penetration rod group.

For the auxiliary tables, the penetration direction is grouped by whether u and/or v are odd or even. u and v must also be co-prime, to ensure  $\mathbf{c}$  is a primitive lattice vector. Auxiliary tables of centred layer groups also add an extra column specifying whether the primitive basis vector  $\mathbf{c}$  is [u, v, 0] or [u/2, v/2, 0] for a given choice of u and v (otherwise, it is assumed that  $\mathbf{c} = [u, v, 0]$ ).

#### 3 Scanning direction

The second column is the scanning direction, given by the scanning vector  $\mathbf{d}$ . Each scanning direction is paired with a penetration direction. The primary role of  $\mathbf{d}$  is to define the location of the penetration line, but it is also used to form a coordinate basis. The scanning vector  $\mathbf{d}$  is chosen such that  $\mathbf{c}$  and  $\mathbf{d}$  form a right-handed conventional basis for the scanning group.

For the auxiliary tables, the scanning direction is given by the integer indices [pq0], with specified constraints on p and q. A conventional right-handed basis is ensured by solving for  $(\mathbf{c} \times \mathbf{d}) \cdot [001] = 1$ , and choosing p, q to be co-prime. For centred groups,  $\mathbf{d} = [p/2, q/2, 0]$  instead, with  $(\mathbf{c} \times \mathbf{d}) \cdot [001] = 1/2$  ensuring a conventional basis.

#### 4 Scanning group

The third column is the scanning group. The scanning group is the maximal subgroup of the scanned group whose point group preserves the penetration direction. By the scanning theorem (Kopský and Litvin (1989)), the scanning table (specifically, the location and penetration rod group columns) of the scanned group along a particular direction is identical to the scanning table of the scanning group with the same setting and origin choice.

Each scanning group applies to all entries in the same row of the table, bounded by horizontal lines. This may include multiple penetration directions and multiple locations.

The scanning group is a layer group. Its HM symbol and IT number (prefixed by L for layer group) are given. The basis is  $(\mathbf{c}, \mathbf{d}, \mathbf{z})$ , where  $\mathbf{z} = [001]$  is an out-of-plane vector. If the scanning group is not in the default setting, the IT number is marked by a prime as a convenience for the reader. If the origin is not the conventional origin, then the position of the origin relative to the conventional origin is given in square brackets, in units of the scanning group basis.

#### 5 Location

The fourth column is the location of the penetration line. For points given by  $P + s\mathbf{d}$ , where P is the scanned group origin, it gives a set of values s in the unit interval [0,1), with each row giving different penetration rod groups.

The first rows are special locations, with discrete values of s. The last row for each scanning group is the general location, which is all values of s not in a special location.

Locations are grouped using square brackets into orbits, that is, points which are the same under the operation of the scanning group. If two values of s are not bound by square brackets, then they are not in the same orbit.

#### 6 Penetration rod group

The fifth column presents the penetration rod group for the given penetration line(s) specified by the location(s) and penetration direction(s).

The HM symbol and IT number (prefixed by R for rod group) are given. If the rod group is not in the default setting, the IT number is marked by a prime as a convenience for the reader. If the origin is not the conventional origin, then the position of the origin relative to the conventional origin in units of  $\mathbf{c}$  is given in square brackets.

The sectional rod group is given in the basis  $(\mathbf{d}, \mathbf{z}, \mathbf{c})$  with an origin  $P + s\mathbf{d}$ , where P is the standard origin of the scanned group. Note that, due to conventions for rod and layer groups, this is a different order of basis vectors to the scanning group.

The specific penetration rod group in the original basis is readily reconstructed from the rod group in the default basis and the information in the table using the transformation  $QgQ^{-1}$  for each element g of the group in standard basis. If the rod group is in its default setting, then the transformation matrix is

$$Q = (\mathbf{d} \ \mathbf{z} \ \mathbf{c} | s\mathbf{d} + t\mathbf{c}) \,, \tag{1}$$

where  $(A|\mathbf{b})$  is an affine transformation  $y = Ax + \mathbf{b}$  and t is the origin shift given in the table. If the group is not in its default setting, then the transformation matrix is instead

$$Q = (\mathbf{z} - \mathbf{d} \ \mathbf{c} | s\mathbf{d} + t\mathbf{c}). \tag{2}$$

#### References

- Field, B. (2024). Griffin Group/scanning-tables-layer-group-data.  $\label{eq:https:/doi.org/10.5281/zenodo.13948517}$
- Kopský, V. and Litvin, D. B. (eds.) (2010). *International Tables for Crystallography: Sub*periodic groups, vol. E. Chester, England: International Union of Crystallography, 2nd ed. https://doi.org/10.1107/97809553602060000109
- Kopský, V. and Litvin, D. B. (1989). In *Group theoretical methods in physics*, edited by Y. Saint-Aubin and L. Vinet, pp. 263–266. Singapore: World Scientific.

### *p*1 **No.** 1

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction <b>d</b>	g	$\begin{array}{c c} \mathbf{canning} & \mathbf{Locar} \\ \mathbf{group} & \mathbf{so} \\ \mathbf{(c, d, z)} & \end{array}$		rod	etration group $(\mathbf{z}, \mathbf{z}, \mathbf{c})$
[100]	[010]	<i>p</i> 1	L1	S	<i>p</i> 1	R1
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	Scan gro (c, c	up	Location sd	rod g	ration group <b>z</b> , <b>c</b> )
Any u, v	Any $p, q$	<i>p</i> 1	L1	S	<i>p</i> 1	R1

# $p\bar{1}$ No. 2

Penetration	Scanning	Sca	anning	Location	Pen	Penetration		
direction	direction $\mathbf{d}$	g	roup	$s\mathbf{d}$	rod	group		
$[uv0] = \mathbf{c}$		(c	$, \mathbf{d}, \mathbf{z})$		(d	l, z, c)		
[100]	[010]	$p\bar{1}$	L2	0, 1/2	$\rho \bar{1}$	R2		
				[s, -s]	/n1	R1		
Penetration	Scanning	Scan	ning	Location	Penet	Penetration		
direction	direction	gro	oup	$s\mathbf{d}$	rod g	rod group		
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{c})$	$(\mathbf{d}, \mathbf{z})$		$(\mathbf{d},$	$\mathbf{z}, \mathbf{c})$		
Any u, v	Any $p, q$	$p\bar{1}$	L2	0, 1/2	ρĪ	R2		
				[s, -s]	$\rho 1$	R1		

# p112 No. 3

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	$ \begin{array}{c c} Scanning \\ group \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array} $	Location sd	Penetration rod group (d, z, c)	
[100]	[010]	<i>p</i> 112 L3	0, 1/2 [s, -s]	ρ121 R3' ρ1 R1	
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group (d, z, c)	
Any u, v	Any $p, q$	p112 L3	0, 1/2 [ $s, -s$ ]	ρ121 R3' ρ1 R1	

### *p*11*m* **No.** 4

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	$\begin{array}{ c c c } Scanning \\ group \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group (d, z, c)
[100]	[010]	<i>p</i> 11 <i>m</i> L4	S	$\rho 1m1 \text{ R4}'$
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group (d, z, c)
Any u, v	Any $p, q$	p11m L4	S	ρ1m1 R4'

### *p*11*a* **No.** 5

Penetration direction	Scanning direction <b>d</b>	Scanning group	$egin{array}{c}  ext{Location} \  ext{\it sd} \end{array}$	Penetration rod group	
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
[100]	[010]	p11a L5	S	ρ1c1 R5'	
[010]	[100]	<i>p</i> 11 <i>b</i> L5′	$[s, (s+\frac{1}{2})]$	η1 R1	
[010]	[110]	p11n L5'	$[s, (s+\frac{1}{2})]$	η1 R1	
Penetration	Scanning	Scanning	Location	Penetration	
direction	direction	group	$s\mathbf{d}$	rod group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
Odd $u$ , even i	V  Odd $q$	p11a L5	S	ρ1c1 R5'	
Any $u$ , odd $v$	Even q	p11b L5'	$[s,(s+\frac{1}{2})]$	η1 R1	
Any $u$ , odd $v$	Odd q	p11n L5'	$[s, (s+\frac{1}{2})]$	ρ1 R1	

### p112/m No. 6

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction <b>d</b>	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group (d, z, c)
[100]	[010]	p112/m L6	$0, 1/2 \\ [s, -s]$	ρ12/m1 R6' ρ1m1 R4'
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$	Location sd	Penetration rod group (d, z, c)
Any u, v	Any $p,q$	p112/m L6	$0, 1/2 \\ [s, -s]$	ρ12/m1 R6' ρ1m1 R4'

### *p*112/*a* **No.** 7

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d}$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group $(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
[100]	[010]	p112/a L7	0, 1/2 [s, -s]	ρ12/c1 ρ1c1	R7' R5'
[010]	[100]	p112/b L7'	$[0, 1/2] \\ [1/4, 3/4]$	μ <u>1</u> μ121	R2 R3'
[010]	[110]	p112/n L7'	$   \begin{array}{c}     [\pm s, (\frac{1}{2} \pm s)] \\     [0, 1/2] \\     [1/4, 3/4]   \end{array} $	$ \begin{array}{c}                                     $	R1 R2 4] R3'
			$[\pm s, (\frac{1}{2} \pm s)]$	$\rho 1$	R1
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$	Location sd	Penetra rod gr (d, z,	oup
Odd $u$ , even	V Odd q	p112/a L7	0, 1/2 [ $s, -s$ ]	ρ12/c1 ρ1c1	R7' R5'
Any u, odd v	Even q	p112/b L7'	$   \begin{bmatrix}     0, 1/2 \\     1/4, 3/4 \\     [\pm s, (\frac{1}{2} \pm s)]   \end{bmatrix} $	μ1 μ121 μ1	R2 R3' R1
Any u, odd v	Odd q	p112/n L7'	$ \begin{array}{c c}                                    $	$ \begin{array}{c c}                                    $	R2

#### *p*211 **No.** 8

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	Scanning group (c, d, z)	Location sd	Penetration rod group (d, z, c)	
[100]	[010]	p211 L8	' '	η112 R8	
[010]	[100]	p121 L8	$\begin{bmatrix} s, -s \end{bmatrix}$	ρ1 R1 ρ211 R3	
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group (d, z, c)	
Any $u, v$	Any $p, q$	<i>p</i> 1 L1	S	ρ1 R1	

### *p*2<sub>1</sub>11 **No. 9**

Penetration direction	Scanning direction d	Scanning group		Location sd	n	Penetration rod group	
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$			$(\mathbf{d}, \mathbf{z}, \mathbf{d})$	
[100]	[010]	p2 <sub>1</sub> 11 L9		0, 1/2	?	p112 <sub>1</sub>	R9
				[s, -s]		<i>p</i> 1	R1
[010]	[100]	p12 <sub>1</sub> 1 L9	)'	$[s, (s + \frac{1}{2})]$	<u>[</u> )]	$\rho 1$	R1
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	roup sd rod group		od group		
Any $u, v$	Any $p, q$	<i>p</i> 1 L1		S	p	1 R1	

#### c211 No. 10

Penetration direction $[uv0] = \mathbf{c}$		nning tion <b>d</b>	g	anning roup $(\mathbf{d}, \mathbf{d}, \mathbf{z})$	$\begin{array}{c} \text{Location} \\ s\mathbf{d} \end{array}$		Penetra rod gr ( <b>d</b> , <b>z</b> ,	oup			
[100]	[0]	10]	c21	1 L10	$   \begin{bmatrix}     0, 1/2 \\     1/4, 3/4 \\     [\pm s, (\frac{1}{2} \pm s)]   \end{bmatrix} $	1	n 112 n 112 <sub>1</sub> n 1	R8 R9 R1			
[010]	[1	00]	c12	1 L10'	$[s, (s+\frac{1}{2})]$		n211	R3		Г	
Penetration direction [uv0]		С			Scanning direction $= [p, q, 0]/2$		Scann grow (c, d	up	sd	rod g	roup
$\begin{array}{c} \operatorname{Odd} u, v \\ \operatorname{Even} u \operatorname{OR} e \end{array}$		$\begin{bmatrix} u, v, 0 \\ u, v, \end{bmatrix}$	-	Even p	p, q  OR odd  p, q	1	<i>p</i> 1	L1	S	<i>p</i> 1	R1

#### *pm*11 **No. 11**

Penetration	Scanning	Scannin	g	Location		Penetratio		n
direction	direction $\mathbf{d}$	group	group			rod group		,
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	)			$(\mathbf{d}, \mathbf{z})$	<b>, c</b> )	
[100]	[010]	pm11 L	pm11 L11			p 11m	R1	0
[010]	[100]	p1m1 L1	1′	0, 1/2		pm11	R	4
				[s, -s]		$\rho 1$	R	1
Penetration	Scanning	Scanning	L	ocation	Р	enetration	on	
direction	direction	group		sd :		od grou	$p \mid$	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$				$(\mathbf{d},\mathbf{z},\mathbf{c})$		
Any $u, v$	Any $p, q$	<i>p</i> 1 L1		S	1	1 I	R1	

### *pb*11 **No. 12**

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	gr	$\begin{array}{c} \text{nning} \\ \text{oup} \\ \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	on	Penetra rod gr ( <b>d</b> , <b>z</b> ,	oup
[100]	[010]	<i>pb</i> 11	L12	$[s, (s + \frac{1}{2})]$	$\left[\frac{1}{2}\right]$	<i>p</i> 1	R1
[010]	[100]	p1a1	L12'	0, 1/2		pc11	R5
				[s, -s]		$\rho 1$	R1
Penetration	Scanning	Scann	ing	Location	Pe	netration	ı
direction	direction	grou	ıp	$s\mathbf{d}$	rc	d group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d},$	( <b>z</b> )			$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
Any $u, v$	Any $p, q$	<i>p</i> 1	L1	S	$\rho$	l R1	

#### *cm*11 **No. 13**

Penetration direction $[uv0] = \mathbf{c}$		nning tion d	g	anning roup $(\mathbf{d}, \mathbf{d}, \mathbf{z})$	$\begin{array}{c} \text{Location} \\ s\mathbf{d} \end{array}$	Penetrod g	roup			
[100]	[0]	10]	cm1	11 L13	$[s, (s+\frac{1}{2})]$	p 11m	R10			
[010]	[ 1	00]	c1n	11 L13'	[0, 1/2]	pm11	R4			
					[1/4, 3/4]	$\rho c11$	R5			
					$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	<i>p</i> 1	R1			
Penetratio	on	c		5	Scanning	Scan	ning	Location	Penet	ration
direction	l			(	direction	gro	up	$s\mathbf{d}$	rod g	group
[ <i>uv</i> 0]				d =	= [p, q, 0]/2	$(\mathbf{c}, \mathbf{c})$	$\mathbf{l}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z})$	$\mathbf{z}, \mathbf{c})$
Odd $u, v$	,	[u, v, 0]	)]/2	Even $p$	q OR odd $p,q$	<i>p</i> 1	L1	S	<i>p</i> 1	R1
Even $u$ OR e	ven v	[u, v,	0]							

#### p2/m11 No. 14

Penetration	Scanning	Scanni	ng	Loca	tion	Penetra	tion
direction	direction $\mathbf{d}$	group	)	sd		rod gro	oup
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	<b>z</b> )			$(\mathbf{d}, \mathbf{z},$	<b>c</b> )
[100]	[010]	p2/m11	$L14 \mid 0, 1,$		/2	$\rho 112/m$	R11
				[s, -	-s]	$\rho 11m$	R10
[010]	[100]	p12/m1 I	14'	0, 1	/2	$n^{2/m11}$	R6
				[s, -	-s]	$\rho$ 211	R3
Penetration	Scanning	Scanning	Loc	ation	Pen	etration	
direction	direction	group		$^{\rm sd}$	roc	l group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$			(0	$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
Any $u, v$	Any $p, q$	$p\bar{1}$ L2	0,	1/2	ρĪ	R2	
			[s,	-s]	$\rho 1$	R1	
	•						

### $p2_1/m11$ No. 15

Penetration direction	Scanning direction d	Scanni	_	Lo	$s\mathbf{d}$	Penetrat rod gro		
$[uv0] = \mathbf{c}$	direction d	0	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		54		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	- 1
[100]	[010]	$p2_1/m11$	$p2_1/m11$ L15		0, 1/2		$12_{1}/m$	R12
				[	[s,-s]	$\rho 11$	1m [1/4]	R10
[010]	[100]	$p12_1/m1$	p12 <sub>1</sub> /m1 L15'		[0, 1/2]			R2
				[1/	[1/4, 3/4]		11	R4
				$[\pm s,$	$(\frac{1}{2} \pm s)$	p1		R1
Penetration	Scanning	Scanning	Loca	tion	Penetra	tion		
direction	direction	group	se	d	rod gro	oup		
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$			$(\mathbf{d}, \mathbf{z}, \mathbf{d})$	c)		
Any $u, v$	Any $p, q$	$p\bar{1}$ L2	0, 1	1/2	ρĪ	R2		
			[s, -	-s]	$\rho 1$	R1		

#### *p*2/*b*11 **No. 16**

Penetration	Scanning	Scannir	ng	Location		Pen	etration
direction	direction $\mathbf{d}$	group		$s\mathbf{d}$		roc	l group
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	)			(0	$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
[100]	[010]	p2/b11 1	L16	[0,	1/2]	$\rho \bar{1}$	R2
				[1/4	, 3/4]	p112	R8
					$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$		R1
[010]	[100]	<i>p</i> 12/ <i>a</i> 1 L	16'	0, 1/2		$\rho 2/c$	11 R7
				[s, -s]		p211	[1/4] R3
Penetration	Scanning	Scanning	Loc	cation	Penetr	ation	
direction	direction	group		$s\mathbf{d}$	rod g	roup	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z})$	$(\mathbf{c}, \mathbf{c})$	
Any $u, v$	Any $p, q$	<i>p</i> 1 L2	$p\bar{1}$ L2 0,		ρĪ	R2	
			[s	,-s]	$\rho 1$	R1	

#### $p2_1/b11$ No. 17

Penetration	Scanning	Scanning		Location		Pene	tration
direction	direction $\mathbf{d}$	grou	group		$s\mathbf{d}$		group
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{d})$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$				$(\mathbf{z}, \mathbf{c})$
[100]	[010]	$p2_1/b11$	p2 <sub>1</sub> /b11 L17		[0, 1/2]		R2
				[1/	4, 3/4]	p112	$2_1$ R9
				$[\pm s,$	$(\frac{1}{2} \pm s)$	p1	R1
[010]	[100]	$p12_{1}/a1$	p12 <sub>1</sub> /a1 L17'		[0, 1/2]		R2
				[1/4]	4, 3/4]	$\rho c1$	1 R5
				$[\pm s,$	$(\frac{1}{2} \pm s)]$	<i>p</i> 1	R1
Penetration	Scanning	Scanning	Loca	ation	Penetra	ation	
direction	direction	group	s	$\mathbf{d}$	rod gr	oup	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$			$(\mathbf{d}, \mathbf{z},$	<b>c</b> )	
Any u, v	Any $p, q$	<i>p</i> 1 L2	0,	1/2	ηĪ	R2	
			[ <i>s</i> ,	-s]	$\rho 1$	R1	

#### c2/m11 No. 18

Penetration	Scar	nning	S	cann	ing	Location	P	enet	ration	1		
direction	direc	tion $\mathbf{d}$		grou	ıp	$s\mathbf{d}$	1	od g	group			
$[uv0] = \mathbf{c}$			(	$(\mathbf{c}, \mathbf{d},$	$\mathbf{z})$			$(\mathbf{d},$	$\mathbf{z}, \mathbf{c})$			
[100]	[0	10]	c2/	m11	L18	[0, 1/2]	p112	/m		R11		
						[1/4, 3/4]	p112	$_1/m$	[1/4]	R12		
						$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	$\rho 11n$	ı		R10		
[010]	[1	00]	c12	2/m1	L18'	[0, 1/2]	$\rho^{2/m}$	111		R6		
						[1/4, 3/4]	$\rho^{2/c}$	11 [	1/4]	R7		
						$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	p211			R3		
Penetratio	on	С			Sca	anning	Scann	ing	Loca	ation	Penet	ration
direction	ı				dir	rection	grou	р	s	d	rod g	group
[ <i>uv</i> 0]					d = [	[p, q, 0]/2	$(\mathbf{c}, \mathbf{d},$	$\mathbf{z})$			$(\mathbf{d}, \mathbf{d})$	$\mathbf{z}, \mathbf{c})$
Odd $u, v$		[u, v, 0]	]/2	Ev	en $p,q$	OR odd $p, q$	$p\bar{1}$	L2	0,	1/2	ρĪ	R2
Even u OR e	ven $v$	[u, v,	0]						[s,	-s]	$\rho 1$	R1

### p222 No. 19

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction <b>d</b>	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group (d, z, c)
[100] [010]	[010] [100]	p222 L19	[s, -s]	ρ222 R13 ρ211 R3
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group (d, z, c)
Any u, v	Any $p,q$	p112 L3	0, 1/2 [ $s, -s$ ]	μ121 R3' μ1 R1

# *p*2<sub>1</sub>22 **No. 20**

Penetration	Scanning	0		Loca	tion	Pen	etration
direction	direction d	group		sc	l	roc	l group
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	$,\mathbf{z})$			(0	$(\mathbf{l}, \mathbf{z}, \mathbf{c})$
[100]	[010]	<i>p</i> 2 <sub>1</sub> 22 L:	22 L20 0, 1		0, 1/2		[1/4] R14
				[s, -s]		p211	[1/4] R3
[010]	[100]	<i>p</i> 22 <sub>1</sub> 2 L2	0 <b>′</b>	[0, 1]	/2]	p 121	R3′
				[1/4,	3/4]	$n^{112}$	R8
				$[\pm s, (\frac{1}{2})]$	$\pm s$ )]	$\rho 1$	R1
Penetration	Scanning	Scanning	Lo	ocation	Penet	tration	
direction	direction	group		$s\mathbf{d}$	$\operatorname{rod}$	group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$			(d,	$\mathbf{z}, \mathbf{c})$	
Any $u, v$	Any $p, q$	<i>p</i> 112 L3	(	0, 1/2	p 121	R3'	
			[	[s, -s]	<i>p</i> 1	R1	

# $p2_12_12_1$ No. 21

Penetration	Scanning	Scanning		Location		Penet	ration
direction	direction $\mathbf{d}$	group	group		$s\mathbf{d}$		group
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	i)			( <b>d</b> ,	$\mathbf{z}, \mathbf{c})$
[100]	[010]	$p2_12_12_1$	L21	[0,	1/2]	p 121	R3′
[010]	[100]			[1/4]	, 3/4]	p 112	1 R9
				$[\pm s, ($	$\frac{1}{2} \pm s$	$\rho 1$	R1
Penetration	Scanning	Scanning	Loc	cation	Penetr	ation	
direction	direction	group		$s\mathbf{d}$	rod g	roup	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$			$(\mathbf{d}, \mathbf{z})$	$(\mathbf{c}, \mathbf{c})$	
Any $u, v$	Any $p, q$	p112 L3	0,	1/2	p121	R3'	
			[s	,-s]	$\rho 1$	R1	

#### c222 **No. 22**

Penetration direction $[uv0] = \mathbf{c}$		nning tion <b>d</b>	g	nning roup $(\mathbf{d}, \mathbf{z})$	$\begin{array}{c} \text{Location} \\ s\mathbf{d} \end{array}$	_	renetration rod group (d, z, c)			
[100] [010]	· -	10] 00]		2 L22	$[0, 1/2]  [1/4, 3/4]  [\pm s, (\frac{1}{2} \pm s)]$	1	222 R13 2222 <sub>1</sub> R14 2211 R3	I		
Penetration direction [uv0]		c	•	d	Scanning direction $= [p, q, 0]/2$		$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetr rod gr (d, z	roup
$\begin{array}{c} \operatorname{Odd} u,v \\ \operatorname{Even} u \operatorname{OR} e \end{array}$		[u, v, 0] [u, v, 0]	_	Even	p, q  OR odd  p,	q	<i>p</i> 112 L3	0, 1/2 [s, -s]	ρ121 ρ1	R3′ R1

#### pmm2 No. 23

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	group	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$		n	Penetration rod group (d, z, c)		
[100]	[010] [100]		pmm2 L23		2 \( \rho m2m \text{ R1} \)		2m R18	
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	L	sd	_	Penetrod grod $(\mathbf{d}, \mathbf{z})$	coup	
Any u, v	Any $p, q$	p112 L3		0, 1/2 [s, -s]	,	121 1	R3′ R1	

#### pma2 No. 24

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	$egin{array}{c} Scanning \\ group \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	roup sd			$\operatorname{rod}$	etration group $(\mathbf{z}, \mathbf{c})$
[100]	[010]	pma2 L2	24	0, 1, [s, -		ρc2m ρ11m	R19' [1/4] R10
[010]	[100]	pbm2 L24	4'	[0, 1] [1/4, 3] $[\pm s, (\frac{1}{2})]$	3/4]	ρ121 ρm11 ρ1	R3′ R4 R1
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Lo	sd	rod	tration group , <b>z</b> , <b>c</b> )	
Any u, v	Any $p, q$	p112 L3		[s, -s]	/12 /1	1 R3′ R1	

#### pba2 No. 25

Penetration direction	Scanning direction d	O	Location sd	on	Penetr rod gr	roup
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$			$(\mathbf{d}, \mathbf{z})$	$, \mathbf{c})$
[100]	[010]	pba2 L25	[0, 1/2]	2]	p 121	R3'
[010]	[100]		[1/4, 3]	$^{/4}]$	pc11	R5
			$[\pm s, (\frac{1}{2} \pm$	(s)]	$\rho 1$	R1
Penetration	Scanning	Scanning	Location	Per	netration	ı
direction	direction	group	$s\mathbf{d}$	ro	d group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		(	$\mathbf{d}, \mathbf{z}, \mathbf{c})$	
Any $u, v$	Any $p, q$	<i>p</i> 112 L3	0, 1/2	$\rho 1$	21 R3	'
			[s, -s]	$\rho 1$	R1	L

#### *cmm*2 **No. 26**

	Penetration	Scar	nning	Sca	anning	Location	Pene	etrati	on			
	direction	direc	tion $\mathbf{d}$	g	roup	$s\mathbf{d}$	$\operatorname{rod}$	grou	ıp			
	$[uv0] = \mathbf{c}$			( <b>c</b>	$(\mathbf{d}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}$	$(\mathbf{z}, \mathbf{c})$	)			
	[100]	[0	10]	сті	n2 L26	[0, 1/2]	$\rho m2m$		R18′			
	[010]	[1	00]			[1/4, 3/4]	$\rho c2m$	1/4]	R19'			
						$\left[\pm s, (\frac{1}{2} \pm s)\right]$	$\rho 11m$		R10			
	Penetratio	on	С			Scanning	Scann	ning	Locati	ion	Penetr	ation
	direction	1				direction	grou	ıp	$s\mathbf{d}$		rod gr	oup
	[ <i>uv</i> 0]				$\mathbf{d}$	= [p, q, 0]/2	$(\mathbf{c}, \mathbf{d})$	$,\mathbf{z})$			$(\mathbf{d}, \mathbf{z})$	, <b>c</b> )
ĺ	Odd $u, v$	,	[u, v, 0]	]/2	Even p	p, q  OR odd  p, q	p112	L3	0, 1/	2	p 121	R3′
	Even $u$ OR e	ven v	[u, v,	0]					[s, -s]	5]	$\rho 1$	R1

# pm2m No. 27

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	group	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$			Penetrat rod grov ( <b>d</b> , <b>z</b> , <b>c</b>	up
[100]	[010]	pm2m L	27	S		p2mm F	R18
[010]	[100]	p2mm L2	7'	0, 1/2		pmm2 F	R15
				[s, -s]	]	$\rho 1m1$ 1	R4′
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Lo	ocation sd	r	enetration od group $(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
Any $u, v$	Any $p, q$	p11m L4		S	p	1m1 R4'	

#### $pm2_1b$ No. 28

Penetration direction	$\begin{array}{c} \text{Scanning} \\ \text{direction } \mathbf{d} \end{array}$	Scanning group	Location sd	Penetration rod group
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
[100]	[010]	$pm2_1b$ L28	$[s, (s+\frac{1}{2})]$	ρ11m R10
[010]	[100]	$p2_1ma \text{ L}28'$	0, 1/2	pmc2 <sub>1</sub> R17
			[s, -s]	ρ1c1 R5'
Penetration	Scanning	Scanning	Location	Penetration
direction	direction	group	$s\mathbf{d}$	rod group
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
Even $u$ , odd $v$	Odd p	p11a L5	S	ρ1c1 R5'
Odd $u$ , any $v$	Even p	p11b L5'	$[s, (s+\frac{1}{2})]$	ρ1 R1
Odd u, any $v$	Odd p	p11n L5'	$[s, (s+\frac{1}{2})]$	ρ1 R1

#### $pb2_1m$ No. 29

Penetration	Scanning	Scannin	ıg	Location		Penetra	ation
direction	direction d	group		sd	l	rod gr	oup
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	)			$(\mathbf{d}, \mathbf{z},$	<b>(c</b> )
[100]	[010]	<i>pb</i> 2 <sub>1</sub> <i>m</i> L	29	[s, (s +	$-\frac{1}{2}$ )]	$\rho 1m1$	R4'
[010]	[100]	p2 <sub>1</sub> am L5	29′	0, 1/2		$\rho cm2_1$	R17′
				[s, -	·s]	$\rho 1m1$	R4′
Penetration	Scanning	Scanning	Lo	cation	Pene	etration	
direction	direction	group		$s\mathbf{d}$	rod	group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$			(d	l, z, c)	
Any $u, v$	Any $p, q$	p11m L4		S	p 1n	n1 R4'	

#### pb2b No. 30

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction <b>d</b>	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$	group sd		
[100]	[010]	<i>pb2b</i> L30	$[s, (s+\frac{1}{2})]$	p211	R3
[010]	[100]	p2aa L30′	0, 1/2 [s, -s]	ρcc2 ρ1c1	R16 R5′
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	$\begin{array}{c} \text{Location} \\ s\mathbf{d} \end{array}$	Penetr rod gr ( <b>d</b> , <b>z</b>	roup
Even $u$ , odd $v$	Odd p	p11a L5	S	p1c1	R5'
			1		
Odd $u$ , any $v$	Even $p$	p11b L5'	$[s, (s + \frac{1}{2})]$	$\rho 1$	R1

#### *pm*2*a* **No.** 31

Penetration direction	Scanning direction <b>d</b>	Scanning group	Location sd	Penetration rod group
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
[100]	[010]	pm2a L31	S	<i>p</i> 2cm R19
[010]	[100]	<i>p</i> 2 <i>mb</i> L31′	[0, 1/2]	ρ112 R8
			[1/4, 3/4]	$\rho m11$ R4
			$[\pm s, (\frac{1}{2} \pm s)]$	] \rho 1 R1
Penetration	Scanning	Scanning	Location	Penetration
direction	direction	group	$s\mathbf{d}$	rod group
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
Odd $u$ , even	$v \mid \operatorname{Odd} q$	p11a L5	S	ρ1c1 R5'
Any $u$ , odd $v$	Even $q$	p11b L5'	$[s, (s+\frac{1}{2})]$	ρ1 R1
Any $u$ , odd $v$	Odd q	p11n L5'	$[s, (s+\frac{1}{2})]$	ρ1 R1

### $pm2_1n$ No. 32

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d		$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$		Lo	sd	Penetratio rod group (d, z, c)	
[100]	[010]		pm2 <sub>1</sub> n L32		$[s, (s + \frac{1}{2})]$		$\rho 11m$	R10
[010]	[100]		<i>p</i> 2 <sub>1</sub>	mn L32'	[1/	[4, 1/2] [4, 3/4] $(\frac{1}{2} \pm s)]$	ρm11 ρ112 <sub>1</sub> ρ1	R4 R9 R1
	enetration direction $[\mu\nu] = \mathbf{c}$		$ \frac{1}{2} $ $ 1$	Scannin group (c, d, z)		Location sd	Penet rod g	group
Odd u, odd	d v	Any j	p,q	<i>p</i> 11 <i>a</i> L	5	S	p1c1	R5'
Even $u$ OR e	ven v	Odd	p,q	<i>p</i> 11 <i>b</i> L5	5' [.	$[s,(s+\frac{1}{2})]$	<i>p</i> 1	R1
Even $u$ , odd $v$ Odd $u$ , even $v$		Even Even	_	<i>p</i> 11 <i>n</i> L5	5′ [.	$s, (s+\frac{1}{2})]$	p1	R1

### $pb2_1a$ No. 33

Penetration	Scanning	Scanning	Location	Penetr	ation
direction	direction $\mathbf{d}$	group	$s\mathbf{d}$	rod g	roup
$[uv0] = \mathbf{c}$		$(\mathbf{c},\mathbf{d},\mathbf{z})$		$(\mathbf{d}, \mathbf{z})$	$(\mathbf{c}, \mathbf{c})$
[100]	[010]	$pb2_1a$ L33	$[s, (s+\frac{1}{2})]$	] \rho 1c1	R5'
[010]	[100]	$p2_1ab \text{ L}33'$	[0, 1/2]	p112 <sub>1</sub>	R9
			[1/4, 3/4]	$\rho c11$	R5
			$[\pm s, (\frac{1}{2} \pm s)$	)] /n1	R1
Penetration	Scanning	Scanning	Location	Penetrati	on.
direction	direction	group	$s\mathbf{d}$	rod grou	ıp
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	)
Odd $u$ , even	$v \mid \operatorname{Odd} q$	p11a L5	S	<i>p</i> 1 <i>c</i> 1 F	R5′
Any $u$ , odd $v$	Even q	p11b L5'	$[s, (s+\frac{1}{2})]$	<i>γ</i> 1	R1
Any $u$ , odd $v$	Odd $q$	p11n L5'	$[s, (s+\frac{1}{2})]$	<i>p</i> 1	R1

#### pb2n No. 34

Penetration	Scanning		Scanning		L	Location		enetrat	ion
direction	direc	irection d		group		$s\mathbf{d}$		rod group	
$[uv0] = \mathbf{c}$			(c.	$(\mathbf{d}, \mathbf{z})$			$(\mathbf{d}, \mathbf{z}, \mathbf{c})$		;)
[100]	[0	10]	pb2n L34		$[s, (s+\frac{1}{2})]$		p	211	R3
[010]	[ ]	00]	p2a	n L34'		[0, 1/2]	p	112	R8
					[1	/4, 3/4]	p	c11	R5
					[±	$s, (\frac{1}{2} \pm s)]$	p	1	R1
Penetratio	on	on Scann		ning   Scanni		Location	ı	Penet	ration
direction	L	direct	tion grou		р	$s\mathbf{d}$		rod g	group
$[uv0] = \mathbf{c}$	2	$\mathbf{d} = [p]$	[c, d]		$\mathbf{z})$			$(\mathbf{d}, \mathbf{d})$	$\mathbf{z}, \mathbf{c})$
Odd u, odd	d v	Any A	p,q	p11a	L5	S		p1c1	R5'
Even $u$ OR e	ven v	Odd	$p,q \mid p11b \mid I$		$L5'   [s, (s + \frac{1}{2})]$		]	<i>p</i> 1	R1
Even $u$ , ode	d v	Even		p11n	L5'	$[s, (s+\frac{1}{2})]$	]	$\rho 1$	R1
Odd $u$ , ever	n v	Even	p						

#### *cm*2*m* **No.** 35

Penetration direction		$rac{1}{2}$	9	anning group	Location sd	Penetra rod gro	oup		
$[uv0] = \mathbf{c}$			(0	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z},$	<b>c</b> )		
[100]	[0	10]	cm2	2m L35	$[s, (s+\frac{1}{2})]$	$\rho^{2mm}$	R18		
[010]	[ 1	00]	c2n	ım L35′	[0, 1/2]	$\rho mm2$	R15		
					[1/4, 3/4]	$\rho cm2_1$	R17′		
					$\left[\pm s, (\frac{1}{2} \pm s)\right]$	$\rho 1m1$	R4'		
Penetratio	on	С		S	canning	Scannii	ng	Location	Penetration
direction	1			d	lirection	group	)	$s\mathbf{d}$	rod group
[ <i>uv</i> 0]				d =	[p,q,0]/2	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	2)		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
Odd u, v	,	[u, v, 0]	)]/2	Even $p$ ,	q OR odd $p,q$	p11m I	L4	S	ρ1m1 R4'
Even $u$ OR e	ven v	[u, v,	0]						

#### cm2e No. 36

Penetration direction $[uv0] = \mathbf{c}$		nning etion <b>d</b>	0		Location sd	Penetration rod group (d, z, c)	-		
[100]	[(	010]	ст	2e L36	$[s, (s+\frac{1}{2})]$	ρ2cm R1	9		
[010]	[]	[00]	c2r	ne L36'	$   \begin{bmatrix}     0, 1/2 \\     1/4, 3/4 \\     [\pm s, (\frac{1}{2} \pm s)]   \end{bmatrix} $	ρcc2 R1 ρmc2 <sub>1</sub> R1 ρ1c1 R5	7		
	Penetration c direction [w0]			Scanning direction $\mathbf{d} = [p, q, 0]/2$			Location sd	Penetrod g	roup
Odd $u$ , even OR even $u$ , o		[ <i>u</i> , <i>v</i> , 0	)]	Even $p$ ,	$q  ext{ OR odd } p, q$	p11a L5	S	p1c1	R5′
Odd $u, v$		[u,v,0]	]/2	F	Even $p, q$	p11b L5'	$[s, (s+\frac{1}{2})]$	<i>p</i> 1	R1
Odd u, v		[u,v,0]	]/2	(	Odd $p,q$	p11n L5'	$[s, (s+\frac{1}{2})]$	p1	R1

#### pmmm No. 37

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	$\begin{array}{c c} Scanning \\ group \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group (d, z, c)
[100] [010]	[010] [100]	pmmm L37	0, 1/2 [s, -s]	ρmmm R20 ρ2mm R18
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$	Location sd	Penetration rod group (d, z, c)
Any u, v	Any $p, q$	p112/m L6	0, 1/2 [ $s, -s$ ]	ρ12/m1 R6' ρ1m1 R4'

#### pmaa No. 38

		a .			
Penetration	Scanning	Scanning	Location	Penetra	tion
direction	direction $\mathbf{d}$	group	$s\mathbf{d}$	rod gro	oup
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{d})$	<b>c</b> )
[100]	[010]	pmaa L38	0, 1/2	pccm	R21
			[s, -s]	$\rho^{2cm} [1/4]$	4] R19
[010]	[100]	pbmb L38'	[0, 1/2]	$\rho^{2/m11}$	R6
			[1/4, 3/4]	$\rho$ 222	R13
			$[\pm s, (\frac{1}{2} \pm s)]$	$\rho^{211}$	R3
Penetration	Scanning	Scanning	Location	Penetra	ation
direction	direction	group	$s\mathbf{d}$	rod gr	oup
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z},$	, <b>c</b> )
Odd $u$ , even	v Odd q	p112/a L7	0, 1/2	p12/c1	R7′
			[s, -s]	n1c1	R5'
Any $u$ , odd $v$	v Even $q = p112/b L7'$		[0, 1/2]	ηĪ	R2
			[1/4, 3/4]	n 121	R3'
			$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	p1	R1
Any $u$ , odd $v$	Odd $q$	p112/n L7'	[0, 1/2]	ρĪ	R2
			[1/4, 3/4]	$n_{121} [1/$	'4] R3'
			$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	$\rho$ 1	R1

#### pban No. 39

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction <b>d</b>		$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$				Penetration rod group $(\mathbf{d}, \mathbf{z}, \mathbf{c})$		
[100]	_	[010] [100]		n L39	$ \begin{bmatrix} [0, 1/2] \\ [1/4, 3/4] \\ [\pm s, (\frac{1}{2} \pm s)] \end{bmatrix} $		μ2/c11 R7 μ222 [1/4] R13 μ211 [1/4] R3		
Penetration direction $[uv0] = 0$	1	Scanr direct $\mathbf{d} = [p]$	ion	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$				Penetrar rod gro (d, z, c	up
Odd $u$ , odd	d v	Any	p,q $p112/$		a L7	0, 1 [s, -	,	ρ12/c1 ρ1c1	R7' R5'
Even $u$ OR even $v$ O		Odd	p, q p112/		<i>b</i> L7′	$   \begin{bmatrix}     0, 1/2 \\     1/4, 3/4 \\     [\pm s, (\frac{1}{2} \pm s)]   \end{bmatrix} $		μ1 μ121 μ1	R2 R3' R1
Even $u$ , od Odd $u$ , eve		Ever Ever	1	p112/	'n L7'	$ \begin{array}{c c}                                    $		μ1 μ121 [1/4 μ1	R2

### pmam No. 40

Penetration	Scanning	Scanning		Location		ration
direction	direction $\mathbf{d}$	group	sd		rod g	roup
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$				$(\mathbf{c}, \mathbf{c})$
[100]	[010]	pmam L40	0, 1/2	2	ncmm	R22'
			[s, -s]	]	$\rho^{2mm}$ [1	/4] R18
[010]	[100]	pbmm L40'	[0, 1/2]	2]	$\rho 12/m1$	R6'
			[1/4, 3]	[1/4, 3/4]		R15
			$[\pm s, (\frac{1}{2} \pm$	[s]	$\rho 1m1$	R4'
Penetration	Scanning	Scanning	Location	Per	netration	
direction	direction	group	$s\mathbf{d}$	ro	d group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		(	$\mathbf{d}, \mathbf{z}, \mathbf{c})$	
Any $u, v$	Any $p, q$	p112/m L6	0, 1/2	$\rho$ 1	2/m1 R6'	
			[s, -s]	$\rho 1$	m1 R4'	

#### pmma No. 41

Penetration	Scanning	Scanning	Location	Penetration	
direction	direction d	_	$s\mathbf{d}$		
	direction a	group	sa	rod group	
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
[100]	[010]	pmma L41	0, 1/2	pmcm R22	
			[s, -s]	n2cm R19	
[010]	[100]	pmmb L41'	[0, 1/2]	p112/m R11	
			[1/4, 3/4]	ρm2m R18'	
			$[\pm s, (\frac{1}{2} \pm s)]$	ρ11m R10	
Penetration	Penetration Scanning		Location	Penetration	
direction	direction	group	$s\mathbf{d}$	rod group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
Odd $u$ , even	v Odd q	p112/a L7	0, 1/2	$\rho 12/c1$ R7	
			[s, -s]	/n1c1 R5	
Any $u$ , odd $v$	Even $q$	p112/b L7'	[0, 1/2]	$\rho \bar{1}$ R2	
			[1/4, 3/4]	/n 121 R3	
			$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	/n 1 R1	
Any $u$ , odd $v$	Odd $q$	p112/n L7'	[0, 1/2]	$\rho \bar{1}$ R2	
			[1/4, 3/4]	/ 121 [1/4] R3	
			$\left[\pm s, (\frac{1}{2} \pm s)\right]$	/n1 R1	

#### pman No. 42

Penetration direction		nning tion <b>d</b>	g	Scanning group		$s\mathbf{d}$		Penetration rod grou		
$[uv0] = \mathbf{c}$			( <b>c</b>	$, \mathbf{d}, \mathbf{z})$				$(\mathbf{d}, \mathbf{z}, \mathbf{c})$		
[100]	[0]	10]	pmo	<i>in</i> L42	[0	, 1/2]	p11	2/m	R11	
					[1/	[4, 3/4]	$\rho c2$	m [1/4]	R19'	
					$[\pm s,$	$(\frac{1}{2} \pm s)$	p11	m	R10	
[010]	[1	00] <i>pbm</i>		ın L42'	[0	, 1/2]	p2/	m11	R6	
		, I			[1/	[4, 3/4]	$\rho^{22}$	221	R14	
					$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$		p21	1	R3	
Penetratio	on	Scann	ing   Scann		ing	Locati	on	Pene	tration	
direction	1	direct	ion gro		р	$s\mathbf{d}$		$\operatorname{rod}$	group	
[uv0] = 0	$\mathbf{c}$	$\mathbf{d} = [p]$	$[\mathbf{c}, \mathbf{d}, \mathbf{c}]$		$\mathbf{z})$			(d,	$\mathbf{z}, \mathbf{c})$	
Odd $u$ , ode	d v	Any	p,q	p112/a	L7	0, 1/	2	$\rho 12/c1$	l R	7′
				_		[s, -s]		/n 1c1		5'
Even u OR e	ven v	Odd	p,q	p112/b	L7'	[0, 1/	2]	ρĪ	F	R2
						[1/4, 3]	/4]	p 121	R	3'
						$[\pm s, (\frac{1}{2} \pm s)]$	$\pm s$ )]	$\rho 1$	F	R1
Even $u$ , od	d v	Even $q$		p112/n	L7'	[0, 1/2]		ρĪ	F	R2
Odd $u$ , eve	n v	Ever	p			[1/4, 3]	[/4]			3′
						$[\pm s, (\frac{1}{2})]$	<u>+</u> s)]	p1	F	R1

### pbaa No. 43

Penetration	Scanning	Scanning	Location	Penetrati	on
direction	direction $\mathbf{d}$	group	$s\mathbf{d}$	rod grou	p g
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
[100]	[010]	pbaa L43	[0, 1/2]	p12/c1	R7′
			[1/4, 3/4]	$\rho cc2$	R16
			$[\pm s, (\frac{1}{2} \pm s)]$	$\rho 1c1$	R5'
[010]	[100]	pbab L43'	[0, 1/2]	$\rho 2/c11$	R7
			[1/4, 3/4]	$n^{222}$ <sub>1</sub> [1/4]	R14
			$[\pm s, (\frac{1}{2} \pm s)]$	p211 [1/4]	R3
Penetration	Scanning	Scanning	Location	Penetrat	ion
direction	direction	group	sd	rod gro	up
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	:)
Odd $u$ , even	v Odd q	p112/a L7	0, 1/2	$\rho 12/c1$	R7′
	_		[s, -s]	$\rho 1c1$	R5'
Any $u$ , odd $v$	Even $q$	p112/b L7'	[0, 1/2]	$\rho \bar{1}$	R2
			[1/4, 3/4]	p121	R3'
			$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	$\rho 1$	R1
Any $u$ , odd $v$	Odd $q$	p112/n L7'	[0, 1/2]	μĪ	R2
			[1/4, 3/4]	$\rho$ 121 [1/4	] R3'
			$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	<i>p</i> 1	R1

### pbam No. 44

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	Scanning group (c, d, z)	Location sd	Penetration rod group (d, z, c)
[100]	[010] [100]	pbam L44	$   \begin{bmatrix}     0, 1/2 \\     1/4, 3/4 \\     [\pm s, (\frac{1}{2} \pm s)]   \end{bmatrix} $	ρ12/m1 R6' ρcm2 <sub>1</sub> R17'
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group $(\mathbf{d}, \mathbf{z}, \mathbf{c})$
Any u, v	Any $p, q$	<i>p</i> 112/ <i>m</i> L6	0, 1/2 [s, -s]	ρ12/m1 R6' ρ1m1 R4'

#### pbma No. 45

Penetration	Scanning	Scanning	Location	Penetra	tion
direction	direction $\mathbf{d}$	group	$s\mathbf{d}$	rod gro	oup
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{d})$	c)
[100]	[010]	pbma L45	[0, 1/2]	$\rho 12/c1$	R7'
			[1/4, 3/4]	$\rho mc2_1$	R17
			$[\pm s, (\frac{1}{2} \pm s)]$	$\rho 1c1$	R5'
[010]	[100]	pmab L45'	[0, 1/2]	$n^{112} 1/m$	R12
			[1/4, 3/4]	$\rho c2m$	R19'
			$[\pm s, (\frac{1}{2} \pm s)]$	$\rho 11m [1/4]$	4] R10
Penetration	Scanning	Scanning	Location	Penetra	ation
direction	direction	group	$s\mathbf{d}$	rod gr	oup
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z},$	$\mathbf{c})$
Odd $u$ , even	$v \mid \operatorname{Odd} q$	p112/a L7	0, 1/2	p12/c1	R7′
			[s, -s]	$\rho 1c1$	R5'
Any u, odd v	Even q	p112/b L7'	[0, 1/2]	ηĪ	R2
			[1/4, 3/4]	p 121	R3'
			$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	<i>p</i> 1	R1
Any $u$ , odd $v$	$\frac{1}{2}$ Odd $q$	p112/n L7'	[0, 1/2]	ρĪ	R2
			[1/4, 3/4]	$n^{121} [1/$	4] R3'
			$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	<i>p</i> 1	R1

#### pmmn No. 46

Penetration		nning	Sca	nning	Lo	cation		Penetration	
direction	direc	direction $\mathbf{d}$		roup		$s\mathbf{d}$		rod group	
$[uv0] = \mathbf{c}$			( <b>c</b>	$, \mathbf{d}, \mathbf{z})$				$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
[100]	[0	10]	pmr	nn L46	[0	, 1/2]	p11	$2_1/m$	R12
[010]	[ 1	00]			$[1/\epsilon]$	4, 3/4	pm2	2m [1/4] I	R18'
					$[\pm s,$	$(\frac{1}{2} \pm s)$	-		R10
Penetratio	on	Scann	ning	Scann	ing	Locati	ion	Penetr	ration
direction	1	direction		group		$s\mathbf{d}$		rod group	
$[uv0] = \mathbf{c}$	$\mathbf{c}$	$\mathbf{d} = [p]$	$\mathbf{d} = [pq0]$		$(\mathbf{z})$			$(\mathbf{d}, \mathbf{z})$	$(\mathbf{c}, \mathbf{c})$
Odd $u$ , odd	d v	Any $p, q$		p112/a	L7	0, 1/	′2	p12/c1	R7′
			.			[s, -s]		p1c1	R5'
Even $u$ OR e	ven v	Odd	p,q	p112/b L7'		[0, 1/2]		ηĪ	R2
					[1/4, 3]		3/4]		
						$[\pm s, (\frac{1}{2})]$	$\pm s$ )]	<i>p</i> 1	R1
Even $u$ , od	d v Even		q	p112/n	L7'	[0, 1/	<sup>'</sup> 2]	ρĪ	R2
Odd $u$ , eve	n v	Ever	p			[1/4, 3]		n 121 [1	/4] R3′
						$[\pm s, (\frac{1}{2})]$	$\pm s$ )]	<i>p</i> 1	R1

#### cmmm No. 47

Penetration direction		nning tion <b>d</b>			$\begin{array}{c} \text{Location} \\ s\mathbf{d} \end{array}$	Penetration rod group			
$[uv0] = \mathbf{c}$			(c	$(\mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z},$	<b>c</b> )		
[100] [010]	· -	10] 00]	cmr	nm L47	$   \begin{bmatrix}     0, 1/2 \\     1/4, 3/4   \end{bmatrix} $	рттт рстт [1/	R20 41 R22'		
[010]	[-				$[\pm s, (\frac{1}{2} \pm s)]$	$n^{2mm}$	R18		
Penetratio	on	c		Ç	Scanning	Scanning	g Loca	ation	Penetration
direction	1			(	direction	group	s	$\mathbf{d}$	rod group
[ <i>uv</i> 0]				d =	= [p, q, 0]/2	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$			$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
Odd u, v	,	[u, v, 0]	]/2	Even $p$	q OR odd $p,q$	p112/m I	L6 0,	1/2	p12/m1 R6'
Even $u$ OR e	ven v	[u, v,	0]				[s,	-s]	$\rho 1m1  R4'$

#### cmme No. 48

Penetration direction $[uv0] = \mathbf{c}$		nning ction <b>d</b>	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$		up	Location sd	Penetration rod group (d, z, c)				
[100]	[(	010]	cmr	cmme L48		$   \begin{bmatrix}     0, 1/2 \\     1/4, 3/4 \\     [\pm s, (\frac{1}{2} \pm s)]   \end{bmatrix} $	ρccm ρmcm [1/4] ρ2cm [1/4]				
[010]	[]	[00]	cmr [1/4		L48 /4,0]	$   \begin{bmatrix}     0, 1/2 \\     1/4, 3/4 \\     1/4, (\frac{1}{2} \pm s)   \end{bmatrix} $	ртст рсст [1/4] р2ст	R22 R21 R19			
Penetration direction [uv0]		С			di	anning rection $[p,q,0]/2$	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$		ation sd	Penetra rod gr ( <b>d</b> , <b>z</b> ,	oup
Odd $u$ , even OR even $u$ , o		[ <i>u</i> , <i>v</i> , 0	0]	Ev	ren  p, q	OR odd $p, q$	p112/a L7		1/2 -s]	ρ12/c1 ρ1c1	R7' R5'
Odd u,v		[u,v,0]	]/2	Even $p, q$		$\operatorname{ren}p,q$	p112/b L7'	$   \begin{bmatrix}     0, 1/2 \\     1/4, 3/4 \\     [\pm s, (\frac{1}{2} \pm s)]   \end{bmatrix} $		μ1 μ121 μ1	R2 R3' R1
Odd u,v		[u,v,0]	]/2	$\mathrm{Odd}\ p,q$		p112/n L7'	[1/4]	1/2] $1/3$ , $3/4$ ] $1/3$ ,	μ̄ Ī μ121 [1/ μ1	R2 4] R3' R1	

#### p4 No. 49

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	$\begin{array}{ c c c }\hline Scanning \\ group \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \\ \hline \end{array}$	Location sd	Penetration rod group (d, z, c)
[100] [010] [110] [110]	[010] [100] [100] [100]	p112 L3	[s, -s]	ρ121 R3' ρ1 R1
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group (d, z, c)
Any u, v	Any $p, q$	<i>p</i> 112 L3	0, 1/2 [ $s, -s$ ]	μ121 R3′ μ1 R1

# $p\bar{4}$ No. 50

Penetration direction	Scanning direction d	Scanning group	Location sd	Penetration rod group
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
[100]	[010]	p112 L3	0, 1/2	ρ121 R3'
[010]	[100]		[s, -s]	$\rho 1$ R1
[110]	[100]			
[110]	[100]			
Penetration	Scanning	Scanning	Location	Penetration
direction	direction	group	$s\mathbf{d}$	rod group
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
Any $u, v$	Any $p, q$	p112 L3	0, 1/2	ρ121 R3'
			[s, -s]	/n 1 R1

### *p*4/*m* No. 51

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group (d, z, c)
[100] [010] [110] [110]	[010] [100] [100] [100]	p112/m L6	0, 1/2 [s, -s]	ρ12/m1 R6' ρ1m1 R4'
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group $(\mathbf{d}, \mathbf{z}, \mathbf{c})$
Any u, v	Any $p, q$	<i>p</i> 112/ <i>m</i> L6	0, 1/2 [s, -s]	ρ12/m1 R6' ρ1m1 R4'

#### p4/n No. 52

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction <b>d</b>	$\begin{array}{cc} \text{Scanning} & \text{Location} \\ \text{group} & s\mathbf{d} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) & \end{array}$			Penetration rod group $(\mathbf{d}, \mathbf{z}, \mathbf{c})$		
[100] [010]	[010] [100]	p112/n I	[1]	0, 1/2] /4, 3/4]	,	21 [1/4	
[110]	[100]	p112/a		$(\frac{1}{2} \pm s)$ ] $(1/2)$	$\rho 1$	2/c1	R1 R7'
[110]	[100]	p112/u		[s, -s]		2/c1 c1	R5'
Penetration Scann		ing Sc	anning	Locatio	n .	Per	otratio

Penetration	Scanning	Scanning	Location	Penetra	tion
direction	direction	group	$s\mathbf{d}$	rod gro	oup
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z},$	<b>c</b> )
Odd u, odd v	Any $p, q$	p112/a L7	0, 1/2	$\rho 12/c1$	R7′
			[s, -s]	$\rho 1c1$	R5'
Even $u$ OR even $v$	$\mathrm{Odd}\; p,q$	p112/b L7'	[0, 1/2]	$\rho \bar{1}$	R2
			[1/4, 3/4]	p 121	R3'
			$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	p1	R1
Even $u$ , odd $v$	Even $q$	p112/n L7'	[0, 1/2]	ρĪ	R2
Odd $u$ , even $v$	Even $p$		[1/4, 3/4]	n 121 [1/-	4] R3′
			$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	$\rho 1$	R1

#### p422 No. 53

Penetration	Scanning	Scanning	Locatio	on Penetra		tion
direction	direction d	~	sd	1		oup
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$			$(\mathbf{d}, \mathbf{z},$	<b>c</b> )
[100]	[010]	p222 L19	0, 1/2	0, 1/2		R13
[010]	[100]		[s, -s]	[s, -s]		R3
[110]	[110]	c222 L22	[0, 1/2]	[0, 1/2]		R13
[110]	[110]		[1/4, 3]	[1/4, 3/4]		R14
			$[\pm s, (\frac{1}{2} \pm$	[s]	p211	R3
Penetration	Scanning	Scanning	Location	Per	netration	
direction	direction	group	$s\mathbf{d}$	ro	d group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		(0	$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
Any u, v	Any $p, q$	p112 L3	0, 1/2	$\rho 1$	21 R3'	
			[s, -s]	<i>p</i> 1	R1	

### *p*42<sub>1</sub>2 **No.** 54

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction <b>d</b>	Scannin group (c, d, z	,		$\mathbf{ation}$	ro	enetration $(\mathbf{d}, \mathbf{z}, \mathbf{c})$	p
[100] [010]	[010] [100]	p2 <sub>1</sub> 2 <sub>1</sub> 2 <sub>1</sub>	L21	[1/4	1/2]	ρ121 ρ112		R3′ R9
[110] [1Ī0]	[Ī10] [110]	c222 [1/4, 1/4	L22 ,0]	[0, [1/4	$\frac{\frac{1}{2} \pm s)}{1/2}, 3/4, \frac{1}{2} \pm s)$	$\rho^{222}$	2 <sub>1</sub> [1/4] 2 [1/4] 1 [1/4]	R1 R14 R13 R3
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$		eation sd	Penetr rod g: (d, z	ation roup		
Any u, v	Any $p, q$	p112 L3		1/2 , $-s$ ]	ρ121 ρ1	R3′ R1		

#### *p*4*mm* No. 55

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	Scanning group (c, d, z)	sd	$\begin{array}{c} \text{Location} \\ s\mathbf{d} \end{array}$		etration group ( <b>z</b> , <b>c</b> )
[100]	[010] [100]	pmm2 L2	3 0, 1	0, 1/2 [s, -s]		R18' R10
[110] [1Ī0]	[110] [110]	cmm2 L2	$ \begin{array}{c c}                                    $	3/4]	ρm2m ρc2m [ ρ11m	R18' 1/4] R19' R10
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	Scanning group (c, d, z)	Location sd	Pene rod (d	etration group , z, c)	
Any u, v	Any $p, q$	p112 L3	$ \begin{array}{c c} 0, 1/2 \\ [s, -s] \end{array} $	$\rho$ 12 $\rho$ 1	1 R3′ R1	

#### p4bm No. 56

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	Scanning group (c, d, z		Loca		ro	$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	р
[100] [010]	[010] [100]	pba2 I	L25	[0, 1]	3/4]	ρ121 ρc11		R3′ R5
[110]	[110]	cmm2 I	26	$[\pm s, (\frac{1}{2})]$	$\left[\frac{1}{2} \pm s\right]$	$\rho 1$ $\rho c2m$	,	R1 R19'
[110]	[110]	[1/4, 1/4]		[1/4,	3/4]	pm2n	n [1/4]	R18′
				$[\pm s, (\frac{1}{2})]$	$\frac{1}{2} \pm s$	$\rho 11m$	[1/4]	R10
Penetration	Scanning	Scanning	Lo	cation	Penet	ration		
direction	direction	group		$s\mathbf{d}$	rod g	group		
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$			$(\mathbf{d}, \mathbf{z})$	$\mathbf{z}, \mathbf{c})$		
Any u, v	Any $p, q$	<i>p</i> 112 L3	0	, 1/2	p121	R3'		
			[.	[s, -s]	$\rho 1$	R1		

# $p\bar{4}2m$ No. 57

Penetration	Scanning	Scanning	g Locat	Location		etration
direction	direction $\mathbf{d}$	group	sd		rod	group
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$			( <b>d</b>	$(\mathbf{z}, \mathbf{c})$
[100]	[010]	p222 L1	$9 \mid 0, 1,$	/2	p 222	R13
[010]	[100]		[s, -	s]	p211	R3
[110]	[110]	cmm2 L2	[0, 1]	/2]	pm2m	R18′
[110]	[110]		[1/4, 3]	3/4]	pc2m [	1/4] R19'
			$[\pm s, (\frac{1}{2})]$	$\pm s$ )]	p 11m	R10
Penetration	Scanning	Scanning	Location	Pene	etration	
direction	direction	group	$s\mathbf{d}$	rod	group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$		(d	$l, \mathbf{z}, \mathbf{c})$	
Any $u, v$	Any $p, q$	<i>p</i> 112 L3	0, 1/2	p12	1 R3'	
			[s, -s]	<i>p</i> 1	R1	

# $p\bar{4}2_{1}m$ No. 58

Penetration	Scanning	Scannin	ng	Loc	ation	Pe	enetration	
direction	direction d	group	group		$^{ m sd}$	r	rod group	
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	i)				$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
[100]	[010]	$p2_12_12_1$	L21	[0,	1/2]	p 121	R3'	
[010]	[100]			[1/4]	, 3/4]	n112	R9	
				$[\pm s, ($	$\frac{1}{2} \pm s$	<i>p</i> 1	R1	
[110]	[110]	cmm2	L26	[0,	1/2]	pc2n	n R19'	
[110]	[110]	[1/4, 1/4	[0, 0]	[1/4]	, 3/4]		m [1/4] R18'	
				$[\pm s, ($	$\frac{1}{2} \pm s$	p11n	n [1/4] R10	
Penetration	Scanning	Scanning	Loc	cation	Penetr	ation		
direction	direction	group		$s\mathbf{d}$	rod g	roup		
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$			$(\mathbf{d}, \mathbf{z})$	$, \mathbf{c})$		
Any u, v	Any $p, q$	p112 L3	0,	1/2	p121	R3′		
			[s	,-s]	$\rho 1$	R1		

#### $p\bar{4}m2$ No. 59

Penetration direction	Scanning direction d	Scanning	g Locar		Penetra rod gr	
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$				$(\mathbf{c})$
[100]	[010]	pmm2 L2	3 0, 1	0, 1/2		R18′
[010]	[100]		[s, -	[s, -s]		R10
[110]	[110]	c222 L2	[0, 1]	/2]	p222	R13
[110]	[110]		[1/4,	[1/4, 3/4]		R14
			$[\pm s, (\frac{1}{2})]$	$\pm s$ )]	p211	R3
Penetration	Scanning	Scanning	Location	Pene	etration	
direction	direction	group	$s\mathbf{d}$	rod	group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		(d	$(\mathbf{z}, \mathbf{c})$	
Any $u, v$	Any $p, q$	<i>p</i> 112 L3	0, 1/2	p12	1 R3'	
			[s, -s]	<i>p</i> 1	R1	

# $p\bar{4}b2$ No. 60

Penetration direction	Scanning direction d	Scannin	_		$egin{array}{c} \operatorname{Location} \\ s\mathbf{d} \end{array}$		Penetration rod group	
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	)			(	$\mathbf{d}, \mathbf{z}, \mathbf{c})$	
[100]	[010]	pba2 I	L <sub>25</sub>	[0, 1	1/2]	p 121		R3'
[010]	[100]			[1/4,	3/4]	$\rho c11$		R5
				$[\pm s, (\frac{1}{2})]$	$\left[\frac{1}{2}\pm s\right]$	$\rho 1$		R1
[110]	[110]	c222 I	c222 L22		1/2]	μ222 <sub>1</sub> [1/4] R14 μ222 [1/4] R13		R14
[110]	[110]	[1/4, 1/4	,0]	[1/4,	3/4]	$\rho$ 222	[1/4]	R13
				$[\pm s, (\frac{1}{2})]$	$\left[\frac{1}{2} \pm s\right]$	p211	[1/4]	R3
Penetration	Scanning	Scanning	Lo	cation	Penet	ration		
direction	direction	group		$s\mathbf{d}$	rod g	group		
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$			$(\mathbf{d}, \mathbf{z})$	$\mathbf{z}, \mathbf{c})$		
Any $u, v$	Any $p, q$	p112 L3	0	, 1/2	p121	R3'		
			[.	[s, -s]	<i>p</i> 1	R1		

#### *p*4/*mmm* **No. 61**

Penetration	Scanning	Scanning	Locatio	on	Peneti	ration
direction	direction $\mathbf{d}$	group	$s\mathbf{d}$		rod g	roup
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$			$(\mathbf{d}, \mathbf{z})$	$\mathbf{z}, \mathbf{c})$
[100]	[010]	pmmm L37	0, 1/2		nmmm	R20
[010]	[100]		[s, -s]	[s, -s]		R18
[110]	[110]	cmmm L47	[0, 1/2]		nmmm	R20
[110]	[110]		[1/4, 3/	[1/4, 3/4]		/4] R22'
			$[\pm s, (\frac{1}{2} \pm$	<i>s</i> )]	p2mm	R18
Penetration	Scanning	Scanning	Location	Pe	netration	
direction	direction	group	$s\mathbf{d}$	ro	d group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		(	$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
Any $u, v$	Any $p, q$	p112/m L6	0, 1/2	ρ12/m1 R6'		
			[s, -s]	p1	m1 R4'	

#### *p*4/*nbm* **No. 62**

Penetration direction	$\begin{array}{c} \text{Scanning} \\ \text{direction } \mathbf{d} \end{array}$	Scanning group	Location sd	Penetration rod group
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
[100]	[010]	pban L39	[0, 1/2]	$ \rho 2/c11 $ R7
[010]	[100]		[1/4, 3/4]	ρ222 [1/4] R13
			$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	ρ211 [1/4] R3
[110]	[110]	cmme L48	[0, 1/2]	pccm R21
			[1/4, 3/4]	pmcm [1/4] R22
			$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$	p2cm [1/4] R19
[110]	[110]	cmme L48	[0, 1/2]	pmcm R22
		[1/4, 1/4, 0]	[1/4, 3/4]	pccm [1/4] R21
			$\left[\pm s, (\frac{1}{2} \pm s)\right]$	p2cm R19

Penetration	Scanning	Scanning	Location	Penetra	tion
direction	direction	group	$s\mathbf{d}$	rod gro	oup
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z},$	<b>c</b> )
Odd u, odd v	Any $p, q$	p112/a L7	0, 1/2	$\rho 12/c1$	R7′
			[s, -s]	p1c1	R5'
Even $u$ OR even $v$	$\mathrm{Odd}\; p,q$	p112/b L7'	[0, 1/2]	$\rho\bar{1}$	R2
			[1/4, 3/4]	$\rho$ 121	R3'
			$[\pm s, (\frac{1}{2} \pm s)]$	$\rho 1$	R1
Even $u$ , odd $v$	Even $q$	p112/n L7'	[0, 1/2]	$\rho \bar{1}$	R2
Odd $u$ , even $v$	Even $p$		[1/4, 3/4]	p 121 [1/4	4] R3′
			$[\pm s, (\frac{1}{2} \pm s)]$	<i>p</i> 1	R1

#### *p*4/*mbm* **No. 63**

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	Scanning group (c, d, z)	Locat sd		$\operatorname{rod}$	$\mathbf{z}$
[100]	[010]	pbam L4	[-/		$\rho 12/m1$	R6'
[010]	[100]		$[1/4, \frac{1}{2}]$	, ,	ρcm2 <sub>1</sub> ρ1m1	R17' R4'
[110] [110]	[110] [110]	cmmm L4   [1/4, 1/4, 0	.   [-/		pcmm pmmm	R22' [1/4] R20
			$[\pm s, (\frac{1}{2})]$	$\pm s$ )]	p2mm [	1/4] R18
Penetration direction	Scanning direction	Scanning group	Location sd		etration l group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	~		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
Any u, v	Any $p, q$	<i>p</i> 112/ <i>m</i> L6	$0, 1/2 \ [s, -s]$	ρ12 ρ1n	m1 R6'	

#### *p*4/*nmm* **No. 64**

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction <b>d</b>	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	$\begin{array}{c} \text{Location} \\ s\mathbf{d} \end{array}$	Penetration rod group (d, z, c)
[100] [010]	[010] [100]	pmmn L46	$[0, 1/2]  [1/4, 3/4]  [\pm s, (\frac{1}{2} \pm s)]$	ρ112 <sub>1</sub> /m R12 ρm2m [1/4] R18' ρ11m [1/4] R10
[110]	[110]	<i>cmme</i> L48 [1/4, 1/4, 0]	$   \begin{bmatrix}     0, 1/2 \\     1/4, 3/4 \\     1/4, (\frac{1}{2} \pm s)   \end{bmatrix} $	ρmcm R22 ρccm [1/4] R21 ρ2cm R19
[110]	[110]	cmme L48	$   \begin{bmatrix}     0, 1/2 \\     [1/4, 3/4] \\     [\pm s, (\frac{1}{2} \pm s)]   \end{bmatrix} $	ρccm         R21           ρmcm [1/4]         R22           ρ2cm [1/4]         R19

Penetration	Scanning	Scanning	Location	Penetra	tion
direction	direction	group	$s\mathbf{d}$	rod gro	oup
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z},$	<b>c</b> )
Odd u, odd v	Any $p, q$	p112/a L7	0, 1/2	$\rho 12/c1$	R7′
			[s, -s]	p1c1	R5'
Even $u$ OR even $v$	$\mathrm{Odd}\; p,q$	p112/b L7'	[0, 1/2]	$\rho\bar{1}$	R2
			[1/4, 3/4]	$\rho$ 121	R3'
			$[\pm s, (\frac{1}{2} \pm s)]$	$\rho 1$	R1
Even $u$ , odd $v$	Even $q$	p112/n L7'	[0, 1/2]	$\rho \bar{1}$	R2
Odd $u$ , even $v$	Even $p$		[1/4, 3/4]	p 121 [1/4	4] R3′
			$[\pm s, (\frac{1}{2} \pm s)]$	<i>p</i> 1	R1

#### *p*3 No. 65

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction <b>d</b>	gr	$egin{aligned} &  ext{nning} \ &  ext{oup} \ &  ext{d},  ext{z}) \end{aligned}$	Location sd	rod	tration group , <b>z</b> , <b>c</b> )
[100]	[010]	<i>p</i> 1	L1	S	$\rho 1$	R1
[010]	[100]					
[110]	[100]					
[110]	[100]					
[120]	[010]					
[210]	[100]					
Penetration	Scanning	Scann	ning	Location	Penetr	ration
direction	direction	gro	up	$s\mathbf{d}$	rod g	roup
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d})$	$,\mathbf{z})$		$(\mathbf{d}, \mathbf{z})$	z, <b>c</b> )
Any $u, v$	Any $p, q$	<i>p</i> 1	L1	S	p1	R1

# $p\bar{3}$ No. 66

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	grou	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$		rod	etration group , z, c)
[100] [010] [110] [110] [120] [210]	[010] [100] [100] [100] [010] [100]	$p\bar{1}$	L2	0, 1/2 [s, -s]	/n Ī /n 1	R2 R1
Penetration direction $[uv0] = \mathbf{c}$ Any $u, v$	Scanning direction $\mathbf{d} = [pq0]$ Any $p, q$	Scannin group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$	,	Location $s\mathbf{d}$ $0, 1/2$ $[s, -s]$	Penet: rod g (d, z  // 1	group

### *p*312 **No. 67**

Penetration	Scanning	Scanning	g Locat	ion	Penetra	tion
direction	direction $\mathbf{d}$	group	sd	$s\mathbf{d}$		oup
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$			$(\mathbf{d}, \mathbf{z},$	$\mathbf{c})$
[100]	[120]	c121 L10	' [s, (s +	$\frac{1}{2}$ )]	p211	R3
[010]	[210]			2	,	
[110]	[110]					
[110]	[110]	c211 L1	0 [0, 1/	[2]	p112	R8
[120]	[100]		[1/4, 3]	[3/4]	$n112_1$	R9
[210]	[010]		$[\pm s, (\frac{1}{2})]$	$\pm s$ )]	$\rho 1$	R1
Penetration	Scanning	Scanning	Location	Pen	etration	
direction	direction	group	$s\mathbf{d}$	rod	group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$		(c	$\mathbf{l}, \mathbf{z}, \mathbf{c})$	
Any u, v	Any $p, q$	<i>p</i> 1 L1	S	<i>p</i> 1	R1	]
						='

#### *p*321 **No. 68**

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	group	$ \begin{array}{ccc} \text{Scanning} & \text{Location} \\ \text{group} & s\mathbf{d} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) & \end{array} $		Penetra rod gro (d, z,	oup
[100] [010] [110]	[120] [210] [110]	c211 L1	$ \begin{array}{c c} 0 & [0, 1, \\  & [1/4, 5] \\  & [\pm s, (\frac{1}{2}, \frac{1}{2}, \frac$	3/4]	μ112 μ112 <sub>1</sub> μ1	R8 R9 R1
[1Ī0] [120] [210]	[110] [100] [010]	c121 L10	[s,(s+	$(\frac{1}{2})$ ]	p211	R3
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	roc	etration l group $(\mathbf{l}, \mathbf{z}, \mathbf{c})$	
Any $u, v$	Any $p, q$	<i>p</i> 1 L1	S	$\rho 1$	R1	

#### *p*3*m*1 **No. 69**

Penetration direction	Scanning direction d		Scanning Location group sd			Penetrod gr		
$[uv0] = \mathbf{c}$		(c,	$\mathbf{d}, \mathbf{z})$				$(\mathbf{d}, \mathbf{z})$	, <b>c</b> )
[100] [010]	[120] [210]	cm1	cm11 L13 [s,		[s, (s +	$\frac{1}{2}$ )]	p11m	R10
[110]	[110]							
[110]	[110]	c1m	c1m1 L13'		[0, 1/2]		pm11	R4
[120]	[100]				[1/4, 3]	3/4]	pc11	R5
[210]	[010]				$[\pm s, (\frac{1}{2})]$	$\pm s$ )]	p1	R1
Penetration	Scanning	Scanr	ning	L	ocation	Pene	etration	
direction	direction	grou	ıp		$s\mathbf{d}$	$\operatorname{rod}$	group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d})$	$,\mathbf{z})$			$(\mathbf{d}$	$,\mathbf{z},\mathbf{c})$	
Any $u, v$	Any $p, q$	<i>p</i> 1	L1		S	<i>p</i> 1	R1	

# *p*31*m* **No. 70**

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	group	$\begin{bmatrix} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{bmatrix}$		Location sd		ation coup , <b>c</b> )
[100] [010] [110]	[120] [210] [110]	c1m1 L1		$   \begin{bmatrix}     0, 1/\\     1/4, 3\\     1/4, 3   \end{bmatrix} $	3/4]	ρm11 ρc11 ρ1	R4 R5 R1
[1Ī0] [120] [210]	[110] [100] [010]	cm11 L	cm11 L13		$[s,(s+\frac{1}{2})]$		R10
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	L	$s\mathbf{d}$	$\operatorname{rod}$	etration group , z, c)	
Any u, v	Any $p, q$	<i>p</i> 1 L1		S	<i>p</i> 1	R1	

# $p\bar{3}1m$ No. 71

		1 -						
Penetration	Scanning	Scannii	Scanning		Location		Penetration	
direction	direction $\mathbf{d}$	group	)		$^{ m sd}$		rod group	
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	2)				$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
[100]	[120]	c12/m1 I	18'	[0,	1/2]	$\rho^{2/n}$	n11	R6
[010]	[210]			[1/4]	3/4	$\rho^{2/c}$	211 [1/4]	R7
[110]	[110]			$[\pm s, ($	$\frac{1}{2} \pm s$	p211	l	R3
[110]	[110]	c2/m11	L18	[0,	1/2]	p112	2/m	R11
[120]	[100]			[1/4	[3/4]	$\rho 112$	$2_1/m [1/4]$	R12
[210]	[010]			$[\pm s, ($	$\frac{1}{2} \pm s$	$\rho 11n$	n	R10
Penetration	Scanning	Scanning	Loc	ation	Penetr	ation		
direction	direction	group		sd	rod gr	oup		
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$			$(\mathbf{d}, \mathbf{z})$	, <b>c</b> )		
Any u, v	Any $p, q$	<i>p</i> 1 L2	0,	1/2	ρĪ	R2		
			[s.	[s-s]	$\rho 1$	R1		

# $p\bar{3}m1$ No. 72

Penetration direction	Scanning direction <b>d</b>	Scanningroup	)		ation s <b>d</b>		Penetration rod group	
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	z)				$(\mathbf{d}, \mathbf{z}, \mathbf{c})$	
[100]	[120]	c2/m11	L18	[0,	1/2]	p112	2/m	R11
[010]	[210]			[1/4	[3/4]	$\rho 112$	$2_1/m [1/4]$	R12
[110]	[110]			$[\pm s, ($	$\frac{1}{2} \pm s$	$\rho 11n$	n	R10
[110]	[110]	c12/m1 I	L18'	[0,	1/2]	$\rho^{2/n}$	n11	R6
[120]	[100]			[1/4	, 3/4]	$p^{2/c}$	:11 [1/4]	R7
[210]	[010]			$[\pm s, ($	$\frac{1}{2} \pm s$	p211	1	R3
Penetration	Scanning	Scanning	Loc	ation	Penetr	ation		
direction	direction	group		sd	rod gr	oup		
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$			$(\mathbf{d}, \mathbf{z})$	<b>, c</b> )		
Any $u, v$	Any $p, q$	<i>p</i> 1 L2	0,	1/2	μĪ	R2		
			[s.	,-s]	$\rho 1$	R1		

#### p6 No. 73

Penetration	Scanning	Scanning	Location	Penetration
direction	direction $\mathbf{d}$	group	$s\mathbf{d}$	rod group
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
[100]	[010]	p112 L3	0, 1/2	ρ121 R3'
[010]	[100]		[s,-s]	$\rho 1$ R1
[110]	[100]			
[110]	[100]			
[120]	[010]			
[210]	[100]			
Penetration	Scanning	Scanning	Location	Penetration
direction	direction	group	$s\mathbf{d}$	rod group
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$		$(\mathbf{d}, \mathbf{z}, \mathbf{c})$
Any $u, v$	Any $p, q$	p112 L3	0, 1/2	ρ121 R3'
			[s, -s]	ρ1 R1

# $p\bar{6}$ No. 74

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$	Location sd	Penetration rod group (d, z, c)
[100] [010] [110] [110] [120] [210]	[010] [100] [100] [100] [010] [100]	p11m L4	S	ρ1m1 R4'
Penetration direction $[uv0] = \mathbf{c}$ Any $u, v$	Scanning direction $\mathbf{d} = [pq0]$ Any $p, q$	Scanning group (c, d, z)	Location sd	Penetration rod group (d, z, c)

### *p*6/*m* No. 75

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	Penetration rod group (d, z, c)
[100] [010] [110] [110] [120] [210]	[010] [100] [100] [100] [010] [100]	p112/m L6	$0, 1/2 \\ [s, -s]$	ρ12/m1 R6' ρ1m1 R4'
Penetration direction $[uv0] = c$ Any $u, v$	Scanning direction $\mathbf{d} = [pq0]$ Any $p, q$	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$ $p112/m \text{ L6}$	Location $sd$ $0, 1/2$ $[s, -s]$	Penetration rod group ( <b>d</b> , <b>z</b> , <b>c</b> ) <i>ρ</i> 12/ <i>m</i> 1 R6' <i>ρ</i> 1 <i>m</i> 1 R4'

#### p622 No. 76

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd	on	Penetrat rod gro (d, z, c	up
[100] [010] [110] [110] [120] [210]	[120] [210] [110] [110] [100] [010]	c222 L22	$   \begin{bmatrix}     0, 1/2 \\     \hline     [1/4, 3/2]   \end{bmatrix}   $ $   \begin{bmatrix}     \pm s, (\frac{1}{2} \pm \frac{1}{2} \pm \frac$	[4]	ρ222 1 ρ222 <sub>1</sub> 1 ρ211	R13 R14 R3
Penetration direction $[uv0] = \mathbf{c}$ Any $u, v$	Scanning direction $\mathbf{d} = [pq0]$ Any $p, q$	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$ $p112$ L3	Location sd 0, 1/2	ro (		
			[s, -s]	$\rho 1$	R1	

#### p6mm No. 77

Penetration	Scanning	Scanning	^   _	Location		etration
direction	direction $\mathbf{d}$	group	sd	$s\mathbf{d}$		group
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$			( <b>d</b>	$(\mathbf{z}, \mathbf{c})$
[100]	[120]	cmm2 L2	[0, 1]	[0, 1/2]		R18′
[010]	[210]		[1/4, 3]	3/4]	рт2т рс2т [	[1/4] R19'
[110]	[110]		$[\pm s, (\frac{1}{2})]$	$\left[\pm s, \left(\frac{1}{2} \pm s\right)\right]$		R10
[110]	[110]					
[120]	[100]					
[210]	[010]					
Penetration	Scanning	Scanning	Location	Pene	etration	
direction	direction	group	$s\mathbf{d}$	rod	group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c},\mathbf{d},\mathbf{z})$		(d	$l, \mathbf{z}, \mathbf{c})$	
Any u, v	Any $p, q$	p112 L3	0, 1/2	p12	1 R3'	
			[s, -s]	p1	R1	

# $p\bar{6}m2$ No. 78

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction <b>d</b>	$\begin{bmatrix} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{bmatrix}$		Location sd		Penetr rod gr ( <b>d</b> , <b>z</b>	coup
[100] [010] [110]	[120] [210] [110]	cm2m L:	35	[s, (s +	$-\frac{1}{2}$ )]	p2mm	R18
[1Ī0] [120] [210]	[110] [100] [010]	c2mm L3	5 <b>′</b>	[0, 1] [1/4, 1] $[\pm s, (\frac{1}{2})]$	3/4]	ρmm2 ρcm2 <sub>1</sub> ρ1m1	R15 R17' R4'
Penetration direction $[uv0] = \mathbf{c}$	Scanning direction $\mathbf{d} = [pq0]$	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Lo	$s\mathbf{d}$	$\operatorname{rod}$	$\mathbf{z}, \mathbf{c}$	
Any u, v	Any $p, q$	p11m L4		S	$\rho 1m$	1 R4'	

# $p\bar{6}2m$ No. 79

Penetration	Scanning	Scannin	g	Location		Penetr	ation
direction	direction $\mathbf{d}$	group	group		sd		roup
$[uv0] = \mathbf{c}$		$(\mathbf{c}, \mathbf{d}, \mathbf{z})$	)			$(\mathbf{d}, \mathbf{z})$	$(\mathbf{c}, \mathbf{c})$
[100]	[120]	c2mm L3	c2mm L35'		[0, 1/2]		R15
[010]	[210]			[1/4,		$\rho cm2_1$	
[110]	[110]			$[\pm s, (\frac{1}{2})]$	$\pm s$ )]	$\rho 1m1$	R4'
[110]	[110]	cm2m L	cm2m L35		$[s, (s+\frac{1}{2})]$		R18
[120]	[100]				2	_	
[210]	[010]						
Penetration	Scanning	Scanning	Lo	ocation	Pene	tration	
direction	direction	group		$s\mathbf{d}$	$\operatorname{rod}$	group	
$[uv0] = \mathbf{c}$	$\mathbf{d} = [pq0]$	$(\mathbf{c}, \mathbf{d}, \mathbf{z})$			(d,	$\mathbf{z}, \mathbf{c})$	
Any u, v	Any $p, q$	p11m L4		S	$\rho 1m$	1 R4'	

### *p*6/*mmm* **No.** 80

Penetration direction $[uv0] = \mathbf{c}$	Scanning direction d	$\begin{array}{c} \text{Scanning} \\ \text{group} \\ (\mathbf{c}, \mathbf{d}, \mathbf{z}) \end{array}$	Location sd			ration roup (c, c)
[100] [010] [110] [110] [120] [210]	[120] [210] [110] [110] [100] [010]	cmmm L47	$[0, 1/2]$ $[1/4, 3/2]$ $[\pm s, (\frac{1}{2} \pm \frac{1}{2} \pm 1$	$^{'}4]$	pmmm pcmm [1 p2mm	R20 /4] R22′ R18
Penetration direction $[uv0] = \mathbf{c}$ Any $u, v$	Scanning direction $\mathbf{d} = [pq0]$ Any $p, q$	Scanning group $(\mathbf{c}, \mathbf{d}, \mathbf{z})$ $p112/m \text{ L6}$	Location $s\mathbf{d}$ $0, 1/2$ $[s, -s]$	rc	netration od group (d, z, c) 2/m1 R6' m1 R4'	