State machine diagram:

- **adjust_x**: $x_{\text{calc}} \leftarrow m$

- **ends**:
  $x_{\text{out}} \leftarrow x_{\text{calc}}$
  $y_{\text{out}} \leftarrow y_{\text{calc}}$
  $z_{\text{out}} \leftarrow z_{\text{calc}}$
  $done \leftarrow 1$

- Transition adjust_x from check_v ($i \geq 16$):
  $x_{\text{in}} \leftarrow \text{q45\_to\_q516}(x)$
  $y_{\text{in}} \leftarrow \text{q45\_to\_q516}(y)$
  $z_{\text{in}} \leftarrow 0$
  $done \leftarrow 0$
  $i \leftarrow 0$

- Transition from check_r to ends ($i \geq 16$):
  $x_{\text{in}} \leftarrow 0.6072529351$
  $y_{\text{in}} \leftarrow 0$
  $z_{\text{in}} \leftarrow \text{q416\_to\_q516}(z)$
  $done \leftarrow 0$
  $i \leftarrow 0$

- **idle_v** / **idle_r** transitions:
  - $mode \wedge \overline{start}$ (idle_v self-loop)
  - $\overline{mode} \wedge \overline{start}$ (idle_r self-loop)
  - $\overline{mode} \wedge \overline{start}$ (idle_v → idle_r)
  - $mode \wedge \overline{start}$ (idle_r → idle_v)
  - $start$ (idle_v → init)
  - $start$ (idle_r → init)

- ends → idle_v: $mode$
- ends → idle_r: $\overline{mode}$

- **init**:
  $x_{\text{calc}} \leftarrow x_{\text{in}}$
  $y_{\text{calc}} \leftarrow y_{\text{in}}$
  $z_{\text{calc}} \leftarrow z_{\text{in}}$

- init → check_v: $mode$
- init → check_r: $\overline{mode}$

- **iter_2_v** (check_v → iter_2_v, $(y_{\text{calc}} \geq 0) \wedge \overline{i \geq 16}$):
  $x_{\text{calc}} \leftarrow x_{\text{calc}} + (y_{\text{calc}} \gg i)$
  $y_{\text{calc}} \leftarrow y_{\text{calc}} - (x_{\text{calc}} \gg i)$
  $z_{\text{calc}} \leftarrow z_{\text{calc}} + \arctan s(i)$
  $i \leftarrow i + 1$

- **iter_2_r** (check_r → iter_2_r, $(z_{\text{calc}} \geq 0) \wedge \overline{i \geq 16}$):
  $x_{\text{calc}} \leftarrow x_{\text{calc}} - (y_{\text{calc}} \gg i)$
  $y_{\text{calc}} \leftarrow y_{\text{calc}} + (x_{\text{calc}} \gg i)$
  $z_{\text{calc}} \leftarrow z_{\text{calc}} - \arctan s(i)$
  $i \leftarrow i + 1$

- **iter_1_v** (check_v → iter_1_v, $\overline{y_{\text{calc}} \geq 0} \wedge \overline{i \geq 16}$):
  $x_{\text{calc}} \leftarrow x_{\text{calc}} - (y_{\text{calc}} \gg i)$
  $y_{\text{calc}} \leftarrow y_{\text{calc}} + (x_{\text{calc}} \gg i)$
  $z_{\text{calc}} \leftarrow z_{\text{calc}} - \arctan s(i)$
  $i \leftarrow i + 1$

- **iter_1_r** (check_r → iter_1_r, $\overline{z_{\text{calc}} \geq 0} \wedge \overline{i \geq 16}$):
  $x_{\text{calc}} \leftarrow x_{\text{calc}} + (y_{\text{calc}} \gg i)$
  $y_{\text{calc}} \leftarrow y_{\text{calc}} - (x_{\text{calc}} \gg i)$
  $z_{\text{calc}} \leftarrow z_{\text{calc}} + \arctan s(i)$
  $i \leftarrow i + 1$

m:
$$m = [(x \gg 1) + (x \gg 3)] - \{[(x \gg 6) + (x \gg 9)] + (x \gg 12)\}$$

bits:

x_{in}: 9	x_{calc}: 21	x_{out}: 21	start: 1	i: 1
y_{in}: 9	y_{calc}: 21	y_{out}: 21	done: 1	
z_{in}: 20	z_{calc}: 21	x_{out}: 21	mode: 1	