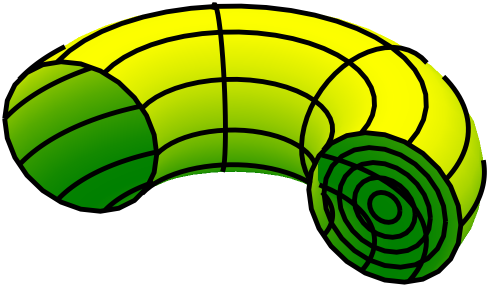
Coordinate system



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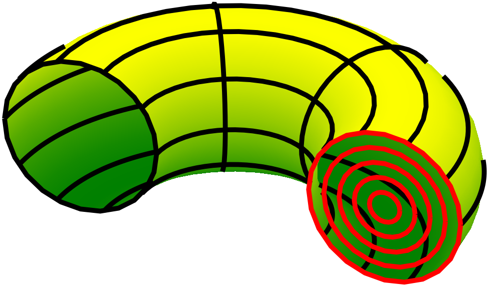

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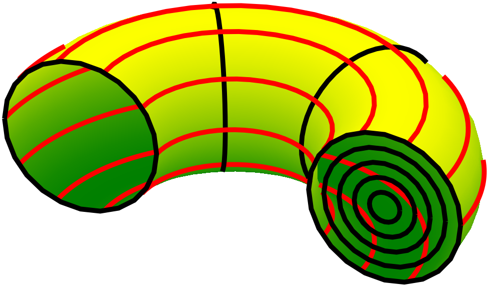

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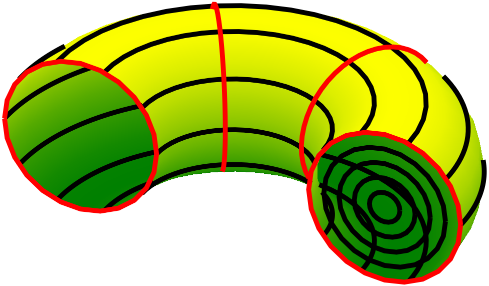

Parallelisation Conditions

1. The number of processes that can be used is maximised
2. The dimensions used by the operator are not distributed
3. The dimensions used by the operator are contiguous
4. The number of MPI messages sent and received is minimised
5. The memory required is minimised
6. After setup no memory is allocated
7. As little copying of data as possible is used

Advection Operators

- ☐ **The dimensions used by the operator are not distributed**
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$$\partial_t f + v_{\parallel} \nabla_{\parallel} f = 0 \tag{1}$$

$$(r, \theta \ , \ z \ , v_{\parallel})$$

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$$\partial_t f + \nabla_{\parallel} \tilde{\phi} \partial_{v_{\parallel}} f = 0 \tag{2}$$

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$$(z, v_\parallel, r, \theta)$$

Dimension Ordering

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$$(r, v_{\|}, \boxed{\theta}, \boxed{z}) \qquad (r, \theta, z, \boxed{v_{\|}}) \qquad (z, v_{\|}, \boxed{r}, \boxed{\theta})$$

$$n_r \cdot n_{v_{\|}} \qquad n_r \cdot n_\theta \cdot n_z \qquad n_z \cdot n_{v_{\|}}$$

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$(r, v_{\|}, \theta, z)$ $\quad$ $(r, \theta, z, v_{\|})$ $\quad$ $(z, v_{\|}, r, \theta)$

$n_r \cdot n_{v_{\|}}$ $\quad$ $n_r \cdot n_\theta \cdot n_z$ $\quad$ $n_z \cdot n_{v_{\|}}$

- Flux-aligned method allows fewer points to be used along z

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$$(r, v_{\|}, \theta, z) \qquad (r, \theta, z, v_{\|}) \qquad (z, v_{\|}, r, \theta)$$

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- Flux-aligned method allows fewer points to be used along z
- A fine grid is required in the poloidal plane

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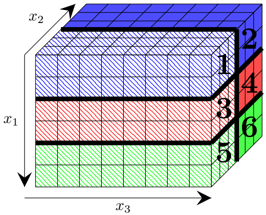
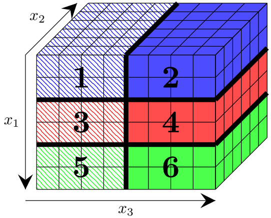


(x_1, x_2, x_3)



(x_1, x_3, x_2)

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