

## metrix

Calculates the metric quantities required for volume integrals.

[called by: [ma00aa.](#)]

[calls: [coords.](#)]

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### 1.1 metrics

1. The Jacobian,  $\sqrt{g}$ , and the ‘lower’ metric elements,  $g_{\mu\nu}$ , are calculated by [coords](#), and are provided on a regular grid in ‘real-space’, i.e.  $(\theta, \zeta)$ , at a given radial location, i.e. where  $s$  is input.

### 1.2 plasma region

1. In the plasma region, the required terms are  $\bar{g}_{\mu\nu} \equiv g_{\mu\nu} / \sqrt{g}$ .

$$\begin{aligned}\sqrt{g} \, g^{ss} &= (g_{\theta\theta} g_{\zeta\zeta} - g_{\theta\zeta} g_{\theta\zeta}) / \sqrt{g} \\ \sqrt{g} \, g^{s\theta} &= (g_{\theta\zeta} g_{s\zeta} - g_{s\theta} g_{\zeta\zeta}) / \sqrt{g} \\ \sqrt{g} \, g^{s\zeta} &= (g_{s\theta} g_{\theta\zeta} - g_{\theta\theta} g_{s\zeta}) / \sqrt{g} \\ \sqrt{g} \, g^{\theta\theta} &= (g_{\zeta\zeta} g_{ss} - g_{s\zeta} g_{s\zeta}) / \sqrt{g} \\ \sqrt{g} \, g^{\theta\zeta} &= (g_{s\zeta} g_{s\theta} - g_{\theta\zeta} g_{ss}) / \sqrt{g} \\ \sqrt{g} \, g^{\zeta\zeta} &= (g_{ss} g_{\theta\theta} - g_{s\theta} g_{s\theta}) / \sqrt{g}\end{aligned}\tag{1}$$

### 1.3 FFTs

1. After constructing the required quantities in real space, FFTs provided the required Fourier harmonics, which are returned through global. (The “extended” Fourier resolution is used.)