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## *Coupling Algorithm for the Storage Ring*

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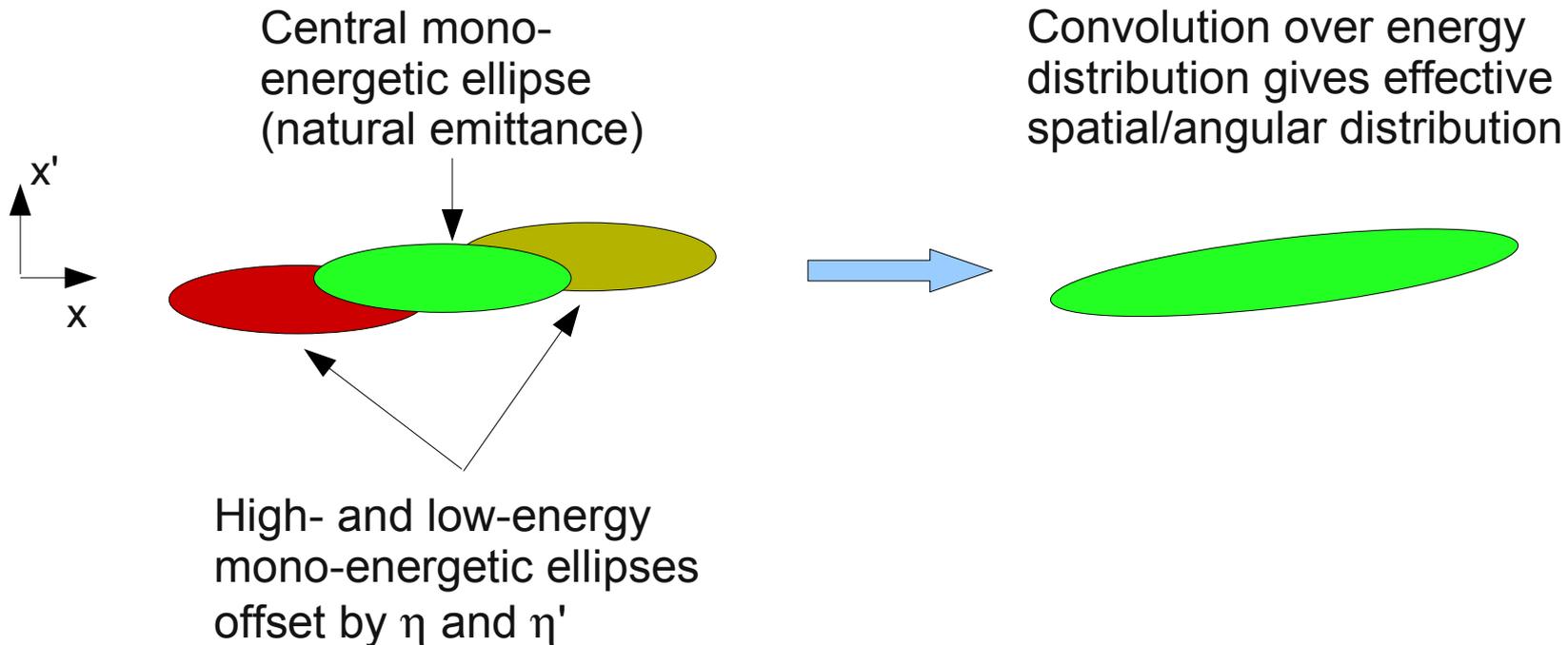
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# Beam Emittance Refresher

- Beam emittance in the simplest case is the product of size and divergence:

$$\varepsilon = \sigma * \sigma'$$

- In a storage ring, there are two potential contributions to size and divergence
  - The beam energy spread through the “dispersion function”  $\eta$
  - The raw or natural beam emittance



# Coupling

- Coupling is the ratio of vertical to horizontal emittance
  - We tune for a specific coupling (1.5% these days)
- The horizontal emittance, both natural and effective, is quite constant
  - Varies by less than  $\sim 10\%$  even with various lattices
- The vertical emittances can be varied quite easy
  - Has a strong effect on beam lifetime
  - Even with top-up this matters (radiation damage, injector limits,...)
- Which emittances (V/H) should be used to report coupling?
  - Nat./Nat.: Seems inappropriate, as users don't see the natural horizontal emittance. Traditionally used by accelerator physicists.
  - Nat./Eff.: If you image the beam, probably measures what you see.
  - Eff./Eff.: If your don't image the beam, this is probably more representative.
  - Eff./Nat.: This is the most modest choice (makes the coupling largest).
- For beamlines that care about vertical emittance, what's the most relevant number?