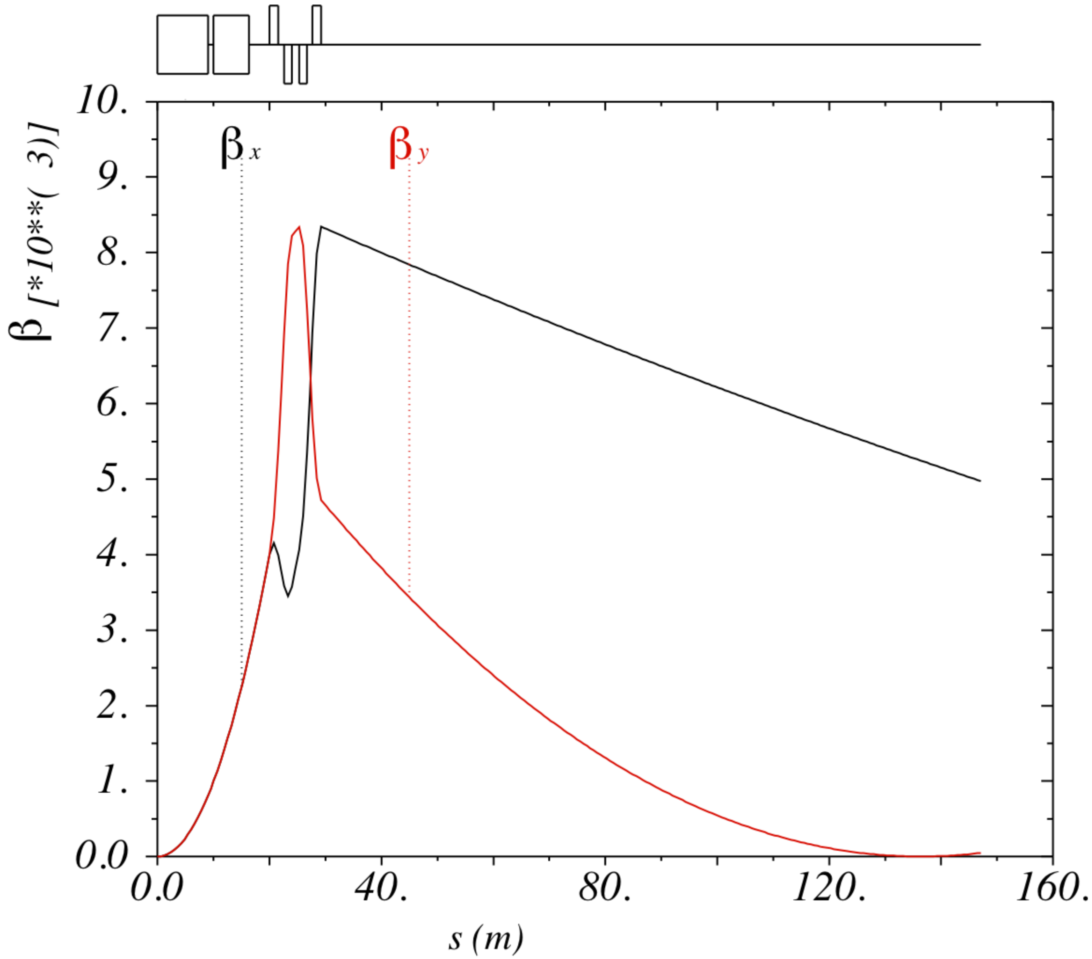
Old Electron IR Optics

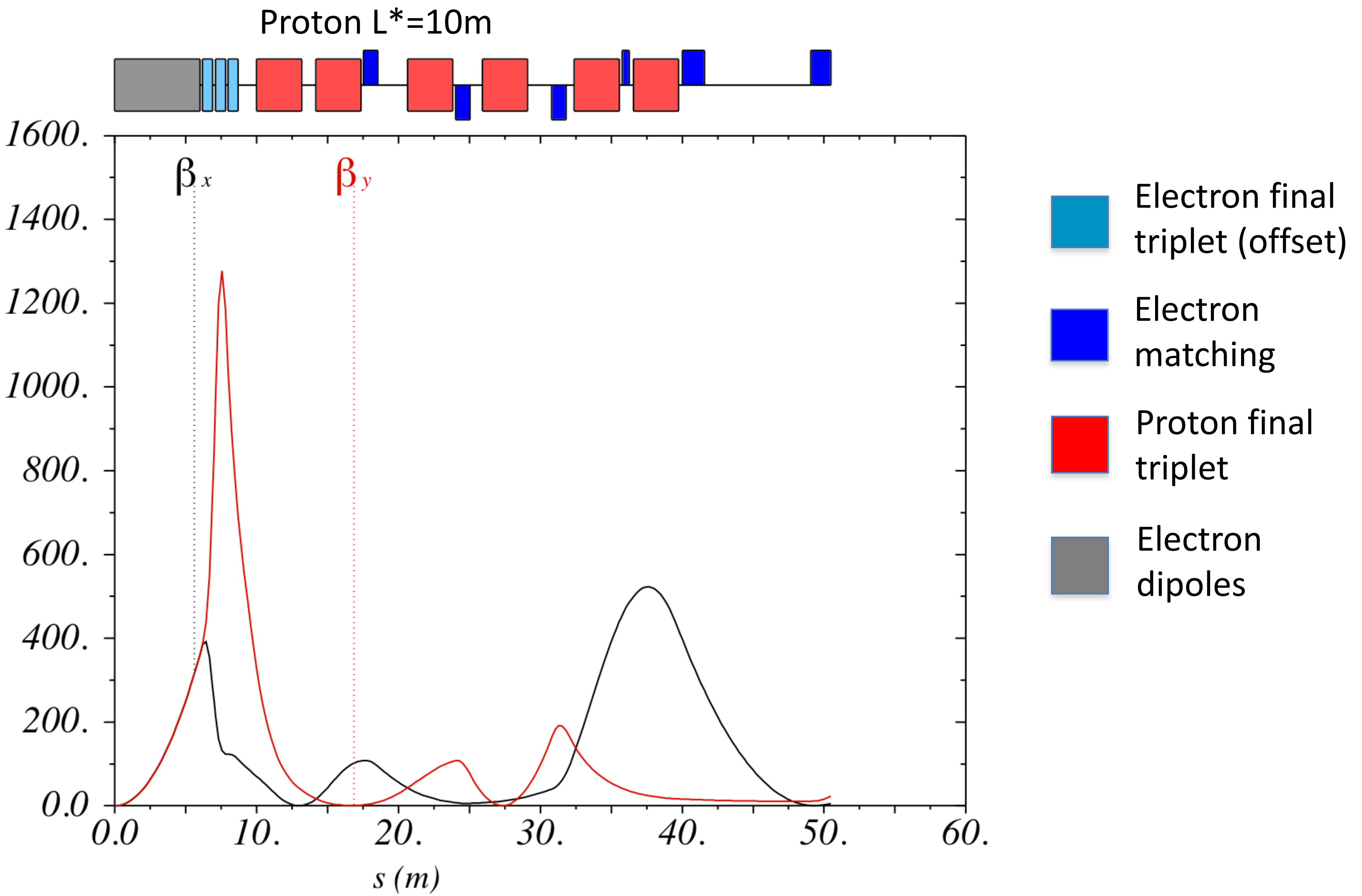
- Proton L*=10m
- e optics doesn't take account of stray fields in proton half-quadrupole aperture



Electron IR Optics – Half-Quadrupole

- Proton L*=10m
- Optics and layout arranged around proton elements
- Brute-force method
  - Matching quadrupoles to correct for linear stray fields
  - Does not deal with higher order terms yet
  - Early electron IR
    - Cannot successfully focus after encountering proton stray fields
- New half-quadrupole design for lower proton quadrupole strength looks more feasible (S. Russenschuck), but still challenging optically and magnetically

Electron IR Optics – Half-Quadrupole

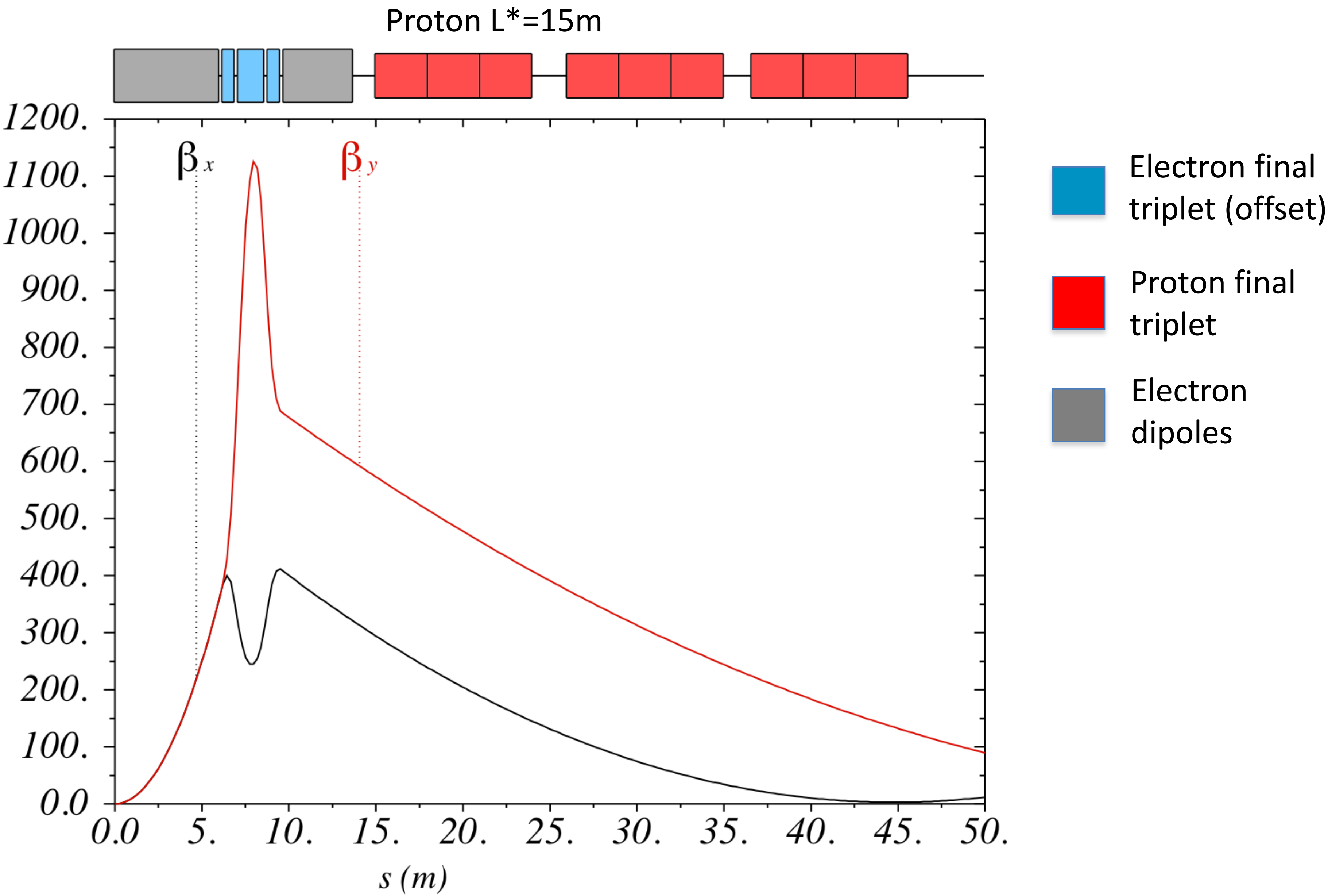


Proton L*=15m Optics

- Moving proton quads to 15m:
  - Decreases strength of Q1
  - Increases space for electron separation
    - More control over synchrotron radiation

- Lower proton Q1 strength and greater separation:
  - Allows regular quadrupole design with field-free pocket closer to proton aperture
    - Fewer SC coil layers
    - 82mm separation – easily achieved with proton L*=15m

Electron IR Optics – No Half-Quadrupole



Electron IR Optics – No Half-Quadrupole

- Removal of half-quadrupole makes optics simple
- Higher-order field terms negligible
- No loss of luminosity
- Still advantageous to have early electron focusing
  - Placing electron IR after proton quads increases electron L* significantly
  - Negligible loss of bend length in IR with offset quadrupoles
- Synchrotron radiation ~22kW