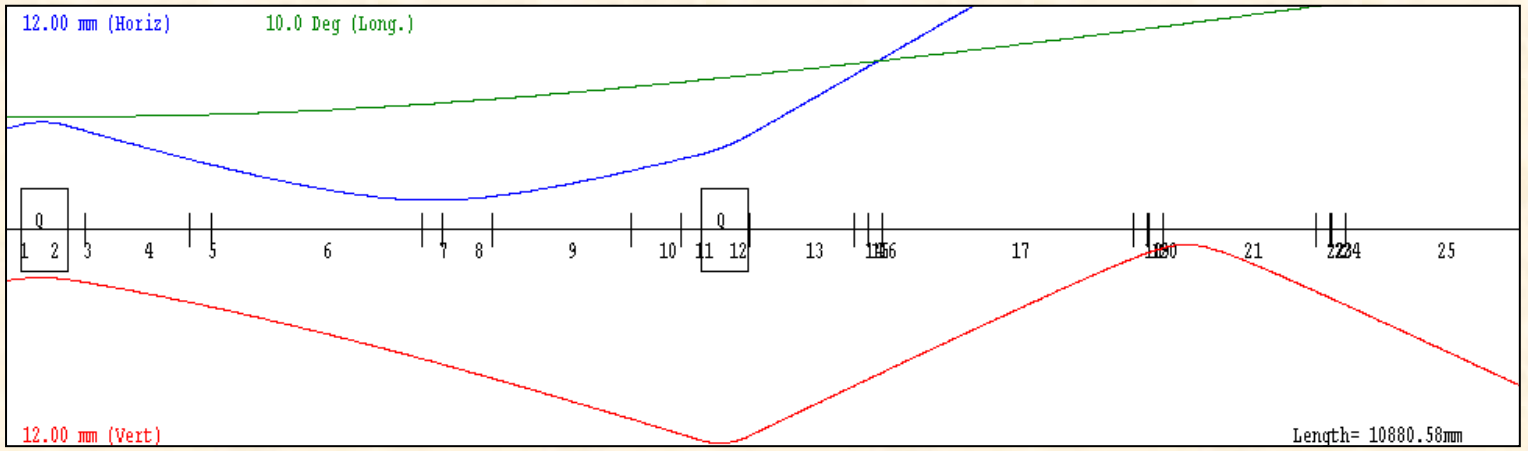
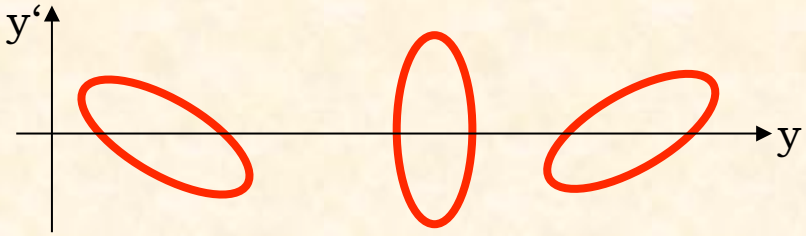
Principle of Measurement





- Determine beam sizes at three different positions
- Calculate emittance value by knowledge of the transfer matrices

- Phase space ellipses optimally turn by $\Delta\varphi=60°$ from position to position

Input Parameters

- 1σ-beam sizes: 1.6 - 3.7 mm for the two outer positions

- Key Problem
  Beam size of the ellipse at the mid-position close to the beam waist

- Angle-optimized solution (horizontal/vertical)
  - Mid-Ellipse approximately upright: $\Delta\varphi_{12} \approx 53°/50°$ and $\Delta\varphi_{23} \approx 61°/63°$
  - 1σ-beam size: 0.6mm/0.6mm

- Size-optimized Solution (horizontal/vertical)
  - Mid-Ellipse more inclined: $\Delta\varphi_{12} \approx 39°/34°$ and $\Delta\varphi_{23} \approx 66°/67°$
  - 1σ-beam size: 1.4mm/1.4mm

- ⇒ Large enough beam size implies unfavourable turning angle(s)
- ⇒ Optimal turning angle requires to resolve a very small beam size

Results on Emittance Values

	Angle-optimized Solution			Size-optimized Solution		
Precision	1 nm	10 μm	100 μm	1 nm	10 μm	100 μm
Δε (horizontal)	+1.1%	+1.4%	+10.0%	+2.1%	+2.5%	-38.9%
Δε (vertical)	+1.7%	+2.5%	-1.3%	+1.0%	+2.4%	+13.8%

- Deviation Δε calculated between simulated and calculated values
- Conclusions
  - The better the resolution the better the precision on the emittance value
  - Need for a good compromise between the two solutions
- Slight correction of the mid-position reduces Δε but as well the beam size