17TH ADVANCED BEAM DYNAMICS WORKSHOP ON

FUTURE LIGHT SOURCES

YAG:Ce Profile Monitor

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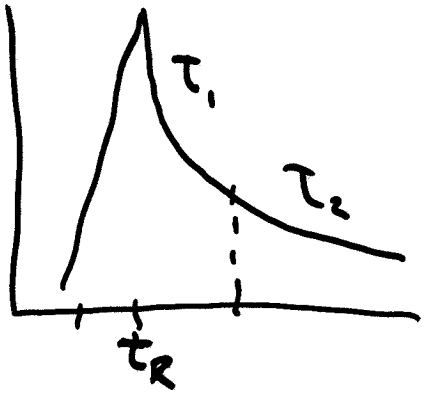
YAG:Ce Properties

~ 2×10^4 photons/MeV (~50% NaI)

$\tau_R = 5$ ns

$\tau_1 = 90$ ns (80%)

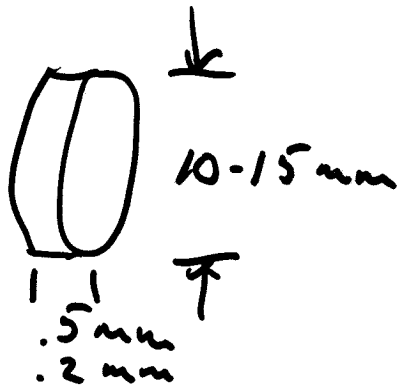
$\tau_2 = 300$ ns (20%)



Material is almost clear - slight yellow tinge.

$\lambda \approx 560$ nm

$\Delta\lambda \approx 100$ nm (?)



Fair conductivity - metal coating not needed

Good damage resistance.

No granularity (unlike phosphor).

See also YAP:Ce

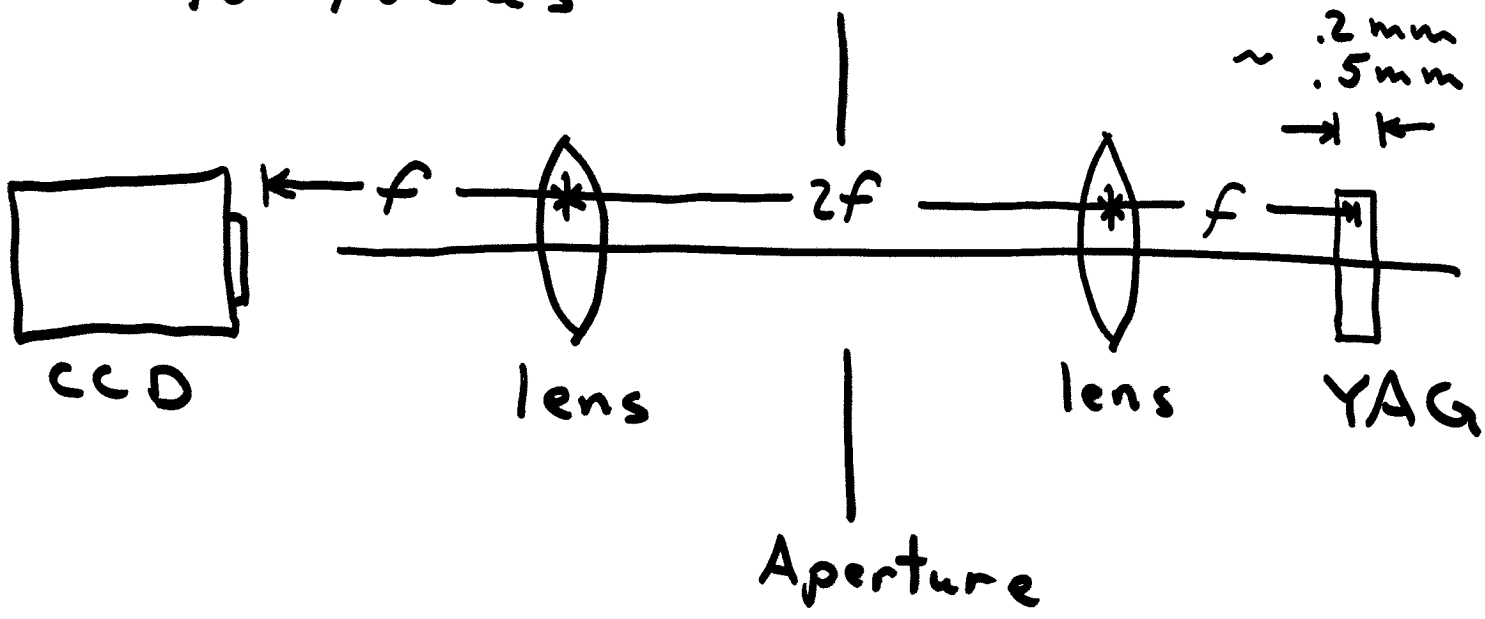
$\lambda \approx 380$ nm

$\tau \approx 20$ ns

Slightly less photon yield.

Resolution Limits

1) Extended object difficult to focus



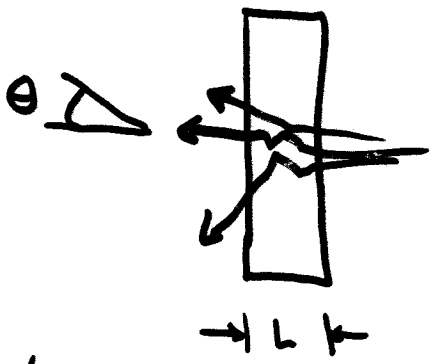
Use telecentric lens arrangement to increase depth of field.

Resolution Limits

2) Multiple scattering

$\theta \propto \frac{1}{\gamma}$

$\Delta x = \int_L \theta \, dz$



$\lesssim 10 \mu m$ at 10 MeV

$\sim 1 \mu m$ at 100 MeV

3) Bremstrahlung in YAG

$\theta \propto \frac{1}{\gamma}$

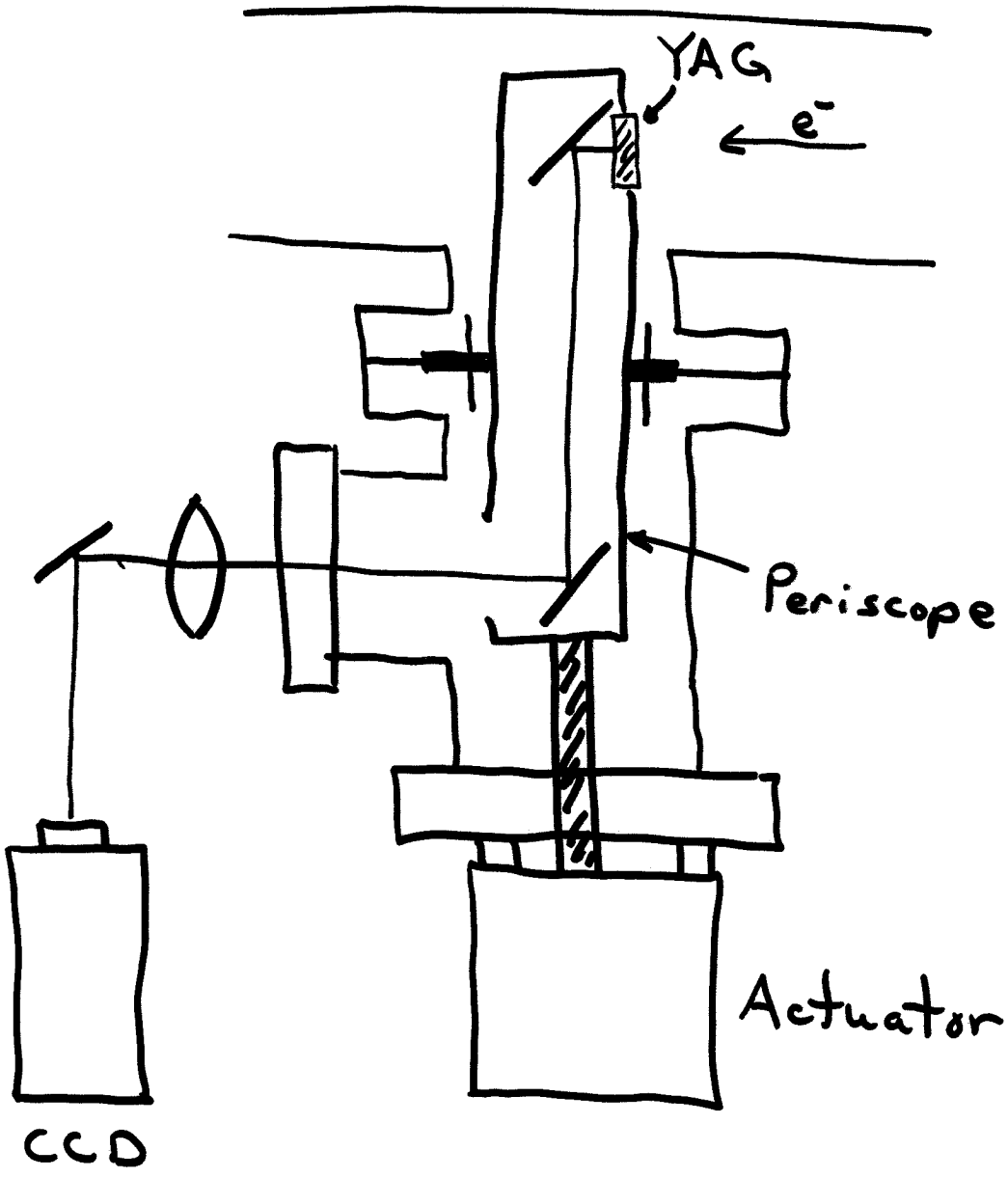
$\Delta x \sim$ few μm at 10's of MeV

Disadvantages

1) Destructive to beam.

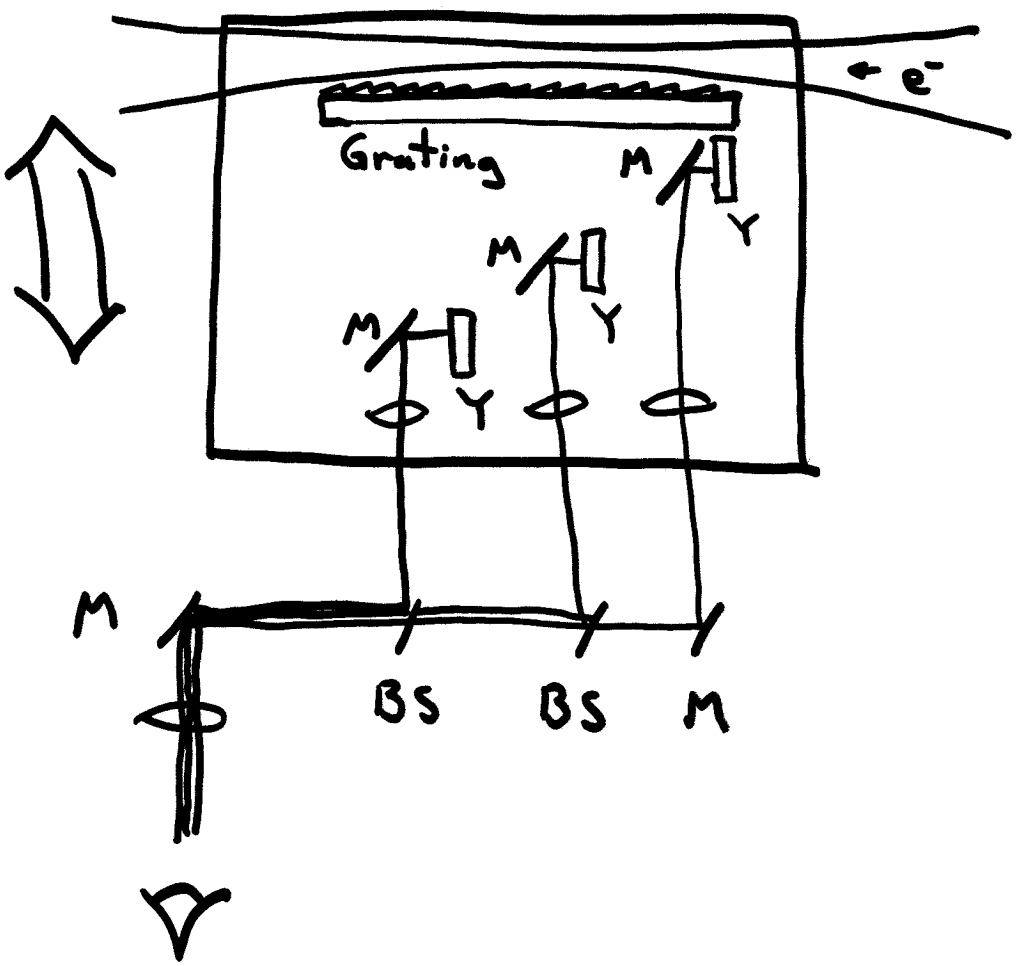
2) Spatial Resolution limit still a question.

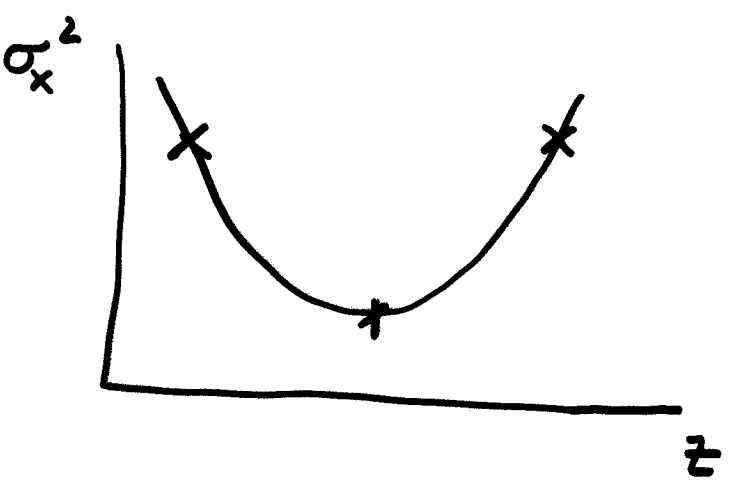
3) Moderate (100 ns) time resolution.



Periscope Profile Monitor

Emittance Monitor





Conclusions

YAG:Ce is a robust, bright, high resolution electron beam (and photon beam) profile monitor.

For intense Xray FEL electron beams, OTR may be a better choice.