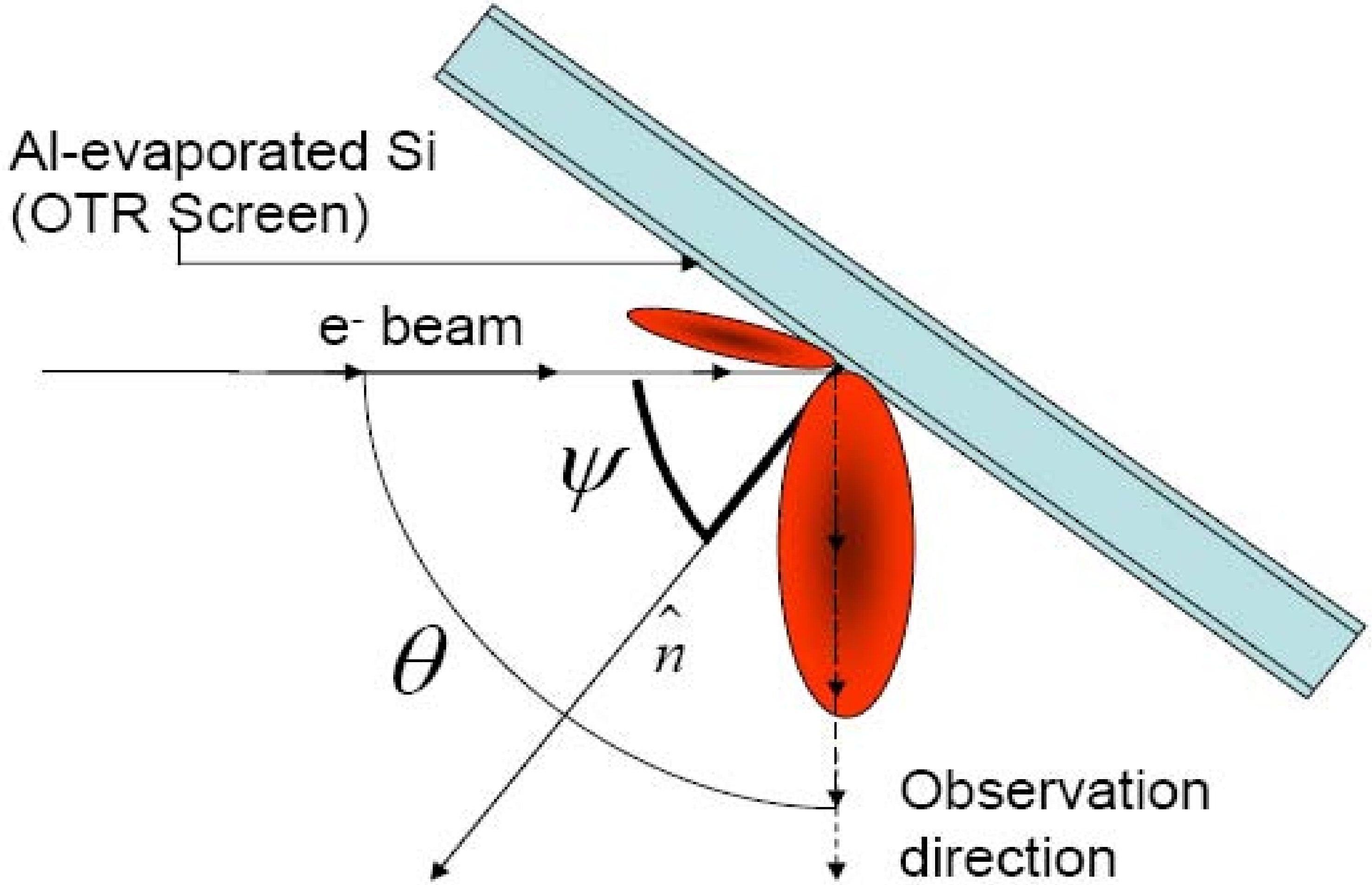
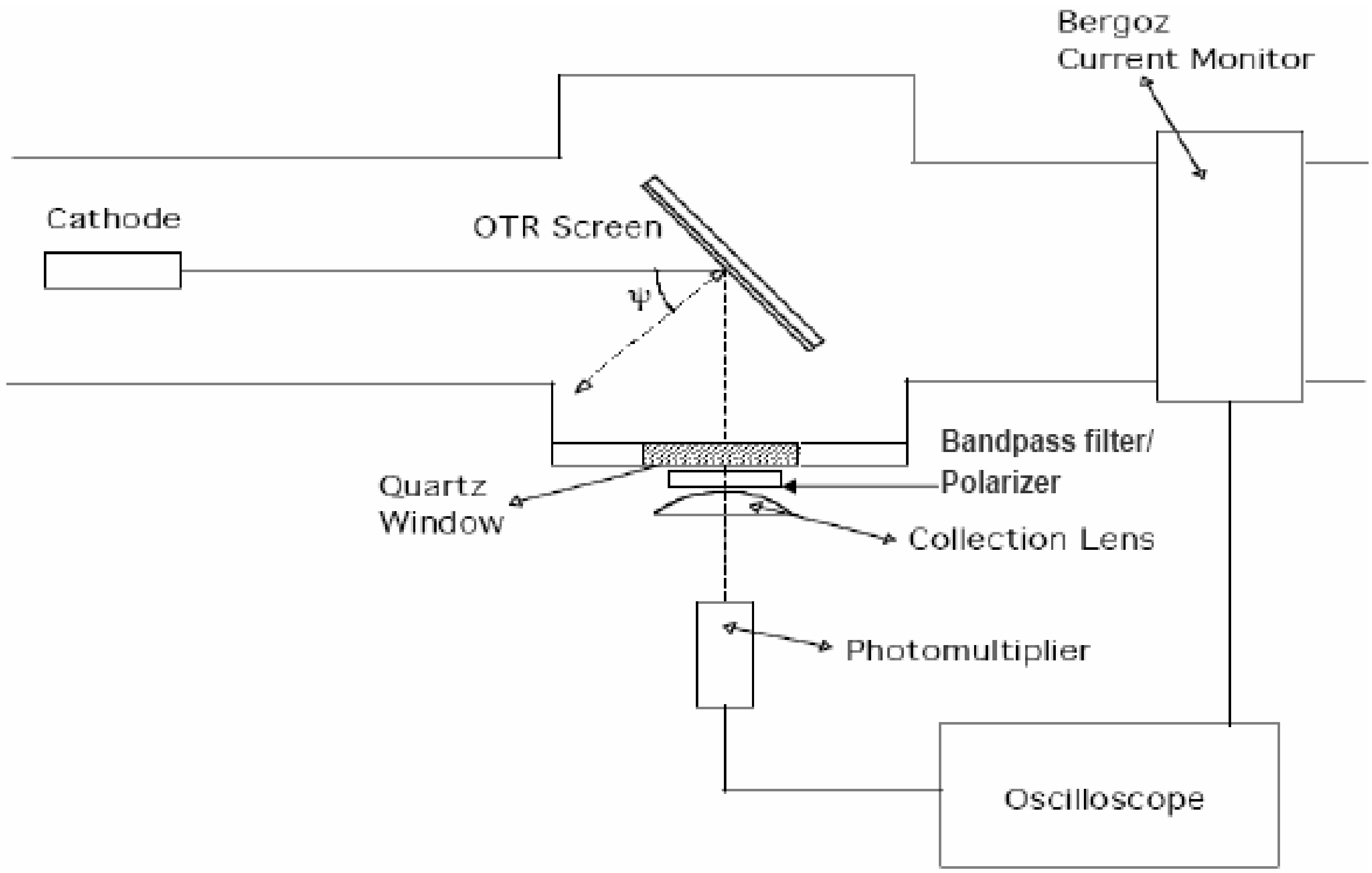
OBSERVING OPTICAL TRANSITION RADIATION FROM 10keV ELECTRONS

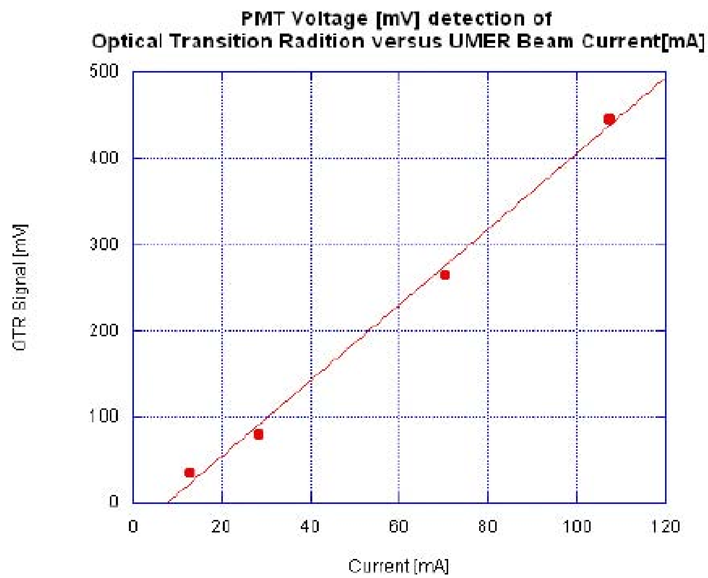
Sean Casey
Dickinson College, Carlisle PA
University of Maryland, TREND 2005
Advisors:
Dr. Ralph Fiorito, Dr. Donald Feldman, Dr. Patrick O'Shea

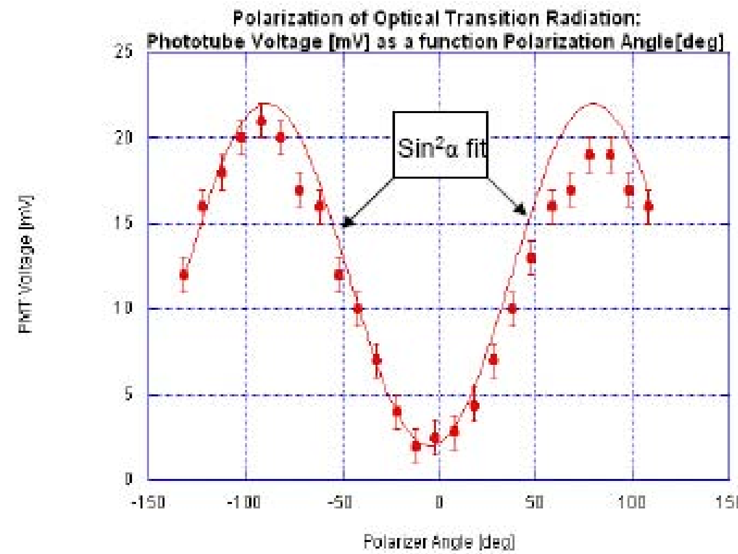

Al-evaporated Si
(OTR Screen)
e- beam
ψ
θ
n̂
Observation
direction

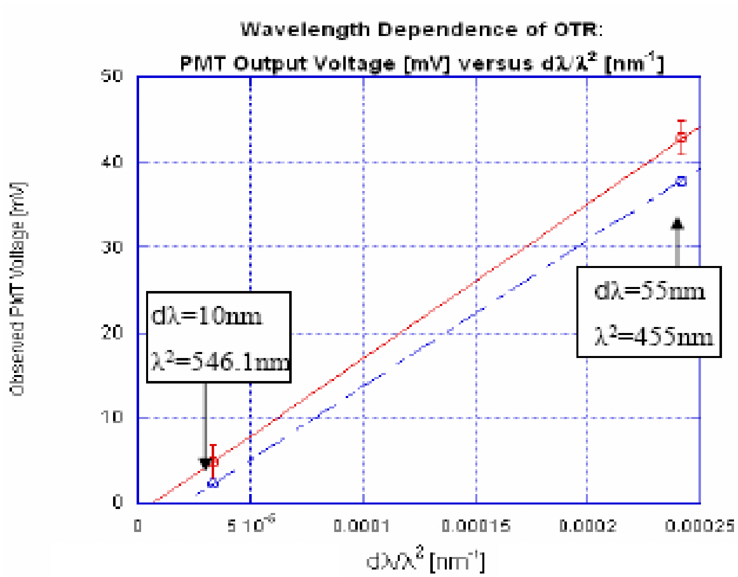

Bergoz
Current Monitor
Cathode
OTR Screen
ψ
Bandpass filter/
Polarizer
Quartz
Window
Collection Lens
Photomultiplier
Oscilloscope

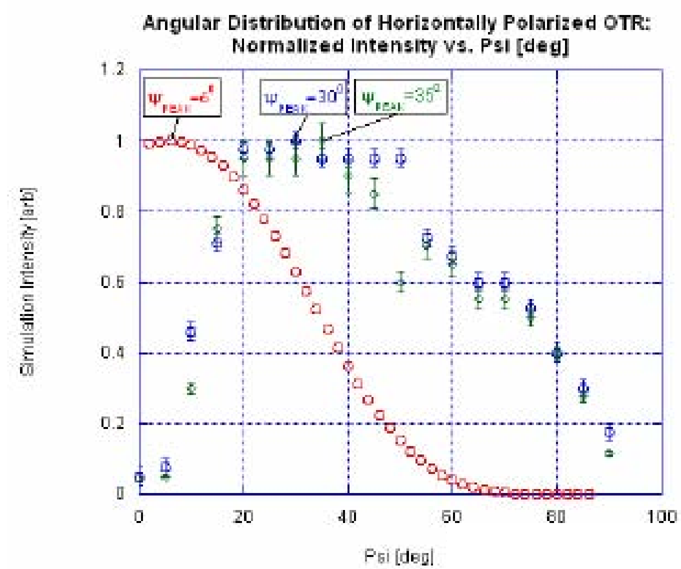
Characteristics of OTR

- Fast timescale (ns- same as beam timescale)
- Linearly Dependent on Electron Beam Current
- Highly Polarized- $\sin^2\alpha$ Dependent (α= Angle of Polarization)
- Linearly Dependent on Wavelength Term ($\frac{d\lambda}{\lambda^2}$)
- Dependent on ψ (ψ=screen angle)


PMT Voltage [mV] detection of
Optical Transition Radition versus UMER Beam Current[mA]
OTR Signal [mV]
Current [mA]


Polarization of Optical Transition Radiation:
Phototube Voltage [mV] as a function Polarization Angle[deg]
PMT Voltage [mV]
Sin²α fit
Polarizer Angle [deg]


Wavelength Dependence of OTR:
PMT Output Voltage [mV] versus dλ/λ² [nm⁻¹]
Observed PMT Voltage [mV]
dλ=10nm
λ²=546.1nm
dλ=55nm
λ²=455nm
dλ/λ² [nm⁻¹]


Angular Distribution of Horizontally Polarized OTR:
Normalized Intensity vs. Psi [deg]
Simulation Intensity [arb]
Psi [deg]

Conclusions

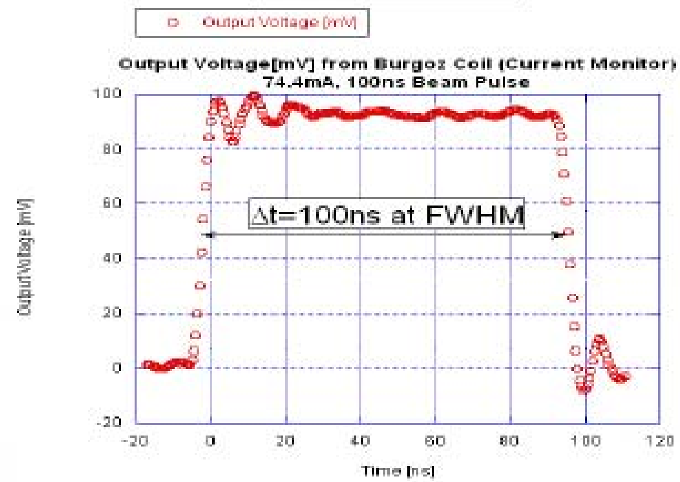
Observed OTR from 10keV electrons with high degree of certainty

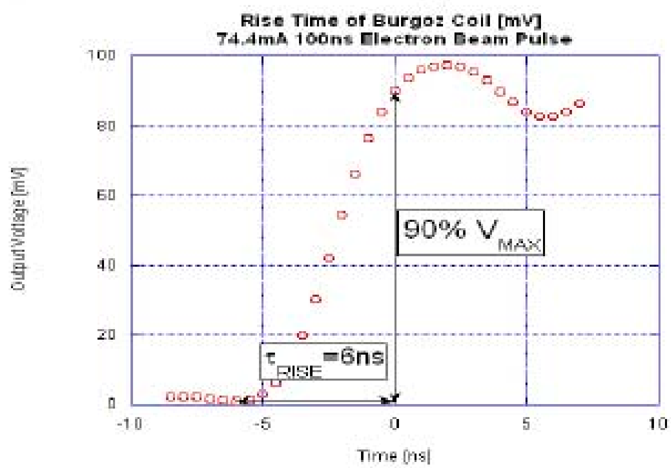
Future Considerations

Need further investigation with angular distribution

to reconcile theory with data

1) Beam Current Time Response and Rise Time





2) OTR Time Response and Rise Time