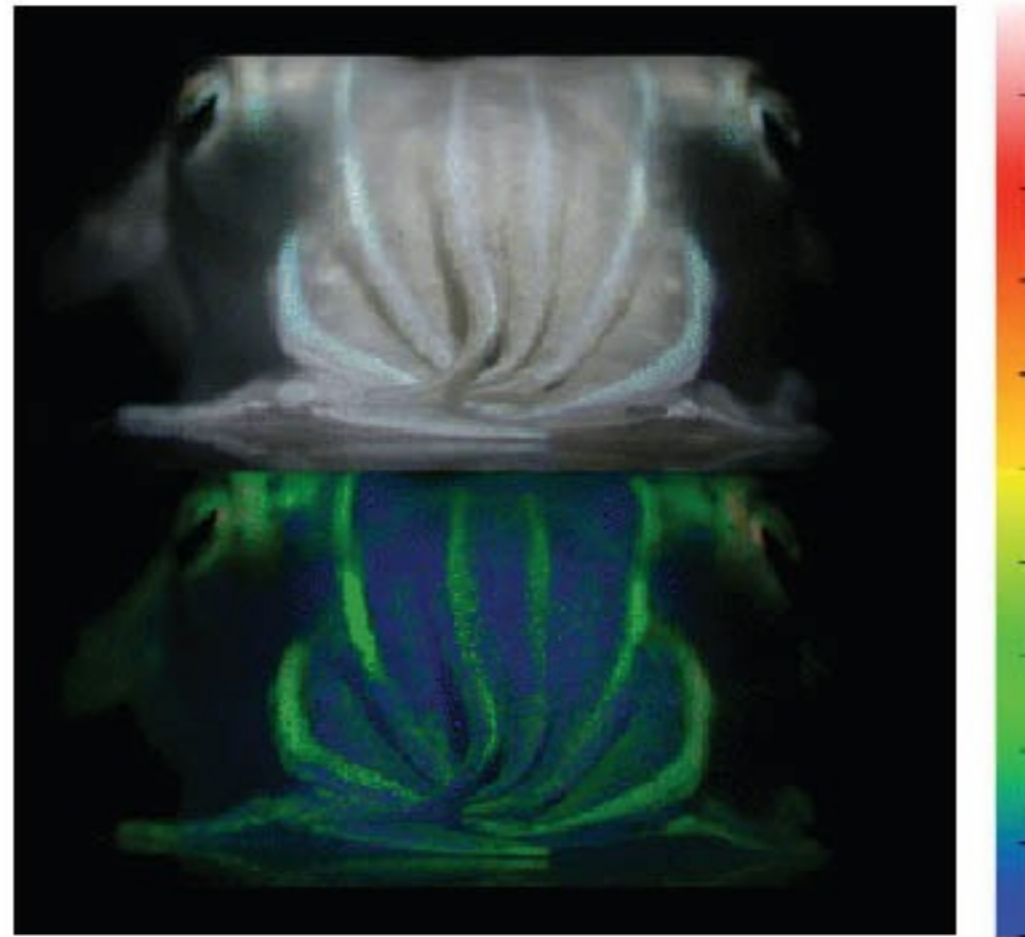
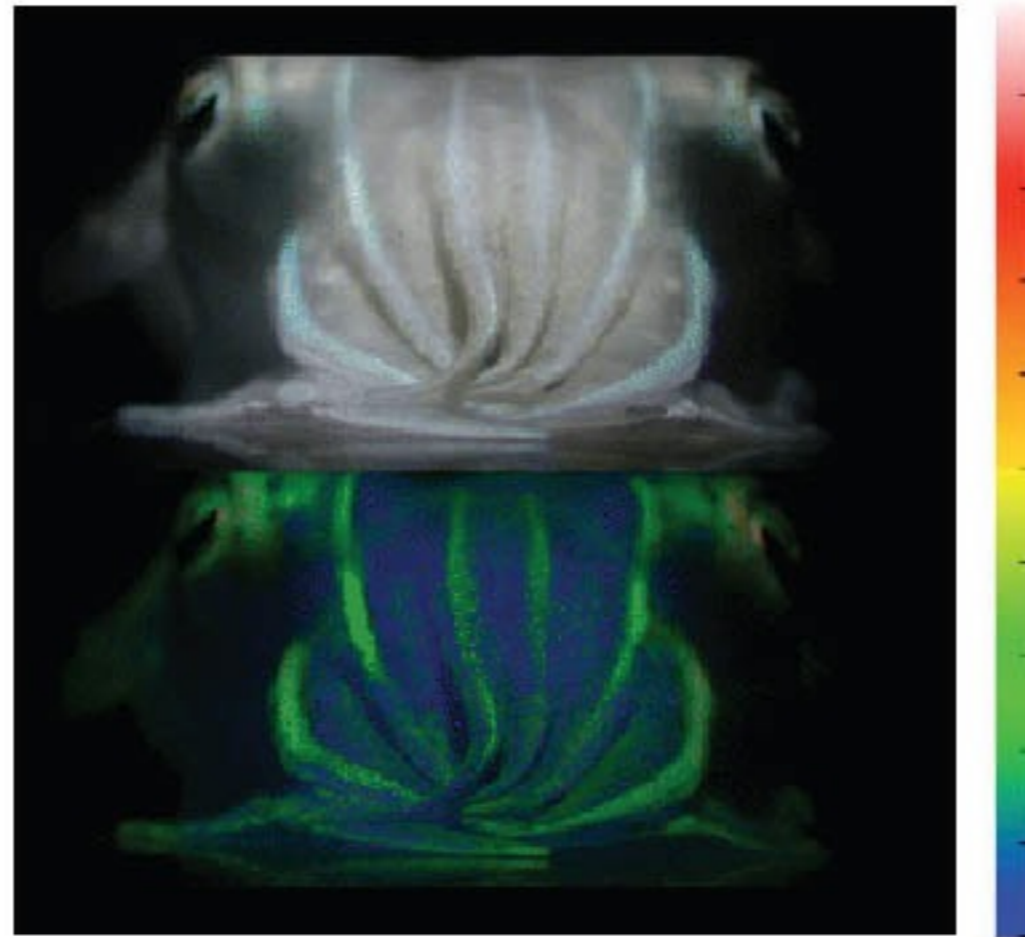


Polarized gamma-rays



Jean-François Rajotte
McGill University

Polarized gamma-rays



The list of parameters offered
by gamma rays is short:

- Direction
- Energy
- Time
- polarization

Polarized gamma-rays

Departure

- Synchrotron radiation
- Inverse Compton
- Bremsstrahlung
- ...

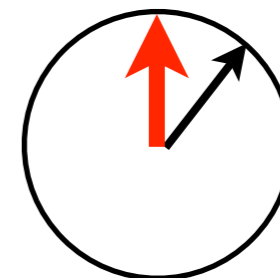
Polarized production



Arrival

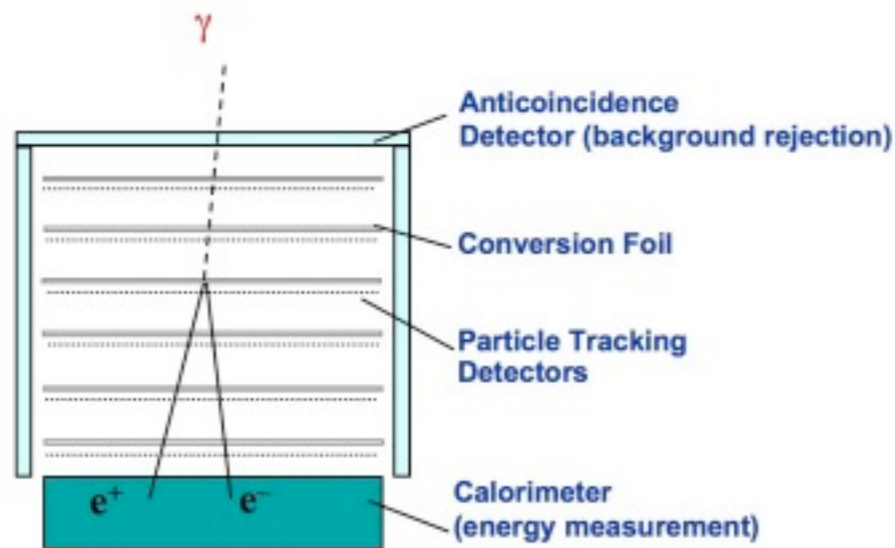
- photoelectric
- Compton scattering
- Pair production
- ...

Azimuthal dependent interaction

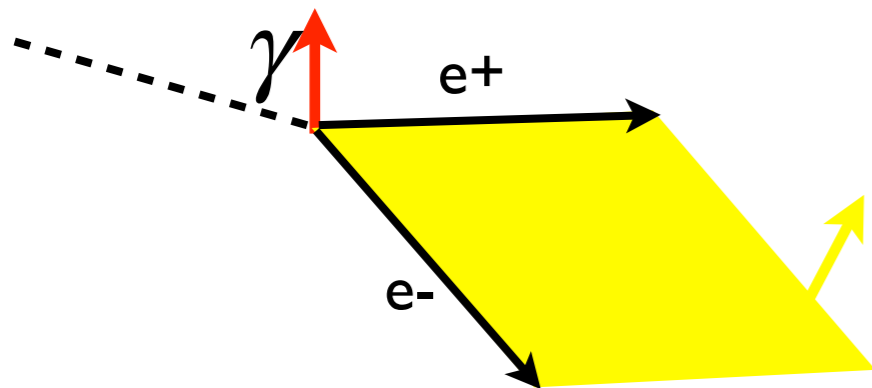
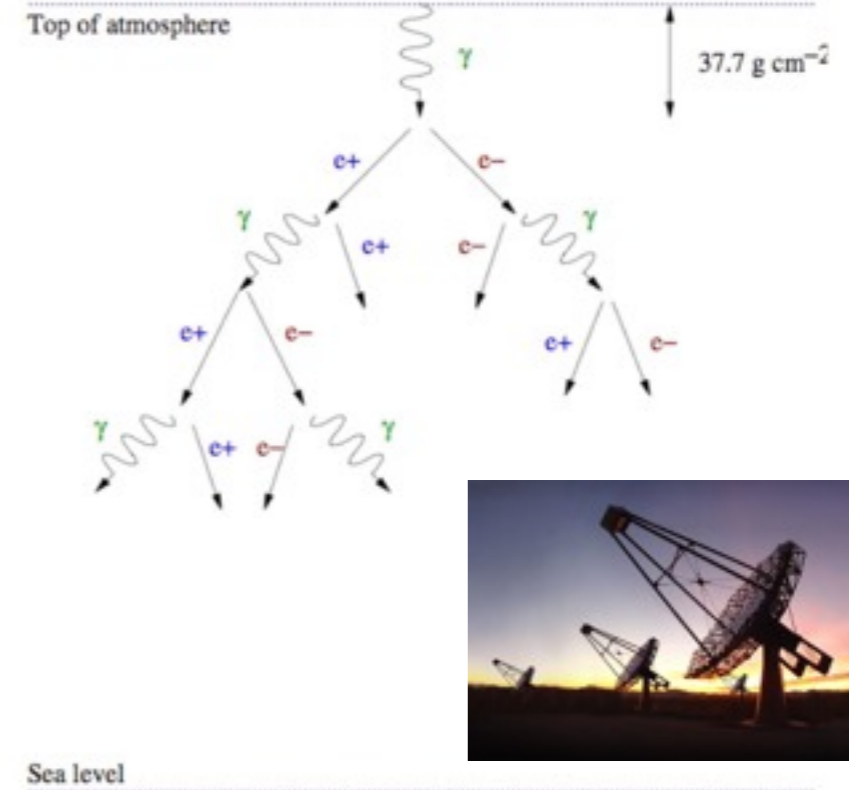


Pair production

Fermi



VERITAS

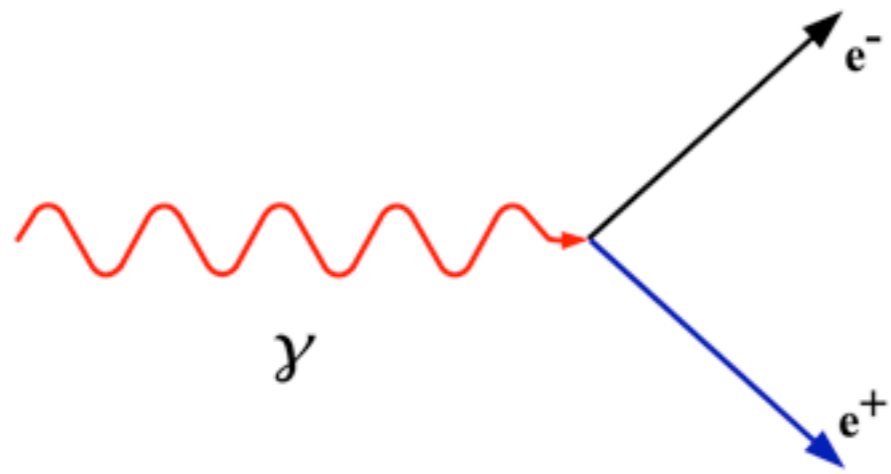


$$\sigma(\phi) \propto \left[1 + PR \cos(2(\phi - \phi_0)) \right]$$

P: polarization fraction of gamma
R: material dependent “dilution” factor



Fermi

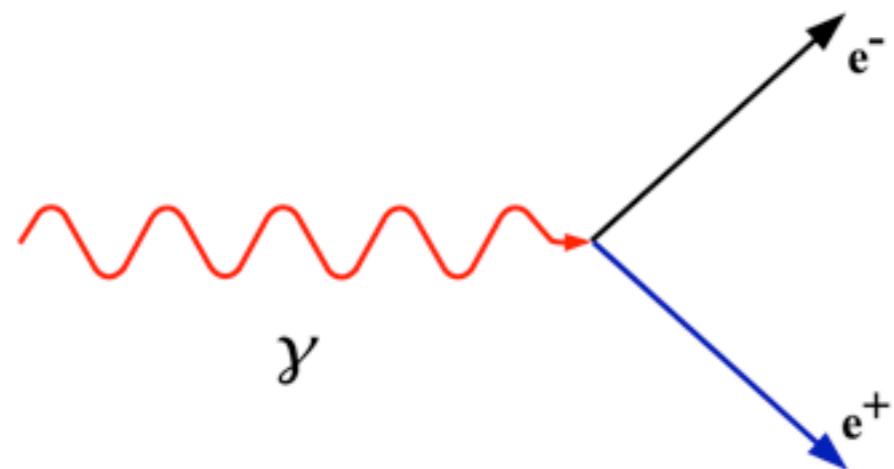


Typical pair opening angle $\sim 4m/E$
1 deg @ 100MeV

Tracker angle resolution ~ 0.4 deg



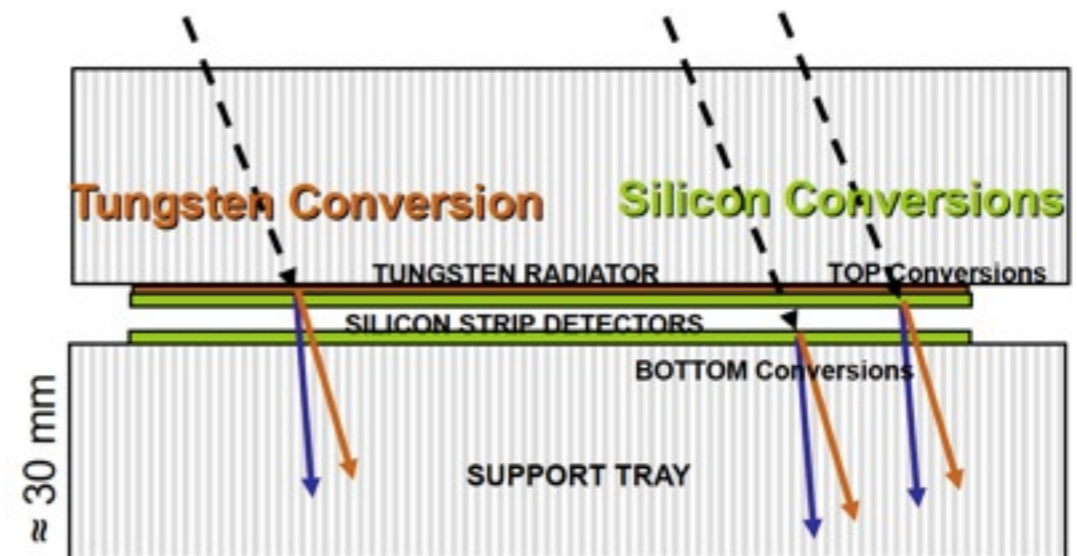
Fermi



Typical pair opening angle $\sim 4m/E$
1 deg @ 100MeV

Tracker angle resolution ~ 0.4 deg

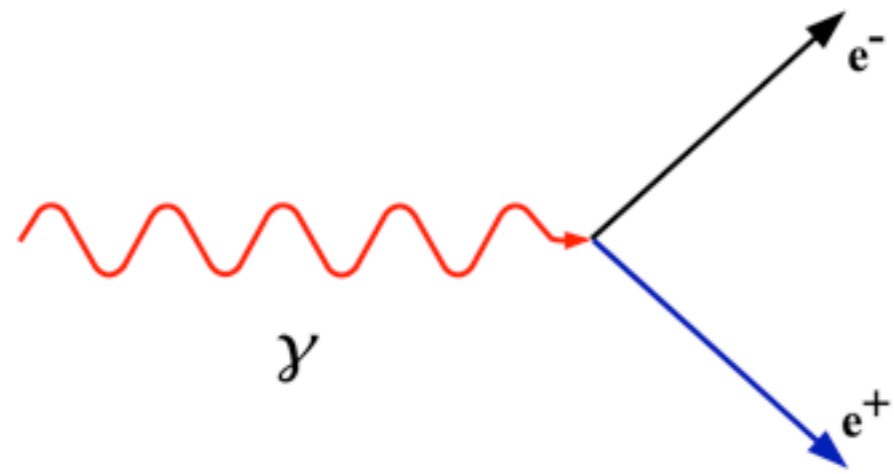
Multiple scattering
related to
radiation length X



$$X(\text{tungsten}) = 0.028$$
$$X(\text{silicon}) = 0.004$$



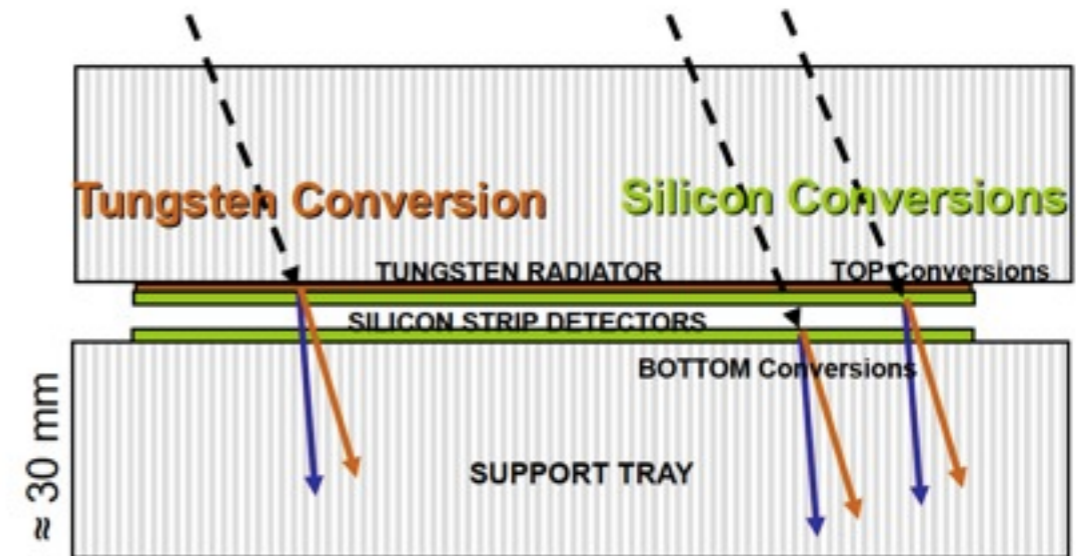
Fermi



Typical pair opening angle $\sim 4m/E$
1 deg @ 100MeV

Tracker angle resolution ~ 0.4 deg

Multiple scattering
related to
radiation length X

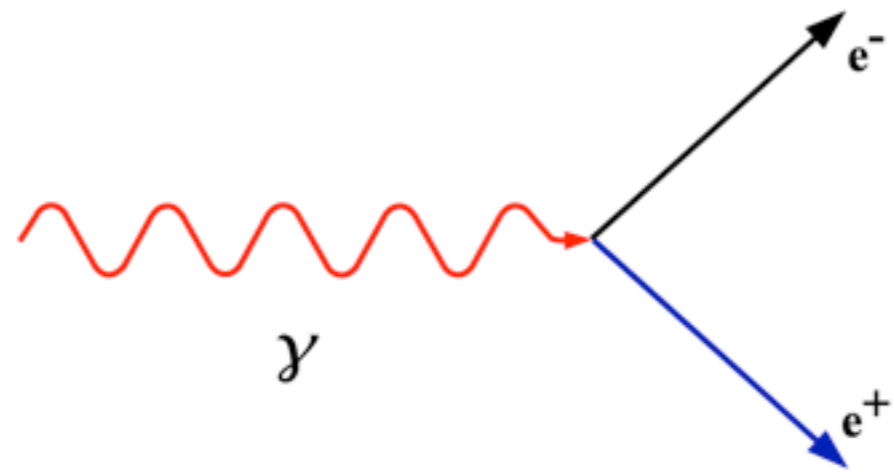


~~$$X(\text{tungsten}) = 0.028$$~~

$$X(\text{silicon}) = 0.004$$



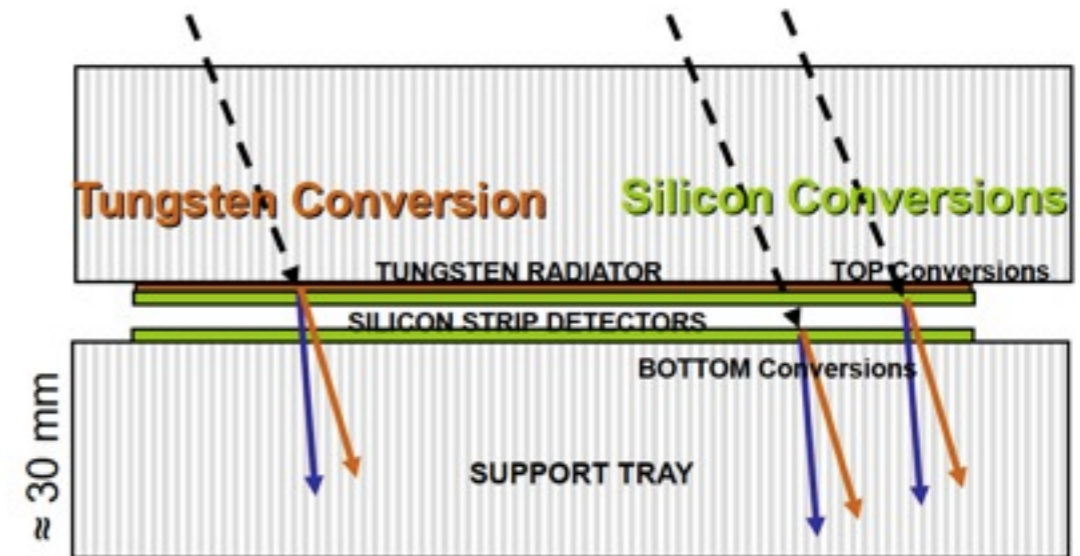
Fermi



Typical pair opening angle $\sim 4m/E$
1 deg @ 100MeV

Tracker angle resolution ~ 0.4 deg

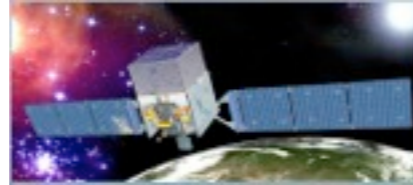
Multiple scattering
related to
radiation length X



~~$$X(\text{tungsten}) = 0.028$$~~

$$X(\text{silicon}) = 0.004$$

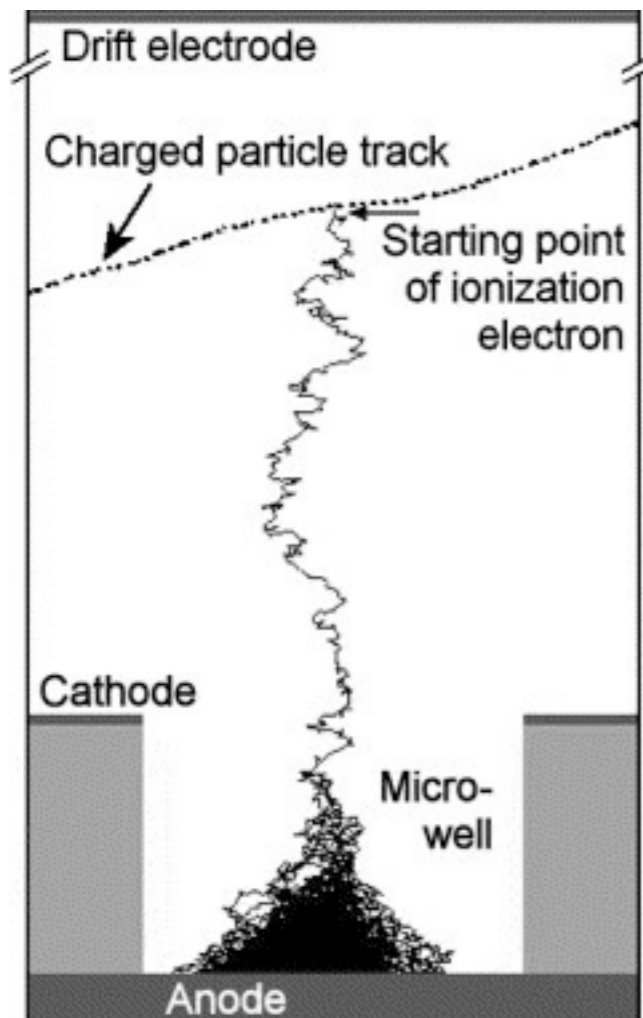
Possibly measurable polarization $> \sim 10\%$
for Bright sources



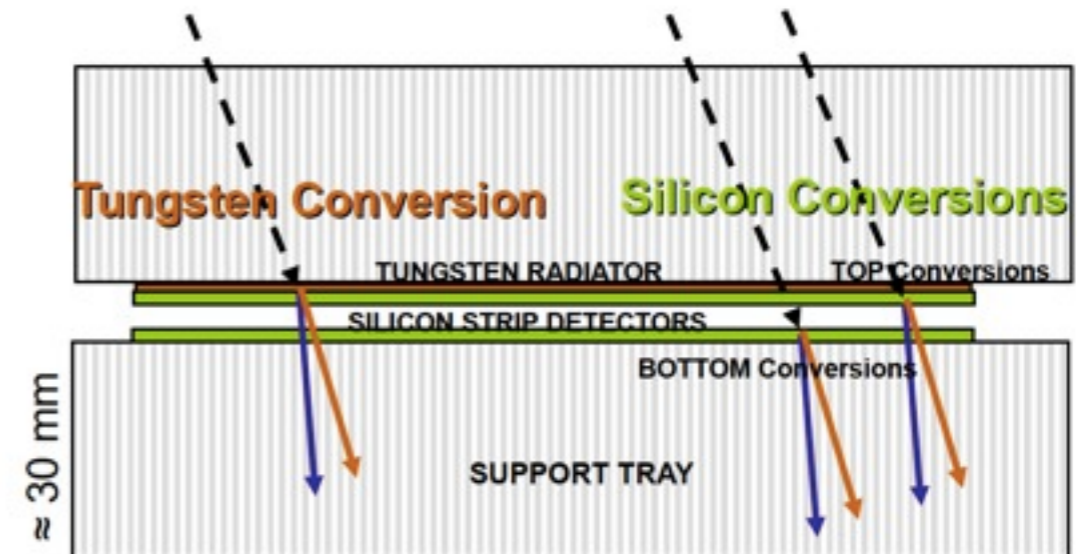
Fermi

A gas tracker would be better suited

e.g. gas micro-well tracker



Multiple scattering related to radiation length X



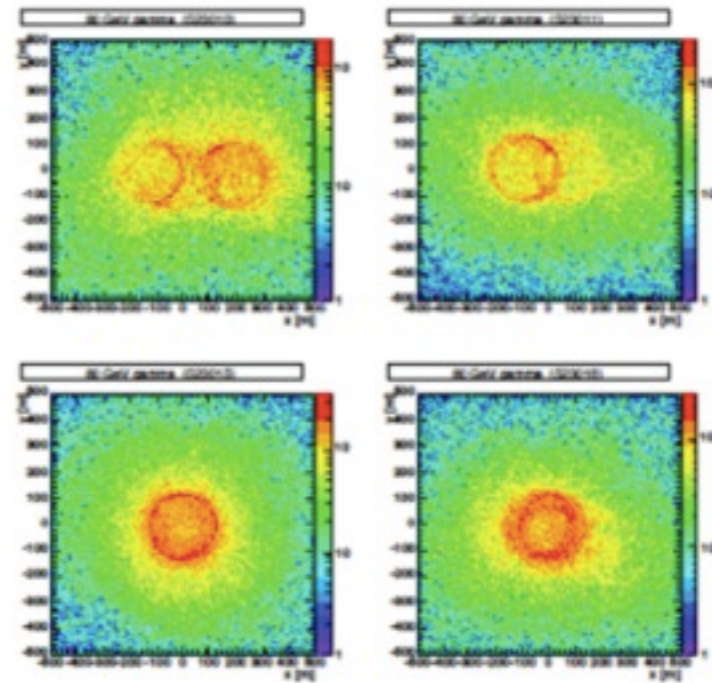
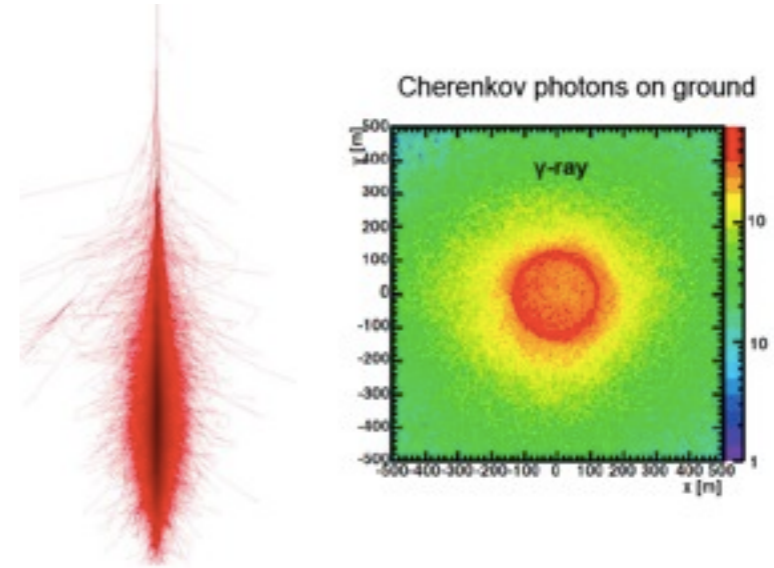
~~$X(\text{tungsten}) = 0.028$~~
 $X(\text{silicon}) = 0.004$

Possibly measurable polarization $> \sim 10\%$ for Bright sources



VERITAS

Atmosphere is less distorting

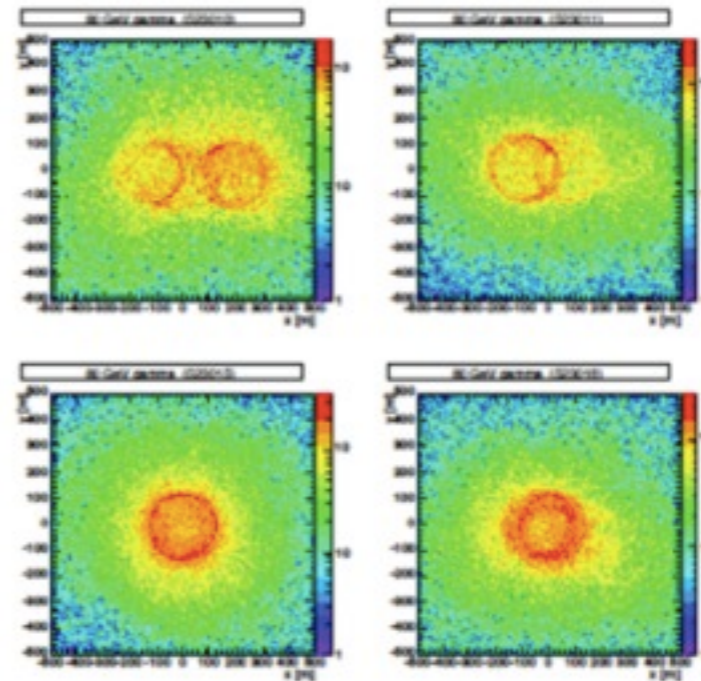
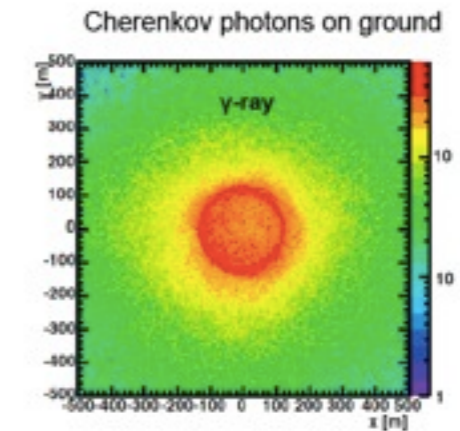
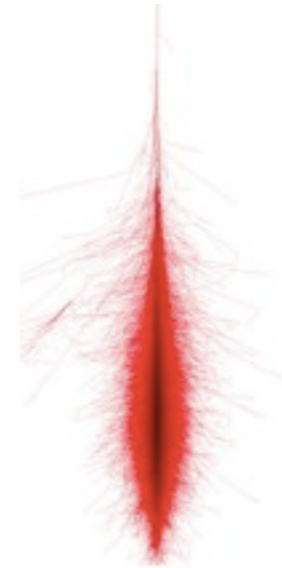




VERITAS

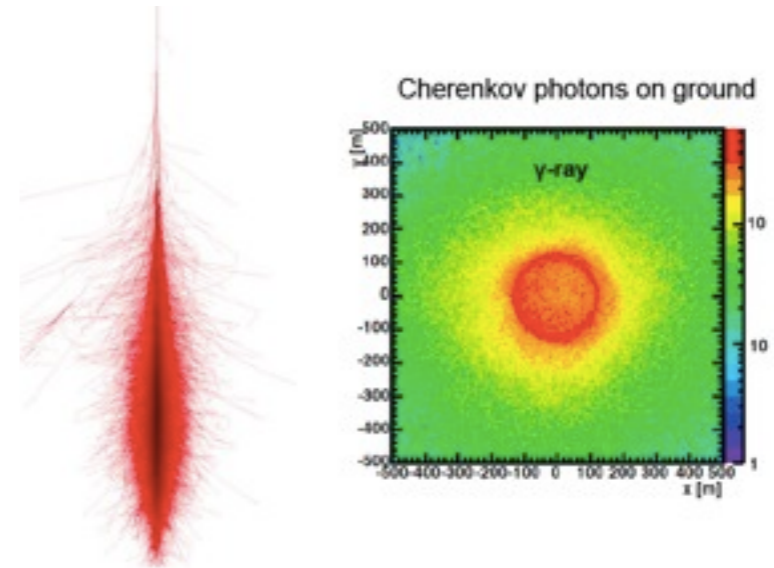
Atmosphere is less distorting

Opening angle $\sim 4m/E = 0.0015 \text{ deg}$
@ 80 GeV

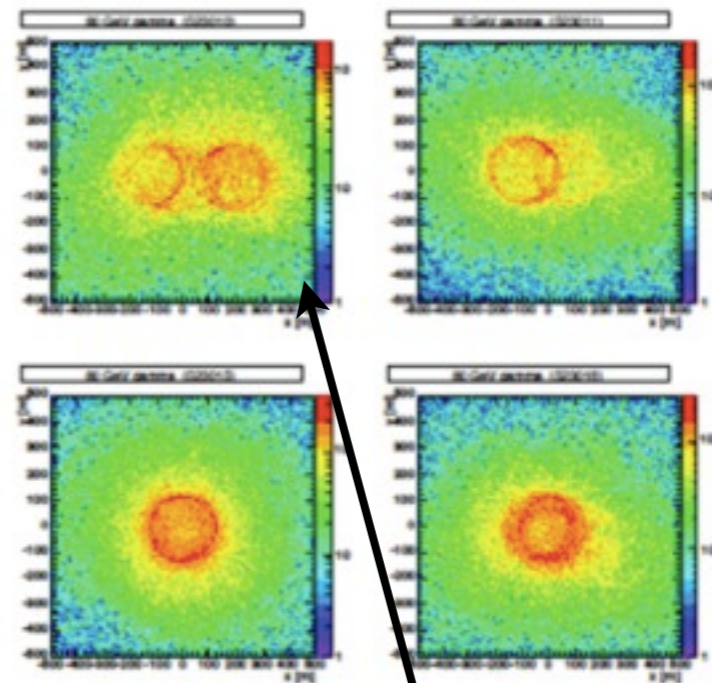
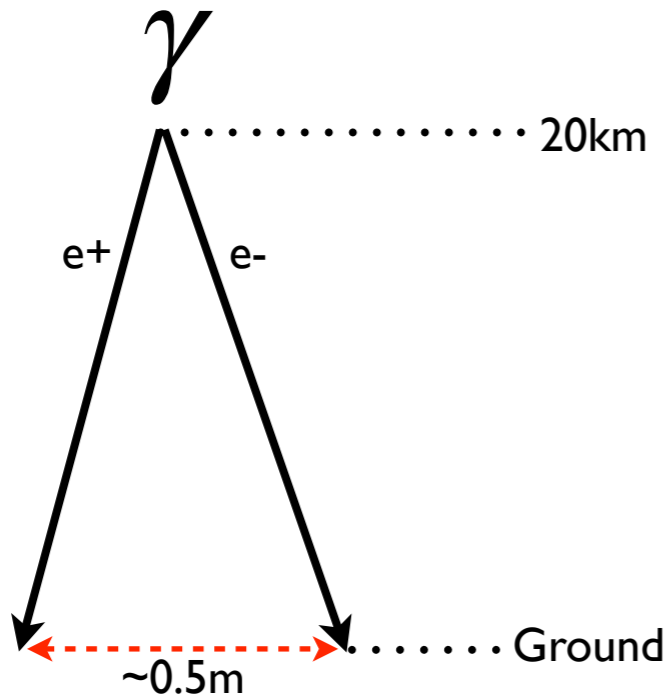




VERITAS



Opening angle $\sim 4m/E=0.0015\text{deg}$
@ 80GeV



**GMB-field
enhanced**