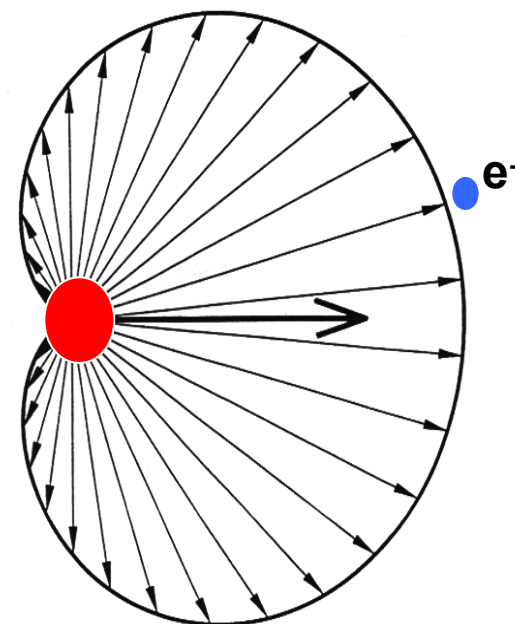
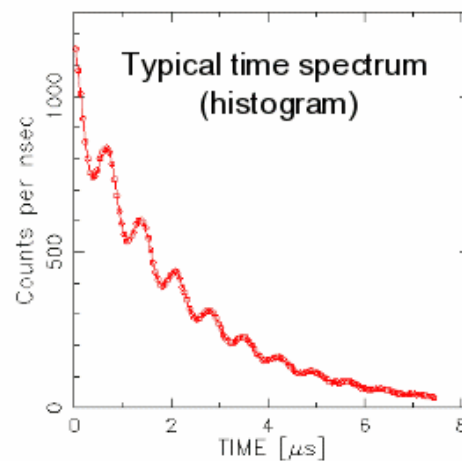
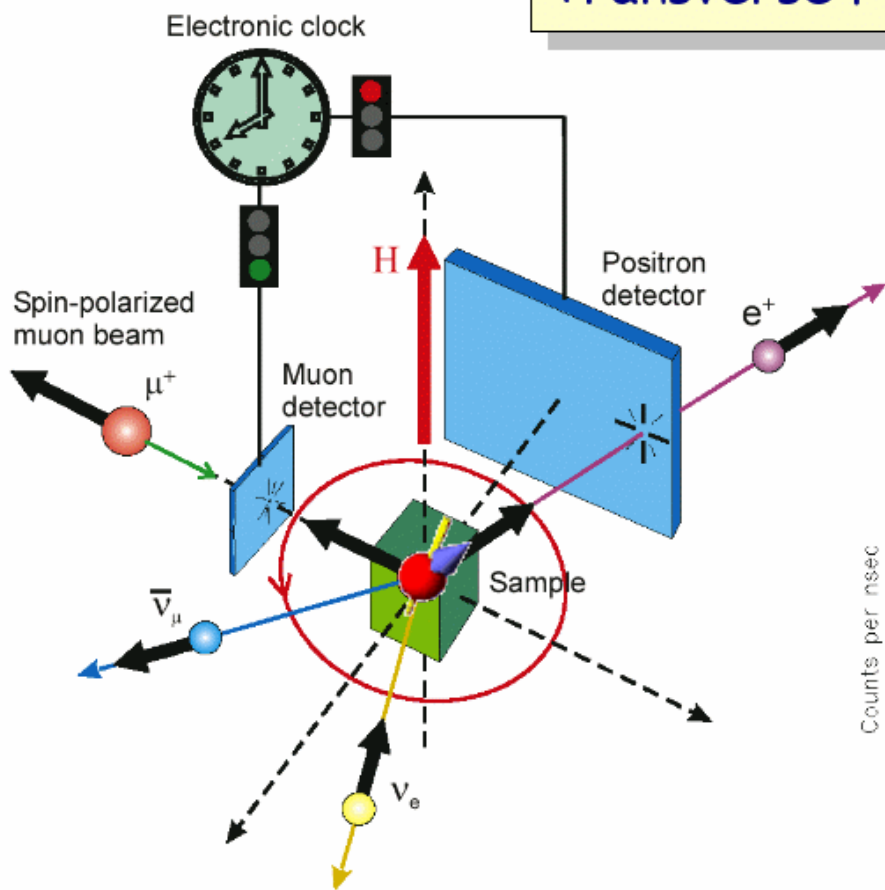


**Followup on the Monte Carlo simulation of MUSR using
GEANT 4**

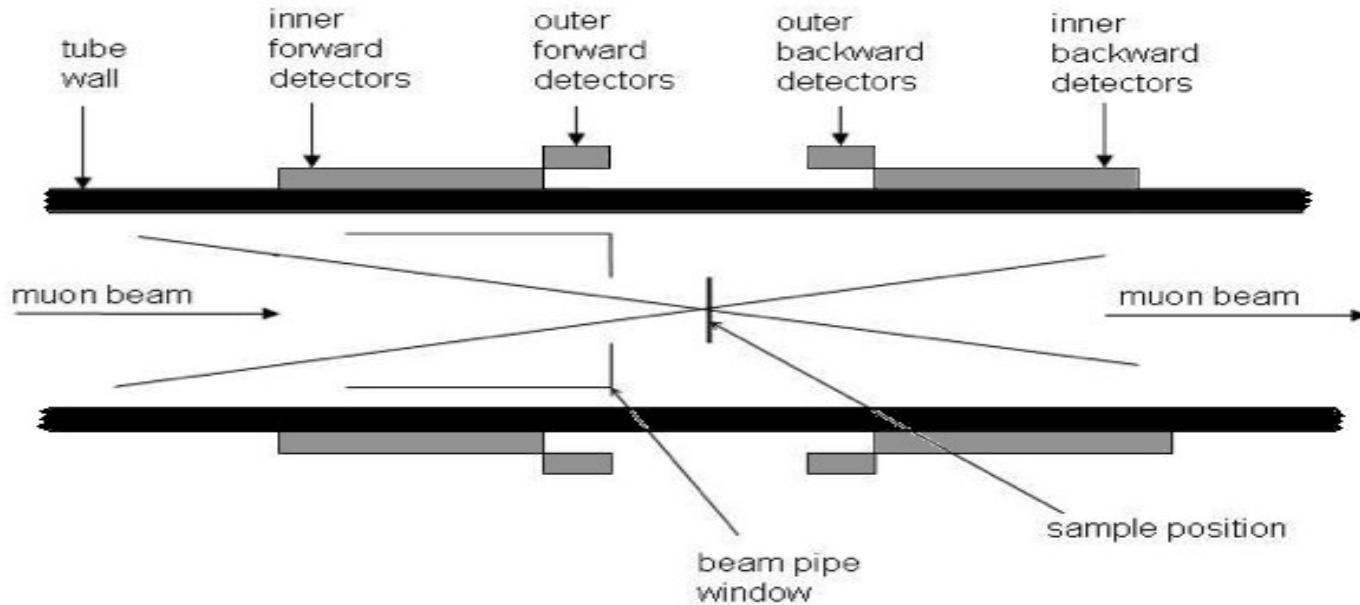


How the μ SR experiments work

Transverse Field (TF)- μ SR

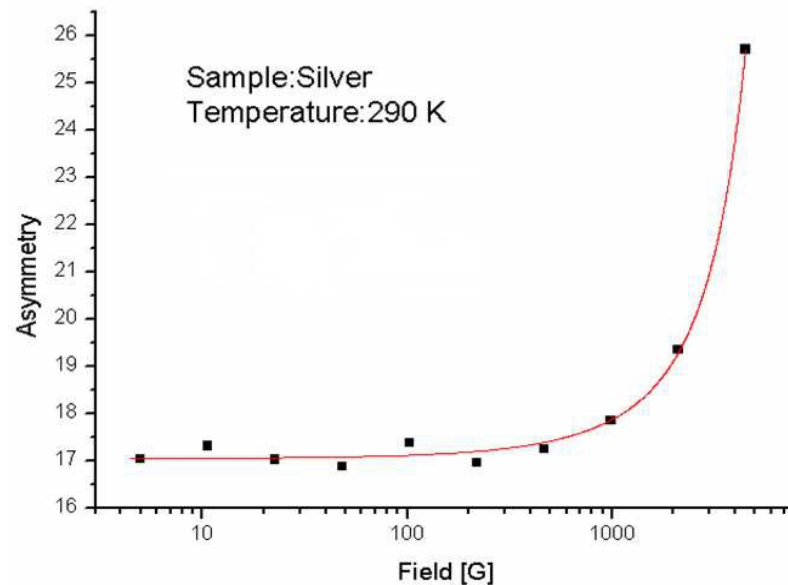


MSR – Longitudinal Field

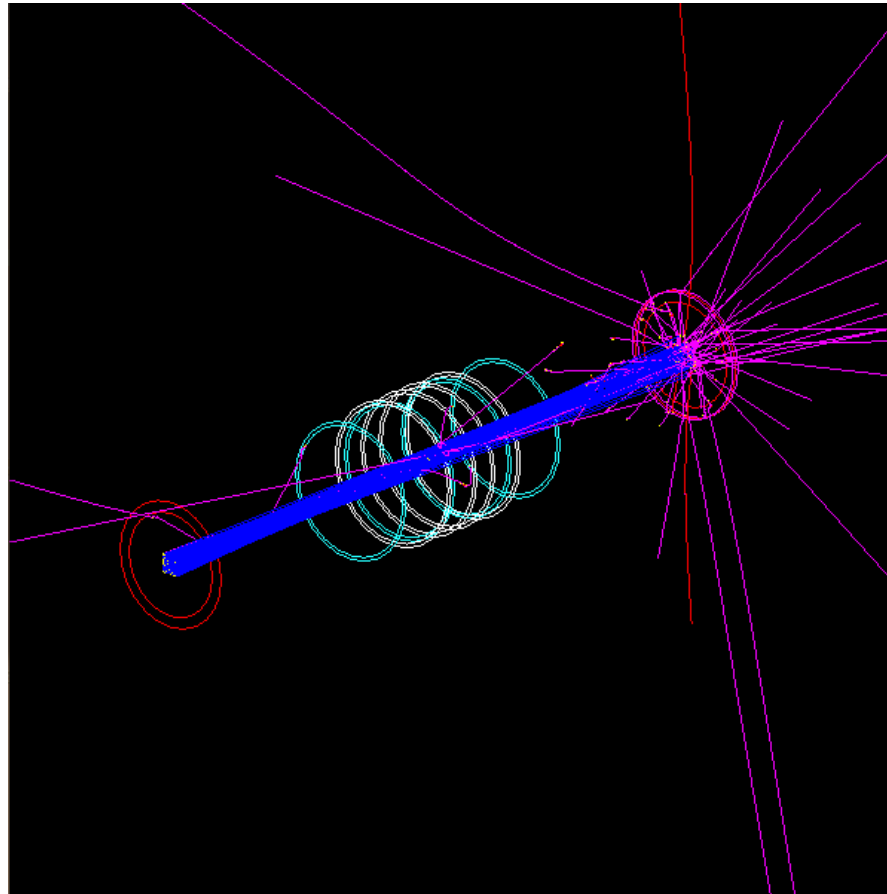


$$A = \frac{F - \alpha B}{F + \alpha B}$$

- A false field dependent asymmetry is induced for small samples

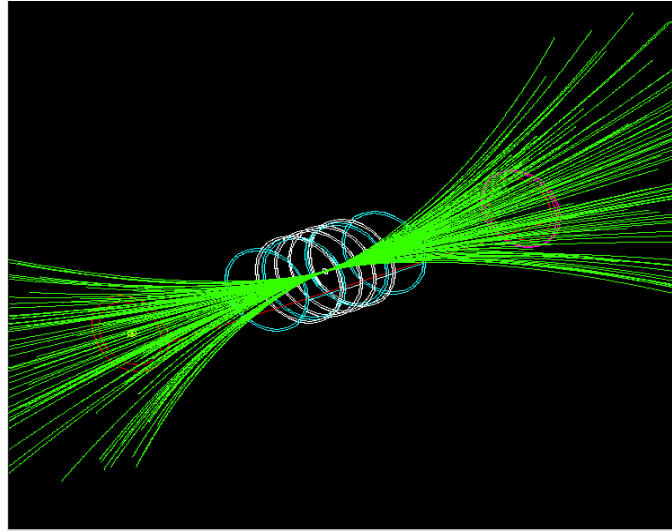


Geant 4 Simulation



- Muon experiments are a problem if the sample is smaller than the beam
- Simulate muon for small samples
- Use results for advanced analysis of experimental data

The Application



Previous Work

- Developed the capacity to describe magnetic fields in the GEANT simulation
- Verified that the calculation of the magnetic field is correct (using moving test charges)
- Developed the capacity to run GEANT4 in parallel on the UJ cluster (gLite and OSG)
- Did many runs with scans over various parameters of the simulation and studied MSR experiment behaviour

New Work

Motivation

- Identify the sources of the false asymmetry

Possibilities

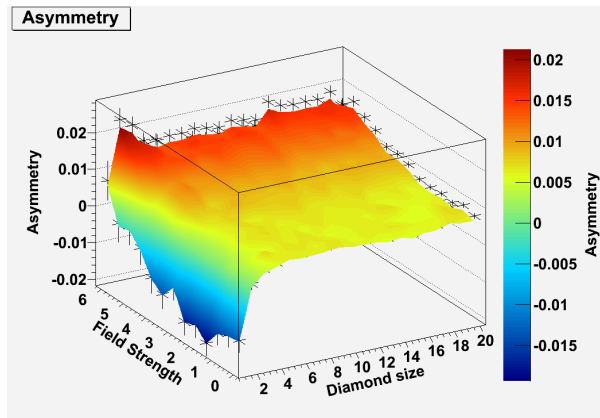
- Field dependence of the extent of the muon flypast
- Field dependence of the positron detection efficiency (from target and flypast muons)
-

Further Work Done

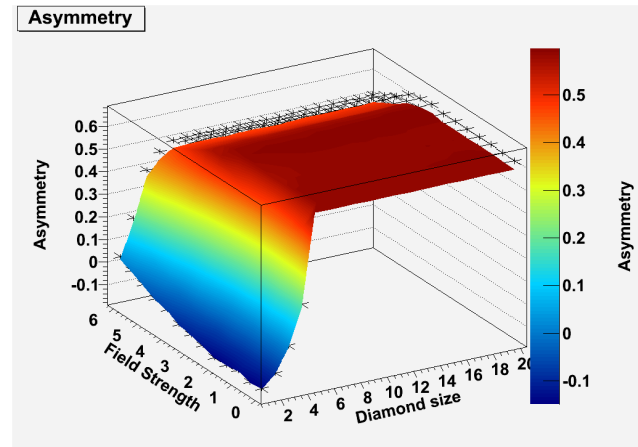
- Did more runs on the cluster to determine the field dependence on of the detector efficiency for positrons from the sample
- Also did runs in order to determine the detector efficiency for positrons originating from flypast muons
- Did a short run on the cluster to determine what proportions of the detected positrons originating from the sample were detected by which of the individual detectors for no electromagnetic field

Previous Results

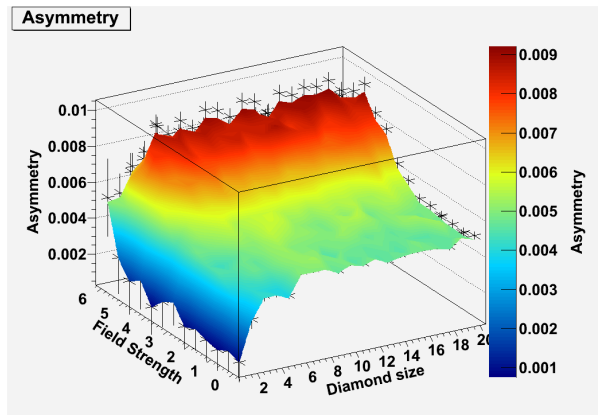
- Total asymmetry



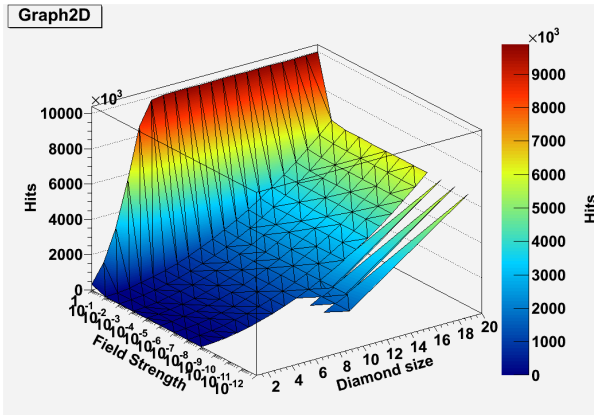
- Asymmetry of positrons not originating from the diamond



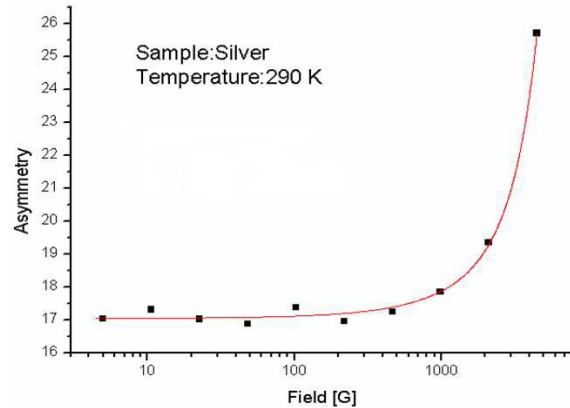
- Asymmetry of positrons originating from diamond sample.



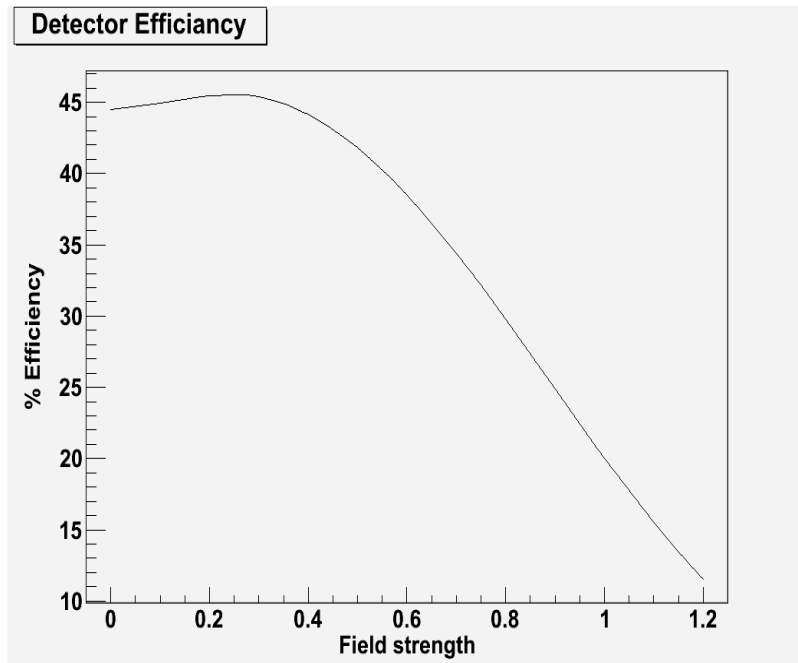
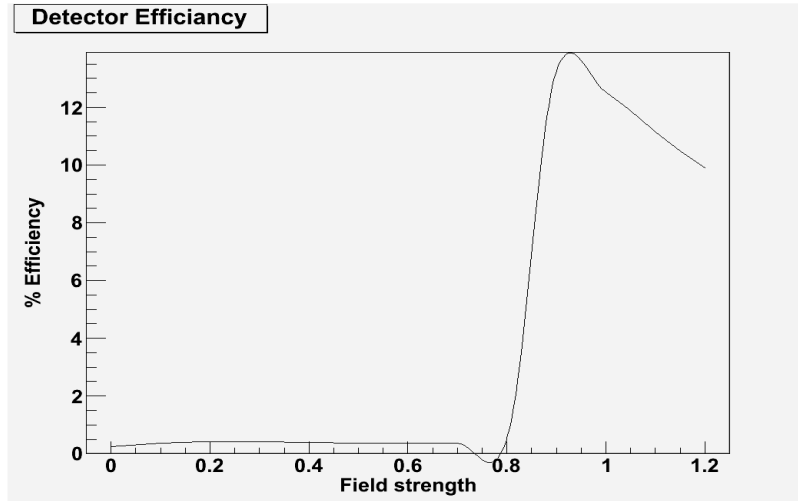
Comparison between results of simulation and experiment



- Graph of the number of muon hits with respect to field strength and diamond size. Each cross section of the graph has qualitatively the same shape as the asymmetry of the silver sample with respect to field strength.



New Results



- Top graph shows flypast efficiency.
- Bottom graph shows efficiency for detecting impact positrons from the diamond sample.
- Flypast efficiency increases sharply after a certain point.
- Efficiency for the impact positrons starts off high but decreases slowly as the field strength increases

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	Percentage
Outer F	15.7 %
Outer B	11.1 %
Inner B	41.6 %
Inner F	30.7 %
Total Outer	26.8 %
Total Inner	72.3 %
Outer LCKE	15.5 %
Inner LCKE	72.3 %

- Consistent with results found experimentally in another paper:
/Users/jonathanhartman/Desktop/small_samples_isis.pdf
- Would be interesting to see dependence on field.

Conclusions and further Work

Future work includes:

- Add the positron emission angular distribution correlation to the muon polarization.

Conclusions:

- Will be able to fully characterise the asymmetry of the positrons due to previous results.
- Can use the new efficiency data for advanced analysis of experimental data.
- Can compare the new data about individual detectors from the simulation with previous experimental results.

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