A SUPERCONDUCTING GAS-FILLED SEPARATOR

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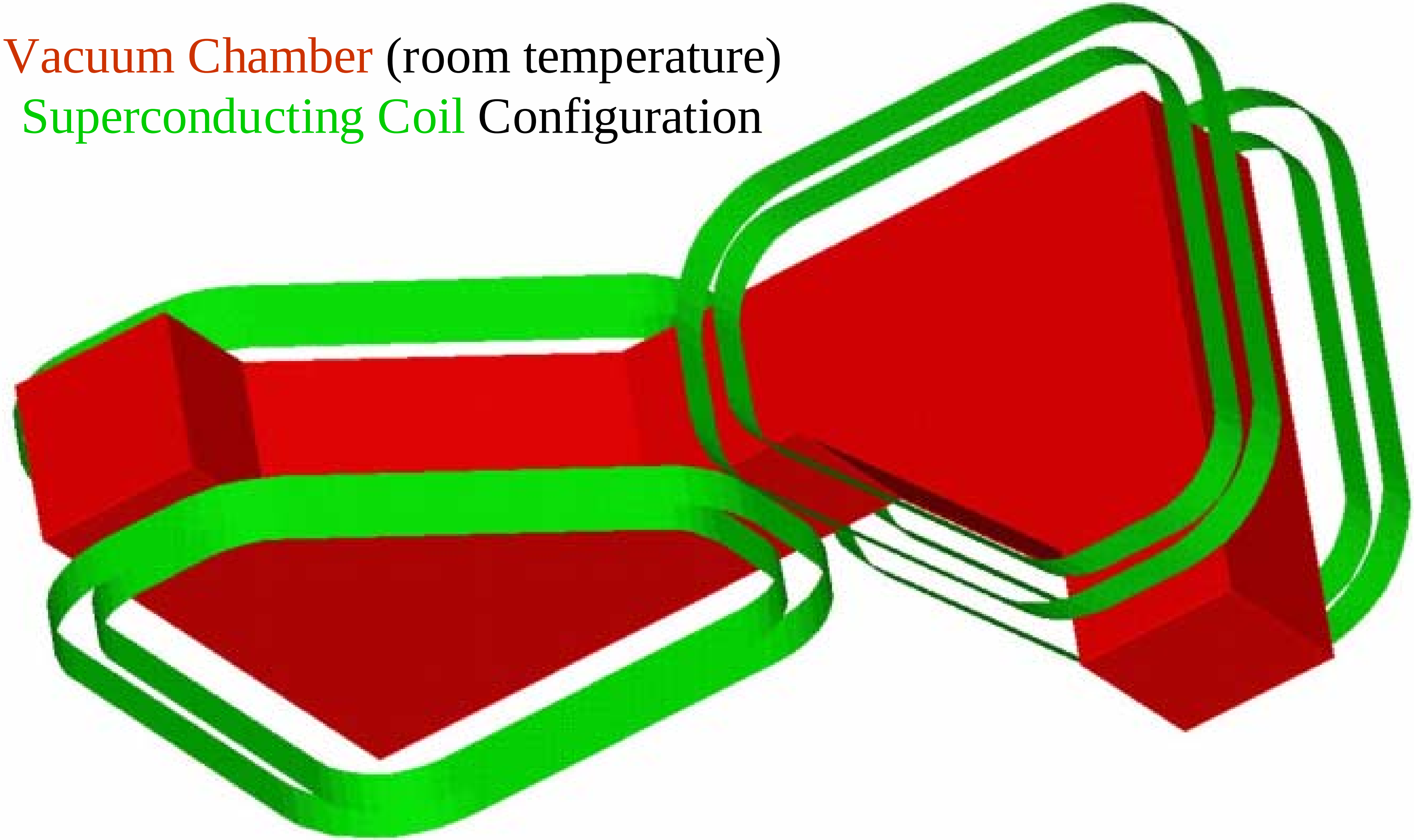
A gas-filled separator consisting of superconducting magnets is being considered. The favored design consists of two 5-Tesla flat-field magnets, each with a 90-degree bend angle and a 0.5-meter bend radius for the central trajectory. With one magnet bending recoils in the horizontal direction, and the other bending in the vertical, all focusing is achieved geometrically. This results in a separator with a short (2.5m) flight path, and a large (100 msr) angular acceptance. Results of preliminary calculations will be presented, and the applicability for a dedicated separator for heavy element chemical studies will be discussed.

SGS Schematic

Vacuum Chamber (room temperature)
Superconducting Coil Configuration



Superconducting Gas-filled Separator: a general-purpose separator for RIA experiments

High Selectivity: removal of radioactive beam

- RIA beam intensities up to = 10^{11} ions/sec: ~ 3Ci of $\beta-\gamma$
- Most interesting experiments will have low detection rates
- Detection systems must be kept clean of long-lived daughters

High Efficiency: good for nearly any compound nucleus reaction

- Maximize detection for low-production-rate experiments
- Large angular acceptance
- Large momentum (energy) acceptance

Powerful Magnetic Optics Configuration

Short flight path:	access to sub-microsecond half-lives
Geometric focusing:	no need for quadrupole magnets
H_2 gas fill:	minimize scattering, flat $B\rho$ vs. v curve

Could be built and tested at LBNL during RIA construction

Superconducting Gas-filled Separator Specifications

• Proposal Submitted for FY2002 LDRD funding: Denied . . . Will re-submit for FY2003.

SGS Design Work Plan

• Simulate magnet configuration with TOSCA

• Calculate B-field map

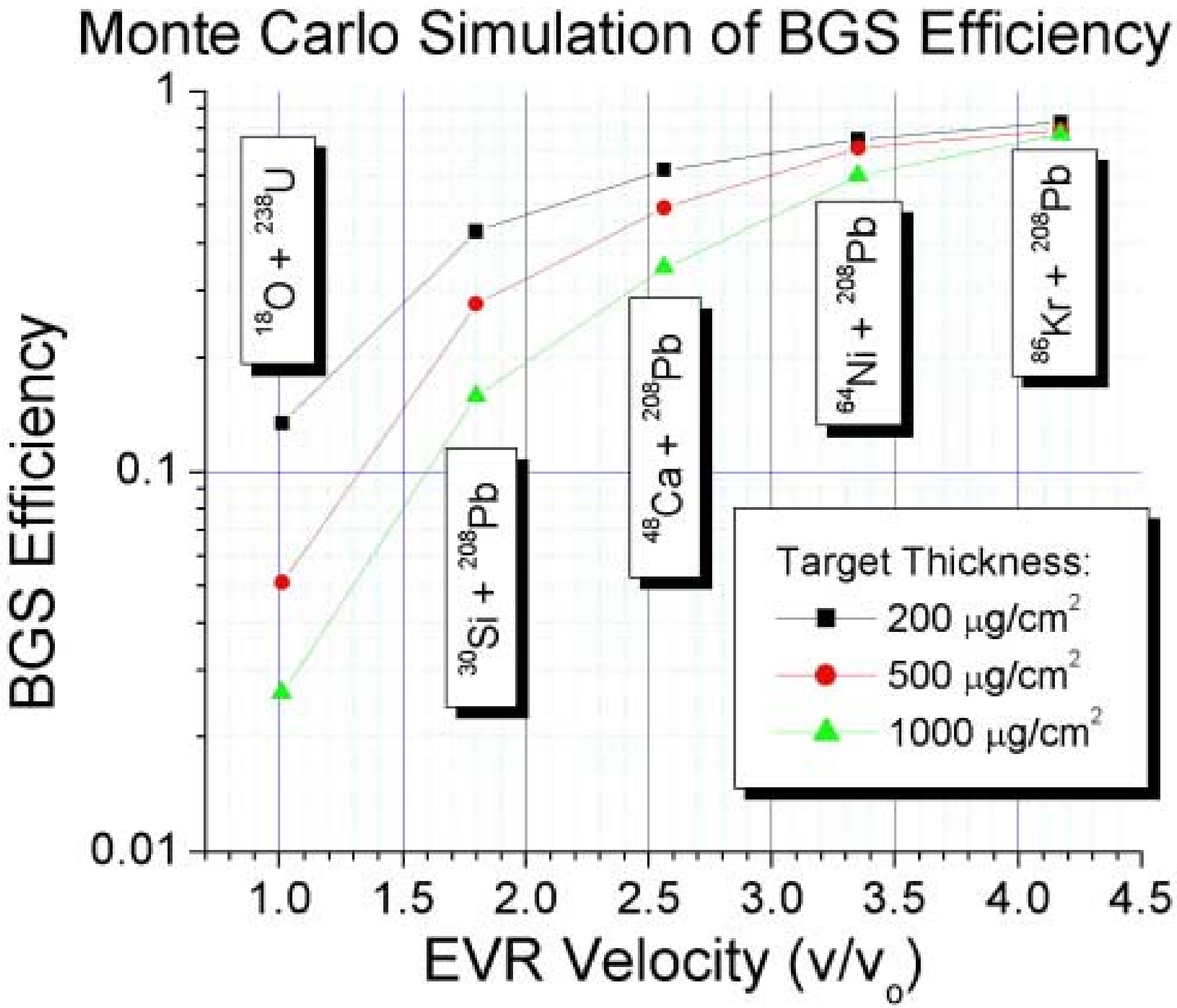
• Simulate particle trajectories

• Refine B-field shape

• If successful, engineering design work, a detailed construction schedule, and cost estimate could begin in a second year

	SBGS	BGS
Vertical Dipole fields and dimensions		
Maximum magnetic field	5.0 T	
Bend radius	0.5 m	
Bend angle	90°	
Aperture (inside vacuum chamber)	12.5 cm	
Field-free length from target to magnet	24.3 cm	
Central trajectory length in magnet	78.5 cm	
Horizontal Dipole fields and dimensions		
Maximum field	5.0 T	
Bend radius	500 cm	
Bend angle	90°	
Aperture	12.5 cm	
Field-free length from magnet to detector	24.3 cm	
Central trajectory length in magnet	78.5 cm	
Optical paramerers and comparison to BGS		
Central trajectory length	205.6 cm	461.5 cm
Total bend angle	90°v + 90°h	70°h
Horizontal angular acceptance	$\pm 6.28^\circ$	$\pm 4.29^\circ$
Vertical angular acceptance	$\pm 12.7^\circ$	$\pm 8.53^\circ$
Average angular acceptance	$\pm 8.94^\circ$	$\pm 6.05^\circ$
Acceptance solid angle	99 msr	45 msr
Horizontal magnetic dispersion	0.74 cm/%	2.02 cm/%
Vertical magnetic dispersion	1.53 cm/%	0
Total magnetic dispersion	1.70 cm/%	2.02 cm/%
Horizontal image magnification	0.49	0.60
Vertical image magnification	2.06	7.12
Total image size magnification	1.00	4.30

Efficiency will be greater than for the BGS



High-Intensity Multiple Target