

GlueX Collaboration Meeting.

Jefferson Lab.

September 9 – 11, 2004.

Review of

Tagger System.

Agenda.

1. Progress on tagger design. – Jim Kellie (15 mins.)
2. Discussion. – (15 mins.)
3. Design of two magnet tagger and vacuum system. – G. Yang (20 mins.)
4. Discussion. – (15 mins.)
5. General Discussion on Manpower/Time schedule/Funding. etc. – (25 mins.)

Progress On Tagger Design.

a) Tagger Options.

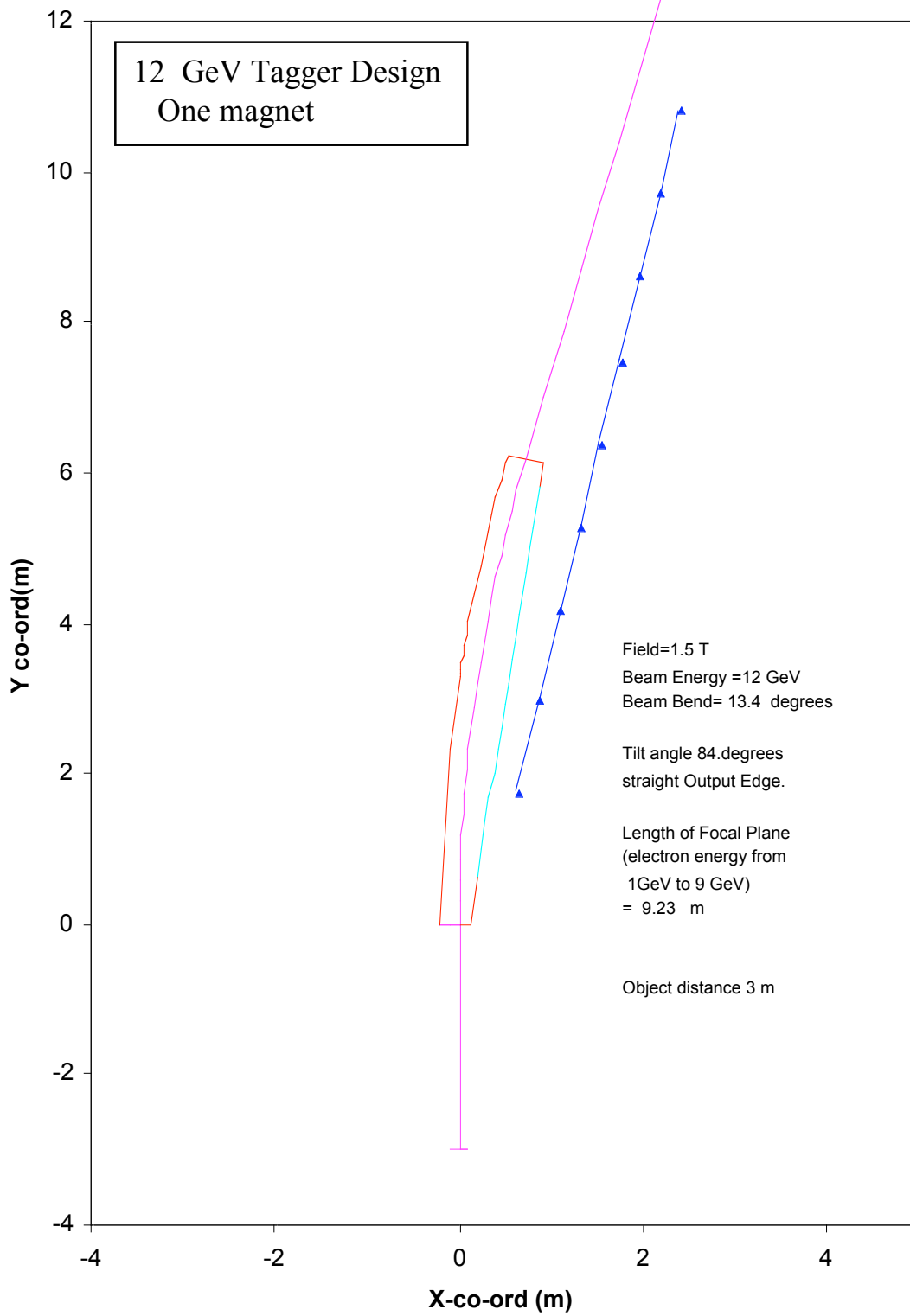
- 1. Design Report Specification.**
- 2. Two Magnet Option.**
- 3. Superconducting Option.**

b) Conclusions.

Progress on tagger design.

1. Specification in Design Report. (Nov. 2002)

Field at 12 GeV	1.5 Tesla
Radius of curvature	26.7 m
Full-energy deflection	13.4 deg.
Gap width	2.0 cm
Length of pole	6.1 m
Weight	~100 tons
Length of focal plane	8.7 m
Coil Power	800 A at 22V.
Focal plane	
(i)	Set of 128 fixed scintillators covering 1 GeV to 9 GeV electron energy.(Photon range 3 to 11 GeV)
(ii)	Moveable microscope of 64 counters covering for example photon range from 8 to 9 GeV.



Tagger with a single dipole magnet.

1. The design report parameters were confirmed to be optimal apart from increasing the object distance from 1.0 m to 3.0 m. This improves the resolution by almost a factor of $\sim 30\%$ and gives more room for the goniometer vacuum chamber, a quadrupole, and monitors if required.
2. 3-D TOSCA field calculations by P. Brindza and G. Yang confirmed magnetic field attainable with acceptable coil and yoke configurations.
3. Behavior of the effective magnetic field boundary is very predictable.
4. Preliminary vacuum system designs.
 - a) External to dipole magnet.
 - b) Use pole shoes as part of vacuum system.
 - c) Both welded and O-ring/welded systems considered.

Comments on Single Magnet Tagger.

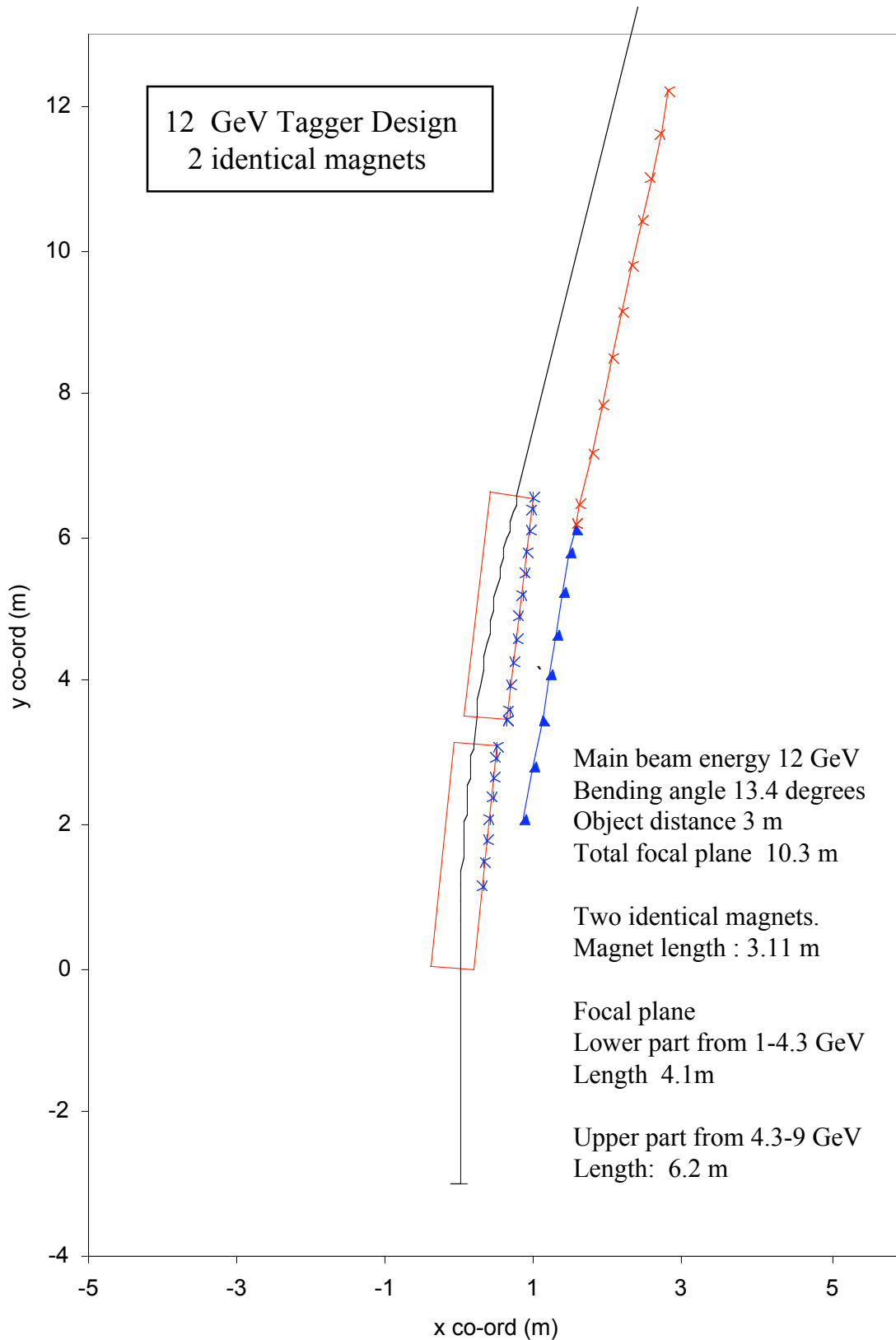
Disadvantages.

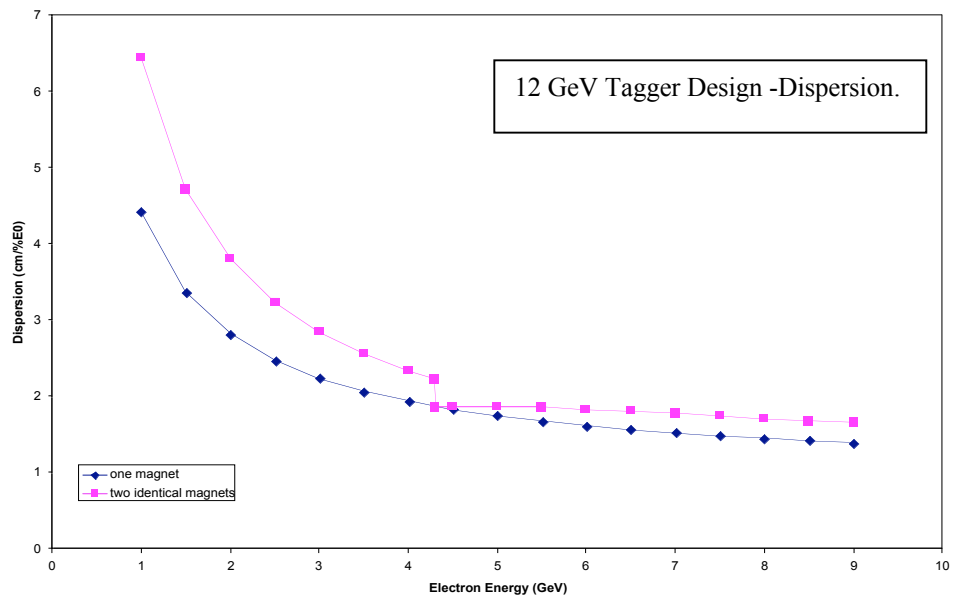
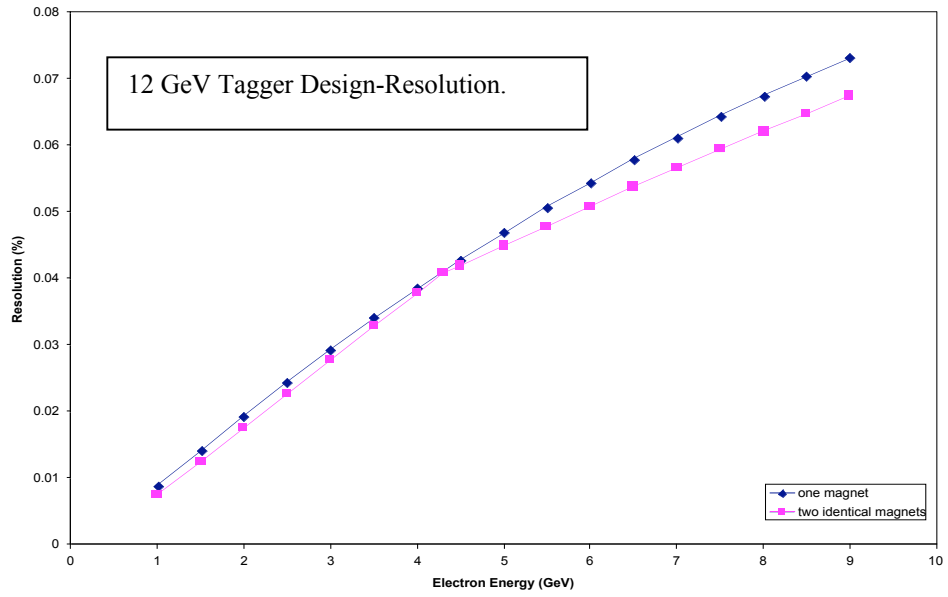
- a) Difficult to find a supplier of 6.5 m lengths of high quality magnetic iron.
- b) Weight of top and bottom yoke pieces each in excess of 20 tons.
- c) Difficult to design sufficient stiffness into such a long, thin structure.
- d) Awkward to install.

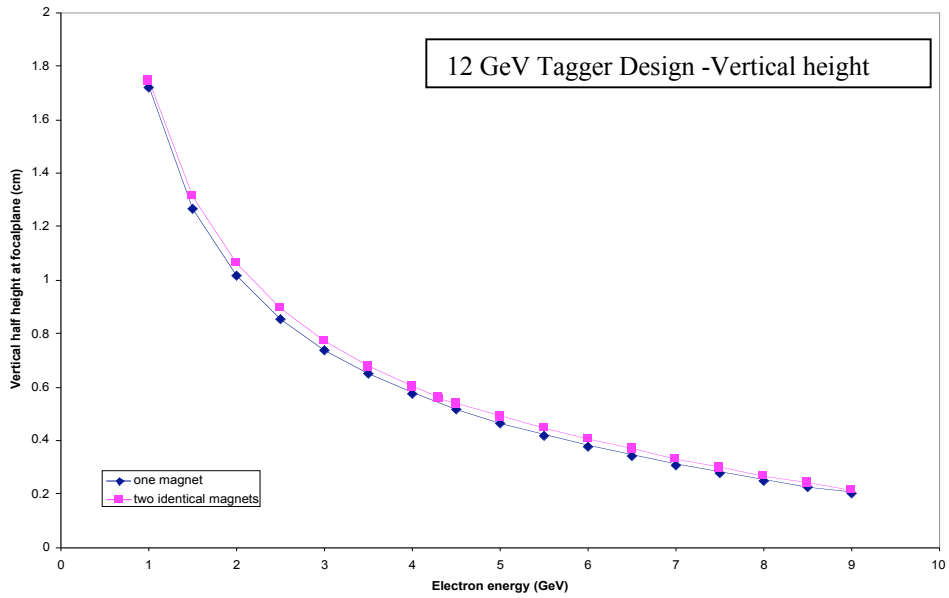
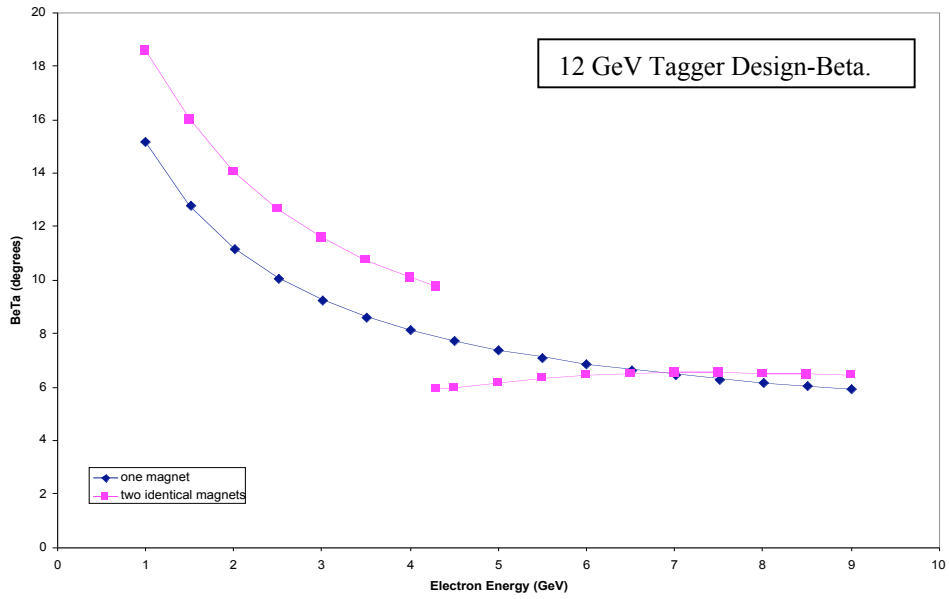
Potential Solution.

Consider a 12 GeV tagger consisting of two identical uncomplicated magnets.

2. Two magnet option.







Comparison of single and 2 magnet systems.

- The focal plane geometry, resolution, dispersion and focal plane vertical height are very comparable.
- The angle beta is continuous for the **single magnet tagger**, but is discontinuous for the **two magnets tagger**.
- For GlueX energies beta is larger – and better - for the **two magnets tagger**.
- The difference between beta for the two options is at most 2 deg. and can be taken into account by the focal plane design.
- A two magnet design is optimal. For more than two, the dividing energy between magnets would interfere with the GlueX range of photon energies.

f) The smaller magnets can be made by more manufacturers and would be cheaper.

g) Lower building costs. (cheaper crane, smaller access doors etc.)

h) Both magnets could possibly run from a single power supply.

j) The two identical magnets tagger has several significant advantages and no serious disadvantages.

3. Superconducting option.

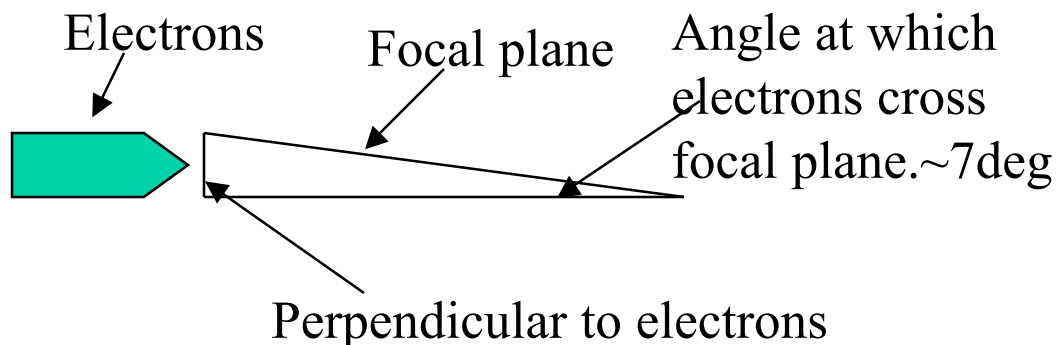
(Increasing field reduces size of magnet and focal plane in proportion to the increase.)

Advantages.

- (i) Jlab has expertise in superconducting magnet technology.
- (ii) Smaller tagger hall.
- (iii) Low power consumption.

Disadvantages.

- (i) Room temperature magnet straightforward.
- (ii) Reduction in size.
 - a) Focal plane moves closer to magnet – difficult to shield detectors.
 - b) Focal plane detectors become very small. ie:



Field.	Length perp. to electrons.		
	Focal plane.	Fixed detectors.	Microscope detectors
1.5 T	1.12 m	~9 mm	~2 mm
3.0 T	~0.55 m	~4.5 mm	~1 mm

(iii) A coil power consumption of ~17.6 kW is not excessive.

(iv) Cryogenics and liquid He required.

Conclusions

- **We have carried out a comprehensive investigation into the design of a 12 GeV tagger for GlueX.**
- **The two identical dipole magnet tagger looks the best option, and fulfils the design criteria in the design report.**
- **Since the May Collaboration Meeting Glasgow has undertaken a more detailed design of the two magnet tagger and vacuum system.**

Further work required.

- (i) Alternative designs for vacuum system.**
- (ii) Focal plane design.**
- (iii) Design of support structure.**
- (iv) Production of preliminary engineering drawings.**
- (v) Specification of tagger hall.**
- (vi) Cost estimates.**

