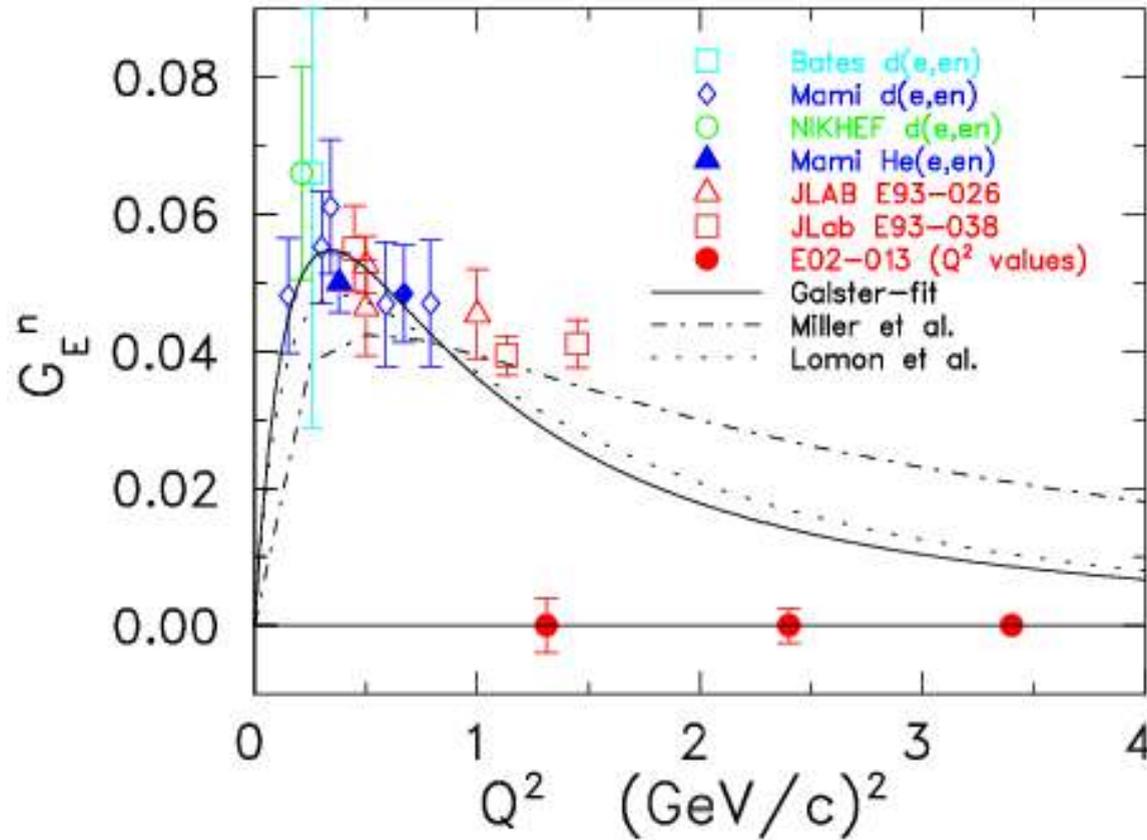


Hall A Collaboration Meeting  
Jefferson Lab, Newport News  
December 14, 2004

**Update on E02-013:  
Measurement of the Neutron Electric  
Form Factor  $G_E^n$  at High  $Q^2$   
and  
Status of the Polarized  $^3\text{He}$ -Target**

Bodo Reitz / Gordon Cates

# Data on $G_E^n$ from Double Polarization Experiments



Mainz and JLab Hall C data are published!

Theory: lots of interest in electro-magnetic form factors due to Hall A  $G_E^p$  results

**Proposed Measurement:**  
**Cross Section Asymmetry in**

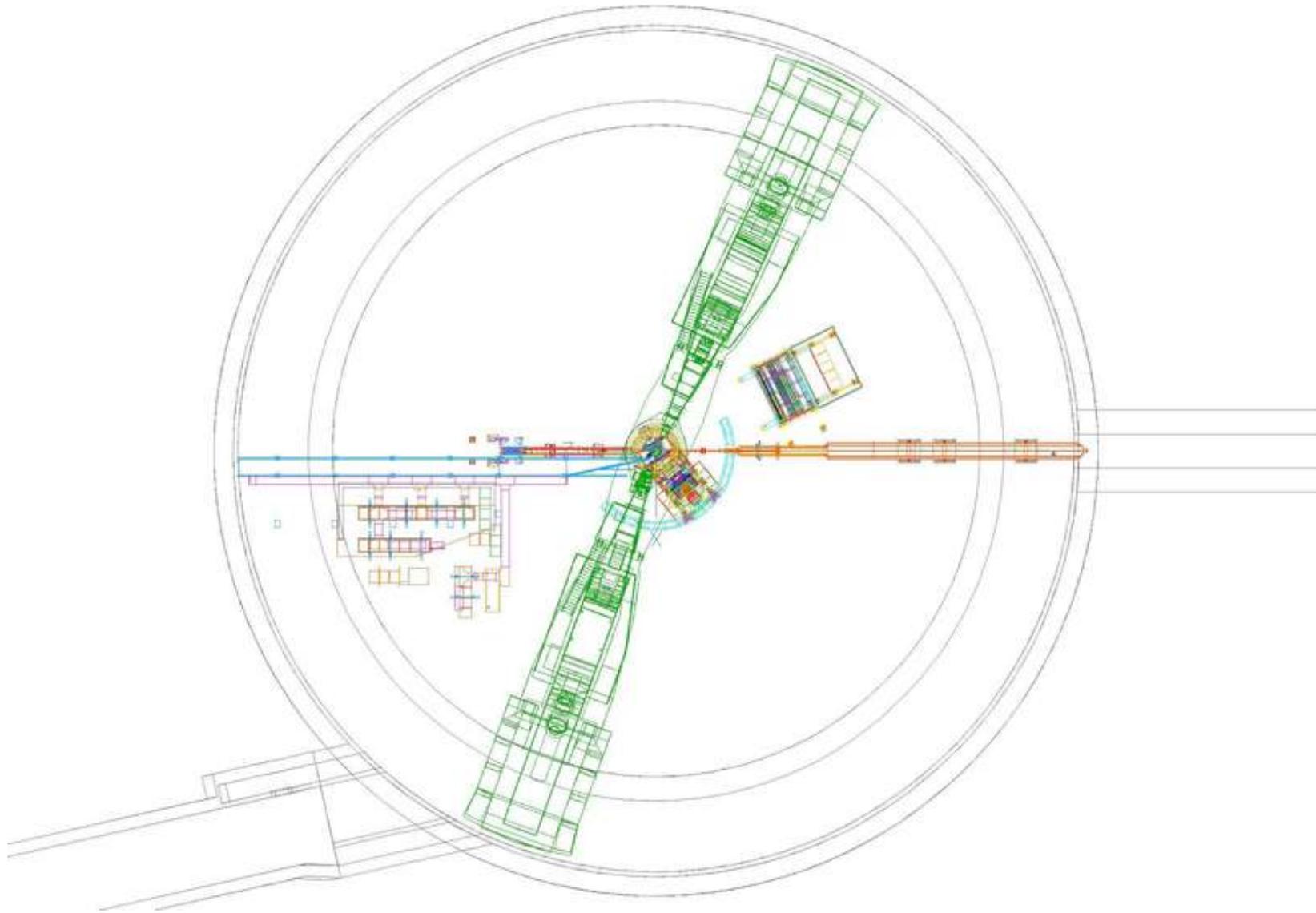
$${}^3\text{He}(\vec{e}, e'n)$$

**To obtain  $G_E^n$  at three different  $Q^2$**

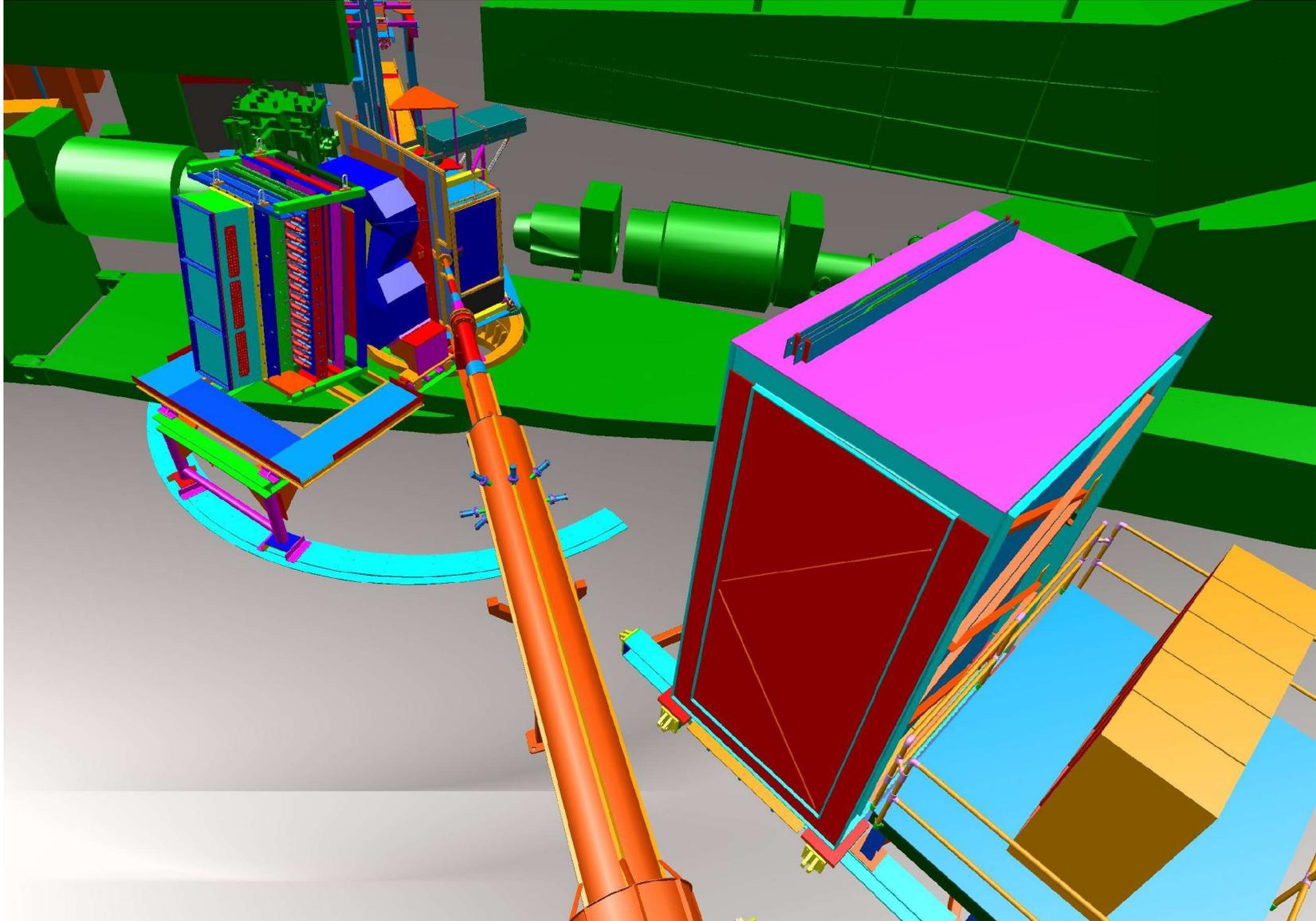
$Q^2$ (GeV/c) <sup>2</sup>	$E_i$ GeV	$\theta_e$ deg	$p_e$ GeV/c	$\theta_n$ deg	$p_n$ GeV/c
1.26	1.57	56.5	0.9	34.5	0.7
2.3	2.34	56.5	1.1	28	1.96
3.2	3.1	51	1.45	26	2.5

**Approved beam time: 32 PAC days**  
 **$Q^2$  lower than in proposal (compatibility with G0)**

# Hall A: Layout for E02-013

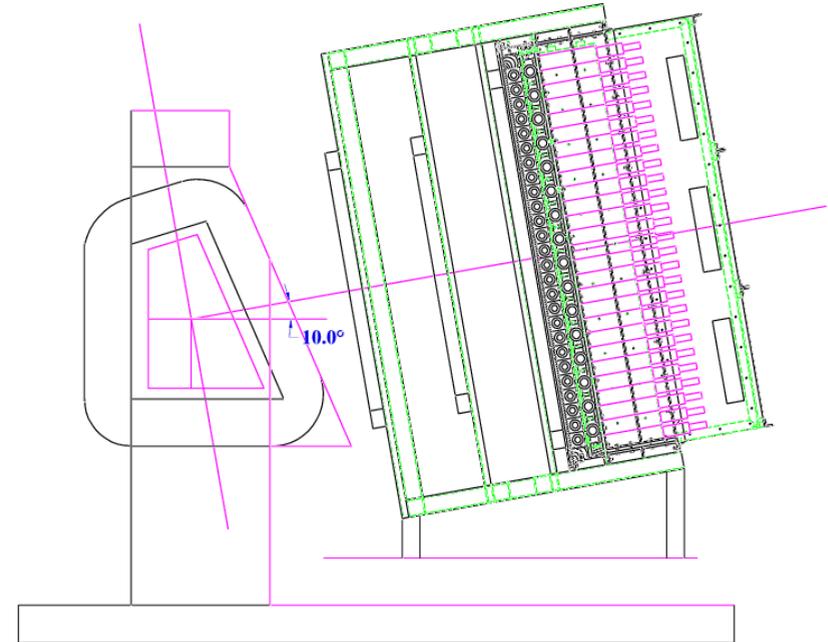


# Hall A E02-013: An Artists View

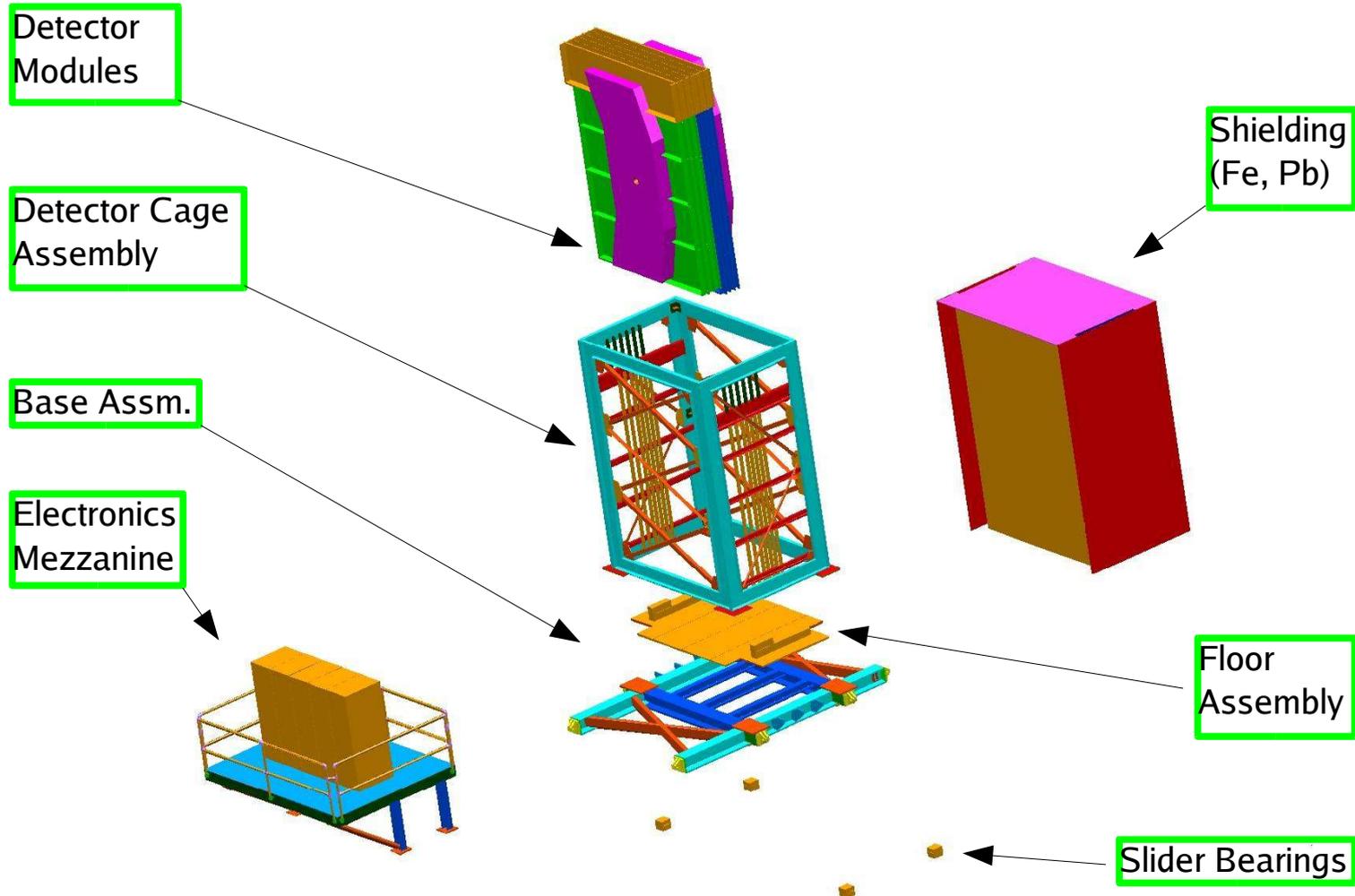


# BigBite Spectrometer

- Status of BigBite: see O.Gayous talk
  - BigBite is mounted on its stand in the Hall for SRC
  - Magnet was powered up to 500 Amps (we will need 700 Amps)
- Special for  $G_E^n$ : detector package
  - Detector support frame:
    - on-site (physics storage)
  - MWDCs for tracking
    - 1<sup>st</sup> chamber tested at UVa
    - 2<sup>nd</sup> & 3<sup>rd</sup> under construction (UVa)
  - Lead-glass shower/pre-shower:
    - lead-glass (100%) + PMTs (80%) on-site
    - UV curing finished
    - PMTs are being tested right now
  - Trigger scintillator
    - plastic is missing



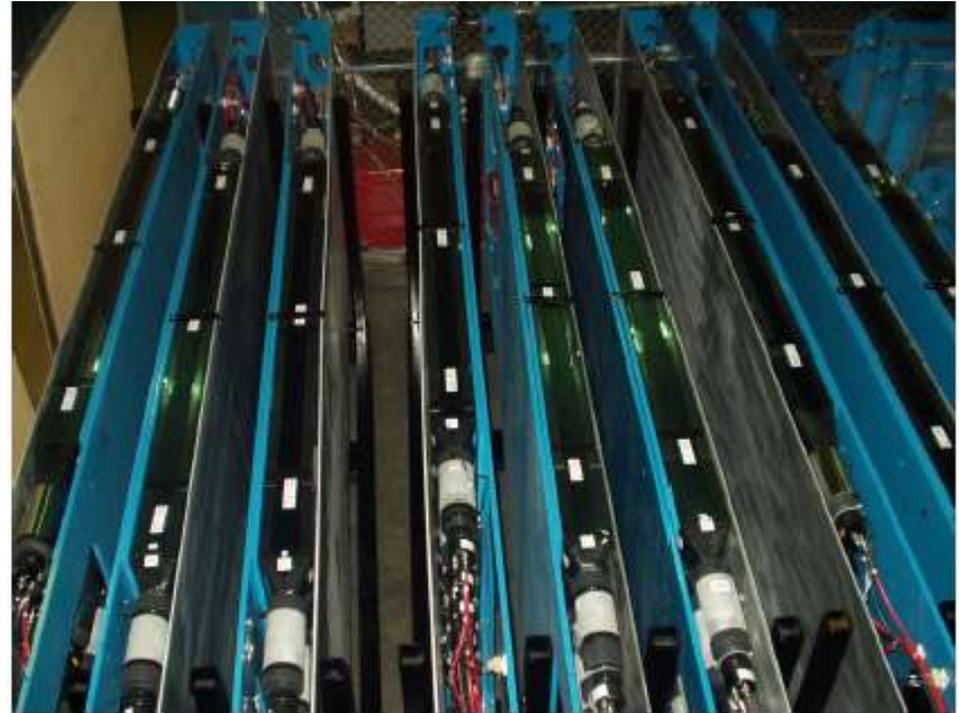
# Neutron Arm: An Artists View



# Status: Neutron Detectors

- UVA/JLab bars are refurbished, tested, and mounted in the cassettes or in N20 test-setup
- Glasgow bars: have been refurbished at Univ. of Glasgow, will arrive at JLab by mid of January
- CMU bars: refurbished at CMU, 50 just arrived at JLab, 50 more will come in March. PMTs need to be mounted
- Veto detector: are constructed, part of them are used for SRC
- Detector stand:
  - cassettes are on-site (besides CMU cassettes)
  - design of cage is 90% finished, final drawings should go to procurement this year
  - delivery of all parts in mid of February

# UVA/Jab Cassettes



# Status: Front End Electronics / DAQ

- FEE/DAQ for neutron arm is mostly assembled
  - ½ of it is in the Hall and will be used in SRC
- TDCs for neutron arm are ordered
- ½ of DAQ for MWDC is assembled at UVA for testing the first chamber, remaining modules are on-site
- detailed concept for BigBite DAQ (shower/trigger) is finished, nearly all electronics modules are on-site or located. not too many spares available.
  - assembly needs to wait until end of SRC
- 75% of cables are finished

# Timeline (in my world, detectors only)

- January/February 2005
  - finish vetos
  - work on lead-glass
  - work on 1<sup>st</sup> wire chamber at JLab with cosmics/radiative source
  - work on CMU and Glasgow bars
- March/April/May 2005
  - 2<sup>nd</sup> wire chamber finished and tested with cosmics
  - 1<sup>st</sup> wire chamber tested with beam (parasitic with SRC, facility development time)
  - BigBite tested at max. field, effect on PMTs studied
  - N20 tested with beam
  - remaining n-bars mounted in cassettes, installation of cassettes in neutron cage, cabling of N-200 starts
  - construction of Shower/Preshower/Trigger box
- June/July 2005
  - 3<sup>rd</sup> wire chamber finished and tested with cosmics
  - mounting BigBite detectors in frame
  - assembly of FEE/DAQ for BigBite
  - finishing cabling of N-200

# Timeline (in my world, detectors only)

- August/September 2005:
  - test of the full N-200 detector with cosmics
  - test of the full BigBite detector package with cosmics
  - pulser tests of the complete setup (coincidences, relative timing)
- October/November 2005:
  - de-cabeling of N-200, BigBite detectors and DAQ in TestLab
- December 2005, January/February 2006:
  - de-installation of HAPPEX (cryo-target, septa), installation of E02-013
- March/April/May2006:
  - E02-013 takes commissioning, calibration and production data

this is only a rough draft for the detector

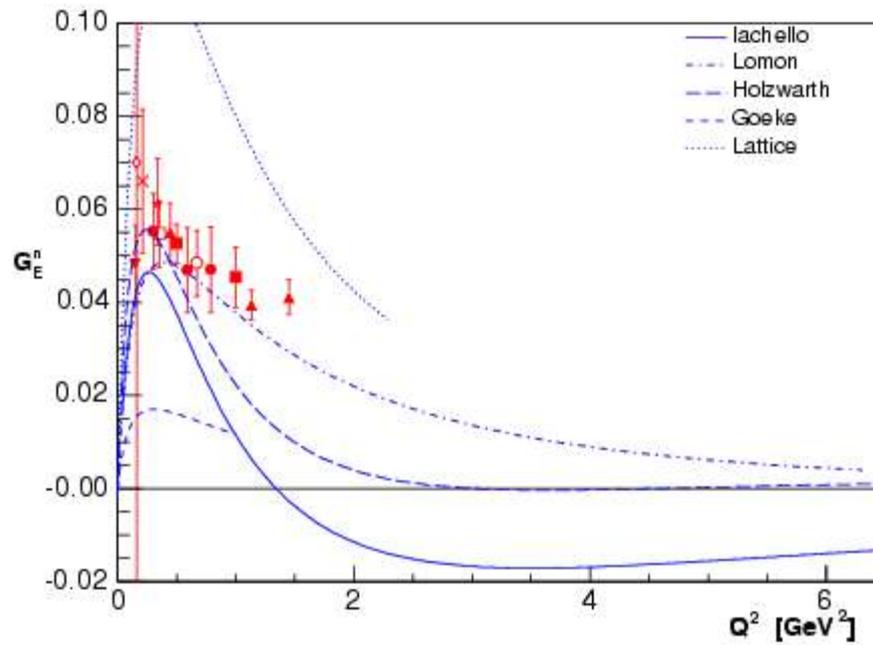
similar timelines for target and software are worked on

some of the tasks are labor intensive

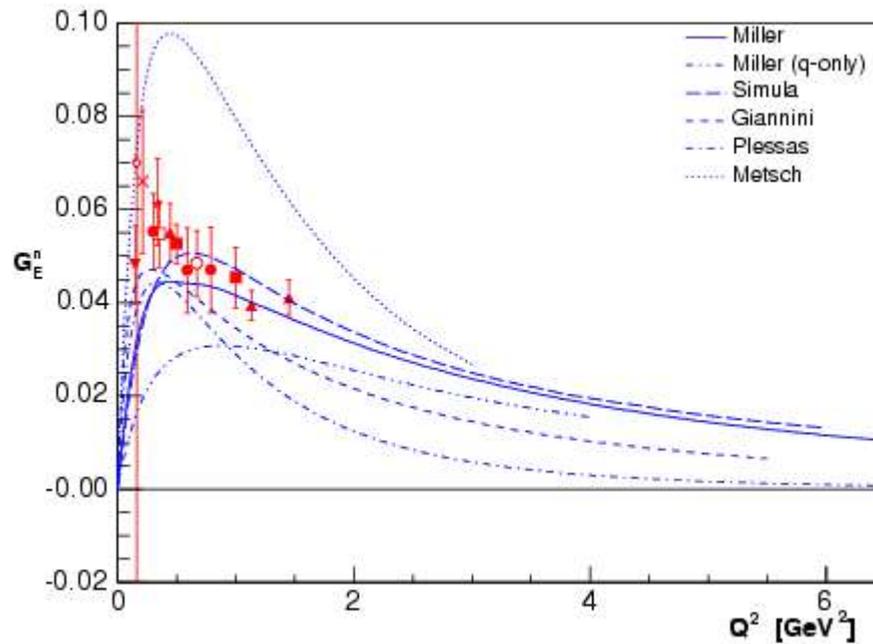
need support from collaboration (will counted like shifts)

# Theory (examples)

- **Vector Meson Dominance (VMD)**  
(Iachello, Gari-Kruempelmann; Lomon, nucl-th/0203081; PRC 66, 045501 (2002))
- **Combined Models**
  - Isovector  $\pi\pi$  channel, dispersion relations (Hoehler, Mergell)
  - Chiral perturbation theory (Fuchs) (limited to small  $Q^2$ )
- **Relativistic Chiral Soliton Model**  
(Holzwarth et al., hep/0201138)
- **SU(3) Nambu-Jona-Lasinio model**  
(Goeke et al., PRD 53:4013 (1996))
- **Light-Cone Diquark Model**  
(Ma, PRC 65 035205 (2002))
- **Relativistic Constituent Quark Models**
  - Light-front Cloudy Bag Model  
(G.A. Miller, PRC 66, 032201 (2002))
  - Light-front form of CQ  
(Simula, nucl-th/0105024)
  - Goldstone-Boson-Exchange Quark Model  
(Wagenbrunn et al., PL B511 33 (2001))
  - Hypercentral CQ  
(Giannini, PRC 62:025208 (2008))
  - Relativistic CQ  
(Metsch, EPJ A)
- **pQCD predictions**
  - Asymptotic behaviour (very high  $Q^2$ )
- **Lattice QCD** (Ashley, Schierholz, QCDSF)
  - Ab initio calculation
  - Presently: large error bars in quenched approximation



Misc. Models



Constituent  
Quark Models