Magnetic Field Measurements of JGG and Rosie

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- Ziptrack
  - Why do it
  - What is it
  - Who did it
- Results
  - Preliminary field maps
  - Comparison with previous field maps

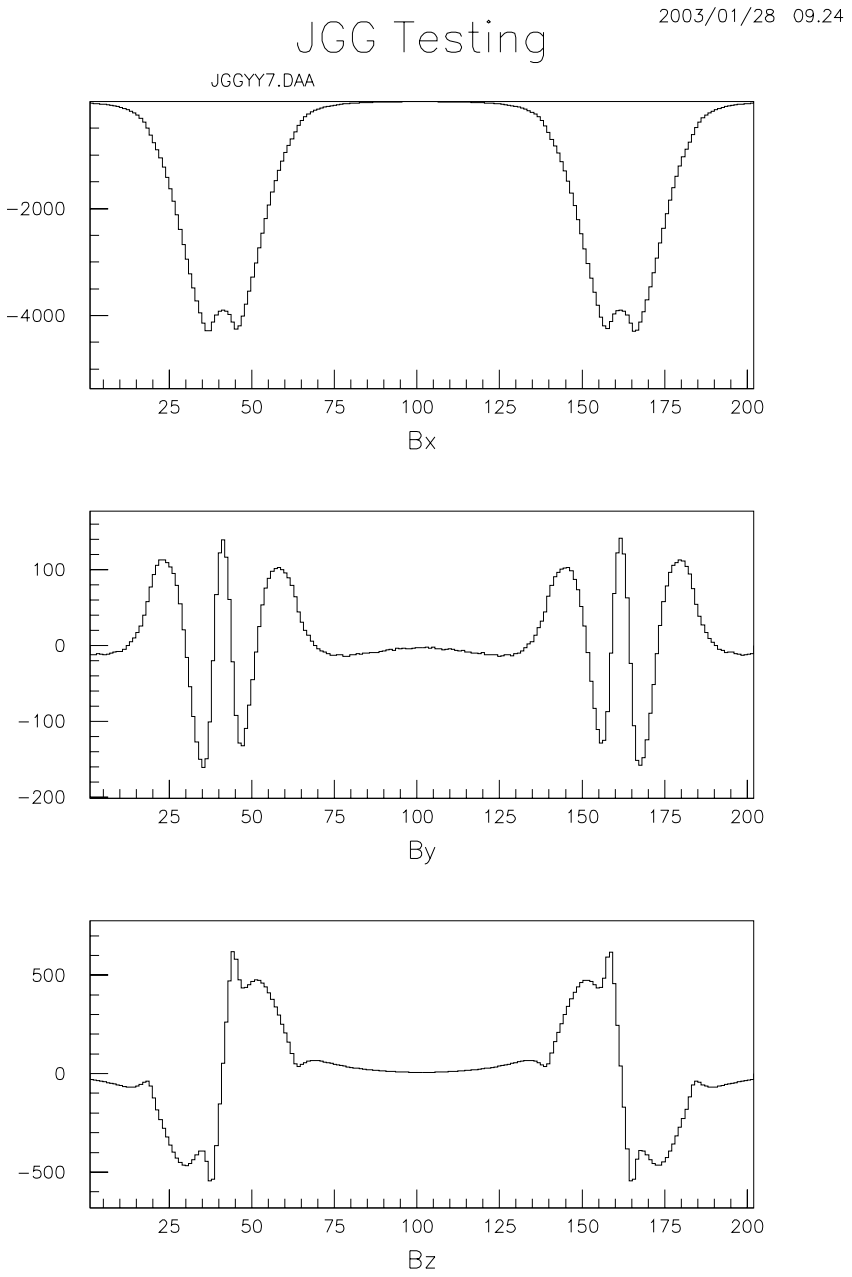
- Particle ID needs magnetic field.
  - Momentum resolution depends on good magnetic field map.
- Magnetic fields in MIPP:
  - +0.7 T in JGG (parallel to +y direction, up)
  - -0.6 T in Rosie (parallel to -y direction, down)
    - permanently installed Hall probes and magnet current monitor B-field stability
- Ziptrack
  - provides 3 components of B-field at each point of a grid throughout the magnet aperture
    - B-field at arbitrary point can be constructed using interpolation constrained by Maxwell equations
  - Large apparatus
    - Conflicts with other detector setup -> critical in time-line
  - Old, but finally worked quite well
    - Multiple repairs delayed work many times
    - Noise is a few Gauss -> sufficient

- Ziptrack was set up twice to cover full JGG aperture and once to cover Rosie
  - Two maps of Rosie were taken:
    - All eight coils
    - Six coils, shorting the one with the slow water leak and its partner
- Grid size: 2" ∗ 2" ∗ 2"
- Each setup was surveyed completely
  - Fermilab surveyors, Laser-tracker
  - magnet coordinate system
  - Roll, pitch, yaw, position for each grid point
- Start 13 Dec. 2002, finish 4 Feb. 2003

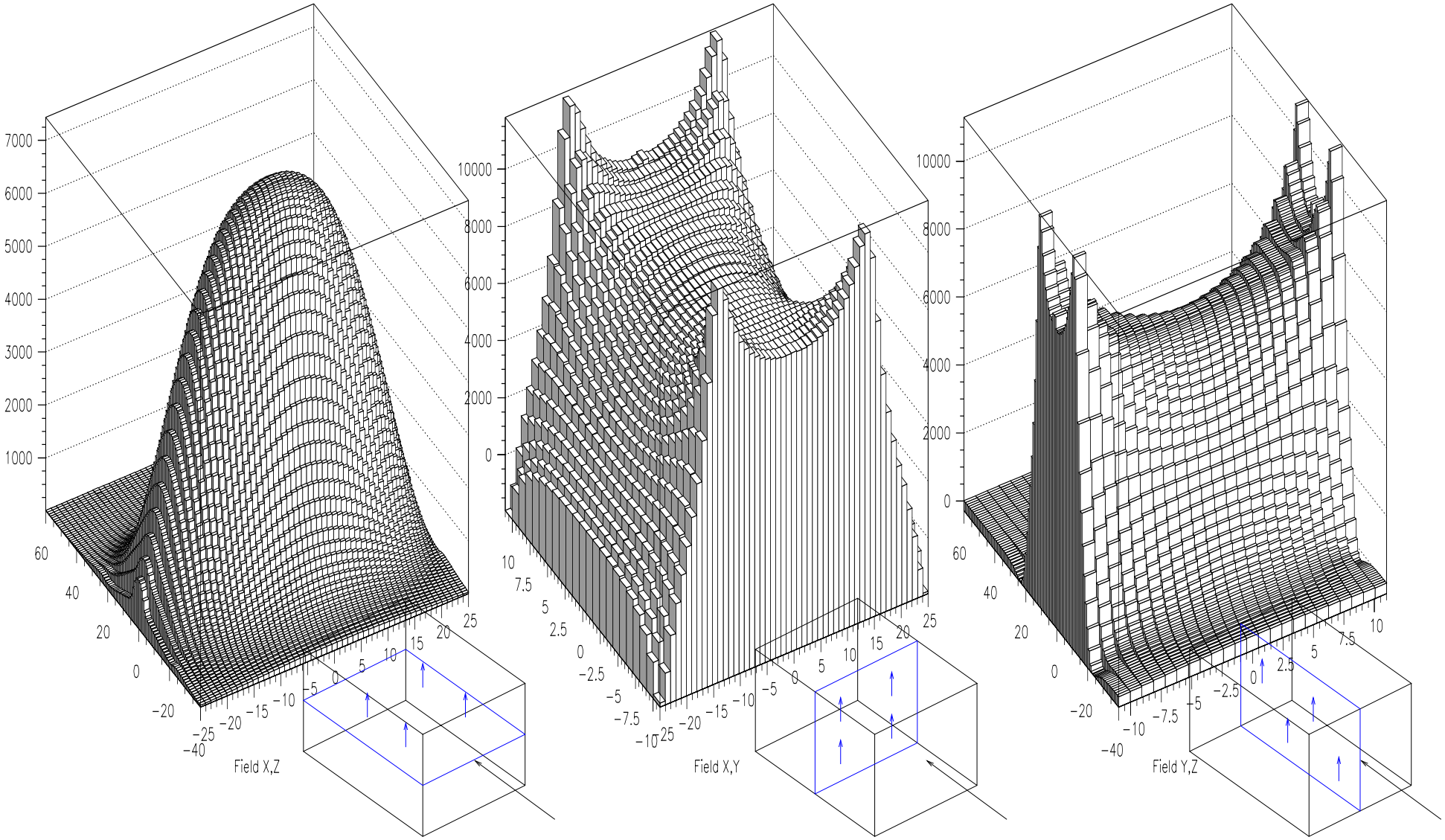
- Who's done it? Credits
  - Survey:
    - One day before B-field measurements, two days after that
    - Fermilab surveyors and Holger, Raja, Mike Roman
  - 8 hour Ziptrack shifts (8am-4pm / 4pm-midnight / midnight-8am)
    - Holger (5/5/2)
    - Pierrick (1/0/2)
    - Raja (2/1/1)
    - Dave Miller (0/1/1)
    - Win (0/2/0)
    - Adam Para, Dave Carey, Durga, Hangkyu (0/1/0)
    - Nick, Mike Roman (1/0/0)
  - Preliminary data verification and analysis
    - Doug Jensen and Holger

- Data in 2" grid with
  - -50" < x < +50"
  - -22" < y < +22" JGG
  - -80" < z < +120"
  - -32" < x < +32"
  - -16" < y < +14" Rosie
  - -140" < z < +114"
  - 354045 grid points
- Preliminary Analysis
  - Preliminary because...
    - Survey data not included in analysis, nominal positions used
    - Absolute calibration of Ziptrack Hall-probes not done yet
  - Software
    - In Fortran, inherited from KTeV
    - Simple data consistency checks, i.e.: Do 'forward' and 'backward' zip agree? Is data set complete and readable? Are data points 'smooth'?
    - Build and plot B-field
    - Use Maxwell equations to cross calibrate the three Hall-probes

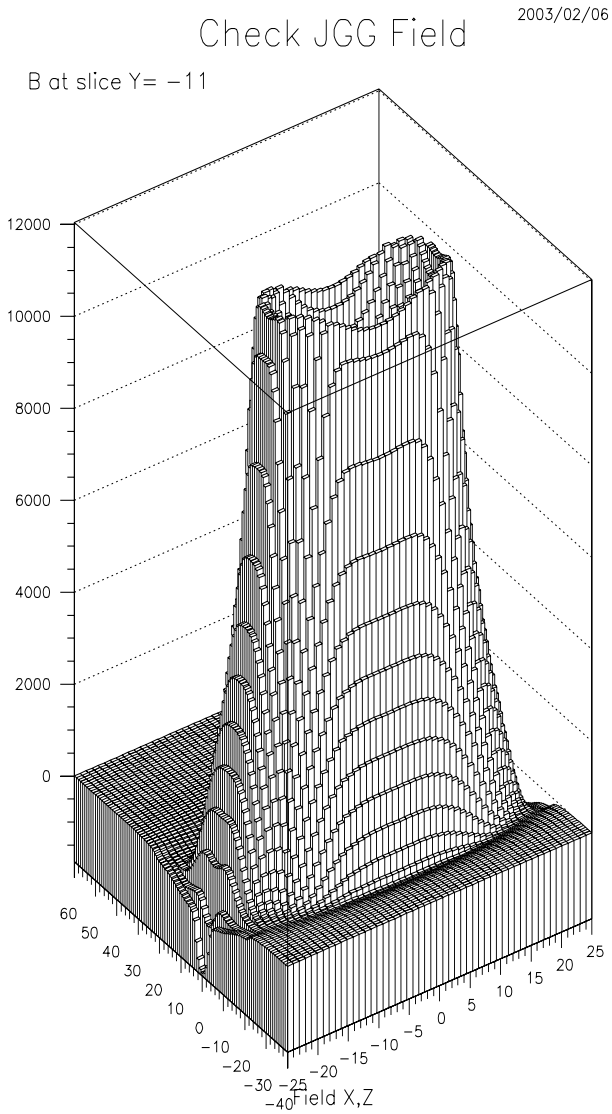
- One zip:
  - Take each point twice:
    cart moving forward, then backward
  - This zip shows the bottom west edge of the JGG aperture
    - Field changes rapidly near sides of JGG
    - Rosie looks much smoother

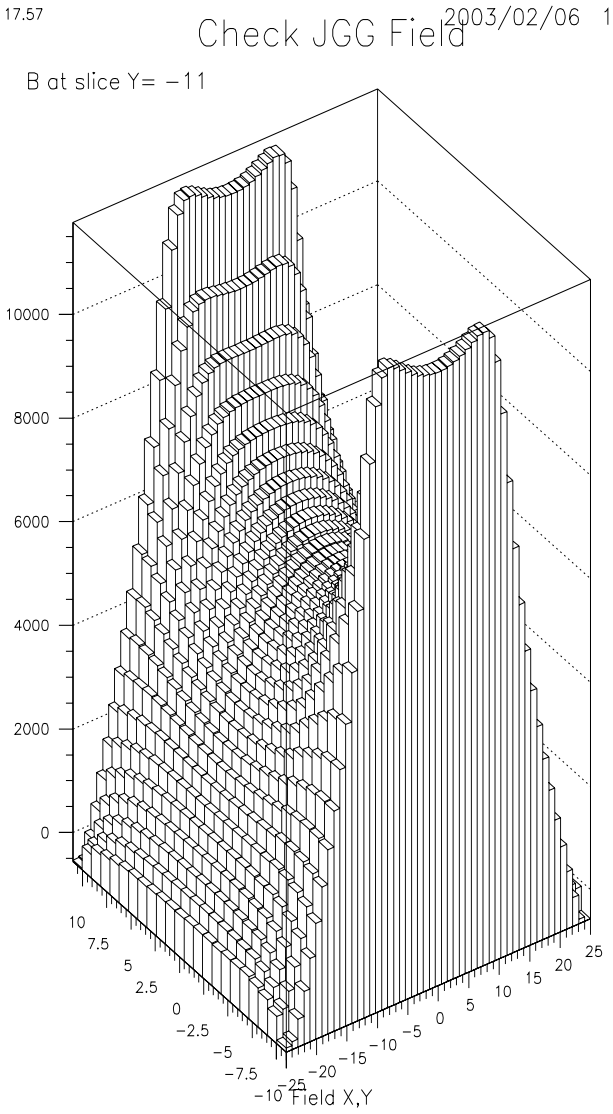


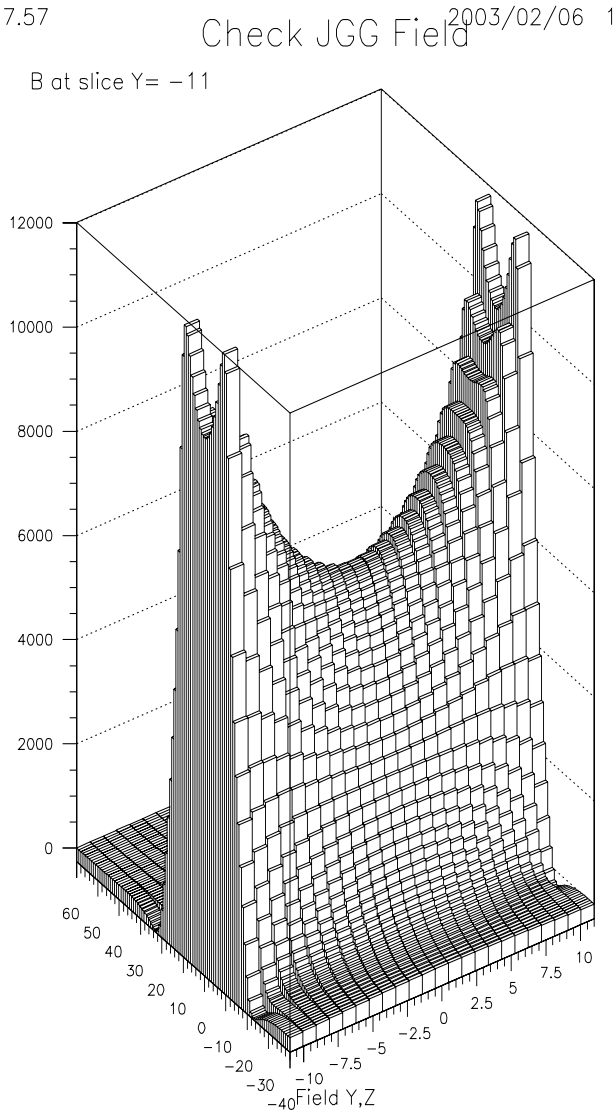
- JGG field plots: B_y component of field in projections at y=0, z=0, and x=0



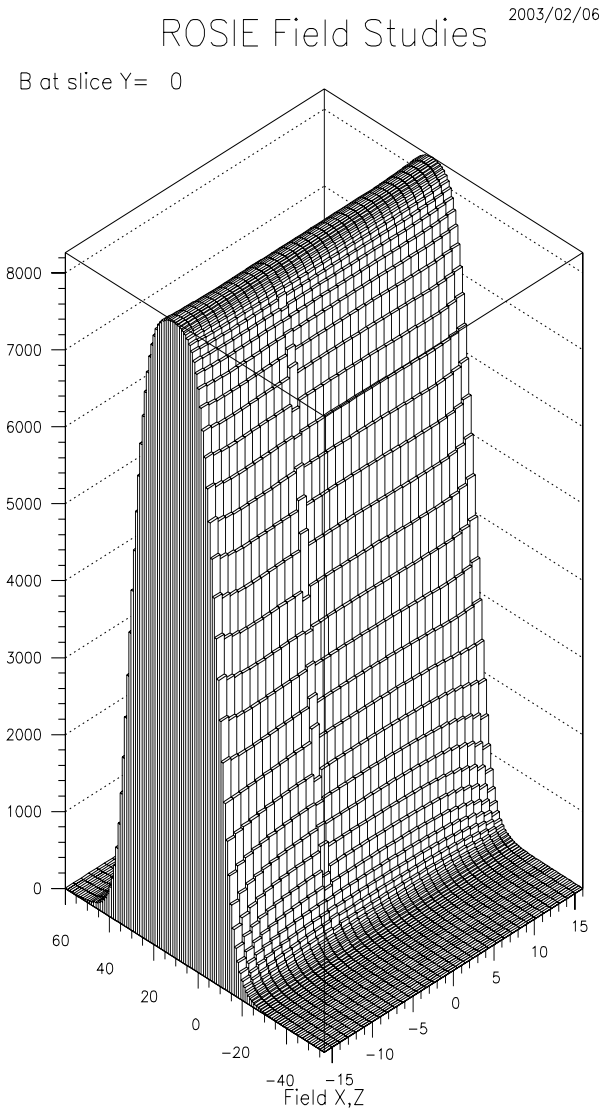
- JGG field plots: B_y component of field in projections at y=-22", z=-22", and x=-22"

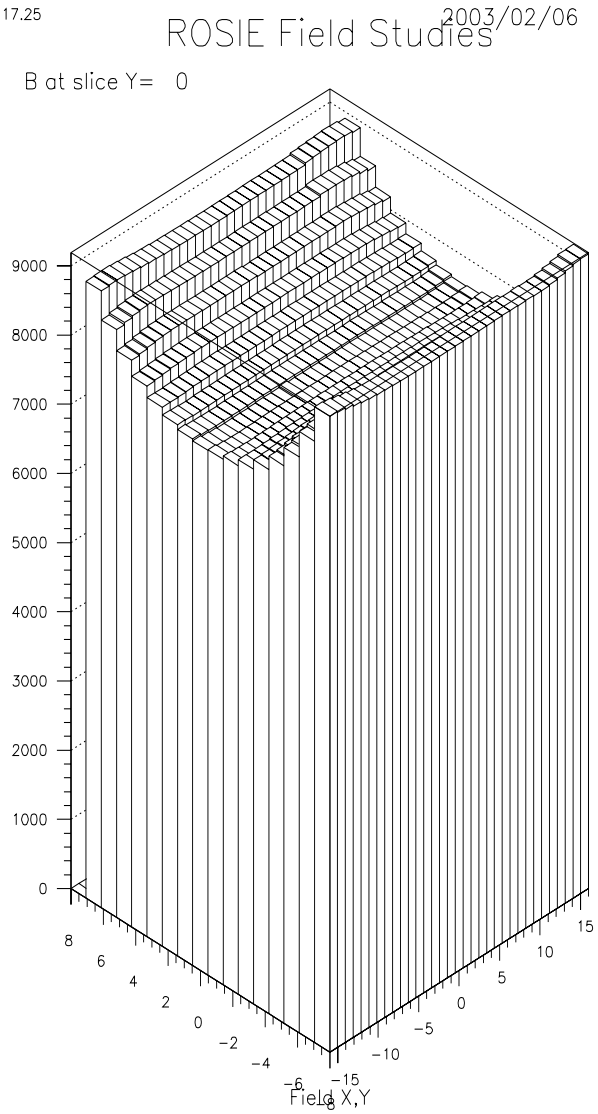


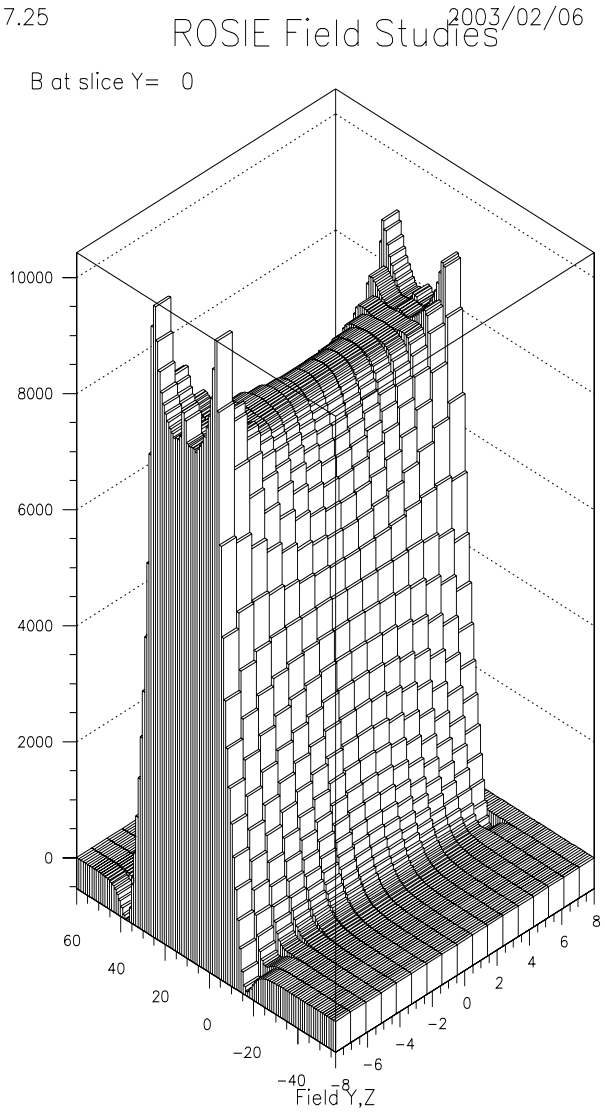




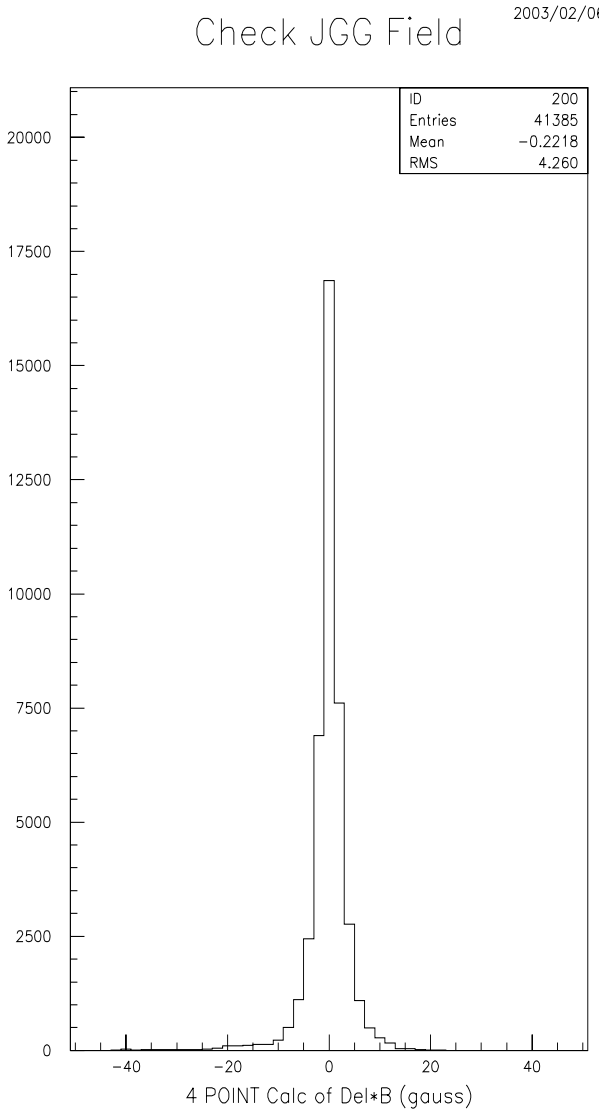
- Rosie field plots: almost independent of x-position

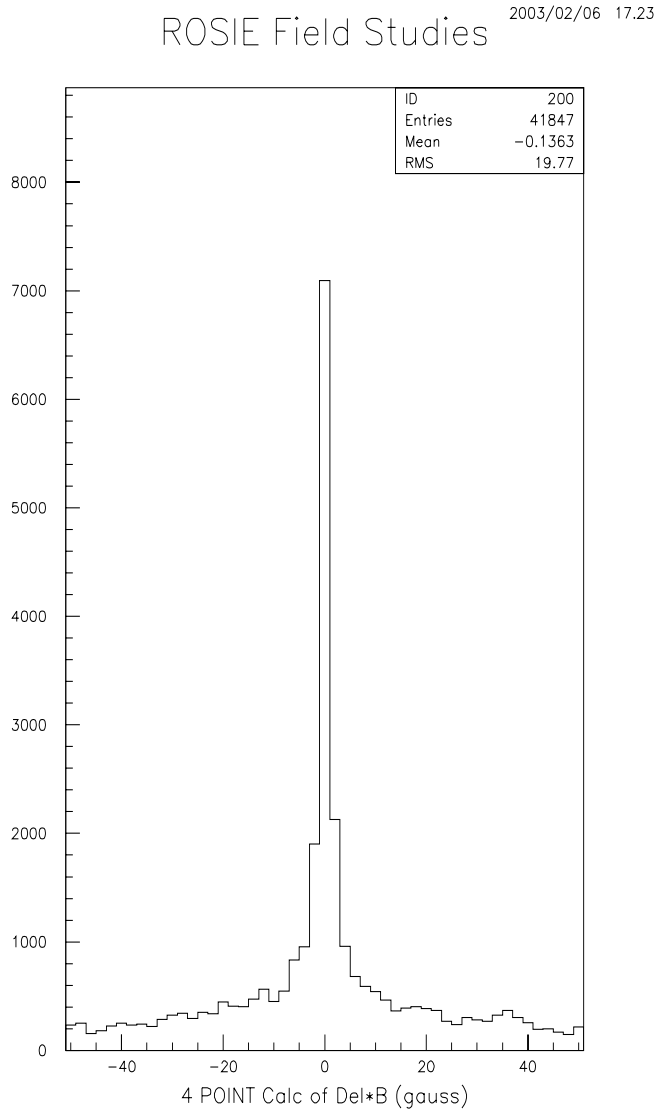






- How about Maxwell? $\nabla \bullet B$ in Gauss/Inch





- Previous B-field maps:
  - Both magnets have been ziptracked many times before
  - Currently used in MC
  - Based on smaller grids (but 1" spacing in z-direction)
  - Measured at different field strength (irrelevant)
  - To first order identical to the new field maps (after scaling)
  - Too early to make detailed comparisons