1. NAME OF INITIATIVE: GTeV (Gluon Physics at the Tevatron).
List of major collaborating institutions (including non-US partners).
No institutions have yet been asked to make a commitment to collaborate. We expect that the collaboration will form in early 2005. Co-leaders of this initiative are Michael Albrow (Fermilab) and Andrew Brandt (UTA). There are other conveners of study groups.

2. SCIENTIFIC JUSTIFICATION:
Physics goals. How does it fit into the global physics goals for the entire field.
Quantum Chromodynamics (QCD) is the Theory of Strong Interactions among quarks and gluons, and has been tested in certain domains, in particular at small distances or (equivalently) high momentum transfers Q. That is "perturbative QCD". At large distances/small Q the strong coupling becomes ~ 1 and perturbative calculations fail. This domain, non-perturbative QCD, is rich in phenomena and tends to be led by experiment. It is a dominant part of strong interaction physics, present in every collision involving hadrons (thus every collision at the Tevatron and the LHC), and we do not understand it well theoretically. There are phenomenological models that enable one to simulate collisions, but all involve some arbitrariness. An ultimate and worthy goal is to explore the strong interactions at all scales (Q = 0 to infinity!) and understand it at a theoretical level.

Much of this physics is being done now in CDF and D0, but much will not be done, mainly because of the focus on high pT phenomena (Higgs, SUSY, top, W/Z etc). Around 2008 this focus will shift to the LHC and an opportunity to make a serious study of QCD will present itself. The idea is that GTeV will use an existing central detector (the CDF, D0 or BTeV detectors) supplemented by relatively minor additions to increase the QCD potential. (In the case of the BTeV detector being chosen, it remains to be seen whether GTeV would exist as a separate collaboration or whether it would be incorporated.) The detector additions would be a series of small "roman pot" detectors far downstream for measuring very forward scattered protons and antiprotons. In the case of re-using the CDF detector an option would be to fully instrument the forward region (theta < 3 deg) with tracking and deeper calorimetry. In the case of using the BTeV detector, probably the full solid angle not instrumented by BTeV would be covered by simple shower counters (to veto hadrons and pi-o's). These options are still at the conceptual level.

Some specific physics goals (there are many others) are (1) measure the gluon content of the proton at very small momentum fraction x_Bjorken. (2) study the fragmentation and other properties of gluon jets. (3) study the spectra of glueball and hybrid states and other exotic hadrons (4) study exclusive reactions pp --> p+X+p where X is a state with vacuum quantum numbers, e.g. chi_c, chi_b. (At the LHC one would include Higgs in this list.)

How does it fit into the global physics goals for the entire field:
Our mission is to understand the elementary particles and their interactions. Apart from gravitation, the interactions are strong and electroweak. Much attention is focused on the

electroweak interactions, both experimentally and theoretically (neutrinos, CP violation, W/Z, t,b,c decays etc.). The strong interaction, especially at large distances/small momentum transfers, is rich in phenomena that we must measure and understand theoretically before we can claim to have a complete understanding of QCD. Lattice Gauge Theory is a major initiative to attack this field, but it is restricted to volumes of hadron size and it approximates spacetime as discrete. Thus it cannot calculate any reactions, even as "simple" as elastic scattering. Other diffractive phenomena and the nature of the pomeron are beyond its reach. They are addressed by Regge theory, which should ultimately be derivable from QCD. This initiative is to do high statistics precision measurements of QCD phenomena in hadron-hadron collisions, focusing on studies that cannot be done at the LHC or RHIC.

3. VALIDATIONS FOR SCIENTIFIC JUSTIFICATION:

Examples of recommendations and supporting statements from the committees, panels, and the community at large.

This initiative has not yet been presented to any committees. There has been a workshop at Fermilab May 20-22 2004: http://conferences.fnal.gov/qcdws/
on "The Future of QCD at the Tevatron" with 40 participants to review possibilities.

4. DESIRED SCHEDULE:

List major milestones (month & year) such as design complete, construction start, construction complete, etc.

March 2005: Letter of Intent to PAC
September 2005: Proposal to PAC
December 2005: Decision to make ~8 high field superconducting dipoles for Tevatron.

Summer 2009: Installation of s/c dipoles, roman pot detectors and other upgrades to CDF, D0 or BTeV. Commission new detectors, triggers etc.

5. ROUGH ESTIMATE OF COST RANGES:

Whatever the best information available (eg. $M +/-30~50%, $150~250M, etc.). Total cost range including non-DOE funding (if any other funding sources are assumed and if known, state from where and how much. Also indicate remaining R&D cost to go.

Eight high field (6.2T - 6.5T) dipoles including contingency, if built at Fermilab: $15M
Roman pots with detectors and other additions to central detector, approx: $2M

6. DESIRED NEAR TERM R&D:

Major activities needed to be completed before start construction.

High precision timing (~30 ps) on small (~ 3 cm x 3 cm) area detectors in pots.
No other detector R&D identified at present. Interest in radiation hard silicon strip detectors.
High field dipole studies desirable before proposal submission.

7. BRIEF DESCRIPTION OF LABORATORY'S ANTICIPATED ROLE:

Expected unique capabilities to be provided by lab. Rough estimate of human resources from lab (#FTE in what type labor).

Fermilab should design 6.2T – 6.5T dipoles for Tevatron, with same temperature and current as existing dipoles. (Two HF dipoles replace three existing dipoles opening space for detectors.) Construct and test short prototype, and construct eight magnets (six for installation in Tevatron plus two spares). This magnet construction could be contracted out to another accelerator laboratory.

Accelerator Division to provide, or supervise construction from outside source, sections of vacuum chamber incorporating roman pots, and take responsibility for installation and operation of pot mechanics.