

BTeV - A Dedicated B Physics Experiment at the Tevatron Collider

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ABSTRACT: Exploiting the large number of heavy quarks produced at the Tevatron collider, the BTeV experiment is designed to make precision measurements of Standard Model parameters and to perform an exhaustive search for physics beyond the Standard Model. Last year the BTeV collaboration has been given approval by the Fermilab director. In our presentation at the HEP 2001 conference we discussed some of the many technological challenges the BTeV collaboration faces designing and building the detector. High interaction rates with a very unfavorable signal to noise ratio, large radiation backgrounds and the need to minimize the amount of material in the fiducial volume requires innovative designs for every detector component.

This report will not provide a detailed discussion of the BTeV detector. As we are in an active research and development phase the interesting details will change much faster than the time scales typical for the publication of conference proceedings. Instead, we will give only a brief description of the major components of the BTeV spectrometer and provide links to the up-to-date information on the World Wide Web.

1. The BTeV Experiment

General information about BTeV is available on the collaboration's web site. This site can be accessed using the URL:

<http://www-btev.fnal.gov/btev.html>

The transparencies of the presentation can be found on the conference web site:

<http://www.hep2001.elte.hu/>

The transparencies can also be downloaded in pdf format from the author's web site using the URL:

<http://www-physics.mps.ohio-state.edu/~klaus/research/talks/eps2001.pdf>

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2. The BTeV Detector

A schematic view of the detector is shown in Figure 1. The geometry is complementary to that used in current collider experiments. Each arm of the spectrometer covers the forward direction, 10 - 300 mrad, with respect to the colliding beams. This geometry allows BTeV to take advantage of the large b -production cross section at the Tevatron, a large Lorentz boost in the forward/backward direction which increases the reconstruction efficiency for B decays and improves the proper time resolution, as well as correlations in $b\bar{b}$ production at hadron colliders which significantly improve flavor tagging efficiencies.

Charged particle tracking and vertexing is accomplished by a combination of a silicon pixel vertex detector and a forward tracker. The pixel detector will contain approximately 3×10^7 rectangular pixels, each $50 \mu\text{m} \times 400 \mu\text{m}$, connected to a custom designed read-out circuit by a "bump bond". The pixel detector is arranged in 31 stations each consisting of two $10 \text{ cm} \times 10 \text{ cm}$ planes. A $12 \text{ mm} \times 12 \text{ mm}$ hole is cut out for the colliding beams. Details of the BTeV pixel detector and the custom designed readout electronics can be found at <http://www-rhvd.fnal.gov/>

The forward tracker consists of 4-mm diameter straw tube driftchambers and silicon strip detectors in the high occupancy areas near the beam pipe. Further details are available at <http://www-btev.fnal.gov/workgroup/straws/straws.html> and <http://www-btev.fnal.gov/workgroup/tracking/index.html>

Particle identification over a wide momentum range will be provided by ring-imaging Cherenkov counters (RICH). Access <http://www-btev.fnal.gov/workgroup/pid/index.html> for more information on the BTeV RICH detector.

The BTeV design includes an electromagnetic calorimeter for photon and neutral pion reconstruction as well as electron identification. The BTeV calorimeter will be built out of PbWO_4 crystals, very similar to the CMS calorimeter. Detailed information on the design, performance and readout of the BTeV EM calorimeter is available at

<http://www-btev.fnal.gov/ecal/>

The BTeV Muon detector (<http://web.hep.uiuc.edu/btev/public/>) provides independent momentum measurements for muon candidates using two 1 m long steel toroid magnets at 1.5 T. The active detection planes are built out of stainless steel proportional tubes.

Of central importance to the BTeV physics program is the detached vertex trigger. Using information from the silicon pixel detector this trigger searches every beam crossing for detached vertices, the characteristic signature of b quark decays. This first level trigger together with higher trigger levels and a high performance data acquisition system will give BTeV high efficiency for interesting b decays combined with excellent background suppression. Further information on the trigger and data acquisition systems can be found at:

<http://www-btev.fnal.gov/workgroup/trigger/trigger.html> and
<http://www-btev.fnal.gov/workgroup/daq/rocket/doc/html/index.html>

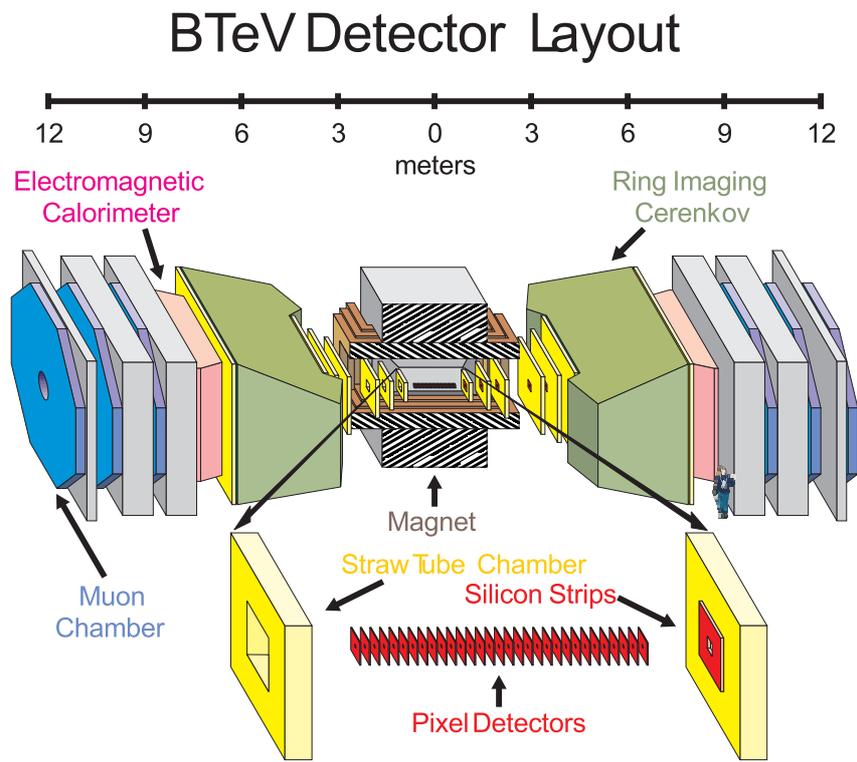


Figure 1: Schematic view of the BTeV Spectrometer.

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