Collaboration meeting,

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Multijet Trigger: Studies and Validation of Recent Data

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- What we are doing and why
- Calorimeter-only rates
- SVT: using present data
- Combined rates
- Conclusions

What it's All About

The use of SVT in combination with calorimetric requirements at Level 2 has been proposed as a means of obtaining a heavy-flavor enriched multijet sample, to be used for Higgs searches (as well as for several other exotic adventures): see CDF-5534, CDF-5547.

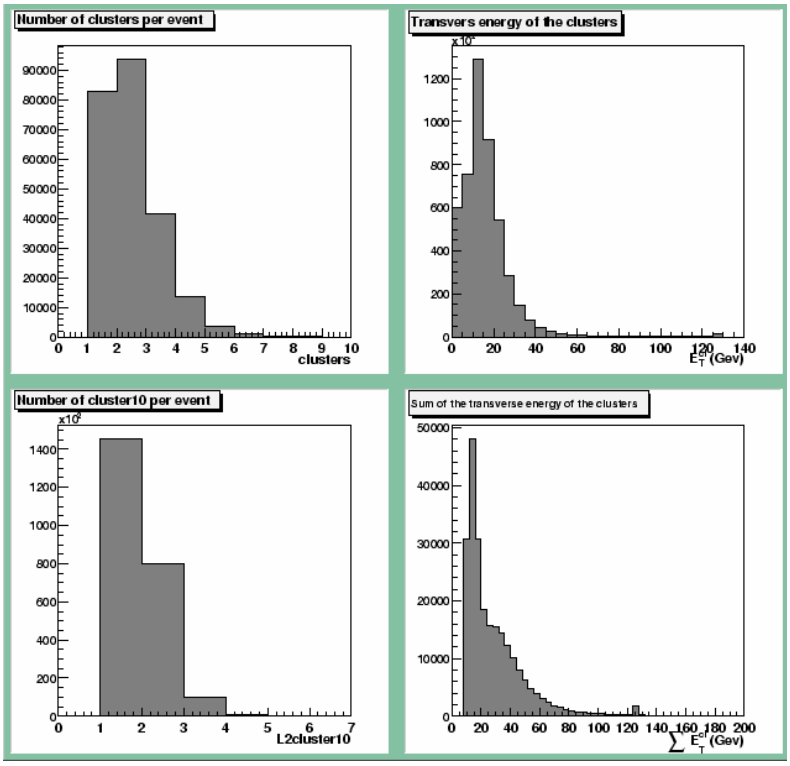
We are using the existing data to monitor the performance of the proposed Level 2 requirements of this trigger, and to verify and validate the predictions of earlier work with Monte Carlo data and Run I data.
As a by-product, we are in a way validating the data with respect to the primitives used in our studies.

The results and documentation of our ongoing work are available in
http://home.fnal.gov/~cortiana/multijet.html
and links therein.

Calorimeter-Only Rates

In order to verify the predicted rate of the new L2 multijet trigger we use data from the SingleTower10 L1 trigger, which consitutes its prerequisite.
Results shown refer to runs taken between 8/11 and 9/15; *they are being adjourned constantly in the web site as data pour in.*

Primitives: Trigger towers from TC2D_StorableBank, L2 Clusters reconstructed offline.

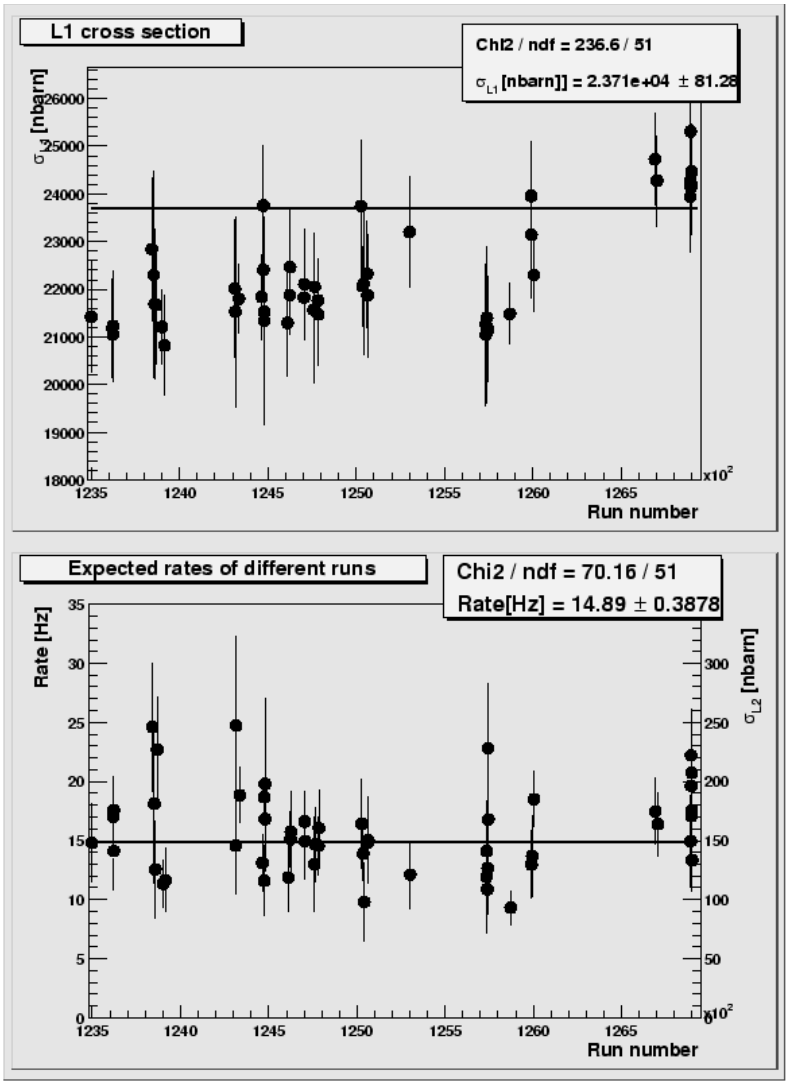


Three or more $E_T \geq 10\ GeV$ clusters are required, with total $\Sigma E_T \geq 90\ GeV$.

Computing L2 Rates

- $\star$ R_{L1} from DB;
- $\star$ $\overline{\mathcal{L}}$ aver. by run;
- $\star$ f_{L2} =pass/tot;

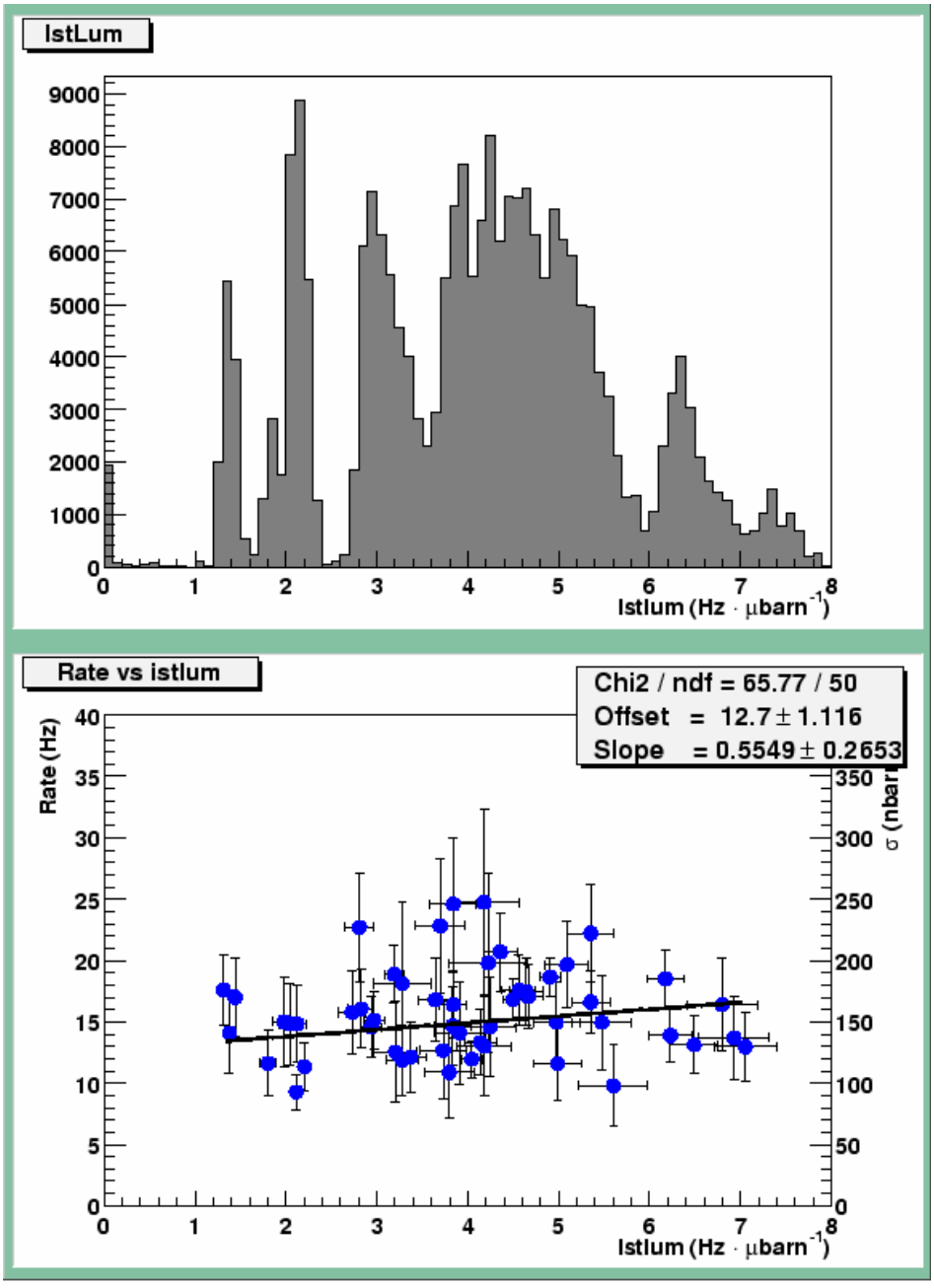
$\rightarrow \sigma_{L2} = f_{L2} * R_{L1}/\overline{\mathcal{L}}$.



The computed cross sections are stable and in good agreement with our predictions (CDF-5485: 154 nb).

Computing L2 Rates

We also monitor the dependence of the L2 cross section on instantaneous luminosity (it should rise slightly with $\mathcal{L}$):



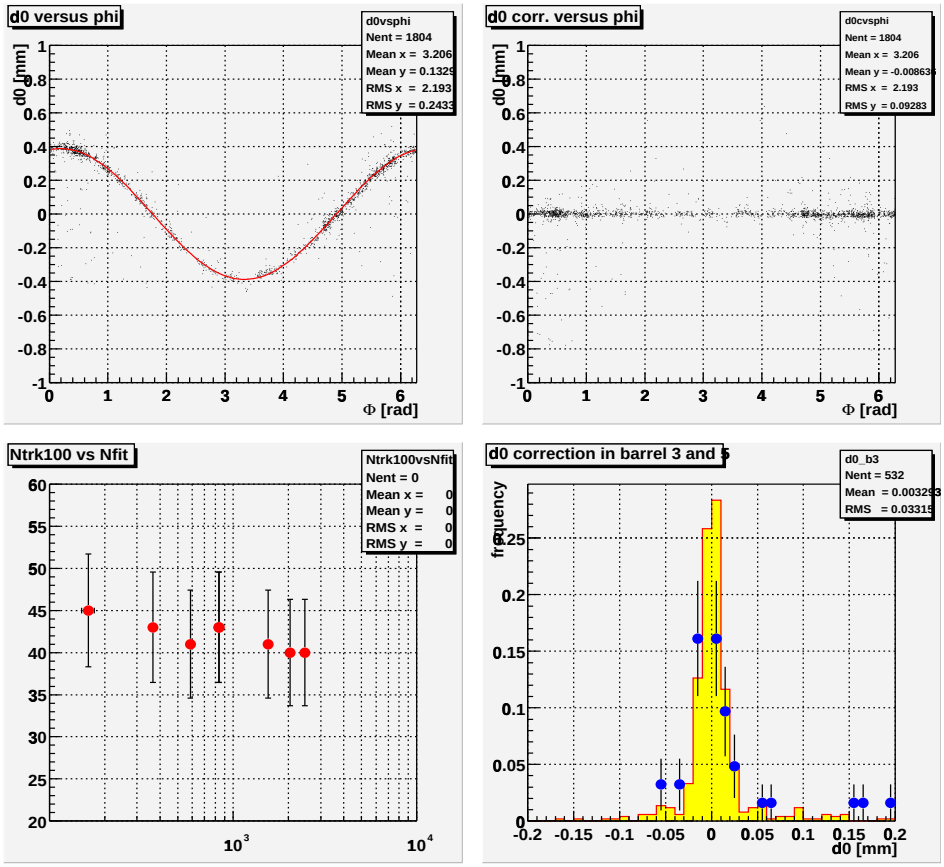
SVT: Using Early Data

Due to the *lack of the SVTD bank* in most of the data collected during August, in order to estimate the cross section of a Level 2 trigger using both multijet cuts and SVT requirements we ran SVTqwkSim_Standalone (courtesy G.Punzi), using the hits contained in the SIXD Storable Bank.

We considered tracks with start and end in the same half-barrel having $\chi^2 \leq 12.6$, $P_T \geq 2\ GeV$.

Using Jet20 data we fit the correlation between d_0 and ϕ to make the necessary correction on d_0. We obtain

$d_{corr} = d_{SVT} + (x_0 + x_s * B)\sin\phi - (y_0 + y_s * B)\cos\phi$.

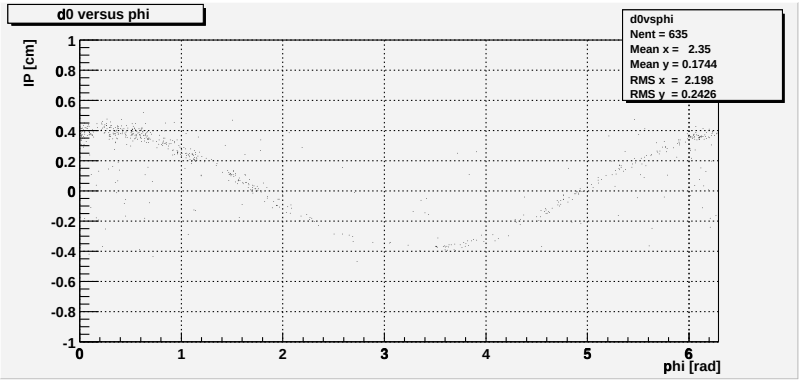


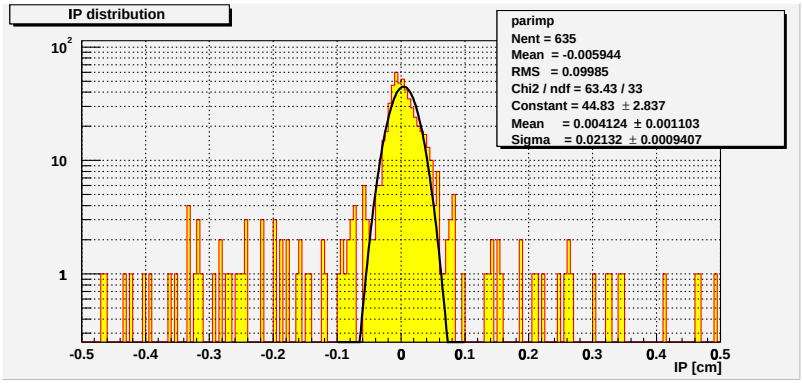
Combined Multijet+SVT Rates

Most data collected in August did not have the SVTD bank → at the TDWG on 9/7 we showed results using G.Punzi's SVTqwkSim_Standalone.

Recent data have SVT information which we substitute to the simulation. We still fit the $d \div \phi$ distribution, we will revert to SVDD info in a few days.

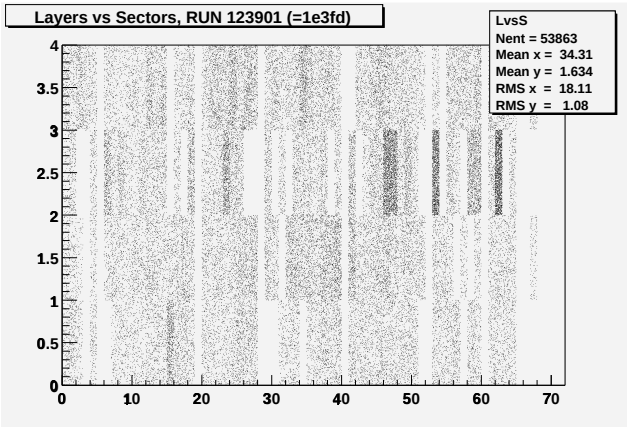
Data used: Jet20 from runs 124,475 to 126,900. L2 multijet criteria applied.





The correction is not very accurate, results are only demonstrative yet.

Extrapolating to a fully operational SVT



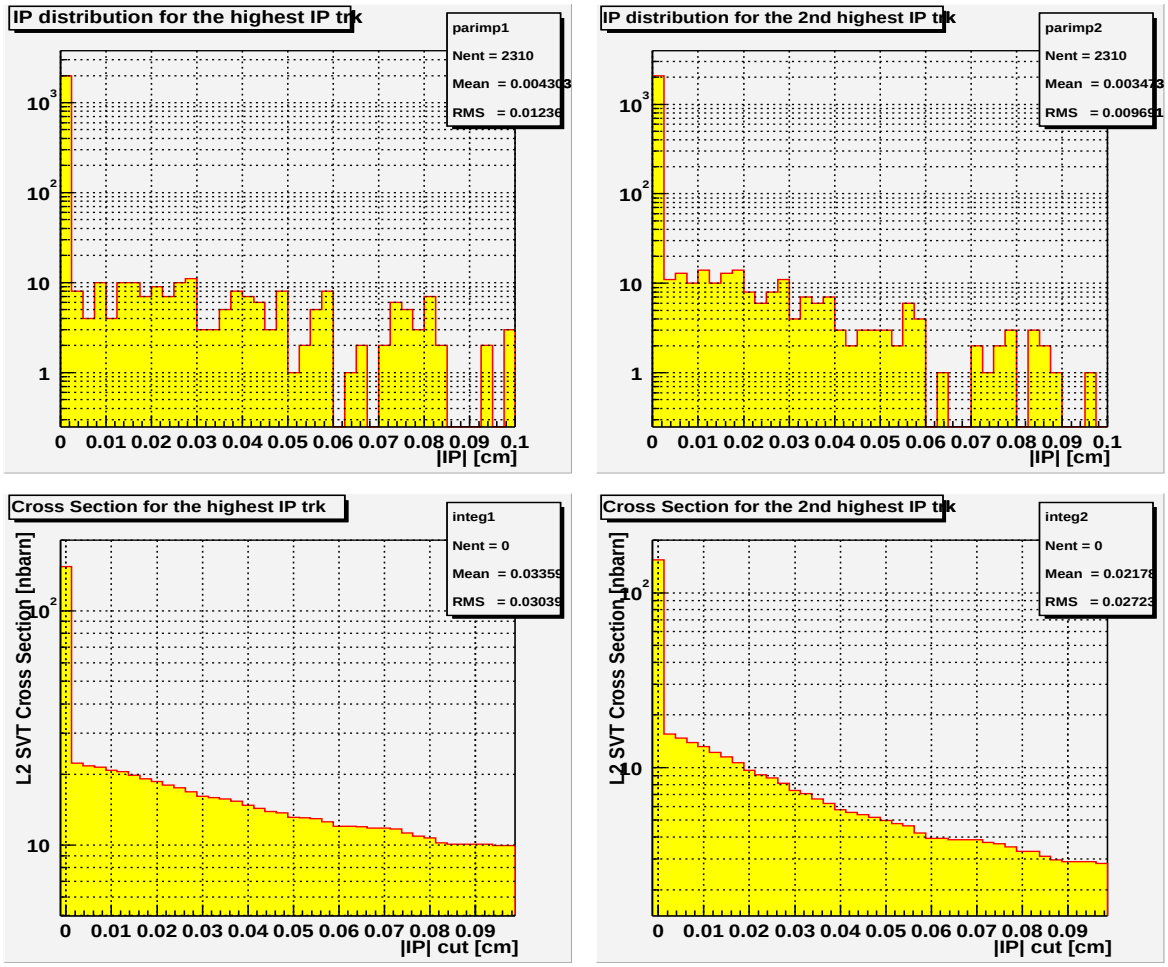
SVT data currently exists for only part of the 72 layers, and coverage varies run by run. We perform a simple extrapolation:

- For each half-barrel, compute the active fraction f and the observed N_{obs} SVT tracks in an event;
- get the most probable value of lost tracks as $N_{lost} = N_{obs} * (1 - f)/f$;
- get N_{add} from a Poissonian of mean N_{lost};
- use the observed distribution of impact parameters to assign a d_0 to each of the N_{add} tracks;
- $\rightarrow$ count how many tracks have $|d_0| > x$.

This probably results in an overestimate for prompt-track events; for real heavy flavors, it goes the other way.

Current Rate Estimates

The requirement of two tracks with $IP \geq 100\mu m$ reduces rates by an order of magnitude, roughly as expected ($\sigma_{L2} = 15\ nb$, CDF-5534).



However, we need more data and a more accurate correction to get realistic estimates.

Conclusions (if any)

- ⋆ Work is ongoing to verify the feasibility of the multijet+SVT trigger.
- ⋆ We hope to materialize this in a concrete stream as soon as SVT starts working at its full power.
- ⋆ Our goal is to get $20 \div 30 Mevents/fb^{-1}$ of high quality multijet+HF events on tape.