Exotic Trigger meeting,

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Higgs Multijet+SVT Trigger: short report

G.Busetto, **G.Cortiana**, T.Dorigo,

L.Scodellaro, R.Valandro

Padova University

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Review

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.

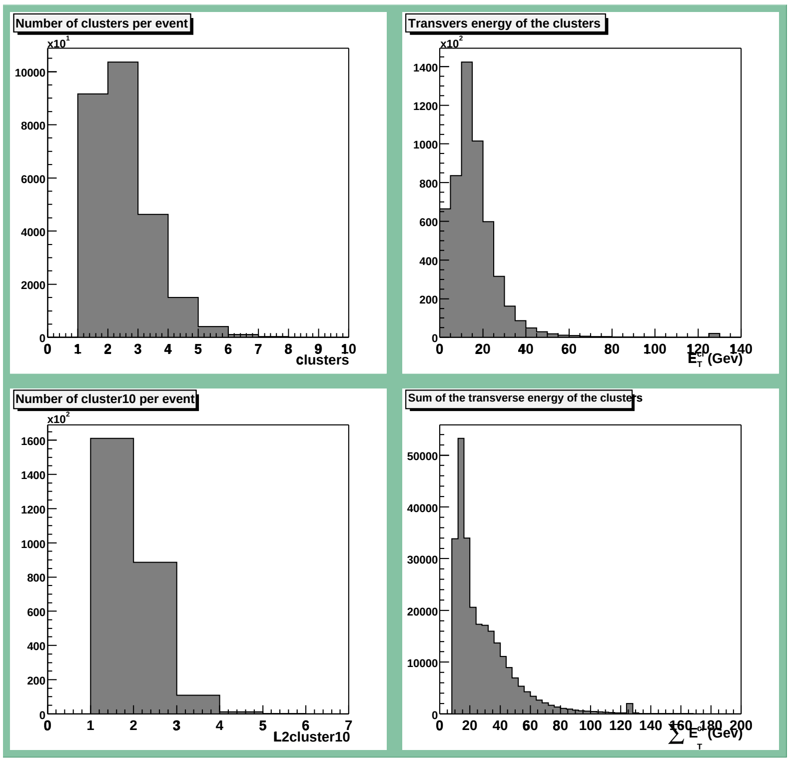
We are using the existing data to monitor the performance of the proposed Level 2 requirements of this trigger, and to verify and validate the predictions of earlier work with Monte Carlo data and Run I data.

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

Calorimeter-Only Rates

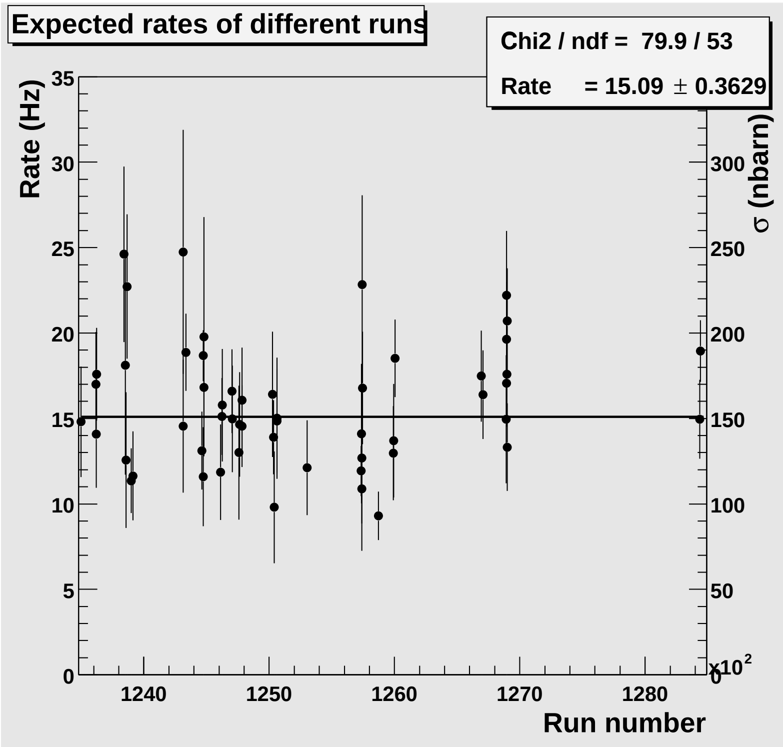
In order to verify the predicted rate of the new L2 multijet trigger we use data from the SingleTower10 L1 trigger, which consitutes its prerequisite.
Results shown refer to runs taken between 8/11 and 10/06; *they are being adjourned constantly in the web site as data pour in.*

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



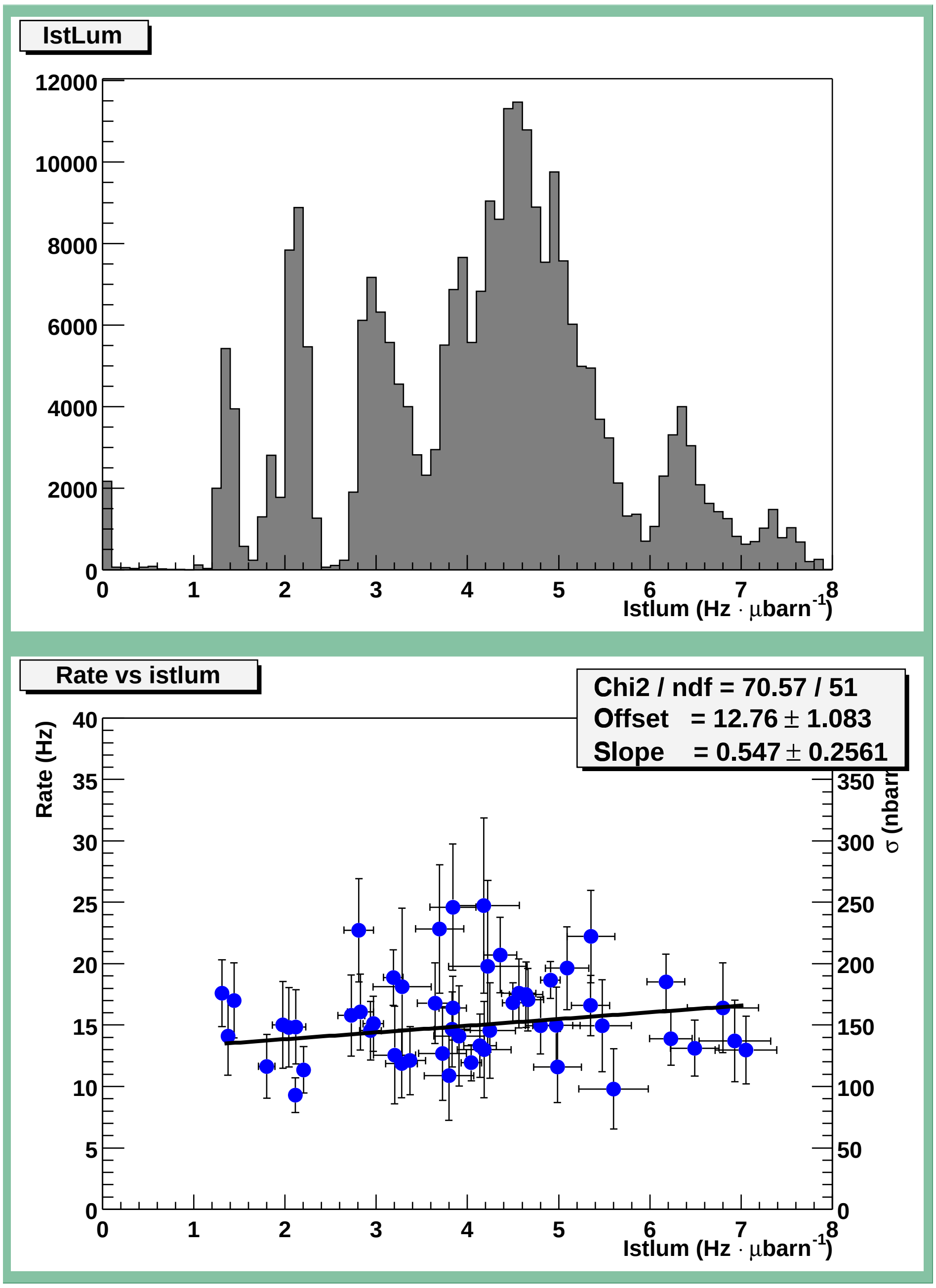
- ⋆ R_{L1} from DB;
- ⋆ $\overline{\mathcal{L}}$ aver. by run;
- ⋆ f_{L2} =pass/tot;

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

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 $\mathcal{L}$):



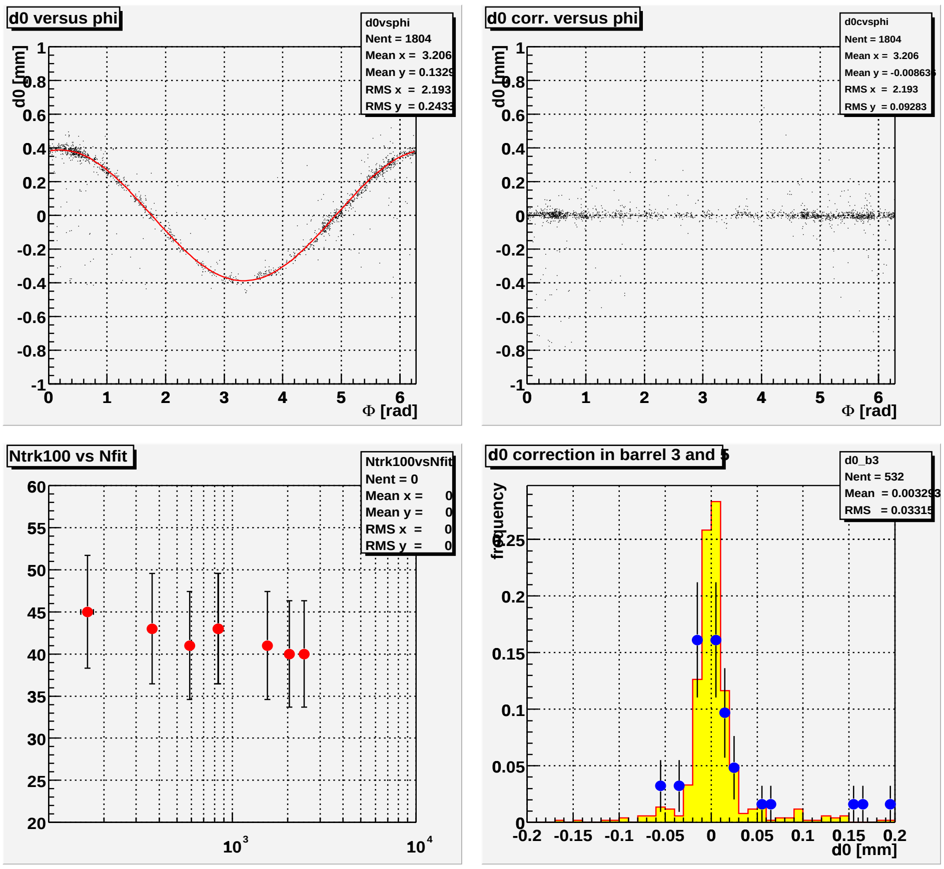
SVT: Using Early Data

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

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

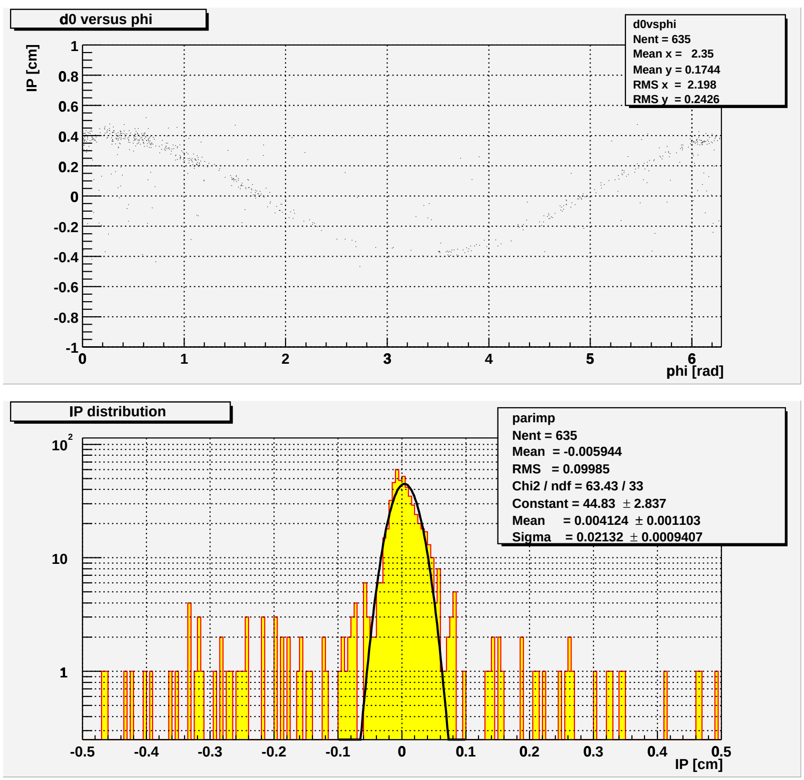


Combined Multijet+SVT Rates

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.

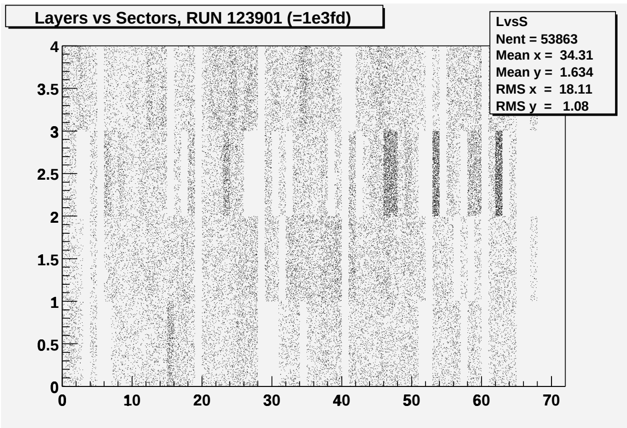
Recent data have SVT information which we substitute to the simulation. We still fit the $d \div \phi$ distribution.

Data used: Jet20 from runs 124,475 to 126,900. L2 multijet criteria applied. We still fit the beam position with an home-made fitting algorithm. Later data had the online correction performed.



Right now, the correction is not very accurate, results are only demonstrative yet.

Extrapolating to a fully operational SVT



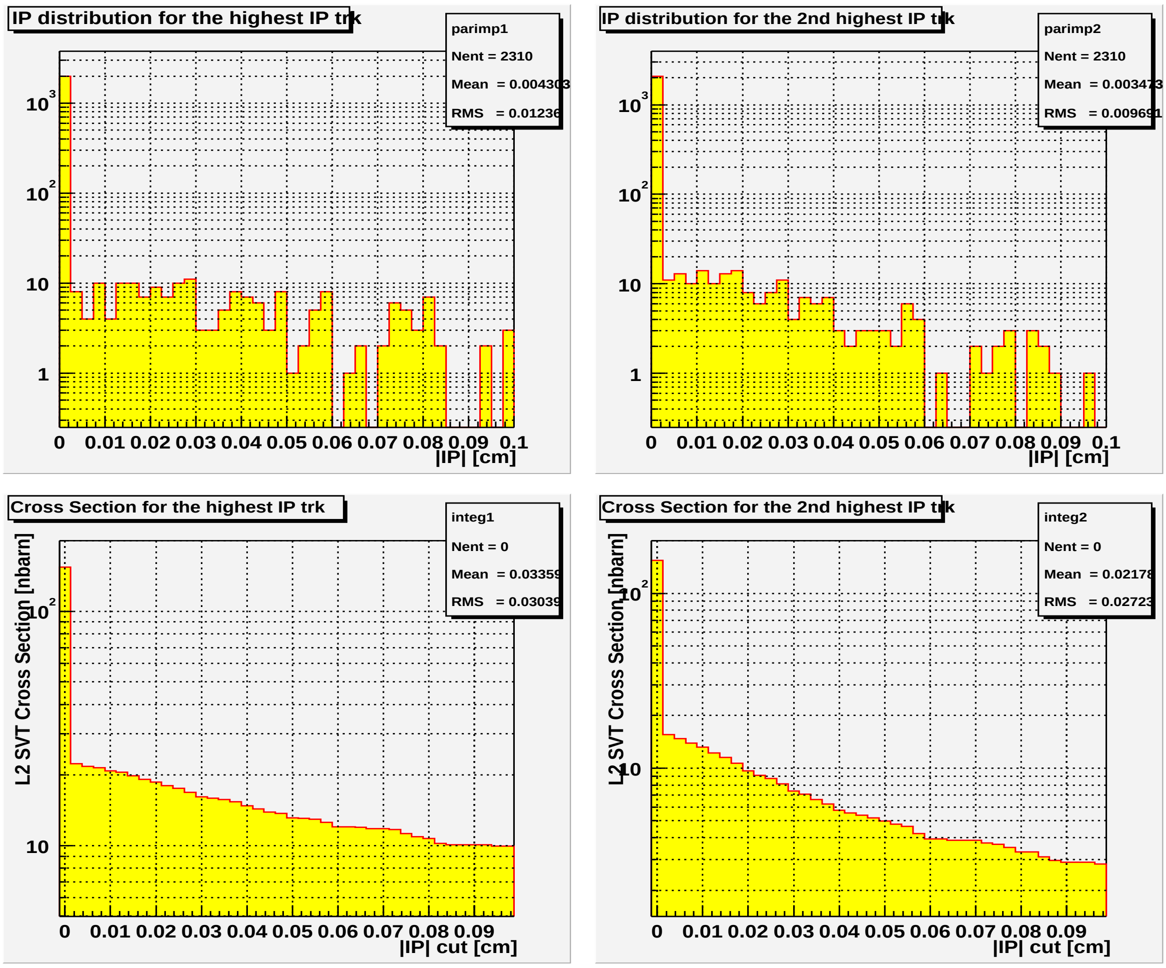
SVT data currently exists for only part of the 72 layers, and coverage varies run by run. We perform a simple extrapolation:

- 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).



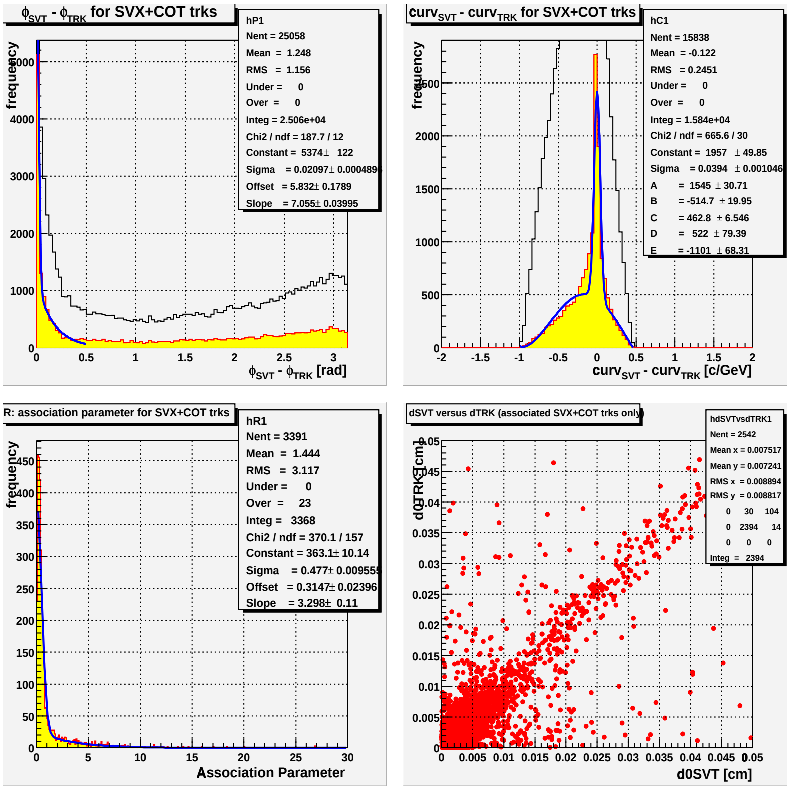
However, we need more data and a more accurate correction to get realistic estimates.

L3-Plans for the Ongoing Work

As shown in the previous slides, rates seem to be under control: we wish to further lower rates by studying primitives available at *Level 3*. What we are planning to start doing:

- *regional tracks reconstruction at L3*. MonteCarlo studies on VH signal and on outcoming data are planned.
- With about $2 \div 3$ Hz in input at Level 3, we should verify the *feasibility* of a regional tracking reconstruction *in terms of processing time* for those events passing L2 requirements.
- If this possibility could be realized, we should make our studies of rates by using the *improved resolutions* given by L3 algorithms to confirm L2 cuts.
- *Our hope is to lower, a little more, our final rates of events on tape.*

L3 + SVT Association



To analize the possibilities offered by the algorithms of tracking reconstruction at L3, we first perfom a match between tracks founded, on one hand, by SVT simulation on VH events, on the other from the global tracking on the same events. The association parameter is calculated using the following:

$$R_{Ass} = \sqrt{\frac{(\phi_{SVT} - \phi_{OFF})^2}{\sigma_{\phi}^2} + \frac{(Curv_{SVT} - Curv_{OFF})^2}{\sigma_{Curv}^2}}$$

On this tracks we will perform the same requirements of L2 tracks. We are looking forward to the possibility to require 1 o 2 SecVtX tags on the events. Our expectation are those that on tagged events will be quite fully efficient with our trigger.

Status of the Art

SVT working group is reporting in these days on the status of the silicon detector, because it seems to be more inefficient than expected with respect to the offline reconstructed tracks.

The two existent simulation of SVT, svtsim and svtqwk are in this moment in contrast, maybe due to the problem of the real SVT that is bit per bit simulated by svtsim.

The efficiency in $VH \to 4j$ events, by requiring 2 SVT fiducial tracks with IP over 100 μm is:

- $\sim$ 25% for svtsim;
- $\sim$ 50% for svtqwk.

Such a problem could have strongly affected our preliminary trigger validation on data taken during this summer.

Taking in account of this situation we are also planning some different requirements that will suit the task better than those previously studied in the case (remote we hope) that problems in SVT will still persist in the next times.

The possibility to trigger only 1 SVT track with IP greater than $\sim$ 150μm is going to be verified.

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.