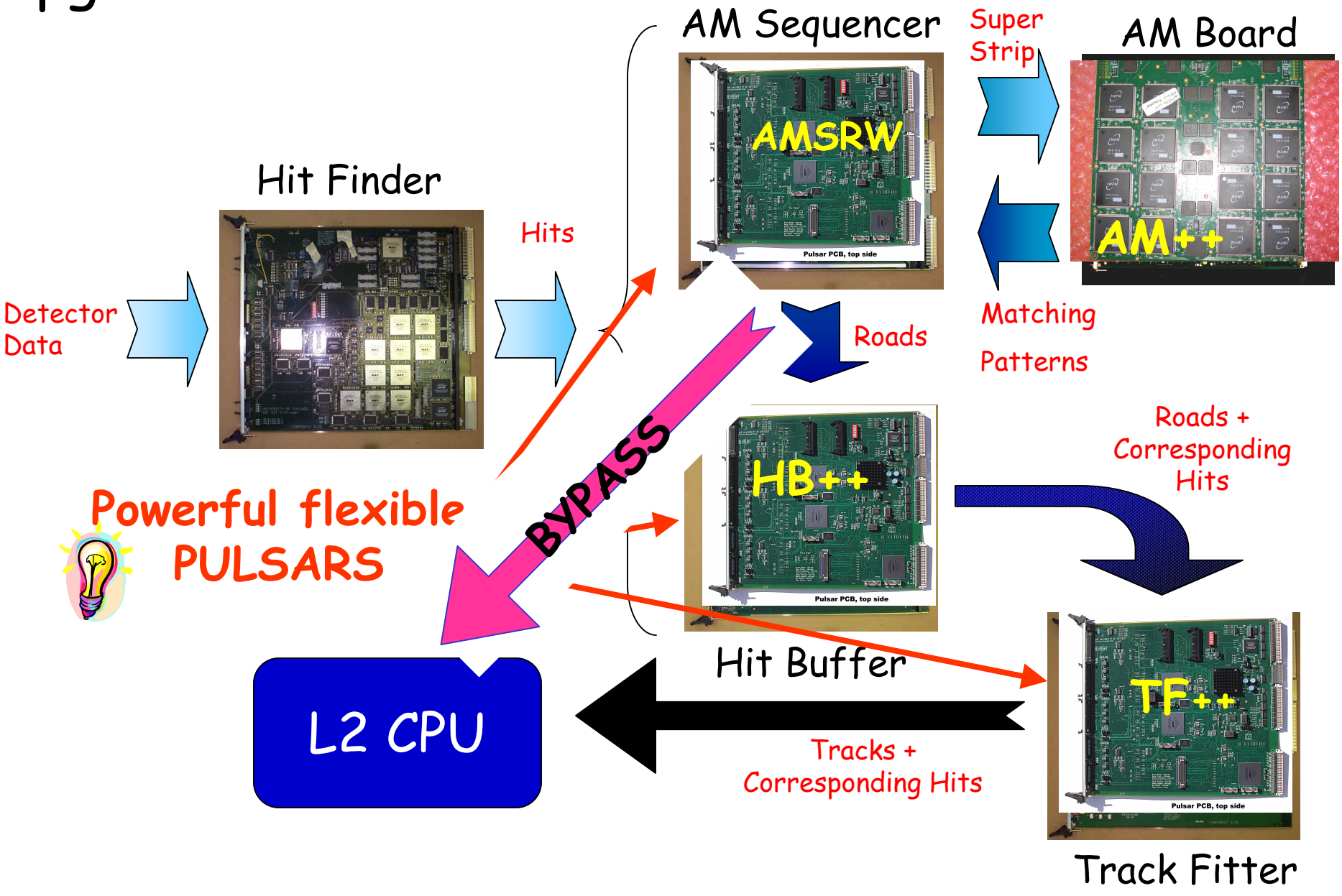
The SVT Bypass

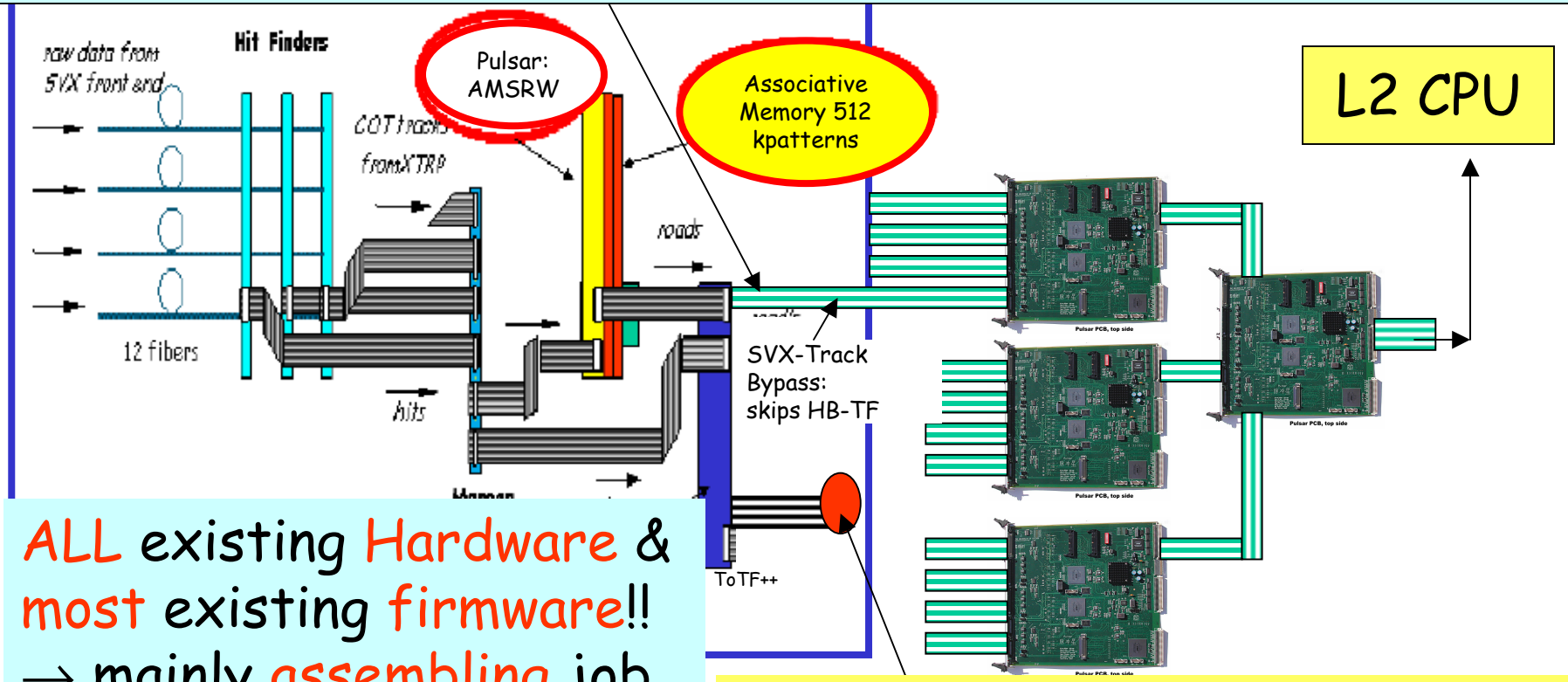
(not for review)

1. Hardware description;
2. Possible applications;
3. Technical feasibility;
4. Hardware requirements/needs; estimate on firmware/software effort, also include possible impact/correlation with other proposals.
5. Effort required to extract PHYSICS with these triggers
6. Man/woman power and time line of the schedule.
7. Conclusion - To-do list

SVT: many different boards→ 2 years for upgrade → PULSAR



Pulsar flexibility: A bypass to improve the road flow



ALL existing Hardware & most existing firmware!!
→ mainly assembling job

Stenosis: high resol. path

If an application requires extra patterns not to be fitted, and/or you need tracks wo IP measurement (IP-NO tracks)
→ SAVE TF++ TIME
IP-NO tracks do not go to the HB++, TF++
They use the bypass to new pulsars that make the track selection working in parallel with the high resolution path (TF)

Possible applications for IP-NO tracks 1 :

1. **SVX only tracks**, for forw/backw μ/e$\rightarrow$larger lepton acceptance – extra tool to control rates
   $\mu \rightarrow 1.<|\eta|<1.5$ e $\rightarrow 1.<|\eta|<1.5$ (Ws, Z + X$\rightarrow$leptons+X)

SVT track CAN BE DONE IMMEDIATELY by "using UNUSED" patterns. WE HAVE 640 kpatterns but TF++ can fit only 512 kpatterns (see Laura Talk)

How to trigger? More Exclusive selections with higher Lum ?

Lepton (bmu/pem) – SVT match OR Lepton – XFT match?

Later a stronger request

"SVT-XFT(Stiff Track) - lepton match" ?

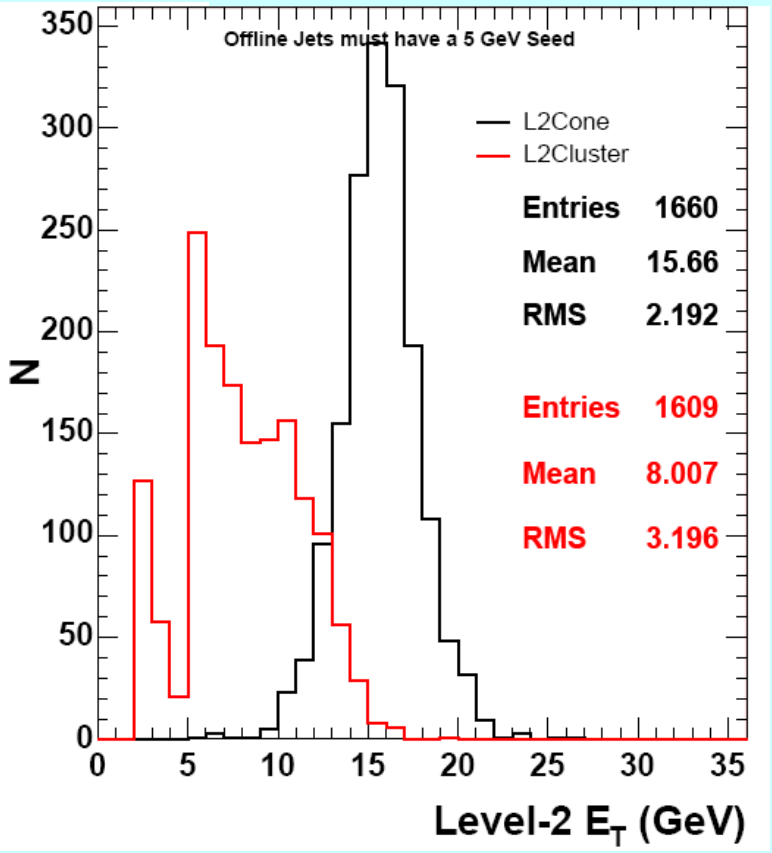
Later a stronger more exclusive request

"good MET - Stiff Track – lepton match (WW)"?

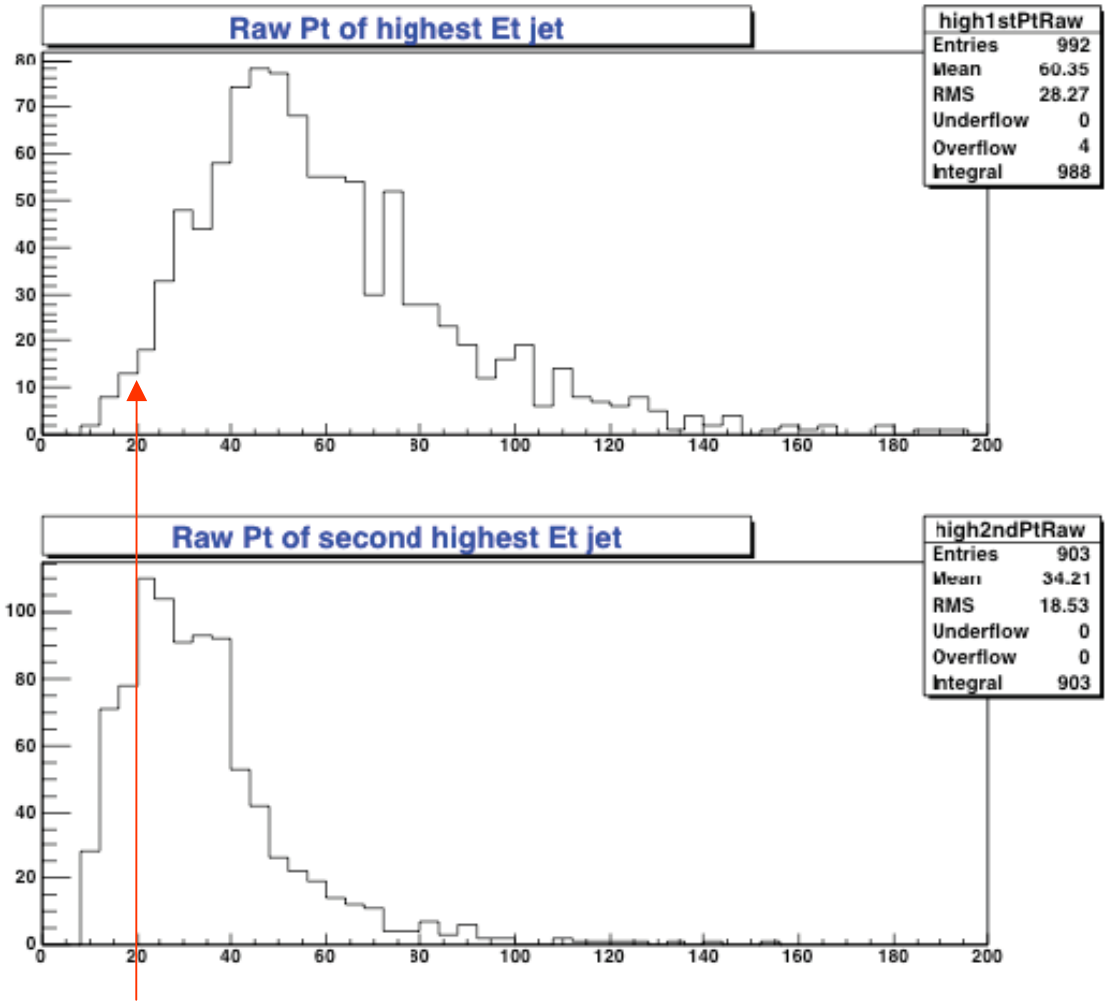
"good JET - Stiff Track – lepton match (W,Z+jet)"?

The goal is: NOT to prescale low xsec physics up to 3×10^{32} and keep efficiency

ZH MET and Jets as an EXAMPLE



[15-16] GeV jets reconstructed by new/old clustering



20 GeV

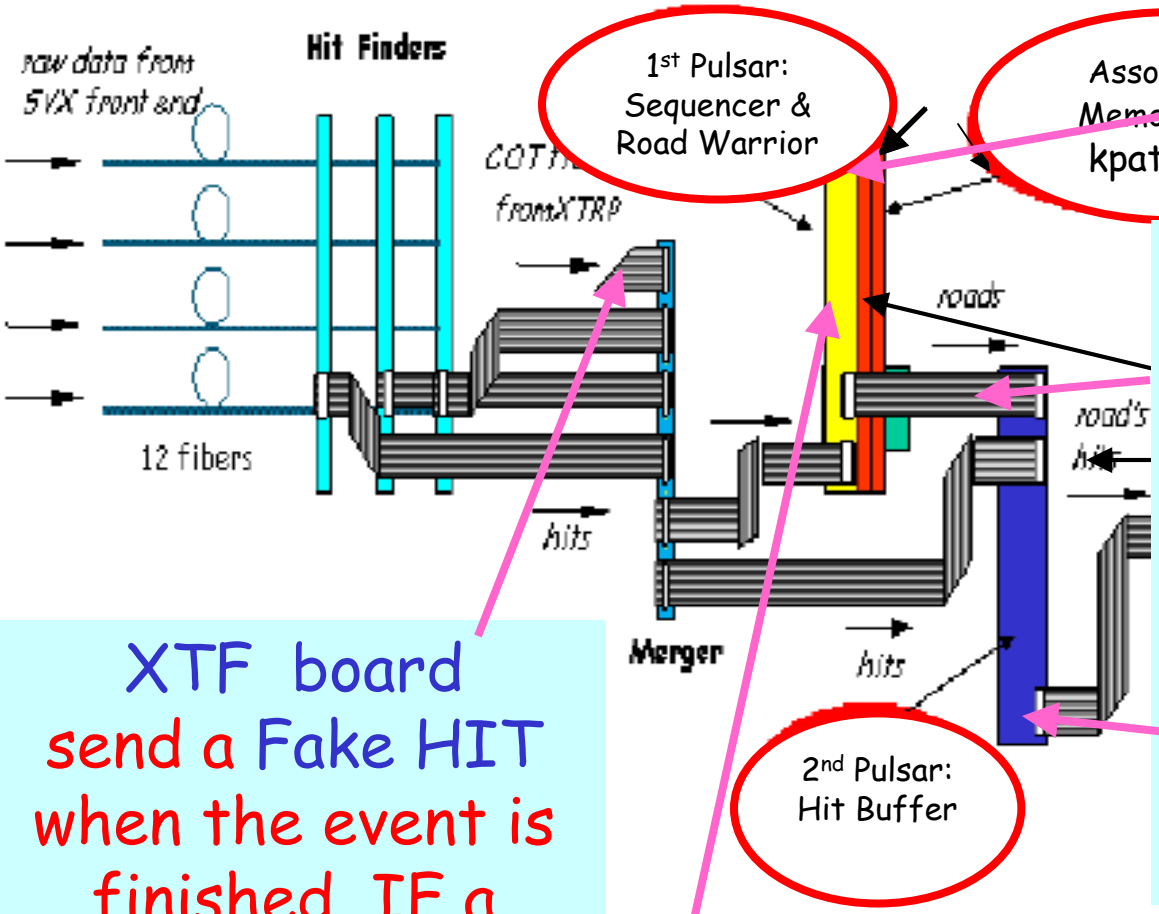
Level of effort required to extract PHYSICS with these triggers. Commissioning, certification, stripping, scale factors, trigger efficiencies, etc.

Surviving @high luminosity will be a major effort anyway.

Prescaling low xsec physics that needs 8 fb^{-1} is not possible.
We can just improve the selection or delete the selection to free bandwidth for other physics.
Higgs triggers already prescaled: L2 BJET15 D120 DPS,
L2 TWO JET15 ETA1.5 & TWO TRK2 D100 DPS,
L2 TWO TRK2 D100 & BJET15 & MET15 DPS,
L2 TWO TRK2 D120 & THREE JET10 SUMET90 DPS
More will be prescaled soon.
Having a clean procedure studied in advance is the best way to save energy, minimize trigger changes ....

How it could work in more detail - 1

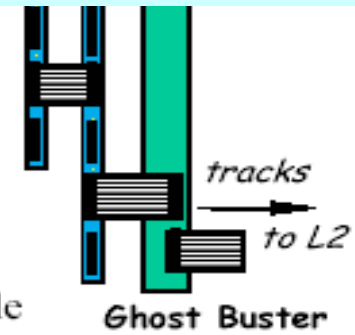
Bw/fw SVX-only patterns:
5 SVX layers+Fake Hit on 6th Layer (XFT)



HB++ reject back tagged IP-NO tracks @its input
HB++ receives roads on AUX card: reads them from input FiFo & send them out on the AUX card again if identified as IP-NO.
On the regular path HB++ trashes roads with the IP-NO bit set.

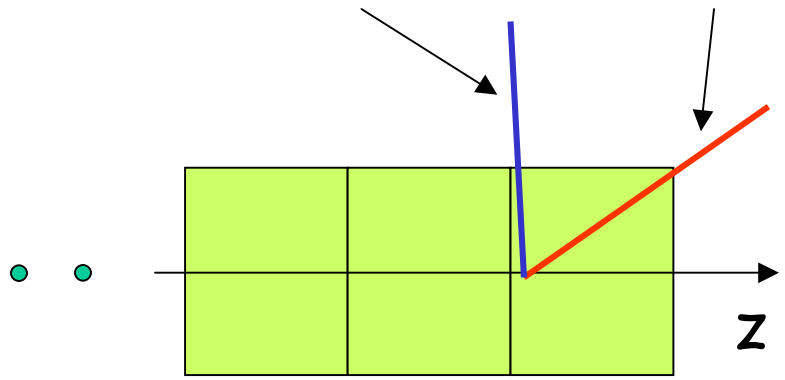
XTF board send a Fake HIT when the event is finished, IF a High-Pt lepton or High MET trigger fired @L1

AMSRW tags the IP-NO roads coming from AM

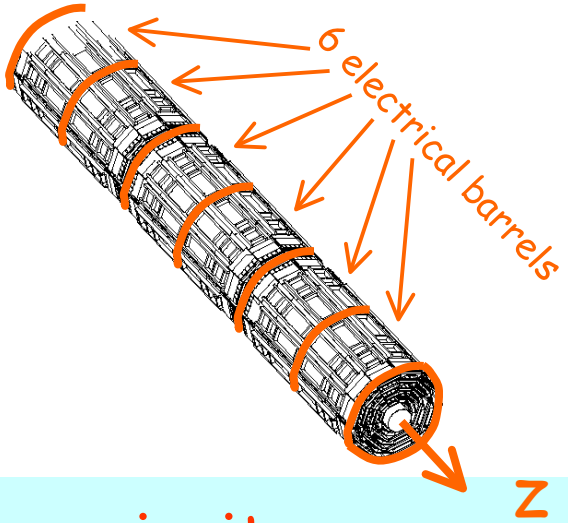


How it could work in more detail – 3
The ghost problem

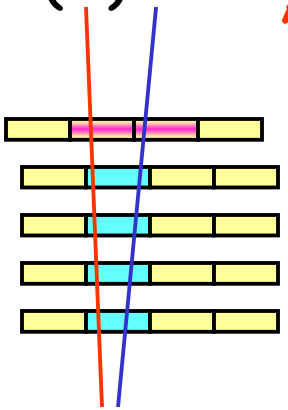
(A) Central track = fake forward at the same ϕ



AMS-RW deletes forward roads if all the SVX superstrips are shared with a central track.



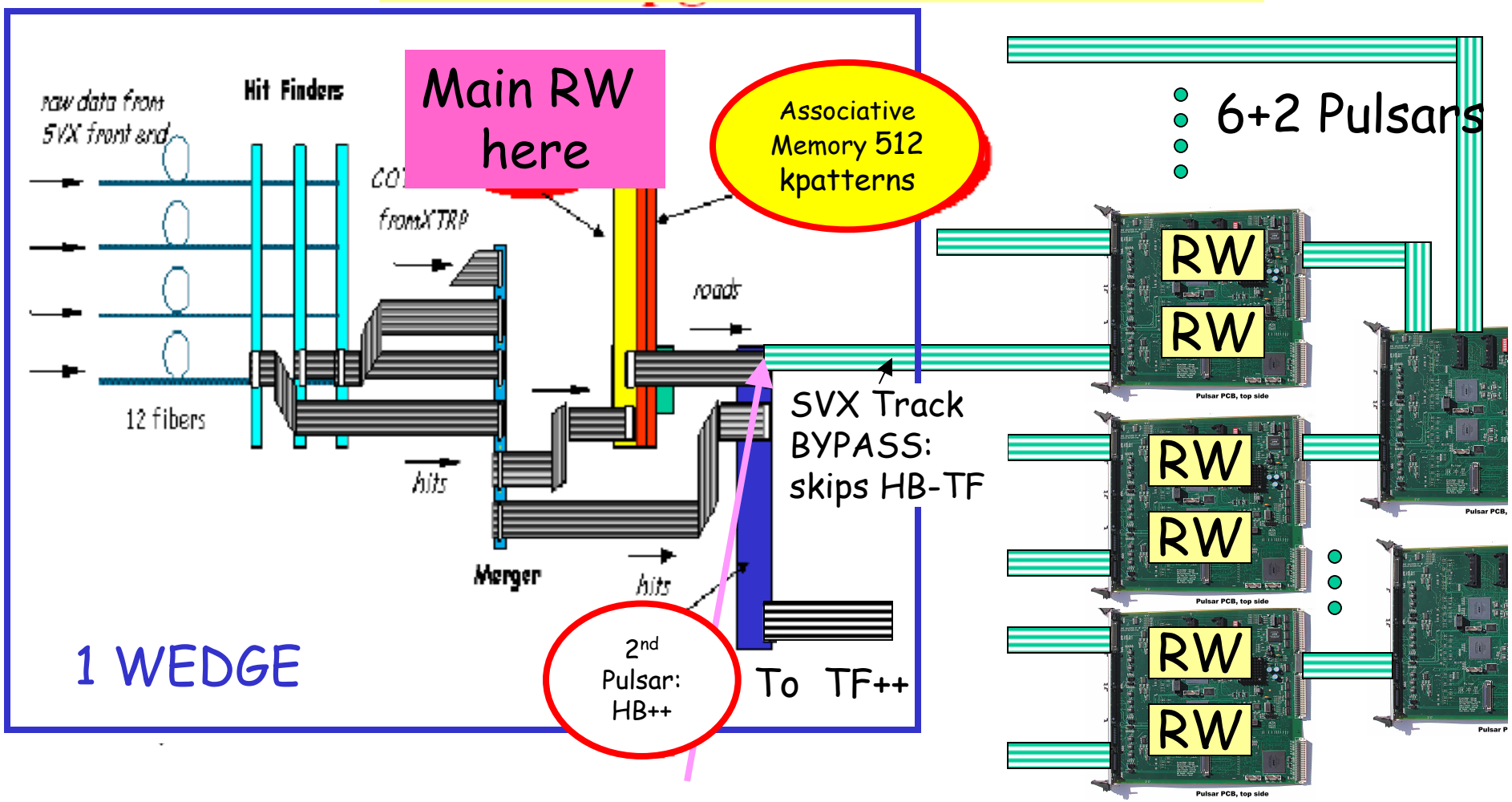
(B)



AMS-RW deletes the usual Ghosts

The Ghost problem due to the majority use:
Ghosts = roads differing only for the
empty SuperStrip
If # of roads is too large AMS-RW is not enough

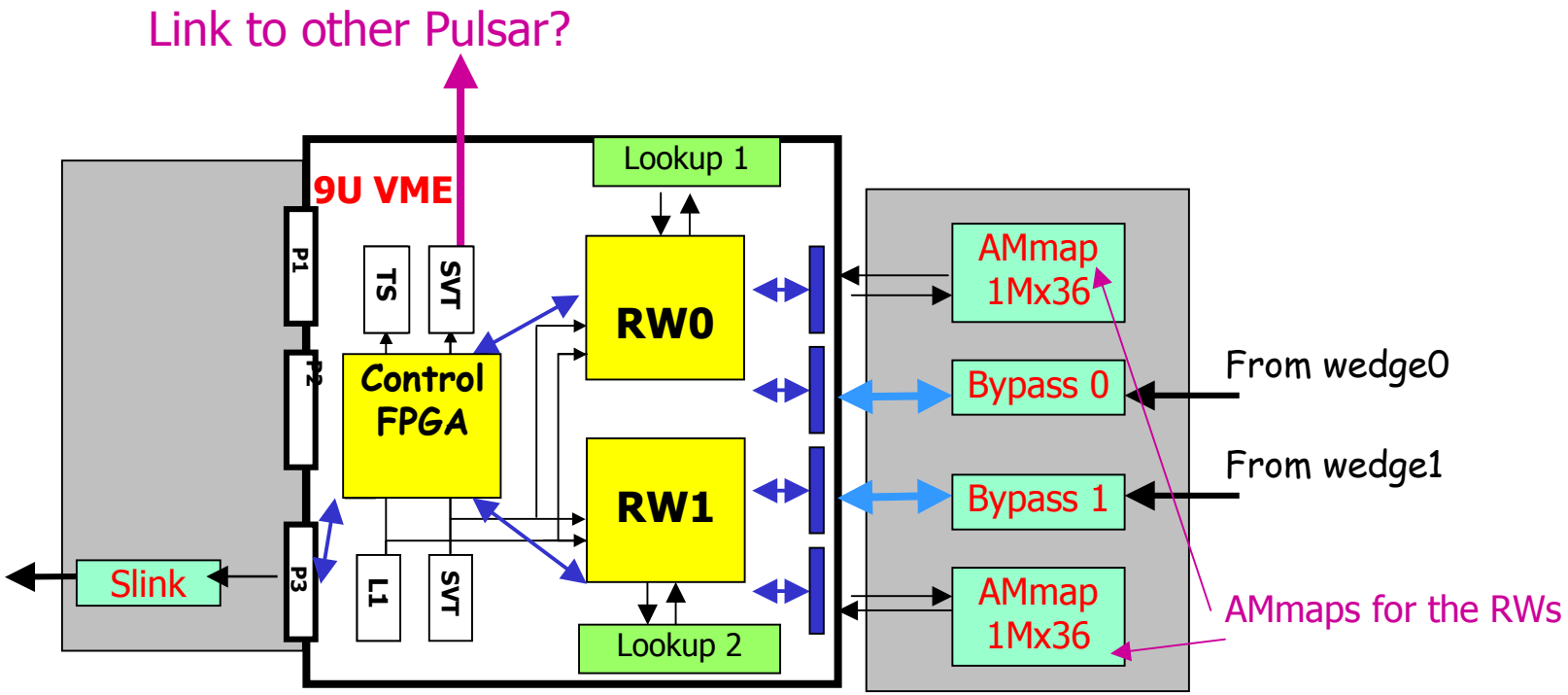
How it could work in more detail -4



If the AMSRW cancellation is not enough, in the new pulsars we can repeat the RW for a deeper deletion of ghosts

If RW is duplicated only two wedges/Pulsar can be allocated: 2 DATAIO=2 RW.

How it could work in more detail - 5



The new Pulsar receiving 2 wedges and implementing 2 RWs.

Possible **other** applications for IP-NO tracks 2:

What we will need @ very high LUM? BE READY to react

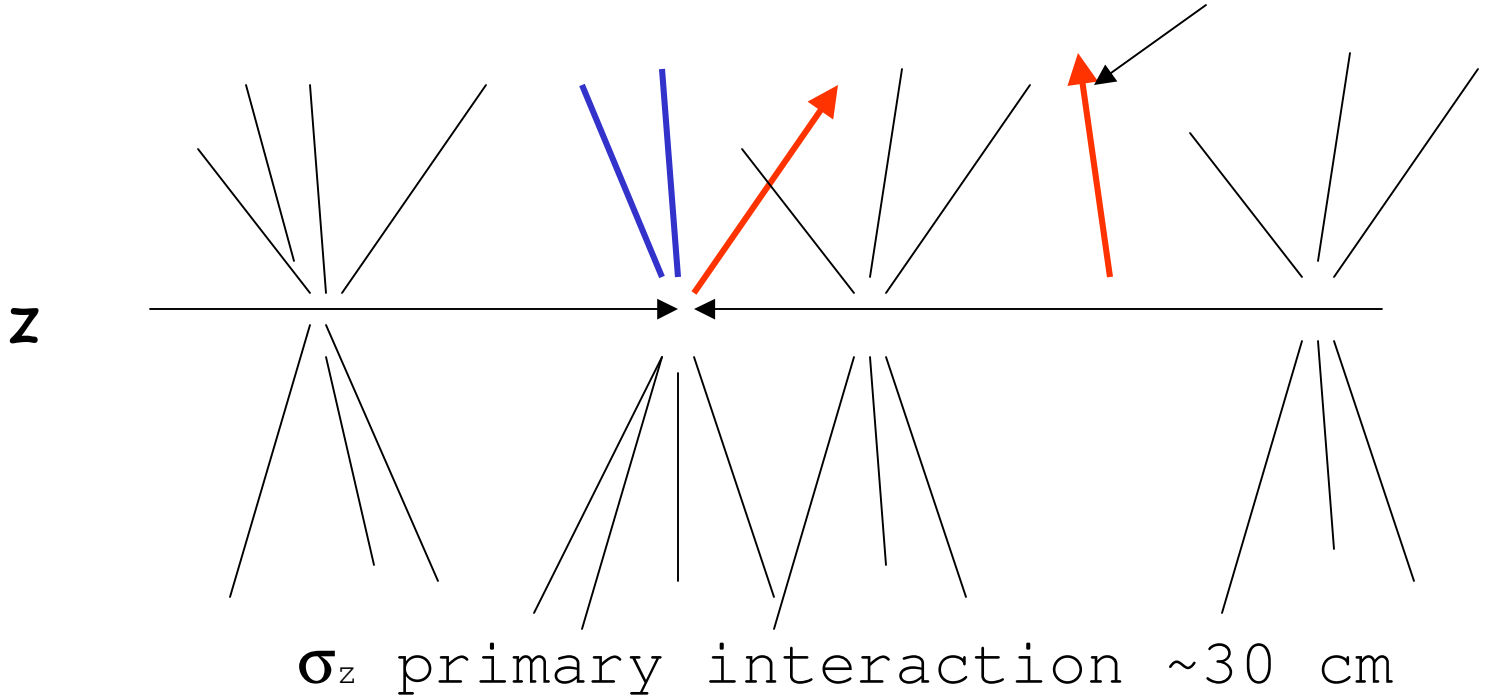
1. IF SVT proc. time increases again: tracks missing the inner silicon layer (bad IP) sent to the bypass:Save TF++ time for bad IP, without killing the track

2. If silicon inefficiency increases: we can use looser majority XFT+ 3/5 instead of XFT + 4/5 $\rightarrow$ bypass for bad 3/5.

3. If COT becomes too inefficient for lepton triggers we can use SVX only tracks for leptons even in the central region @high lum

4. Loose b-tagging idea @very high lum: use tracks down to 1.5 GeV inside SVT, without fitting them

Kevin Pitts idea → loose b-tagging to delete Fake IP tracks:



if 1 track IP>100 um (red track), L2 CPU looks for other SVT roads near the red one, pointing to the same vertex (XFT z resolution ~8 cm), without requiring IP cut on blue tracks;

They can be "not-fitted Low pt tracks"→ use the bypass

Associate tracks with Jet axis → we need good jet axis measurement

Hardware requirements/needs

1. 4 (or 8) Pulsars.
2. N=[12 + 4 (or 8)] connections $\rightarrow$ 2 N mezzanines = 32 (or 40)

Money already requested @INFN: can be assigned in october and available only when/IF approved by CDF

<u>For development in Pisa</u>
AMSRW + HB + Merger test

1 link from HB++ to new Pulsar + 2 mezzanines + 1 AUX card
We have 3 Pulsars, (may be an extra one in Pisa?):
HB++ firmware in Pisa.

Schedule, woman/man power

- All the hardware is already developed: Pulsar firmware
  very little, could be done in ~ 1 months
  (~2 month if extra RW)
  L2 code: ~1 month
- Cal upgrade and bypass are similar: firmware and Cpu code, links. People coming out of Cal upgrade trained very well for next step
  Pisa can provide hardware people, same cal upgrade team :
  M. Piendibene, L. Rogondino engineers
  Laura Sartori, physicist post-doc, studies/hardware

  Missing software people: Wisconsin: Jim Bellinger?
  Other help for integration/monitoring/physics study?

Second priority, later time than Calorimeter upgrade →
Complete studies, see also what happens to XFT 3L

Conclusions

We can easily provide an SVT bypass for IP-NO tracks

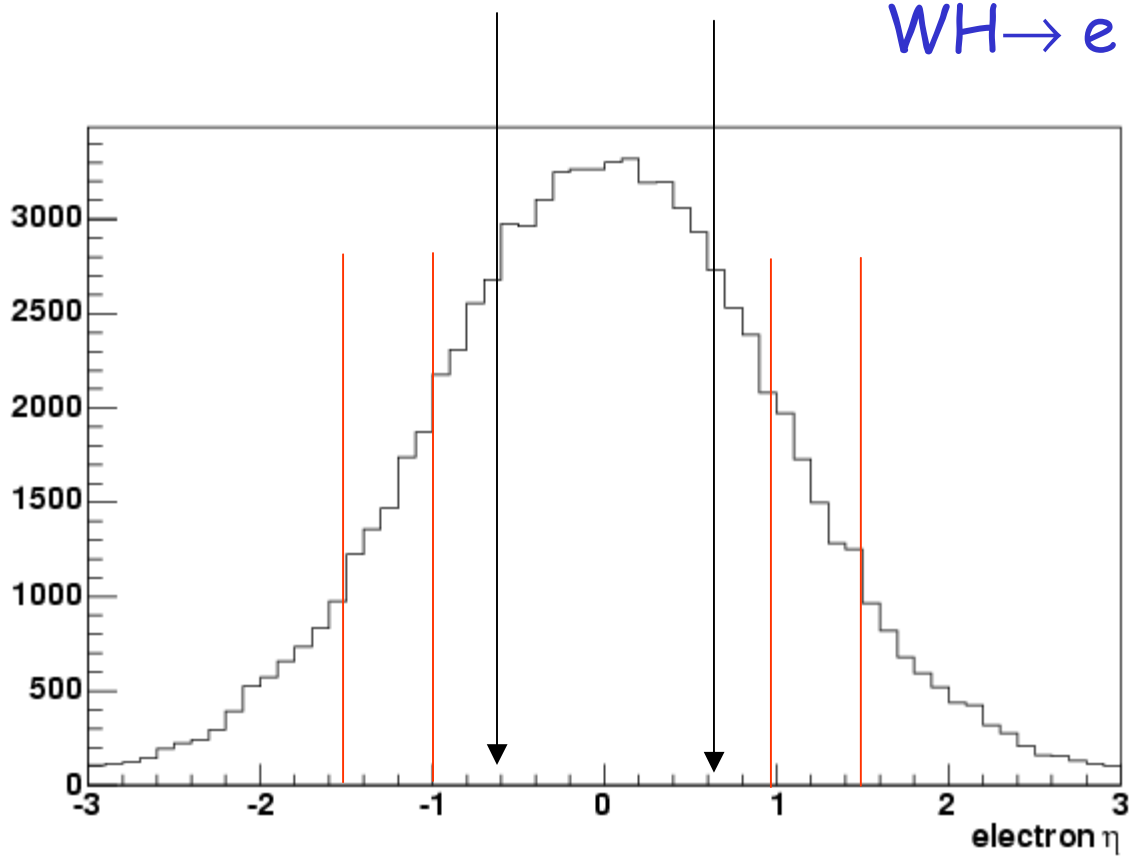
Possible applications:

1. Larger SVT flexibility to extend the SVT use at high Lum and for high Pt physics
2. SVX only tracks in the forward region. Ongoing work:
   - Choose the pattern bank done
   - Check the SVX only track quality done
   - Check the SVT/new pulsars latency done
   - Measure the lepton match efficiency on Z0
   - Measure the L2 rate on a level 1 lepton sample and/or MET sample

Hardware ~ ready… waiting to complete studies (see Laura talk) / physics case

Jose Enrique Garcia & G. Chiarelli studied W with electrons in the plug

WH→ e ν bbar



Muon distribution should be similar!!
CMX rate ?

Forw/Backw leptons (see Laura talk)

1<η<1.25 (FRONT) L1:

BMU*BSU(F)*XFT11

rate 8-16Hz @ 4E31

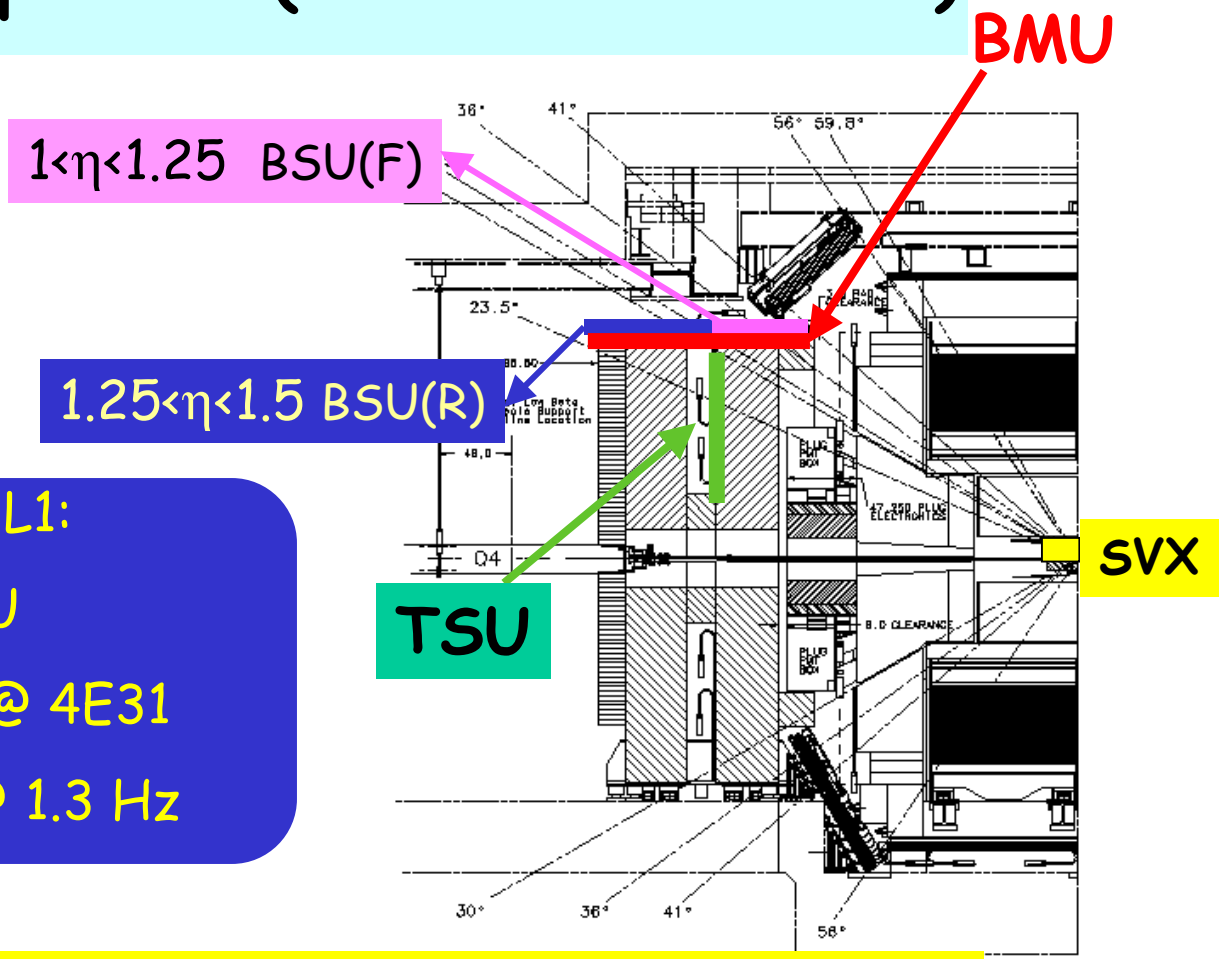
L2: RateLimited @ 0.7 Hz

1.25<η<1.5 (REAR) L1:

BMU*BSU(R)*TSU

Rate 200-400Hz @ 4E31

L2: RateLimited @ 1.3 Hz



Let's use **SVT***BMU*BSU for muons at L2.

high Pt prompt leptons, thin road → ~100 kpat or ~400 kpat

- 95% efficient for Pt>10 GeV e d0<500μm
- Let's use 4/5.

SVX-only η information

Two SVT track types:

1. (Dz=0) Tracks contained in a single barrel; we don't know η

2. (Dz=+-1)Tracks crossing at least 2 barrels. We know the η track from Dz.

In the following plots (2003 study) an SVT track corresponds to an offline track if (a) Dz=0 or (b) Dz has the same sign of an offline track η.