

Forward "Jet" Triggers?

Is it worth looking at?

- What might we gain?
- Do we need something like this anyway?

How might we do it?

- Can it fit in the current design?
- What might the options be?
- What are the problems?

What do we do next?

- What are the questions?
- What are the tools?

Motivations

As an event "tag"?

Used in Higgs and SUSY analyses to improve S/B

- Can trigger on other objects in these events
- May allow thresholds to be lowered?

As a physics trigger

May be useful for QCD studies

- Cross-sections don't stop at $|\eta|=3.2$

All studies rather preliminary at present

Technical

We probably want some of the features anyway:

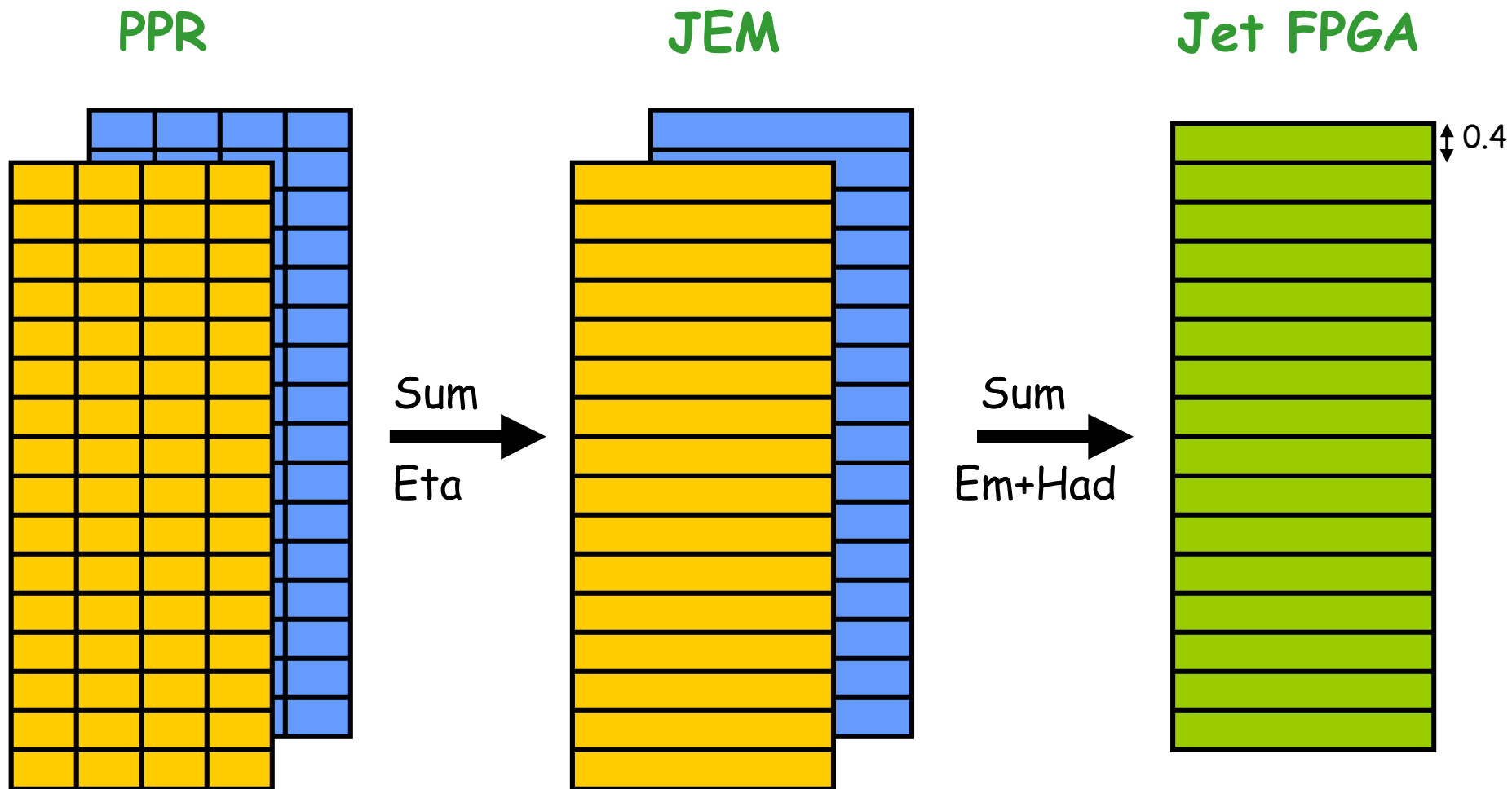
- LVL2 will want pointers to saturated regions (RoIs)
- May need to ensure trigger on saturation in FCAL

Flexibility

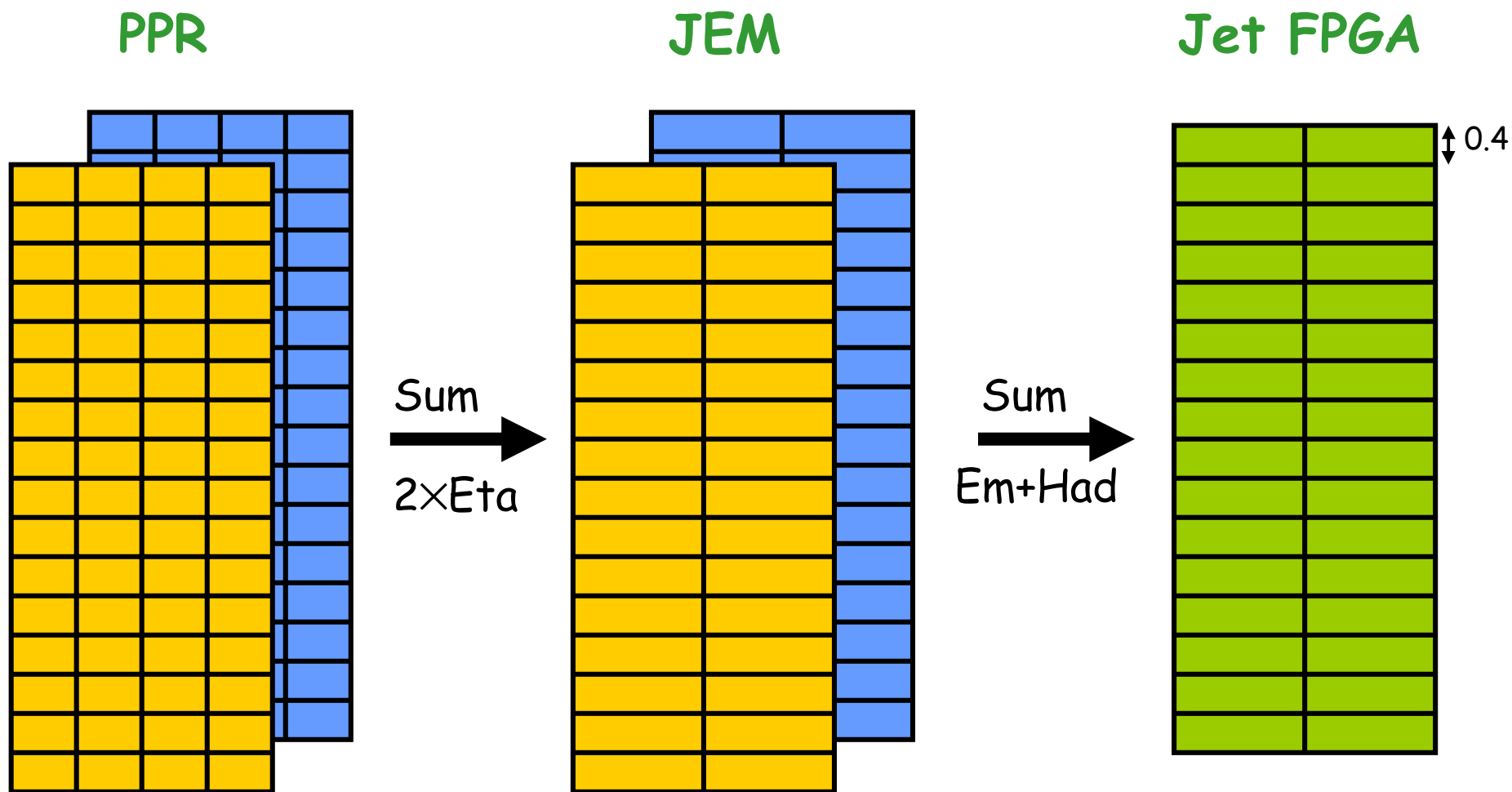
ATLAS is about exploratory physics

- May turn out to be more important than we currently anticipate....

FCAL Signal Granularity



If we need η granularity?



Decluster/RoI Algorithm

Functions:

Same as elsewhere

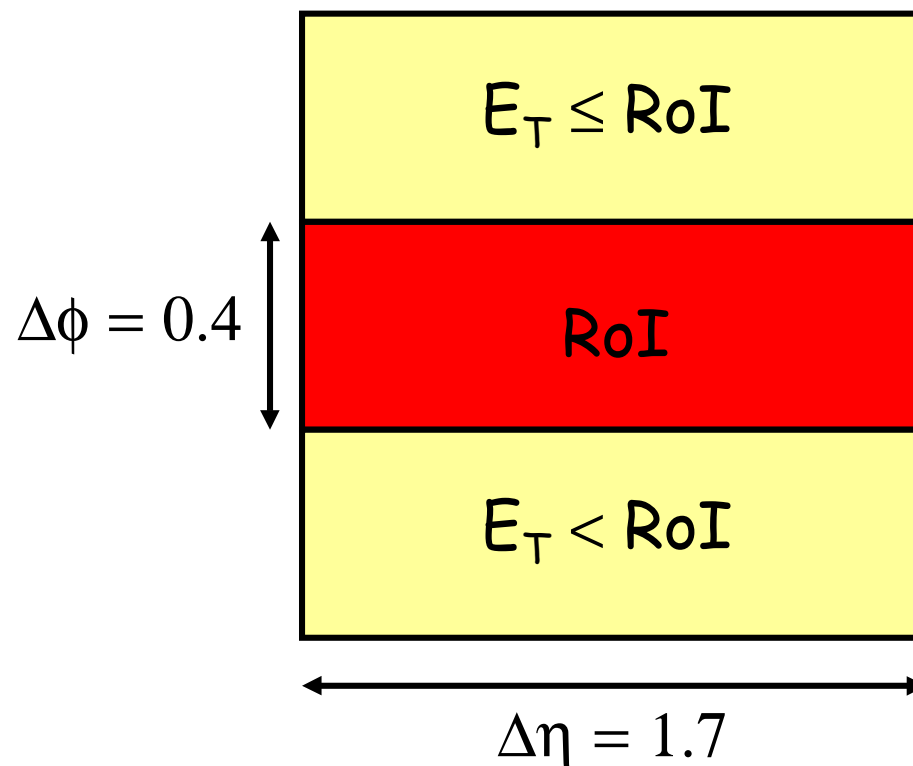
- Avoid multiple-counting
- Determine coordinate for LVL2

Approach:

Use "local E_T maximum" condition

- Only compare with 2 neighbours
- Require $> \text{one}, \geq \text{other}$
- Consider larger RoI clusters??

Study different trigger cluster options



Trigger Cluster Options

What cluster size?

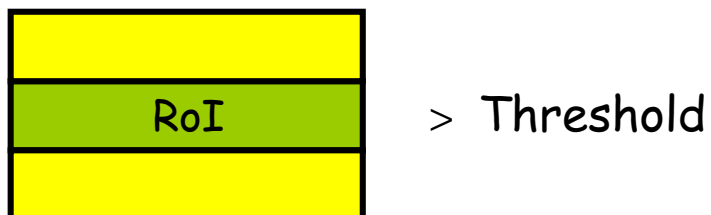
1.7×0.4 (non-overlapping)



1.7×0.8 (RoI + either neighbour)



1.7×1.2 (RoI + both neighbours)

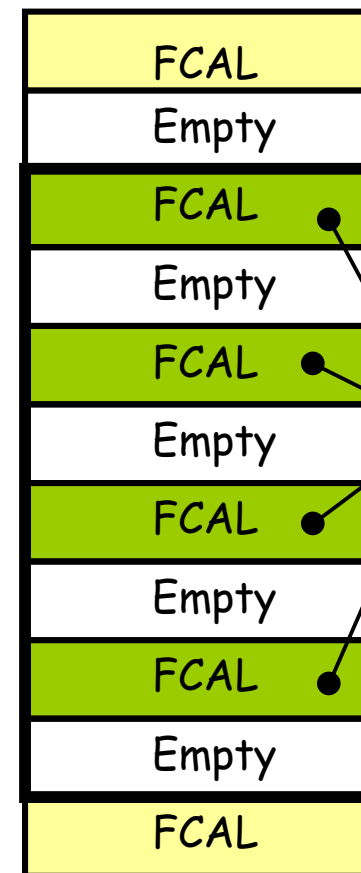


JEM input occupancy

Shared in phi

JEM "core"
towers

Shared in phi



Possible
RoIs

RoI Format

FCAL JEMs differ on one respect:

Neighbouring eta bins correspond to different endcaps

- Can have RoIs in 2 adjacent towers
- Number of RoIs/JEM higher than elsewhere

Is it a problem?

Same as CP RoIs when e/γ and τ/h had different RoI definitions

- Jet RoI word currently has 14 unused bits
- More than enough for a second set of hit flags/coordinates

Hit Counting - A problem?

Propose using JEM for FCAL jets

Current "baseline" has module boundary at $\eta=0$

- Fwd and Endcap towers in same JEM
- 8 jet thresholds must include both normal and FCAL jets
- Will want to separate the two (and probably also 2 ends of FCAL)

Hence 8 jet thresholds are probably inadequate

- Could backplane/merger cope with more?

Can we avoid this?

Sam favours extra JEM for FCAL

- Simplifies ETmiss calculation
- Separates FCAL and normal jets
- Reckons there is space in Jet crate/backplane

Implications:

- Need more backplane inputs to merger (thinks OK)
- More bits between crates for final sum (slightly)
- Extra bits to CTP

An Alternative Approach

More thresholds with existing bits

Currently output 24 bits/JEM

- 8 thresholds * 3 bits

Don't need 3-bit multiplicity for every threshold

- Fewer bits/threshold and more thresholds

A few possibilities:

- 4*3-bit + 6*2-bit (=10)
- 2*3-bit + 9*2-bit (=11)
- 3*3-bit + 6*2-bit + 3*1-bit (=12)

Comments

Makes some thresholds less "general purpose"

- But is less wasteful of outputs

Increases complexity of Jet FPGA

- More comparators needed

Could be applied to CP system?

- Need is less urgent, cost higher

A final thought:

This is **not incompatible** with separate FCAL JEM solution.

- Might affect Jet E_T trigger??

Simulation Studies

Optimise Cluster/RoI choice

Look at rate vs efficiency

- Compared with “reference” jetfinder
- For physics processes

Overlap with “normal” jets?

Study Physics Benefits

Does it allow useful reduction in other thresholds?

- Are any algorithm options better than others?

Is there any gain from eta segmentation?

Detector Model

Use ATLFAST initially

- Can easily & quickly generate required datasets
- Will have to make minor changes to FCAL simulation

Cross-check with Atrig

- Transverse spread of showers likely to be important
- Few suitable datasets
- Currently adding necessary code

Summary



It's probably worth investigating

- May be physics gain (perhaps unanticipated)
- Possibly want much of the functionality anyway

It may not be very hard

- Can use existing JEM (different jet FPGA configuration)
- Mostly straightforward if don't need eta segmentation
- The problems (hit counting) seem to be soluble

What next?

- Look at technical questions & solutions (discussion started)
- Study physics performance of options (starting)