

OLYMPUS Readiness Review – Luminosity Monitoring



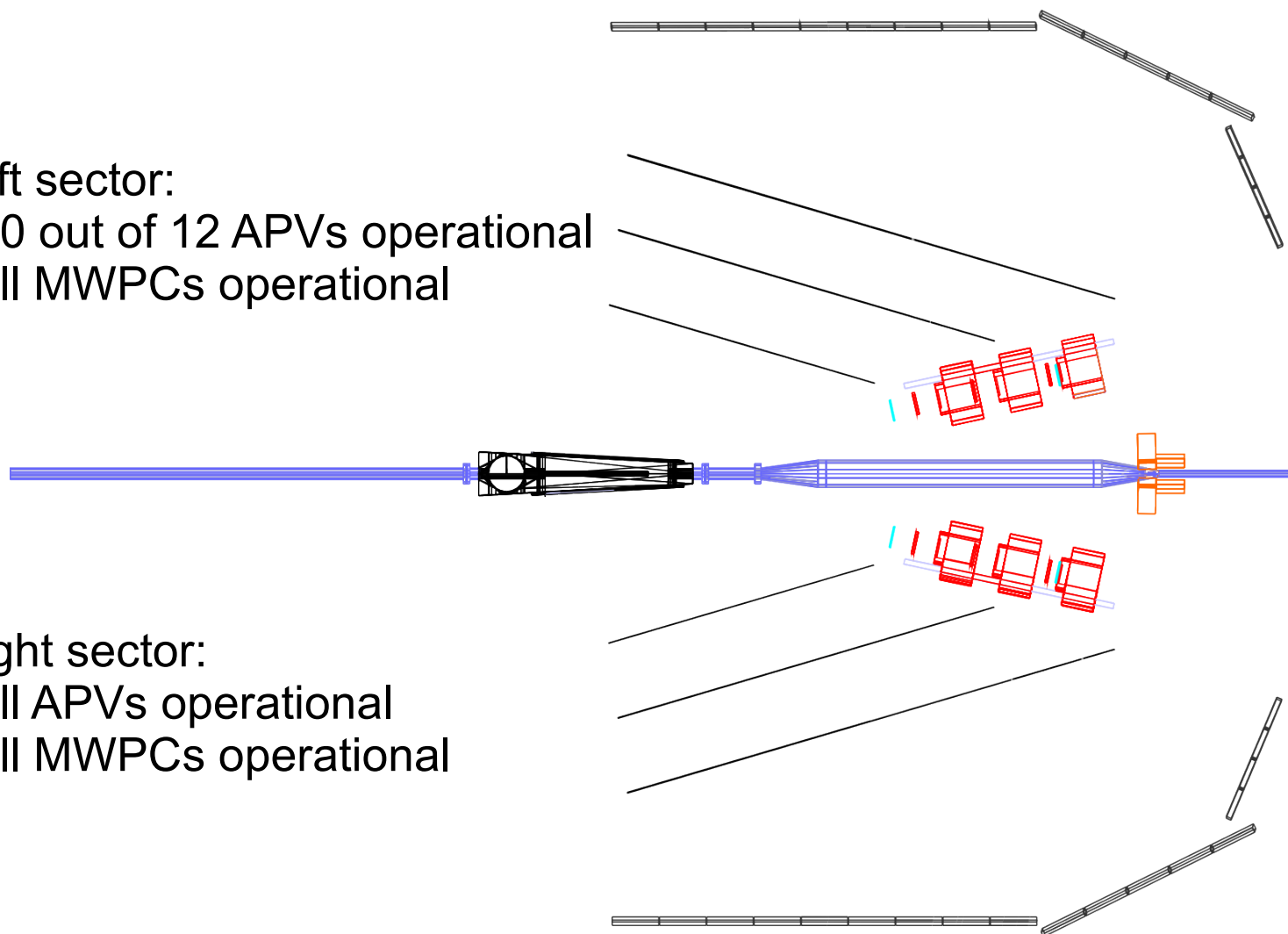
Status of 12° Lumi Monitors

Status of Symmetric Moeller/Bhabha Monitor

Luminosity Comparison February/July

Left sector:

- 10 out of 12 APVs operational
- all MWPCs operational



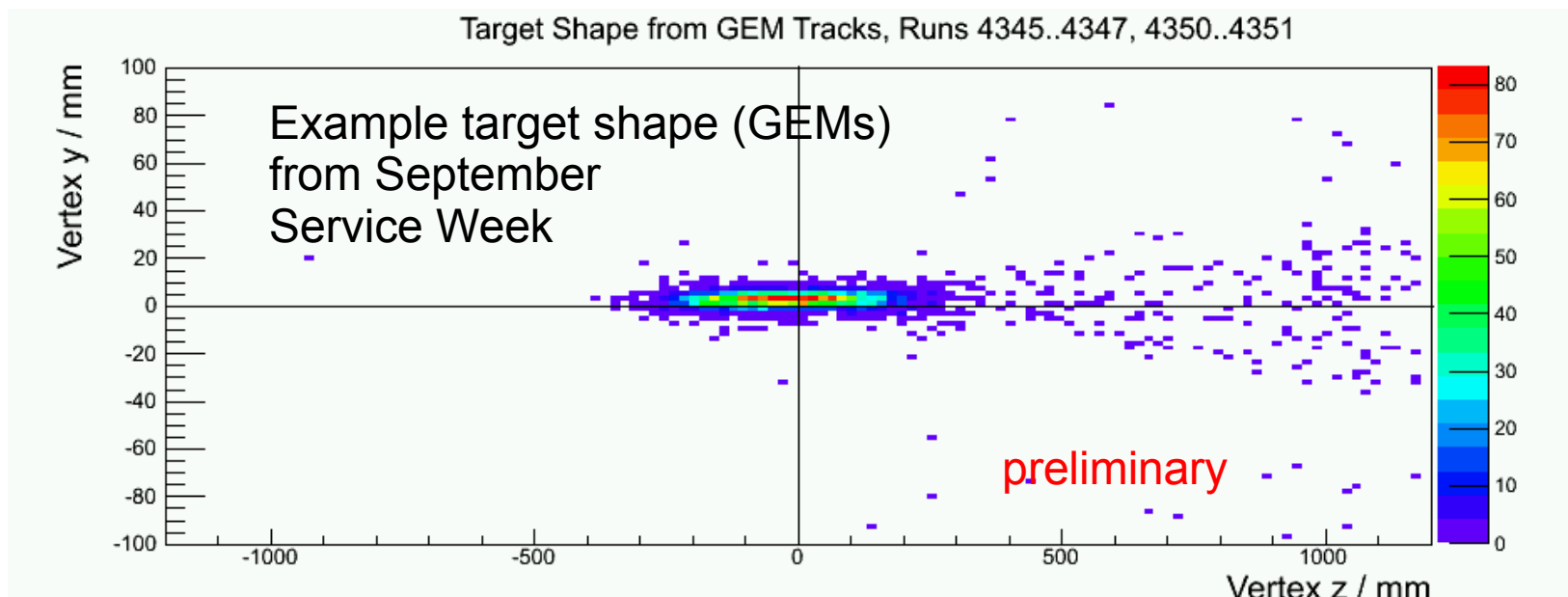
Right sector:

- all APVs operational
- all MWPCs operational

- fully implemented in cooker analysis framework since ~Nov/2011
- typ. <5 minutes per run (raw data → hits/clusters)

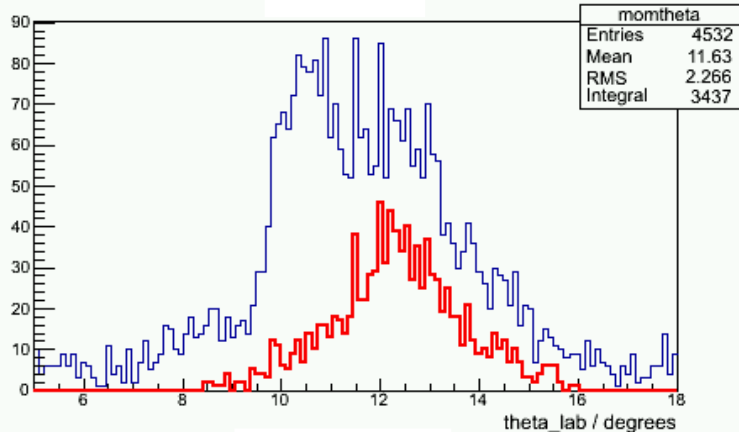
Online / Near Online Monitoring: (in preparation for 2nd run)

- hit maps, charge sharing, cluster multiplicity
- target shape in y-z plane
- luminosity estimate

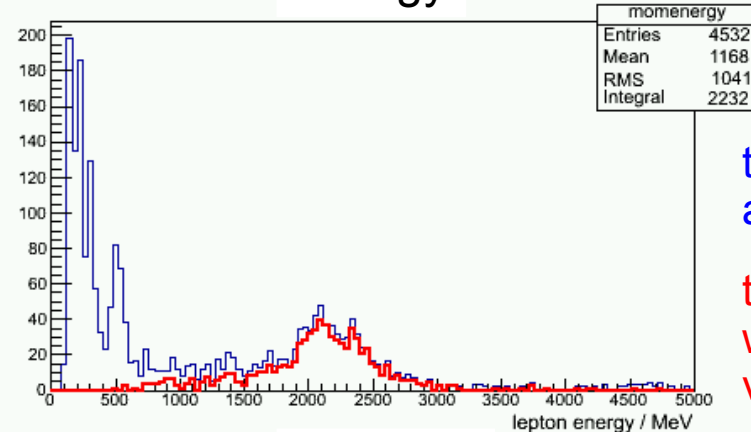


Recent run from service week:
tracking results (GEMs) from LumiFit/TrackFit plugins in cooker framework

Theta



Energy

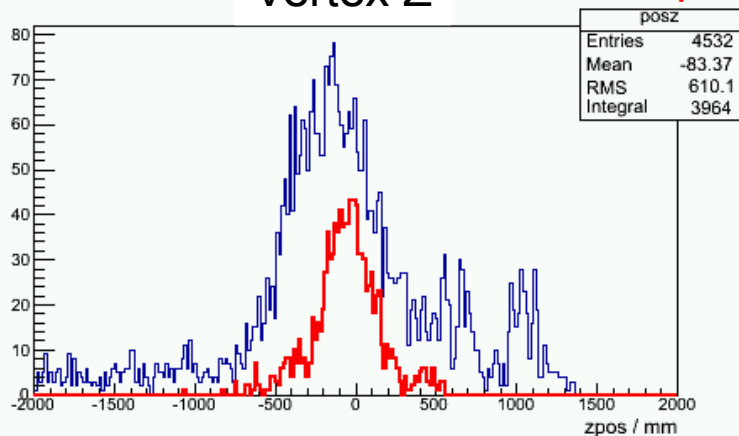


tracks fitted as electrons and positrons, no cuts

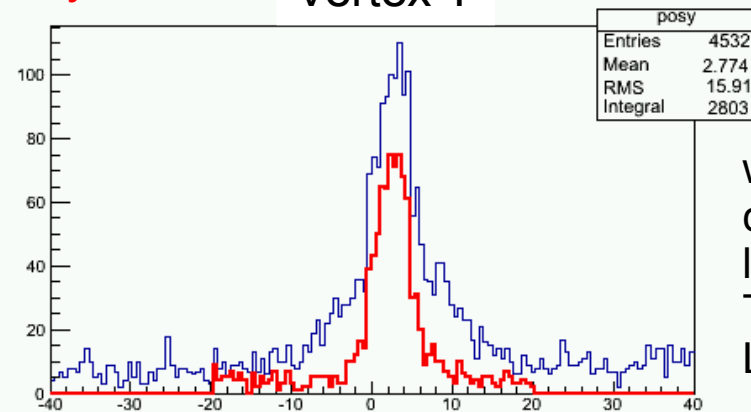
tracks fitted as electrons, with cuts on theta, vertex y, fit convergence

Vertex Z

preliminary

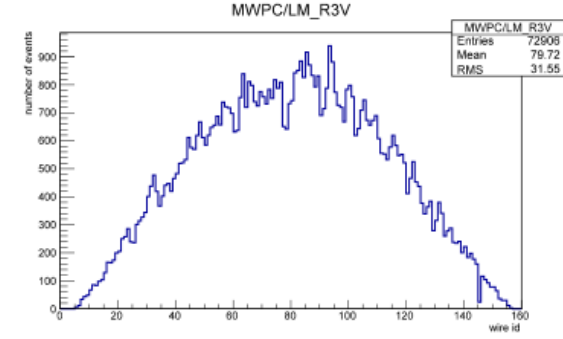
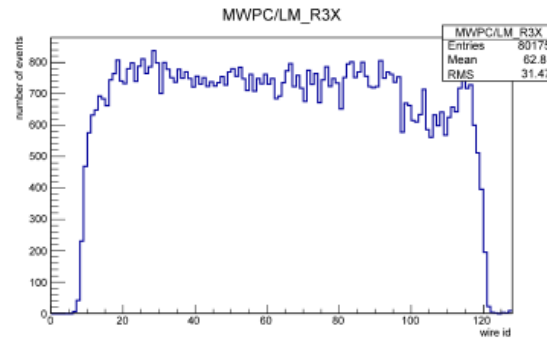
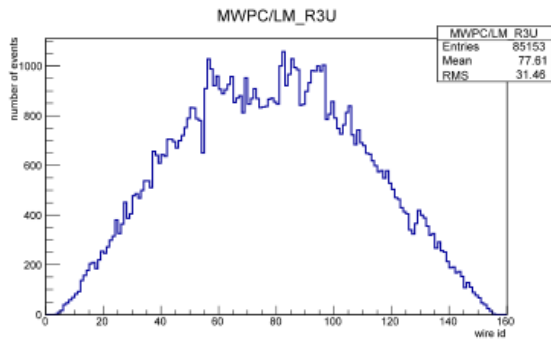
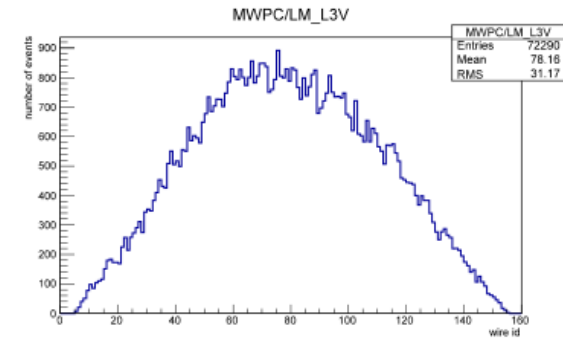
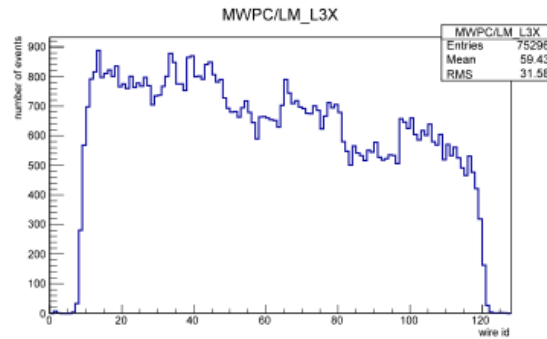
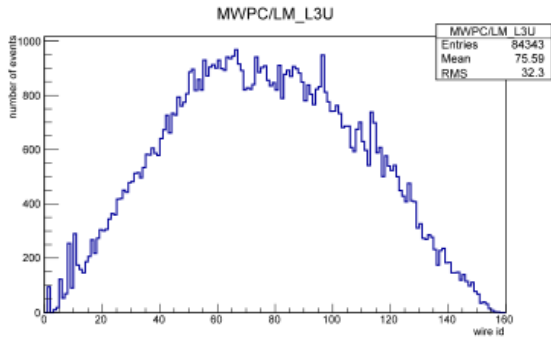


Vertex Y



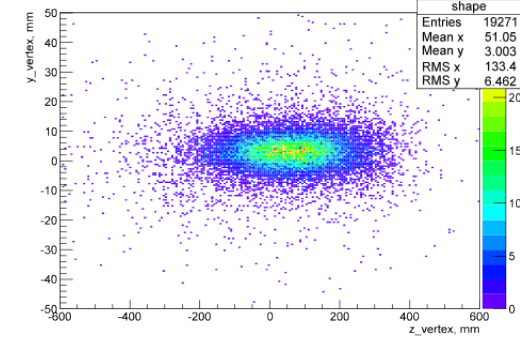
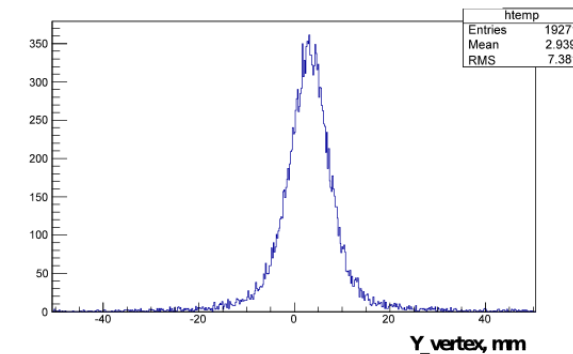
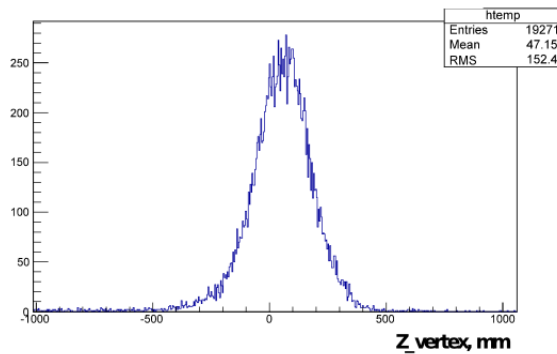
with reasonable cuts distributions look reasonable
To Do:
Lorentz angles (GEMs) → momentum distr.

wiremaps
of
MWPCs



preliminary

target shape
as seen by
MWPCs

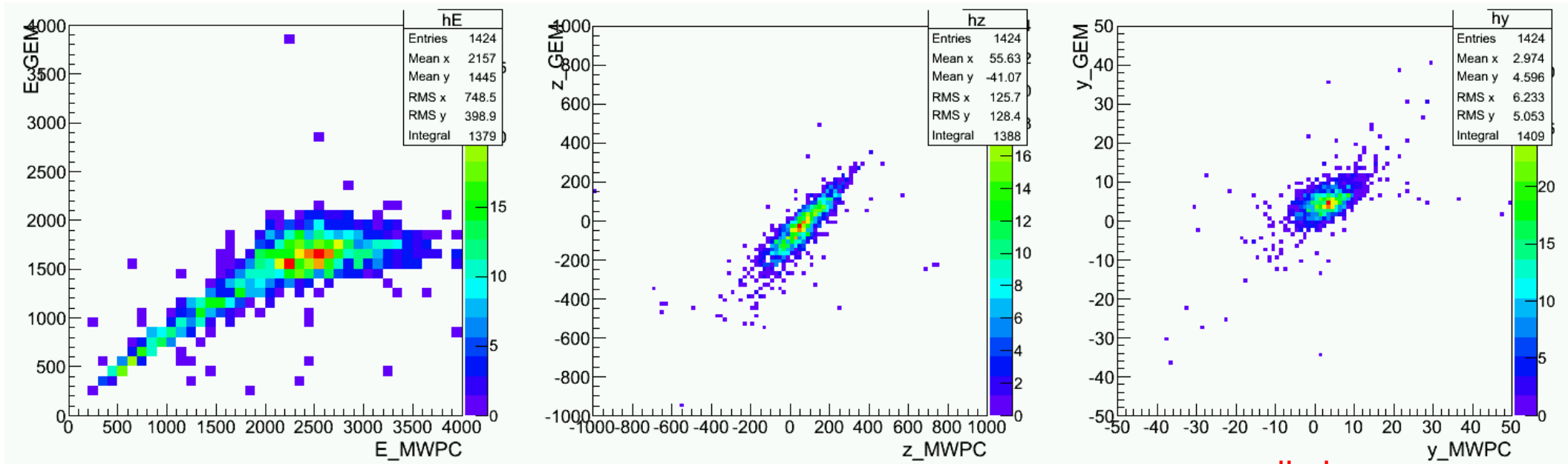


For the same run: tracks fitted to GEM clusters and tracks fitted to MWPC hits

energy vs. energy

vertex z vs. vertex z

vertex y vs. vertex y

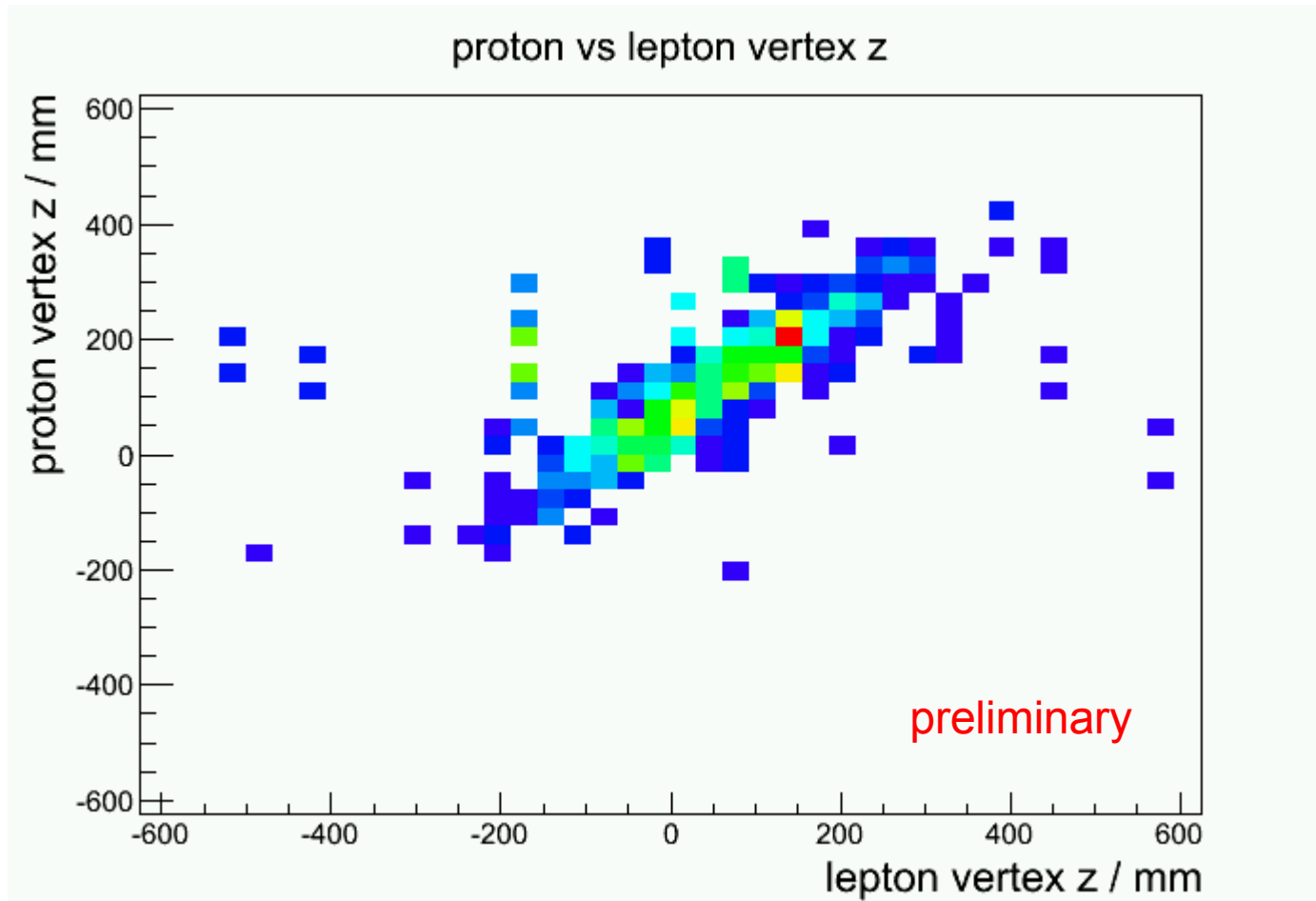


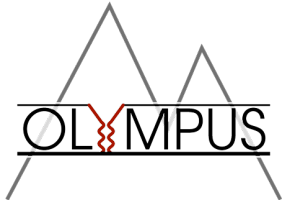
preliminary

Track fitting (within cooker framework):

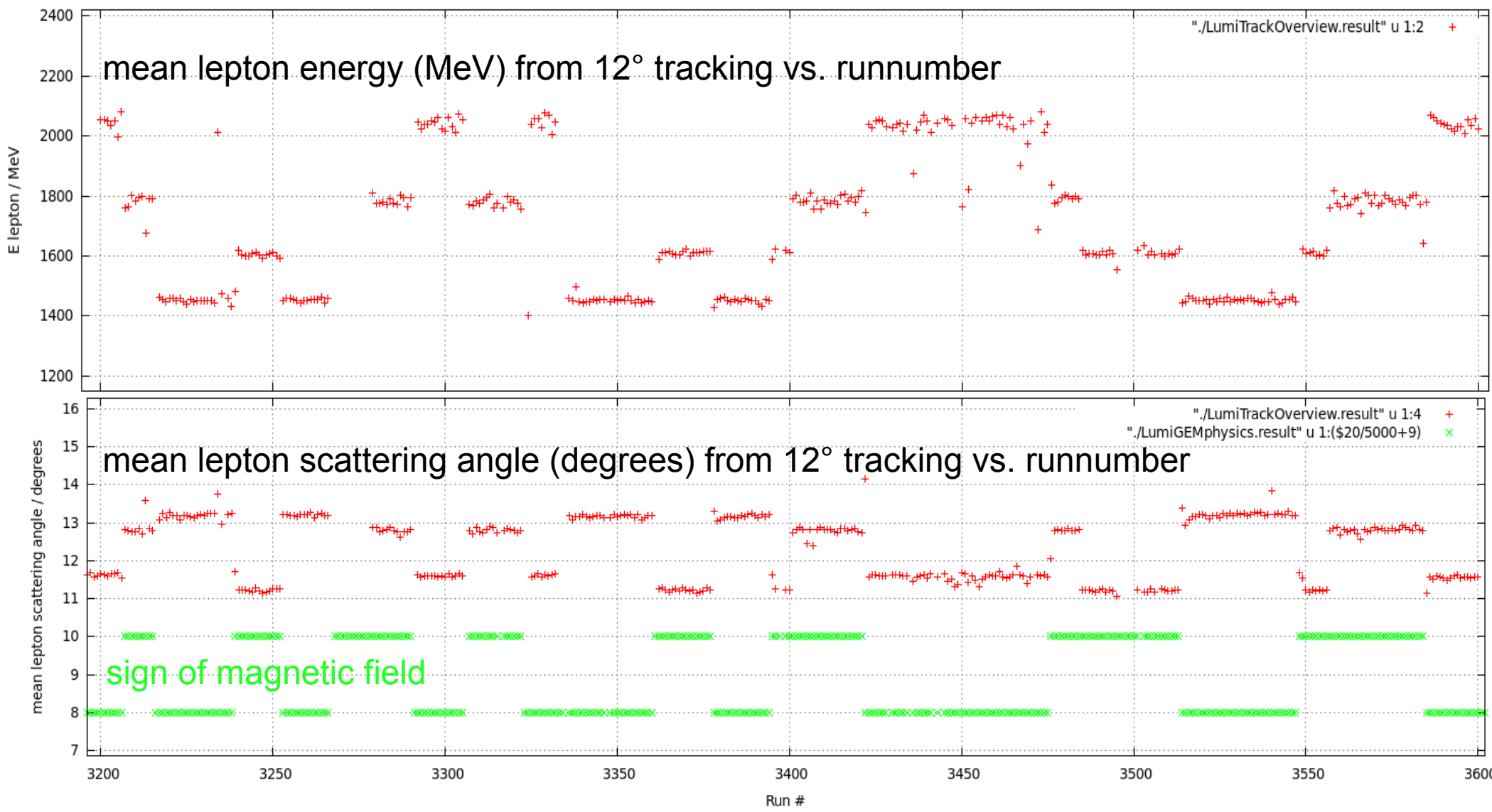
- only GEMs
- only MWPCs
- any combination of GEMs and MWPCs (To Do: tune alignment offsets etc.)

Clear correlation between lepton and proton vertex



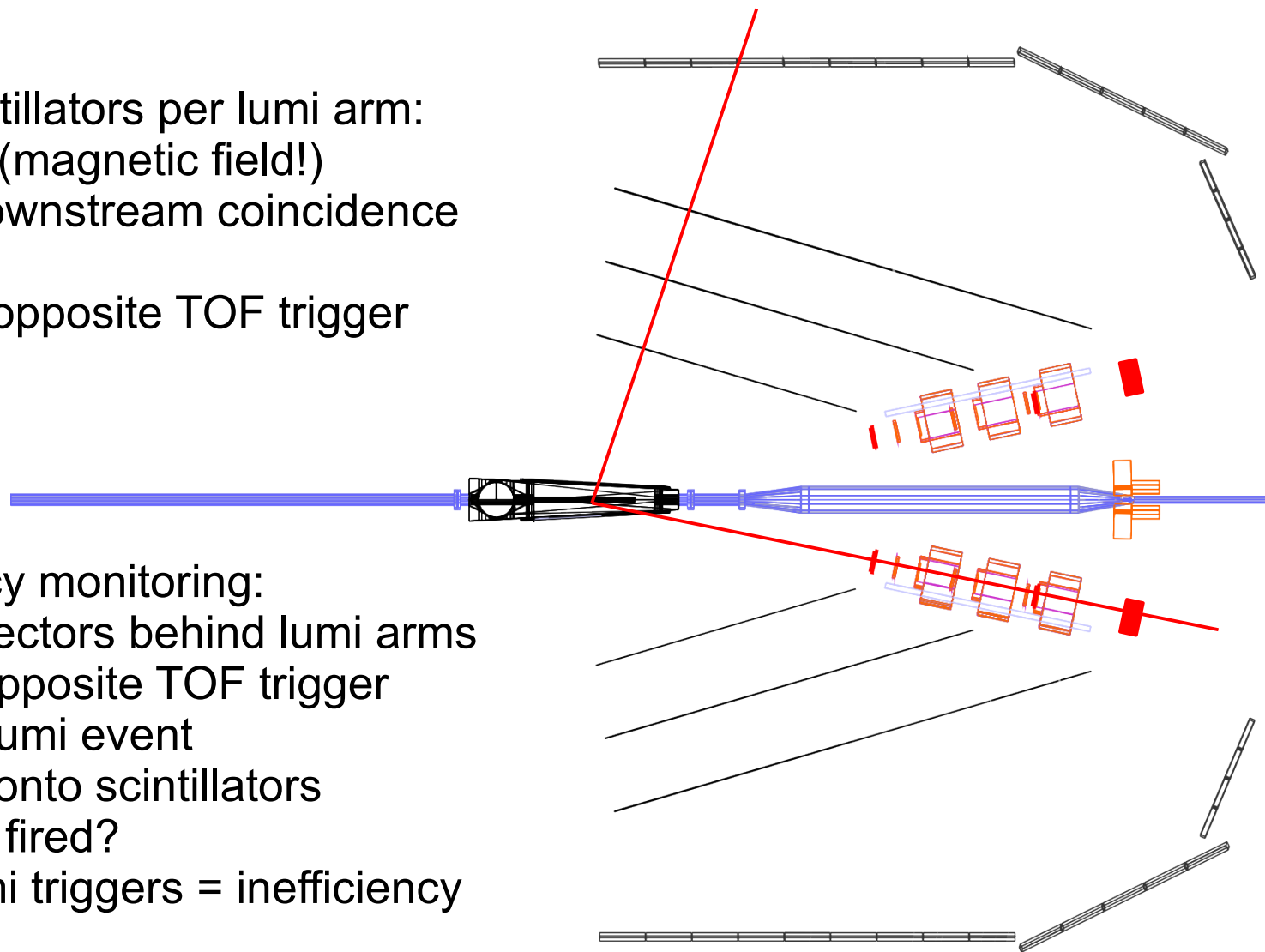


12° Tracking Stability (GEMs)

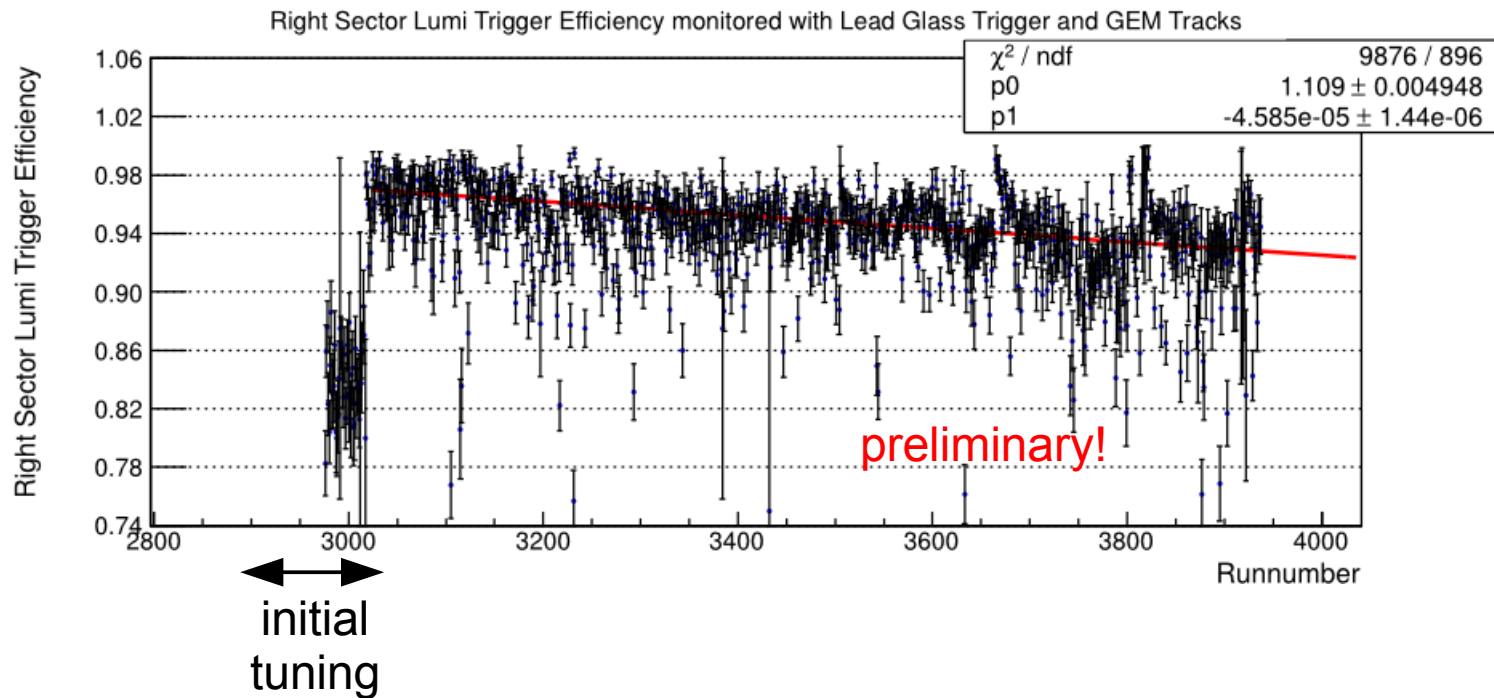


- Two plastic scintillators per lumi arm:
- SiPM readout (magnetic field!)
 - upstream & downstream coincidence = lumi trigger
 - lumi trigger & opposite TOF trigger = lumi event

- Trigger efficiency monitoring:
- lead glass detectors behind lumi arms
 - lead glass & opposite TOF trigger = alternative lumi event
 - project tracks onto scintillators
 - lumi trigger fired?
 - missing lumi triggers = inefficiency



Efficiency monitoring during February data taking
(implemented in cooker framework)

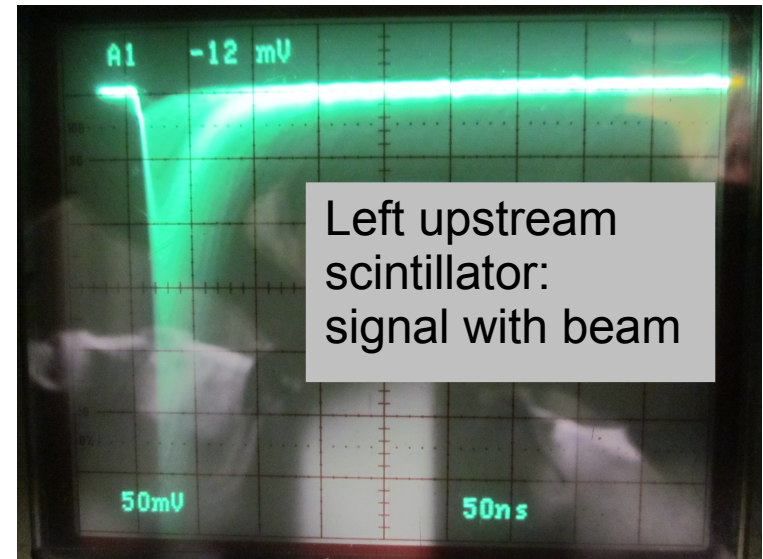
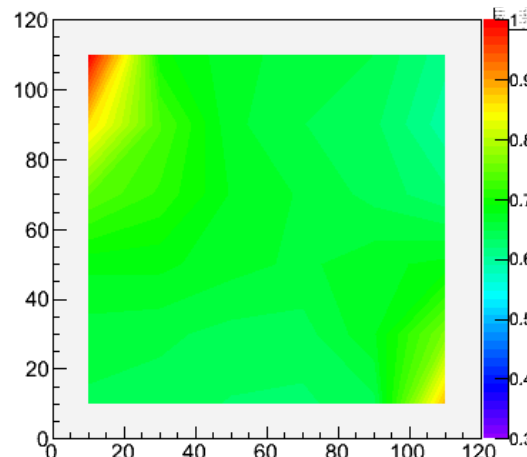
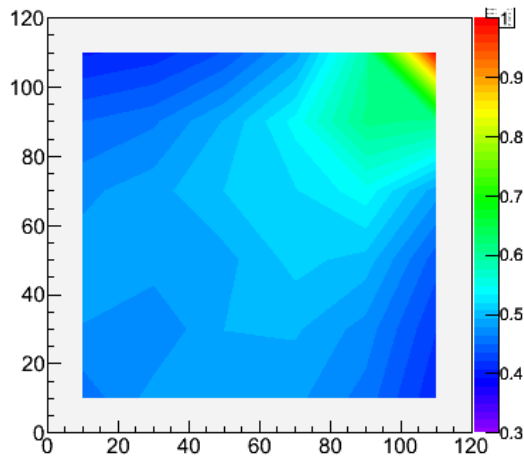


Sufficient statistics from lead glass trigger to monitor lumi trigger efficiency
on ~1% level per data taking run

Complete exchange of existing lumi trigger system:

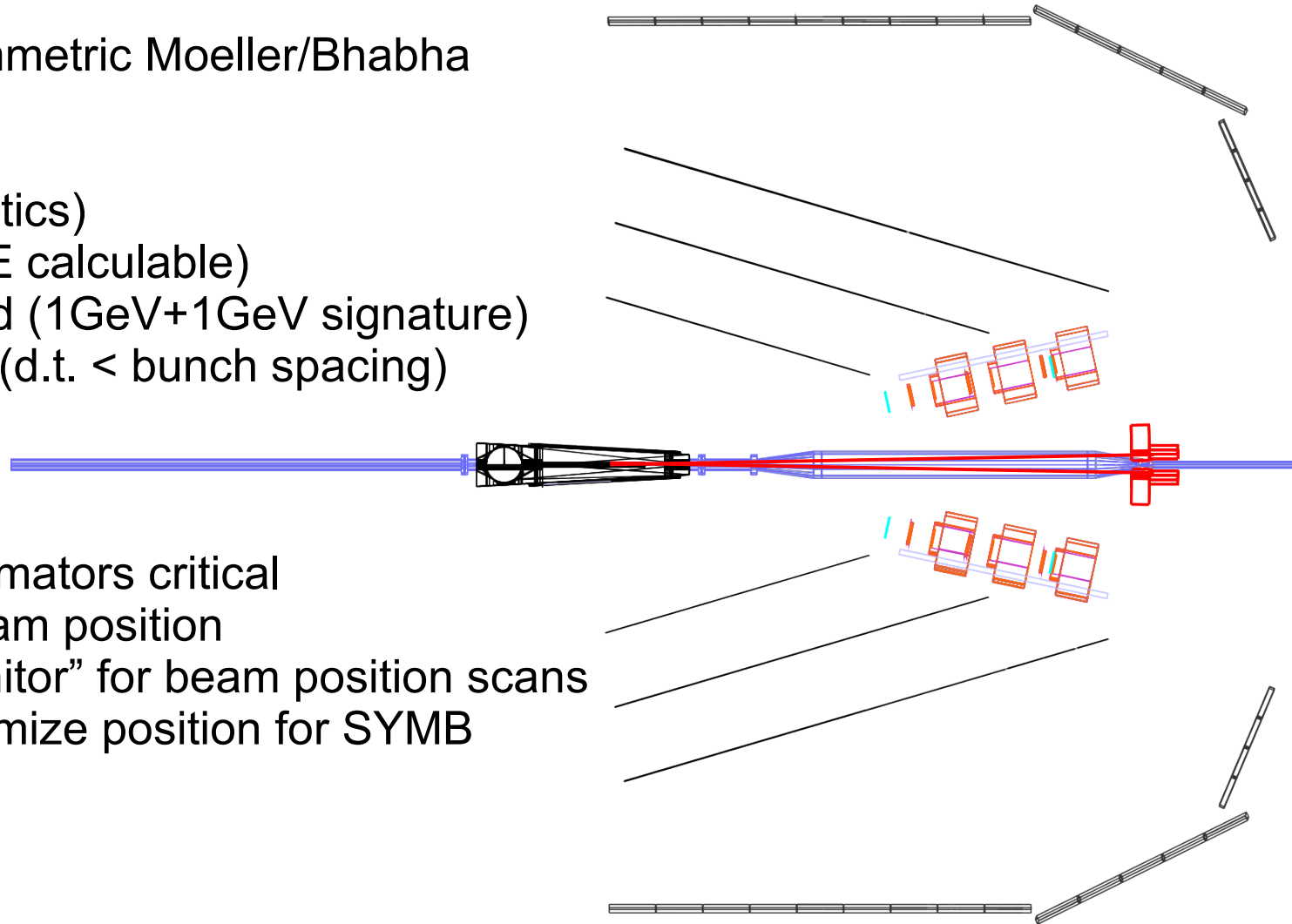
- new scintillators: 4mm instead of 8mm → less multiple scattering
- 2 SiPMs per scintillator instead of only 1 → better uniformity of light yield
- better signal to noise ratio
- redundancy (can run with single SiPM)
- prototypes extensively tested with cosmics, sources and at DESY Testbeam 22
- successful installation in recent service week (September)
 - efficiency >99%
 - (preliminary, needs more analysis!)

Relative Light Yield (prototype comparison @TB22):
old system new system

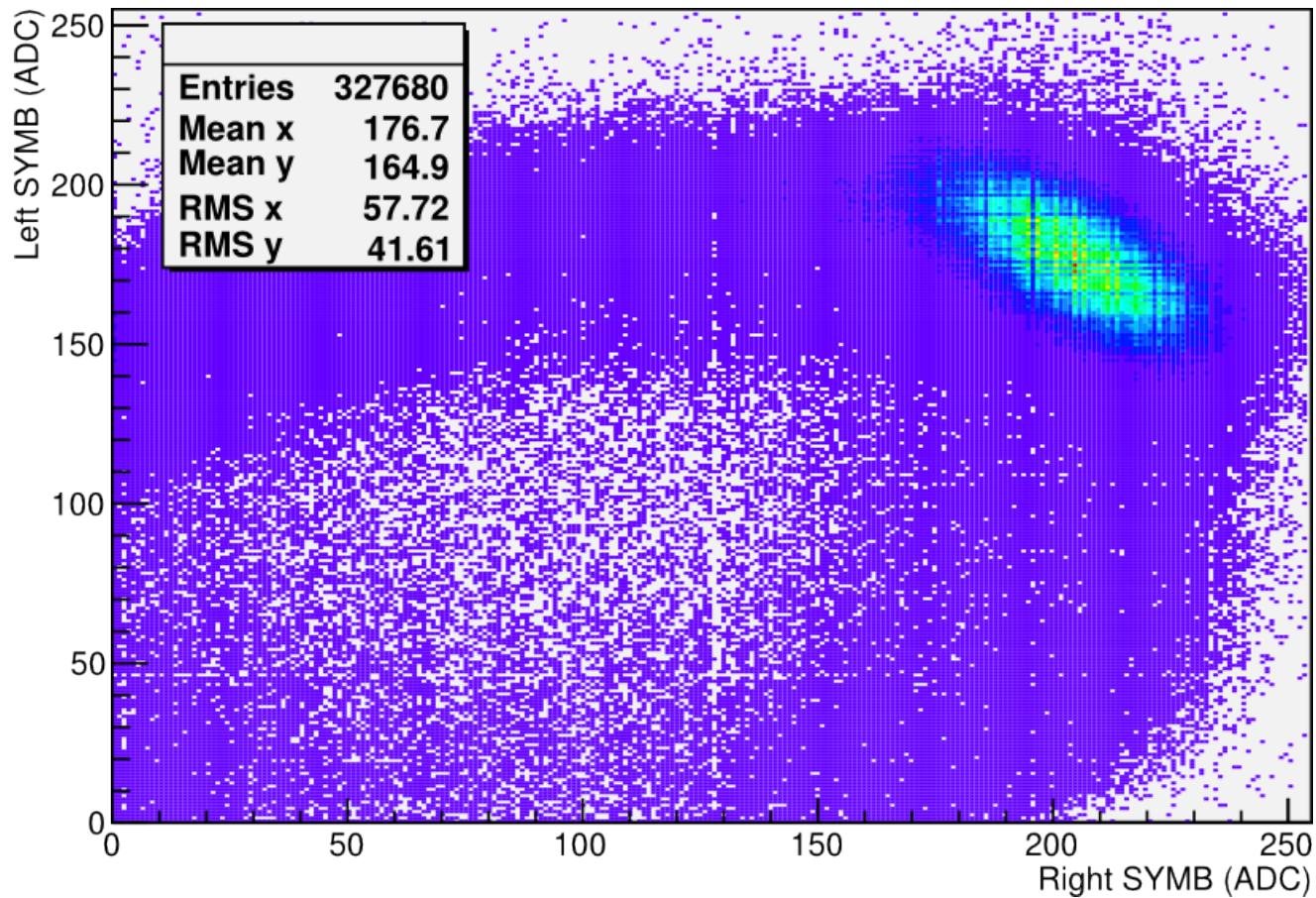


Detection of symmetric Moeller/Bhabha events at 1.29°

- fast (high statistics)
 - pure QED (TPE calculable)
 - low background (1GeV+1GeV signature)
 - dead time free (d.t. < bunch spacing)
-
- position of collimators critical
 - sensitive to beam position
 - use as “monitor” for beam position scans
 - need to optimize position for SYMB

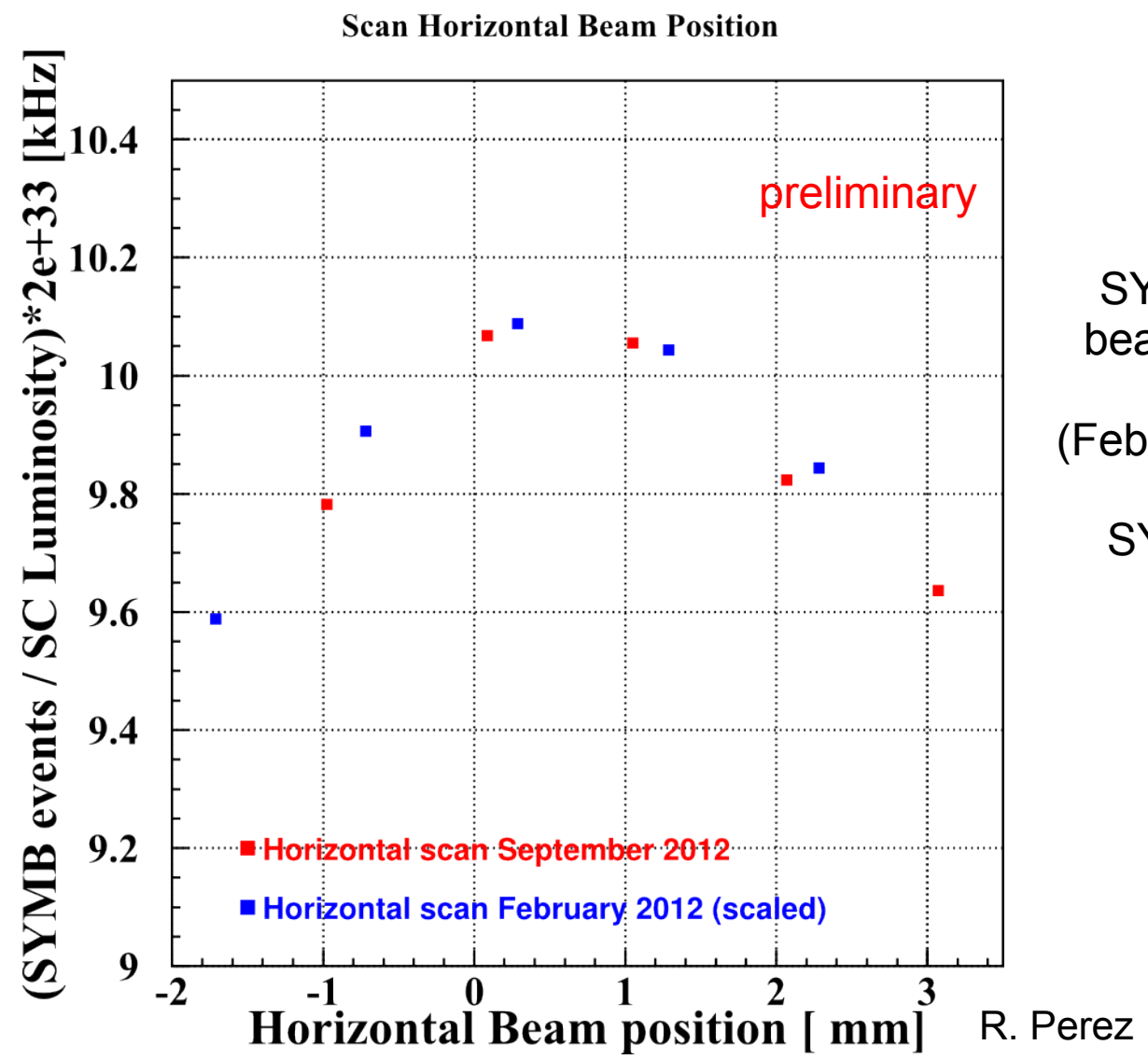


Histogram with Moeller events (coincidences)
(raw ADC vs. raw ADC)



R. Perez

Status of Symmetric Moeller/Bhabha Monitor



SYMB rate during beam position scan reproducible (February/September) Important for SYMB operation!

Slowcontrol Luminosity: lumi from hydrogen flow and beam current

February:

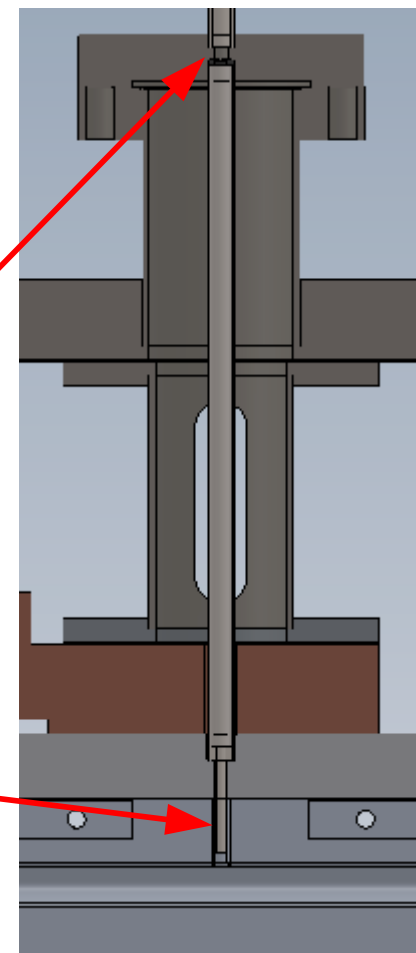
- missing a factor ~8 in luminosity (compared to Slowcontrol Luminosity)
- with given flow for beam lifetime higher than expected

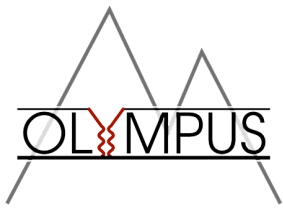
Suspicion: Maybe leakage of hydrogen into scattering chamber?

→ not all hydrogen goes into target cell

July:

- modification of target: additional pipe+sealing to fix leak between input line and cell
- now factor 8 less flow to get 1 hour beam lifetime
- all lumis agree:
factor 8 more luminosity with 0.1sccm flow w.r.t. February





Luminosity Comparison Experiment / MC



Runs from July Service Week (new target):

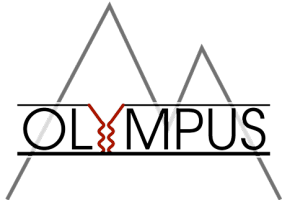
Compare MC (for MWPCs) and measurement with lumis: $\frac{\text{\#tracks}}{\text{SlowcontrolLuminosity}}$

species	field	MC/nb	GEMs/nb	MWPCs/nb
positrons	B+	6.5	7.6	8.1
positrons	B-	11.5	11.5	12.6

preliminary

No corrections applied yet: (work in progress)

- MWPC acceptance is ~120% of GEM acceptance
- GEM Lorentz angles (momentum measurement)
- make use of identification of proton by drift chambers

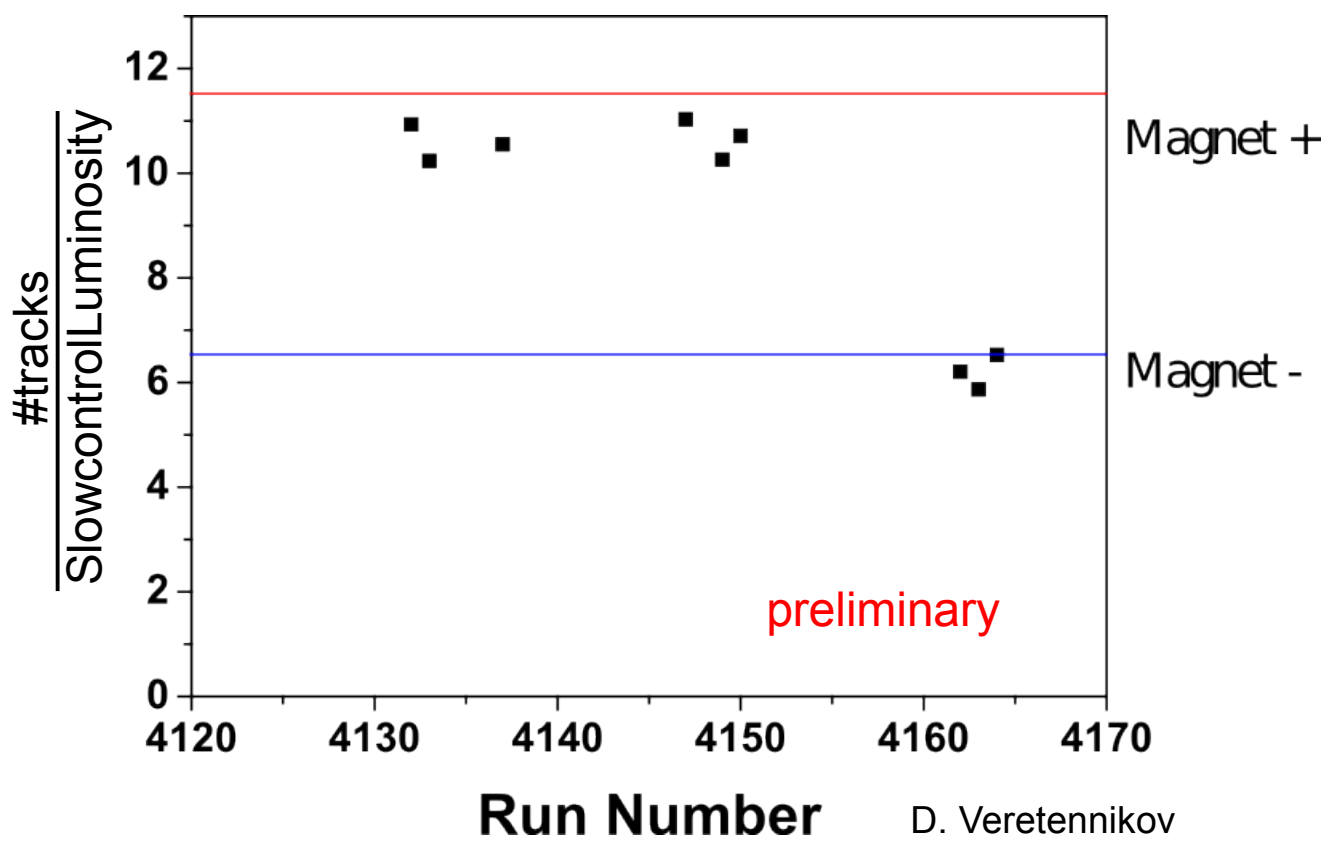


Luminosity Comparison Experiment / MC

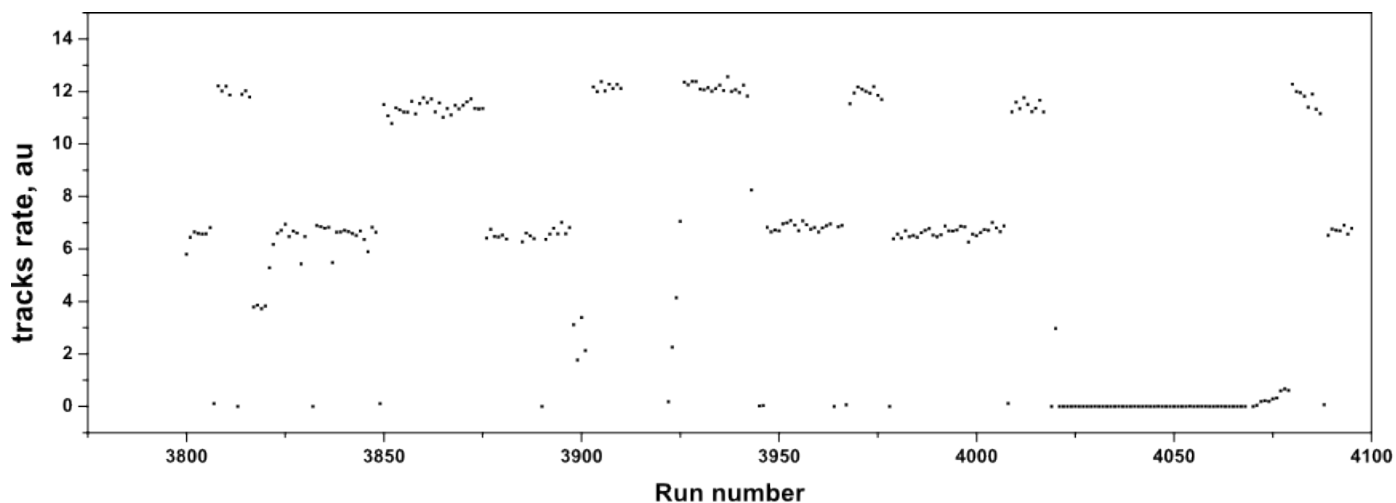


Runs from July Service Week (new target cell), MWPCs only

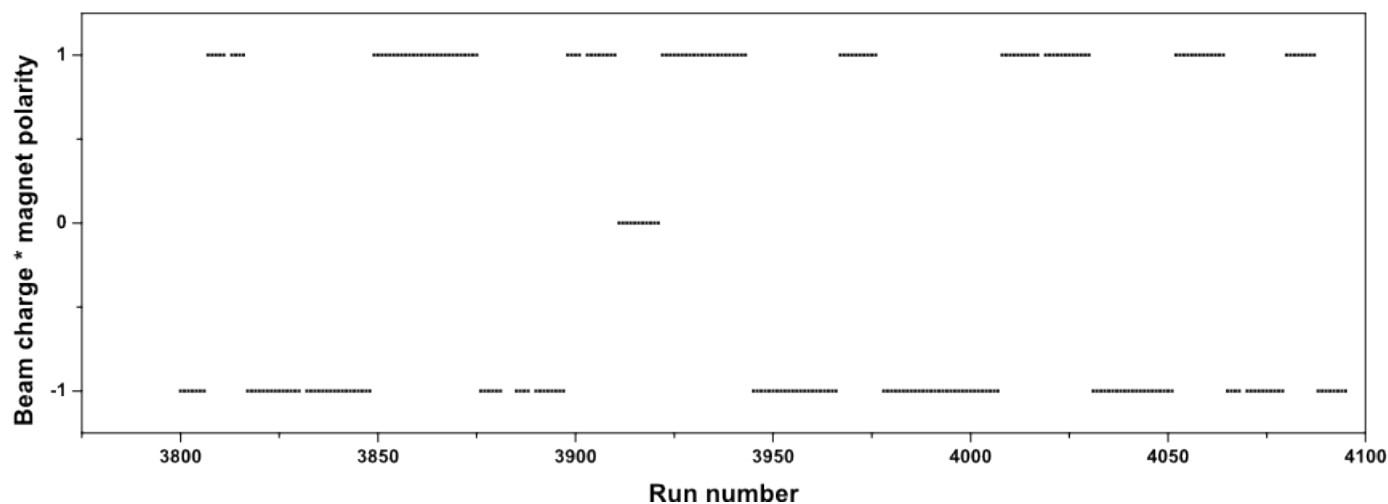
MC number
Magnet + 11.52
Magnet - 6.55



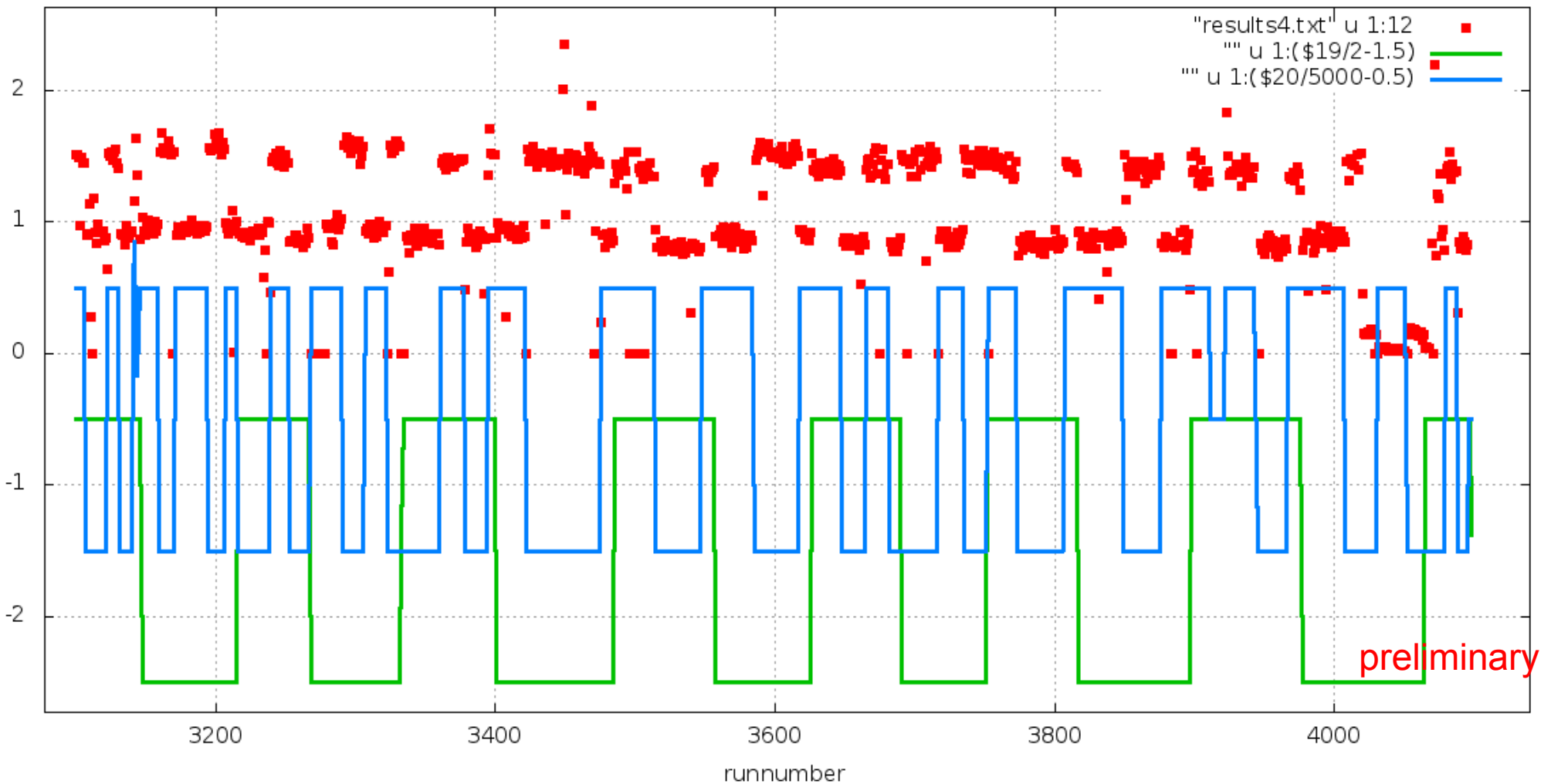
MWPCs – no cuts, #tracks/SlowcontrolLuminosity



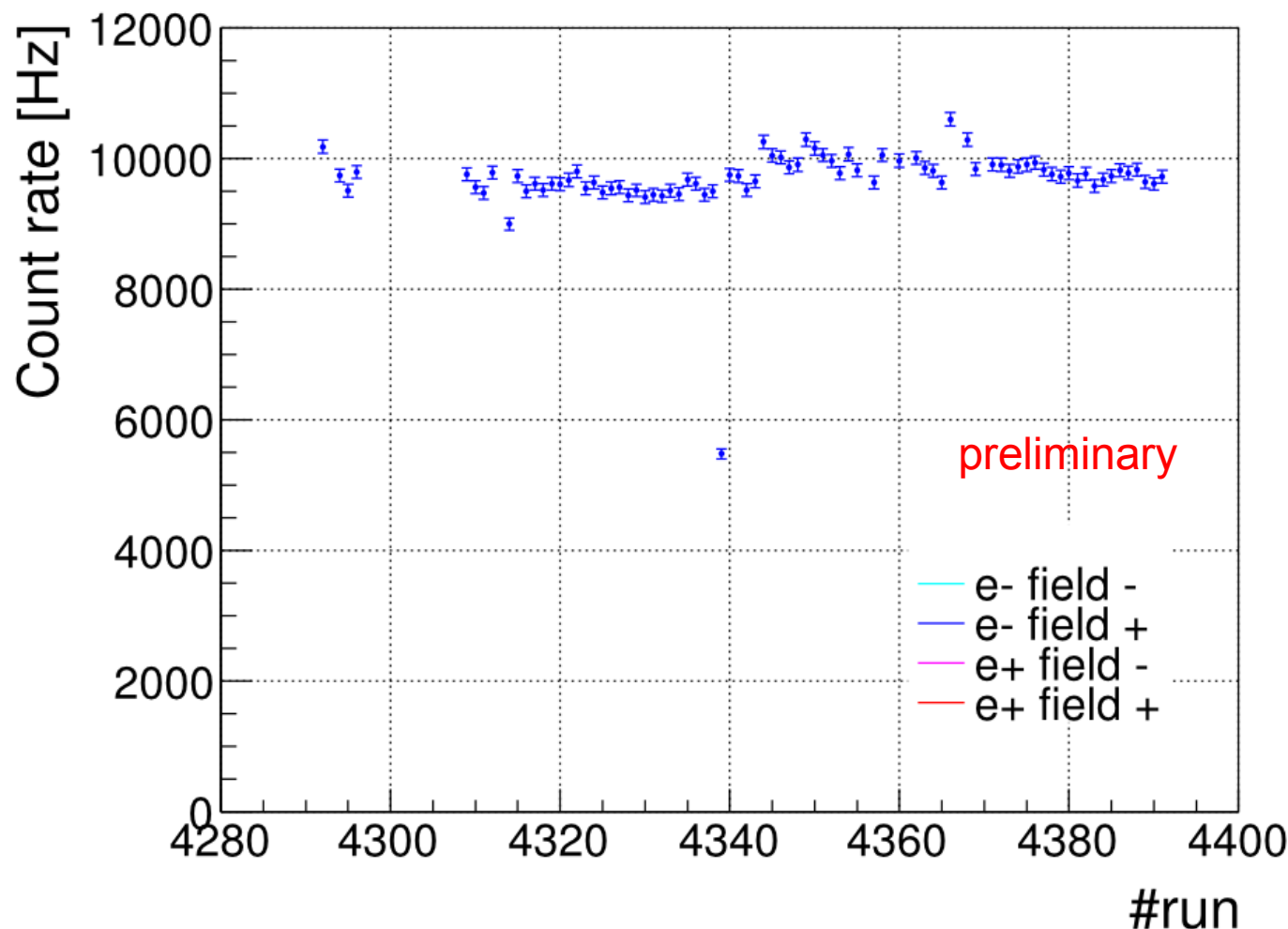
preliminary



GEMs – no cuts, #trackcandidates/SlowcontrolLuminosity



Rate of Moeller coincidences (July Service Week)
in Symmetric Moeller/Bhabha Monitor



R. Perez

Hardware operational

Trigger Upgrade for 2nd Run

Reconstruction / Clustering / Tracking
within cooker Analysis Framework

(*) Online Monitoring / Near Online Monitoring for 2nd Run

Systems agree on factor 8 in Luminosity July / February

(*) Combined Analysis GEMs/MWPCs/WCs under way

(*) 12° Luminosity also close to MC now

(*) work in progress