π^0 yield run dependence

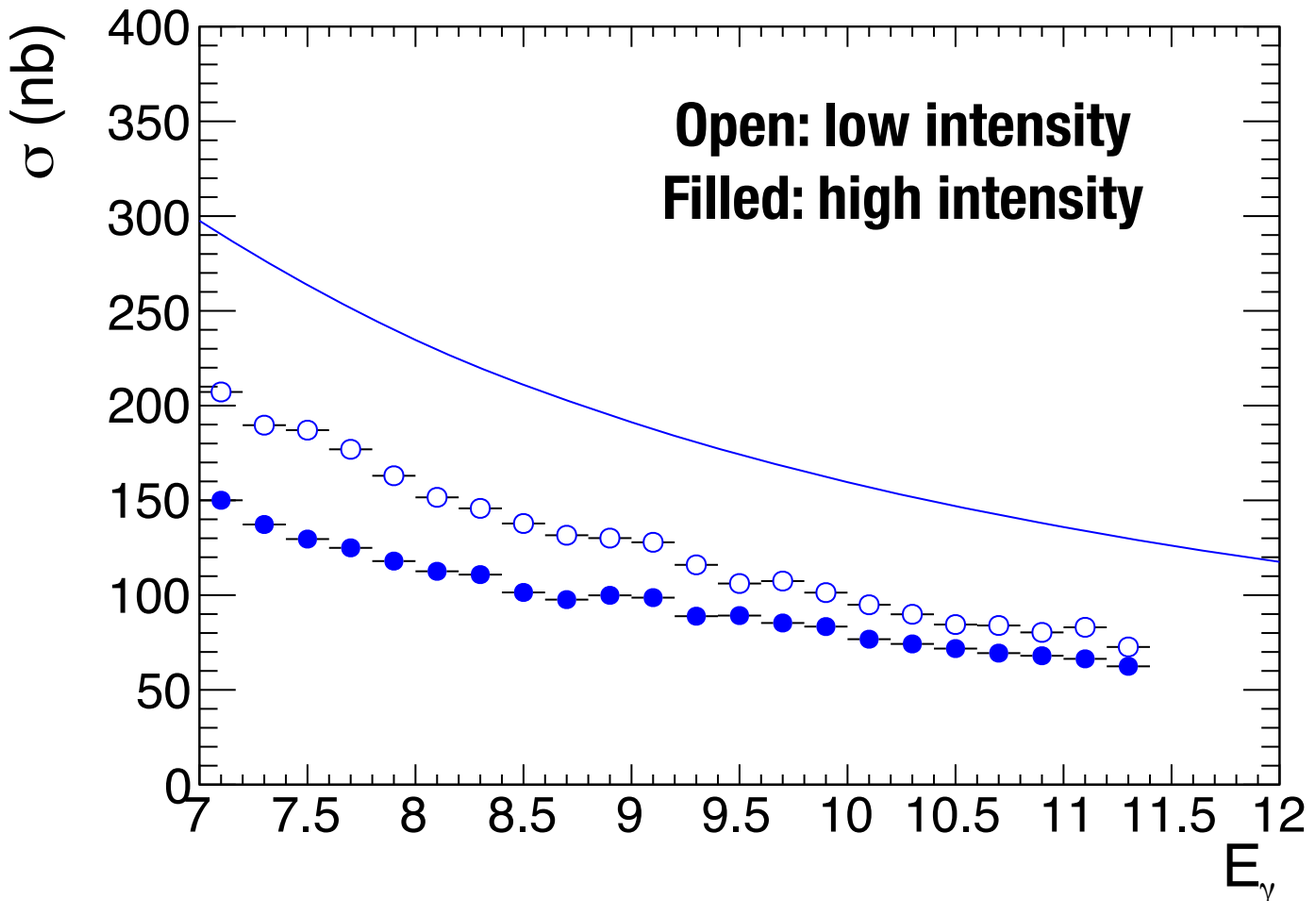
Justin Stevens

Analysis Meeting: 9.13.17

William & Mary
CHARTERED 1693

Initial goal: understand 2017 difference

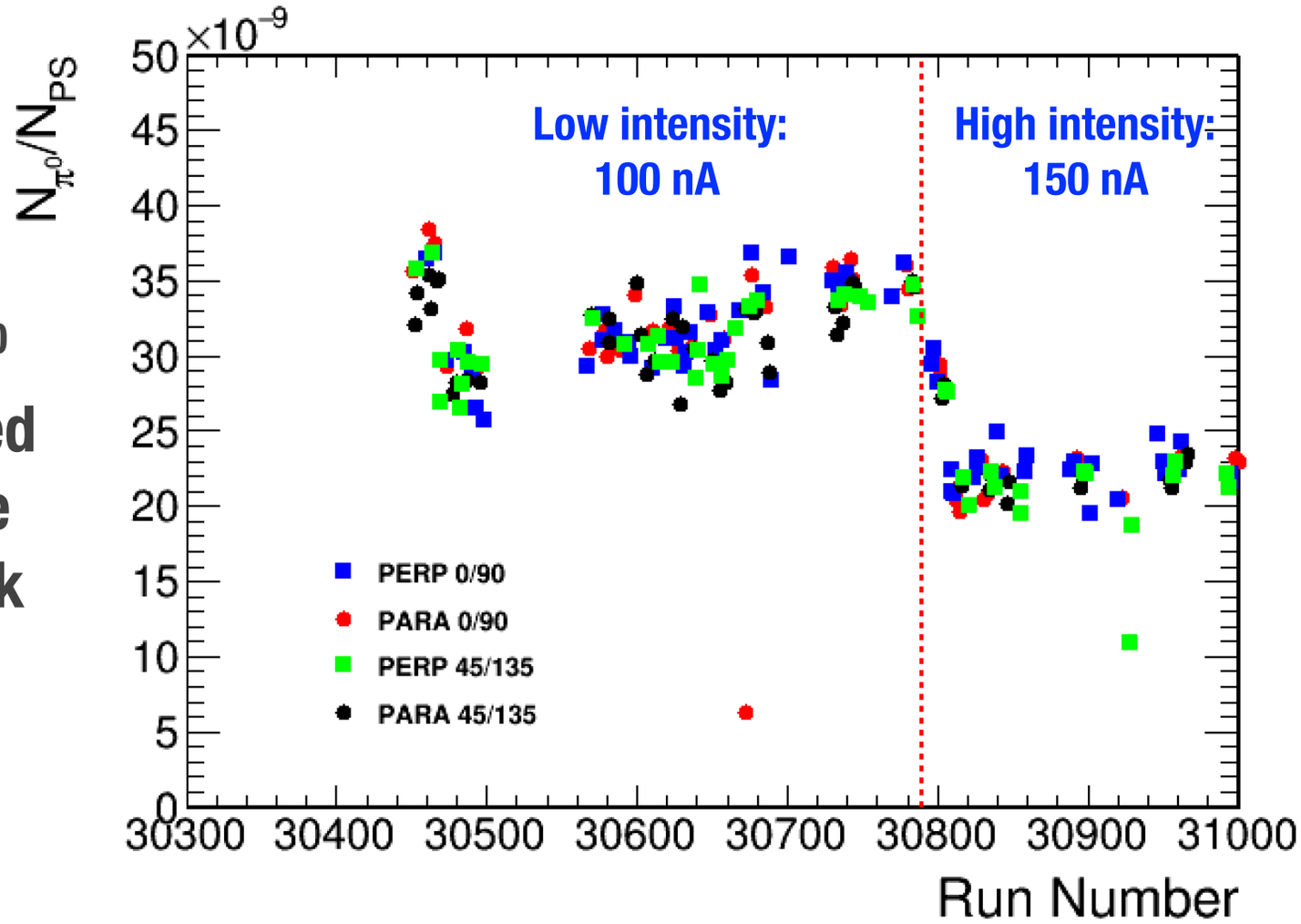
Spring 2017: $\gamma p \to p\pi^0$



- No clear indication that flux or MC efficiency can produce such a large discrepancy for only 50% larger intensity
- Try breaking it down by individual runs…

Run-by-run comparison: N_π/N_{PS}

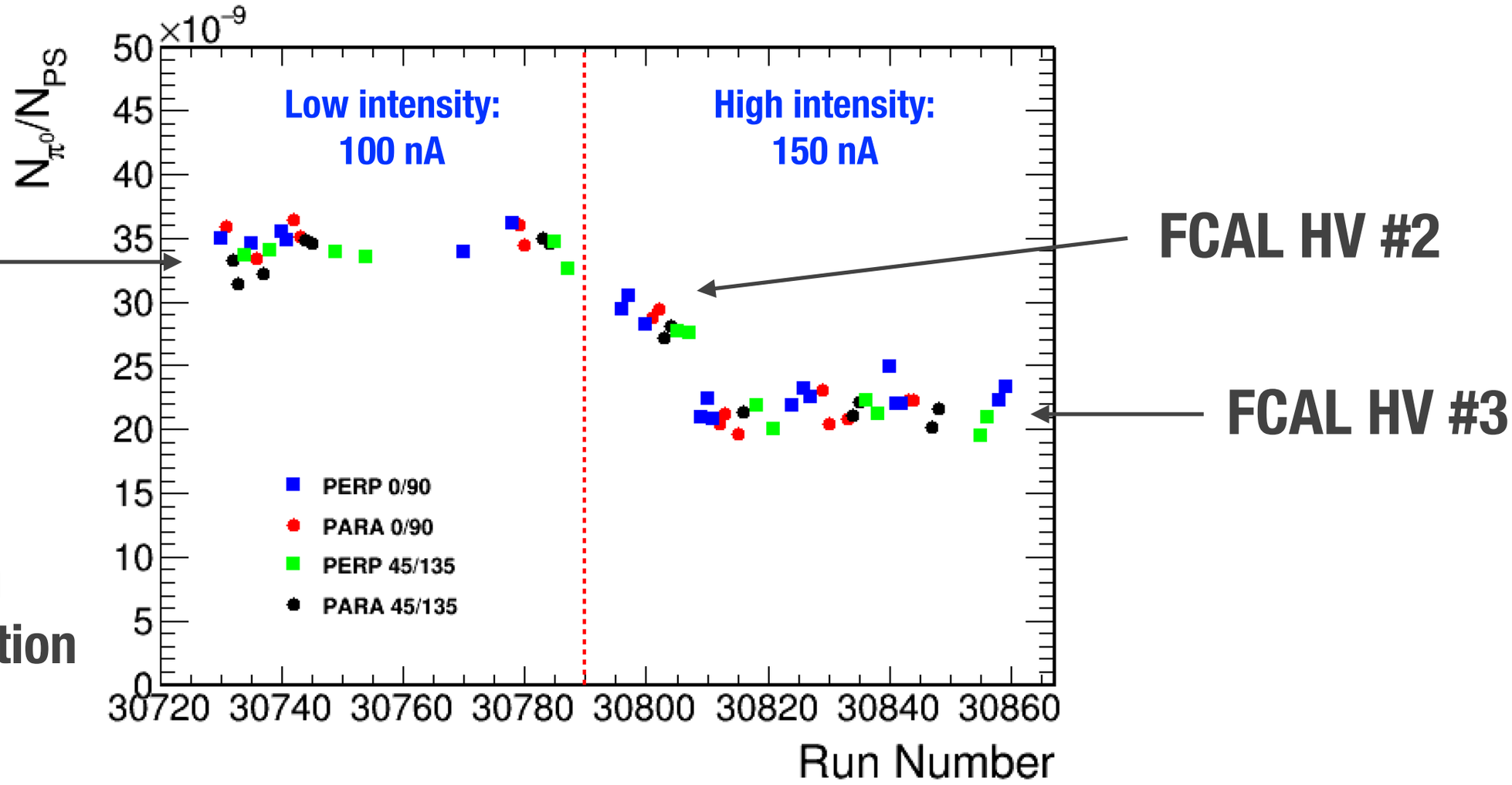
Normalize π^0 yield by tagged PS flux in the coherent peak



RunNumber	Beam Current (nA)	FCAL HV Set	TAGM bias/ threshold Set	Low-E TAGH HV
30274-30788	100	1	1	On
30789-30807	150	2	2	Off
30808-31057	150	3	2	Off

https://halldweb.jlab.org/wiki-private/index.php/Spring_2017_Dataset_Summary#Global_Events

Run-by-run comparison: N_π/N_{PS}



FCAL HV #1

FCAL HV #2

FCAL HV #3

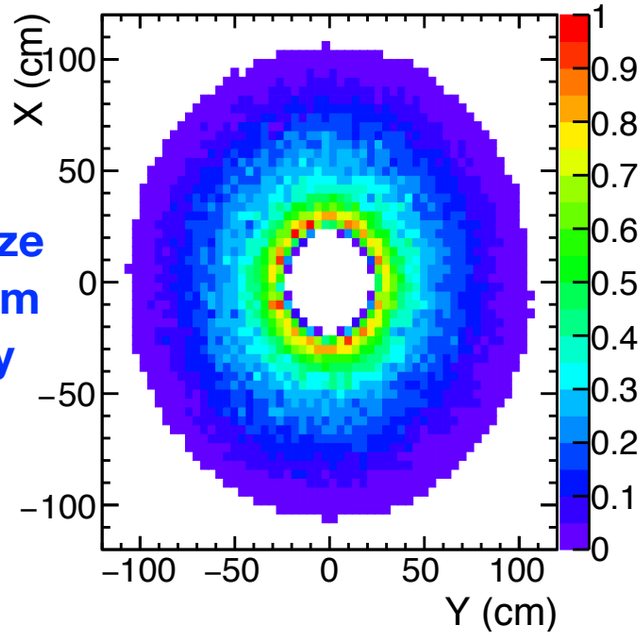
Zoom in on low → high intensity transition

RunNumber	Beam Current (nA)	FCAL HV Set	TAGM bias/ threshold Set	Low-E TAGH HV
30274-30788	100	1	1	On
30789-30807	150	2	2	Off
30808-31057	150	3	2	Off

https://halldweb.jlab.org/wiki-private/index.php/Spring_2017_Dataset_Summary#Global_Events

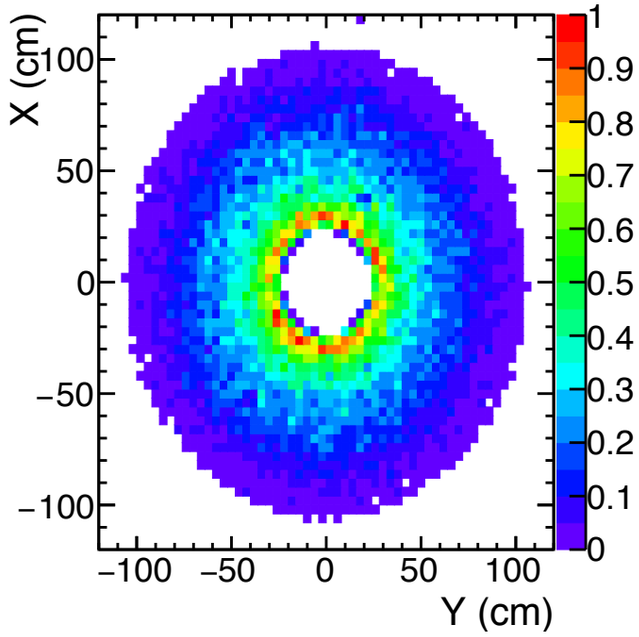
FCAL shower XY position: π^0 events

FCAL HV #1
30700-30788

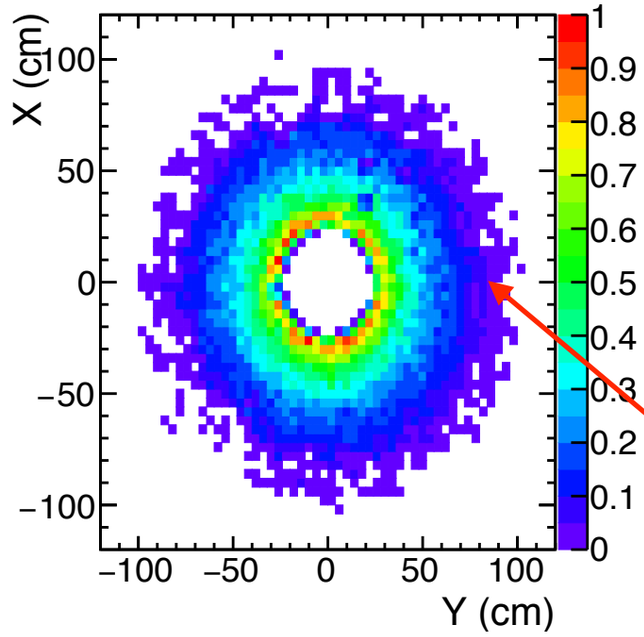


Normalize maximum to unity

FCAL HV #2
30796-30807

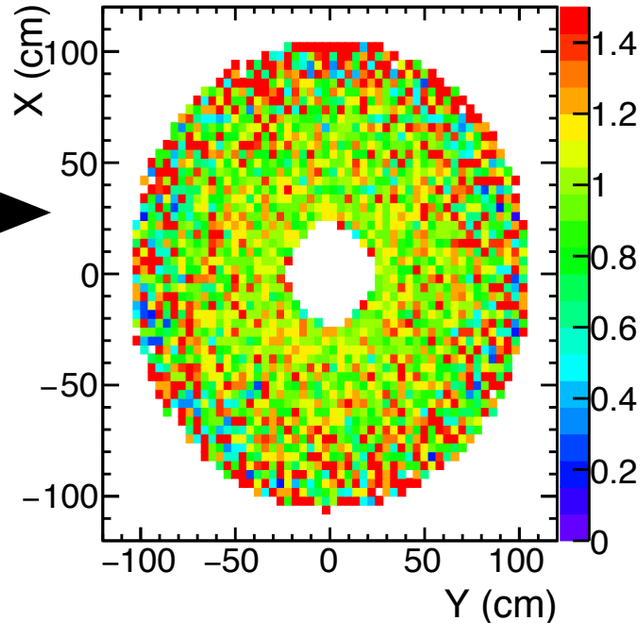


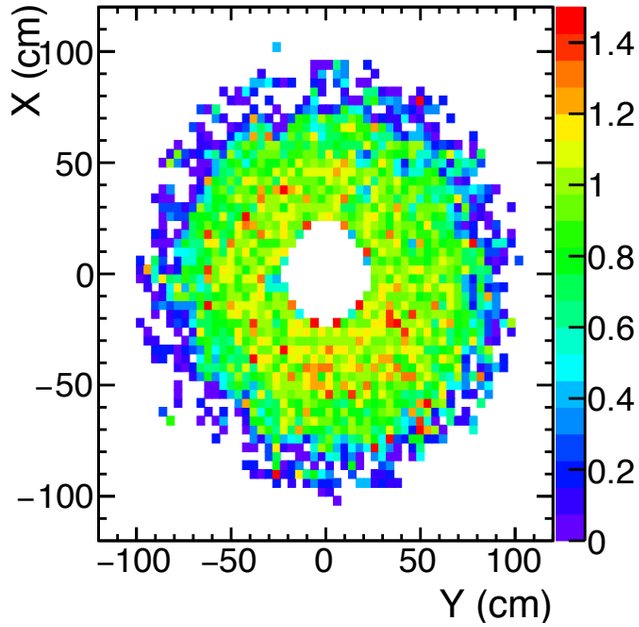
FCAL HV #3
30806-30860



Missing showers?

Take ratio w.r.t. FCAL HV #1

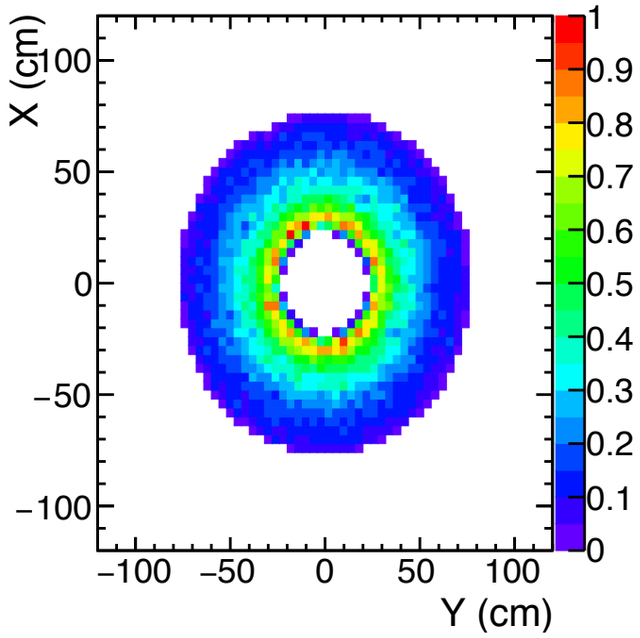




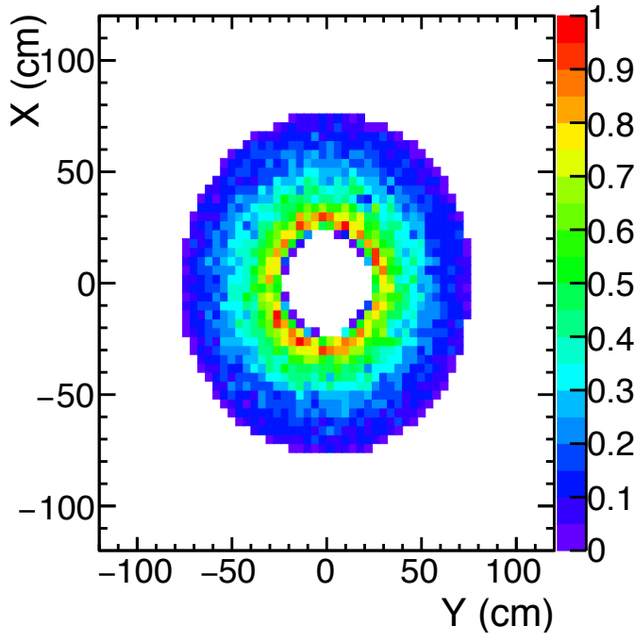
Showers at larger radii are lost in FCAL HV set #3

FCAL shower XY position: π^0 events

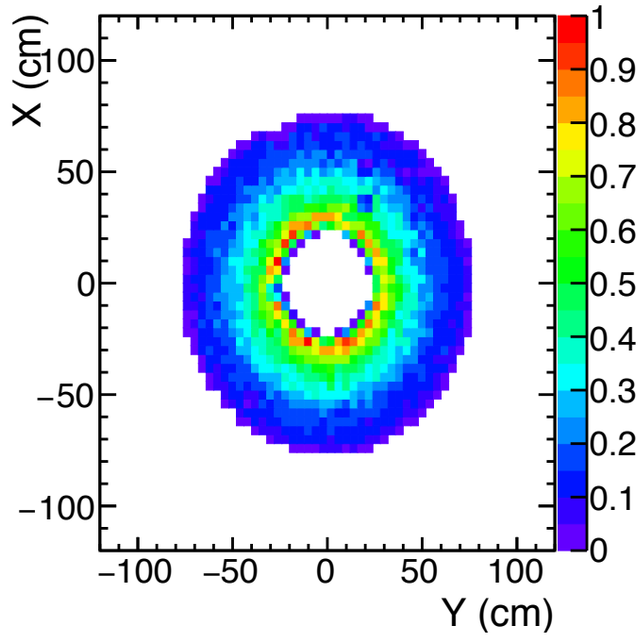
FCAL HV #1
30700-30788



FCAL HV #2
30796-30807

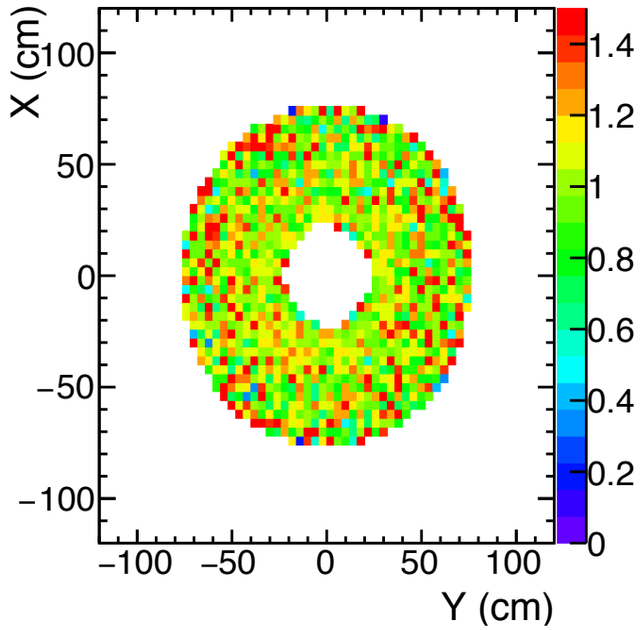


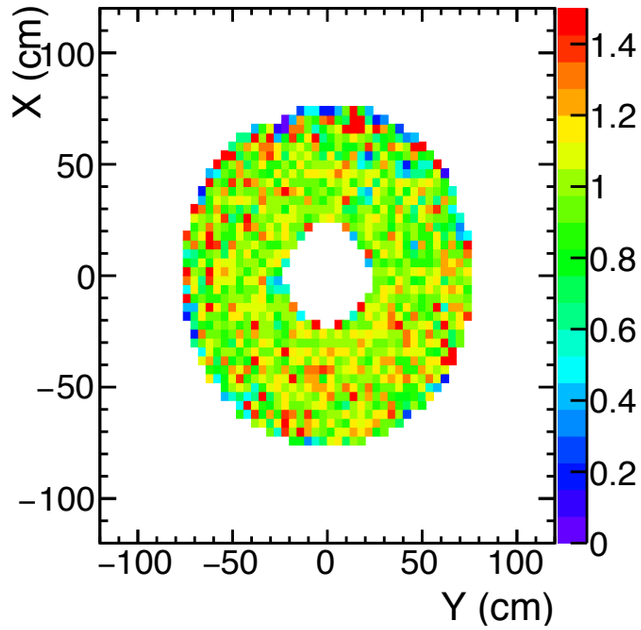
FCAL HV #3
30806-30860



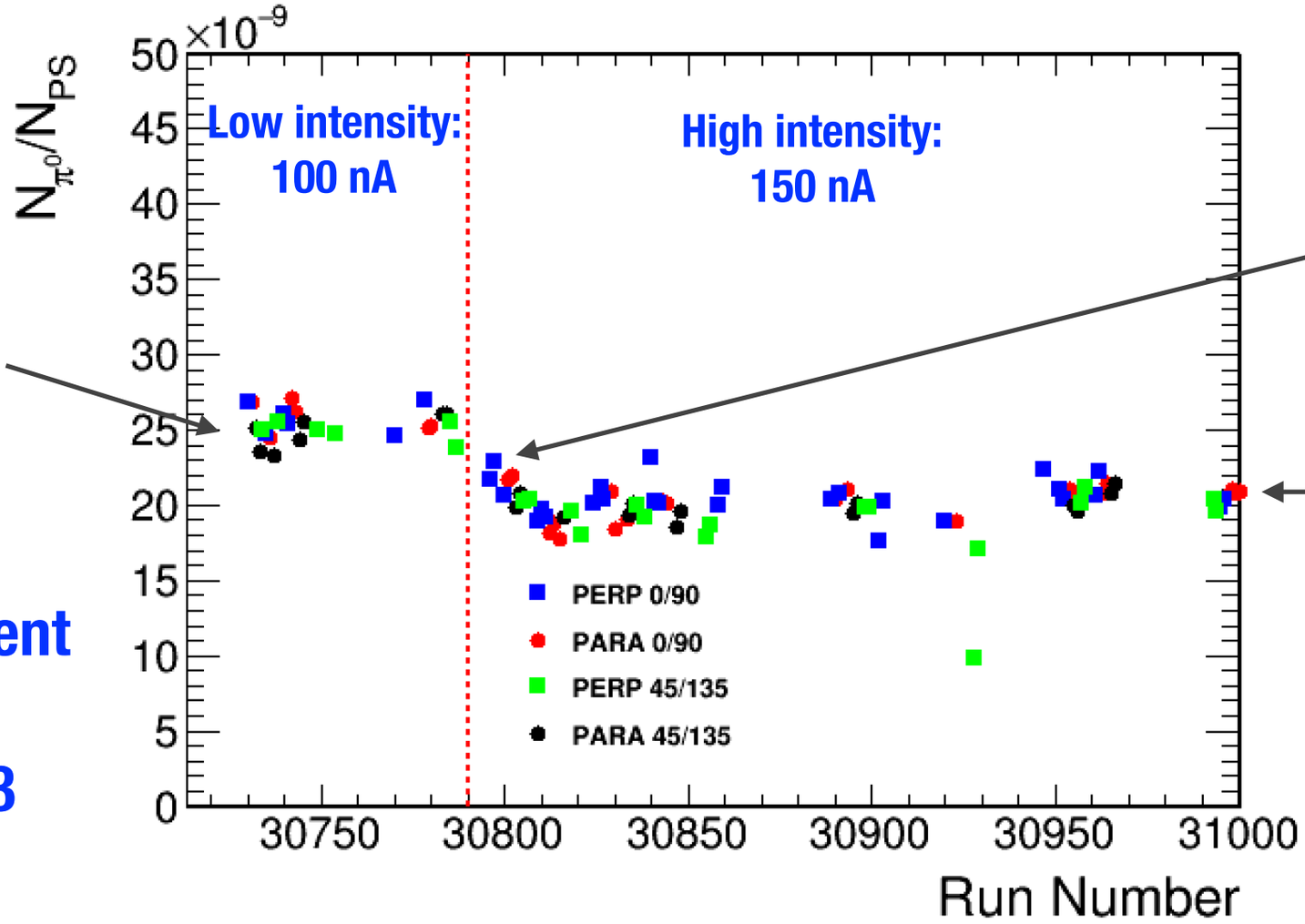
Make a fiducial cut to remove all showers with R_{XY} > 75 cm

Then compare normalized π^0 yields





Run-by-run comparison: N_π/N_{PS}



FCAL HV #1

FCAL HV #2

FCAL HV #3

Better agreement between HV #2 and #3

RunNumber	Beam Current (nA)	FCAL HV Set	TAGM bias/ threshold Set	Low-E TAGH HV
30274-30788	100	1	1	On
30789-30807	150	2	2	Off
30808-31057	150	3	2	Off

https://halldweb.jlab.org/wiki-private/index.php/Spring_2017_Dataset_Summary#Global_Events

Summary

- Observed changes in normalized π^0 yield with FCAL HV settings near low → high intensity transition
- Showers from the π^0 events in the outer radius of the FCAL seem to be suppressed in HV set #3
- A fiducial cut to exclude the outer radius of FCAL brings the HV #2 and #3 results into ~agreement
- Interest in comparing to fully charged channels which may be less sensitive to FCAL HV settings
  - (Or do they have larger trigger-dependent effects?)