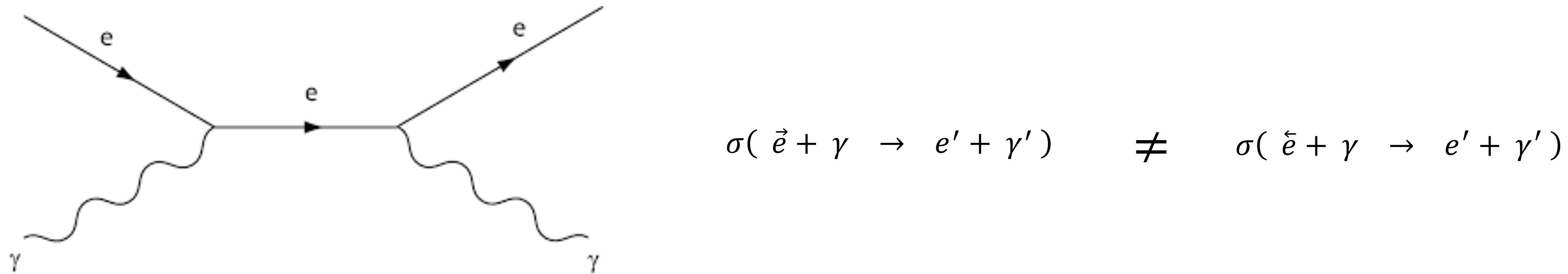


SULI: Compton Polarimeter Photon Analysis

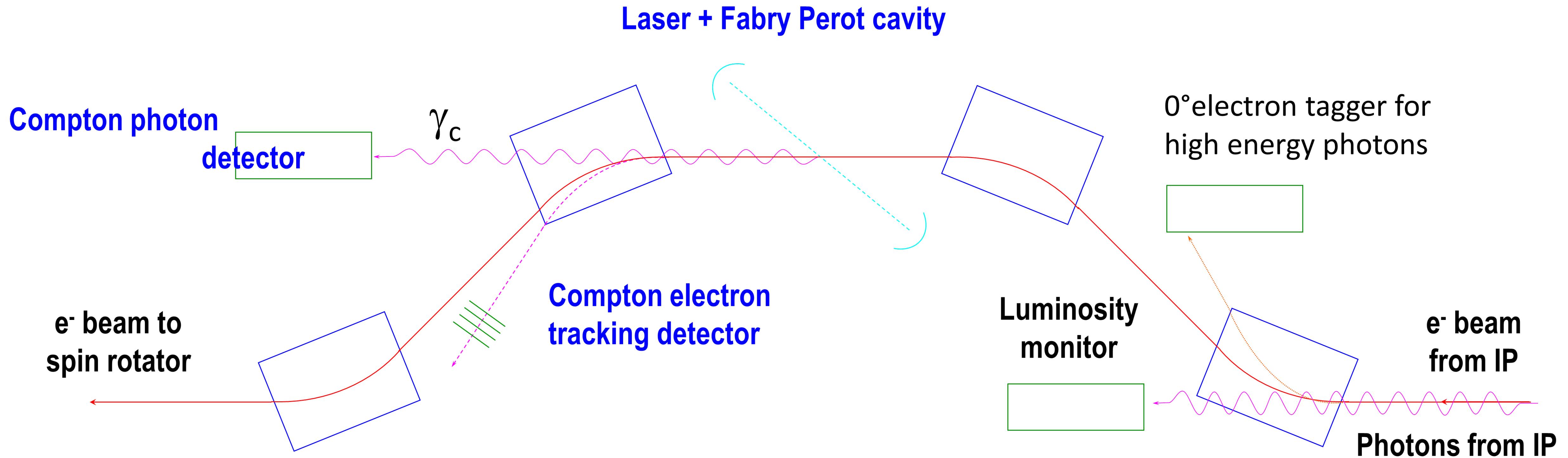
Beatrice Liang-Gilman
Mentor: Alexandre Camsonne

General Idea

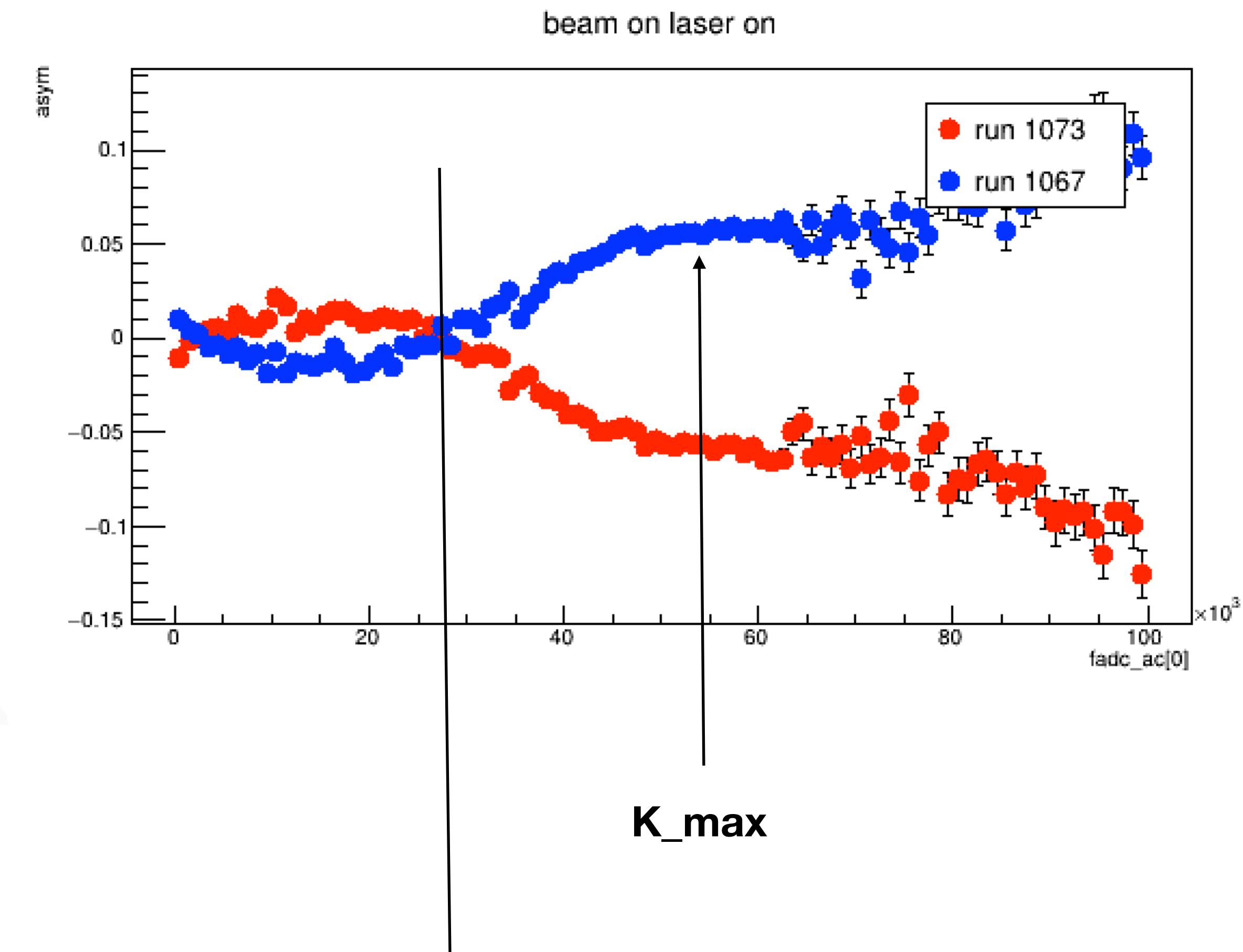
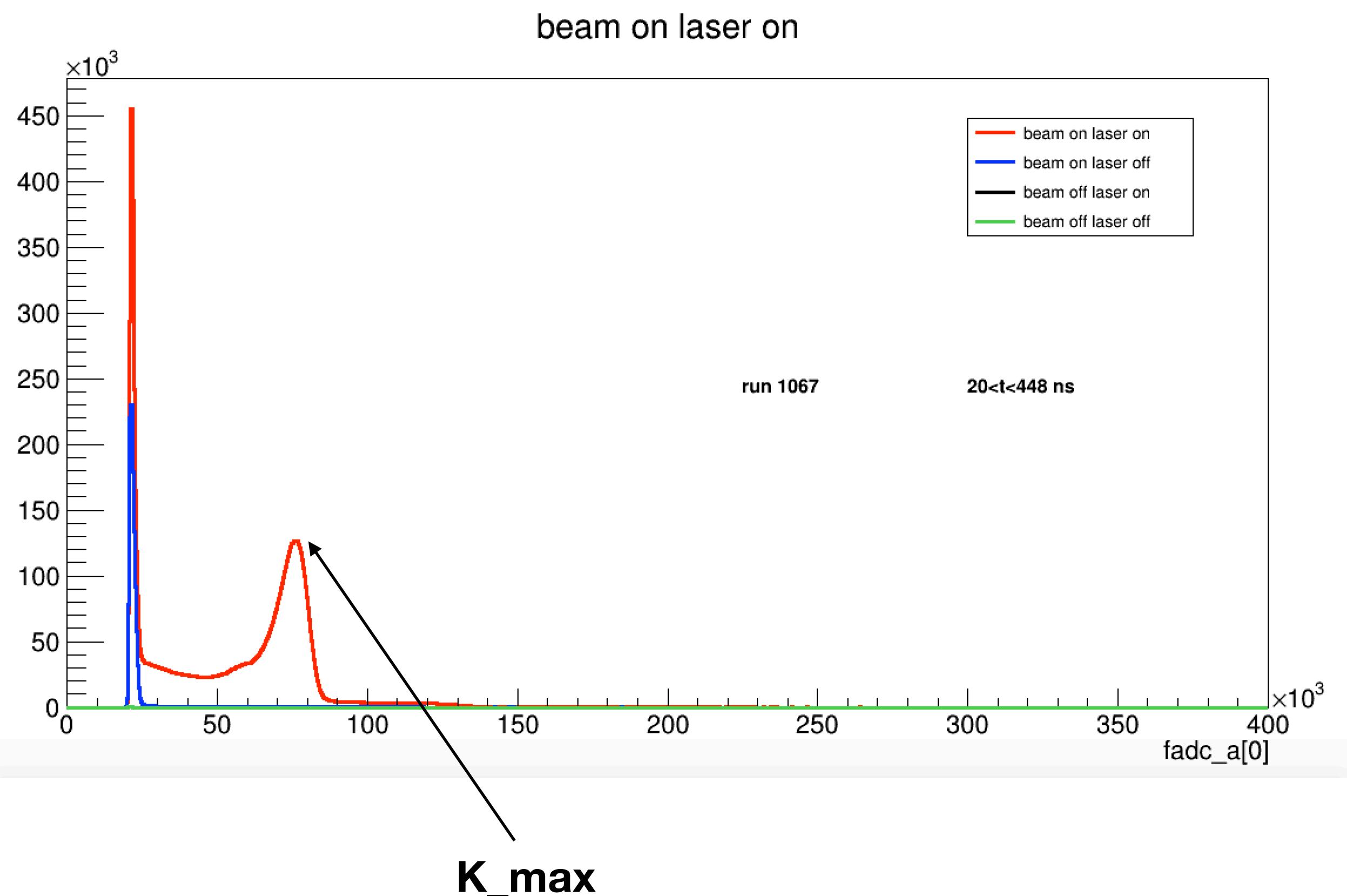


$$A_{EXP} \equiv \frac{N^+ - N^-}{N^+ + N^-} = P_e * P_\gamma * A_{QED}(E_e, k_\gamma, k_{\gamma'})$$

Experimental Set-up



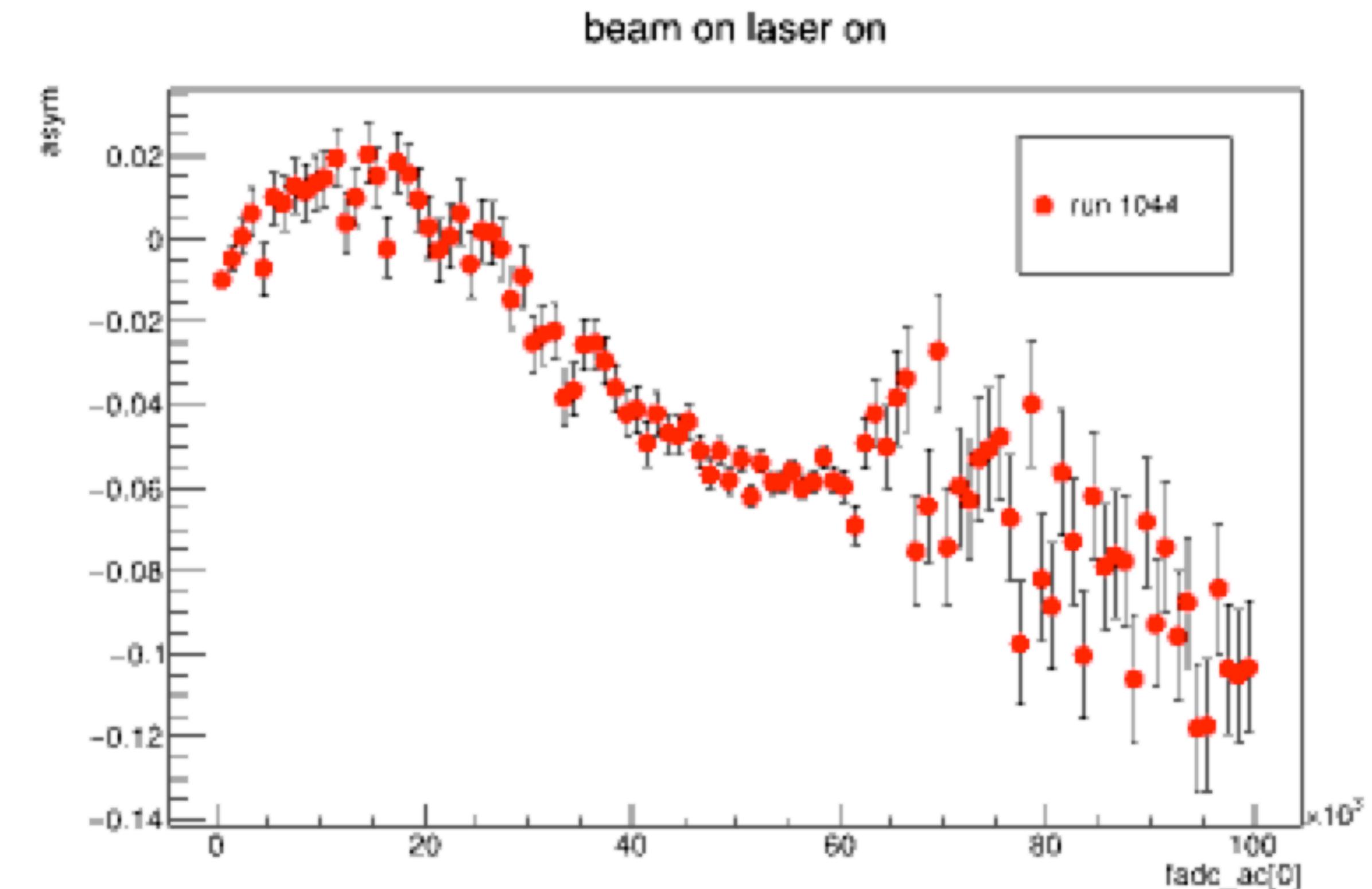
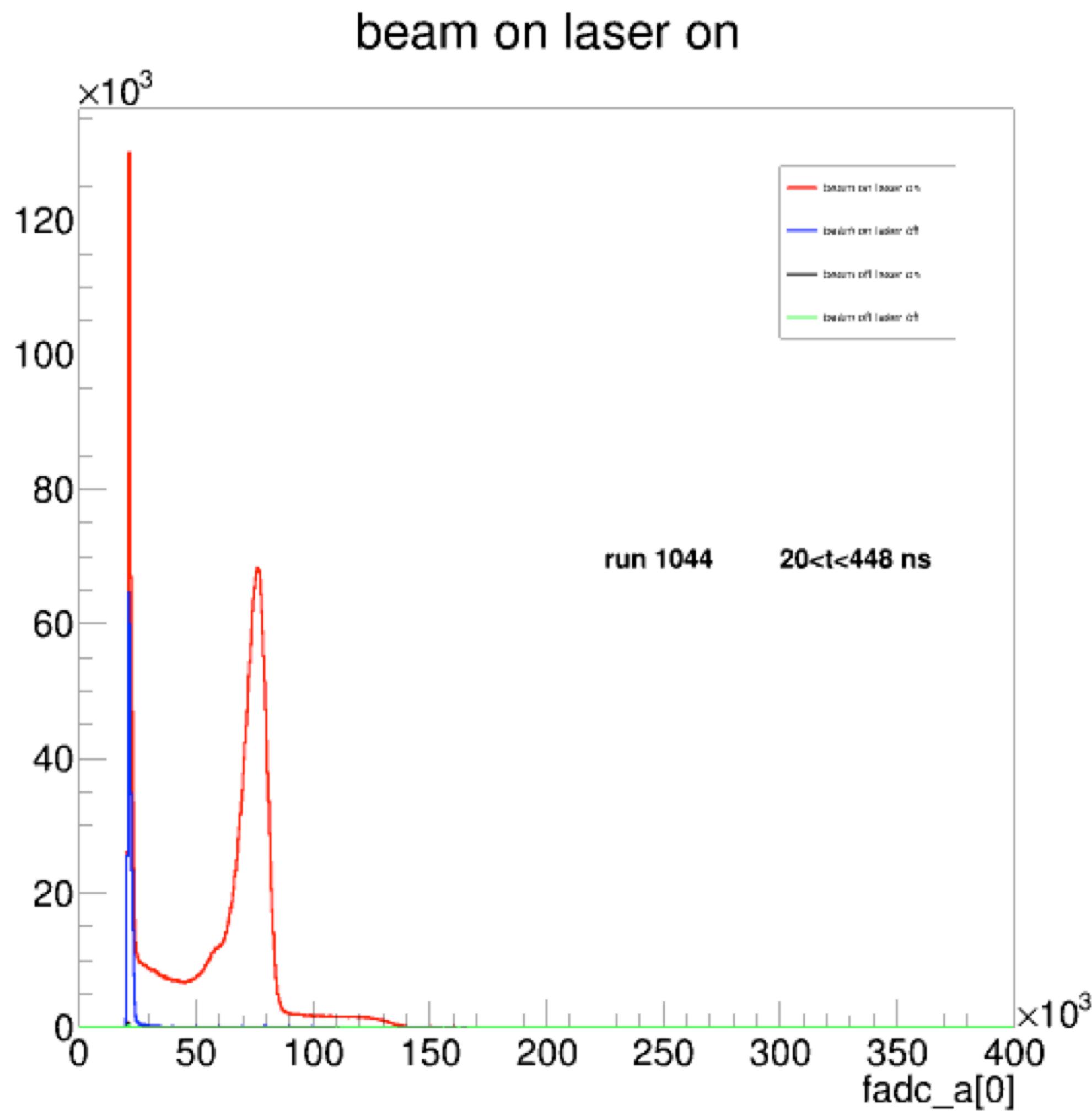
Plots



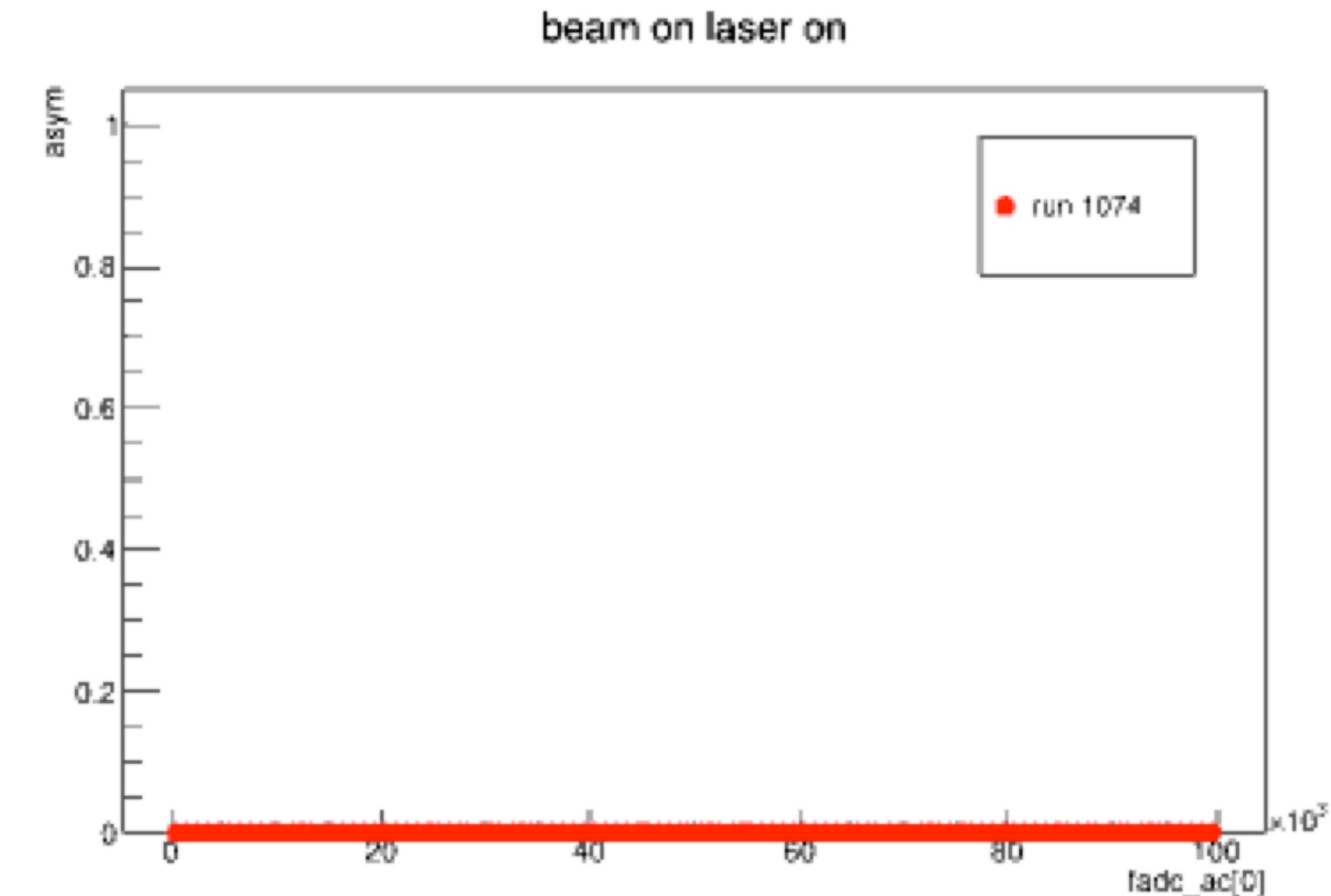
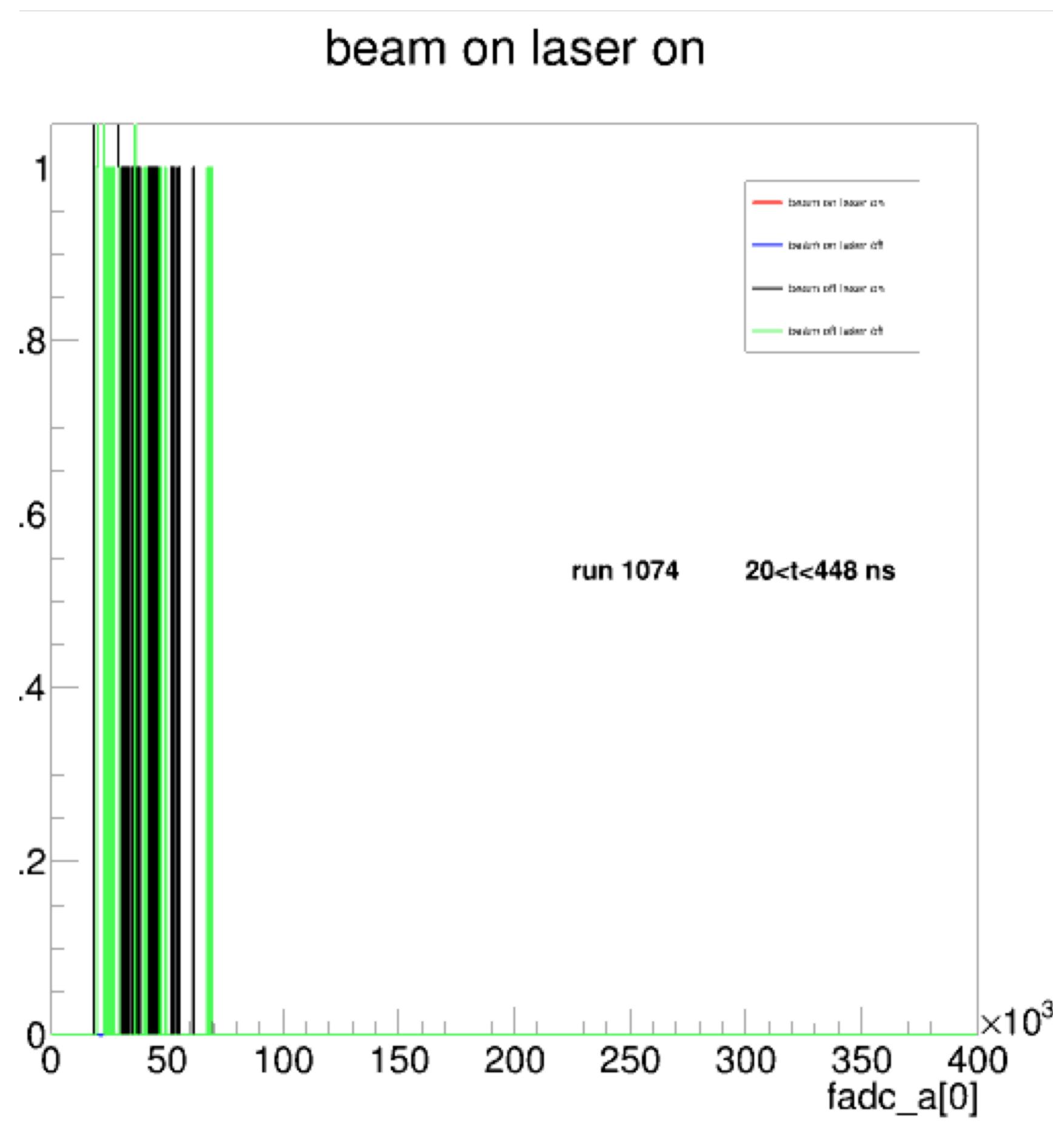
Completed Tasks

- Plot Compton spectrum for photon for all runs in run period 3
- Update spreadsheet with any anomalies
 - [https://docs.google.com/spreadsheets/u/1/d/16HPttGTG5GULWUFjlRw-20-SgEolfhAKXEFRMeF7i8/edit?
ouid=105752972584218135444&usp=sheets_home&ths=true](https://docs.google.com/spreadsheets/u/1/d/16HPttGTG5GULWUFjlRw-20-SgEolfhAKXEFRMeF7i8/edit?ouid=105752972584218135444&usp=sheets_home&ths=true)
- Calculate energy calibration
- Plot asymmetry as a function of energy

Some Examples: Run 1044

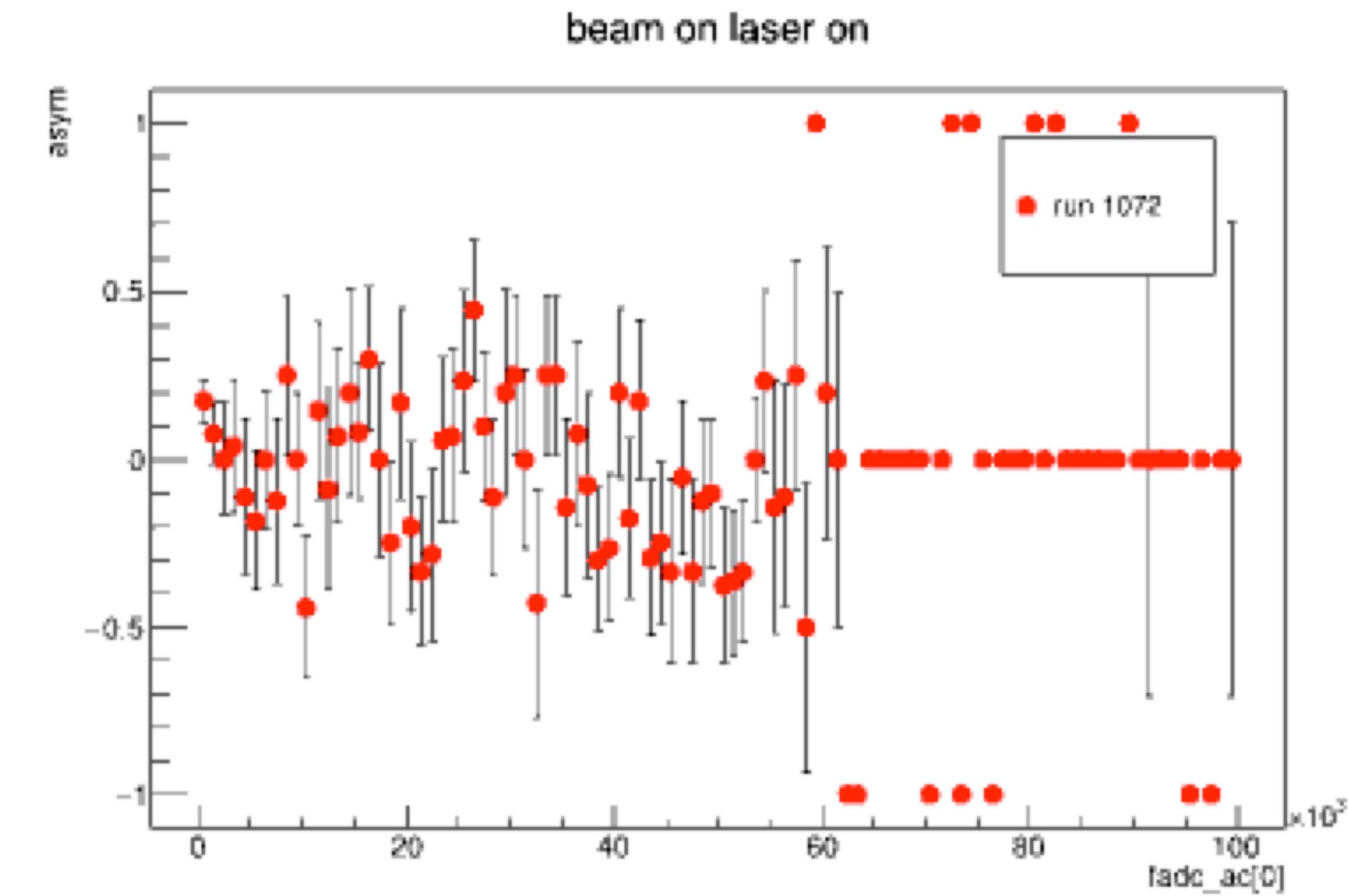
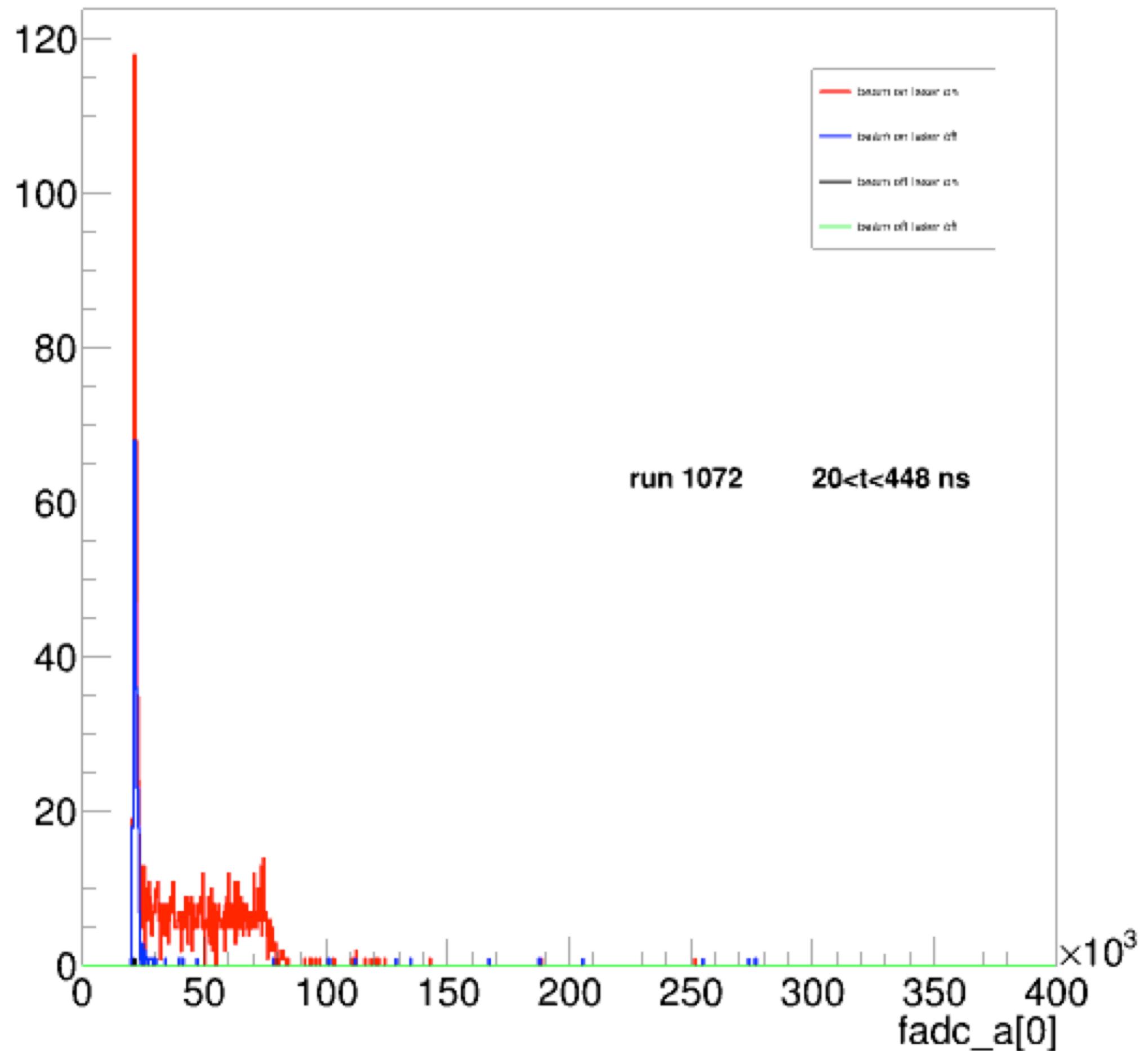


More Examples: Run 1074



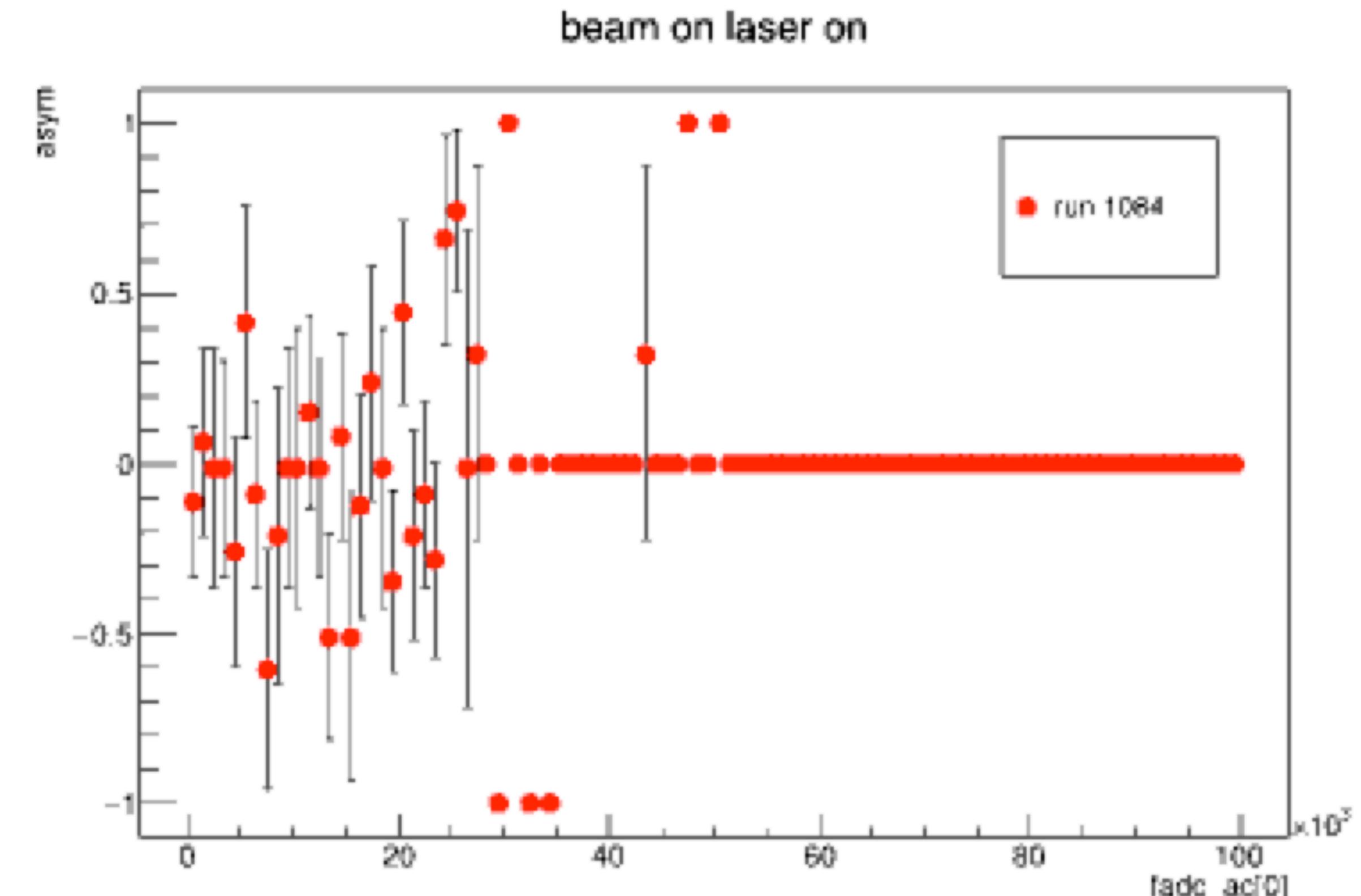
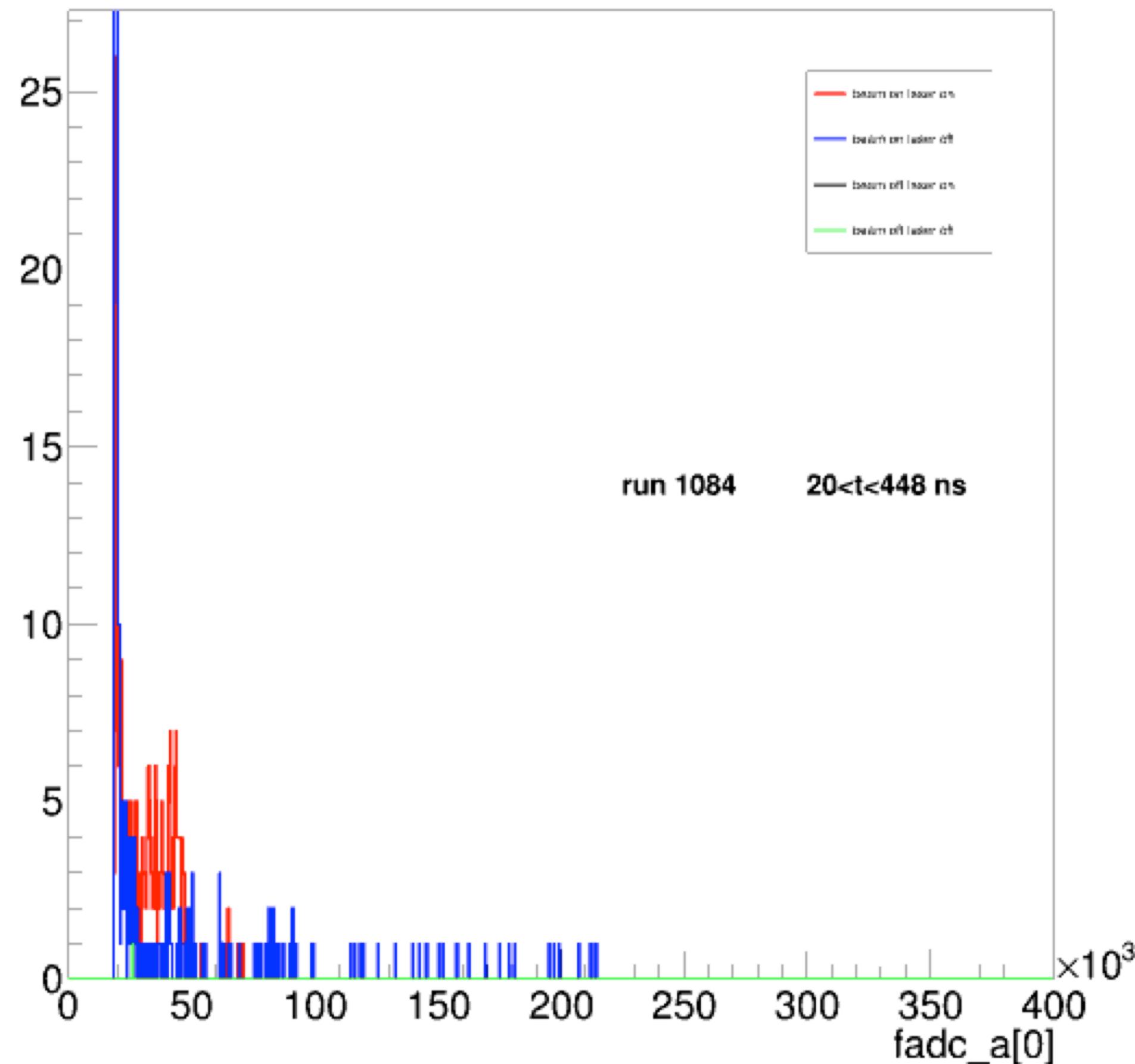
More Examples: Run 1072

beam on laser on

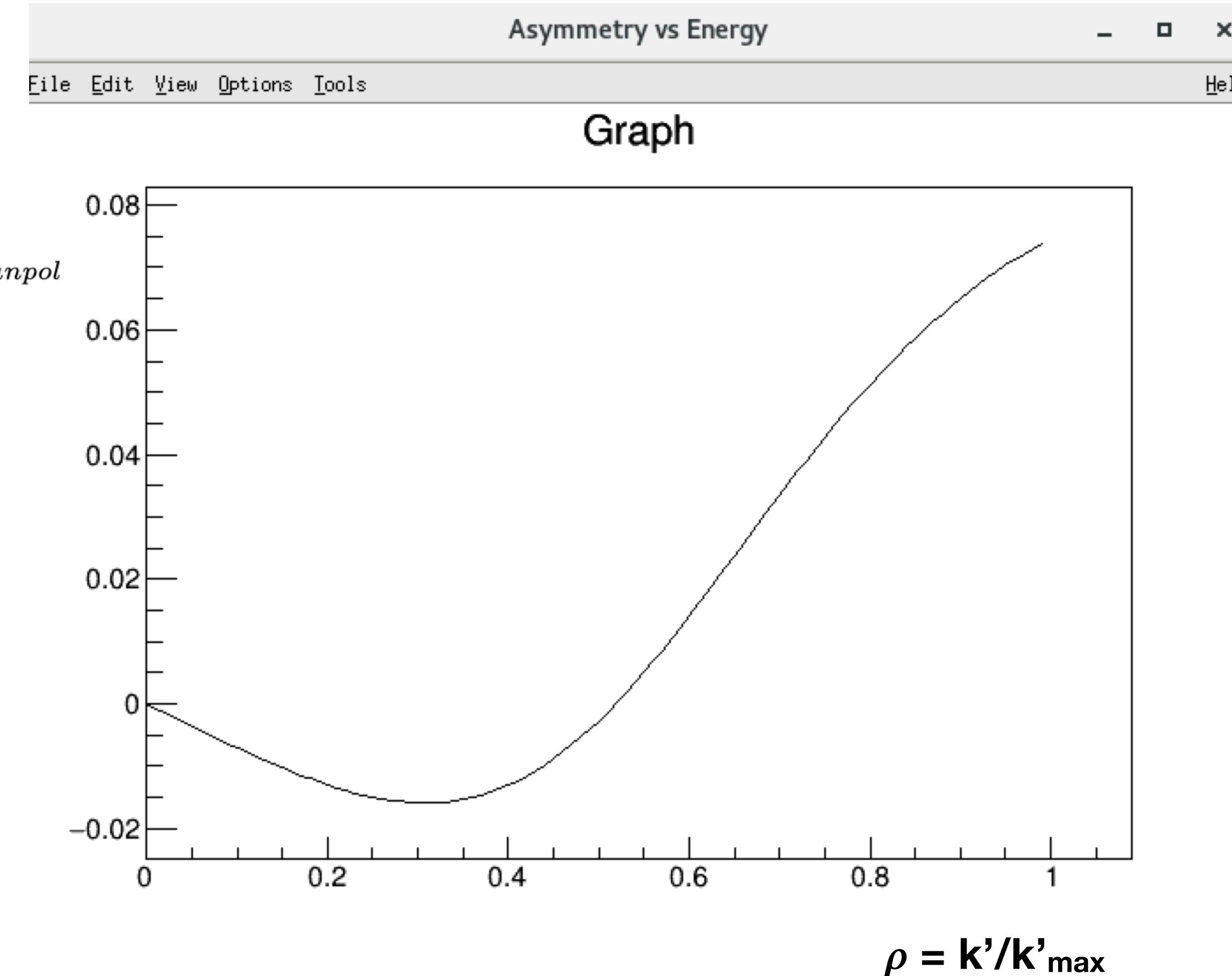


More Examples: Run 1084

beam on laser on



Asymmetry Curve



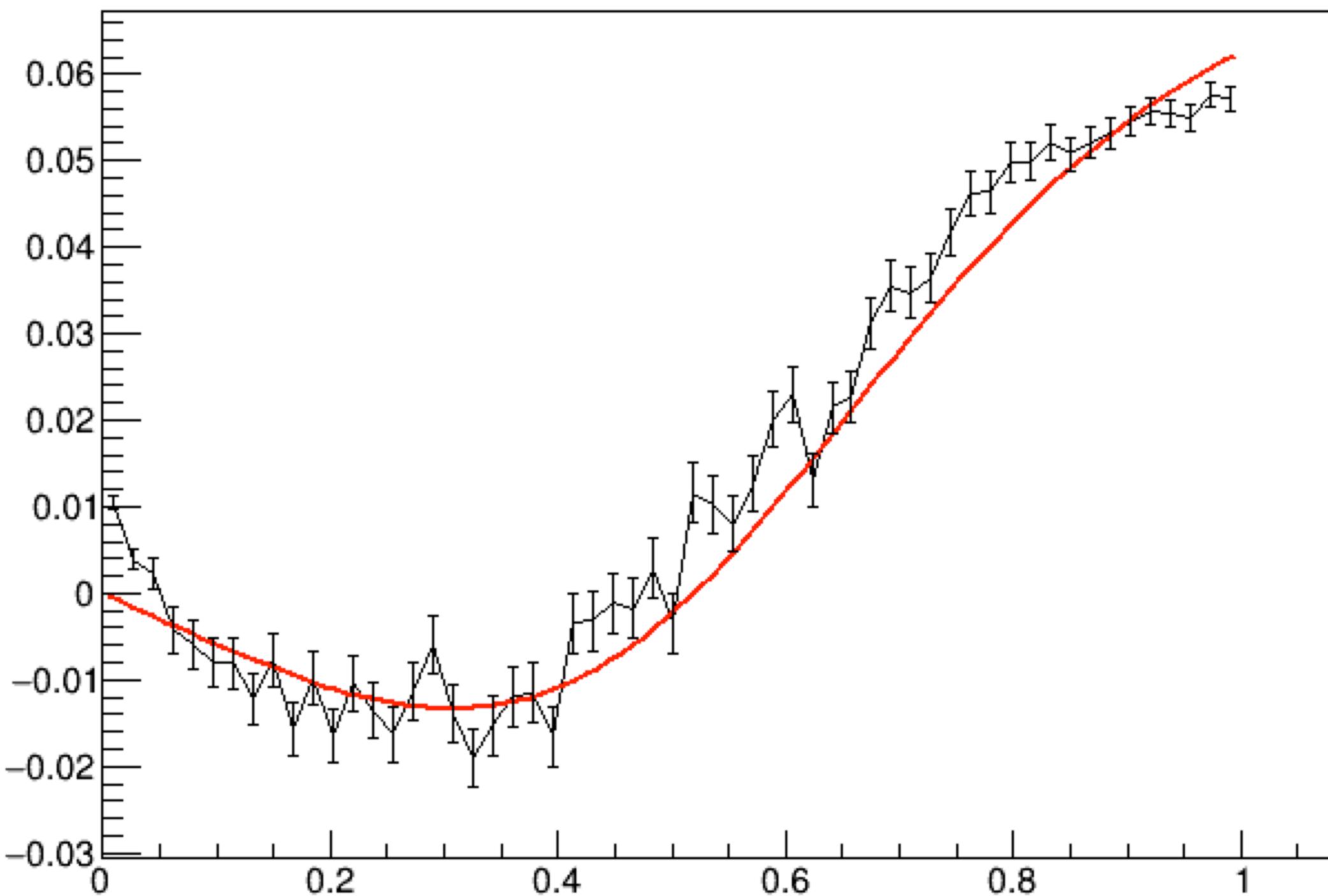
$$A_l \equiv \frac{\sigma^{\uparrow\uparrow} - \sigma^{\uparrow\downarrow}}{\sigma^{\uparrow\uparrow} + \sigma^{\uparrow\downarrow}} = \frac{2\pi r_0^2 a}{d\sigma/d\rho} [1 - \rho(1+a)] \left[1 - \frac{1}{[1 - \rho(1-a)]^2} \right]$$

$$a \equiv \frac{1}{1 + \frac{4kE}{m^2}}$$

k=2.33 eV, E=2.176 GeV

$$\left(\frac{d\sigma}{d\rho}\right)_{unpol} = 2\pi r_0^2 a \left[\frac{\rho^2(1-a)^2}{1 - \rho(1-a)} + 1 + \left(\frac{1 - \rho(1+a)}{1 - \rho(1-a)} \right)^2 \right]$$

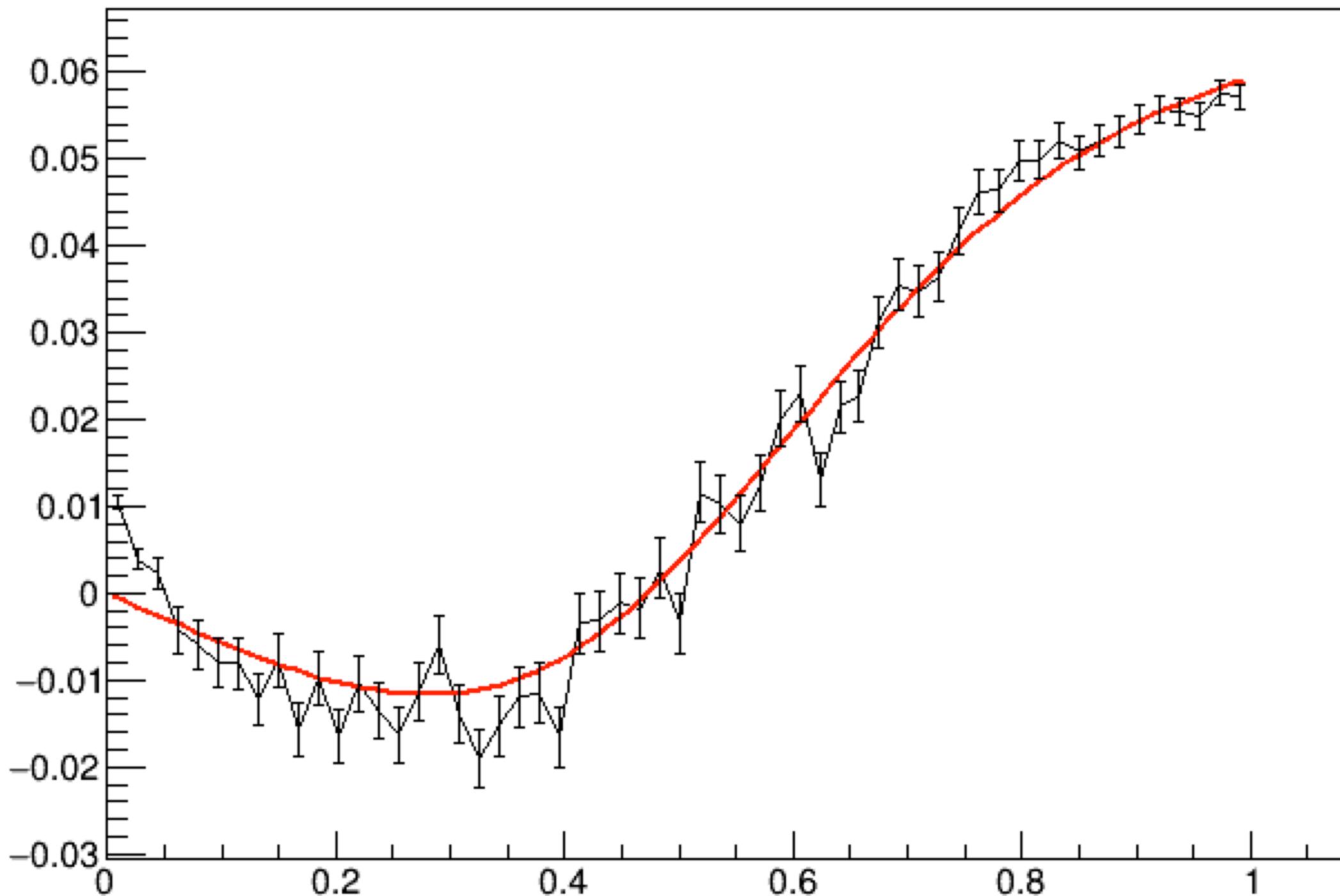
Asymmetry Fit



Run 1067
Compton edge @ 57000

EXT PARAMETER			ERROR	STEP SIZE	FIRST DERIVATIVE
NO.	NAME	VALUE			
1	polarization	8.37842e-01	7.13150e-03	6.76322e-05	-2.37435e-07

Asymmetry Fit



Run 1067
Compton edge @ 57000

EXT PARAMETER			STEP	FIRST	
NO.	NAME	VALUE	ERROR	SIZE	DERIVATIVE
1	polarization	7.34263e-01	1.09027e-02	5.06944e-05	2.27876e-03
2	calibration	1.09884e+00	1.08583e-02	5.04860e-05	2.99429e-03

Next Steps

- Fit asymmetry curve to data to calculate polarization
- Install and use Geant4 to simulate data
 - Install ROOT

End Goals

- Develop script to extract polarization from photon side
- Install script for semi-online analysis
- Determine detector position offsets from data