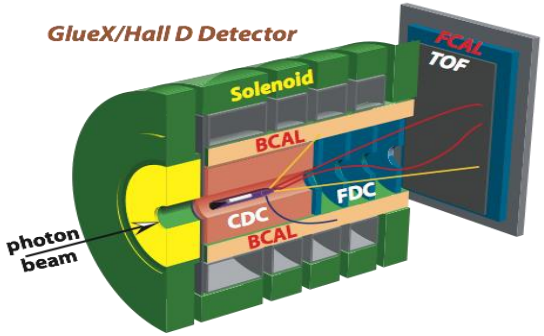


Jefferson Lab

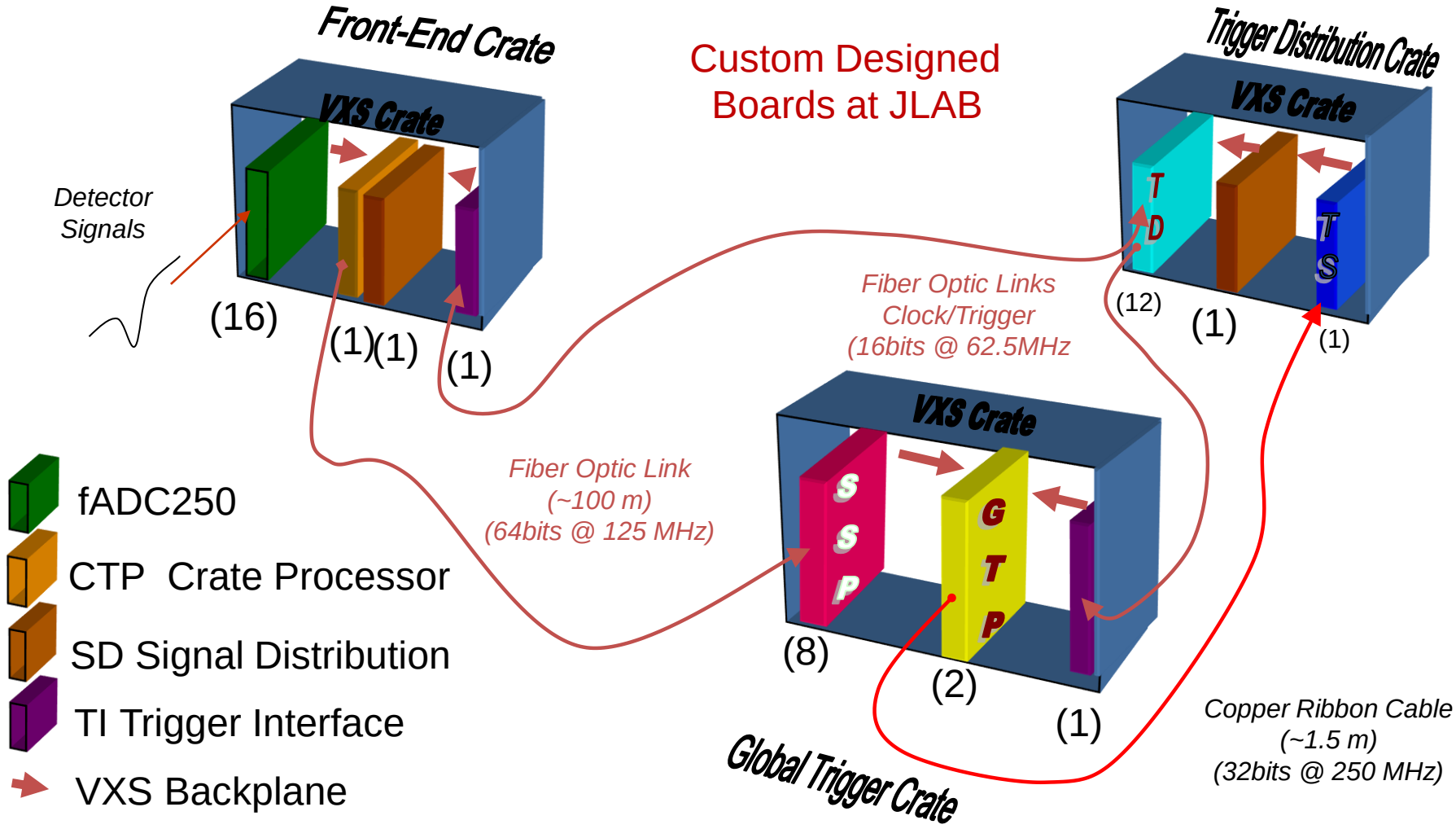
Trigger for the KLF Experiment

A. Somov, Jefferson Lab

KLF Collaboration Meeting, February 12, 2020

- GlueX Trigger Architecture
- GlueX Trigger Performance
- Trigger Requirements for the KLF Experiment

GlueX Trigger Architecture



- Pipelined readout electronics:
  fADC, F1TDC, CAEN TDC, SSP (pipeline ~3.6 μs)
- Two data streams: readout and trigger

Detectors Integrated to the Trigger

Forward Calorimeter (FCAL)	(Energy deposition)
Barrel Calorimeter (BCAL)	(Energy deposition)
Compton Calorimeter (CCAL)	(Energy deposition)
Pair Spectrometer	(Hits)
Start Counter	(Hits)
Time of Flight	(Hits)
Tagger	(Hits)

GlueX Trigger

- Minimum bias trigger for the search of exotic meson candidates

  - different final states of exotic candidates

  - beam energy range of interest: 8.4 GeV – 9.1 GeV

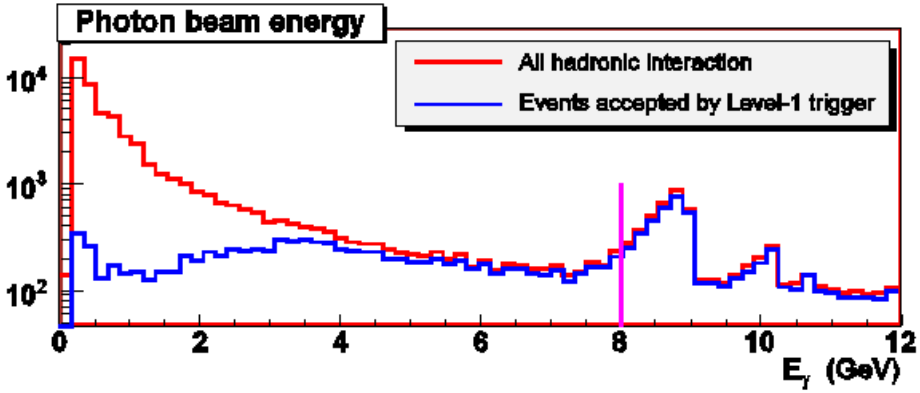
  - trigger efficiency between 90 % and 100 % for most reactions

  - trigger rate: 80 kHz

- Background types:

  - electromagnetic

  - low-energy hadronic interactions



Trigger Types for GlueX

Physics triggers:

Main production trigger (FCAL & BCAL)

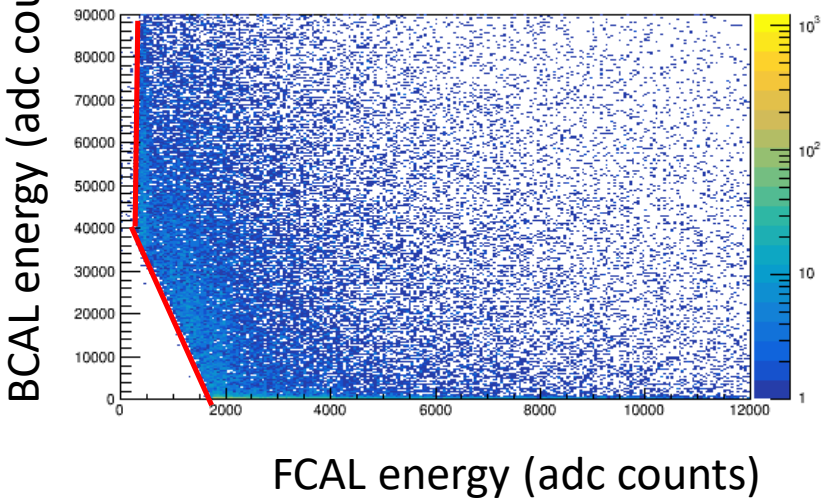
$$E_{FCAL} + 0.5\,E_{BCAL} > 0.5\ GeV$$

Pair Spectrometer trigger (luminosity)

$$(E_{FCAL} + E_{BCAL}) \ \&\ ST$$

TAGH & ST

BIT 1 (FCAL & BCAL)

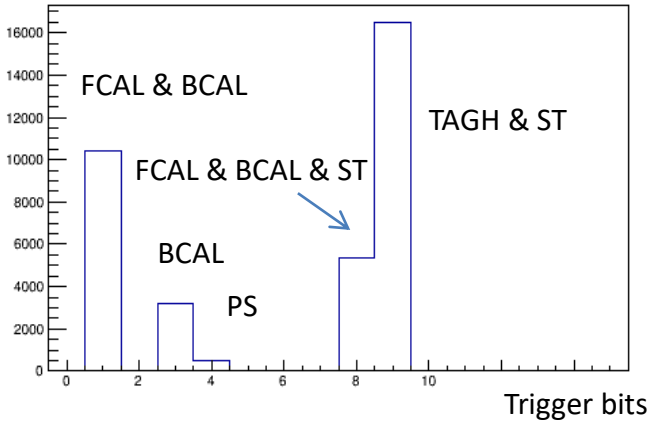


Monitoring triggers:

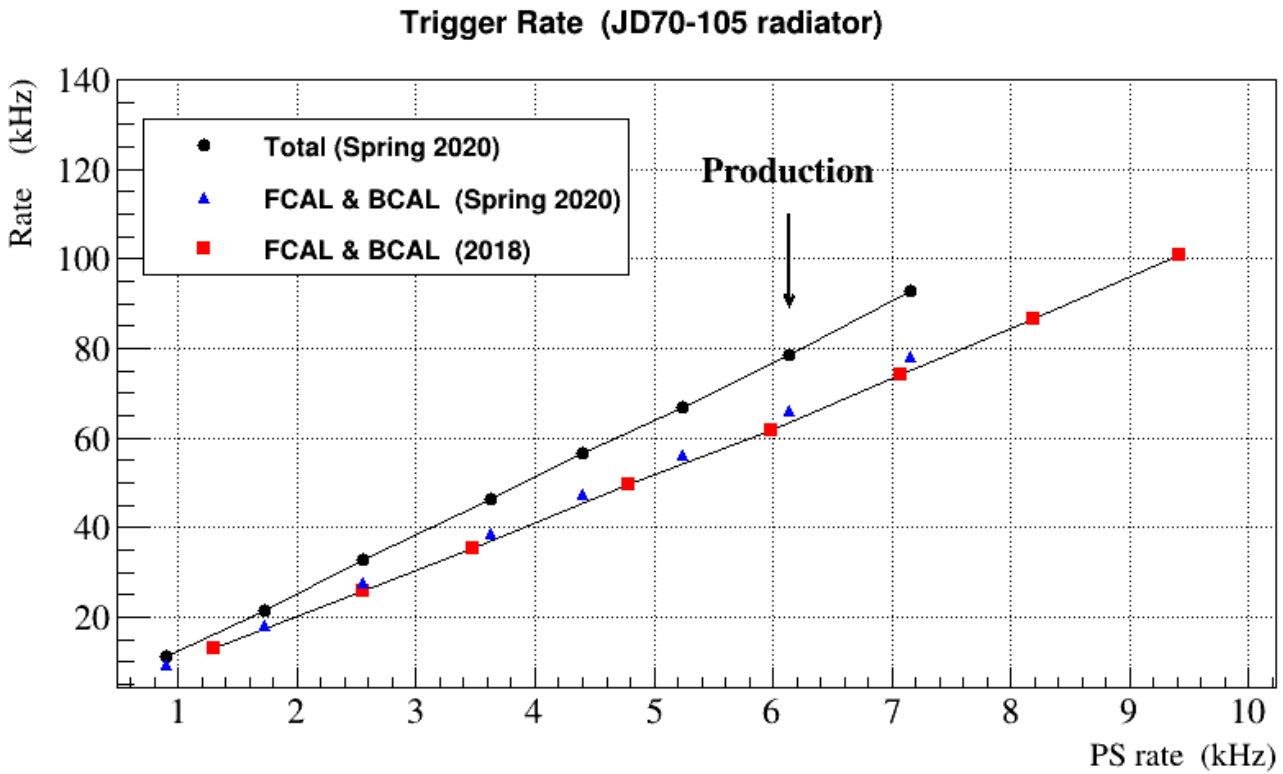
FCAL, BCAL LED triggers (10 Hz), DIRC LED

Random (100 Hz)

Example of trigger bits

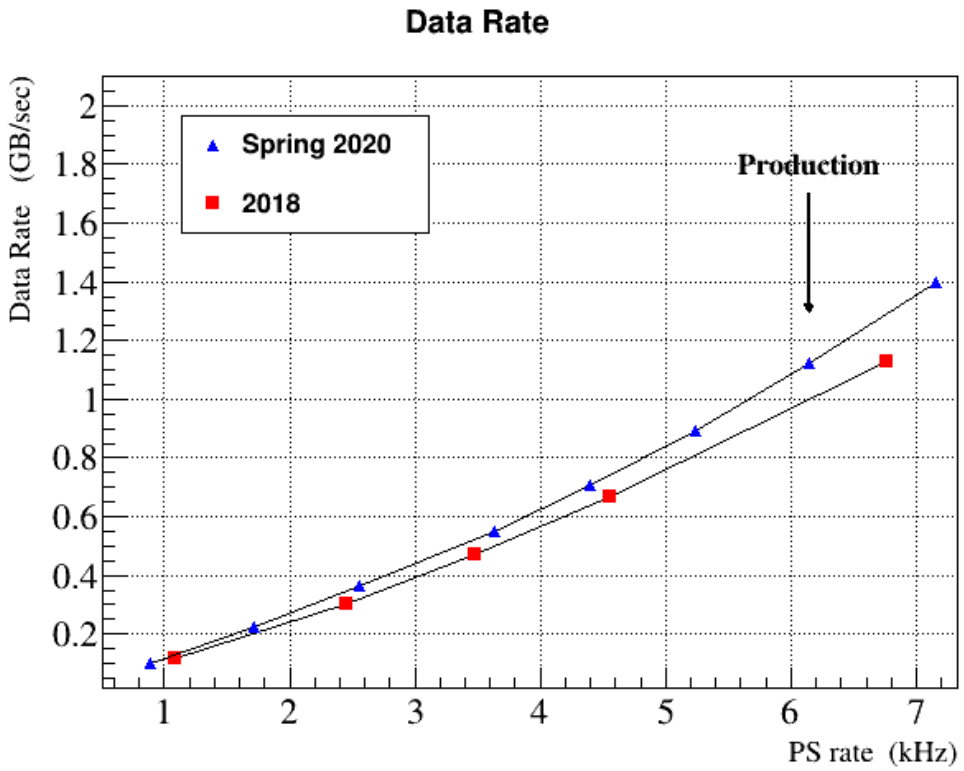


Performance in Spring 2020



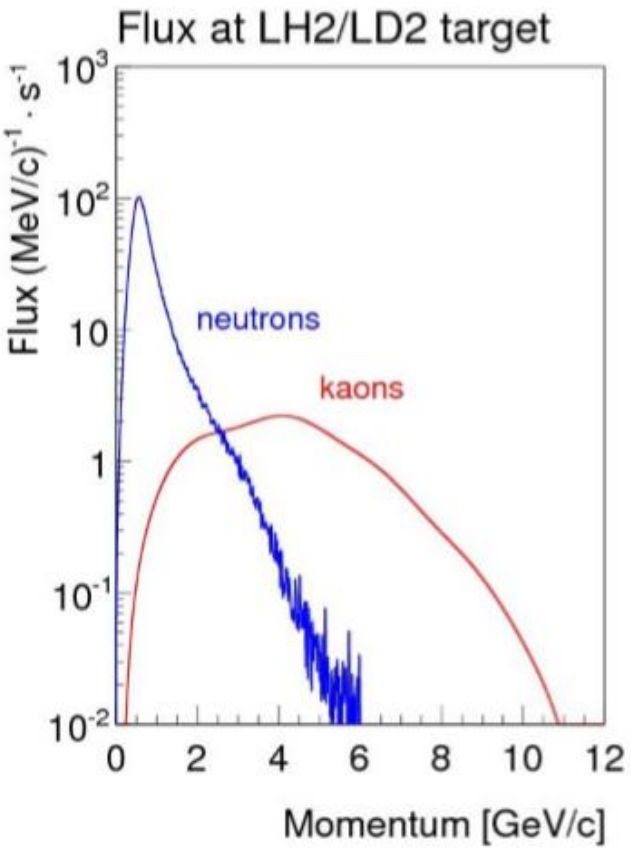
- Taking data at a trigger rate of **80 kHz**, live time 91%, stable run conditions
- Photon flux: about 5×10^7 γ/sec in the coherent peak energy range between 8.4 – 9.1 GeV

Performance in Spring 2020



- Data rate in GlueX production runs about **1.1 Gb/sec**

KLF Trigger Requirements



- Rate of K_L and neutrons on the LH2 / LD2 targets:

  10^4 KL/s and 6x10^4 n/s
  (other background, muons, soft photons – expected to be relatively small ?)

- Target thickness: 3.6 % R.L.

- Can use an open trigger (accept all target induced interaction)

- Require a hit in the ST/TOF or some energy deposition in calorimeters to select target-induced interactions

Reaction	Statistics (events)
$K_L p \to K_S p$	2.7M
$K_L p \to \pi^+ \Lambda$	7M
$K_L p \to K^+ \Xi^0$	2M
$K_L p \to K^+ n$	60M
$K_L p \to K^- \pi^+ p$	7M

Trigger types for KLF:

Trigger from the luminosity monitor
Physics triggers (can use different types depending on reactions)

Discussion

- Trigger hardware used by the GlueX experiment satisfies requirements of the KLF experiment
- The trigger rate of the KLF experiment is expected to be relatively small
  - Simple algorithm can be used to identify target-induced interactions
  - Several trigger types can be implemented (Luminosity trigger, physics triggers)