



# PAC-48, Jeopardy and targets for future running

S. Stepanyan (JLAB)

HPS Collaboration meeting

May 13-15, 2020 (SLAC/virtual meeting)

# Outline

- PAC-48 and Jeopardy process
- HPS update for PAC-48
- Current state of the parameter space
- Future HPS runs
- Conclusions

# Jeopardy in 12 GeV era

[https://www.jlab.org/exp\\_prog/PACpage/PAC47/Jeopardy\\_2016\\_Final.pdf](https://www.jlab.org/exp_prog/PACpage/PAC47/Jeopardy_2016_Final.pdf)

In order to help manage the backlog of nuclear physics experiments at Jefferson Lab, we will implement a Jeopardy program similar to that used in the 6 GeV era of CEBAF. The basic principle is that experiments that remain approved on the books for extended periods of time need to be periodically reevaluated by the PAC. We currently have 70 approved experiments that will require 6-10 years of full operation of CEBAF to complete. By 2020 we may have

## *Review Process*

PAC meetings after the start of the Jeopardy process will be considering both new proposals and resubmitted Jeopardy proposals. Resubmitted proposals in Jeopardy will be requested to submit updates to their original proposals and give a presentation before the PAC. The PAC will review the updated proposals and reconsider their approval status, grade and number of approved PAC days. The spokespersons of these experiments will be notified directly that their experiments will be reviewed under jeopardy along with specific instructions for resubmission.



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# Jeopardy for Hall-B experiments – PAC-48

[https://www.jlab.org/exp\\_prog/PACpage/PAC47/Jeopardy\\_2016\\_Final.pdf](https://www.jlab.org/exp_prog/PACpage/PAC47/Jeopardy_2016_Final.pdf)

In 2020, we propose that the Jeopardy process will be applied to the presently approved Hall B program. Run groups approved prior to 2017 that still have beamtime remaining on the books in 2020 will be considered in Jeopardy, unless they are on the then current schedule for running. We might expect this will include the current Run Groups A, B, C, D, E, G, H, I, K (note: includes HPS as run group I), but of course it depends on the actual run schedule in the next 5 years.

## Run Group I is the HPS

After discussion with the JLUO Board of Directors and some of the Jefferson Lab users, we consulted with the PAC membership regarding rescheduling of the PAC48 meeting this summer. As a result, we have decided to reschedule the PAC meeting to **August 10-14** with a new due date for proposals and Jeopardy updates of **June 22 at 8AM EDT**. The updated call for proposals can be found on the PAC webpage at <https://www.jlab.org/physics/PAC>.



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Dear Dr. Stepanyan,

Based upon the 12 GeV era Jeopardy policy established in 2016, (see [http://www.jlab.org/exp\\_prog/PACpage/PAC47/Jeopardy\\_2016\\_Final.pdf](http://www.jlab.org/exp_prog/PACpage/PAC47/Jeopardy_2016_Final.pdf)) your previously approved Run Group I will be considered in Jeopardy at the next PAC meeting, PAC48.

While it is not required, you may submit a short update (**10 pages maximum**) that focuses on any new developments since your previous PAC approval that the PAC should consider in their new evaluation of your proposal. This optional update document will be due 8:00 a.m. EDT (Eastern Daylight Time) on Monday, ~~June 1~~, 2020, same as for new proposals. **New date June 22**

At the PAC meeting, you will be scheduled (whether you submit a written update or not) for a **20 minute presentation**, followed by 10 minutes of questions/discussion. **Your presentation should contain a single slide summarizing the goal and motivation of the experiment followed by up to 19 slides (no slide animation or overlays for any of the 20 slides) focused on new developments since your previous PAC approval.**

If the PAC recommends that your experiment remain on the books as an approved experiment, it will continue to be eligible for scheduling for the next 4 years when it would again need to be considered for Jeopardy if it has not been scheduled in that time frame.

Please acknowledge receipt of this email to Susan Brown [sbrown@jlab.org](mailto:sbrown@jlab.org) at your earliest convenience.

Bob McKeown

Deputy Director for Science



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# HPS update for PAC-48

- Physics case
- Accomplishments from the engineering runs
  - publications, including technical papers
  - physics results, final results from 2016 resonance and displaced vertex searches
- 2019 detector and its performance during the first physics run
  - vertex resolution, addition of L0
  - increase of the acceptance for long lived  $A'$  after closing L2 and L3
  - reconstruction of single cluster (e+) V0 events, comparison with two cluster (e+e-) V0's
- Expectations from the first physics run – realistic reach based on the accumulated charge for “golden” runs and ~~near to complete analysis of unblinded data sample~~
- Plans for detector rework before the next run
- Plans/strategy for future running,  $E < 6$  GeV

## 1. Introduction

## 2. Motivation for dark photon searches

## 3. Summary of 2015/2016 runs

### 3.1. Engineering run setup and performance

### 3.2. Physics results

## 4. First physics run

### 4.1. Upgraded HPS detector

### 4.2. Hodoscope

#### 4.2.1. General description of the Hodoscope

#### 4.2.2. Hodoscope Readout

### 4.3. Trigger upgrade

### 4.4. 2019 run

### 4.5. Detector performance

### 4.6. Data analysis progress and the expected reach

## 5. Future running

### 5.1. Upcoming run in 2021 at 3.8 GeV

### 5.2. HPS beyond 2021

## 6. Summary

and abstract (John/Stepan) are ready, bit long  
Rouven agreed to write a page

John started, will need a summary of results (Matt G) and results (Rafo/Matt S.). Omar and Maurik will help

Maurik/Tim/Stepan – nothing is done with exception of Rafo's hodoscope/trigger part that is too long

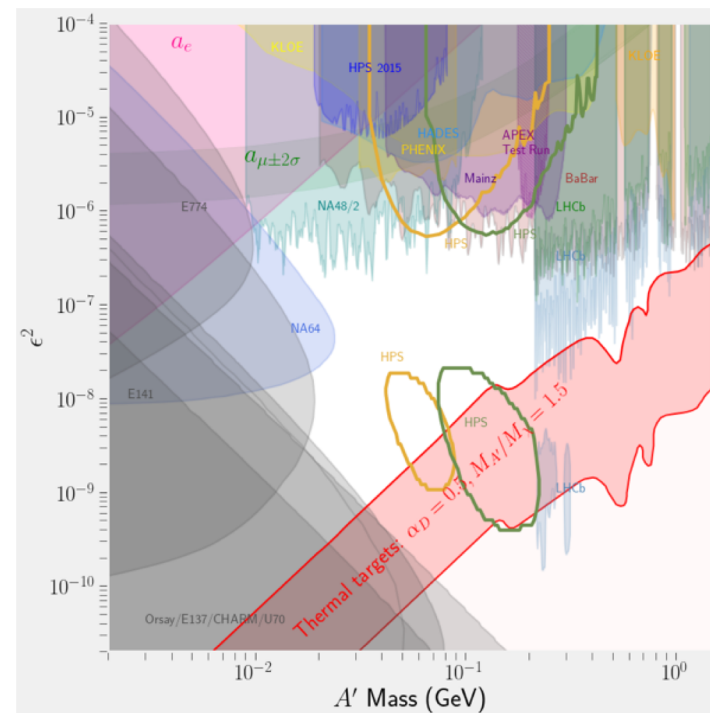
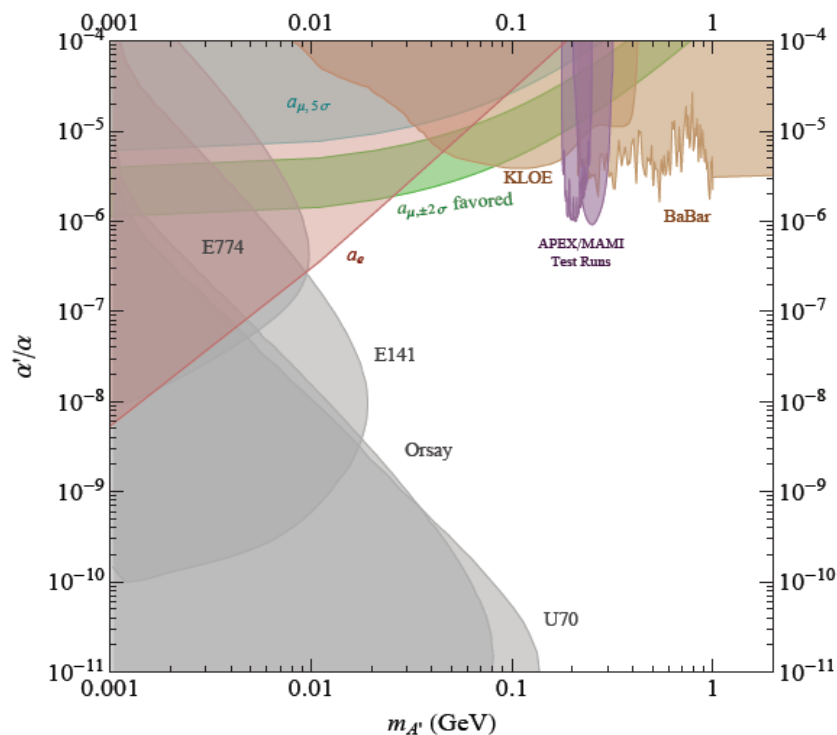
Norman/PF/Omar/Cameron/Nathan/Matt G

Maurik/Tim/Stepan – nothing is done, need input from Cameron et al. on reach

*Even with such incomplete document we are already more than 12 pages long!*

# Current state of the parameter space

- The original proposal asked for 180 days and beam energies from 2.2 GeV and 6.6 GeV (later we added 1.1 GeV).
- Since then, available parameter space for  $A'$  searches has changed significantly:
  - There is no new territory left for HPS for resonance search mode
  - The latest results from LHCb,  $A' \rightarrow \mu^+ \mu^-$ , left very little for HPS in the region  $m_{ee} \geq 2m_\mu$

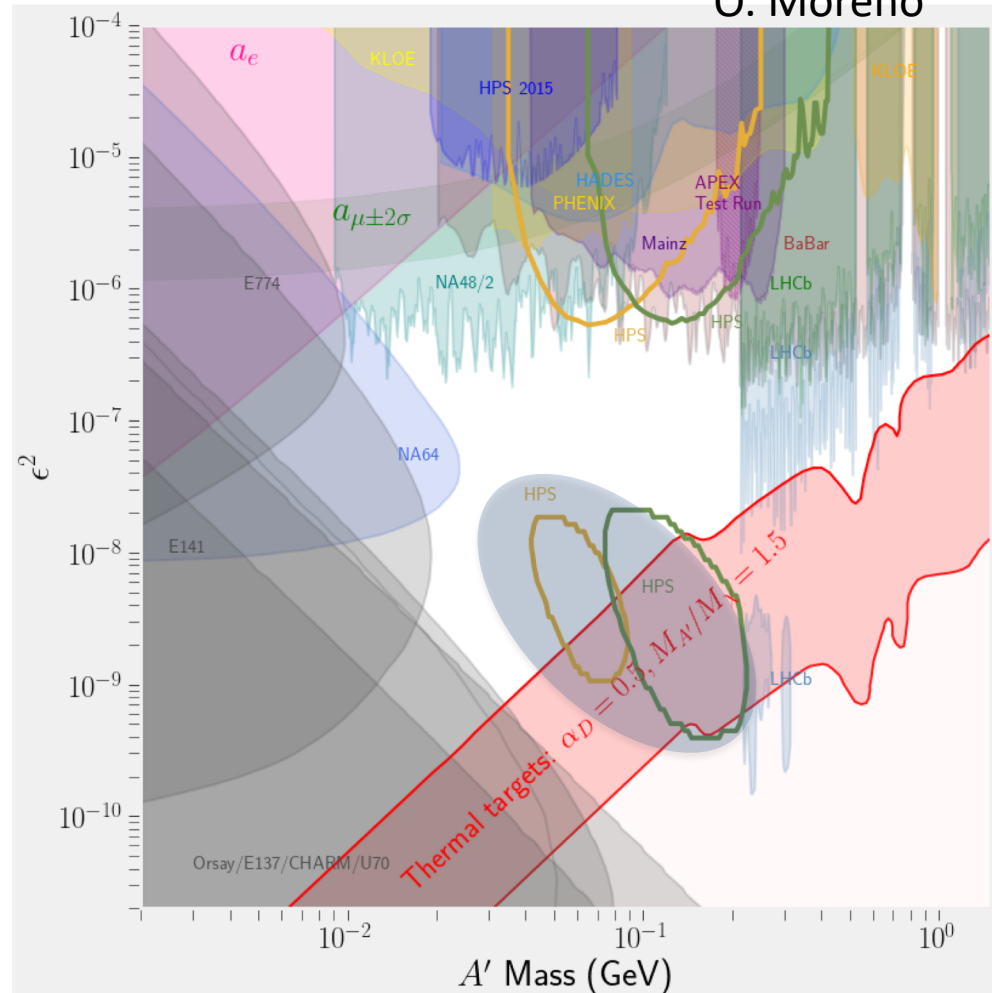




# Future HPS runs

O. Moreno

- 45 days of the approved beam time have been used
- We expect to run  $\sim 30$  days of the remaining 145 days in 2021
- HPS has a unique reach using the **displaced vertex search** in the uncharted region of  $A'$  masses from 20 MeV to 200 MeV and the couplings between few  $\times 10^{-8}$  to few  $\times 10^{-10}$
- The remaining 115 days must be allotted for running with energies between 2 GeV and 6 GeV, to achieve optimum coverage in this mass-coupling region
- A longer running, e.g. 7 weeks at a time, will depend on timely release of 2019 results with claimed new territory
- This will allow to run remaining 115 days in three settings with beam energies between 2 GeV and 6 GeV. Still, will be at least a 10 year long project.



# To conclude

- Jeopardy process at the next PAC meeting will include Hall-B RG-I (HPS)
- About 115 PAC days of beam time is up for jeopardy
- We need to write an update (about 10 pages) and prepare a presentation for PAC-48. The deadline for the submission of the update June 22, PAC meeting is on August 10-14
- **To succeed with the jeopardy we must have:**
  - **final results from the engineering runs (ready to be submitted or be submitted for publication),**
  - **preliminary results of 2019 data analysis showing the z-vertex resolution, improved acceptance for long-lived A's, and increased yield of V0s after recovering pairs with only positrons in ECal**
  - **a realistic estimation of HPS reach from 2019 data**
  - **and a plan for the remaining 115 days (need reach estimates for ~2 GeV to ~5 GeV)**
- Timeline for the update proposal:
  - outline and assignments – beginning of March
  - first draft for review – beginning of April June
  - semi-final draft for review – ~~beginning of May~~ by June 10
  - final version ready for submission – week before the deadline



# List of items to be completed before the next run

- Repair or replace mini-T power supply for HPS chicane
- New tungsten collimator for HPS and fiducialization of the collimator
- Clean-up the cable trays in alcove
- Move SVT and electronics with cables to the clean room in EEL
- Repair SVT sensors and FEBs
- Repair the chiller
- Repair malfunctioning ECal modules
- Lighttightening of hodoscope
- Add nitrogen purge downstream of the target
- DAQ/trigger improvements?

## Less of a priority

- Add a turbo at the upstream end of the scattering chamber
- Design a new neutron shield upstream of the HPS magnet
- A new, light-weight (Al) vacuum chamber for the downstream frascati magnet
- Add a stripline BPM in front of the tagger magnet