



NA61++/SHINE: Physics Opportunities from Ions to Pions

S. Kowalski

E. D. Zimmerman

Discussions for the future

16 December 2022

Options for the future

- NA61/SHINE's currently approved physics program will end in 2025. To realize the physics opportunities for the future, we will have to:
 - develop a prioritized physics program
 - make a proposal and/or addendum
 - secure resources and people to upgrade/operate the detector and perform the calibrations and analyses
- We have seen a huge array of ideas and prospective measurements in this workshop (and more tomorrow). This is great!
- Regardless of the collaboration structure, the programs we are discussing will require a major new influx of personnel and resources, and a rethinking of the way we process data and produce results.

-
- “It would be great for my experiment if NA61 would measure $x+y \rightarrow z$ reaction”

-
- “It would be great for my experiment if NA61 would measure $x+y \rightarrow z$ reaction”

-
- ~~• “It would be great for my experiment if NA61 would measure $x+y \rightarrow z$ reaction”~~
 - Nice to hear this, and it’s the beginning of a new measurement.
 - But this will not make it happen. Measurements require resources, including scientists willing to do the actual work!
 - How do we make the conditions right for people to join and do the work?

**Opinions and
unformed ideas follow.
Stop me at any time.
Let's brainstorm!**

Organizational structures to consider

- Continuation of NA61
- A new collaboration
- A hybrid model
- Conversion to a facility

A continuation: NA61++ = NA61

- A new program would be proposed in an **addendum** to the NA61 proposal
- Current collaboration structure would continue; current groups continue by default
- New groups would join NA61 and have same service and shift responsibilities as current groups
- Common fund structure does not radically change
- Spokesperson/deputy are in common between old and new program
- Anecdotally, I have heard that CERN prefers experiments to begin and end periodically

A new collaboration: NA61++ = NAXX

- Presumably, a similar process to the NA49->NA61 transition
- All groups will have to actively join the new effort, including getting local funding agency approval
- Under current CERN and outside funding agency rules, Russian institutions would probably not be able to join
- New leadership dedicated to the new program can work on that in parallel with leadership of the existing program
- Can build a collaboration structure and common fund optimized for the types of measurements we are planning in the future
 - Some sort of limited-time membership option for people with specific measurement interest?
- The low-energy beam complicates things a little: it is a major part of the new program, but we would like it to begin in 2025. It may be too soon to transfer the detector and its responsibilities to a new collaboration.

A hybrid model:

$$\mathbf{NA61++ = NA61 + NAXX}$$

- “One Detector, Two Experiments”
- Example from Fermilab: E799/E832 “Kaons at the TeVatron (KTeV)” program:
 - E832 measured $\text{Re}(\varepsilon'/\varepsilon)$; E799 studied rare decays of the K_L
 - Same detector, same institutions, shift and author list
 - Separate scientific leadership and program management
- Could envision NA61 “phase 2” continuing for certain physics topics, while low-energy beam and perhaps other new efforts are supported by a parallel structure under a different experiment number
- May be able to harvest some of the benefits of a new collaboration without risking the loss of certain groups that may find approval of participation in a new experiment difficult
- Unclear if CERN can support this model, or if bureaucratic difficulties will be severe

Conversion to a facility:

NA61++ = North Area Multiparticle Spectrometer Facility

- Change the model from a physics collaboration to a beam/detector facility that serves outside groups (“customers”)
- Allows “It would be great for my experiment if NA61 would measure $x+y \rightarrow z$ reaction” as a short-term effort or even a measurement for hire
- Radical rethinking needed! Detector upgrades, maintenance, and calibration would be done by people hired specifically for that purpose, funded by users. These people would likely not be physics paper authors
- Need to write outsider-usable software tools to do what we now treat as physics analysis (“analysis-in-a-box”). Resources to develop and maintain this will also have to be (eventually?) user-funded.
- Could be suited to proposed measurements in support of neutrino, cosmic-ray, muon experiments (especially those that don’t produce publishable physics cross-sections)
- Not an obvious match to a strong-interaction physics program

A spreadsheet to collect more ideas:

The screenshot shows a Google Spreadsheet with the following structure:

	A	B	C	D
1		Pro	Con	Neutral/unclear
2	Model			
3	NA61 continues	Some groups can continue under existing funding agency approval		
4				
5				
6				
7				
8				
9				
10				
11				
12	New collaboration		Existing groups wishing to continue must apply for approval	
13				
14				
15				
16				
17				
18				
19				
20				
21	Hybrid			
22				
23				
24				
25				
26				
27				
28				
29	Facility			
30				
31				
32				

- Write ideas/concerns here as you think of them:

- <https://docs.google.com/spreadsheets/d/1NwjvugNAHzPAu9xnhRuaC814ryY7U-G1OlFpw-Y3Hvk/edit#gid=0>



**Contribute your
thoughts**

Let's be ambitious!

Speaker supported by U.S. Department of Energy