PANDA Scrutiny Group (SG) **March 2014**

1st Physics Questionnaire

Requirements for the (sub)systems from the physics case of the PANDA Detector

The collaboration has decided to review the scientific case of PANDA and the PANDA detectors in order to achieve our ambitious goals in a timely way. An important task is to demonstrate the up-to-dateness of our scientific case as well as to elaborate the day-1 and year-1 measurements and identify the minimal (initial) setup required for a particular scientific case.

Please involve the TAG (Theory Advisory Group) members to help with the scientific case motivation etc.

All answers shall be based preferably on fast simulation. It is known to the SG that this limits the reliability of concrete numbers. Nevertheless it gives access to a global picture, which will help to identify the importance of a certain setup and allows inference on the need for detector (sub)systems for a particular scientific case or a particular channel. This has to be understood in the framework of fast simulations and its parameterization in terms of phase space and lab regions, respective resolutions and thresholds rather than individual detector elements. Reasonable parameterizations of the current layout for the (sub)systems may act as a starting point, but an important goal is to find out at what point of resolution/thresholds and phase space coverage the physics case can't be handled anymore.
For more details we refer to the documentation and examples from the Fast Simulation Group.

Questions 1-5 (except 5e) and 6a-f and 6g,i can be answered without a lot of computing work and a preliminary document on those issues until April 11, 2014 is very much appreciated and a first version is due April 18, 2014.

Questions 5e, 6g,ii-v and 7 are the main workload and will take considerably longer and involve a lot of simulation work. Please provide a preliminary report/status report on whatever is available on May 9, 2014 and the first version of a full report is due May 30, 2014.

If there are shortcomings, please concentrate on a full chain of a fewer number of the channels, rather then having many analyses being stuck in preliminary steps.

This task hopefully results in a clearer view on the needs. It will be combined with the feedback from the scrutiny process for individual (sub)systems. In a second step detailed full simulation results are needed to consolidate the input of both processes.

The SG will summarize your input as a part of the full scrutiny report.

List of questions:

1. Physics Group:
   Example: QCD Exotics

2. Physics Group Convener(s):

3. List of groups involved:

   List of relevant TAG members:

4. List of physics subtopics:
   Example: ccbar Hybrids, ccbar Molecule (XYZ), Light Exotics, Glueballs,

5. Importance/Impact:
   should involve the PANDA TAG members
   a) Please give a short summary (< ½ page) for the motivation of this topic.
   b) Please summarize the originality of the measurements.
      can only PANDA do that, is PANDA the first to do that, why is PANDA in a better position
   c) Please indicate competition in the goals, the methods and the reactions channels involved.
      competition on the narrow and wider physics case
   d) Is there a unique selling point? Please explain this (< ¼ page)
      what can we do, what others can't and how important is it?
   e) Short executive summaries
      can be written after the physics group has done most of the homework
      i. Which of those statements (impact, uniqueness, etc.) made before hold still for 1/100 and 1/10 of the nominal instantaneous luminosity?
      ii. What could be done with 1/100 and 1/10 of the nominal instantaneous luminosity and how long would it take in terms of beam-time?

6. Details for each subtopic listed above
   Example: ccbar Molecule (XYZ)
   a) What are the required momentum(-range) settings?
   b) What is the required integrated luminosity?
      sometimes this can only be guessed, since production cross sections are unknown.
      Please then give a guestimate and explicitly list all input variables,
      like signal and background assumptions (e.g. 1 nb cross section, 10.000 rec. events, S/B=1:1)
   c) List "all" channels of interest
      List either in a generic or in an explicit list (if possible) all or the kind of reactions which need to be investigated.
   d) Which (non-)exclusive channels pose as role models (e.g. for simulations)
      Example: J/psi pipi eta, J/psi pipi scan
   e) What are typical potential trigger scenarios (guestimates!) ?
   f) What are the main background channels and which are the most important filter steps and which detectors are involved to deliver this information?
   g) Minimal setup required for this subtopic
      i. What is the figure of merit for the reactions for this subtopic?
         e.g. S/B, efficiency,… t.b.d. by the subgroup

ii. What is the minimal setup for full performance at nominal instantaneous luminosity
full performance means, that the performance with this setup differs insignificantly (t.b.d. by the individual subgroup, but a guide might be efficiency within 20% and background within a 20%) from the full blown detector

iii. What is minimal setup for full performance in the startup phase (1/100 and 1/10 nom. inst. lum.)?
s. above

iv. What is the minimal setup for reasonable performance at nominal instantaneous luminosity?
reasonable performance (t.b.d. by the individual subgroup, but a guide might be efficiency within factor of 2 and background within a factor of 2), but may involve leaving out detectors with marginal correlation to the full performance

v. What is the minimal setup for reasonable performance in the startup phase (1/100 and 1/10 nom. inst. lum.)?
s. above

7. Options for lower detector performance (short survey)
   - What resolution/thresholds is actually needed for the key components of the minimal setups. Please summarize the performance indicators needed for the (sub)systems of the minimal setup
     try playing with the parameters to find out, at what point the physics case becomes meaningless. T.b.d. by the individual subgroup what the criterion is for that
     What would be the consequences of these changes?
     Please explain all known scientific consequences and risks

8. Room for add. information from the physics group not listed above
   comments, caveats, whatever might be interesting