Summary of the software session and Prospects

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1. What we have done

- 1st trial to generate physical samples of Hyper-K MC with default setup!

  ➢ Generate beam ν and ν-bar (900k events) by WCSim and reconstructed them by fiTQun.

  ➢ They can be easily downloaded. See details in

  https://wiki.hyperk.org/Software/iRODSHK.

  ➢ Physics group can start to study how we can analyze with fiTQun outputs. Note this is the first trial to use only fiTQun for full analysis.

  ➢ Need feedback from physics groups.

- **Succeed to apply Bonsai fit to WCSim.**
  - ➢ Vertex resolution seems reasonable.
  - ➢ Need to import SK library for energy check.
  - ➢ Need to tune for HPD and longer compartment options.
- Preparing HPD and longer compartment options in WCSim.
  - ➢ Most of them has been implemented.
  - ➢ Time response will be implemented soon.
  - ➢ Prepared options with different compartment length.
- Several updates of fiTQun
  - ➢ Improved in multi-ring and multiple scattering μ fit.
  - ➢ New scheme to generate scattered photon table is coming soon.

2. How can we decide detector set up?

- Photo sensor option
  - ➤ Q1: What will be improved if we use HPD ?
    - ✓ Prepare WCSim with HPD option (done except t-response).
    - ☐ Prepare reconstruction tools (fiTQun and Bonsai) for HPD option.
    - ☐ Generate e , μ and π^0 with several momentum. Check detector performance (VTX resolution, Momentum resolution, Particle ID, Ring count, π^0 rejection, e.t.c.).
  - ➤ Q2: Can we reduce number of PMTs ?
    - ☐ Change photo coverage to 15 %.
    - ☐ Compare performance and cost of 20%+PMT, 20%+HPD, and 15%+HPD.

- Compartment option
 - ➢ Q: Do we really need partitions ? If no, we can reduce number of photo-sensors.
    - ✓ Prepare WCSim without partition, 250m long compartment.
    - ☐ Prepare reconstruction tools (fiTQun and Bonsai) for 250m long option.
    - ☐ Generate e, μ and π^0 with several momentum. Check detector performance (VTX resolution, Momentum resolution, Particle ID, Ring counting, π^0 rejection, e.t.c.).

    Any suggestions about detector optimization are welcome !

3. Collaboration with other group
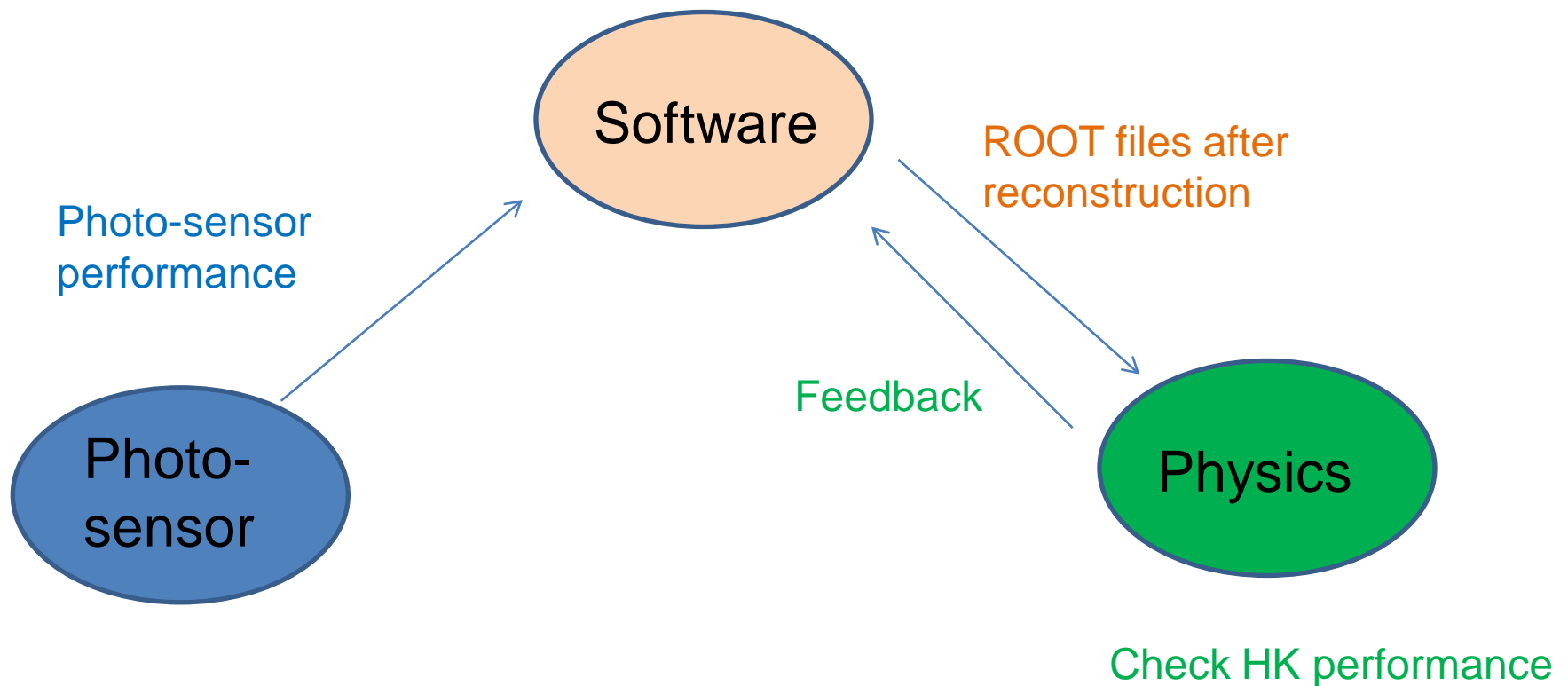
- Request to photo-sensor group

  ➢ Please provide t-response of HPD.

  ➢ Also performance of new PMT(box&line).

- Request to physics group

  ➢ Please play with MC samples (beam ν) to learn how to use fiTQun output.

  ➢ If you find anything strange, please give us feedback.

  ➢ Please compare performance with several set up.

- Any requests to software group ?

Let's work together to optimize detector setup!