Overview of the Photodetector Development

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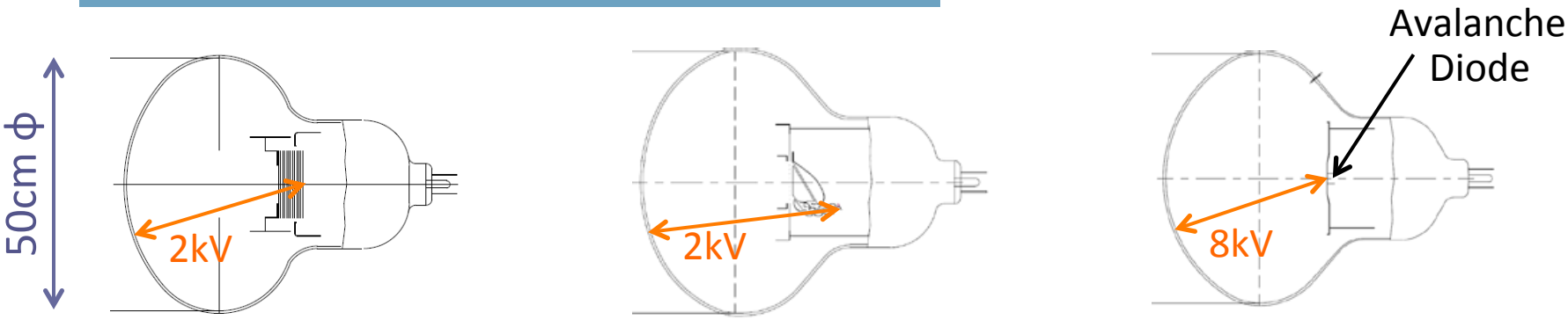
for the Hyper-K Photodetector (HK-PD) WG

January 28, 2014

@ The 4th open Hyper-K meeting

Hyper-K photodetector candidates (for ID)



20″ PMT (Venetian-Blind dynode)	20″ Improved PMT (Box&Line dynode)	20″ HPD (Hybrid Photodetector)
• Super-K ID PMTs	• Under development	• Under development
• Used for ~20 years → Guaranteed	• Better performance (C.E., Timing resolution)	• Far better performance
• Complex production → Expensive	• Same technology → Lower risk	• Simple structure → Lower cost
		• New technology → Higher risk

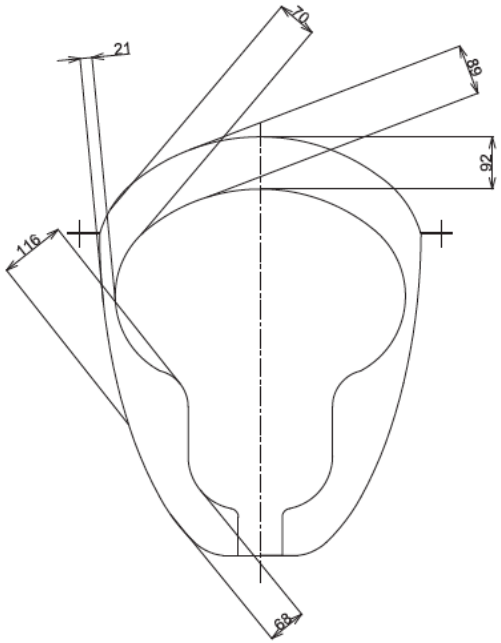
Lower Risk ← → Higher Performance

Photodetector R&D status

- 8″ HPDs under testing in a water Cherenkov detector
  - 20″ HQE SK-PMTs as well
  - Initial performance check done
- 20″ HPDs and Box-Line PMTs to be delivered soon
  - With HQE photocathode
- US 11″ HQE PMT engineering in good progress
  - First prototypes in June
- Photon enhancement ideas
  - WLS+mirror (Canada) : Concluded the first phase of the work
  - Acrylic lens : Evaluation of the first test piece just started

New work items

- Hyper-K simulation studies : softwares in preparation
  - To check detector performances and physics sensitivities with candidate photodetector options, and clarify the requirements to sensors
  - In cooperate with the software WG
- Protective case designing : just started
  - In-case magnetic shield must be considered
  - Mounting structures next
- Technical document : items listed up
  - Aim to release the first version in FY2013



Photodetector session

Overview of the photodetector development (10min)

S. Nakayama (ICRR)

Measurement of large-aperture photodetectors in a water tank (30min)

Y. Nishimura (ICRR)

Status of Texas PMTs (15min)

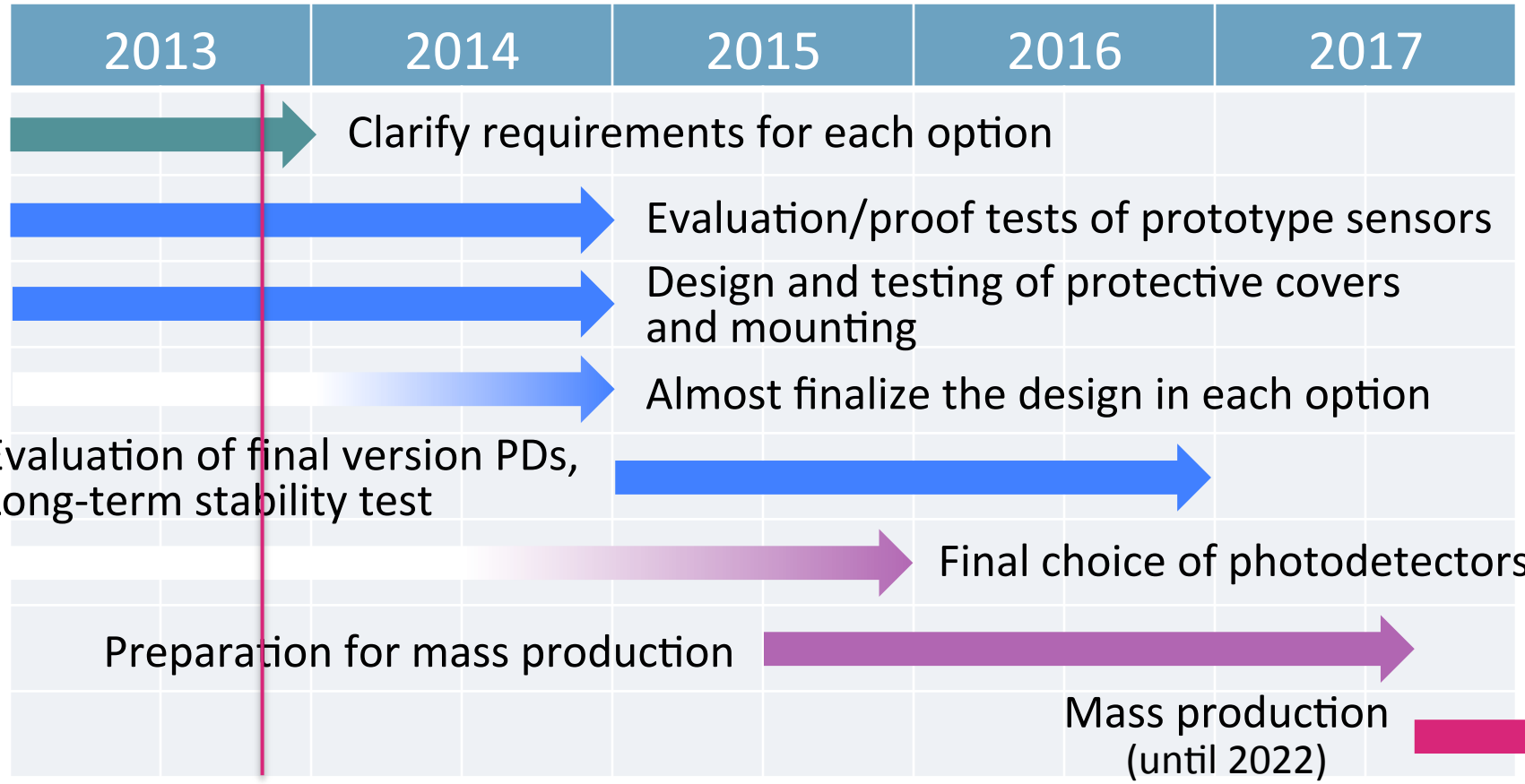
R. Svoboda (UC Davis)

Enhanced light collection with photon trap (20min)

J.-M. Poutissou (TRIUMF)

Supplement

Plan / Schedule



If our proposal to a grant-in-Aid (submitted in March) is approved.

Requirements for Hyper-K photodetectors

- We don't have an accurate grasp of all requirements yet.
- Specification of 20-inch PMT (R3600) must be a reference.
  - QE : 22% @λ=390nm
  - Gain : 10^7
  - Dark rate : 4.5kHz @0.25p.e. threshold
  - Transit time spread : 2.2nsec (1σ) for 1p.e. signals
  - Pressure tolerance : 6kg/cm^2
- Requirements should depend on physics targets and Hyper-K configuration (number of compartments, Gd, …).
- We first have to clarify the requirements for each photo-detector option
  - Possibly based on Hyper-K simulation studies.