More on the expected λ distribution

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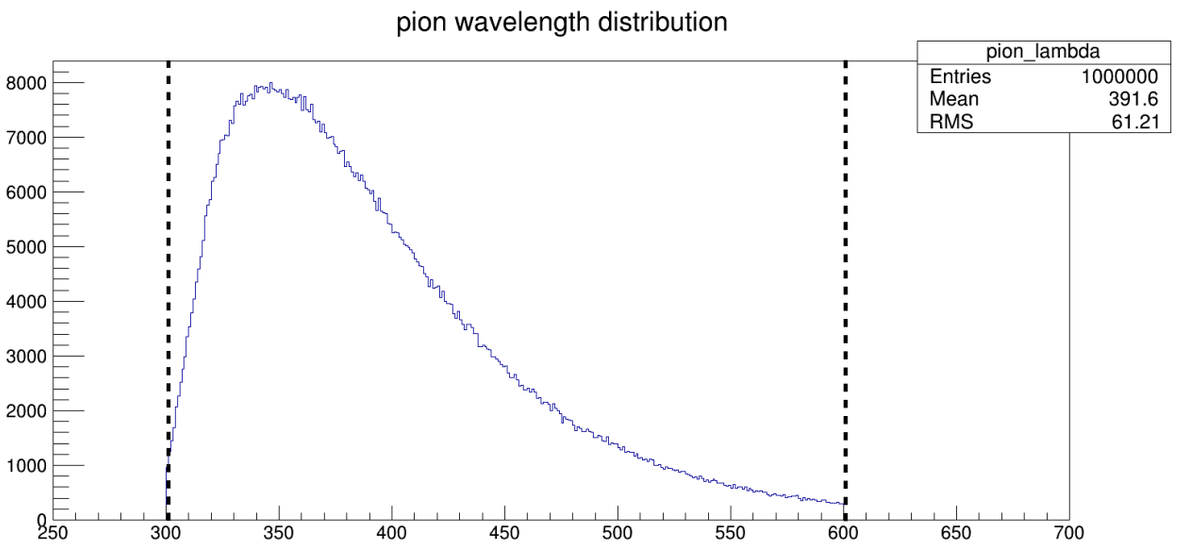
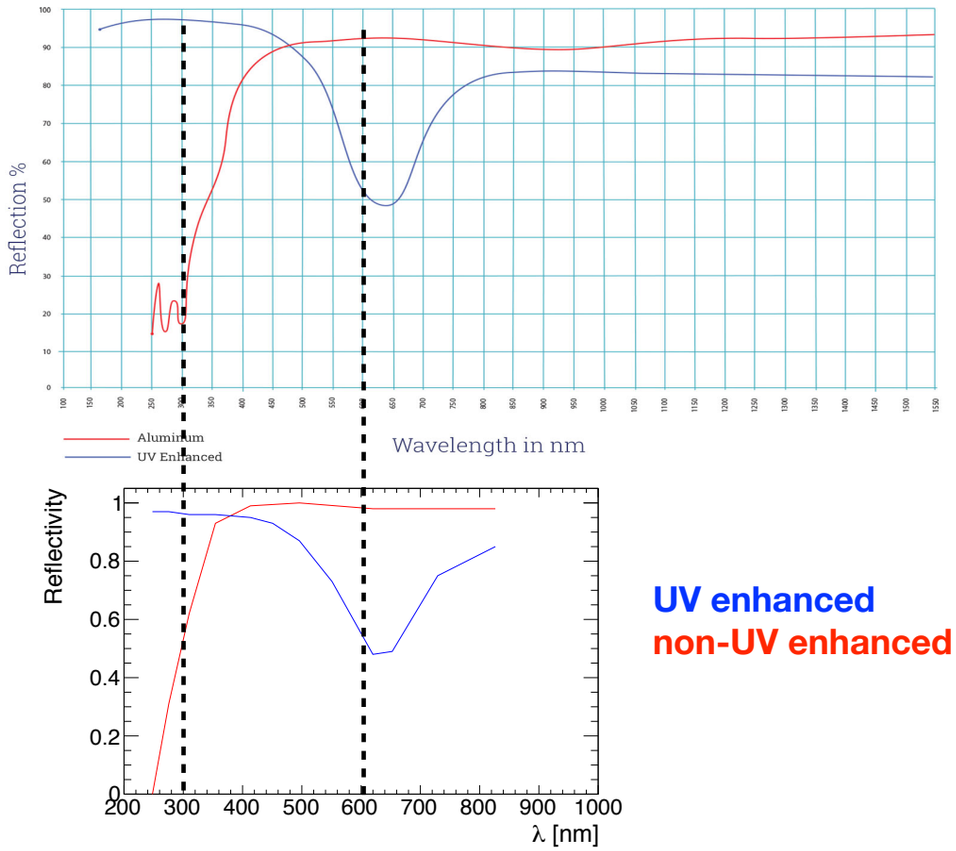
8/20/2019
DIRC meeting

At 7/23 meeting, Justin showed:

Expected λ distribution



From Vendor



Used in simulation

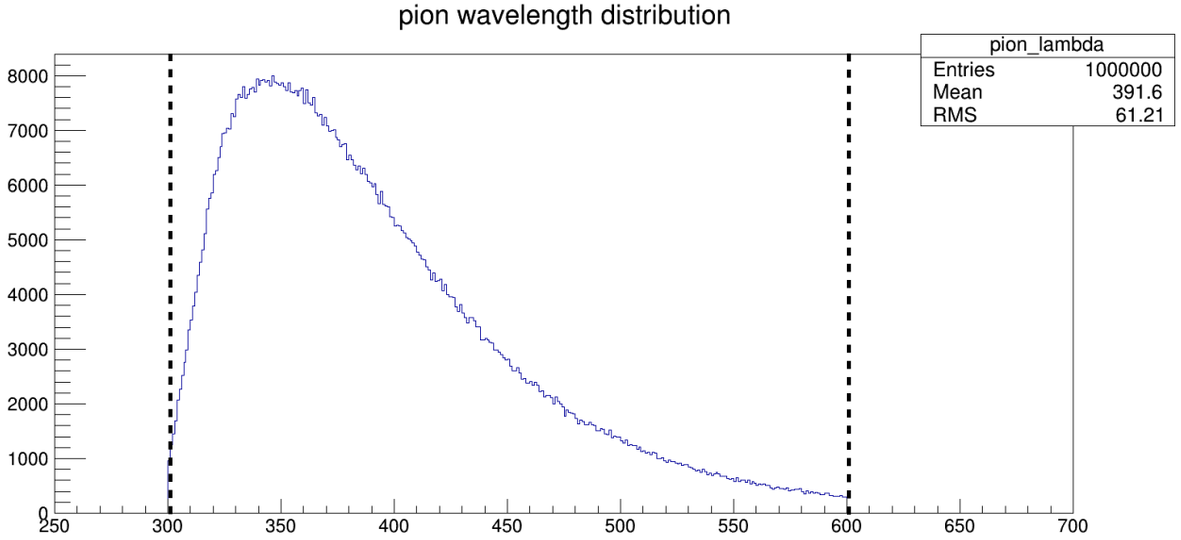
=> useful to understand the expect λ distribution in order to provide additional information to the mirror discussion

Would like to investigate:

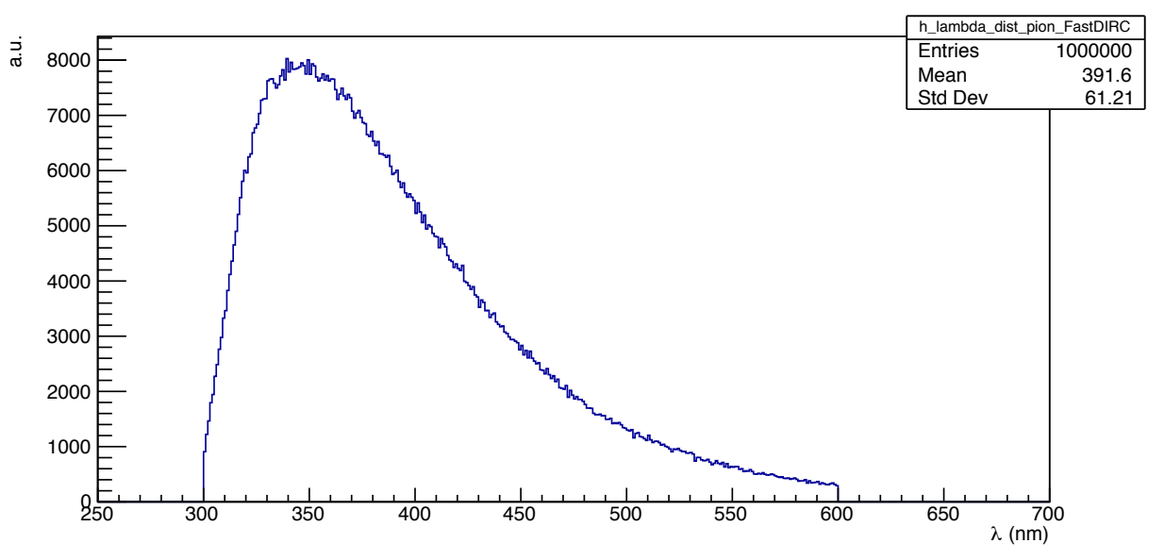
- where does this plot come from?
- what causes the turnaround at ~350nm?
- how confident are we about it?

Q1: where does this plot come from?
Ans. FastDIRC

Justin's plot

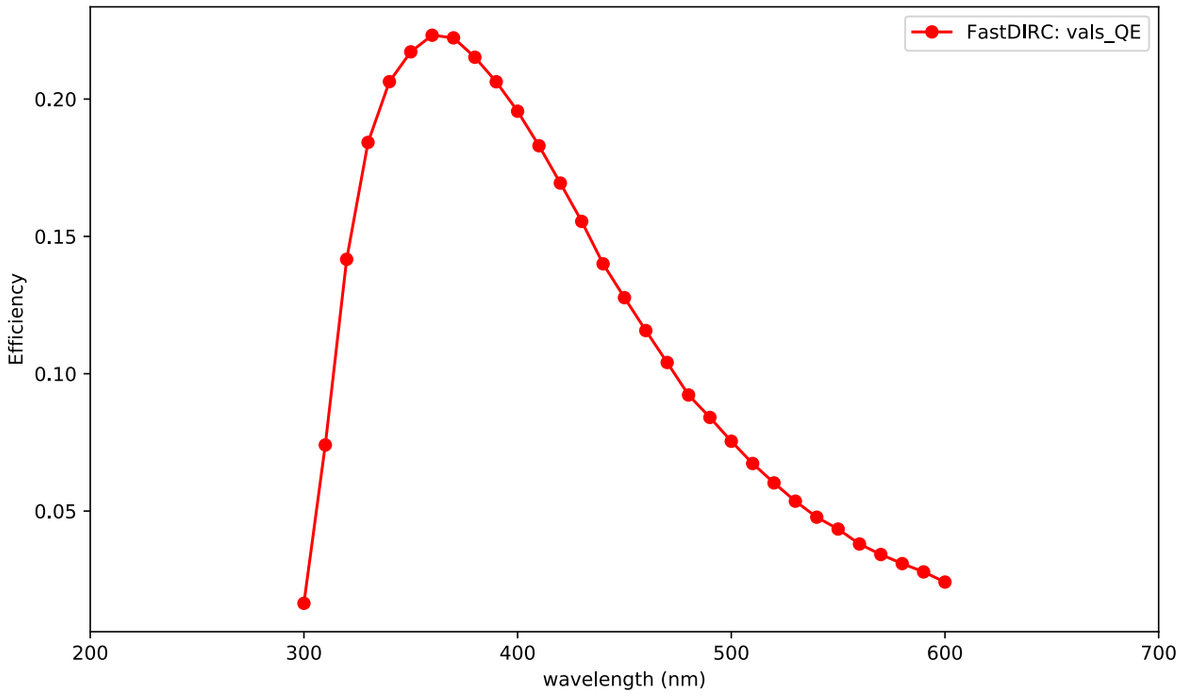


Reproduced with FastDIRC



Follow-up:
how is this produced in FastDIRC?

some hard-coded
efficiency curve



X

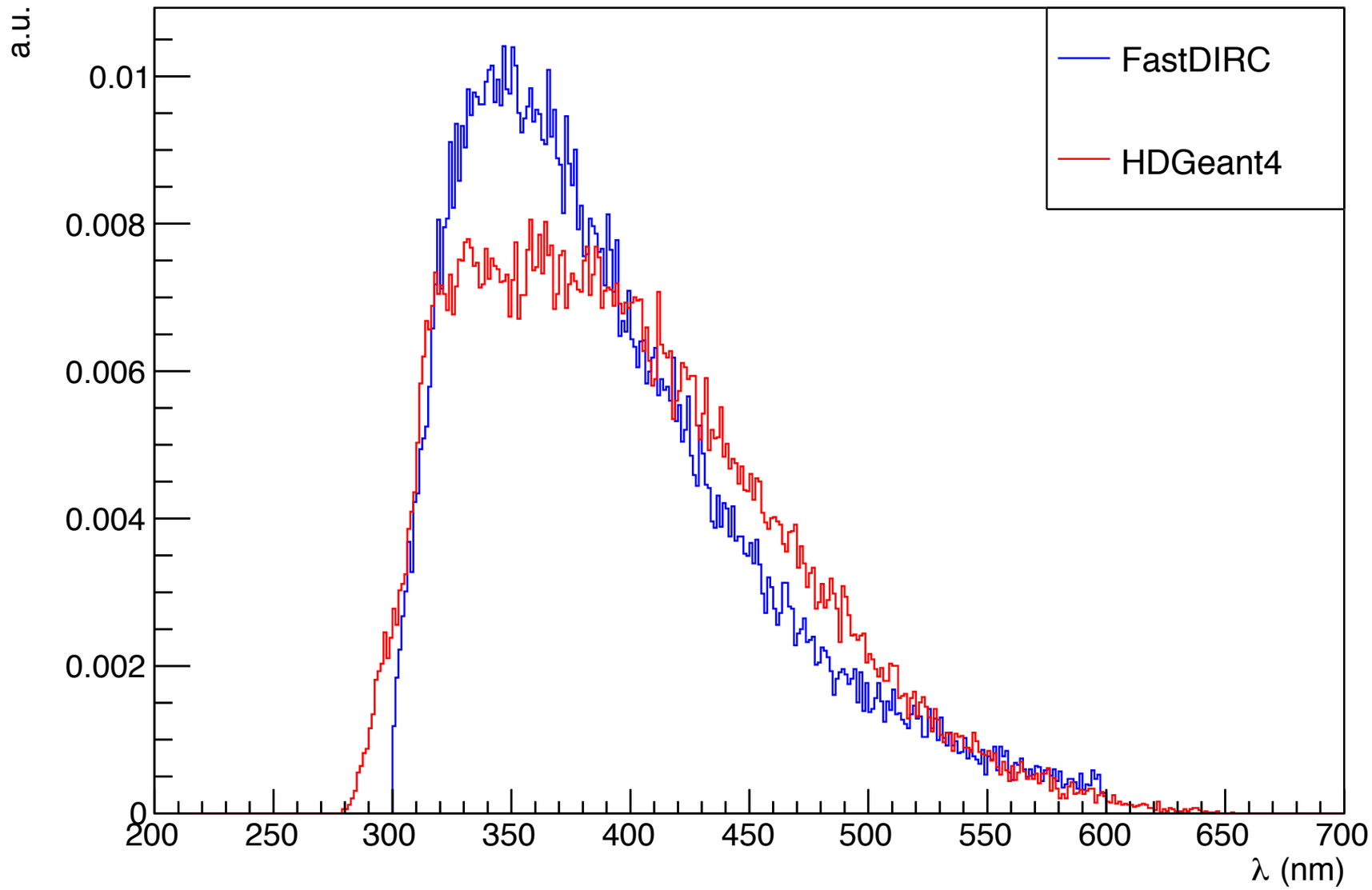
$1/\lambda^2$ Cherenkov
emission spectrum

This curve should represent our knowledge of all the wavelength dependent detector/material effects, such as PMT Q.E., Epotek glue, etc.

Wavelength dependence in the standard GlueX simulation pipeline

- HDGeant4:
  - Cherenkov radiation $1/\lambda^2$ spectrum (Geant4)
  - H12700 quantum efficiency at generation
- hdds: material properties
  - mirror reflectivity
  - Epotek glue
  - fused silica bar
  - …

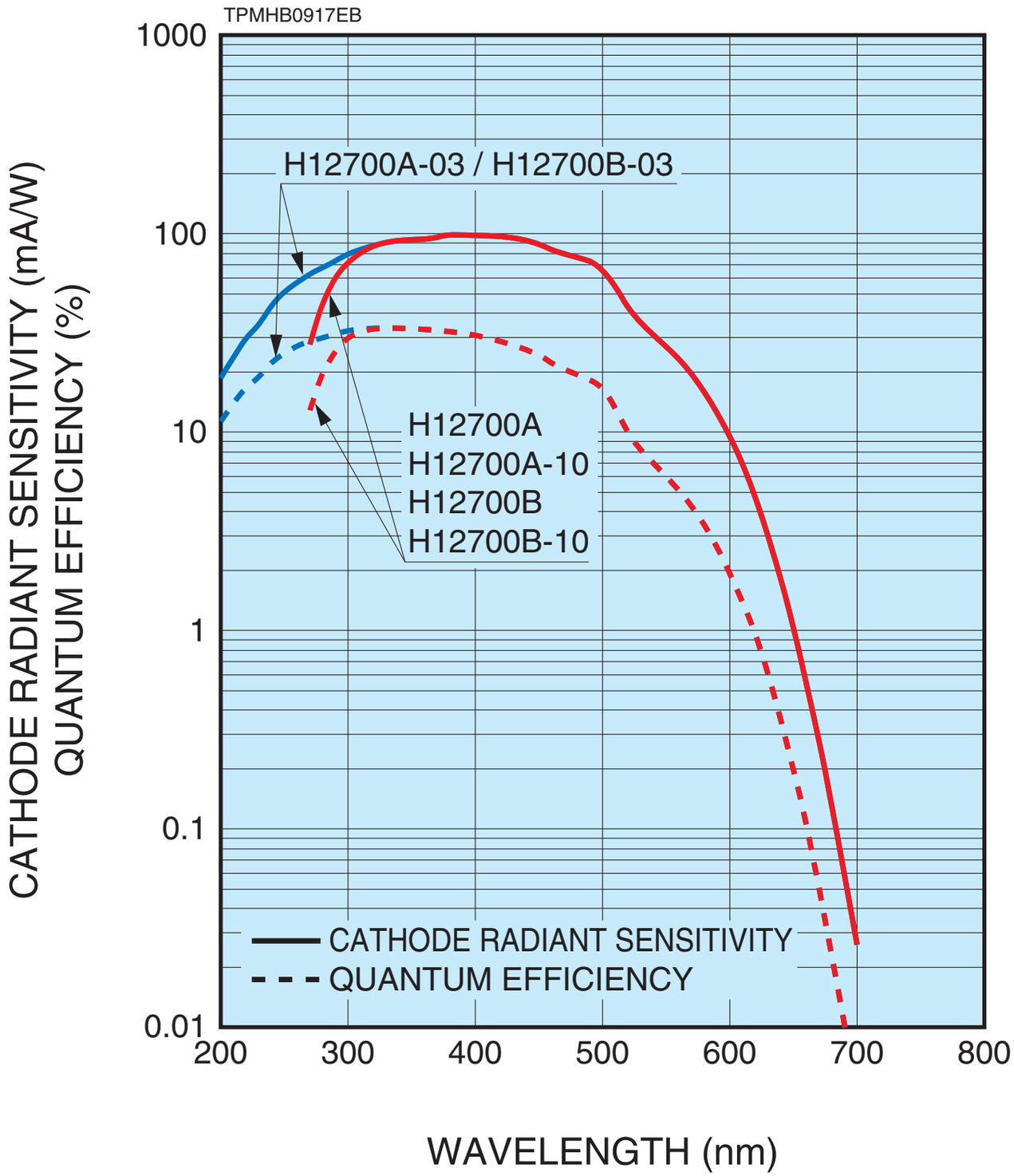
How do they compare?



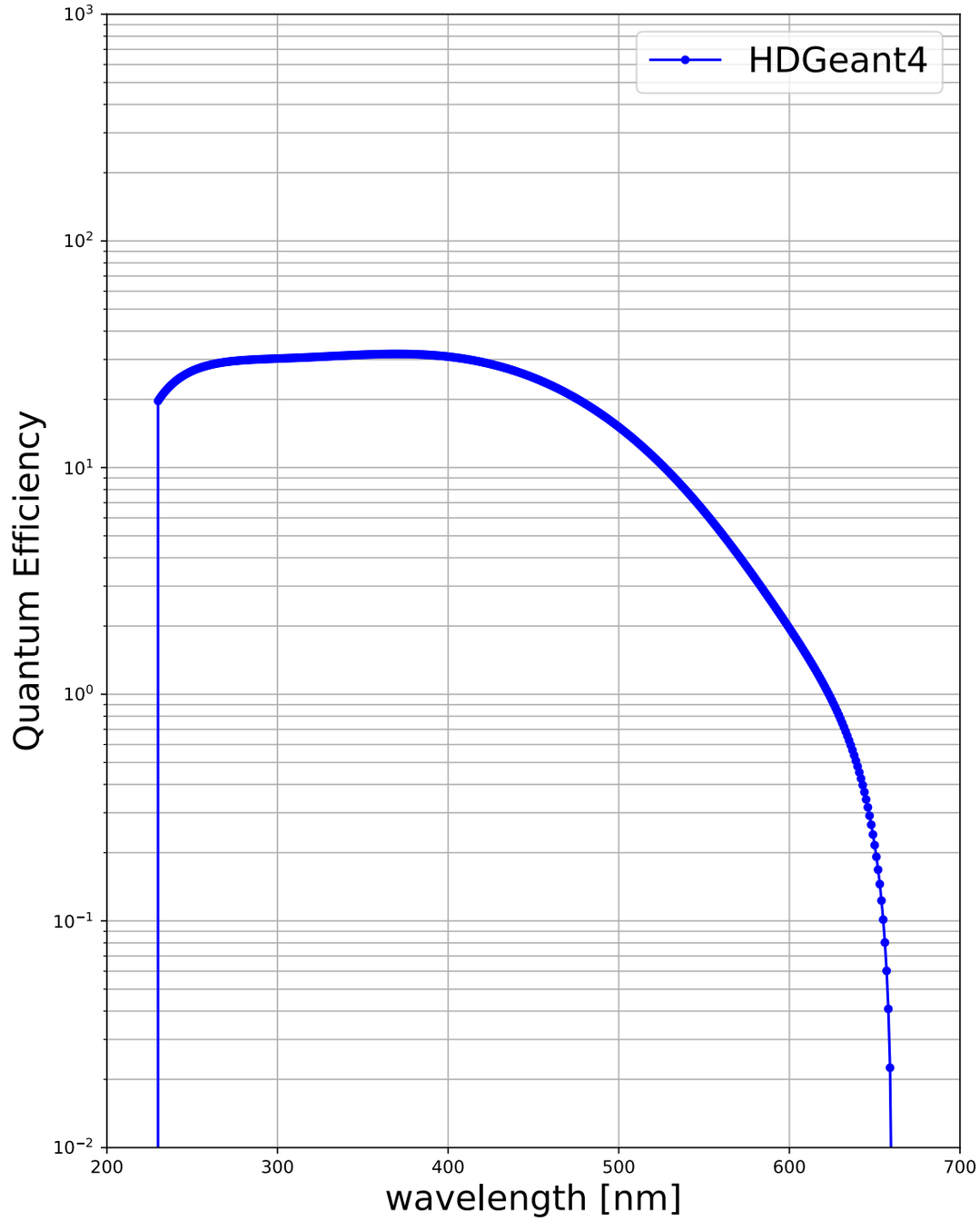
- clear differences, but similar general structure
- will use the standard HDGeant4-based simulation to look at them in detail
- a lot of information documented in Maria's writeup (GlueX-doc-3974)

H12700 MaPMT Q.E.

H12700 datasheet



HDGeant4

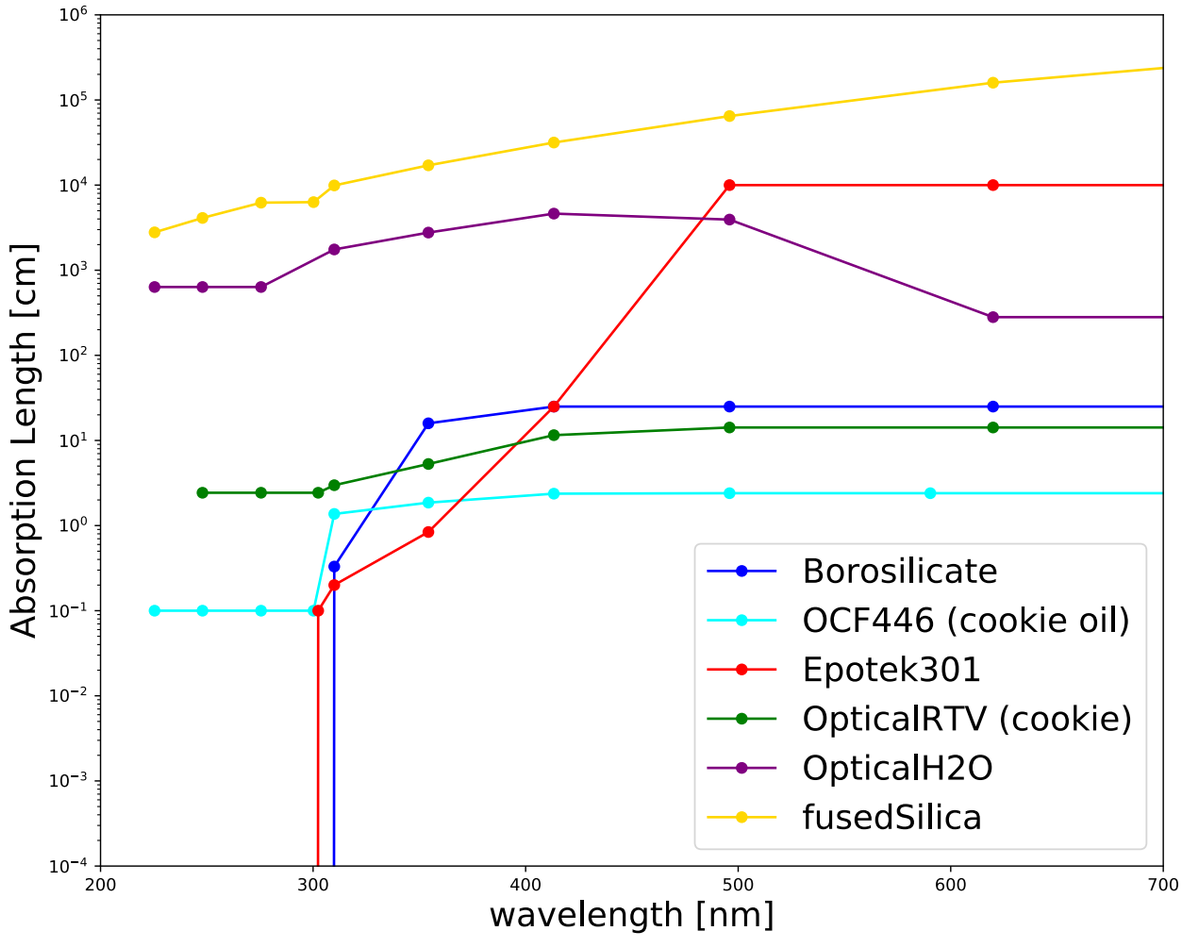


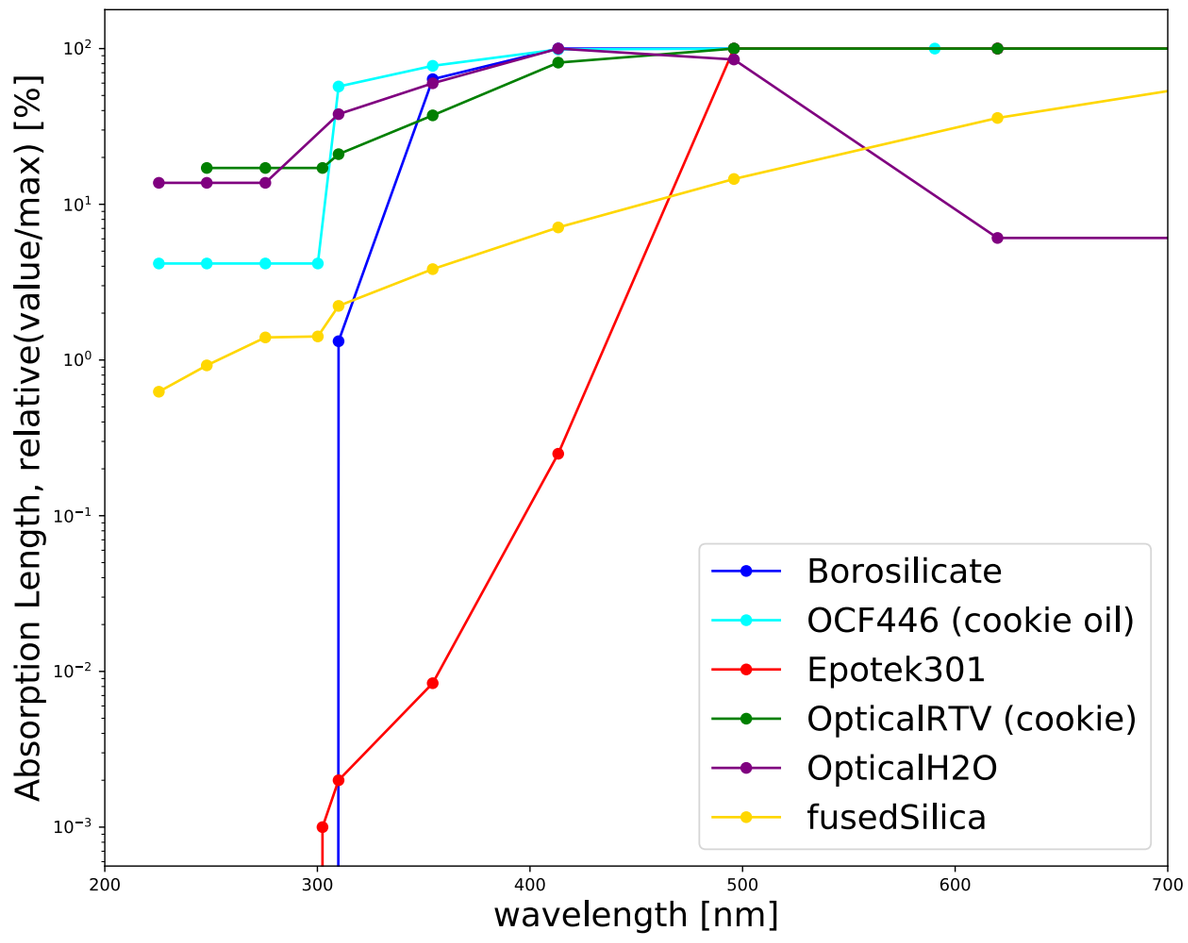
from: HDGeant4/src/GlueXSensitiveDetectorDIRC.cc

λ dependence in HDDS: hdds/Materials_HDDS.xml

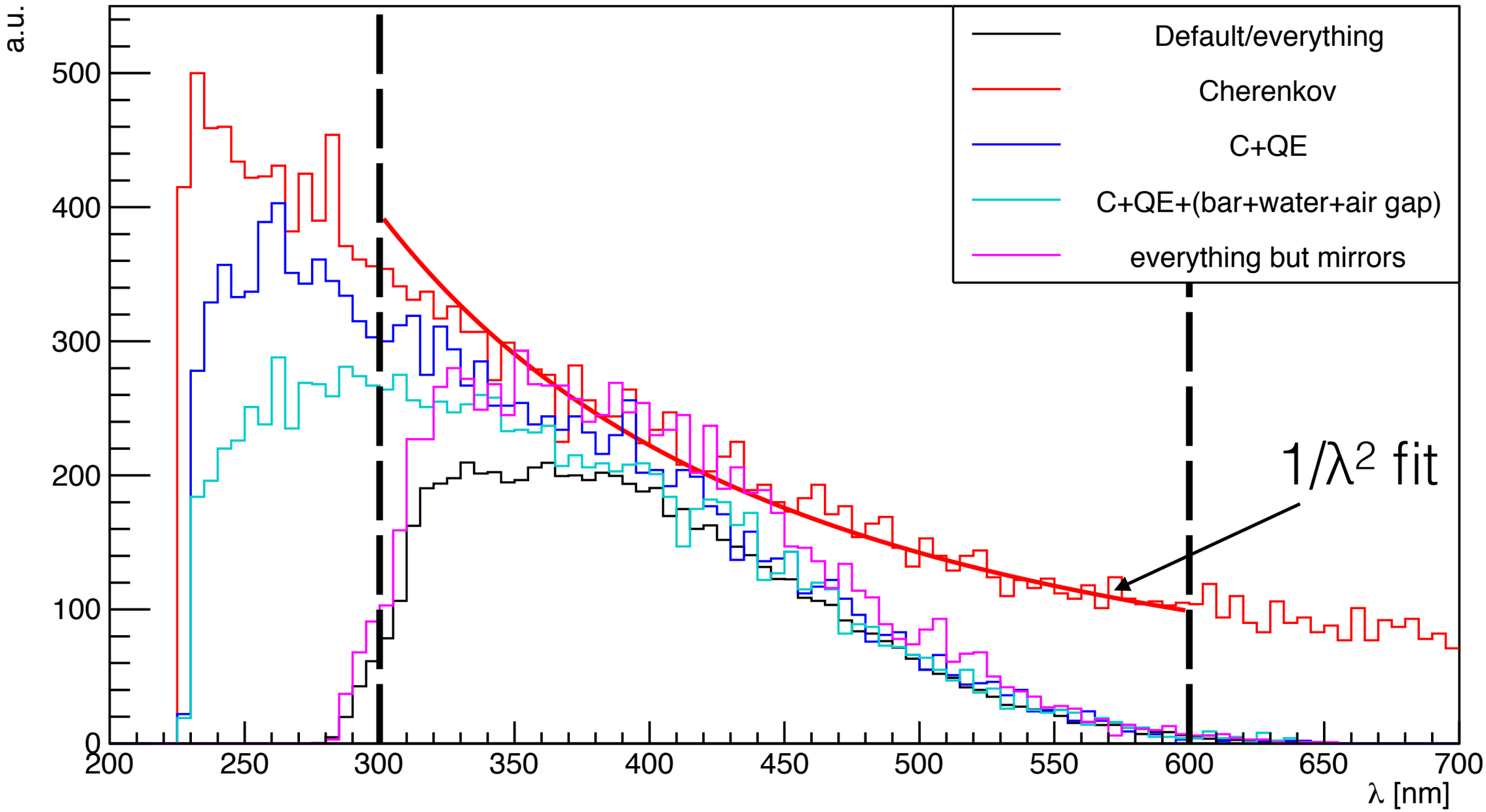
- BorosilicateGlass (PMT window)
- FarEndCerenkovMirror (bar box mirrors)
- ThickCerenkovMirror (optical box mirrors)
- fusedSilica (bar)
- OCF446 (optical oil for cookies)
- OpticalH2O (water in optical box)
- CerenkovPhotocathode (PMT sensitive element)
- OpticalAir (air gaps and envelope volume)
- Epotek301 (glue in bars)
- OpticalRTV (cookies)

λ-dependent absorption lengths for various material: curves from Material_HDDS.xml





Borosilicate PMT window and Epotek glue have important structures in the 300—500 nm range, but not that many data points.



Difference between **cyan** and **magenta**:

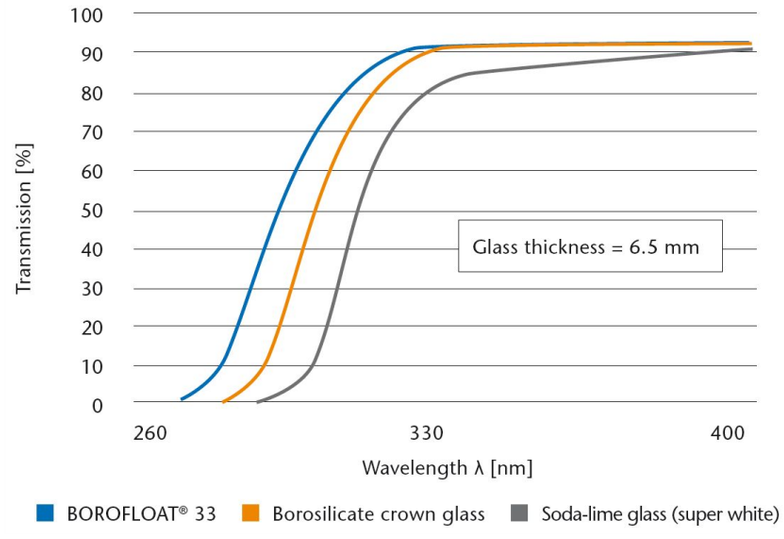
- Epotek301 (glue)
- BorosilicateGlass (PMT window)
- OpticalRTV (cookies)
- OCF446 (optical oil for cookies)

Source for our knowledge of these:

- Epotek 301-2 glue: datasheet

OPTICAL PROPERTIES @ 23°C:		
Spectral Transmission:	≥ 94% @ 320	nm
	≥ 99% @ 400-1,200	nm
	≥ 98% @ 1,200-1,600	nm
Refractive Index:	1.5318 @ 589	nm

- borosilicate PMT window glass: datasheet (orange curve)



- cookie RTV: “our measurements” (Fig.23 in writeup)
- OCF446 oil: “No data on absorption length is available”, “copied from RTV615”

Summary

- The shown expected λ distribution comes from FastDIRC which is in turn based on our knowledge of various materials in the system.

- The turnaround at ~350nm is largely due to the near-UV behavior of Epotek 301 glue in the bars, borosilicate PMT window and cookies (as implemented in simulation).

- Our knowledge about these? questionable?