

Update on electron reconstruction

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Electron interaction with matter

Electron energy loss

$$\left\langle -\frac{dE}{dx} \right\rangle = \frac{4\pi N_A r_e^2 m_e}{2} \frac{Z}{A} \frac{1}{\beta^2} \left[\log \frac{m_e^2 (\beta\gamma)^2 (\gamma-1)}{2I^2} - \delta + (1 - \beta^2) - \frac{2\gamma-1}{\gamma^2} \log 2 + \frac{(\gamma-1)^2}{8\gamma^2} \right]$$

[S. Eidelman et al., Physics Letters B 592, 1 (2004)]

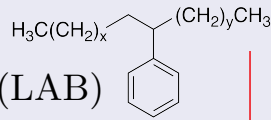
Electron interaction with matter

Electron energy loss

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Scintillator is a compound:



- Solvent – Linear Alkylbenzene (LAB)
- Water – ~2% total mass (~ 34% mol/mol)
- Fluor – 2,5-Diphenyloxazole (PPO) at 2 g/L (~ 0.004% mol/mol)
- secondary Wavelength Shifter under study – bis-MSB or Perylene

relevant for
stopping-power calculations

Mean ionization energy $\langle \log I \rangle = \sum_{\text{element } i} N_i^{\text{atoms}} Z_i \log I_i$

Density effect correction (δ) depends on $\rho = 66\% \rho_{\text{LAB}} + 34\% \rho_{\text{Water}}$

Building a reconstruction tool

Material classes

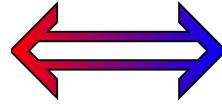
```
class LxCompound
```

```
struct LxElement
```

Building a reconstruction tool

Material classes

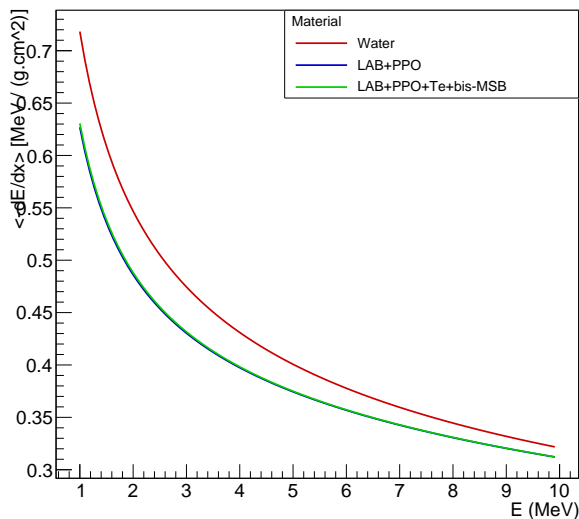
```
class LxCompound
struct LxElement
```



```
class LxdEdx
```

Implements electron's
 $\langle dE/dx \rangle$
for a given medium

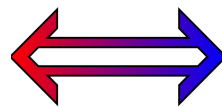
Stopping power for electrons



Building a reconstruction tool

Material classes

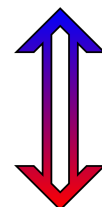
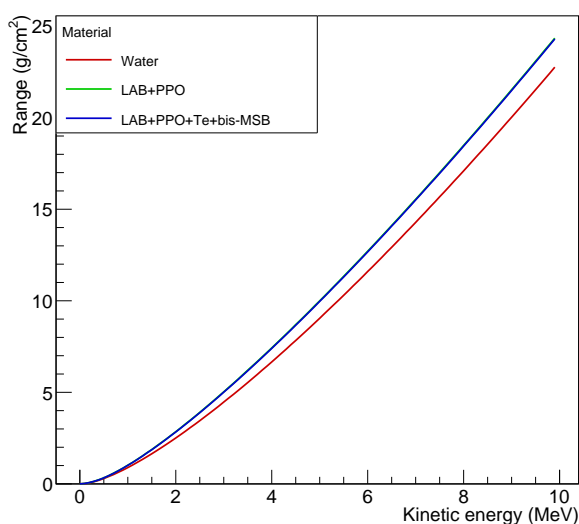
```
class LxCompound
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```
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Implements electron's
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for a given medium

Electron propagation range in different media



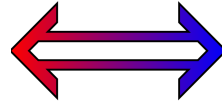
```
class ODESolver
```

Solves particle range
numerically (RK4)

Building a reconstruction tool

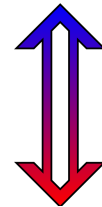
Material classes

```
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```



```
class LxdEdx
```

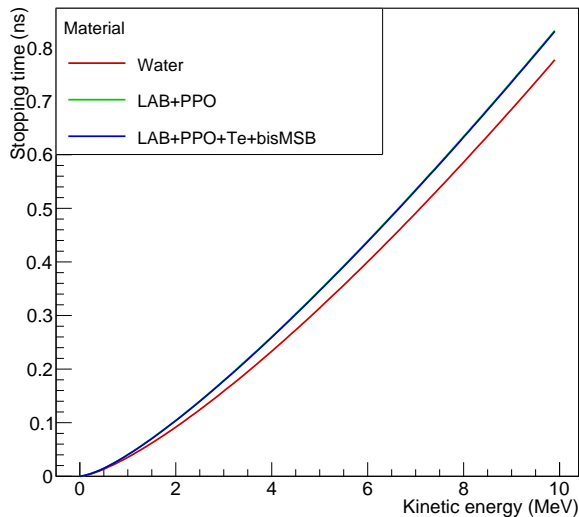
Implements electron's
 $\langle dE/dx \rangle$
for a given medium



```
class ODESolver
```

Solves particle range
numerically (RK4)

Electron stopping time in different media



Building a reconstruction tool

Material classes

```
class LxCompound
struct LxElement
```



```
class LxdEdx
```

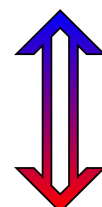
Implements electron's
 $\langle dE/dx \rangle$
for a given medium



```
class LxParticle
```

Particle tracing.

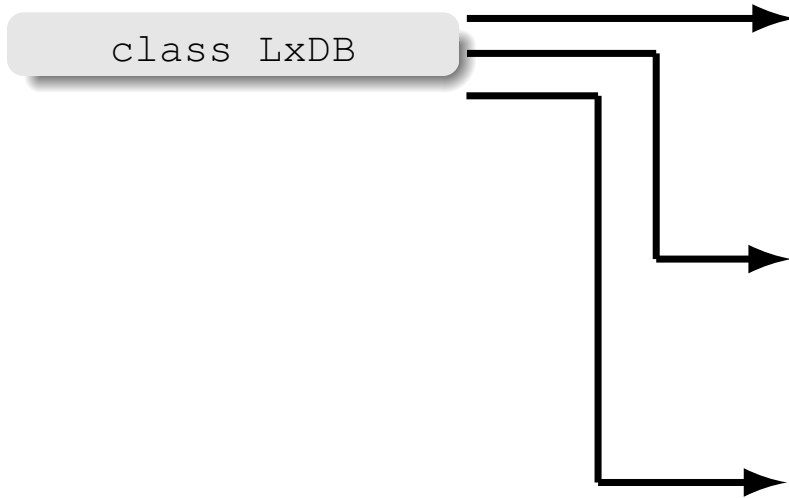
Gives energy, velocity, time
at every step until stopping point



```
class ODESolver
```

Solves particle range
numerically (RK4)

Interaction with SNO+ Database



Optics (water, scintillator)

- Rayleigh scat. length
- Absorption length
- Scintillation spectrum
- Light yield ...

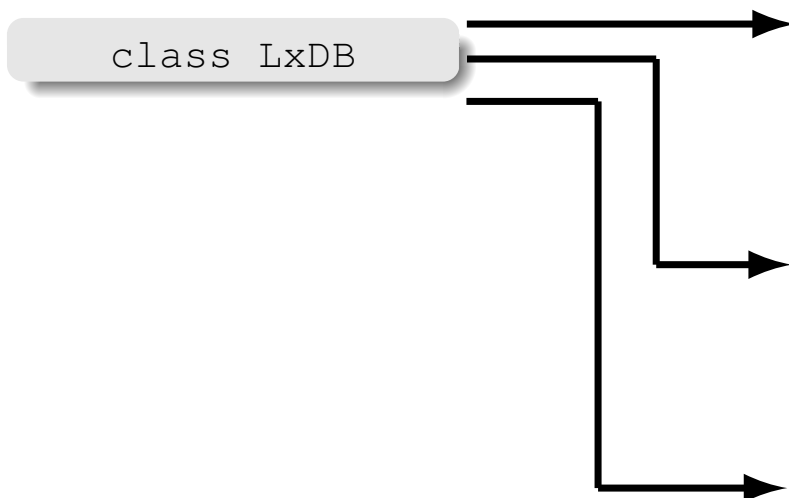
Geometry

- PMT positions
- Pipes, ropes, neck, ...

PMTs

- Dimensions
- Quantum efficiency
- Angular efficiency ...

Interaction with SNO+ Database



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Geometry

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PMTs

- Dimensions
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```
LxDB *LXDB = LxDB::Get();
```

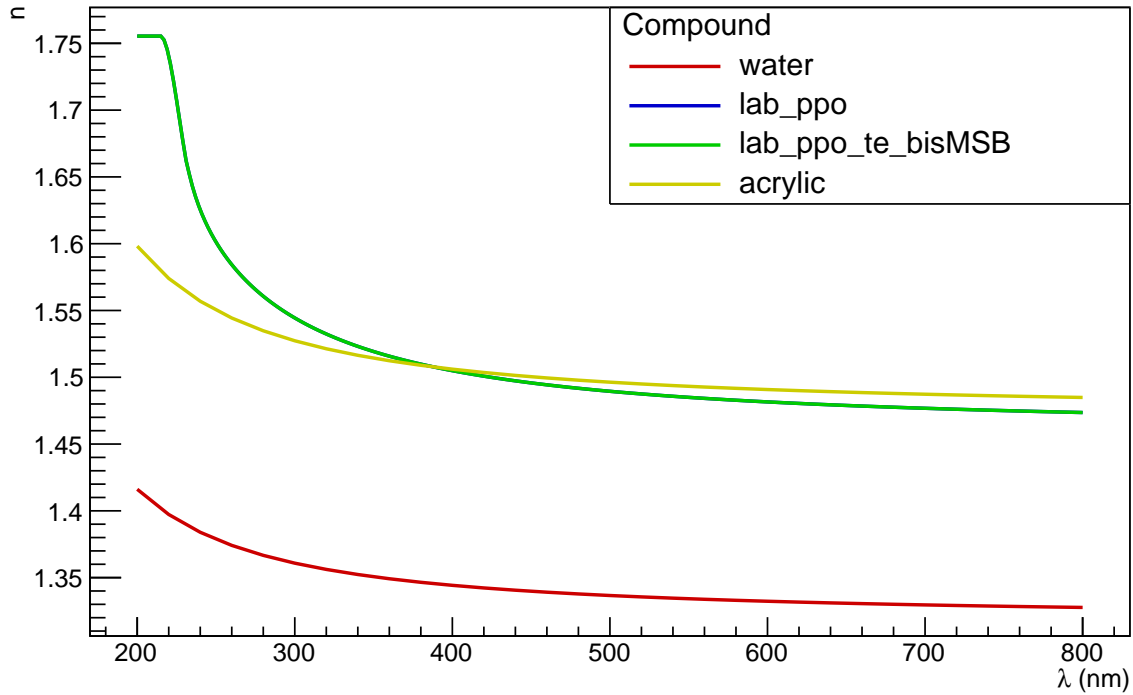
```
LxCompound* LABPPO =
```

```
LXDB->GetCompound('`lab_ppo`');
```

Interaction with SNO+ Database

```
LABPPO->GetGrindex();
```

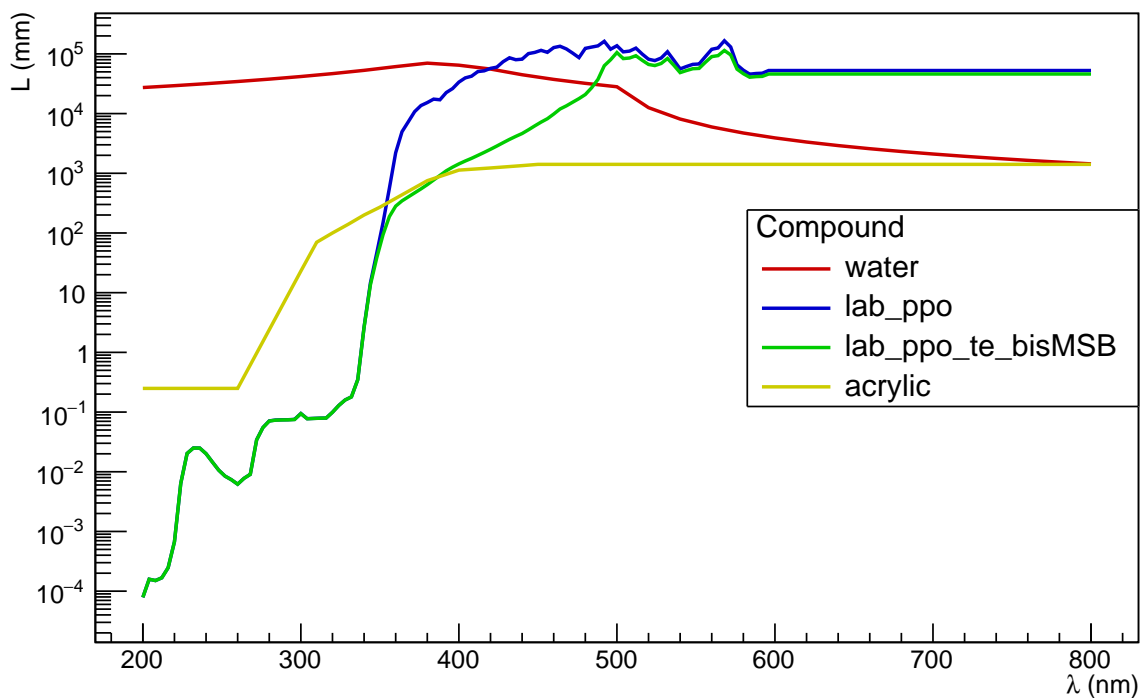
Refractive index



Interaction with SNO+ Database

```
LABPPO->GetGatt_total();
```

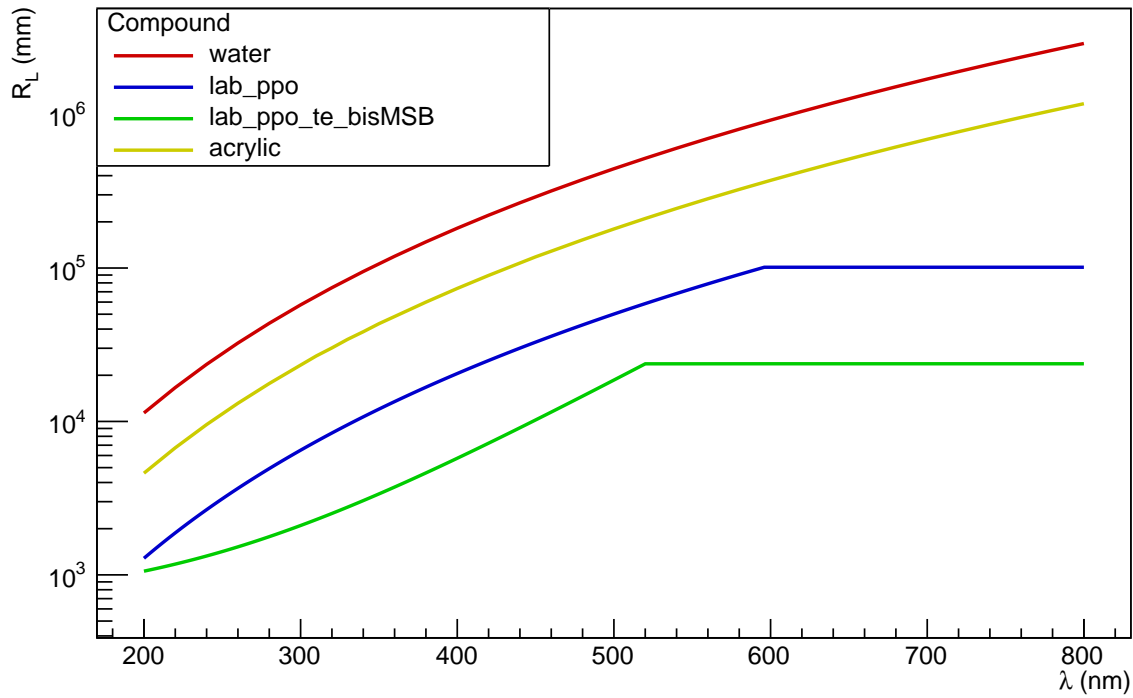
Average absorption length



Interaction with SNO+ Database

```
LABPPO->GetGrayleigh();
```

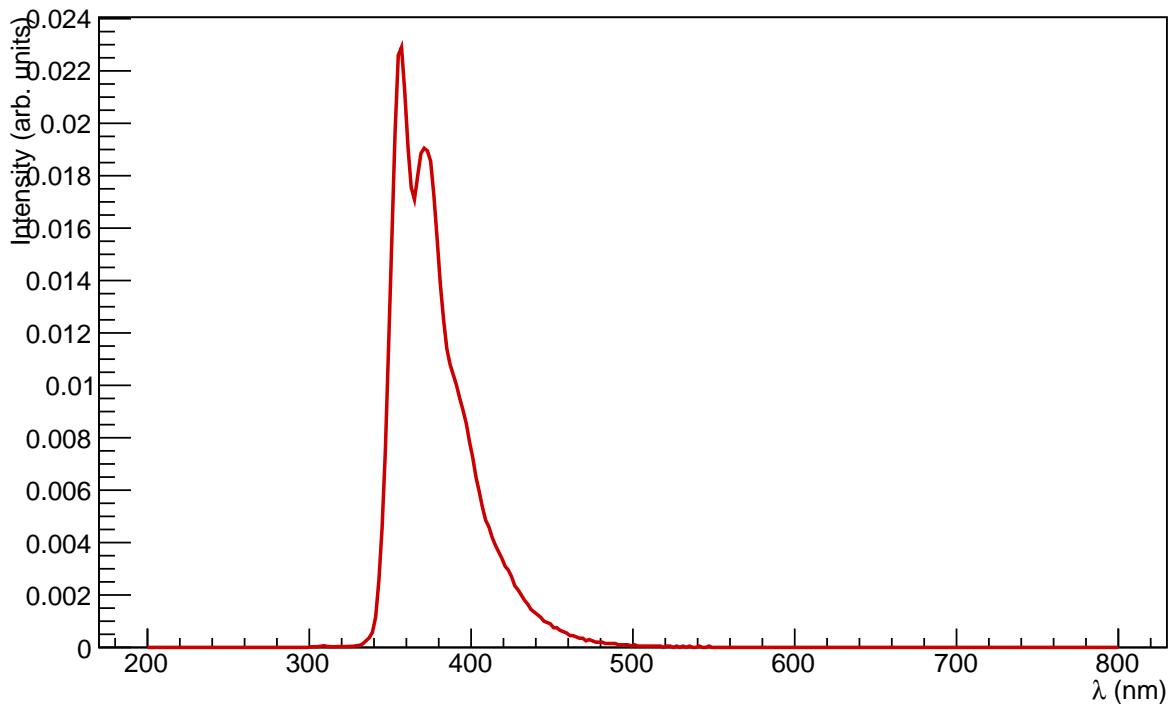
Rayleigh scattering length



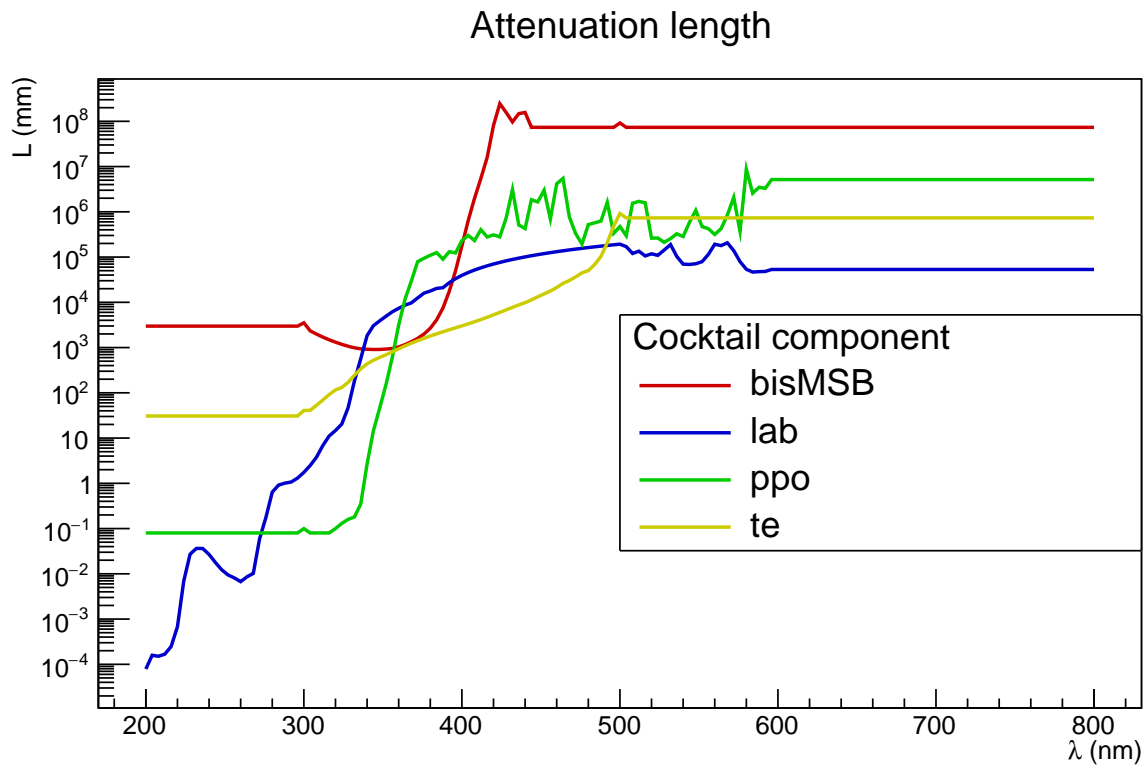
Interaction with SNO+ Database

```
LABPPO->GetGscint();
```

LAB+PPO scintillation spectrum



LABPPO->GetGatt ();



Spectrum at each PMT: non-re-emitted component

(example of a preliminary result)

Scintillation spectrum

