

## GammaLib - Feature #3328

### Implement numerical integration over vectors of functions

09/03/2020 05:21 PM - Knödlseider Jürgen

<b>Status:</b>	Closed	<b>Start date:</b>	09/03/2020
<b>Priority:</b>	Normal	<b>Due date:</b>	
<b>Assigned To:</b>	Knödlseider Jürgen	<b>% Done:</b>	100%
<b>Category:</b>		<b>Estimated time:</b>	0.00 hour
<b>Target version:</b>	2.0.0		
<b>Description</b>			
<p>To improve the efficiency of the computations it should be possible to apply numerical integration to vectors of functions, returning hence the a vector of integrals in a single method call. This allows for example to integrate in one shot a function and its derivatives.</p> <p>For this purpose a new class</p> <pre>class GFunctions { public:      // Constructors and destructors     GFunction(void);     GFunction(const GFunction&amp; function);     virtual ~GFunction(void);      // Operators     GFunction&amp; operator=(const GFunction&amp; function);      // Methods     virtual GVector eval(const double&amp; x) = 0; }</pre> <p>needs to be introduced which an eval() method that returns a vector of values for a given argument x.</p> <p>Methods</p> <pre>explicit GIntegral(GFunctions* kernel); void          kernel(GFunctions* kernel); const GFunctions* kernel(void) const; GVector       trapzd(const double&amp; a, const double&amp; b, const int&amp; n, GVector result); GVector       romberg_vector(const double&amp; a, const double&amp; b, const int&amp; order);</pre> <p>need to be added to the GIntegral class to support these vectors.</p>			
<b>Related issues:</b>			
Related to GammaLib - Action # 3203: Implement spatial IRF integration method...			<b>Closed</b> <b>04/11/2020</b>

#### History

##### #1 - 09/03/2020 05:21 PM - Knödlseider Jürgen

- Related to Action #3203: Implement spatial IRF integration methods that return IRF values for all events added

##### #2 - 09/04/2020 03:46 PM - Knödlseider Jürgen

- Status changed from New to In Progress

- % Done changed from 0 to 10

I implemented the GFunctions class and added a dedicated unit test.

**#3 - 09/04/2020 11:01 PM - Knödseder Jürgen**

- % Done changed from 10 to 90

I replaced GVector by GNdarray to have a more general definition of a set of functions in GFunctions.

For integration of a set of functions I implemented the GIntegrals class. Only the GIntegrals::romberg methods were implemented since the other integration methods are actually nowhere used. They can be added later if really needed.

**#4 - 09/08/2020 09:15 AM - Knödseder Jürgen**

- Status changed from In Progress to Closed

- % Done changed from 90 to 100

Merged into devel.