

# Parameter List

A. Fabich, CERN AB-ATB


N. Emelianenko, CERN AT-MAS

**E. Wildner, CERN AT-MAS**

3<sup>rd</sup> beta-beam task meeting, GSI, May 2006

- Parameter list specification
- Database: added value
- Database design
- Setup and maintenance
- Examples
- Conclusion

- The Parameter List Specification is based on the Specification presented at the 2<sup>nd</sup> bb task meeting 2005
- Single source
- Describe the Baseline
- Versioning
- Insures coherence of studies

Slide from bb task meeting 2 (improvements marked by  )

CERN maintains the completeness and validity 

- With your help!


It will grow rapidly! 

- Regularly we will ask responsables of the sub-tasks to provide input to keep the parameter list complete and updated.

■ **Currently all parameters in one sheet** 

- About 150 entries now

■ **Possible split into parts later**

- Change to separated sheets
- Change to database (MS access) style?
  - Provides enormous increase on flexibility 

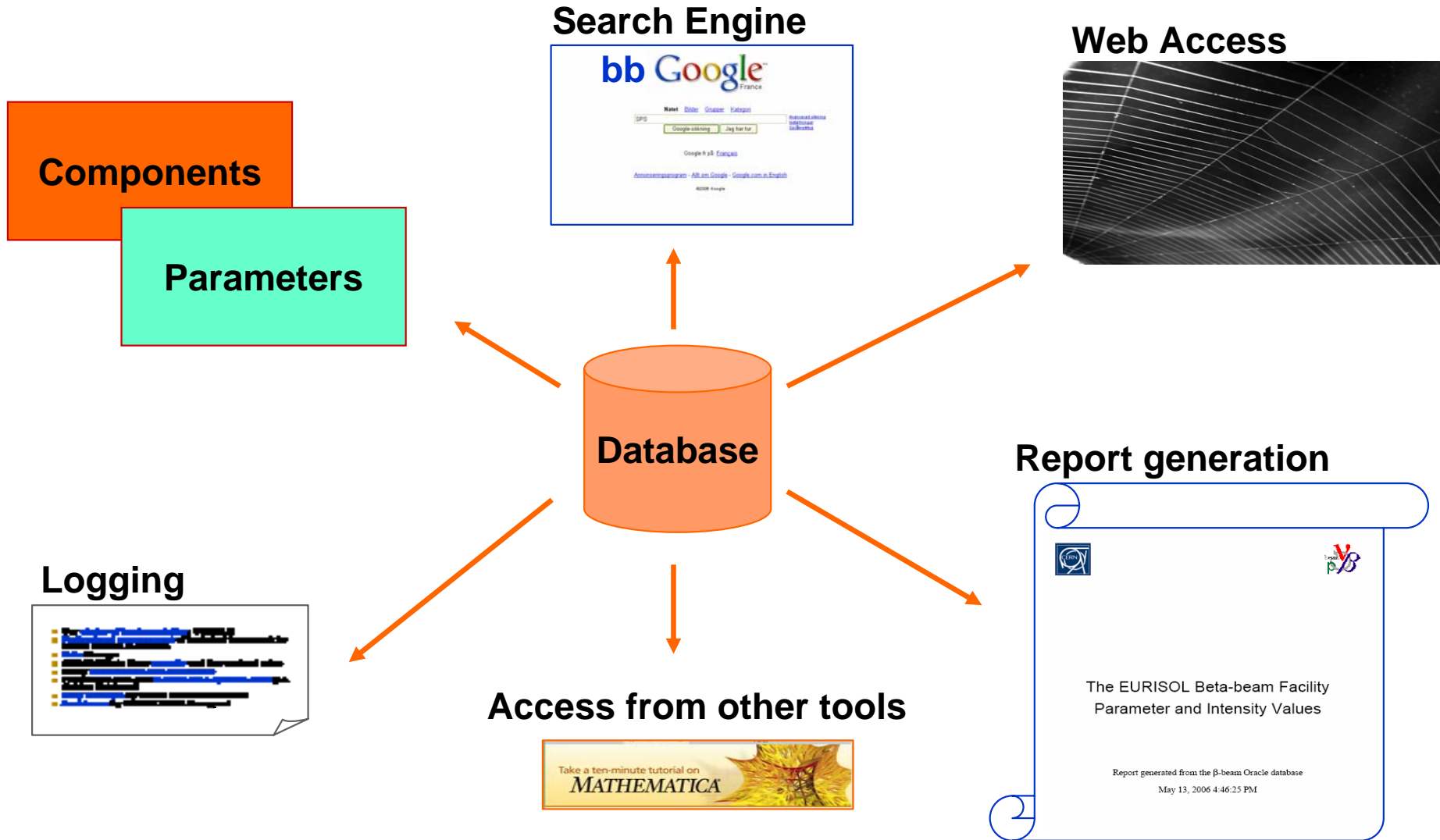
■ **Finally it should provide all numbers ever identified** 

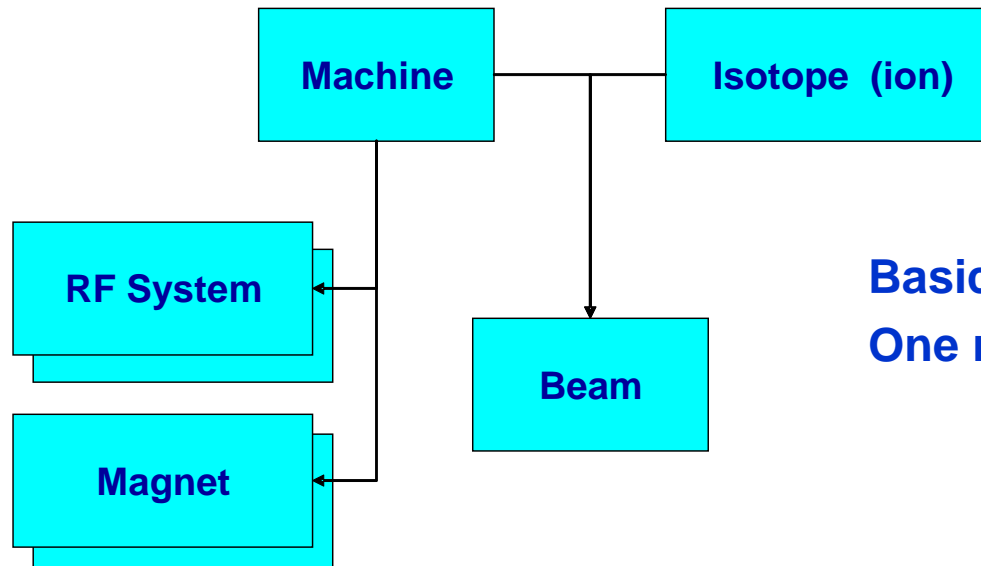
■ **Base reference in the end!** 

- Unique data source
- Easily **maintainable** and extendable
- **Open** system ready to use
- **Common acces** from several programs like Mathematica
- **Data export** in a variety of formats (txt, PDF, csv, ASCII, word...)

## Our choice of implementation: ORACLE

- Reliability
- Security and fine grained access rights
- Powerful access and maintenance systems exist (i.e. Golden Retriever)
- Daily backups by CERN Oracle support
- Assistance by CERN Oracle support





**Basic object structure for this application:  
One node, max two parents**

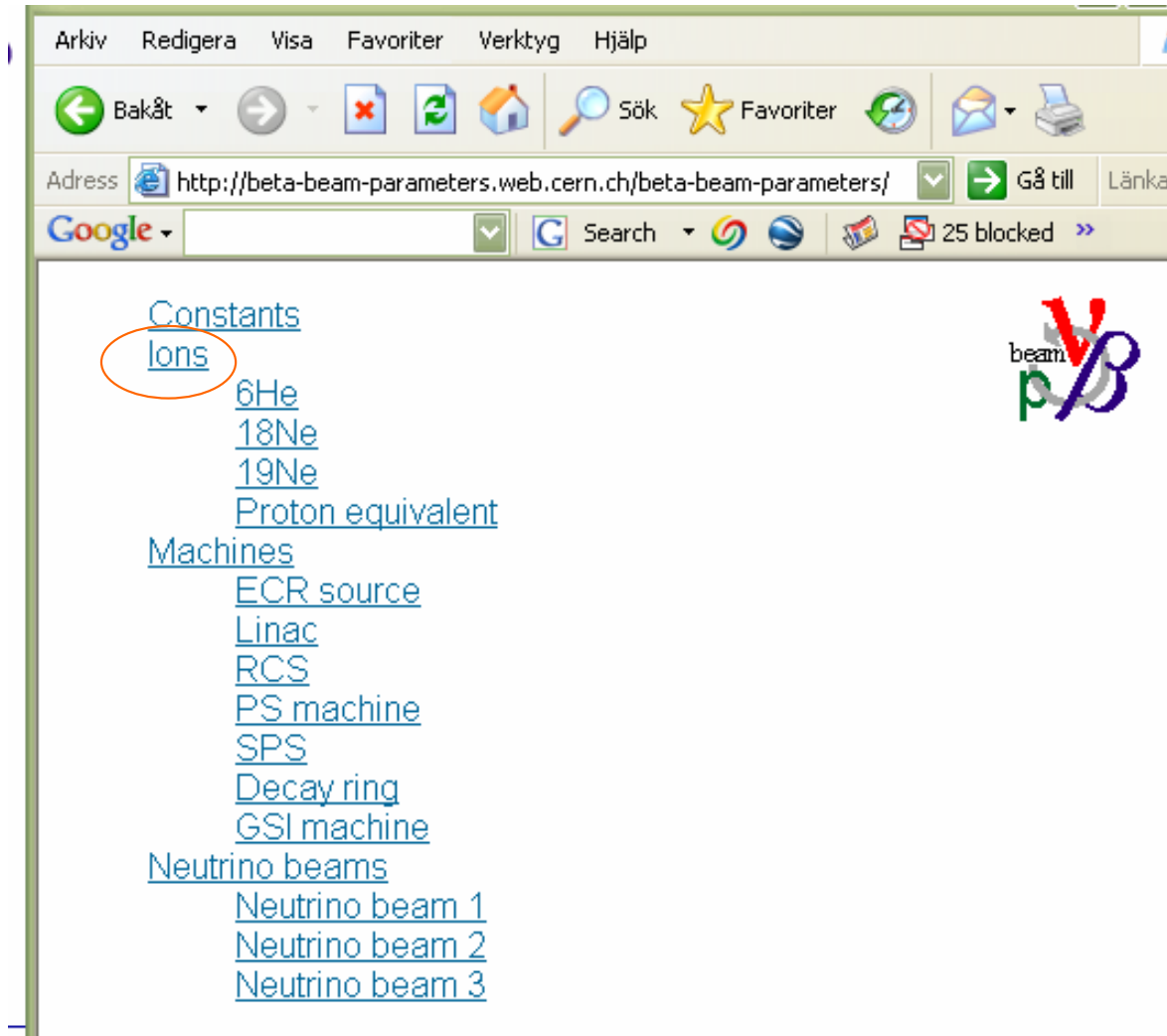
**Impose a rigorous systematization of the knowledge about the system,  
Separate the parameter definition (metadata) and parameter value (data),  
Store the system definition (metadata) in the database.**



- The *values* of a given parameter can have various sources:
  1. **Given value**. The value has to be inserted manually, and for each value the exact source (published document, presentation, web site etc.) must be specified. All sources are registered in the detailed *Data Sources list*.
  2. **Automated input** from e.g. *Mathematica* (for the parameters derived from other requiring complex calculations).
  3. **Calculated on the fly** upon parameter access (the formulae are defined and stored in the database along with the parameter definition).
  
- The **type of the source** for a parameter values and **unit** for the numeric values are defined (fixed) in the parameter *definition*. The *value* itself can be either numeric or alpha-numeric.

- For the database, web and tools:  
CERN, Natalia Emelianenko
- For the parameters: CERN, A Fabich
- Versions to be stamped and generated after agreement in task meeting?
- Older versions can be obtained (.pdf and by special tool or request).

# Parameters on the Web 1

A screenshot of a web browser window. The address bar shows the URL "http://beta-beam-parameters.web.cern.ch/beta-beam-parameters/". The browser's menu bar includes "Arkiv", "Redigera", "Visa", "Favoriter", "Verktyg", and "Hjälp". The toolbar contains navigation buttons like "Bakåt", "Föråt", "Sök", "Favoriter", and "Gå till". The main content area displays a list of links under the heading "Constants". The link "Ions" is circled in orange. Other links include "6He", "18Ne", "19Ne", "Proton equivalent", "Machines", "ECR source", "Linac", "RCS", "PS machine", "SPS", "Decay ring", "GSI machine", "Neutrino beams", "Neutrino beam 1", "Neutrino beam 2", and "Neutrino beam 3". A small "beam" logo is visible in the top right corner of the page content.

Beta Beam Baseline Parameters: ion - Microsoft Internet Explorer

Arkiv Redigera Visa Favoriter Verktyg Hjälp

Bakåt Sök Favoriter

Adress [http://beta-beam-parameters.web.cern.ch/beta-beam-parameters/servlet/rootObjectsData?object\\_type=ion](http://beta-beam-parameters.web.cern.ch/beta-beam-parameters/servlet/rootObjectsData?object_type=ion) Gå till Länkar

Google Search 25 blocked Check AutoLink AutoFill Options

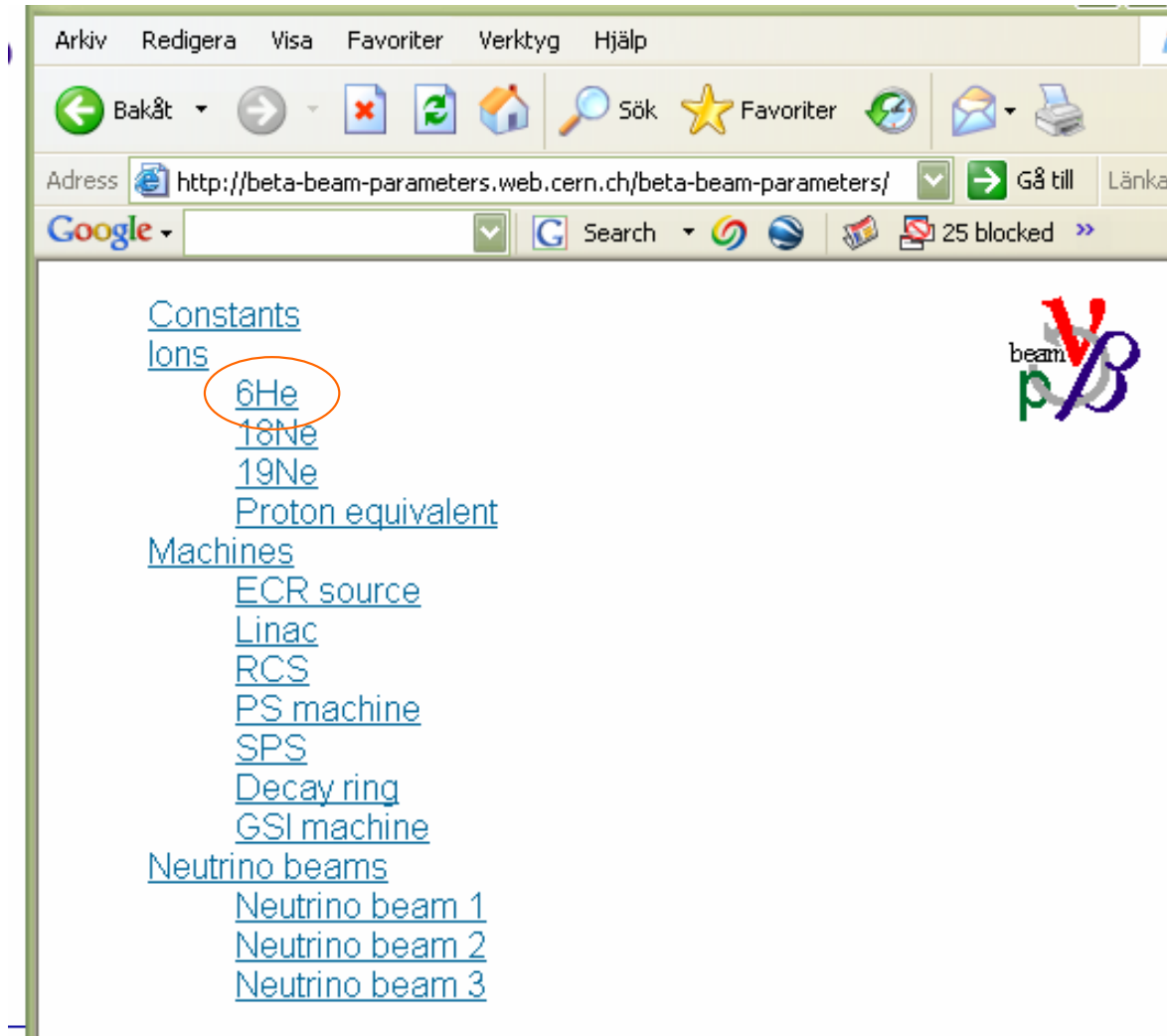
ION

[back to the list of objects](#) [Show object type template](#)

Parameter	Symbol	Unit	Calculated	6He	18Ne	19Ne	Proton equivalent
<b>Ion</b>							
charge	q	e	no	2	10	10	1
A		nucleons	no	6	18	19	1
Q/A			on the fly	0.33	0.56	0.53	1.00
Equivalent mass		amu	no	6.019	18.006	19.002	1.007
lifetime at rest	$t_{1/2}$	s	no	0.81	1.67	17.30	$\infty$
decay mode			no	b- to ${}^6\text{Li}$	EC to ${}^{18}\text{F}$	EC to ${}^{19}\text{F}$	
Q-value		eV	no	3.51E+06	3.30E+06	2.20E+06	
nuclear spin			no	0	0	1/2	1/2
rest mass		eV	no	5.61E+09	1.68E+10	1.77E+10	9.39E+08
rest mass/nucleon		eV/nucleon	on the fly	9.343E+08	9.315E+08	9.313E+08	9.393E+08
<b>Target</b>							
primary proton energy		GeV	no	2.2	2.2		
average current		mA	no	0.10	0.10		
average power		kW	no	220	220		
target method			no	converter	direct	direct	
material			no	BeO	MgO		
production rate (bottom-up)		atoms/s	no	5.0E+13	2.0E+12	4.0E+13	
Target production performance		%	on the fly	101	4	12	

Start 5 M C S Adress till SV 16:40

# Parameters on the Web 3

A screenshot of a web browser window. The address bar shows the URL "http://beta-beam-parameters.web.cern.ch/beta-beam-parameters/". The browser's menu bar includes "Arkiv", "Redigera", "Visa", "Favoriter", "Verktyg", and "Hjälp". The toolbar contains navigation buttons like "Bakåt", "Föråt", "Sök", and "Favoriter". The main content area displays a list of links under the heading "Parameters on the Web 3". The links are organized into categories: "Constants", "Ions", "Machines", and "Neutrino beams". Under "Ions", the link "6He" is circled in red. A small "beam" logo is visible in the top right corner of the page content.

Arkiv Redigera Visa Favoriter Verktyg Hjälp

Bakåt Föråt Sök Favoriter

Adress <http://beta-beam-parameters.web.cern.ch/beta-beam-parameters/> Gå till Länkar

Google Search 25 blocked

[Constants](#)

[Ions](#)

[6He](#)

[18Ne](#)

[19Ne](#)

[Proton equivalent](#)

[Machines](#)

[ECR source](#)

[Linac](#)

[RCS](#)

[PS machine](#)

[SPS](#)

[Decay ring](#)


[GSI machine](#)

[Neutrino beams](#)

[Neutrino beam 1](#)

[Neutrino beam 2](#)

[Neutrino beam 3](#)



Beta Beam Baseline Parameters: 6He - Microsoft Internet Explorer

Arkiv Redigera Visa Favoriter Verktyg Hjälp

Bakåt Sök Favoriter

Adress [http://beta-beam-parameters.web.cern.ch/beta-beam-parameters/servlet/objectData?object\\_id=6He](http://beta-beam-parameters.web.cern.ch/beta-beam-parameters/servlet/objectData?object_id=6He) Gå till Länkar

Google Search 25 blocked Check AutoLink AutoFill Options

### Properties

Name	Calculated	Symbol	Value	Unit	Source	Comments	Last modified	History
charge	No	q	2	e	nubase, PDG		13-Jan-06 14:37	1
A	No		6	nucleons	nubase, PDG		13-Jan-06 14:37	
Q/A	Yes		0.33					
Equivalent mass	No		6.019	amu	nubase, PDG		13-Jan-06 14:37	
lifetime at rest	No	$t_{1/2}$	0.81	s	nubase, PDG		10-Mar-06 16:13	1
decay mode	No		b- to ${}^6\text{Li}$		nubase, PDG		13-Jan-06 14:37	
Q-value	No		3.51E+06	eV	nubase, PDG		13-Jan-06 14:37	
nuclear spin	No		0		nubase, PDG		16-Mar-06 10:02	1
rest mass	No		5.61E+09	eV	nubase, PDG		21-Mar-06 12:09	1
rest mass/nucleon	Yes		9.343E+08	eV/nucleon				

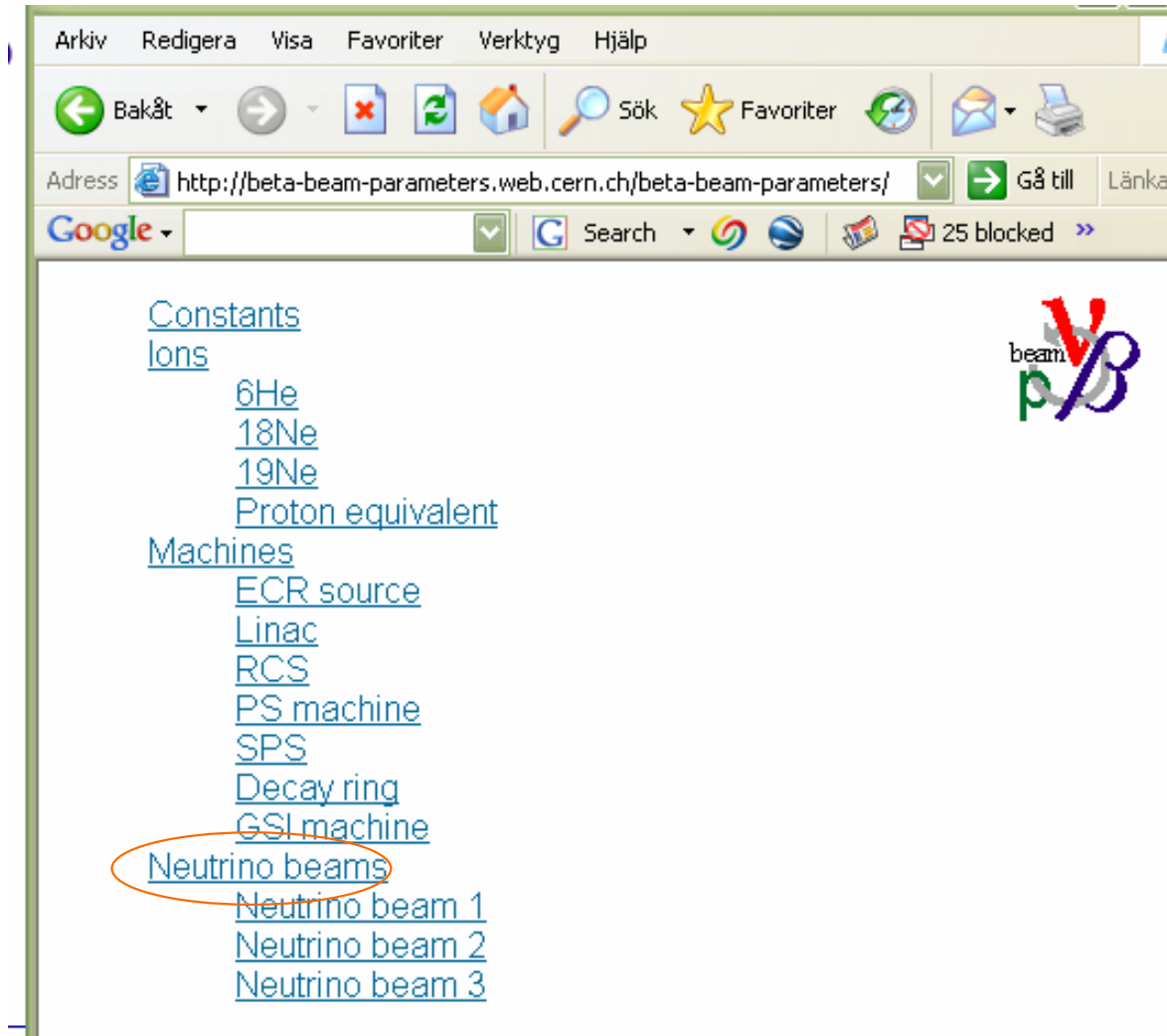
### Target

Name	Calculated	Symbol	Value	Unit	Source	Comments	Last modified	History
primary proton energy	No		2.2	GeV	SPL design report		13-Jan-06 14:37	1
average current	No		0.10	mA	SPL design report		13-Jan-06 14:37	1
average power	No		220	kW	SPL design report		13-Jan-06 14:37	1
target method	No		converter		nufact02		13-Jan-06 14:37	
material	No		BeO		nufact02		13-Jan-06 14:37	
production rate (bottom-up)	No		5.0E+13	atoms/s	unknown		11-Mar-06 07:53	
Target production performance	Yes		101	%				
production rate (top-down)	No		5.0E+13	atoms/s	unknown		10-Mar-06 16:36	1
length of transfer line	No		2.00	m	LLN		13-Jan-06 14:37	
transfer efficiency to ECR	No		0.40		version1		13-Jan-06 14:37	

Klar Internet

Start 5 M C S Adress till SV 16:42

# Parameters on the Web 5

A screenshot of a web browser window. The address bar shows the URL "http://beta-beam-parameters.web.cern.ch/beta-beam-parameters/". The browser's menu bar includes "Arkiv", "Redigera", "Visa", "Favoriter", "Verktyg", and "Hjälp". The toolbar contains navigation buttons like "Bakåt", "Föråt", "Sök", and "Favoriter". The main content area displays a list of links under the heading "Parameters on the Web 5". The links are organized into categories: "Constants", "Ions", "Machines", and "Neutrino beams". The "Neutrino beams" link is circled in orange. A small "beam" logo is visible in the top right corner of the page content.

Arkiv Redigera Visa Favoriter Verktyg Hjälp

Bakåt Föråt Sök Favoriter

Adress <http://beta-beam-parameters.web.cern.ch/beta-beam-parameters/> Gå till Länkar

Google Search 25 blocked

[Constants](#)

[Ions](#)

[6He](#)

[18Ne](#)

[19Ne](#)

[Proton equivalent](#)

[Machines](#)

[ECR source](#)

[Linac](#)

[RCS](#)

[PS machine](#)

[SPS](#)

[Decay ring](#)


[GSI machine](#)

[Neutrino beams](#)

[Neutrino beam 1](#)

[Neutrino beam 2](#)

[Neutrino beam 3](#)



Beta Beam Baseline Parameters: neutrino - Microsoft Internet Explorer

Arkiv Redigera Visa Favoriter Verktyg Hjälp

Bakåt Sök Favoriter

Adress [http://beta-beam-parameters.web.cern.ch/beta-beam-parameters/servlet/rootObjectsData?object\\_type=neutrino](http://beta-beam-parameters.web.cern.ch/beta-beam-parameters/servlet/rootObjectsData?object_type=neutrino) Gå till Länkar

Google Search 25 blocked Check AutoLink AutoFill Options

NEUTRINO

[back to the list of objects](#) [Show object type template](#)

Parameter	Symbol	Unit	Calculated	Neutrino beam 1	Neutrino beam 2	Neutrino beam 3
<b>Neutrino beams</b>						
Parent ion			no	6He	18Ne	19Ne
Neutrino type			no	electron anti-neutrino	electron neutrino	electron neutrino
Neutrino rate per second			in Mathematica	2.900E+11	1.100E+11	1.100E+11
Neutrino rate per physics year			in Mathematica	2.900E+18	1.100E+18	1.100E+18
Design rate (annual)			no	2.900E+18	1.100E+18	1.100E+18
Satisfaction factor		%	on the fly	100.00	100.00	100.00
Total runtime		years	no	5	5	5
Neutrino rate per runtime			on the fly	1.450E+19	5.500E+18	5.500E+18
Average spot at decay (1 $\sigma$ )		cm	no	4.	4.	4.
Divergence		mrad	no	10.	10.	10.

Page generated on Sat May 13 16:44:34 CEST 2006  
 Database & Web design: [Natalia Emelianenko, CERN](#)  
 Content: [Adrian Fabich, CERN](#)

Klar Internet

Start 5 M C S. Adress till SV 16:44



The screenshot shows the Mathematica 5.2 interface with a notebook named 'sample.nb'. The code in the notebook is as follows:

```

In[1]:= (* Loading the packages *)
SetDirectory["C:\Documents and Settings\Demo\Mya dokument\beta beam"];
Print["Mathematica files: ", FileNames[{"*.m", "*.nb"}]]
<< "access_db.m";

Mathematica files: {access_db.m, BB Parameters Browser.nb, decay.nb, sample.nb}
Global`GetPV

GetPV[id_String, par_String] := If[NumericQ[ToExpression[getString[id, par]]],
  ToExpression[getString[id, par]], getString[id, par]]

In[4]:= (* example of picking the value of the parameter t1/2 (6 He) *)
GetPV["6He", "ion_half"]

Out[4]= 0.81
  
```

The BB Parameters Browser window is open, showing a list of constants and ions. The 'constant' category is expanded, showing the following parameters:

- Speed of light in vacuum
- Equivalent proton mass
- Unified atomic mass unit  $u$
- Elementary charge
- Classical proton radius
- Classical electron radius
- Physics year
- $\pi$
- Electron mass

The 'ion' category is also expanded, showing the following parameters:

- 6 He
- 18 Ne
- 19 Ne
- Proton equivalent
- charge
- A
- Q / A
- Equivalent mass

The desktop background shows a window titled 'WOLFRAMRESEARCH' with links to 'Ten-minute Tutorial', 'What's New in 5.2 | 5...', 'Help Browser', and 'Website'. There is also a checkbox for 'Display this window at startup'.

```
n[160]= (* Loading the packages *)
SetDirectory["\\\\\\cern.ch\\dfs\\users\\a\\afabich\\MyDocs\\BetaBeam"];
<<"access_db.m";
<<"prolog.m"; (* define plot options *)

Global`GetPV

GetPV[id_String, par_String] :=
If[NumericQ[ToExpression[getString[id, par]]], ToExpression[getString[id, par]], getString[id, par]]
```

**Standard header, including standard plot options**

```
n[163]= (* choose ion *)
Ion = "18Ne";
Ion = "6He";
(* get parameters from database *)
<<"IonBasicParameters.m"
(* calculate derived values *)
iondecayed = IonTot  $\left( 1 - e^{-\frac{\text{Log}[2] \text{cycleLength}}{\text{topgam thalf}}} \right)$ ;
Print["Energy loss/cycle due to decay: ",
energylossdecay = iondecayed GetPV["DECAY-" <> Ion, "beam_beam_inj_e_ion"] elec]
CoolinatedEmomentum = IonIn e  $\frac{-\text{Log}[2] \text{merges cycleLength}}{\text{topgam thalf}}$  GetPV["DECAY-" <> Ion, "beam_beam_inj_e_ion"] elec;
(* define parameters not yet in database *)
Print["Merging delay [s]: ", MergeDelay = 0.5]
Print["Collimation delay [s]: ", pCollDelay = 0.3]

energy injected [J]: 808325.
Energy loss/cycle due to decay: 434121.
Merging delay [s]: 0.5
Collimation delay [s]: 0.3
```

**Main: loading constants and ion parameters, call packages and define additional parameters (PUT THEM in DB, send mail!!)**

```

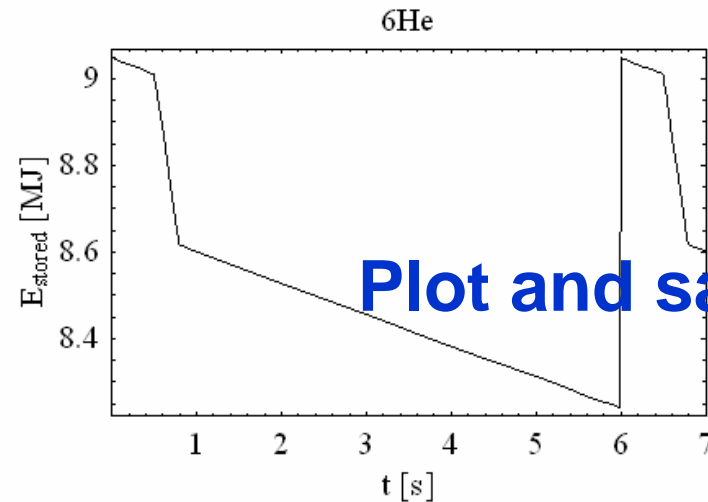
elec = GetPV["constant", "const_e"];
IonIn = GetPV["SPS-" <> Ion, "beam_int_ej_ions_cycle"];
Print["energy injected [J]: ",
Einj = IonIn GetPV["DECAY-" <> Ion, "beam_beam_inj_e_ion"] elec]
IonTot = GetPV["DECAY-" <> Ion, "beam_int_inj_ions_cycle"];
thalf = GetPV[Ion, "ion_thalf"];
topgam = GetPV["DECAY-" <> Ion, "beam_beam_inj_gamma"];
merges = GetPV["DECAY-" <> Ion, "beam_cycle_decay_merges"];
cyclelength = GetPV["DECAY-" <> Ion, "beam_cycle_time"];
storedEtot = N[GetPV["DECAY-" <> Ion, "beam_int_inj_energy"]

```

```

In[171]:= Export["EnergyBalanceDecayRing_" <> Ion <> ".gif",
DisplayTogether[
Plot[
1/10^6
(storedEtot + If[t - Floor[t/cyclelength] cyclelength < MergeDelay + pCollDelay,
CoolimatedEmomentum If[t - Floor[t/cyclelength] cyclelength > MergeDelay,
1/pCollDelay (pCollDelay + MergeDelay - (t - Floor[t/cyclelength] cyclelength)), 1], 0]]
e^-Log[2] (t - Floor[t/cyclelength] cyclelength / topgam thalf), {t, 0, 15},
PlotRange -> {{0, cyclelength + 1}, All}, FrameLabel -> {"t [s]", "E_stored [MJ]"}, PlotLabel -> Ion]
]]

```



**Plot and save.**

**Standard package to load ion parameters**

- Programs valid for all times with the current baseline parameters of the database.

Ring\_6He.gif

- A **database implementation** of the bb parameters is now available
- **CERN** is maintaining the system
- It can be **accessed via web and application** programs
- So far the system seems to **give satisfaction**
- **Feedback from users** is important for the further improvements!
- To add parameters: email request sufficient