LISE^{++} : Asymmetry of momentum distributions

From 15/03/2012

LISE^{++} version 9.4.1

- Asymmetry for Gaussian-like momentum distributions
- Asymmetry parameter "alpha"
- Extracting the asymmetry coefficient from the Convolution model (Universal parameterization)
- Example at low energy
- ^{82}Se momentum distribution results (will be soon)

The code operates under MS Windows environment and provides a highly user-friendly interface.
It can be freely downloaded from the following internet addresses:
http://www.nscl.msu/edu/lise

Asymmetry for Gaussian-like momentum distributions

symmetric

$$f(x) = A \cdot e^{\frac{-(x-x_0)^2}{2\cdot\sigma^2}}$$

$$CS = A\cdot\sqrt{2\cdot\pi}\cdot\sigma$$

$$x_{peak} = x_0$$

$$\langle x \rangle = x_0$$

asymmetric

$$f(x) = A \cdot e^{\frac{-(x-x_0)^2}{2\cdot\sigma_{low}^2}} \text{ , if } x < x_0 \quad \text{and} \quad A\cdot e^{\frac{-(x-x_0)^2}{2\cdot\sigma_{high}^2}} \text{ , if } x > x_0$$

$$CS = A\cdot\sqrt{2\cdot\pi}\cdot\sigma \qquad \text{where} \qquad \sigma = \frac{\sigma_{low} + \sigma_{high}}{2}$$

asymmetry coefficient $\alpha = \frac{\sigma_{low}}{\sigma} - 1 = 1 - \frac{\sigma_{high}}{\sigma}$

$$-100\% < \alpha < +100\%$$

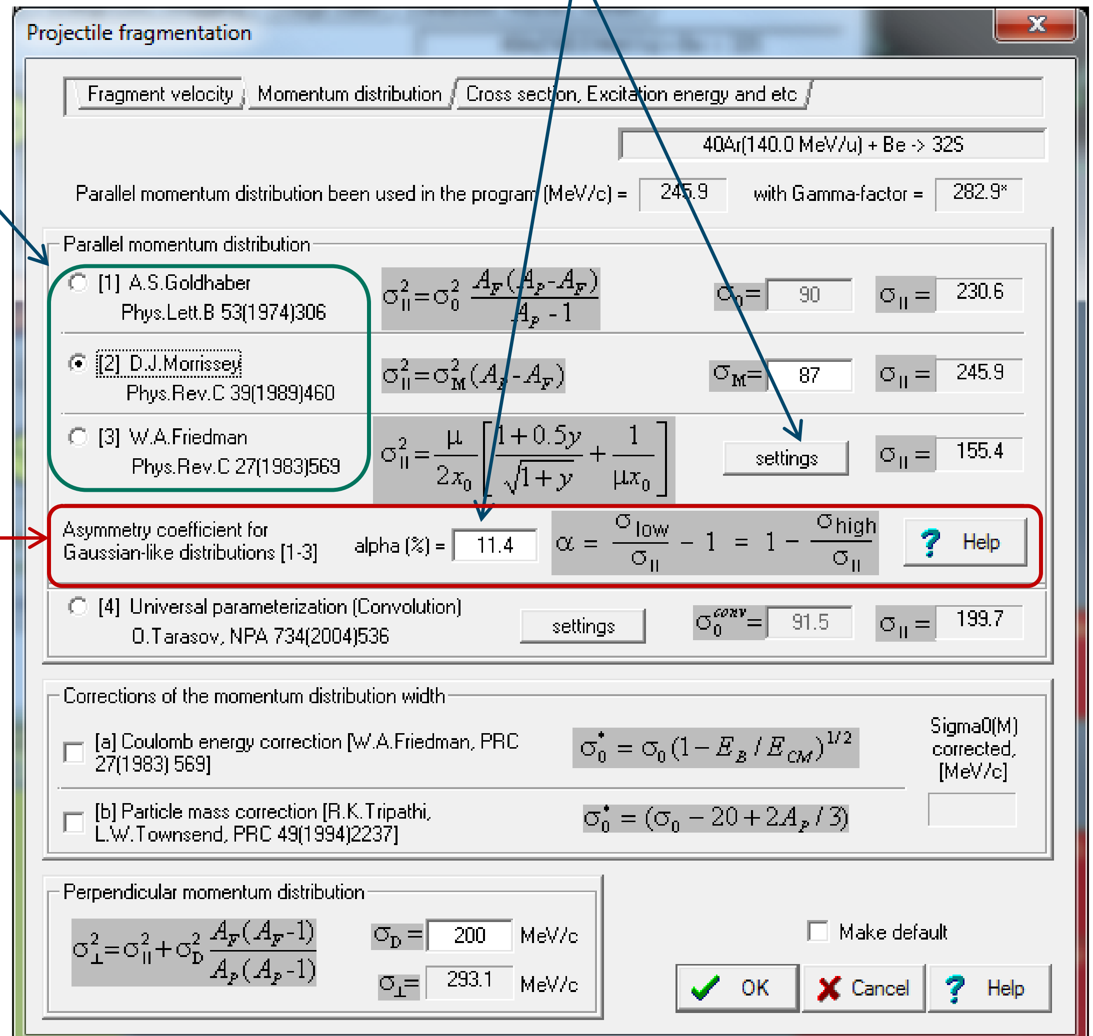
$$x_{peak} = x_0$$

$$\langle x \rangle = \frac{\int_{-\infty}^{x_0} x\cdot A\cdot e^{\frac{-(x-x_0)^2}{2\cdot(\sigma_{low})^2}}\,dx + \int_{x_0}^{\infty} x\cdot A\cdot e^{\frac{-(x-x_0)^2}{2\cdot(\sigma_{high})^2}}\,dx}{\int_{-\infty}^{x_0} A\cdot e^{\frac{-(x-x_0)^2}{2\cdot(\sigma_{low})^2}}\,dx + \int_{x_0}^{\infty} A\cdot e^{\frac{-(x-x_0)^2}{2\cdot(\sigma_{high})^2}}\,dx} = x_0 - \frac{4\,\alpha\,\sigma}{\sqrt{2\cdot\pi}}$$

asymmetry coefficient "α" (in %) and reduced width "σ" are used to describe an asymmetrical Gaussian momentum distribution

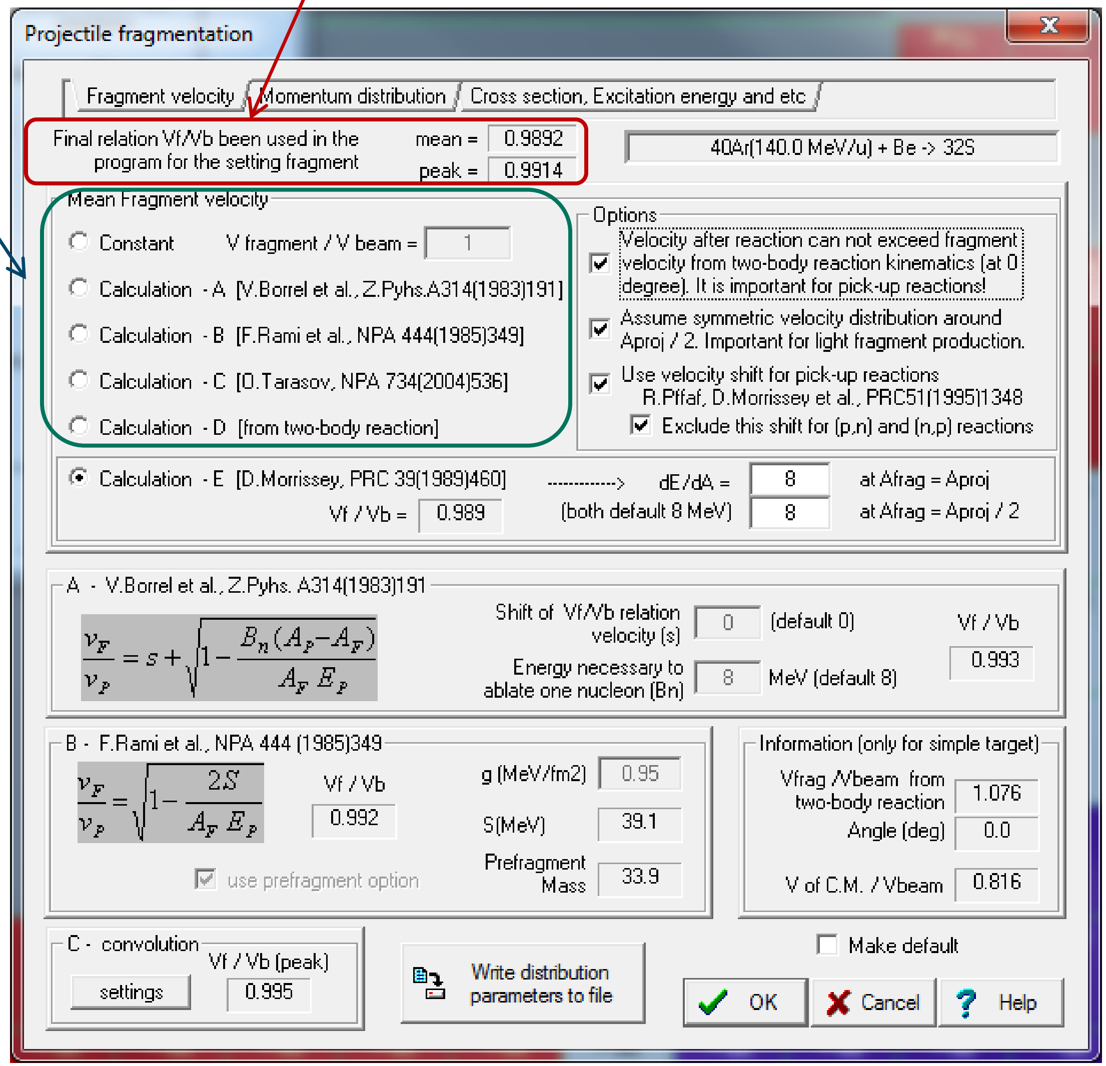
The asymmetry coefficient "alpha" is applied for models [1-3]

asymmetry



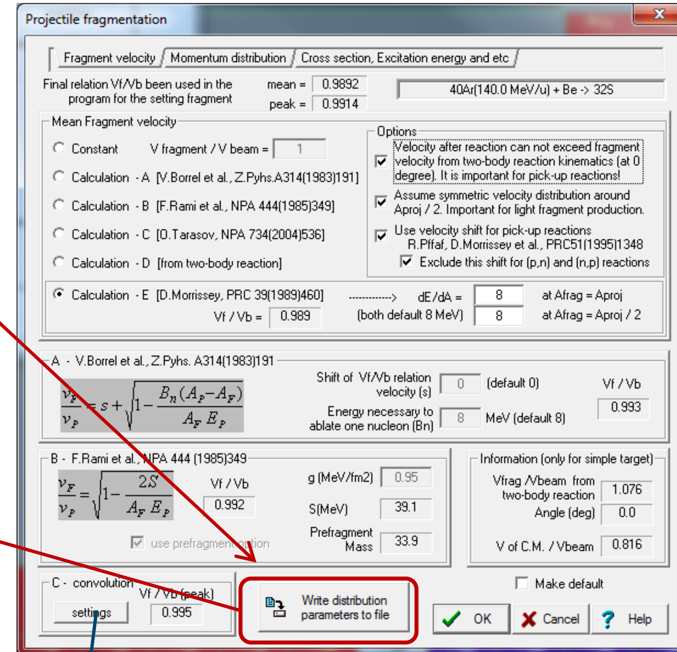
Fragment mean velocity is calculated with the chosen model

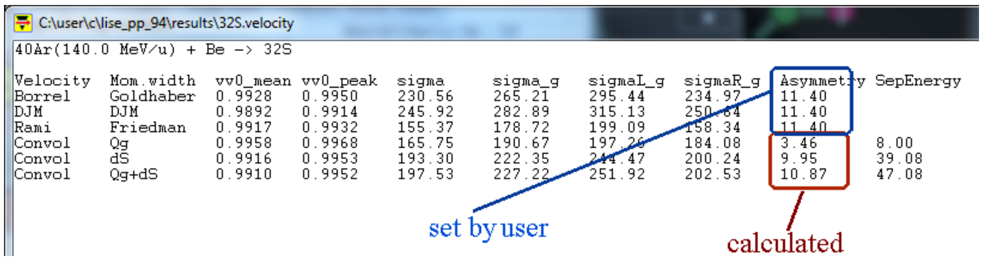
then the peak position will be calculated using the asymmetry coefficient “alpha” and the momentum distribution width “sigma”



Asymmetry coefficient from the Convolution model (1)

To obtain distribution characteristics from different models for the current configuration (beam, target, fragment)





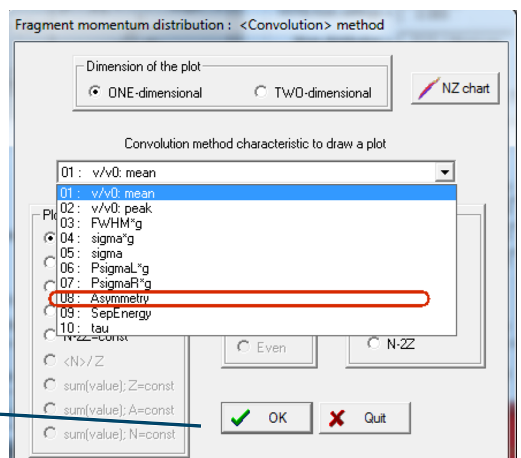
C:\user\c\lise_pp_94\results\32S.velocity

40Ar(140.0 MeV/u) + Be -> 32S

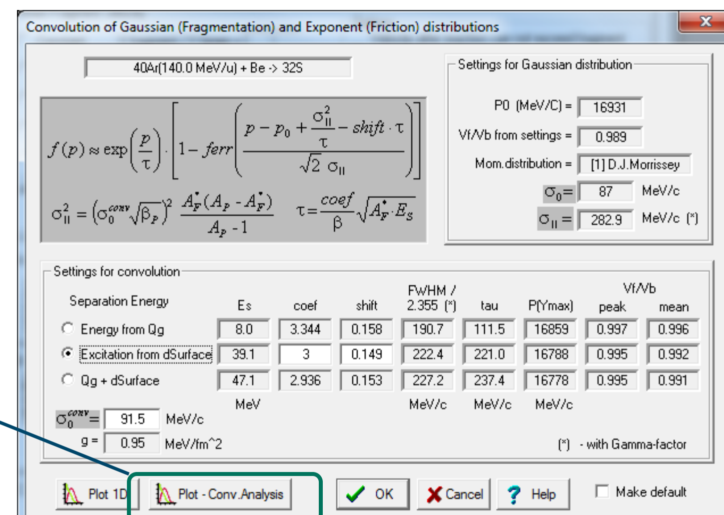
Velocity	Mom.width	vv0_mean	vv0_peak	sigma	sigma_g	sigmaL_g	sigmaR_g	Asymmetry	SepEnergy
Borrel	Goldhaber	0.9928	0.9950	230.56	265.21	295.44	234.97	11.40	
DJM	DJM	0.9892	0.9914	245.92	282.89	315.13	250.64	11.40	
Rami	Friedman	0.9917	0.9932	155.37	178.72	199.09	158.34	11.40	
Convol	Qg	0.9958	0.9968	165.75	190.67	197.26	184.08	3.46	8.00
Convol	dS	0.9916	0.9953	193.30	222.35	244.47	200.24	9.95	39.08
Convol	Qg+dS	0.9910	0.9952	197.53	227.22	251.92	202.53	10.87	47.08

set by user

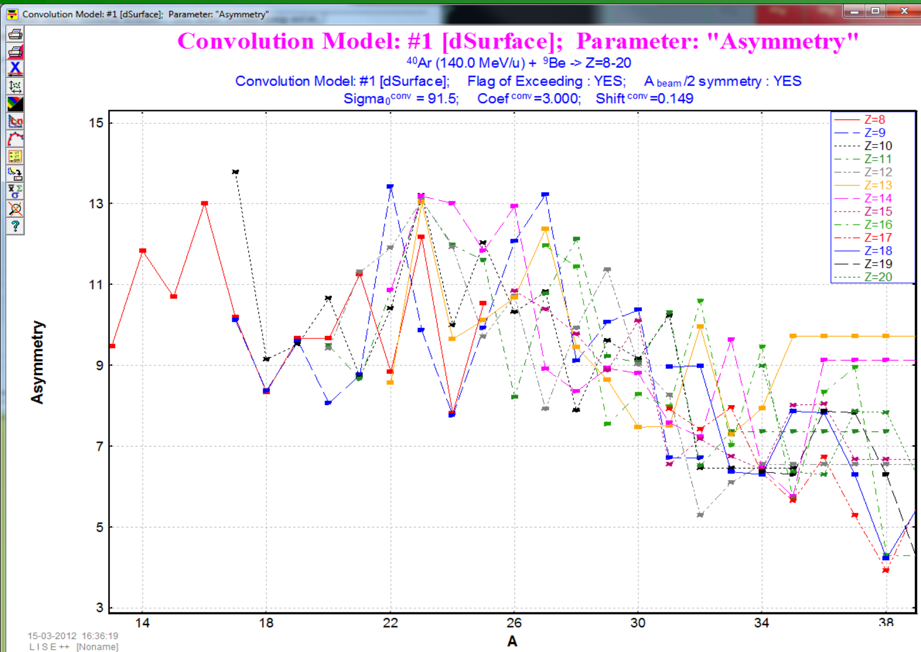
calculated

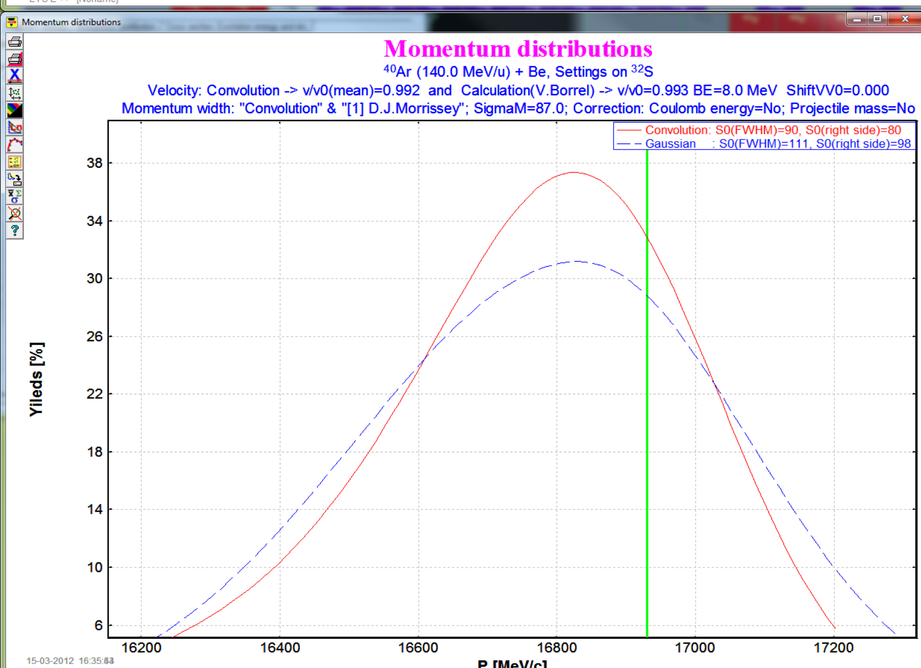


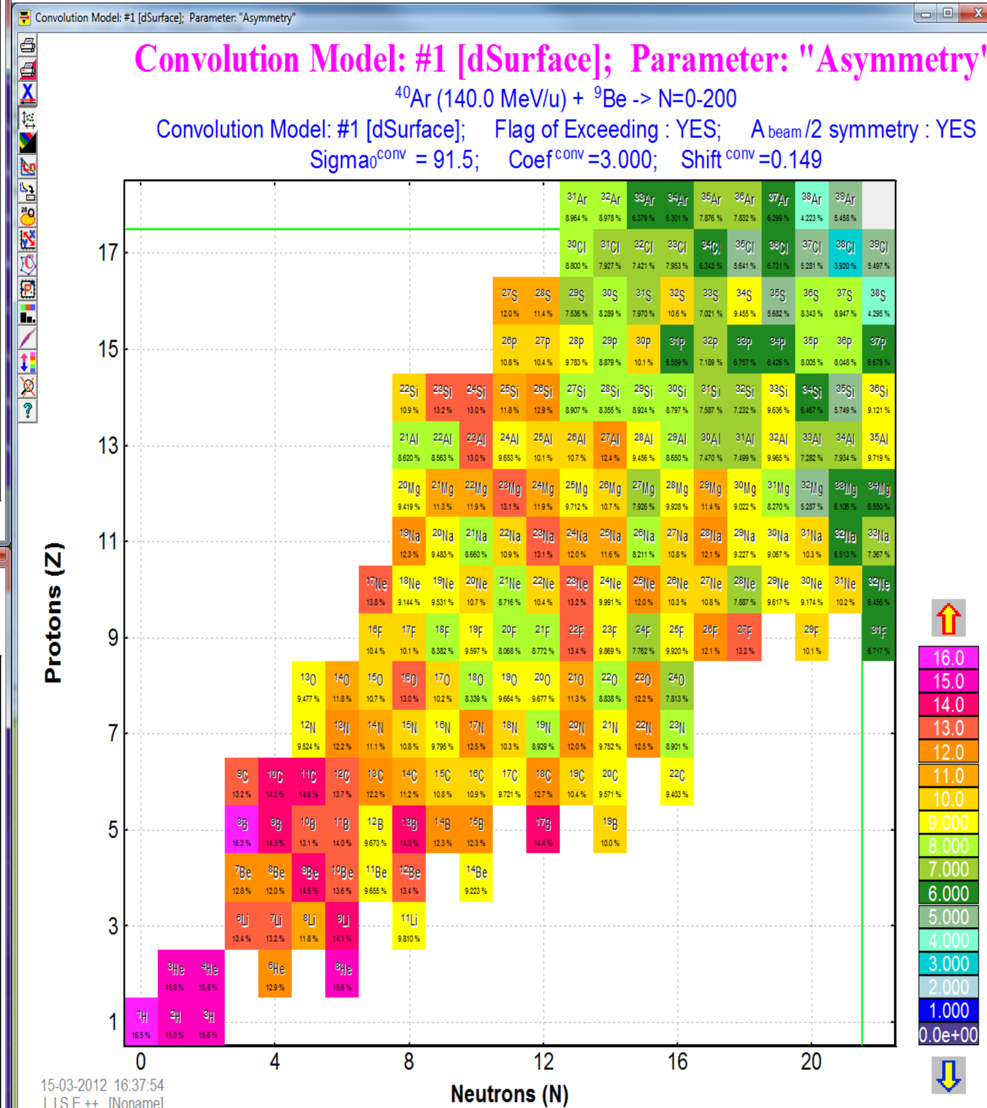
See the next slide



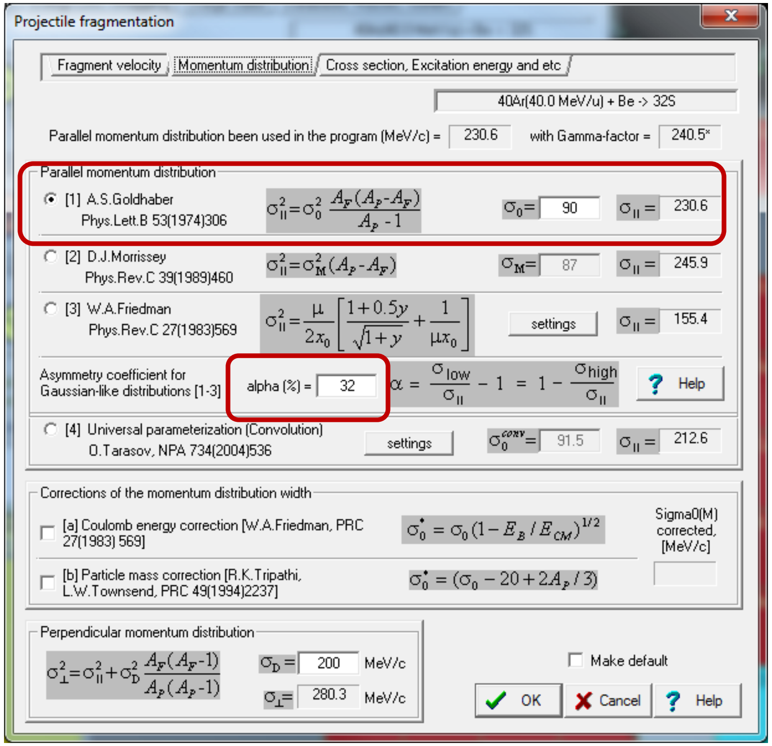
Asymmetry coefficient from the Convolution model (2)

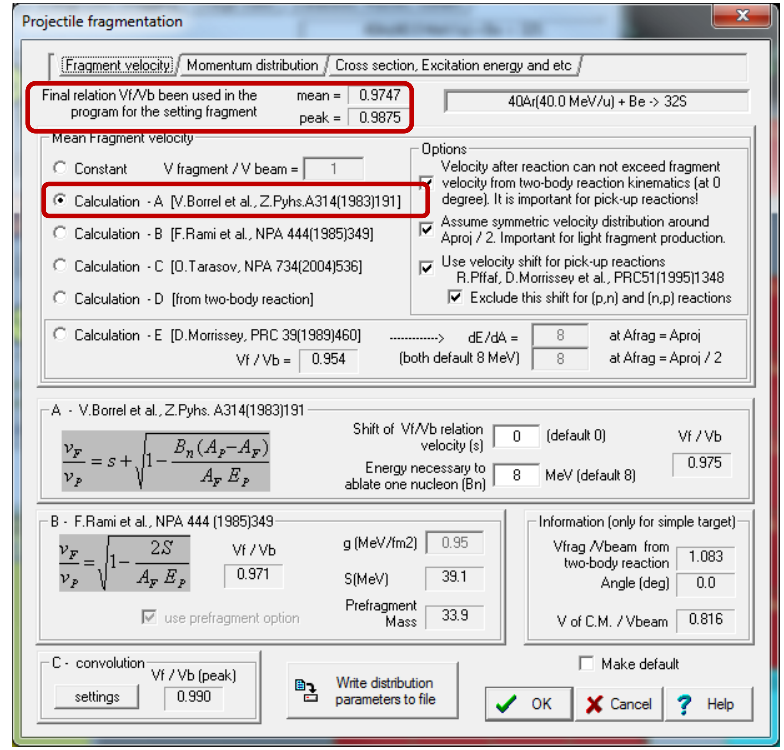


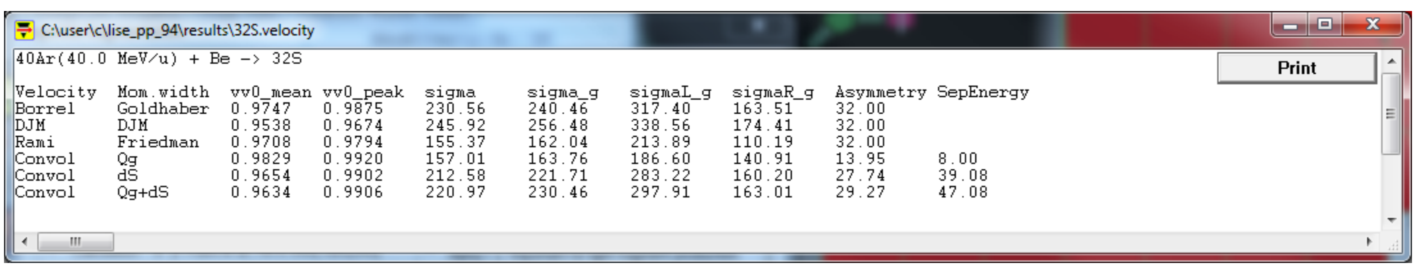




Example at low energy (^{40}Ar 40 MeV/u), #1



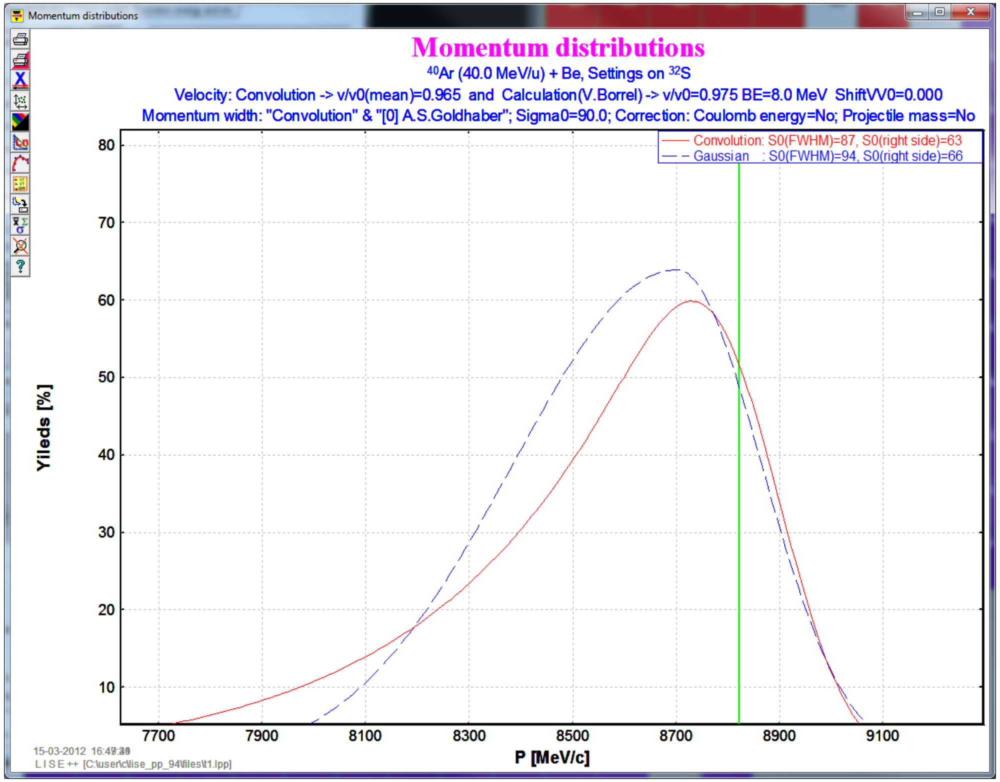




40Ar(40.0 MeV/u) + Be -> 32S

Velocity	Mom.width	vv0_mean	vv0_peak	sigma	sigma_g	sigmaL_g	sigmaR_g	Asymmetry	SepEnergy
Borrel	Goldhaber	0.9747	0.9875	230.56	240.46	317.40	163.51	32.00	
DJM	DJM	0.9538	0.9674	245.92	256.48	338.56	174.41	32.00	
Rami	Friedman	0.9708	0.9794	155.37	162.04	213.89	110.19	32.00	
Convol	Qg	0.9829	0.9920	157.01	163.76	186.60	140.91	13.95	8.00
Convol	dS	0.9654	0.9902	212.58	221.71	283.22	160.20	27.74	39.08
Convol	Qg+dS	0.9634	0.9906	220.97	230.46	297.91	163.01	29.27	47.08

Example at low energy (^{40}Ar 40 MeV/u), #2



Statistics

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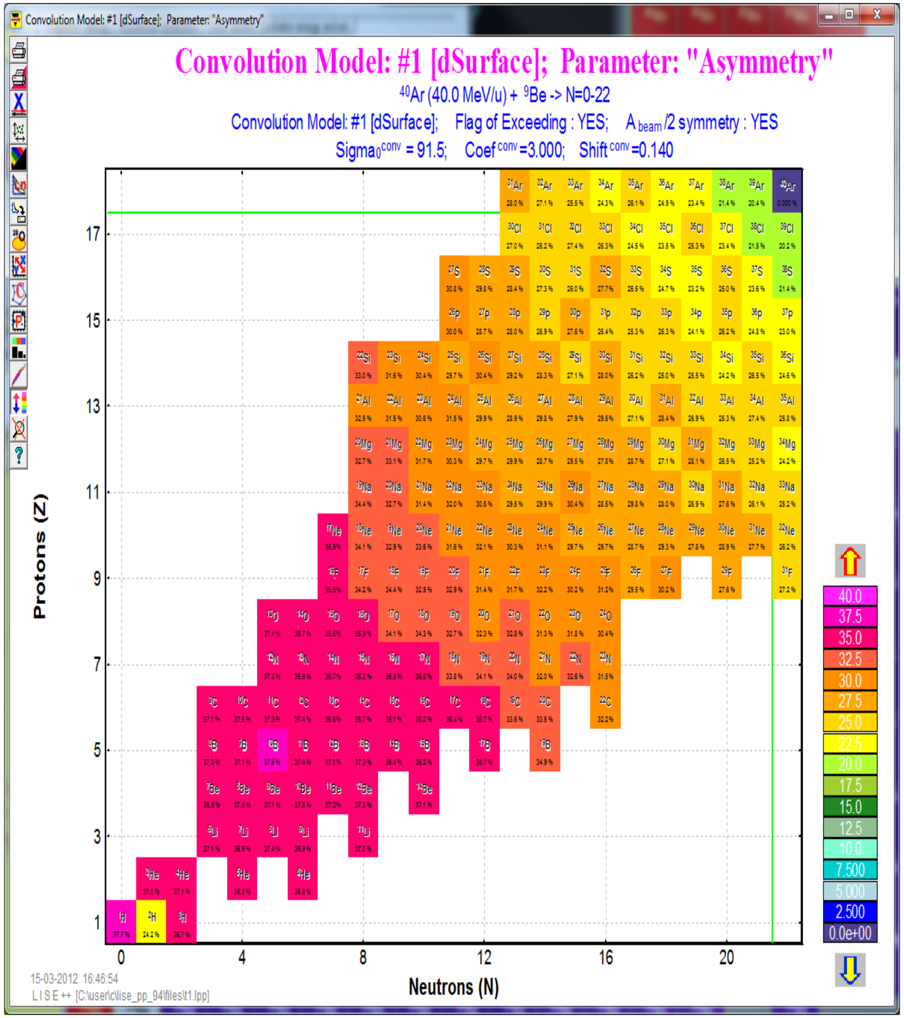
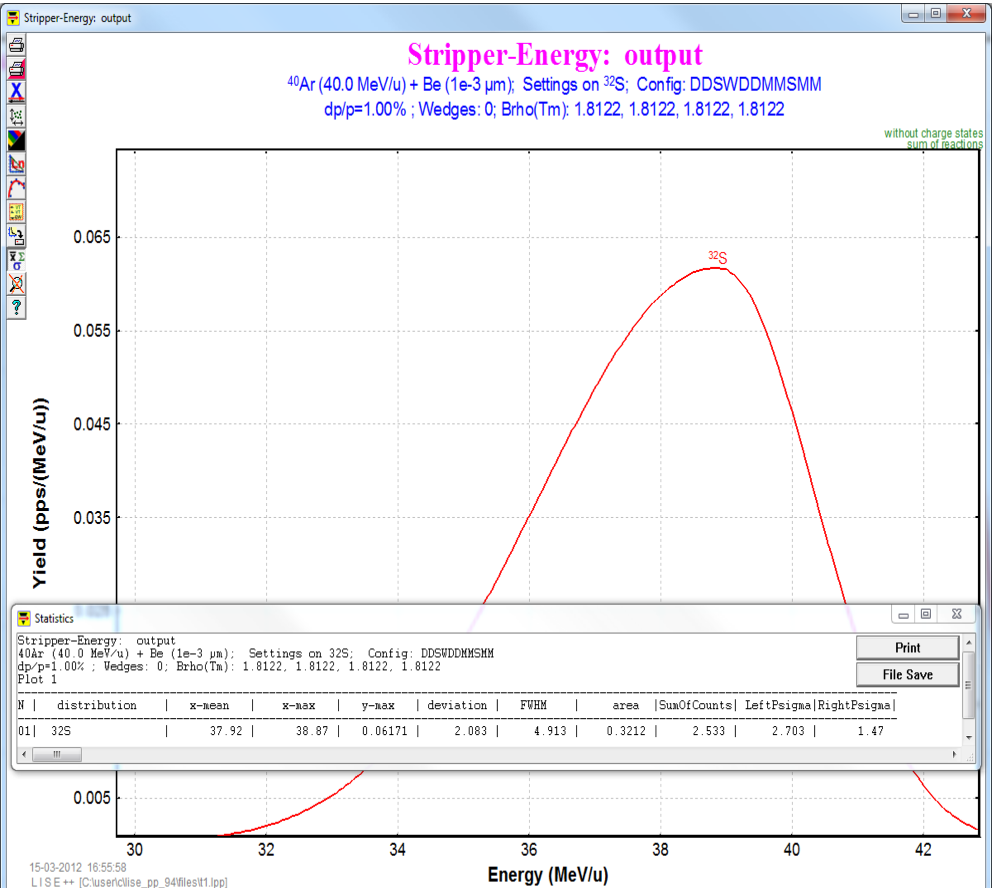
Momentum distributions
40Ar (40.0 MeV/u) + Be, Settings on 32S
Velocity: Convolution -> v/v0(mean)=0.965  and  Calculation(V.Borrel) -> v/v0=0.975 BE=8.0 MeV  ShiftVV0=0.000
Momentum width: "Convolution" & "[0] A.S.Goldhaber"; Sigma0=90.0; Correction: Coulomb energy=No; Projectile mass=No
Plot 1
```

N	distribution	x-mean	x-max	y-max	deviation	FWHM	area	SumOfCounts	LeftPsigma	RightPsigma
01	Convolution: S0(F	8490	8736	59.82	400.3	522.1	3.846e+04	1157	291	152.4
02	Gaussian : S0(	8580	8701	63.92	243.3	566.3	3.846e+04	2560	317.4	163.6

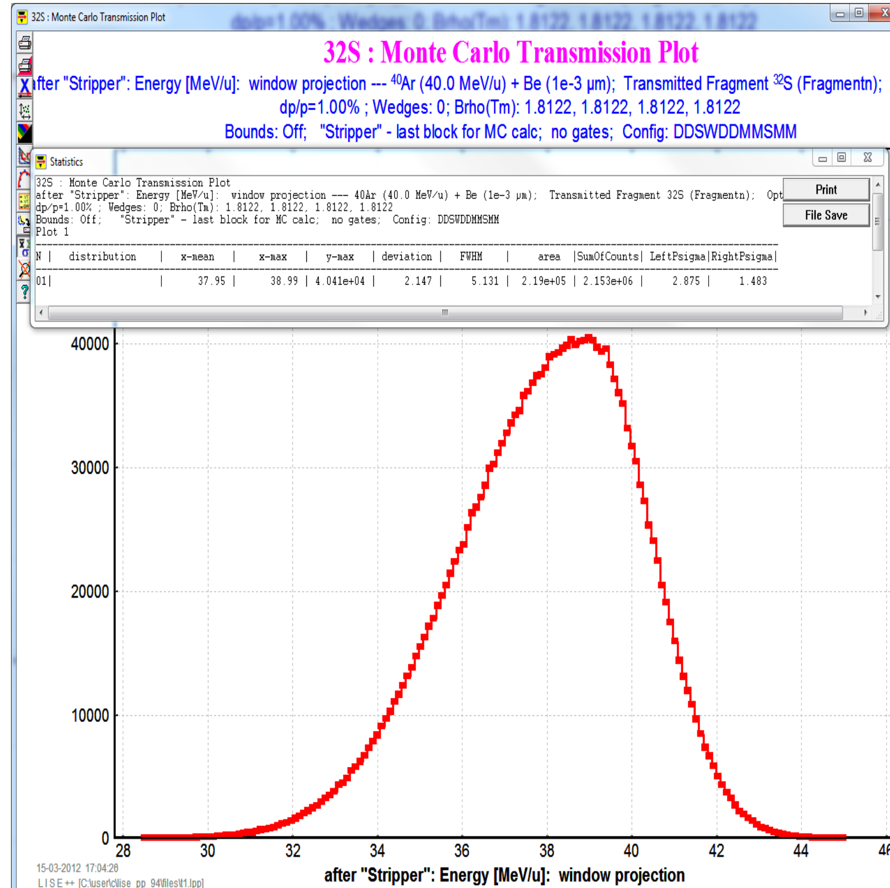


Example at low energy (^{40}Ar 40 MeV/u), #3

"Distribution" method



Monte Carlo method



^{82}Se momentum distribution results (will be soon)