Perturbed Angular Correlation

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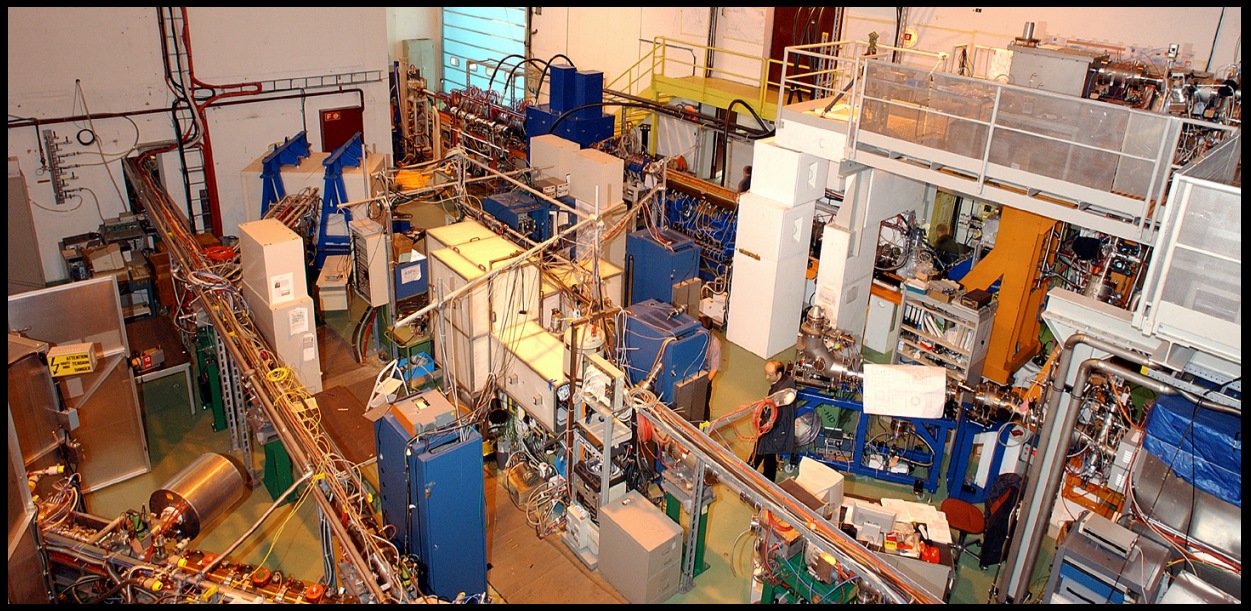
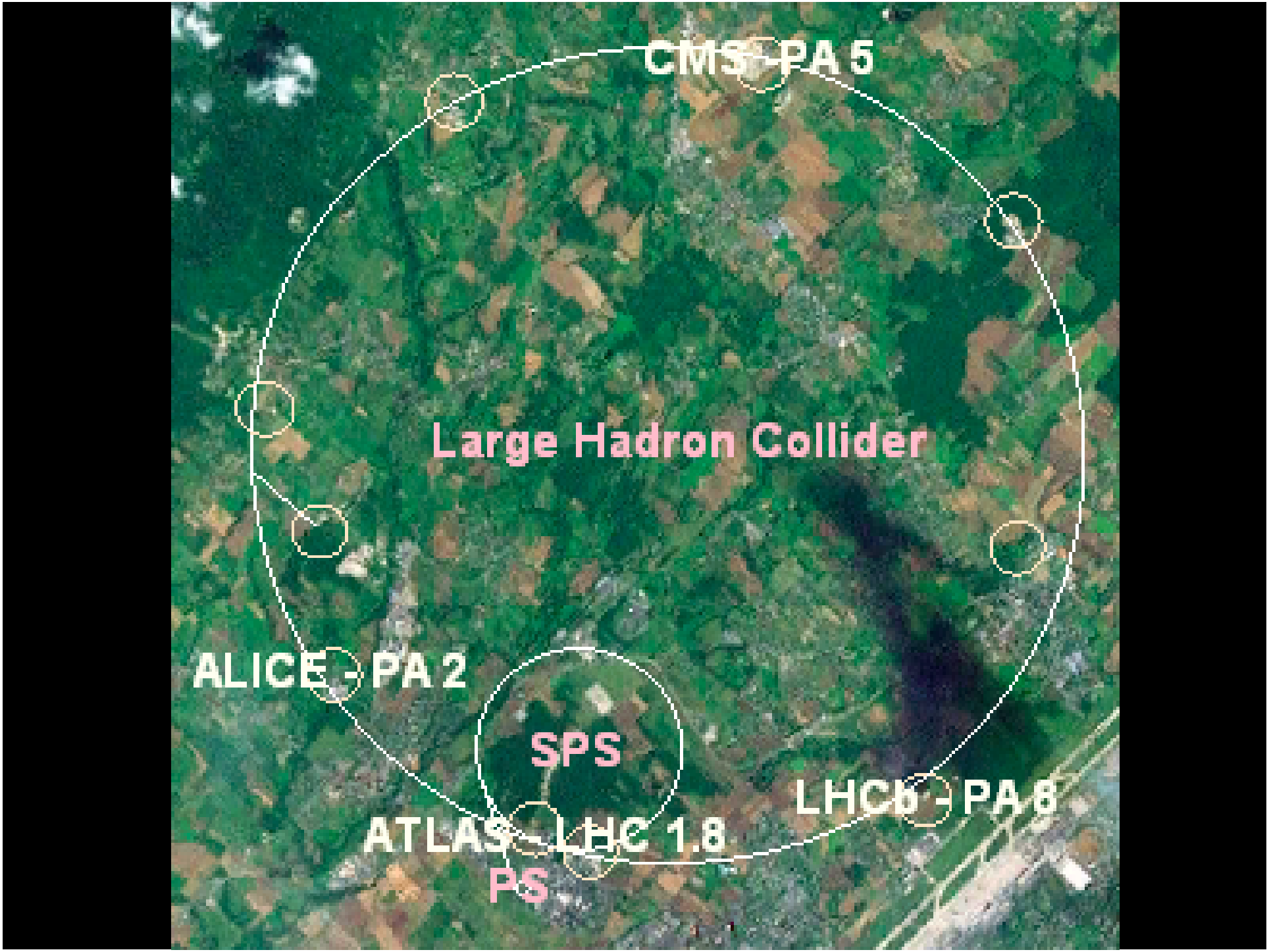
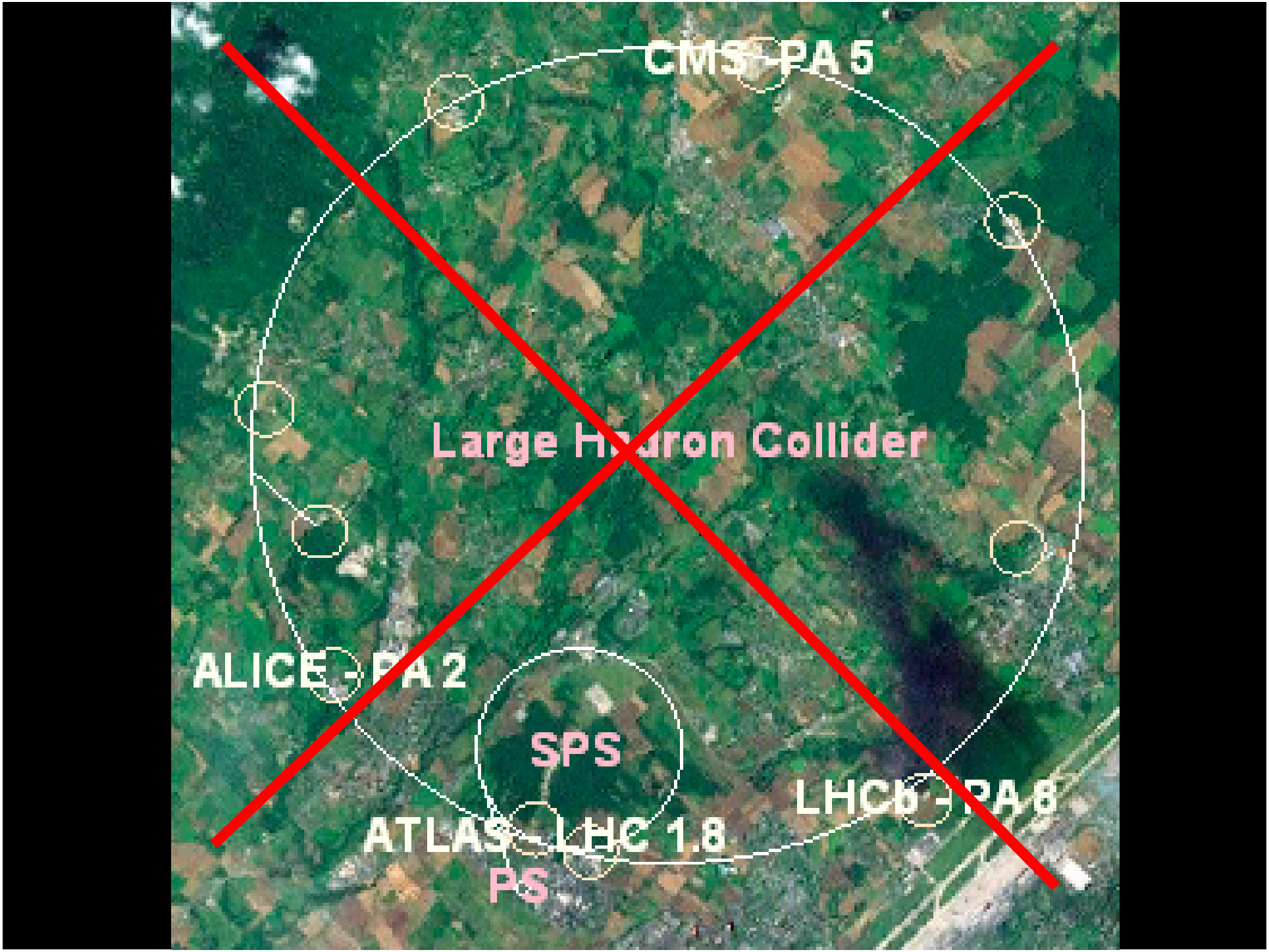
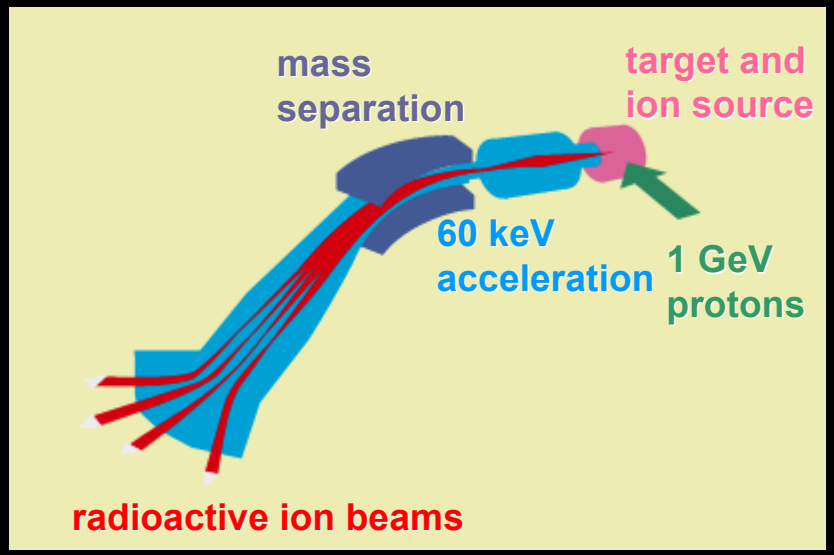


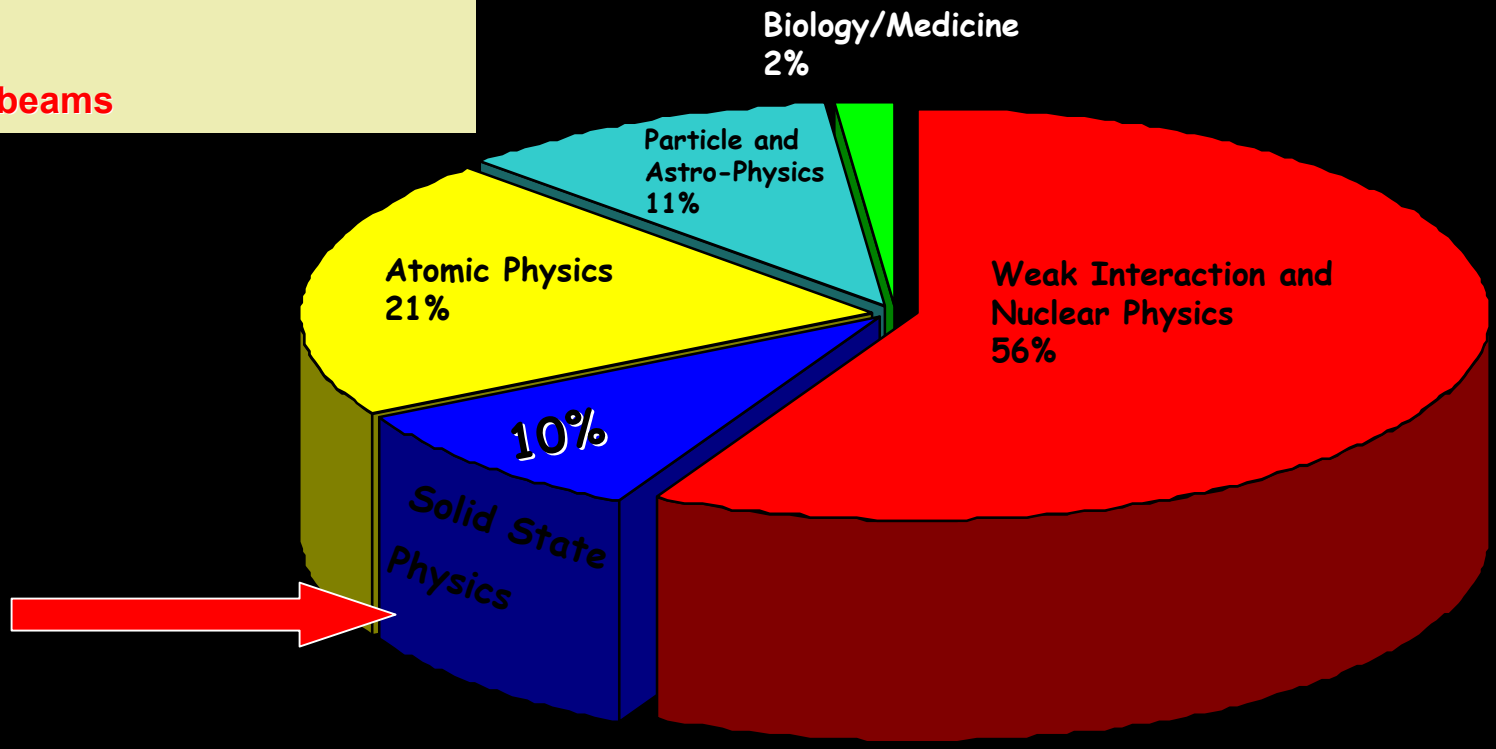

CMS - PA 5
Large Hadron Collider
ALICE - PA 2
SPS
LHCb - PA 8
ATLAS - LHC 1.8
PS


CMS - PA 5
Large Hadron Collider
ALICE - PA 2
SPS
LHCb - PA 8
ATLAS - LHC 1.8
PS

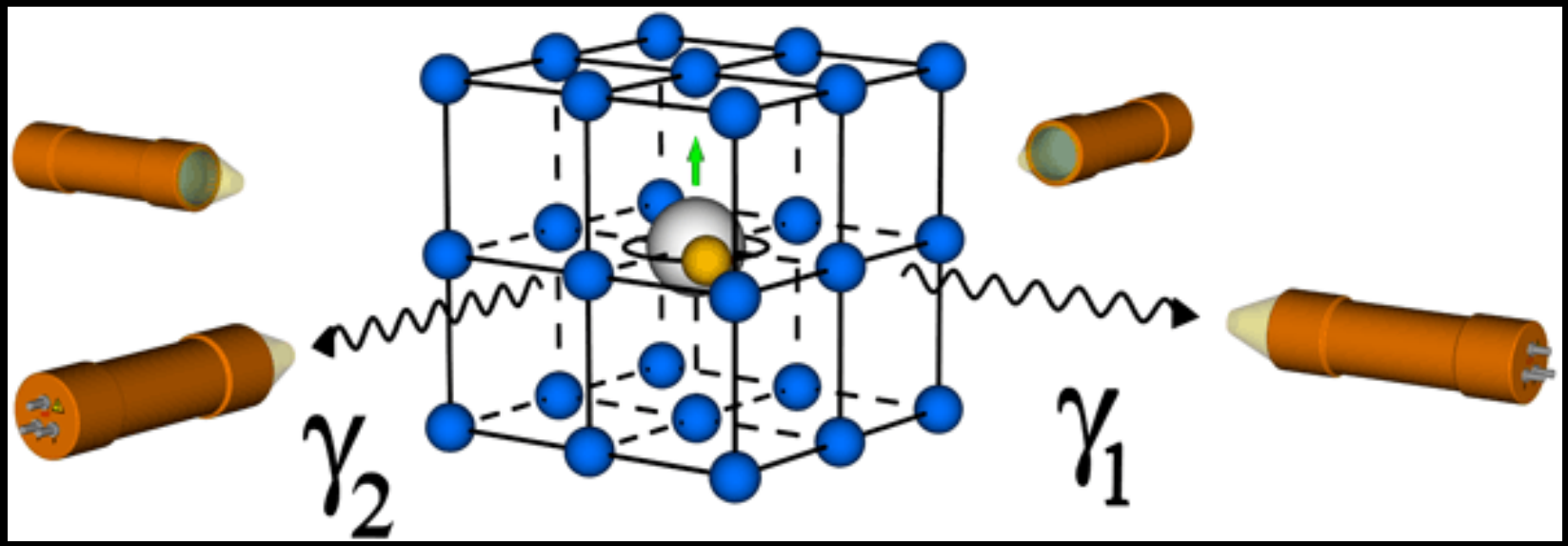
ISOLDE

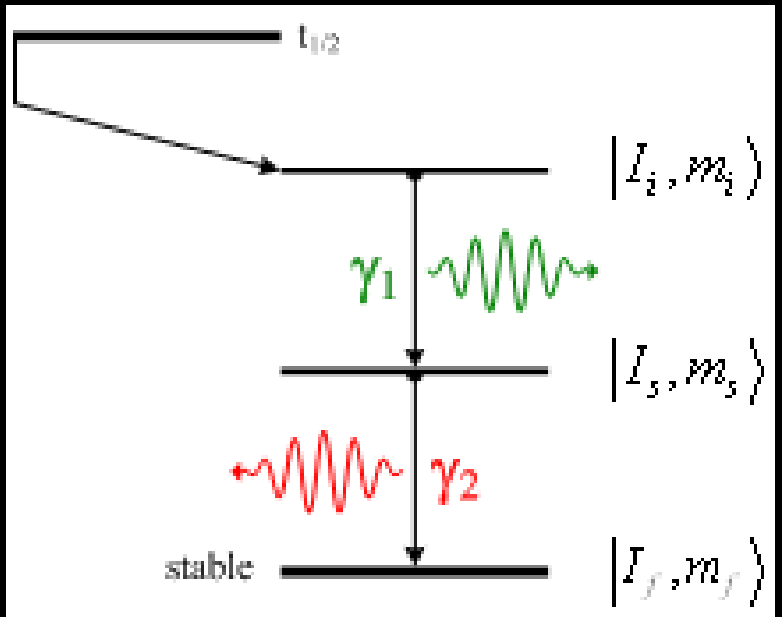


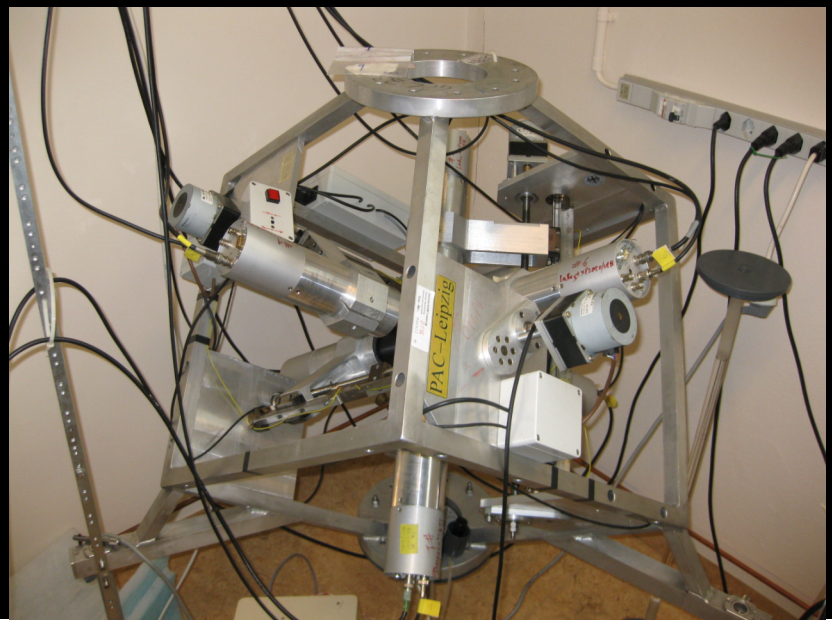
800 isotopes
80 elements



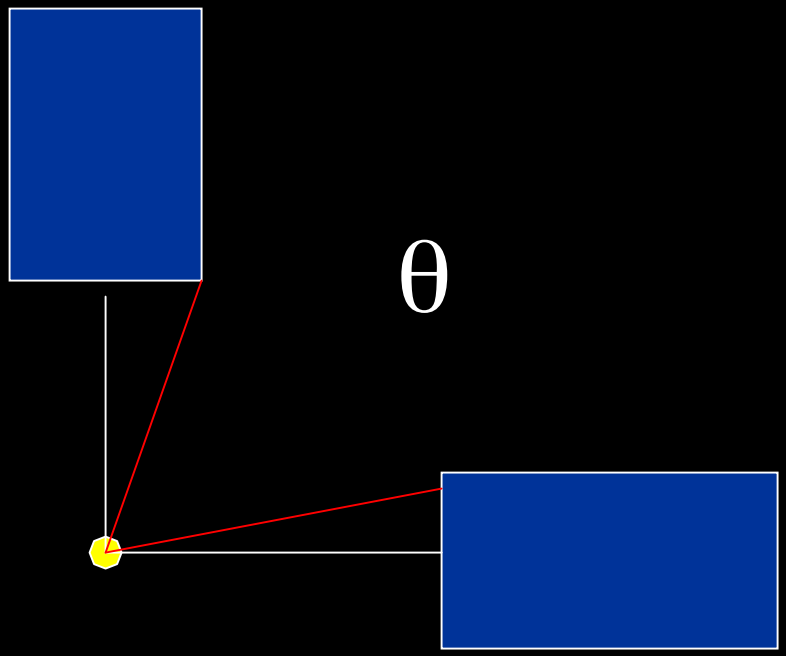
Perturbed Angular Correlation







$$R(t)=\Sigma_{k,k'}\ \text{“}A_k\text{””}A_{k'}\text{”}G_{kk'}(t)$$



$$R(t)\ \text{real}=\Sigma_{k,k'}\ A_k\,Q_k(\gamma_1)\,A_{k'}\,Q_{k'}(\gamma_2)\,G_{kk'}(t)$$

GUI For Attenuation Coefficients

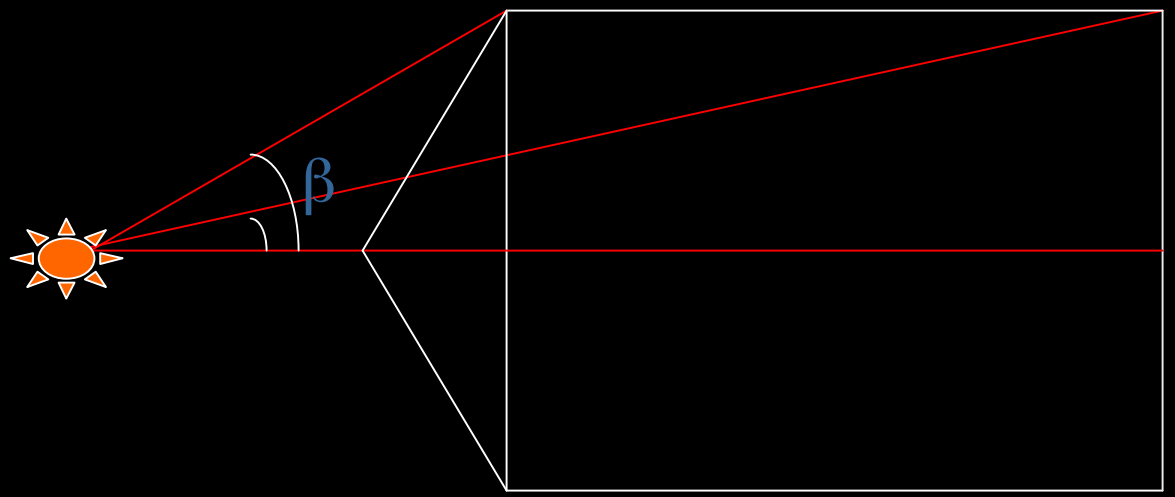
- $Q_l = J_l / J_o$

$$J_l = \int_0^{\gamma} P_l(\cos\beta)\,(1 - e^{-\tau x(\beta)})\,\sin\beta d\beta.$$

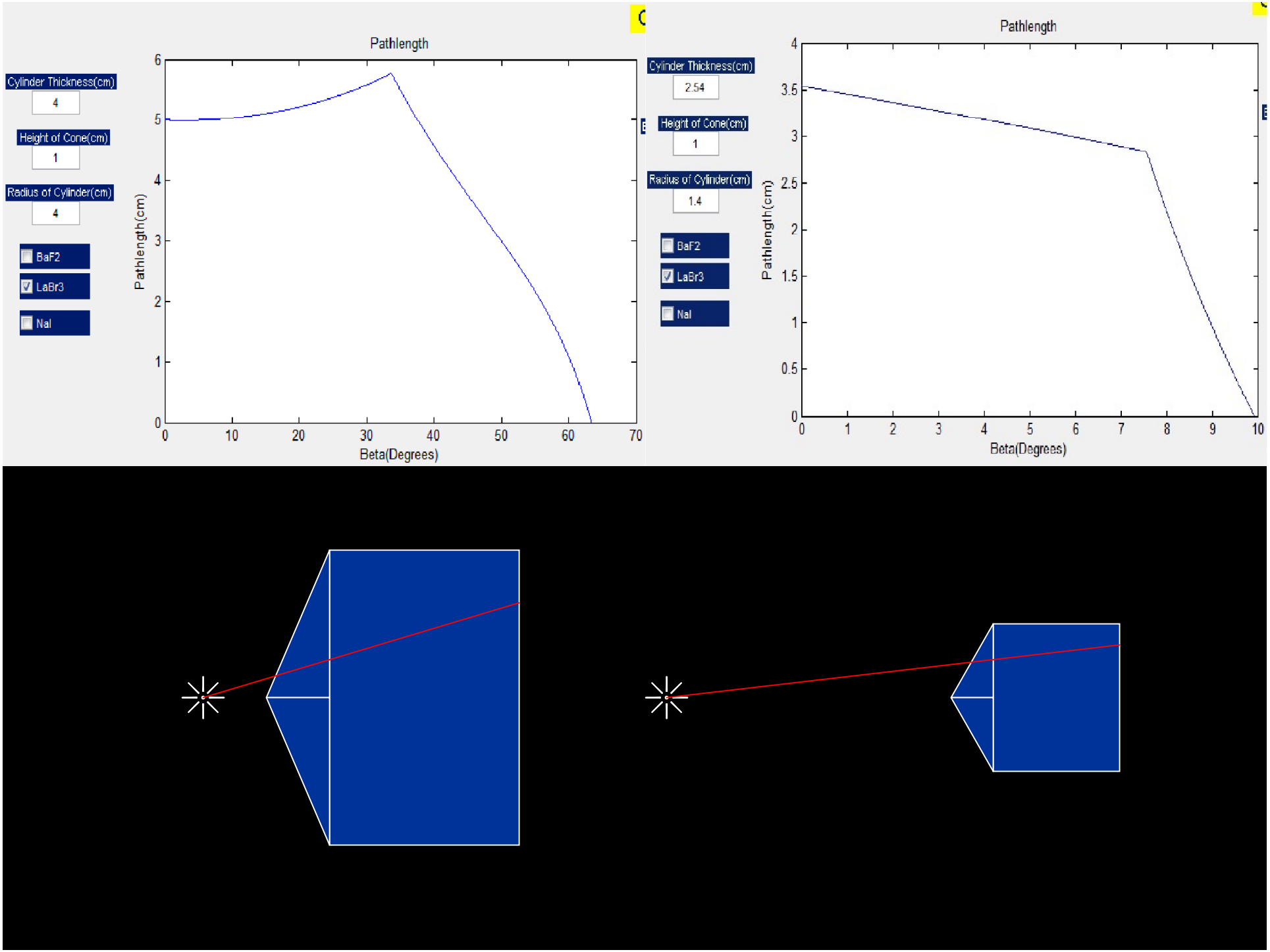
Path length for a given Angle (β)

Path Length

γ



- Equations are too long to show here!


Cylinder Thickness(cm)
4
Height of Cone(cm)
1
Radius of Cylinder(cm)
4
BaF2
LaBr3
NaI
Pathlength
Pathlength(cm)
Beta(Degrees)
0
10
20
30
40
50
60
70
1
2
3
4
5
6
Cylinder Thickness(cm)
2.54
Height of Cone(cm)
1
Radius of Cylinder(cm)
1.4
BaF2
LaBr3
NaI
Pathlength
Pathlength(cm)
Beta(Degrees)
0
1
2
3
4
5
6
7
8
9
10
0.5
1
1.5
2
2.5
3
3.5
4

Linear Attenuation Coefficient

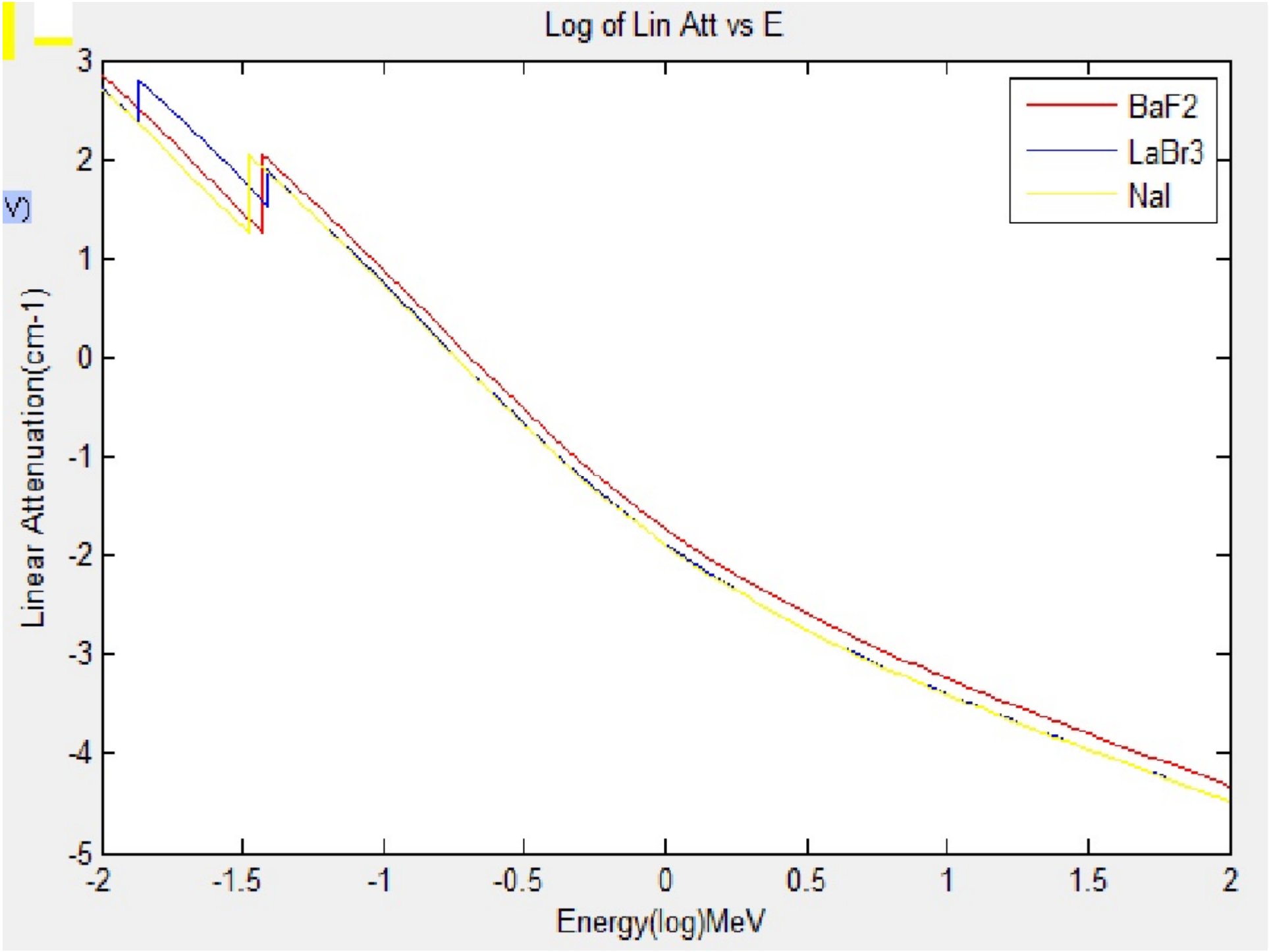
$$J_l = \int_0^{\gamma} P_l(\cos\beta)\,(1 - e^{-\tau x(\beta)})\,\sin\beta d\beta.$$

- Dependent on:

1.) Energies of Gammas

2.) Detector Material (BaF2, LaBr3 NaI)

Need to interpolate


Log of Lin Att vs E
BaF2
LaBr3
NaI
Linear Attenuation(cm-1)
Energy(log)MeV
3
2
1
0
-1
-2
-3
-4
-5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2

Putting It All Together

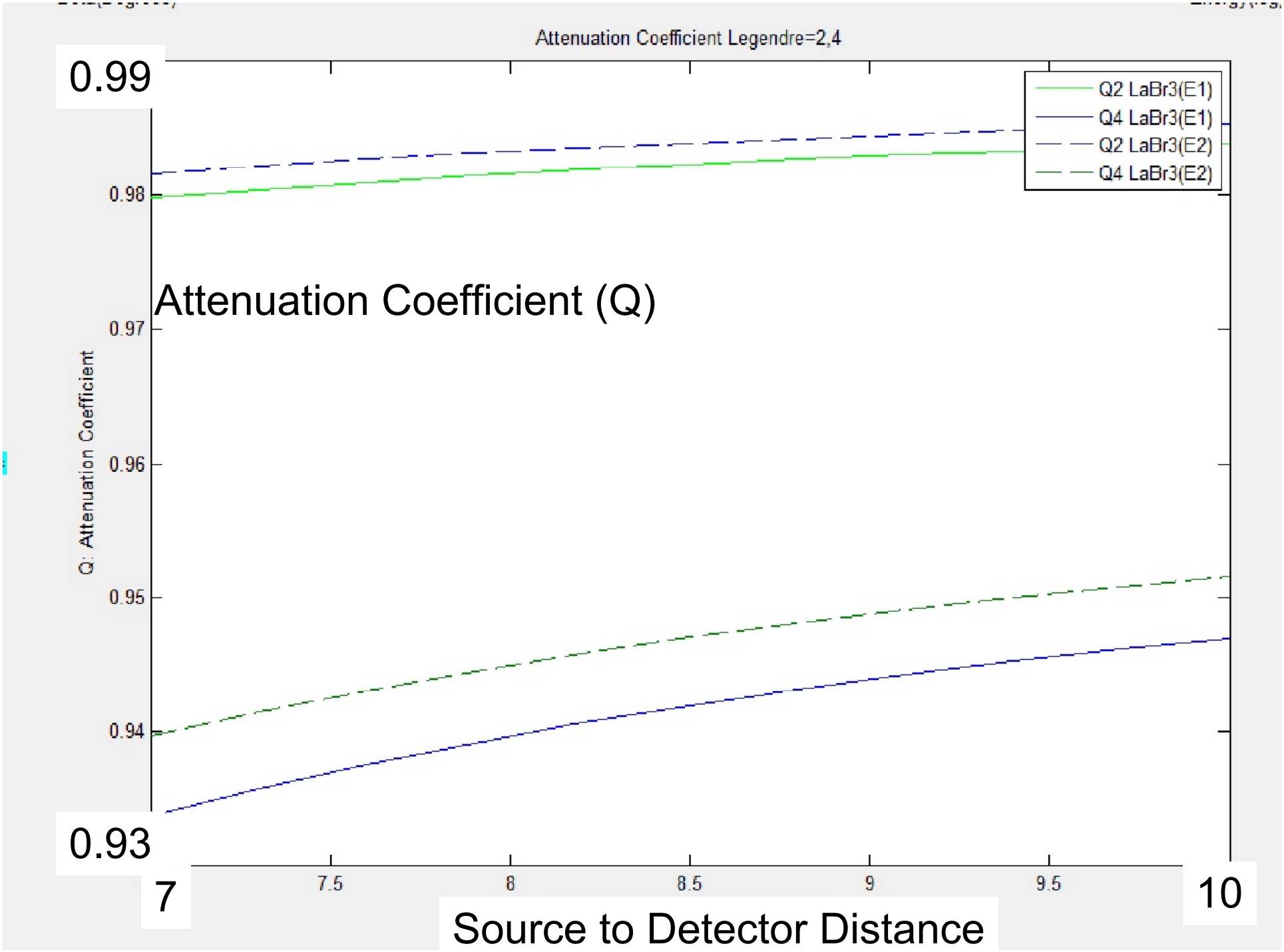
- $Q_l = J_l / J_o$

$$J_l = \int_0^{\gamma} P_l(\cos\beta)\,(1 - e^{-\tau x(\beta)})\,\sin\beta d\beta.$$

- Only Q_2 and Q_4 are used

1.) Even legendres appear due to parity conservation of electromagnetic interactions of the nuclei

2.) L>4 is neglected


Attenuation Coefficient Legendre=2,4
Q2 LaBr3(E1)
Q4 LaBr3(E1)
Q2 LaBr3(E2)
Q4 LaBr3(E2)
Q: Attenuation Coefficient
0.99
0.98
0.97
0.96
0.95
0.94
0.93
7
7.5
8
8.5
9
9.5
10
Attenuation Coefficient (Q)
Source to Detector Distance

AttCalcFinal

Calculating Attenuation Coefficients

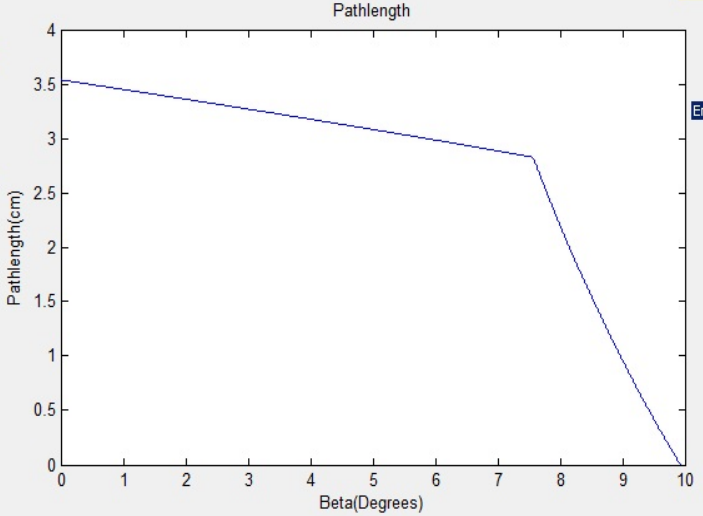
By: Macey Ruble

Cylinder Thickness(cm)
2.54

Height of Cone(cm)
1

Radius of Cylinder(cm)
1.4

- [ ] BaF2
- [x] LaBr3
- [ ] NaI

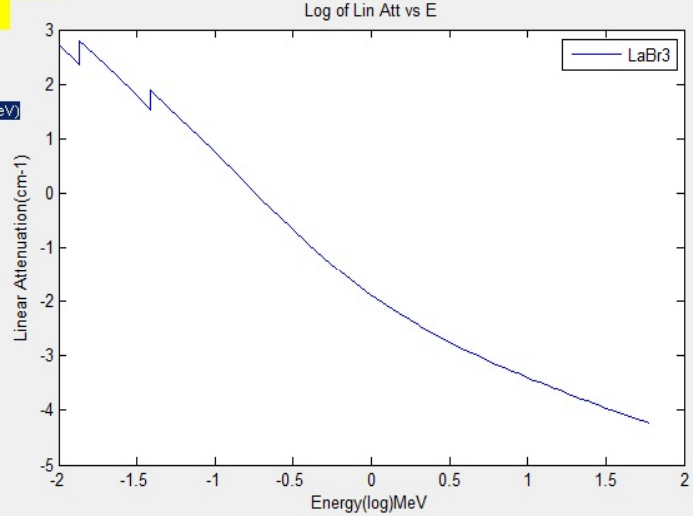


Energy Minimum (MeV)
0.01

Energy Maximum (MeV)
100.0

Cone Tip to Source Distance(cm)
7

Calculate Pathlength and Tau



Gamma 1

E1 (MeV)	A2(1)	A4(1)
.1508	-.3341	.007

Gamma 2

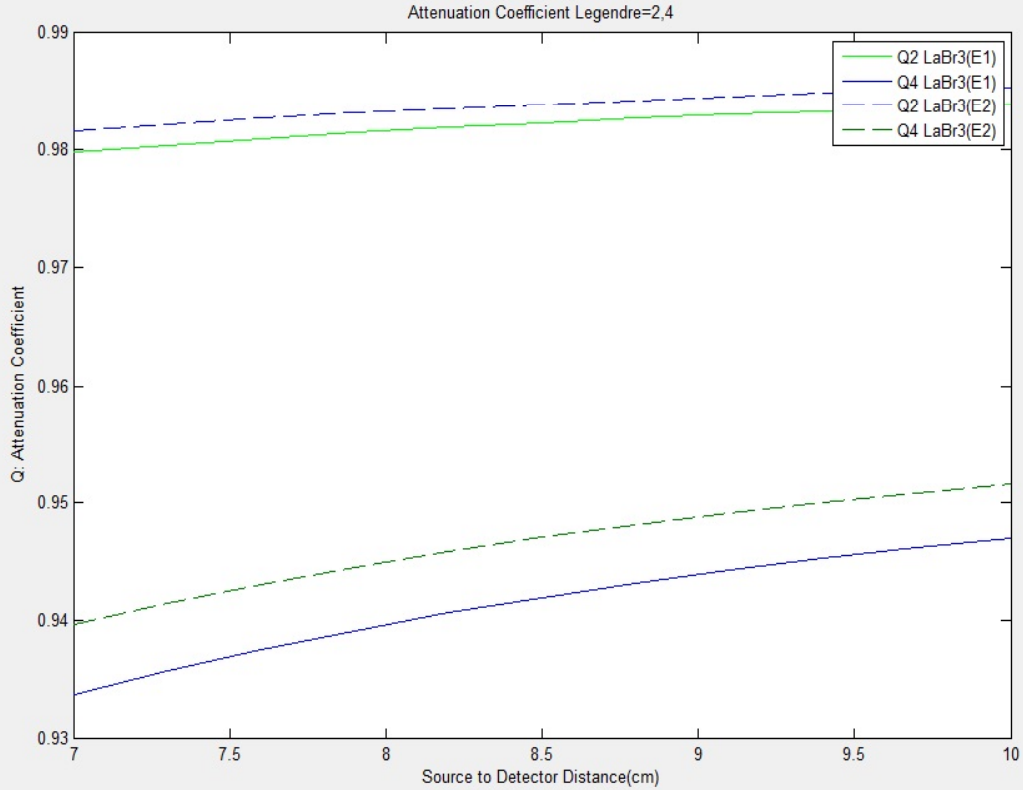
E2 (MeV)	A2(2)	A4(2)
.2454	-.5345	-.6172

Distance From Source to Detector

Minimum (cm)	Maximum (cm)	Number of Steps
7	10	10

Evaluate Attenuation Coefficients

Can only be evaluated for one material at a time



Command Window

File Edit Debug Desktop Window Help

New to MATLAB? Watch this Video, see Demos, or read Getting Started.

Distance	Q2 (G1)	Q4 (G1)	Q2 (G2)	Q4 (G2)	A22	A24	A42	A44	R22	R24	R42	R44
7.00000000	0.97979647	0.93372121	0.98164606	0.93971648	0.17175721	0.18986071	-0.00342940	-0.00379086	0.96181334	0.92073089	0.91658374	0.87743321
7.30000000	0.98042565	0.93575416	0.98220357	0.94152187	0.17196512	0.19034763	-0.00343882	-0.00380642	0.96297757	0.92309220	0.91910108	0.88103301
7.60000000	0.98098798	0.93757347	0.98270326	0.94314199	0.17215128	0.19078453	-0.00344726	-0.00382038	0.96402009	0.92521095	0.92135651	0.88426491
7.90000000	0.98149212	0.93920647	0.98315251	0.94460012	0.17231850	0.19117769	-0.00345484	-0.00383295	0.96495644	0.92711757	0.92338320	0.88717455
8.20000000	0.98194543	0.94067642	0.98355756	0.94591608	0.17246911	0.19153244	-0.00346167	-0.00384430	0.96579985	0.92883797	0.92520940	0.88980094
8.50000000	0.98235418	0.94200314	0.98392373	0.94710682	0.17260514	0.19185338	-0.00346784	-0.00385456	0.96656159	0.93039434	0.92685924	0.89217760
8.80000000	0.98272371	0.94320364	0.98425562	0.94818694	0.17272831	0.19214443	-0.00347343	-0.00386388	0.96725133	0.93180579	0.92835348	0.89433337
9.10000000	0.98305862	0.94429256	0.98455715	0.94916900	0.17284011	0.19240899	-0.00347851	-0.00387235	0.96787740	0.93308877	0.92970999	0.89629322
9.40000000	0.98336288	0.94528253	0.98483174	0.95006390	0.17294182	0.19265000	-0.00348313	-0.00388006	0.96844697	0.93425757	0.93094423	0.89807880
9.70000000	0.98363990	0.94618451	0.98508232	0.95088109	0.17303456	0.19287003	-0.00348734	-0.00388710	0.96896627	0.93532458	0.93206963	0.89970896
10.00000000	0.98389267	0.94700805	0.98531147	0.95162884	0.17311929	0.19307130	-0.00349119	-0.00389355	0.96944074	0.93630064	0.93309789	0.90120017

fx >>

OVR


DIE X AUGUSTI. II ET III SEPTEMBRIS MDCCXCII
HAEC SUNT NOMINA EORUM QUI NE SACRAMENTI FIDEM FALLERENT
FORTISSIME PUGNANTES CECIDERUNT.
SOLERTI AMICORUM CURA CLADI SUPERFUERUNT
DUCES XXVI.
DUCES XVI

Questions?

Thank you to
- Guilherme Correia
- Karl Johnston
- Marcelo Barbosa

Sources:

- M. E. Rose, Physical Review **91**,3(1953)
- http://tdpac.hiskp.uni-bonn.de/pac/tx-pac-de.html