THE PEP-N IP DIPOLE

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gratefully acknowledged

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The PEP-N environment

HER - 8.97 GeV e^- PEP-II ring

LER - 3.12 GeV e^+ PEP-II ring

VLER - 0.20 – 0.50 GeV e^- New ring

$\Downarrow$

LER : fixed energy

VLER : variable energy

$$\mathbf{r_E} = \frac{E_{LER}}{E_{VLER}} = 15.6 \div 6.2$$

PEP-N : A Very Asymmetric Collider

Origins & Requirements

From PEP-N IR

1. LER / VLER large energy ratio r_E allows for magnetic beam separation before / after Collision

2. Integrated Field Strength $\int B_y \, dl$ defines IR Layout

3. $\int B_y \, dl$ limited by COD on LER Beam

4. Gap height limited by LER-HER beam distance (0.890 m)

5. Magnet geometry to integrate HER Beam pipe and comply with floor height in IR 12

Origins & Requirements

From Detector

1. **Large Central Field ⇒ Momentum Tracking**

2. **Good Field Uniformity ⇒ TPC Resolution → (G. Va'vra' s talk)**

3. **Long Field Region in FW Direction ⇒ Long Dipole**

4. **Large FW Angular Acceptance ⇒ Large Gap**

Basic Parameters

- **Central Field :** $\mathrm{B_y} = 0.3\,\mathrm{T}$
- **Field Strength :** $\int \mathrm{B_y}\,\mathrm{dl} = 0.36\,\mathrm{Tm}$
- **Dipole Gap :** $1.200\,\mathrm{m}$
- **Dipole Centerline moved** $0.250\,\mathrm{m}$ **downstream IP**
- **HER beam pipe shielded in bottom iron yoke**

  $\Rightarrow$ **Needs shielding outside dipole** **(see Figs. ?? and ??).**

Modeled Versions

VERSION	TYPE	GAP	POLE GEOMETRY	$\Phi_{\rm fw}$
SV.01	Vert. Solenoid	1.6 m	Coil ϕ 1.6 m Flat	$\pm 37.3^\circ$
DV.02	H-Type	1.2 m	Cyl. ϕ 1.6 m Flat	$\pm 30^\circ$
DV.03	H-Type	1.2 m	Cyl. ϕ 1.6 m Tapered / Flat	$\pm 35.2^\circ$
DV.04	H-Type	$(1.2 + 0.4)$ m	Cyl. ϕ 1.6 m Tapered / Shims	$\pm 35.2^\circ$
DV.05	H-Type	$(1.2 + 0.4)$ m	Square 1.6 m Tapered / Shims	$\pm 35.2^\circ$
DV.06	H-Type	$(1.3 + 0.3)$ m	Square 1.6 m Tapered / Shims	$\pm 37.4^\circ$
DV.07*	H-Type	$(1.3 + 0.3)$ m	Square/Circ. Tapered / Shims	$\pm 37.4^\circ$

* Presently being finalized

IP H-Dipole Parameters

(the "scaling" and "fixed field" scenarios)

ENERGY		FIELD	DV.03		DV.06		DV.07	
E_{CM} (GeV)	E_{VLER} (GeV)	B_o (T)	I (A)	P (kW)	I (A)	P (kW)	I (A)	P (kW)
1.935	0.300	0.180	478	35.0	478	56.0	521	72.0
2.498	0.500	0.300	796	96.0	796	155.0	868	200.0
2.922	0.667	0.400*	1061	171.0	1061	276.0	1157	356.0
3.159	0.800	0.480**	1274	246.0	1274	400.0	1390	512.0
Coils: Cu / 20 x 20 mm^2 Φ 8mm			$N_c = 180$ turns / coil		$N_c = 240$ turns / coil		$N_c = 220$ turns / coil	

* Possible **Fixed Field** rating. Scenarios for different E_{VLER} being studied.

** **Max. Dipole rating.** Presently not compatible with COD on LER.

Outlook

- **Options for the PEP-N IP Dipole have been studied that comply with competing requirements for the PEP-N Interaction Region Layout and track identification / resolution in the Detector.**

- **The TOSCA code was used to model magnetic circuit and pole profiles aiming at optimizing field uniformity performance.**

- **Magnet geometries, studied besides the base-line, are available for comparison in terms of field uniformity and detector requirements.**

- **They are all compatible with the shown detector layout.**

Magnet characteristics / DV03

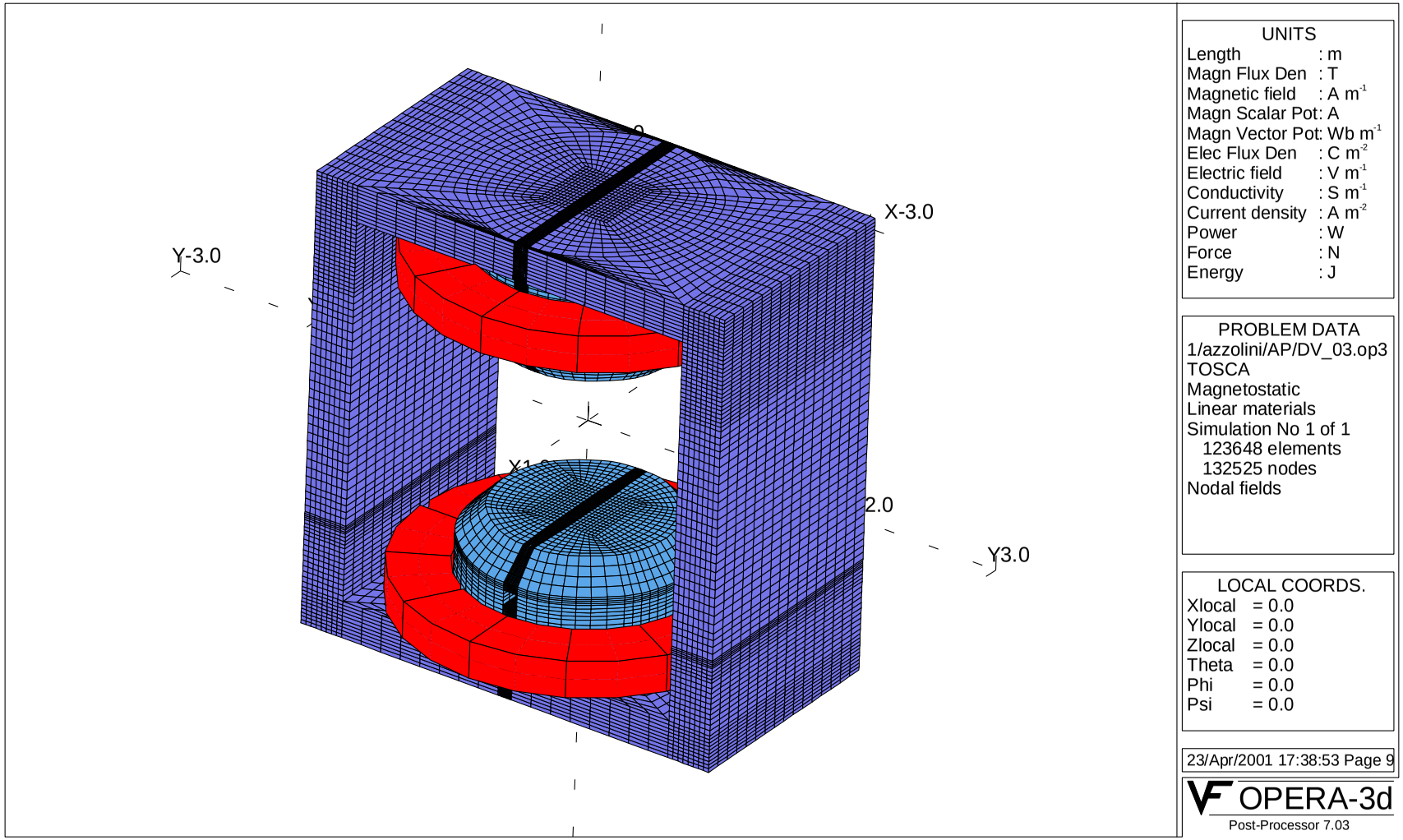

Figure 1: TOSCA 3D view of DV03 dipole.

Magnet characteristics / DV03

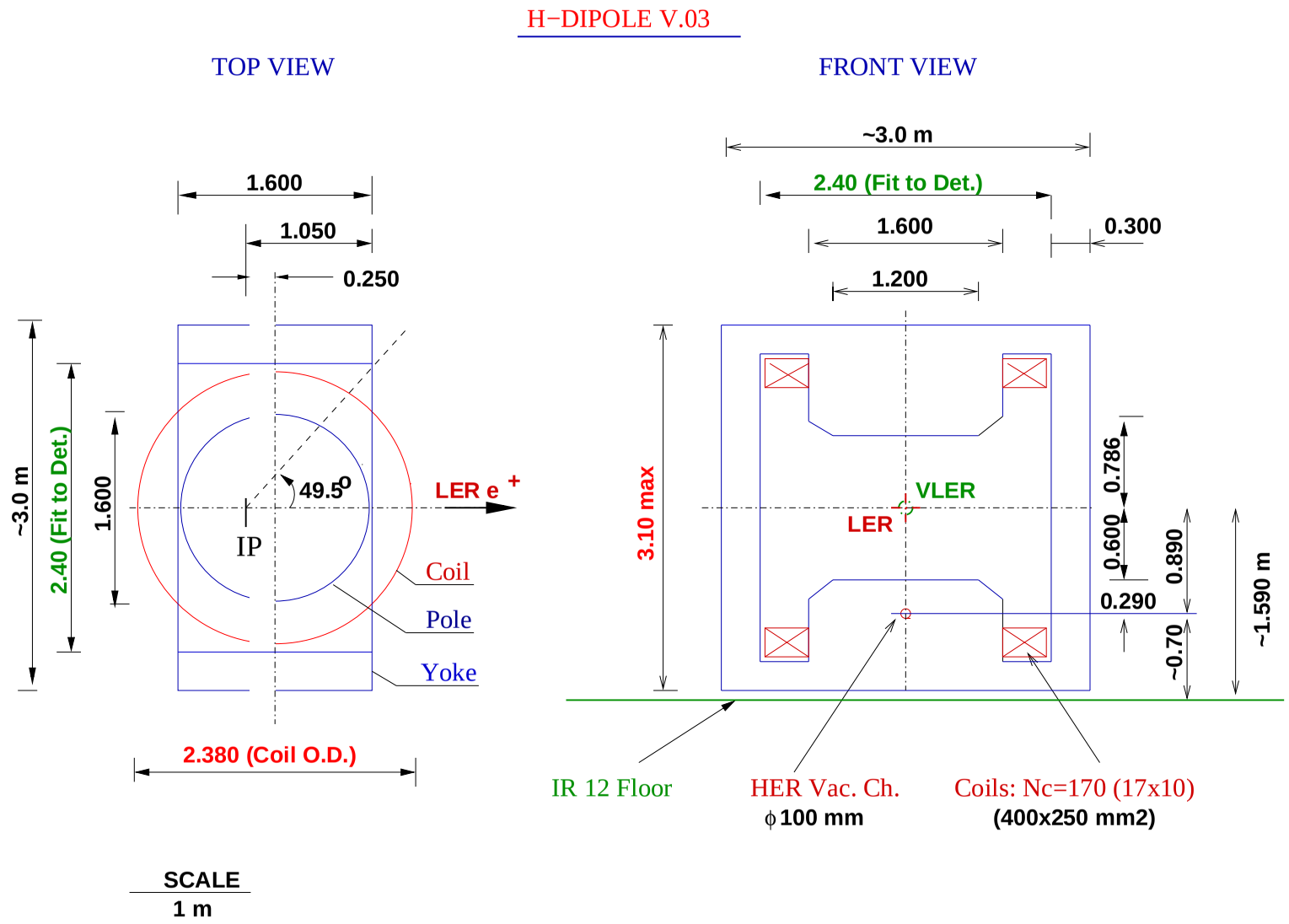

Figure 2: TOP and FRONT quoted drawings.

Magnet characteristics / DV03

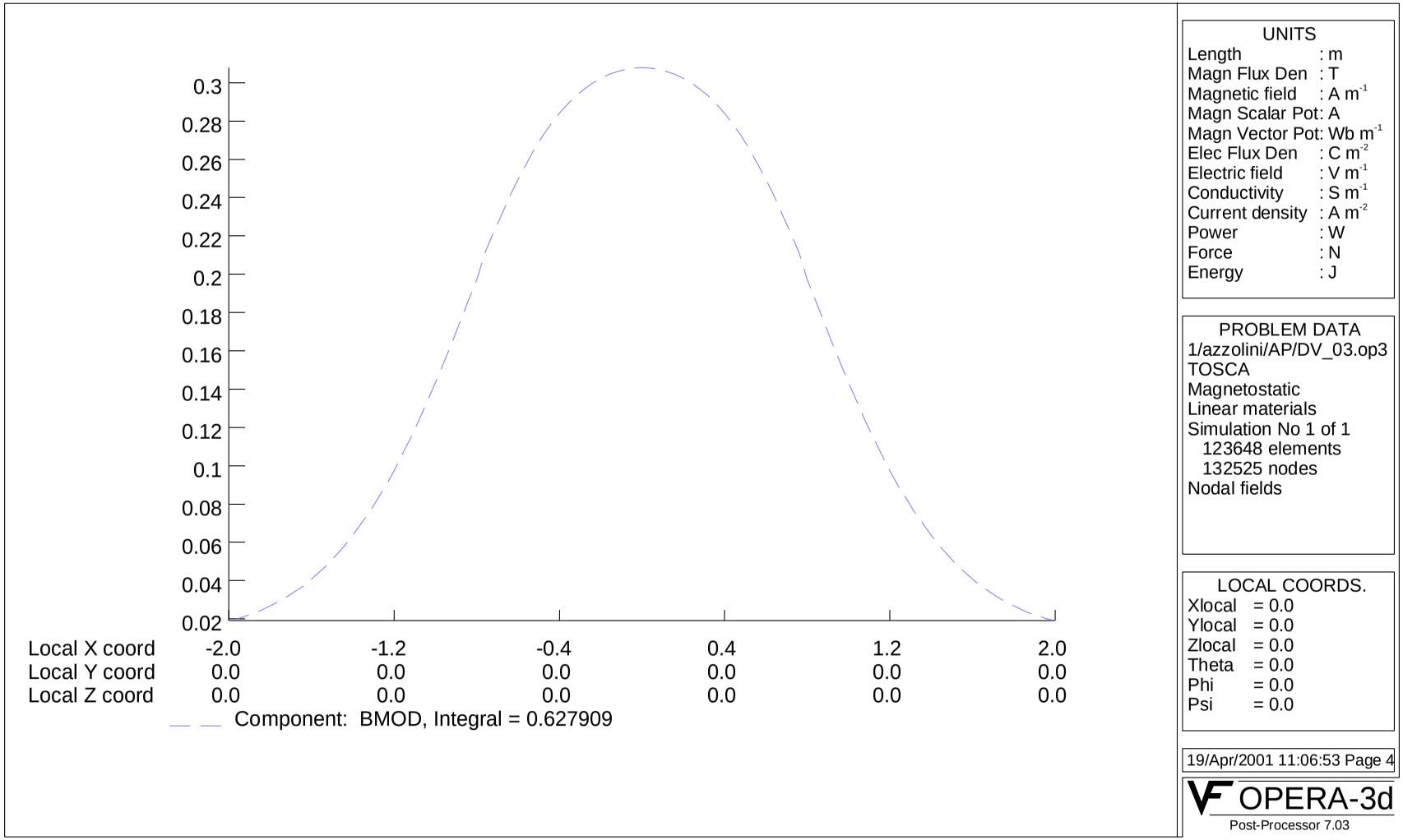

Figure 3: Total field integral on beam axis for B_o =0.30 T.

Magnet characteristics / DV03

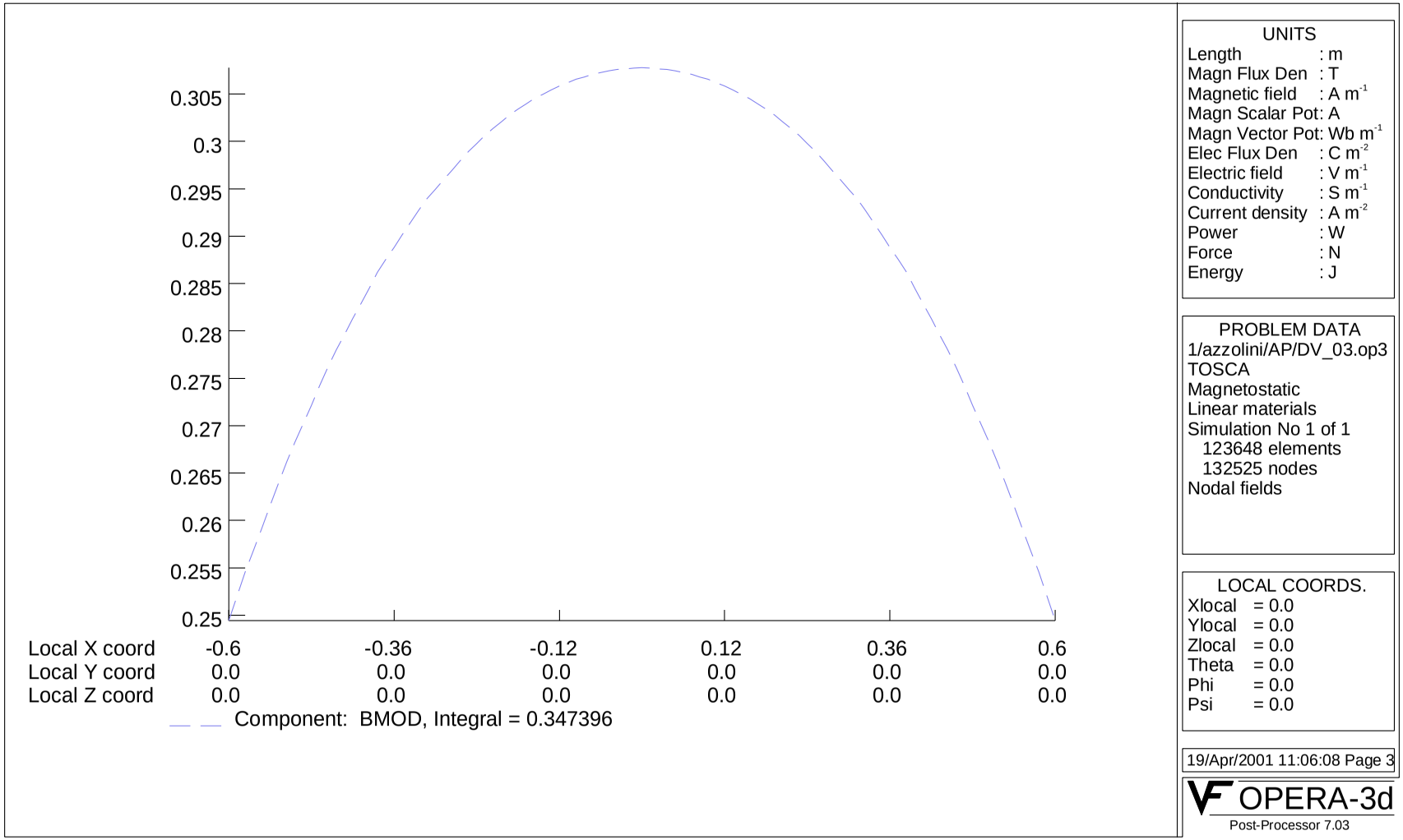

Figure 4: Field integral for X=± 0.6 m on beam axis, B_o =0.30 T. Non-uniformity: η_x (± 0.6 m)=18.9%

Magnet characteristics / DV03

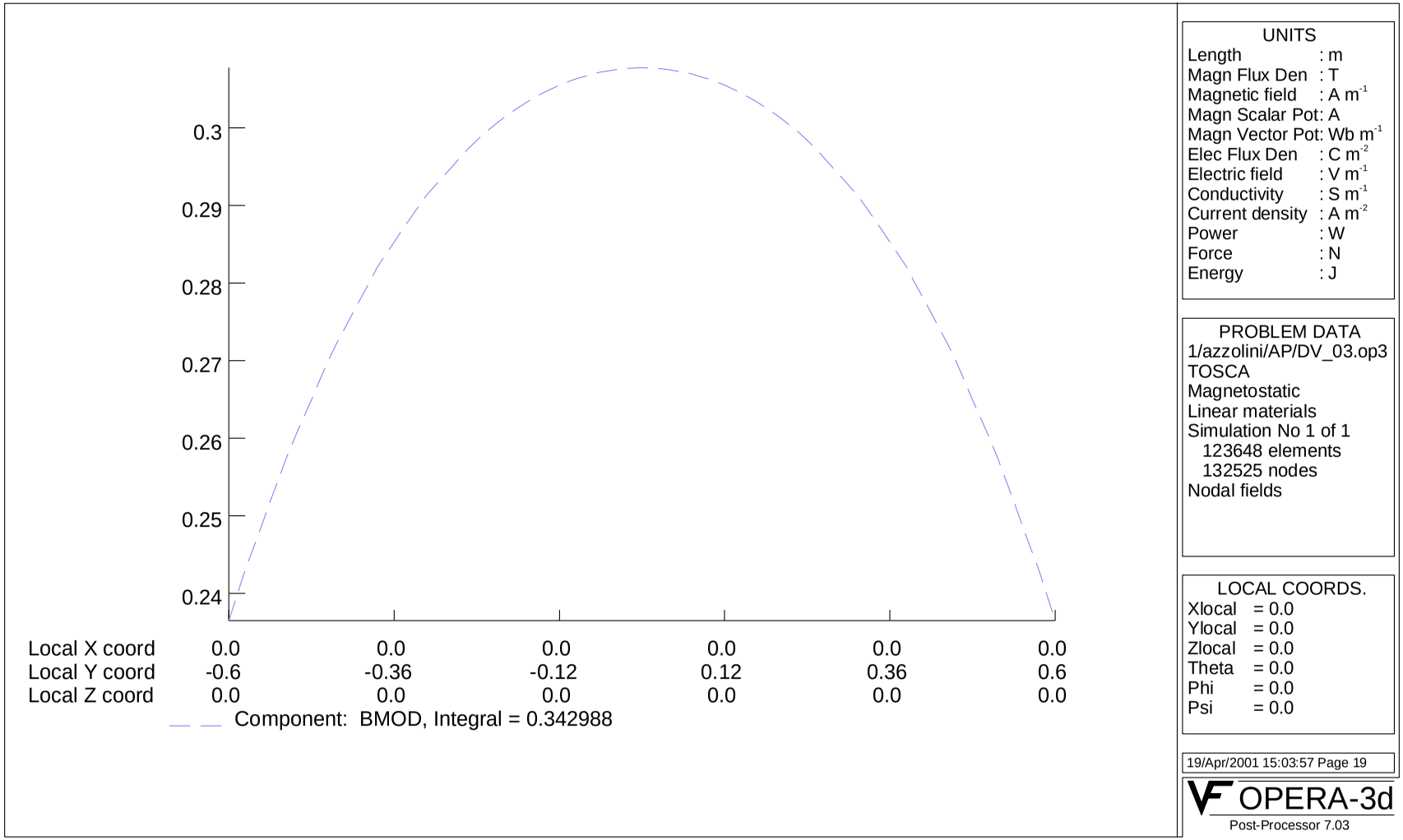

Figure 5: Field integral for Y=± 0.6 m orthogonal to beam axis, B_o =0.30 T. Non-uniformity: η_y (± 0.6 m)=23.2%

Magnet characteristics / DV03

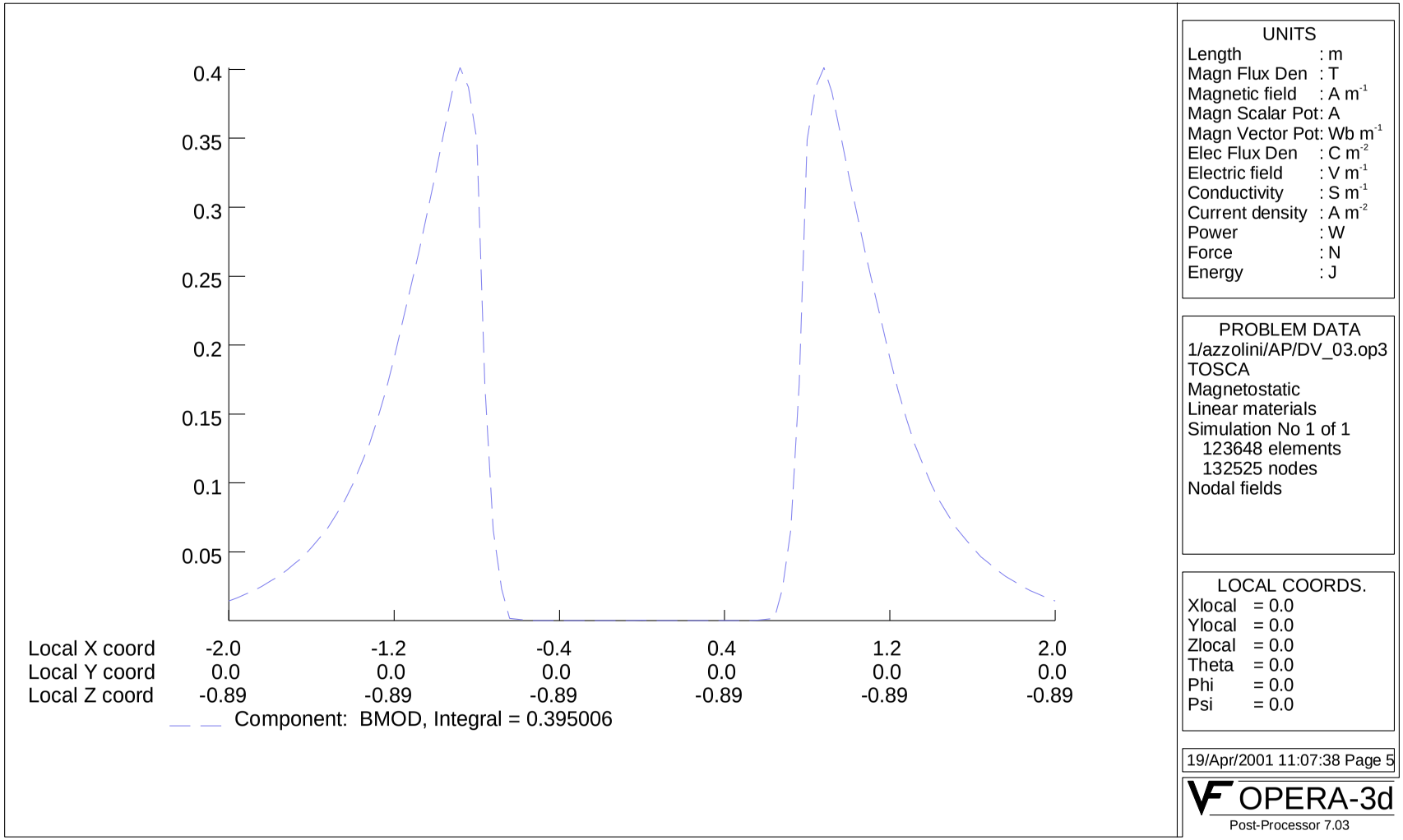

Figure 6: Field integral along HER beam axis for B_o =0.30 T.

Magnet characteristics / DV03

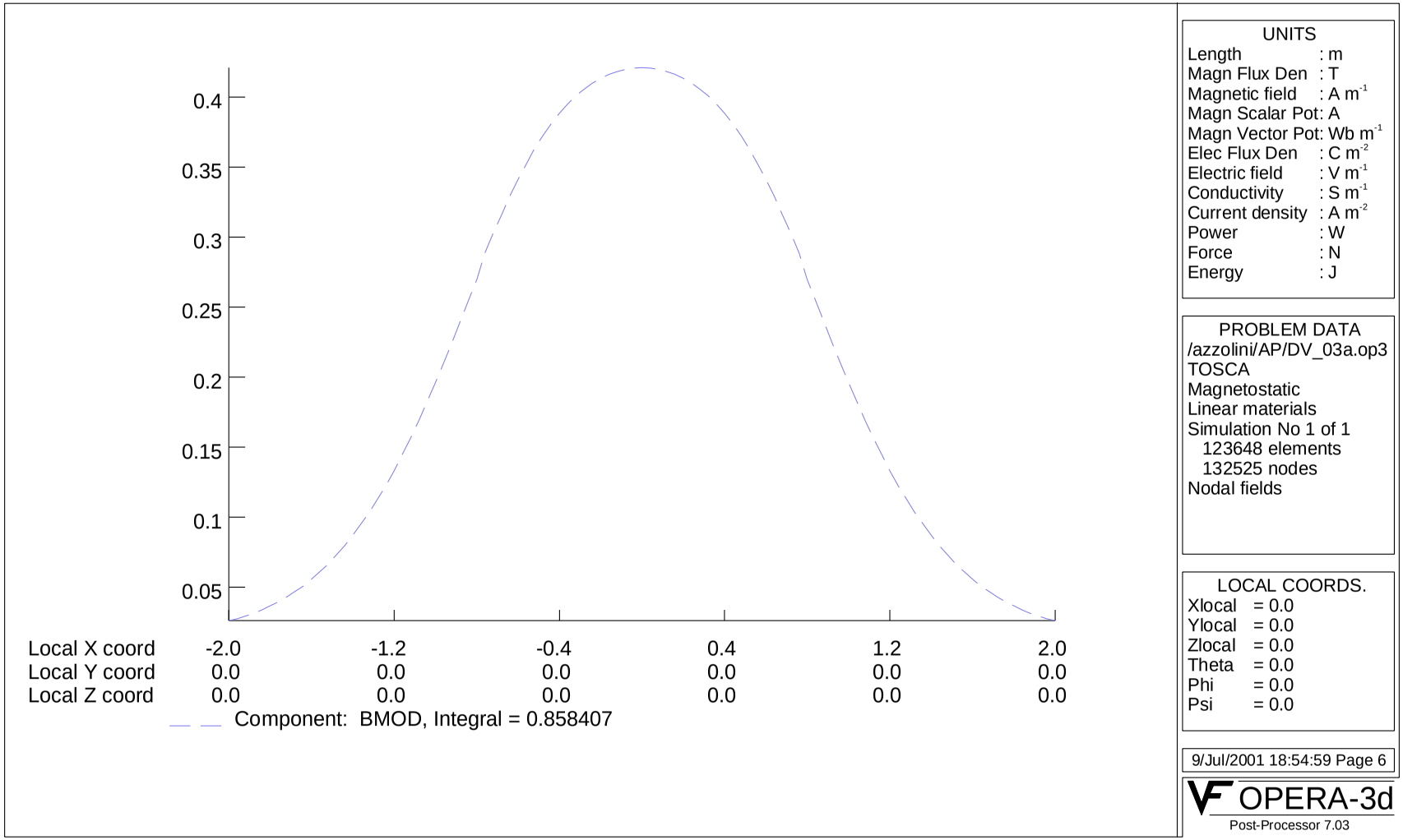

Figure 7: Total field integral on beam axis for B_o =0.42 T,

Magnet characteristics / DV03

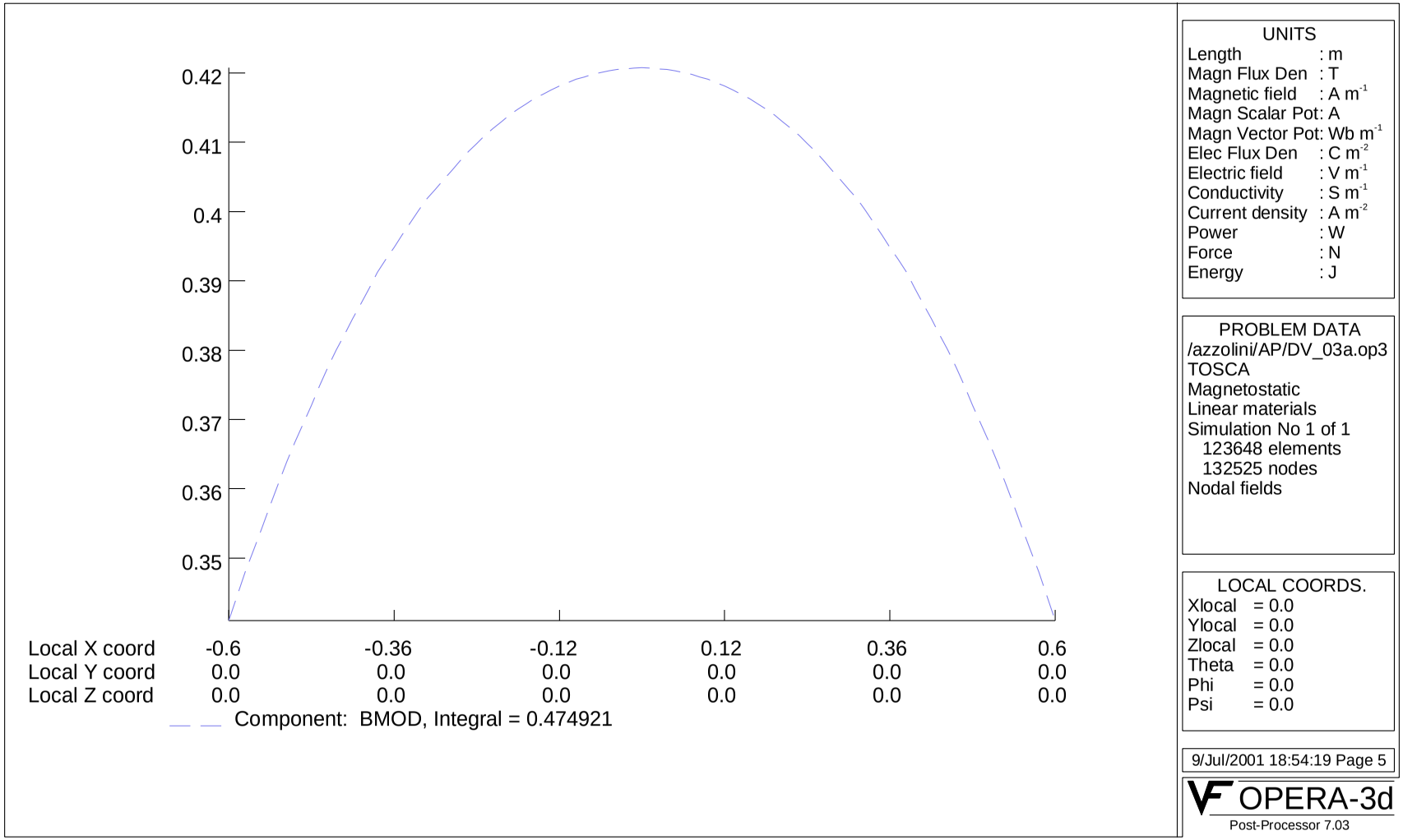

Figure 8: Field integral for X=± 0.6 m on beam axis, B_o =0.42 T. η_x (± 0.6 m)=19.1%

Magnet characteristics / DV03

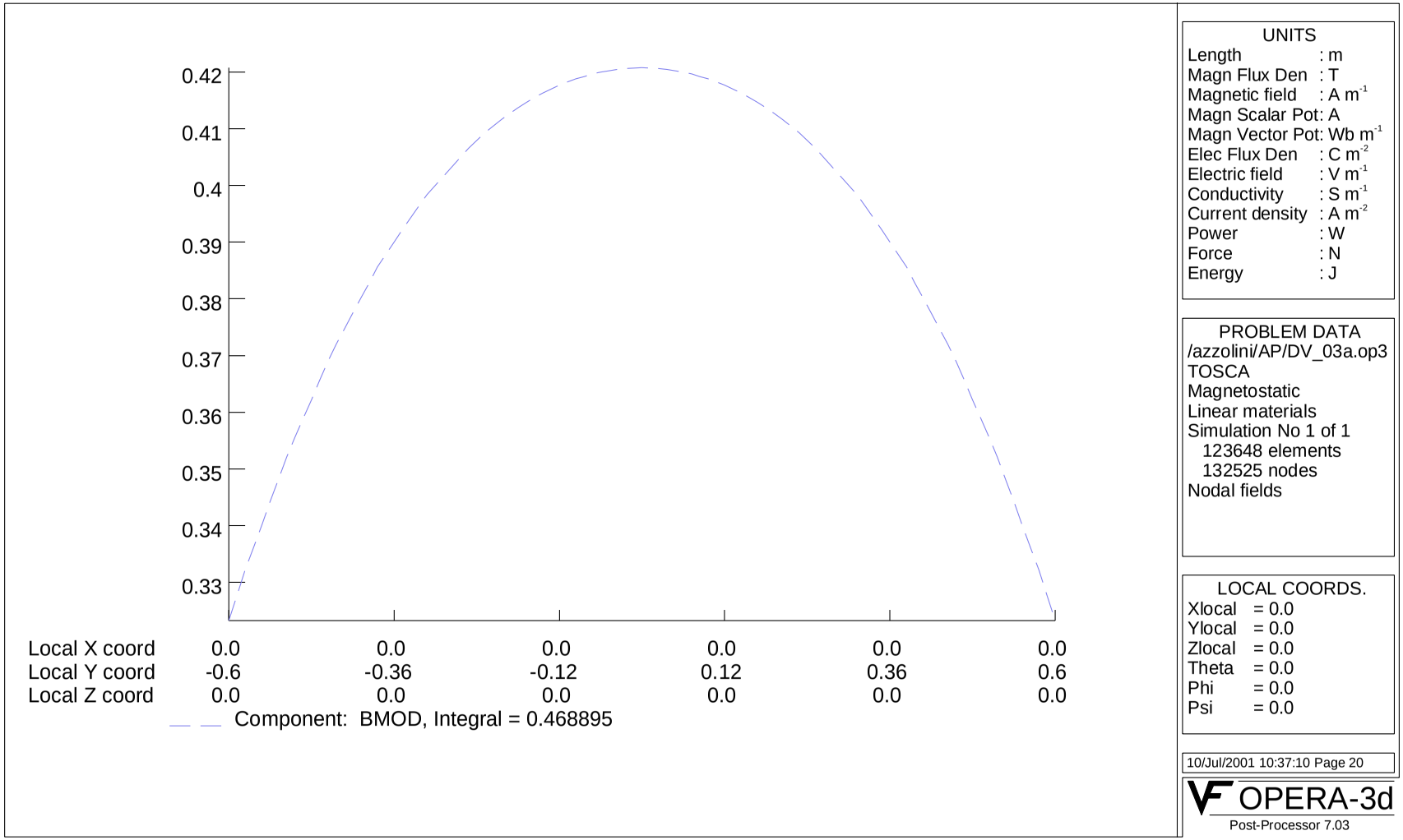

Figure 9: Field integral for Y=± 0.6 m orthogonal to beam axis, B_o =0.42 T. η_y (± 0.6 m)=23.1%

Magnet characteristics / DV03

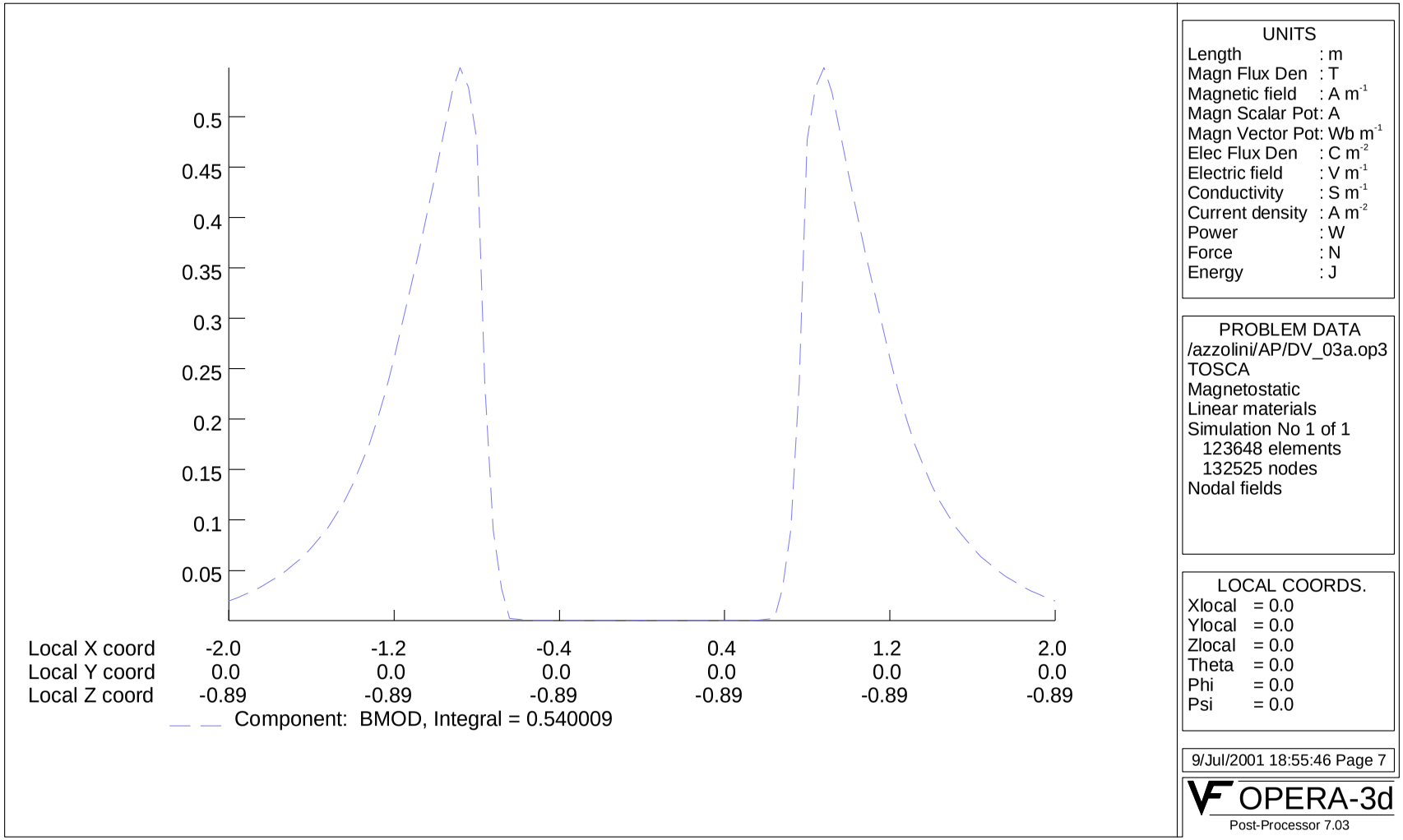

Figure 10: Field integral along HER beam axis for B_o =0.42 T.

Magnet characteristics / DV06

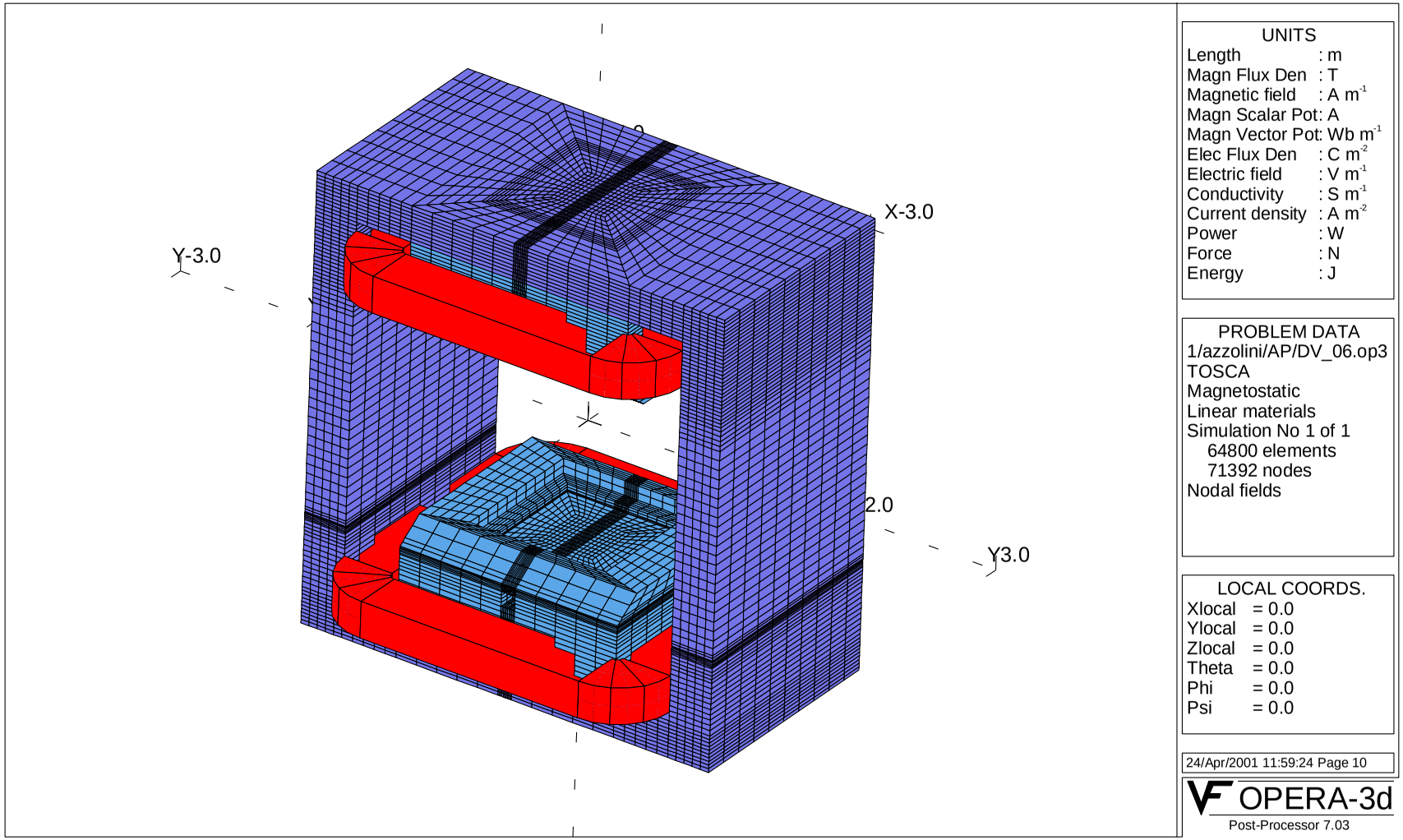

Figure 11: TOSCA 3D view of DV06 dipole.

Magnet characteristics / DV06

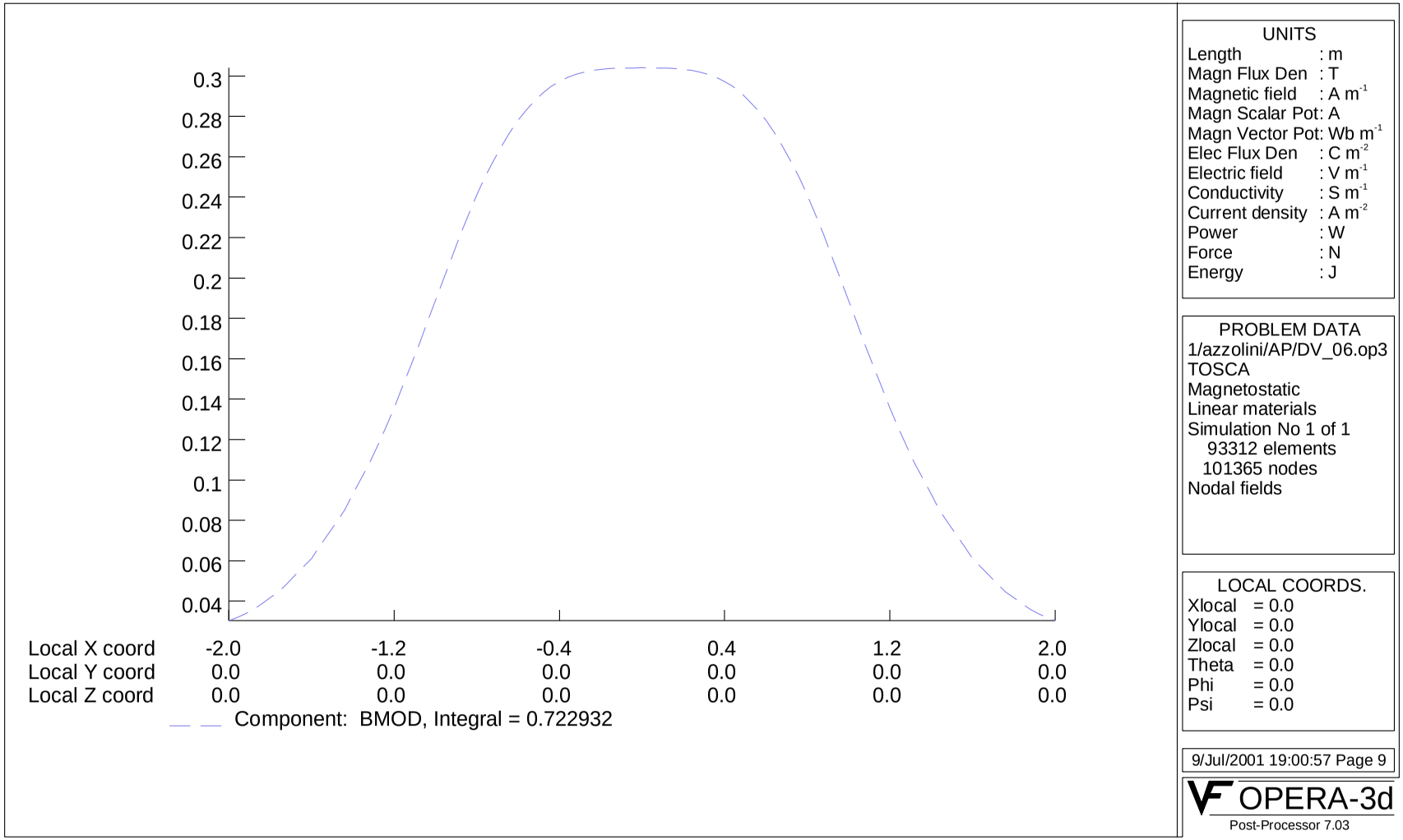

Figure 12: Total field integral on beam axis for B_o =0.30 T.

Magnet characteristics / DV06

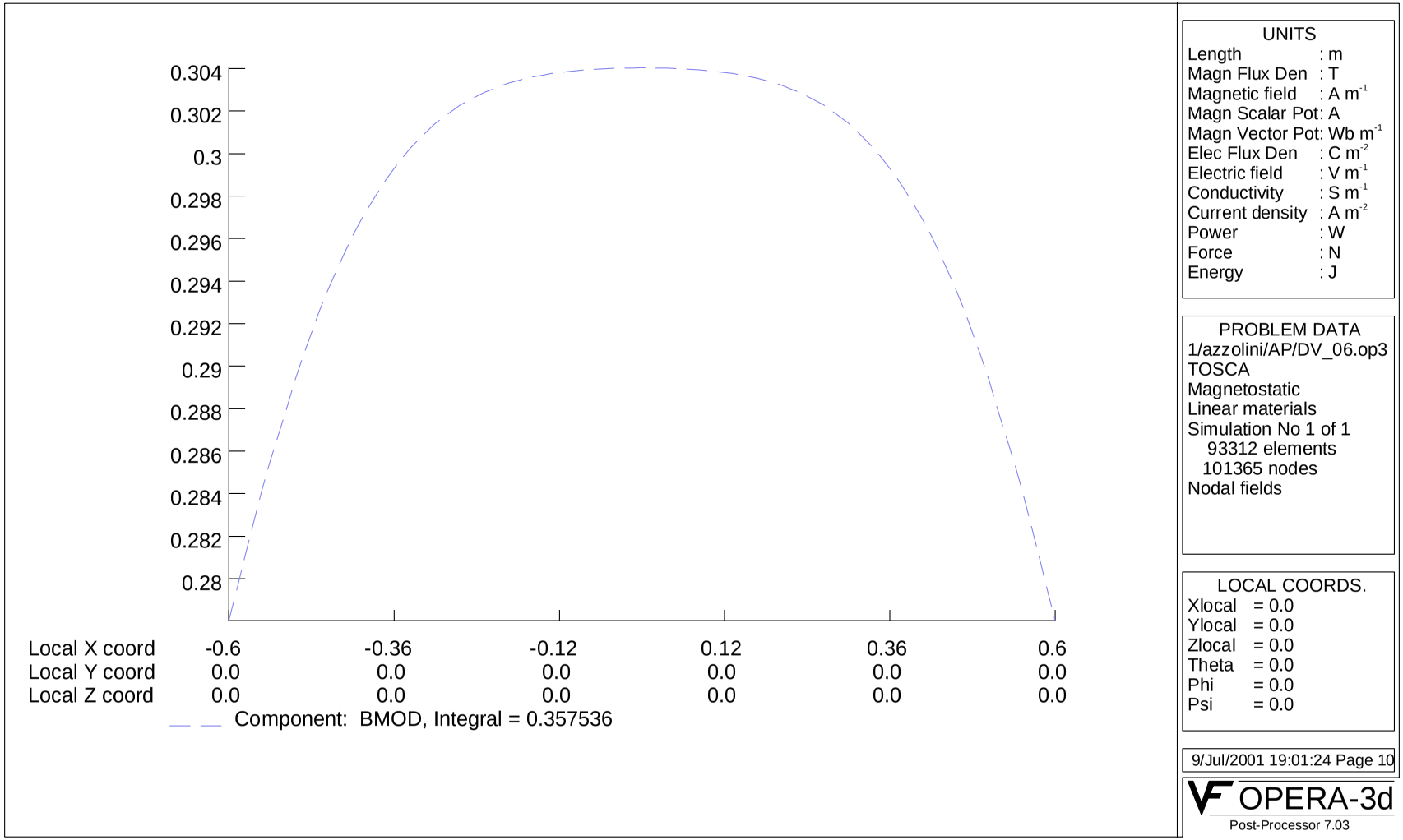

Figure 13: Field integral for X=± 0.6 m on beam axis, B_o =0.30 T. η_x (± 0.6 m)=8.6%

Magnet characteristics / DV06

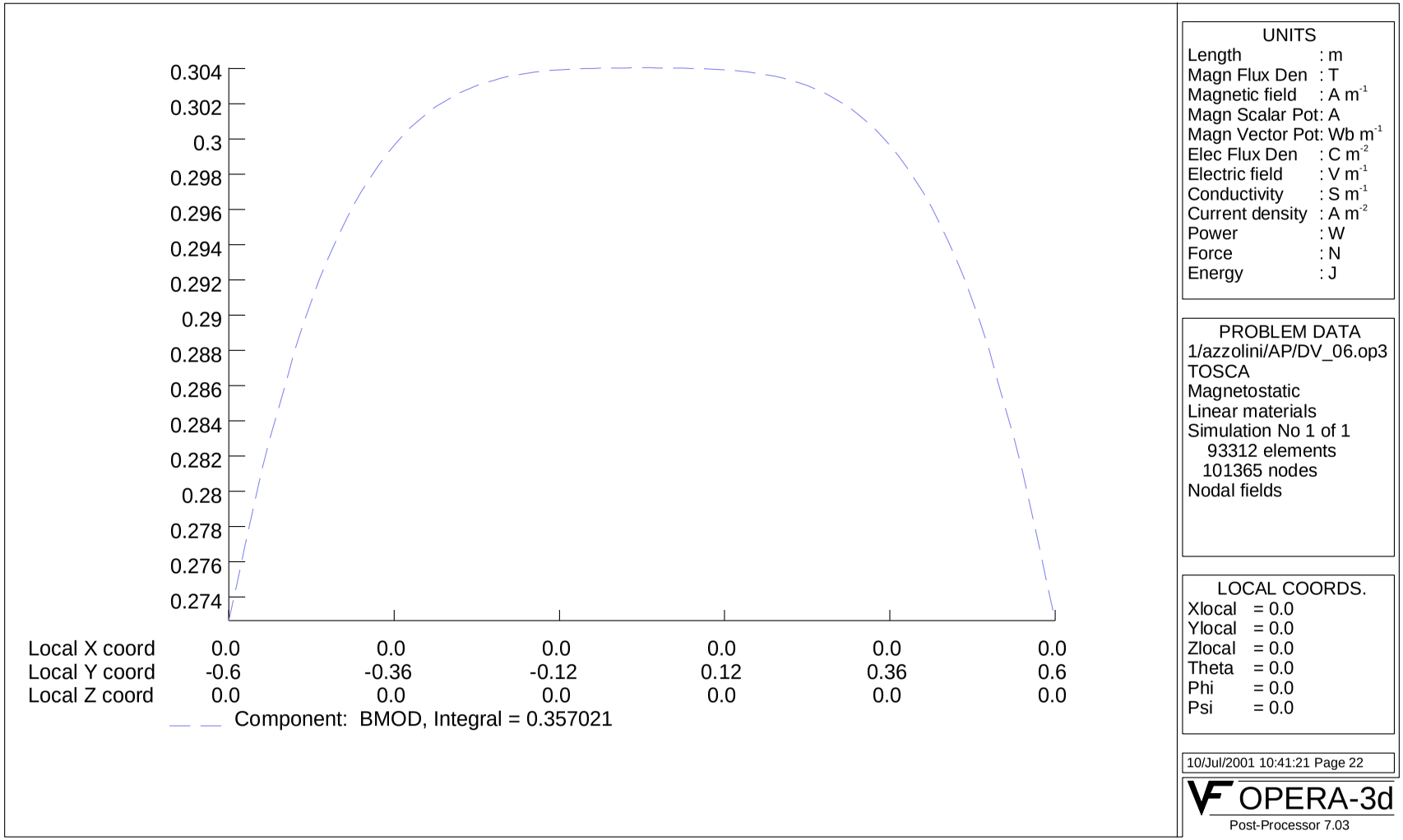

Figure 14: Field integral for Y=± 0.6 m orthogonal to beam axis, B_o =0.30 T. η_y (± 0.6 m)=10.2%

Magnet characteristics / DV06

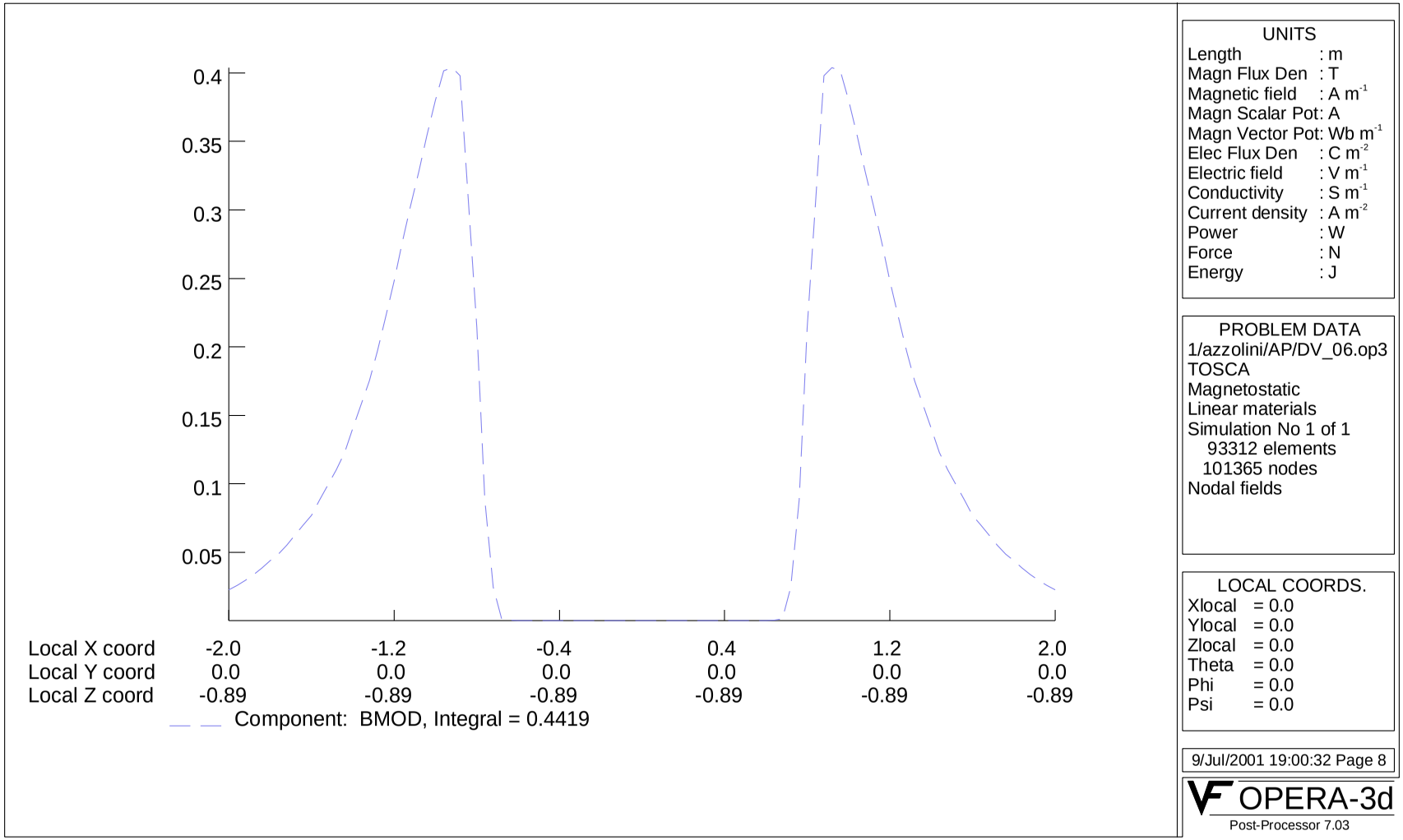

Figure 15: Field integral along HER beam axis for B_o =0.30 T.

Magnet characteristics / DV06

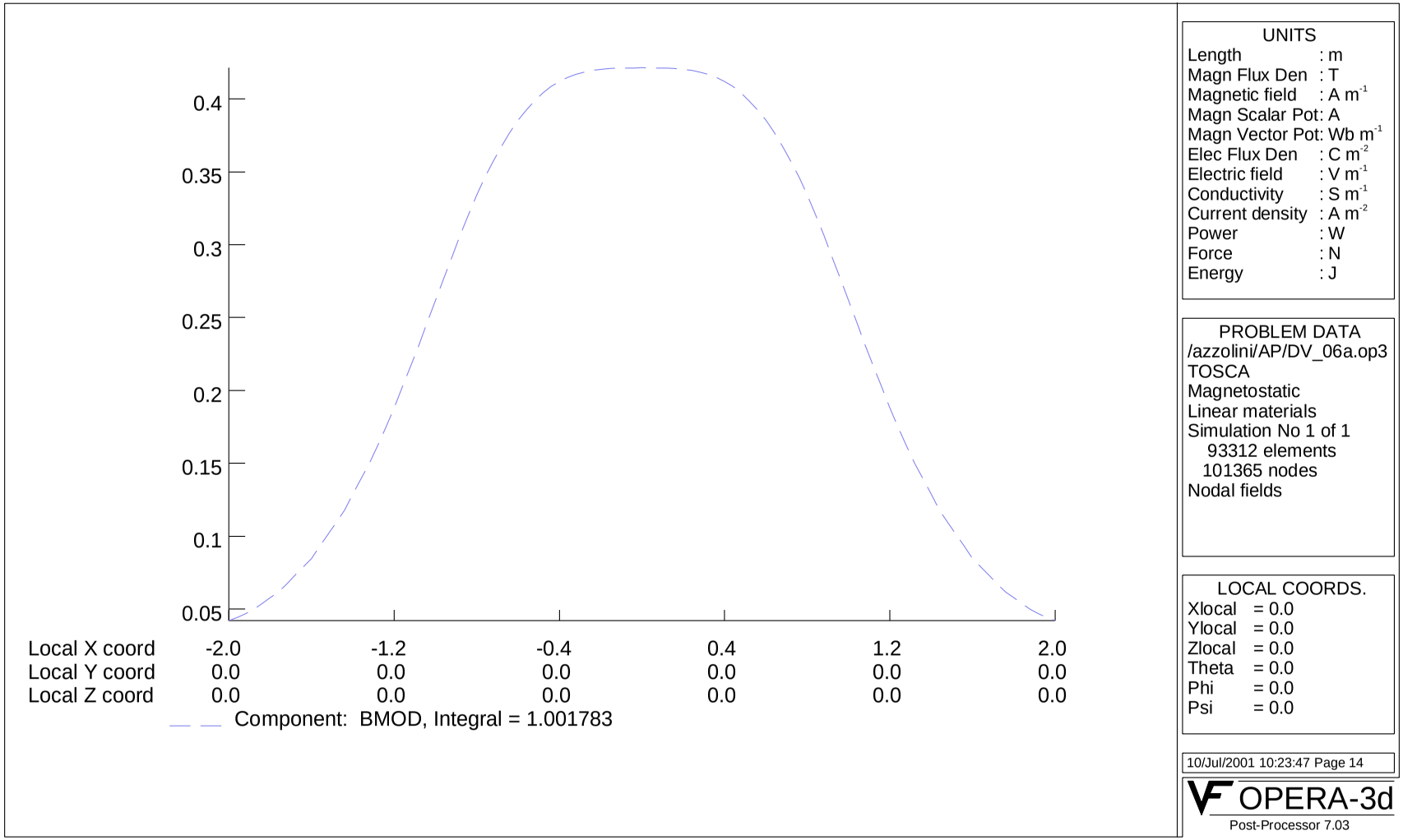

Figure 16: Total field integral on beam axis for B_o =0.42 T,

Magnet characteristics / DV06

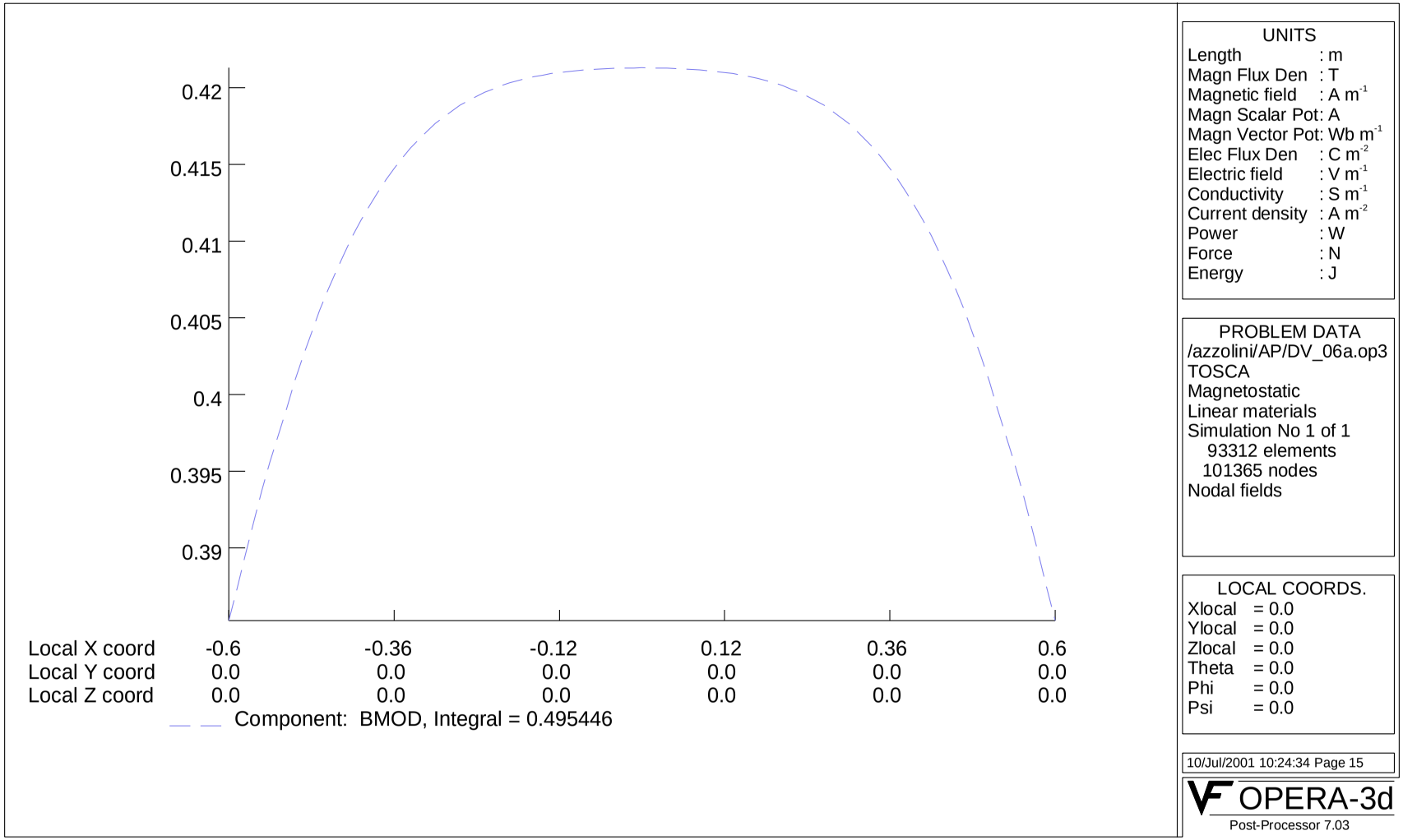

Figure 17: Field integral for X=± 0.6 m on beam axis, B_o =0.42 T. η_x (± 0.6 m)=8.3%

Magnet characteristics / DV06

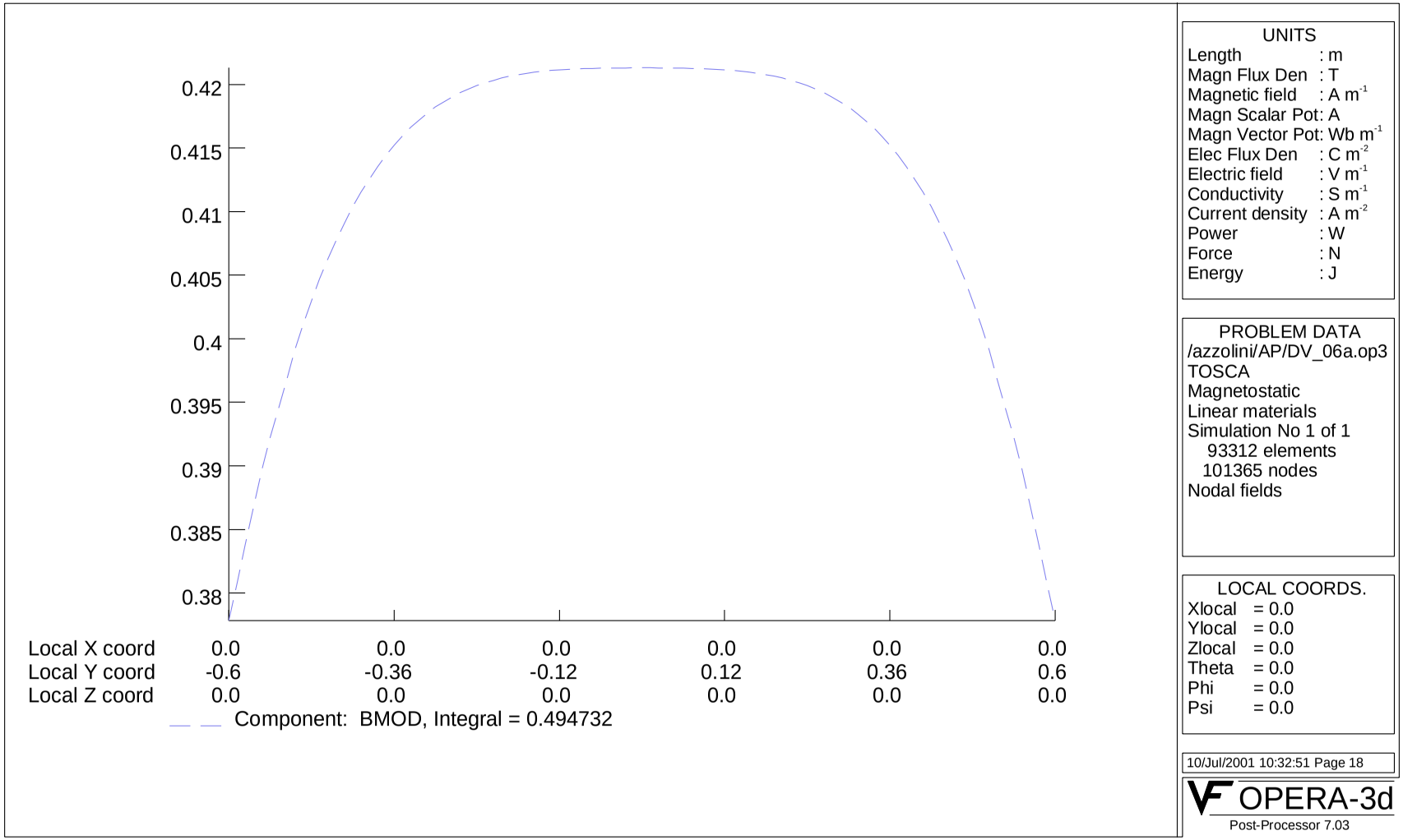

Figure 18: Field integral for Y=± 0.6 m orthogonal to beam axis, B_o =0.42 T. η_y (± 0.6 m)=10.1%

Magnet characteristics / DV06

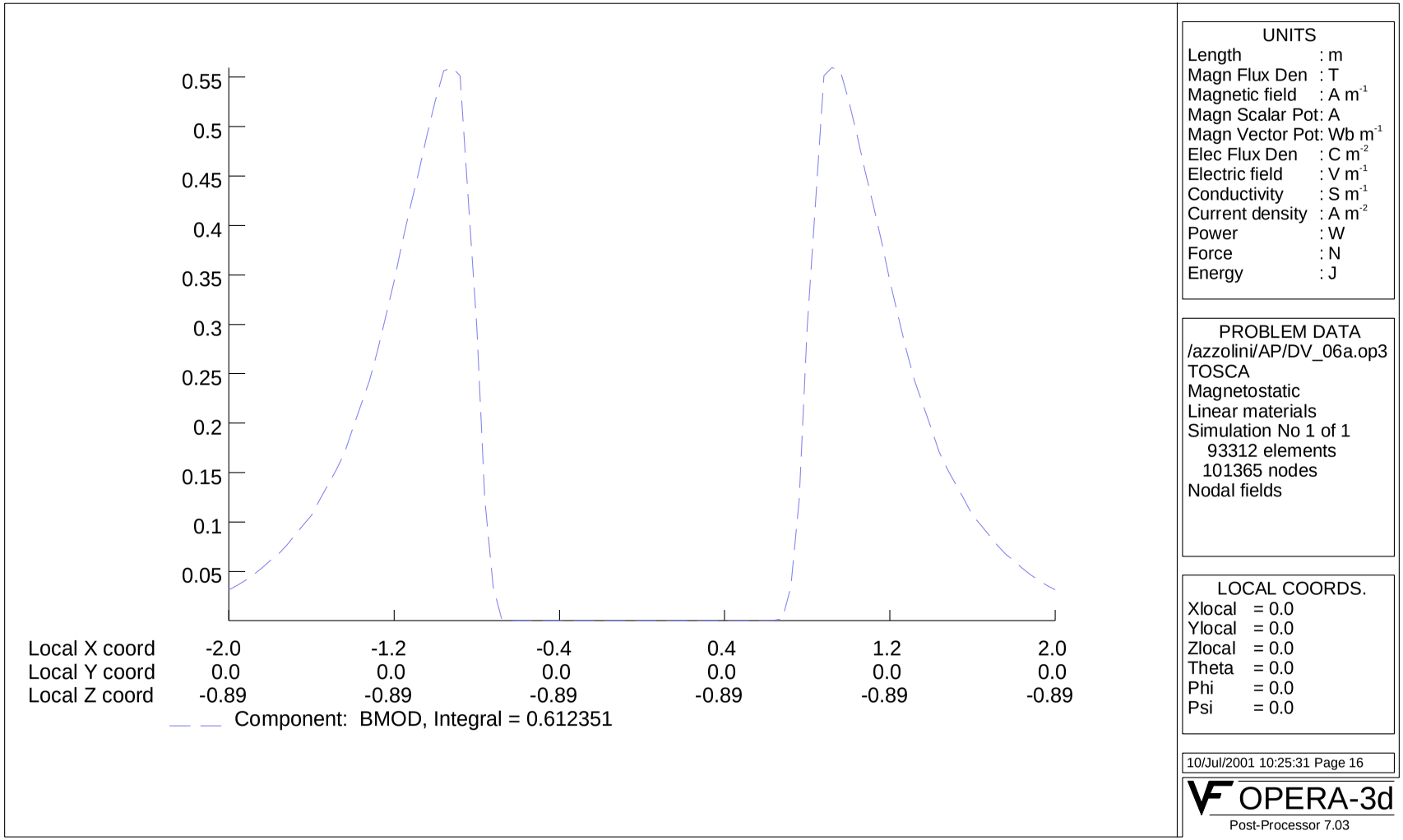

Figure 19: Field integral along HER beam axis for B_o =0.42 T.

Magnet characteristics / DV07

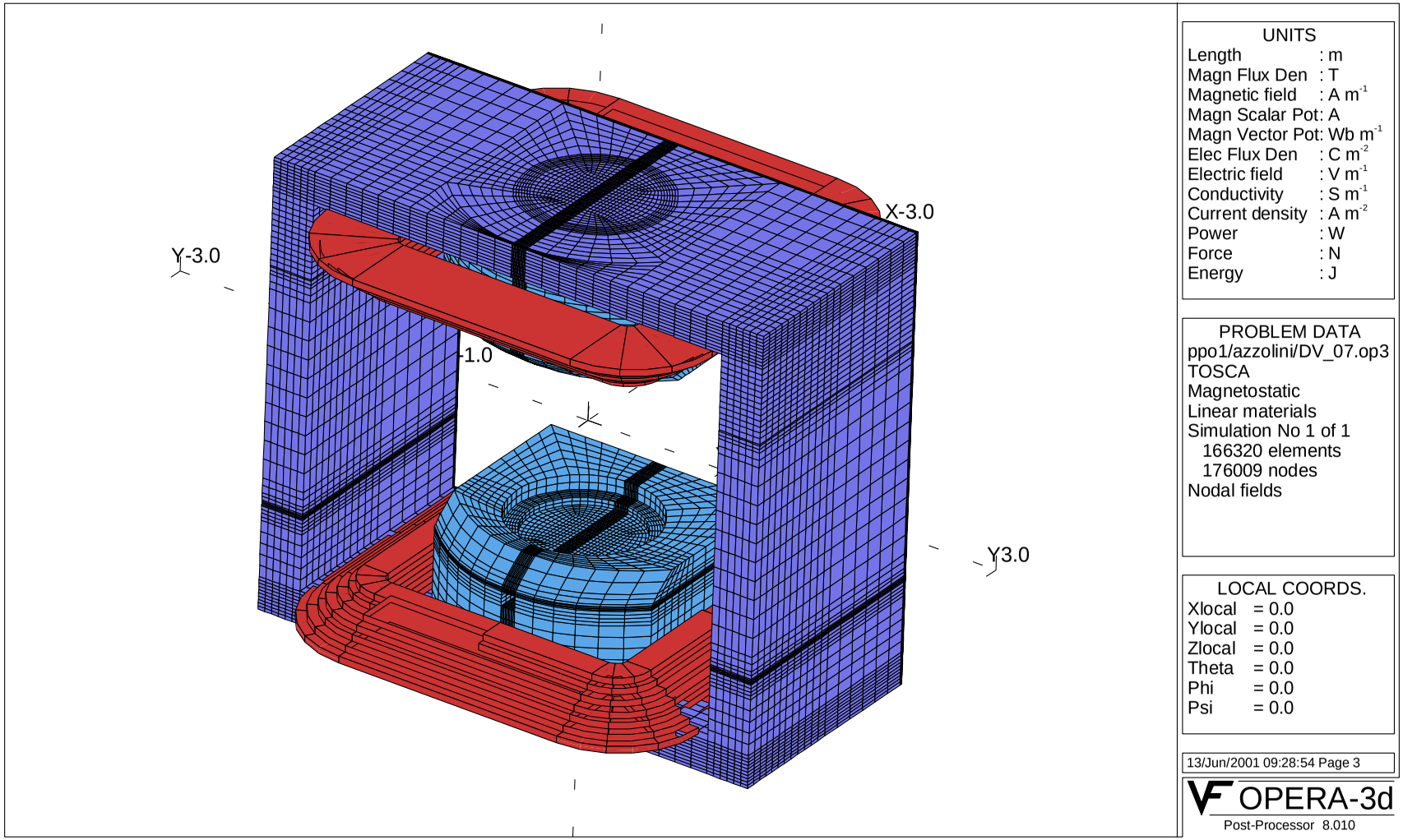

Figure 20: TOSCA 3D view of DV07 dipole.

Magnet characteristics / SV01

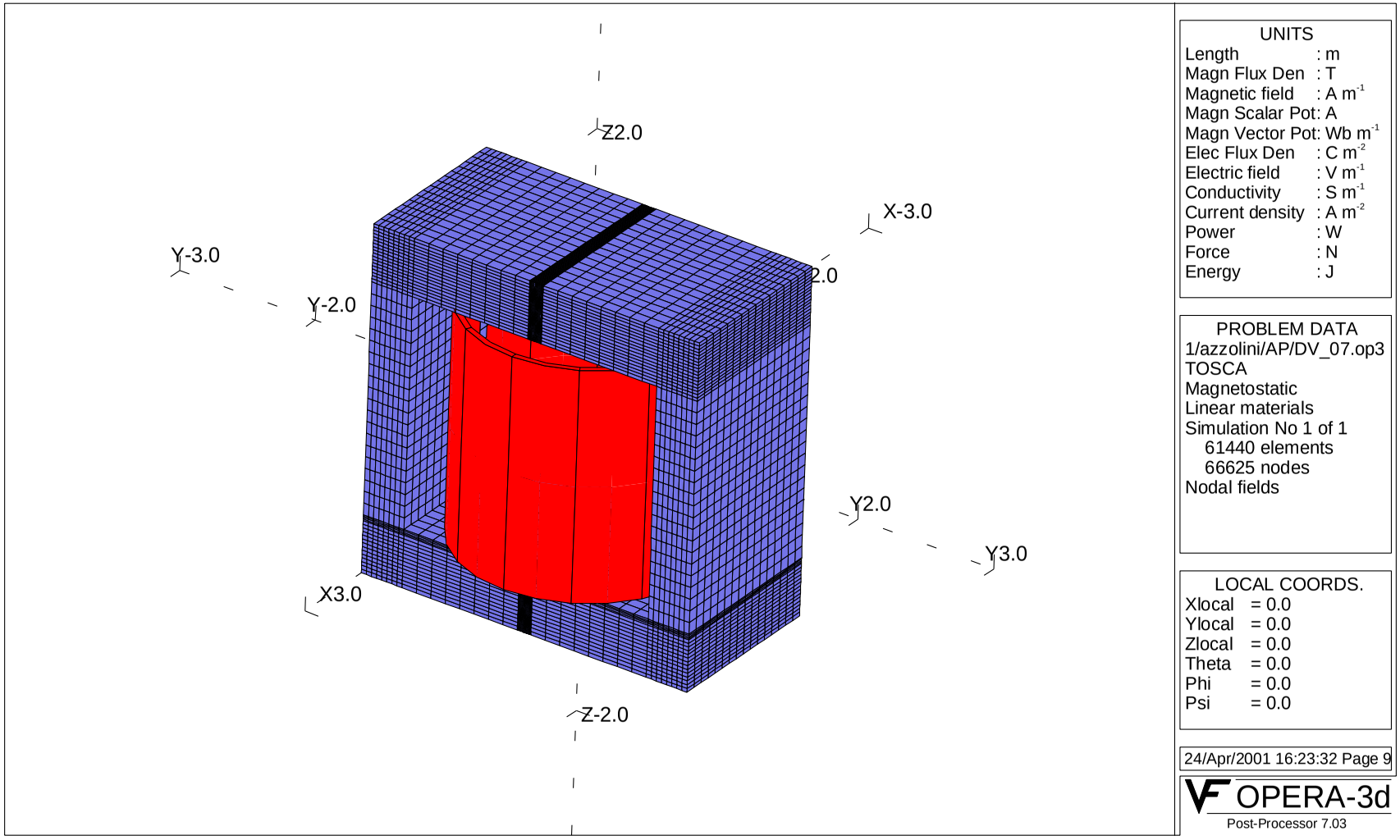

Figure 21: TOSCA 3D view of the SV01 solenoid.

Magnet characteristics / SV01

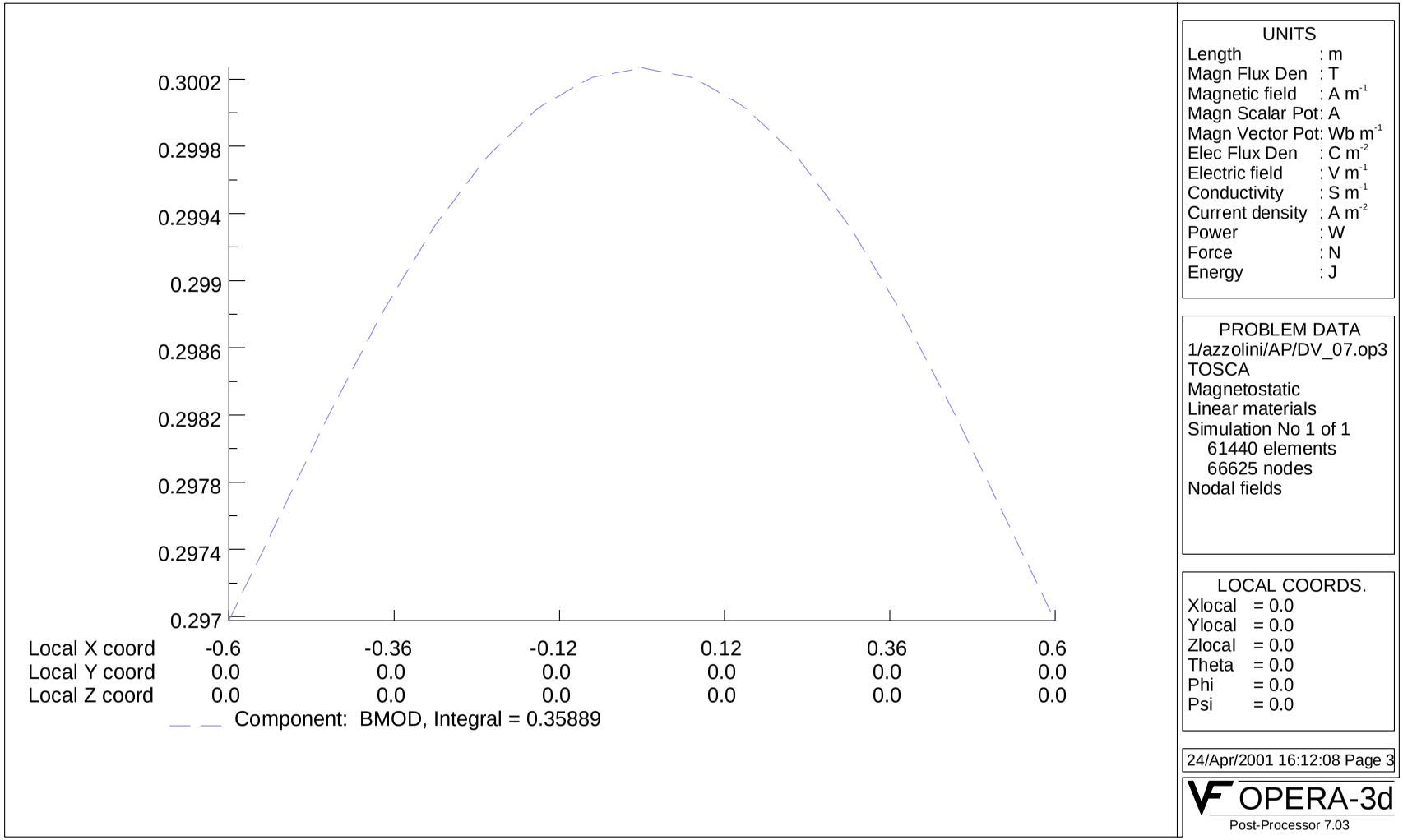

Figure 22: Field integral for X=± 0.6 m on beam axis, B_o =0.30 T. η_x (± 0.6 m)=1.07%

Magnet characteristics / SV01

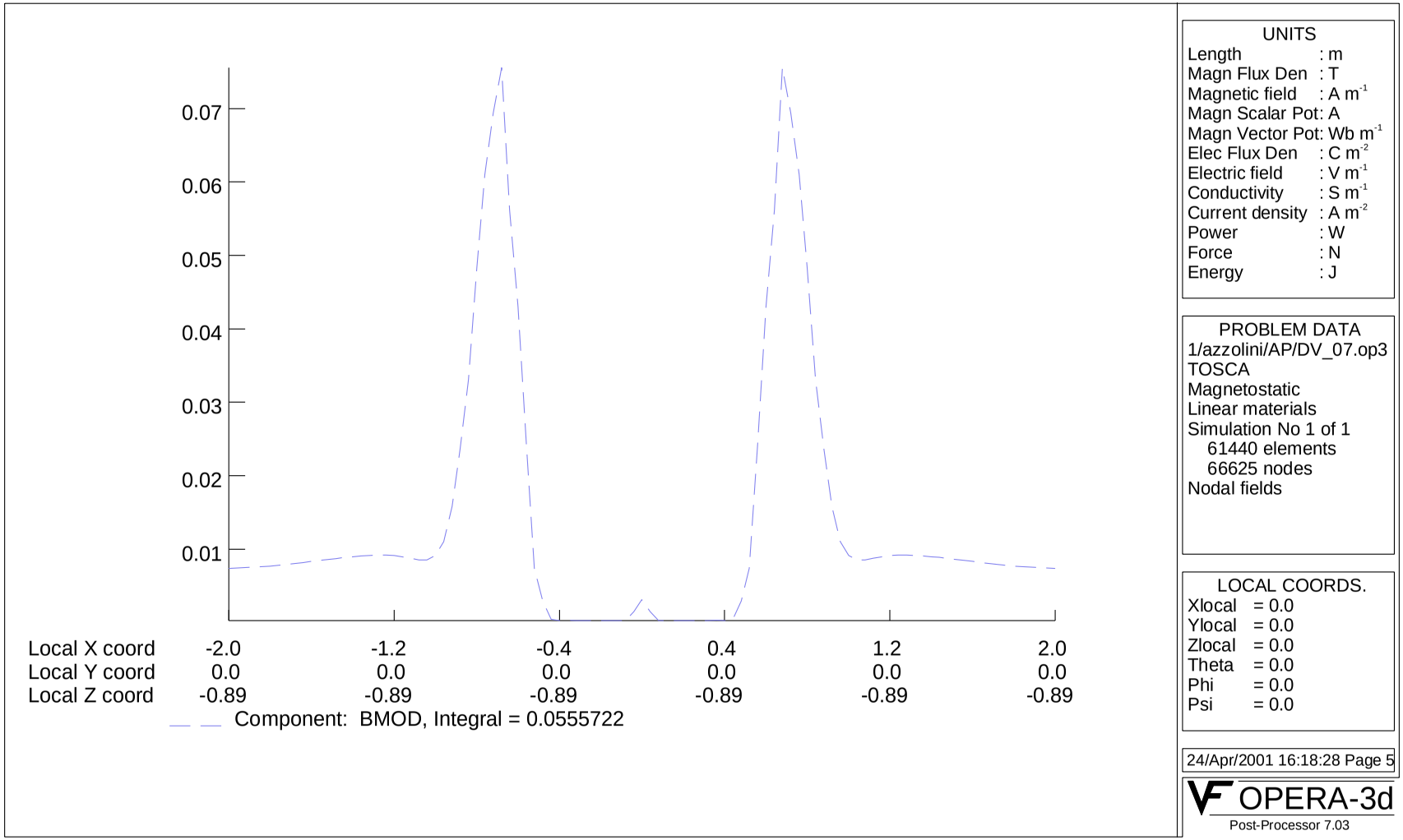

Figure 23: Field integral along HER beam axis, B_o =0.30 T.