



Inter-comparison work MARS/FLUKA in the LHC insertion region

Contribution for the Frascati workshop
November 7th-9th 2007

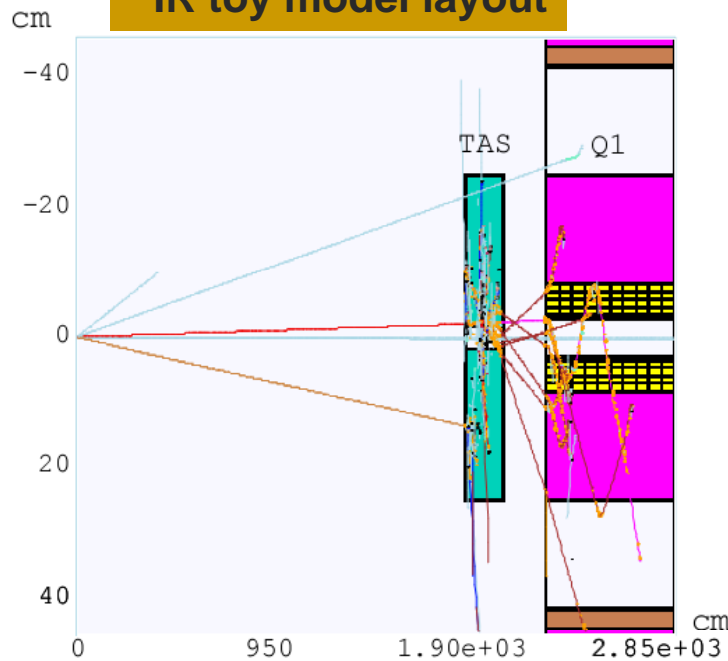


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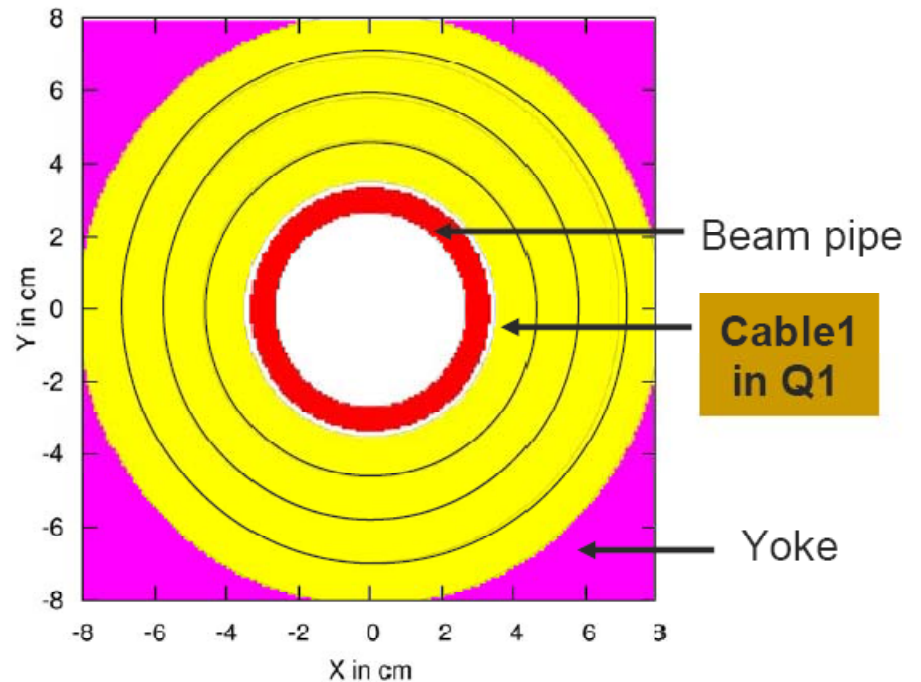
Inter-comparison work MARS/FLUKA on the LHC Insertion Region

- Same simple geometry layout
- Same magnetic field definition
- Same materials
- Same DPMJET3 event generator for 7-7 TeV proton-proton collisions
- Same upgrade luminosity $10^{35}\text{cm}^{-2}\text{s}^{-1}$

MARS15 (Aug. 2007)
IR toy model layout



FLUKA 2006.3 (March 2007)
Q1 quadrupole section



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■ Results: heat loads

Total heat loads in the insertion region elements (W) for upgrade luminosity $L=10 \cdot L_0$

	FLUKA	+/- (%)	MARS	+/- (%)	Ratio FLUKA/MARS
TAS	1866.8	0.5	1827.3	0.1	1.02
Q1 tube	92.4	1.2	97.9	0.4	0.94
Q1 cable	162.4	4.3	159.1	1.6	1.02
yoke	98.4	1.0	78.5	0.4	1.25
alu	2.4	1.2	2.4	0.5	1.01
mila	20.1	1.1	20.4	0.3	0.98
vessel	17.3	0.9	17.3	0.3	0.99

Very good agreement for all the components except the yoke, where FLUKA predicts 25% higher heat load (to be clarified in further studies)

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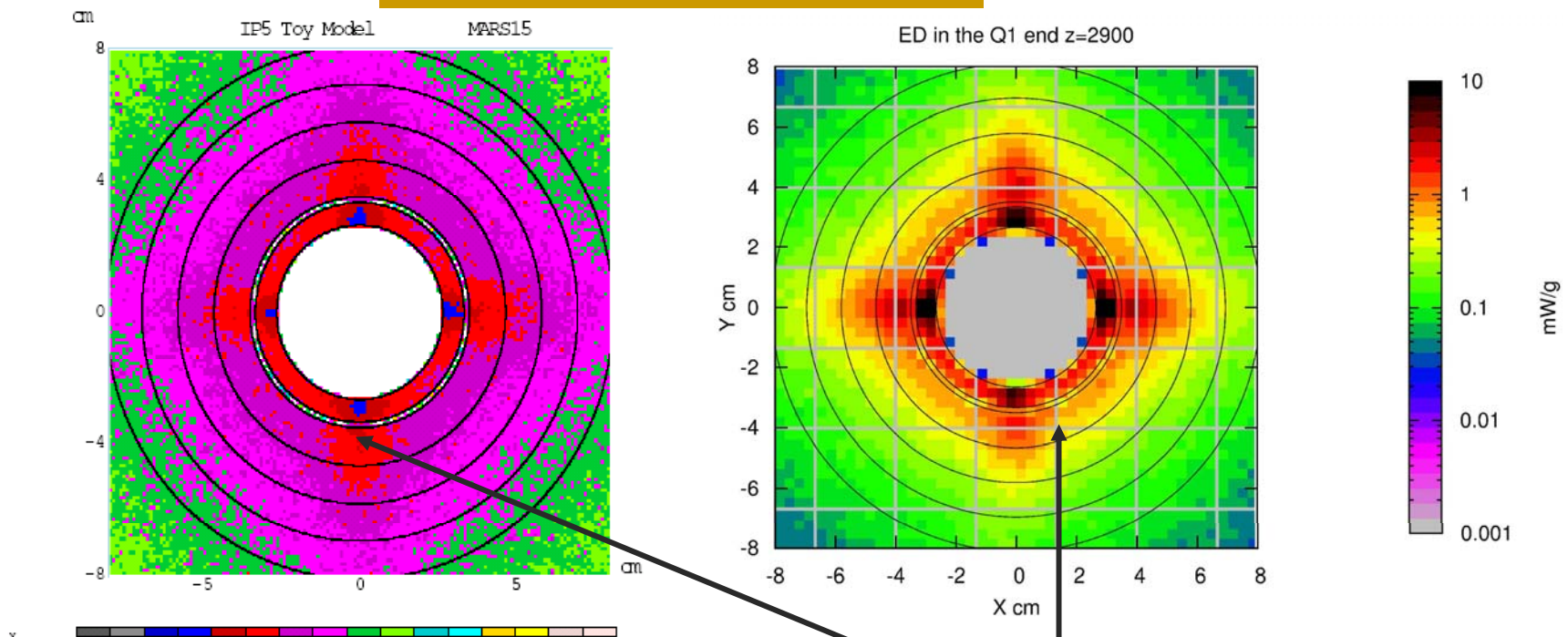
■ Results:

Power density isocontours at the non IP end of Q1

- Same binning size ($0.33 \times 0.33 \times 30 \text{ cm}^3$)
- Maximum values in the vertical and horizontal planes
- Peak power density in cable1 (4 bins in radial)
 - MARS : 17.5 mW/cm^3
 - FLUKA: 18.2 mW/cm^3 +/- 4.4% (statistical error)

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MARS15 power density isocontours at $z=[2900,2930]$ in mW/g **FLUKA 2006.3**



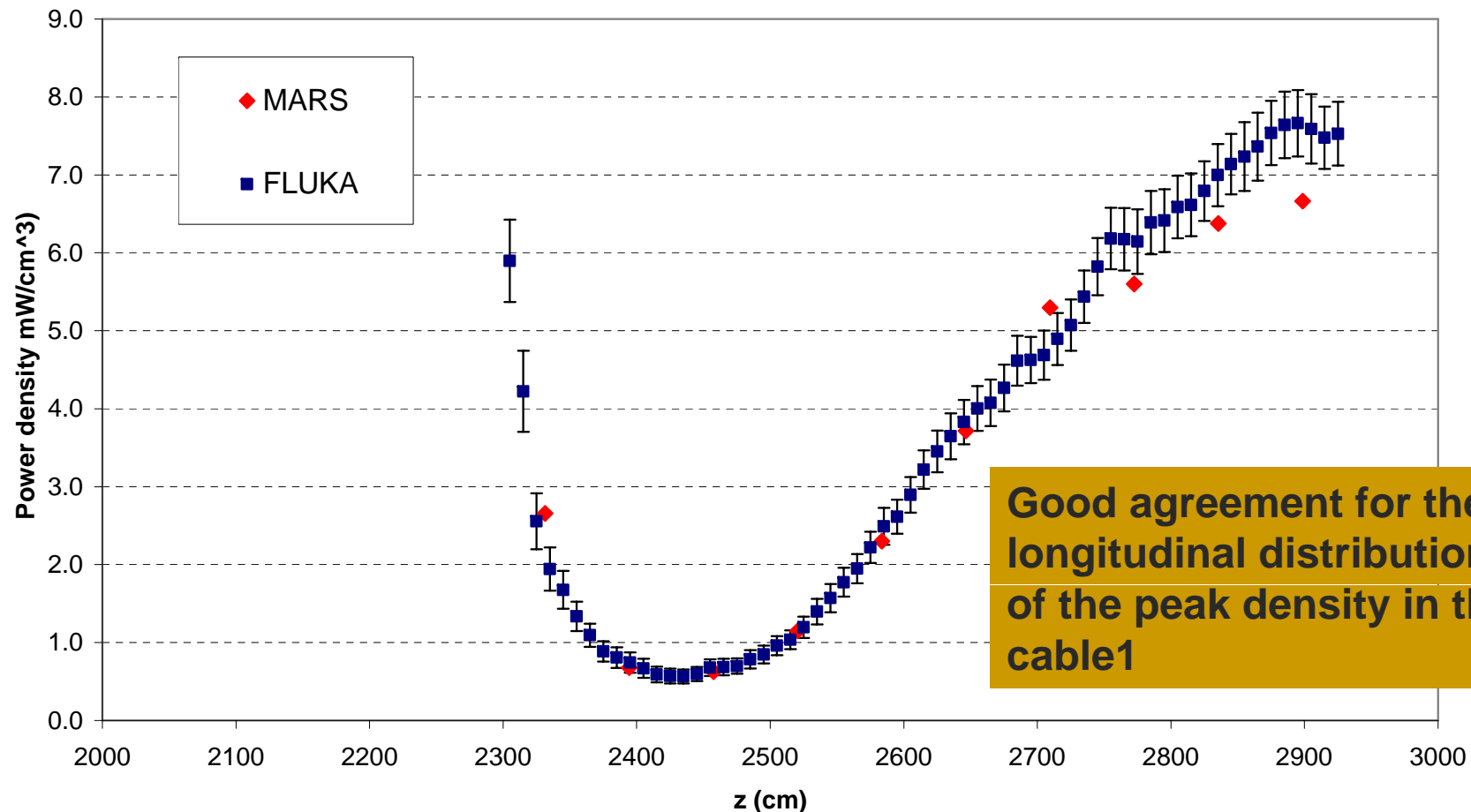
Q1 Focusing
Cable 1: $3.5 < R < 4.65$ cm
Density $7\text{g}\cdot\text{cm}^{-3}$

7-9th November 2007

IR'07 CARE-HHH-APD WorkshopFrascati

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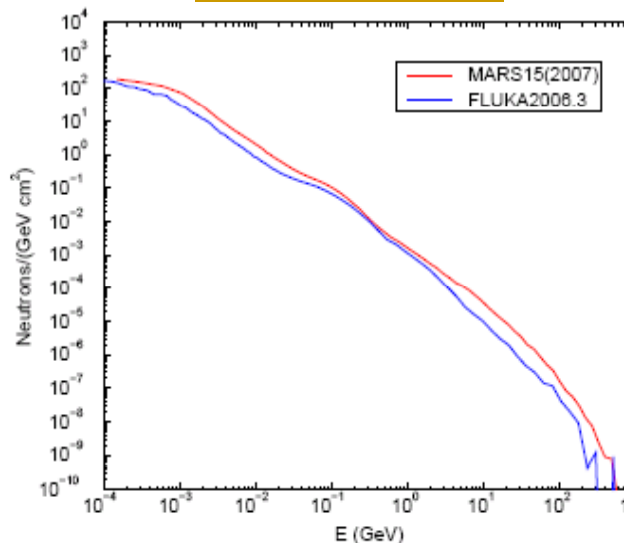
Azimuthally averaged power density longitudinal distribution in cable1



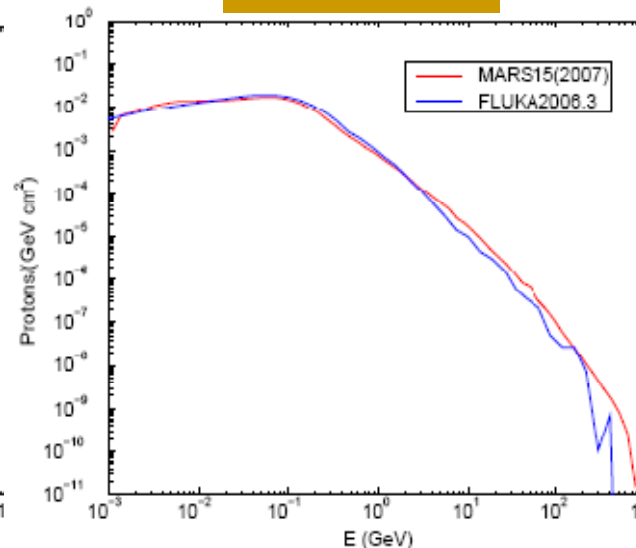
Inter-comparison work MARS/FLUKA on the LHC Insertion Region

- Results: particle spectra in cable1

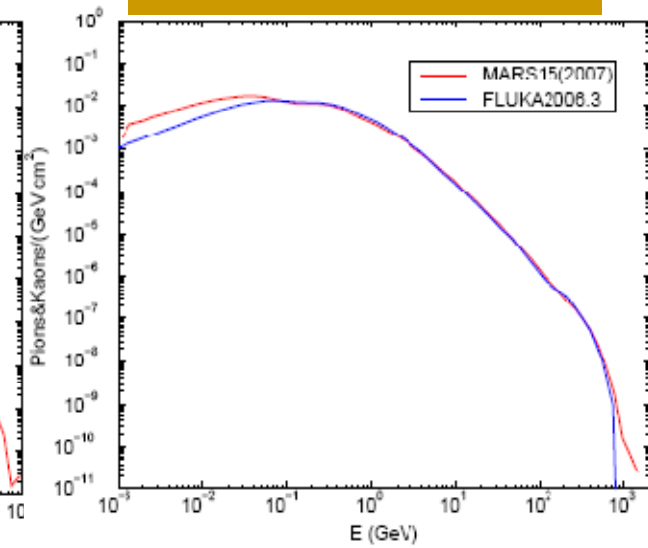
NEUTRONS



PROTONS



PIONS and KAONS



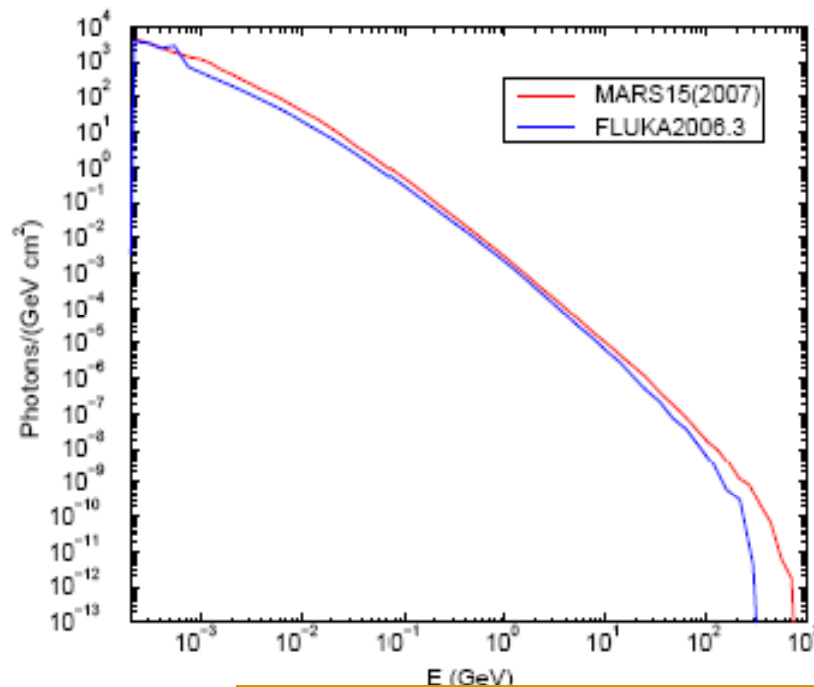
Good agreement between the 2 codes, within statistical errors

Inter-comparison work MARS/FLUKA on the LHC Insertion Region

- Results: particle spectra in cable1

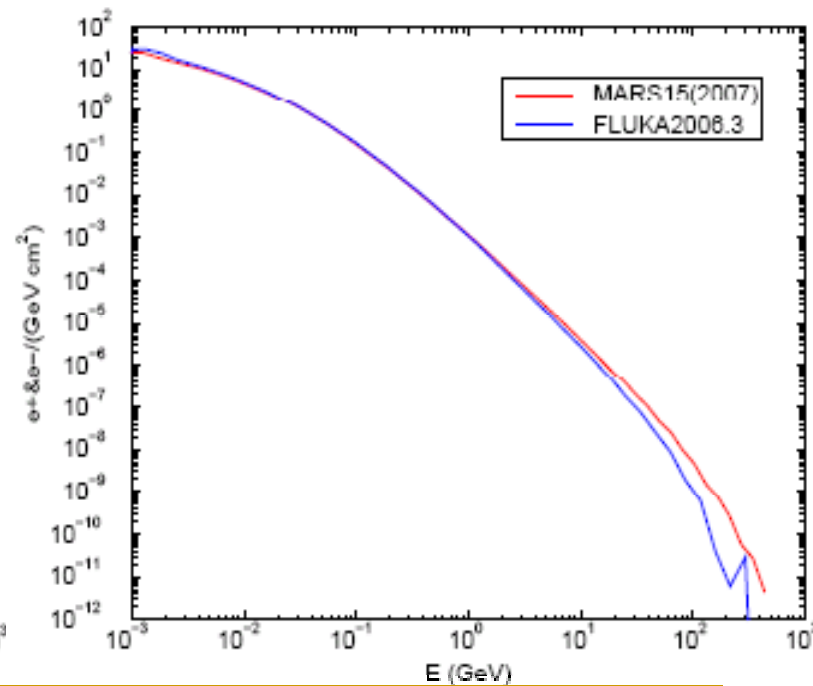
PHOTONS

IP5 Toy Model: Q1 first coil



e⁺/e⁻

IP5 Toy Model: Q1 first coil

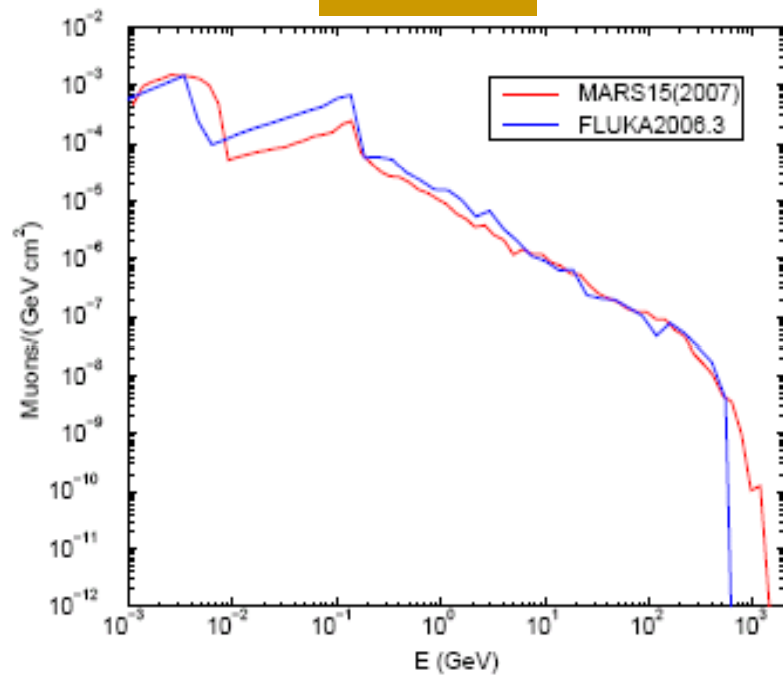


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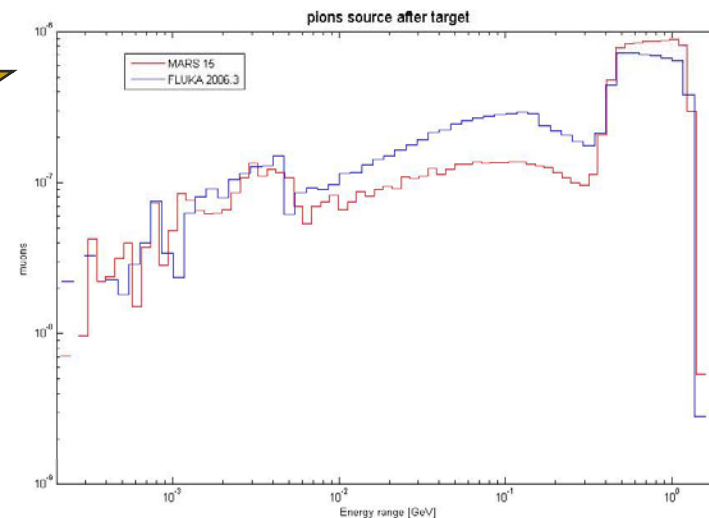
Results: particle spectra in cable 1

MUONS



➤ Good agreement between the 2 codes, although some problems revealed at very high and very low muon energies

➤ Detailed investigations
2 GeV Pions+ interacting with targets



[Conclusions]

- First Inter-comparison work between MARS and FLUKA for
 - LHC insertion region
 - 7-7 TeV proton-proton collisions
- Encouraging results with good agreements in general.
- Summary including detailed investigations to be published very soon (C.Hoa and N. Mokhov)